NVQs for Dental Nurses

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Contents

To my family, and especially my Dad, for believing in me. And also for Puki, a true friend indeed.

Published Review Comments

Carole Hollins's excellent book is published at a particularly important time with the advent of statutory registration of dental nurses in the UK . . . The book is aimed at all those undertaking dental nursing training with a view to obtaining a registrable qualification.

The book is designed to be a study guide rather than a reference book and as such will be an essential addition to any practice or clinic: to be used by both dental nurses undergoing training and also as a revision textbook for qualified dental nurses. The book will also provide a very valuable teaching aid for employers and dental nurse tutors.

European Journal of Dental Education, 2004

Pre-Publication Review Comments

In my opinion, the author has constructed a well-thought out book. The introductory information is clear and will aid the reader to navigate their way around the book and dip in and out as needed. The glossary of terms is excellent and provides the reader with an understanding of the terminology they will encounter throughout the learning programme . . . I for one will be looking out for it on the shelf.

Lynn Nichol, Senior Dental Nurse Tutor, Newcastle-upon-Tyne Dental Hospital.

I read the book in two sittings and found it an easy style to read. I particularly liked the bullet points to explain procedures . . . The chapters that deal with caries and periodontal disease are excellent and Carole Hollins' background of training dental nurses shows in the easy simple way she explains these areas without compromising on detail.

Gillian Key, Former Principal Tutor Dental Nurse, Bristol Dental Hospital, NVQ Co-ordinator for Training and Development, University of Bristol Healthcare Trust.

Foreword

Some textbooks designed to be study aids are often so vast that students cannot possibly read them in their entirety and, in the end, only use them as works of reference. Alternatively, other textbooks can be so brief they are merely aide-memoirs in the revision period leading to exams.

This comprehensive new book is intended to complement students' learning whilst undertaking the Level 3 NVQ Oral Health Dental Nurse Programme. The format is set out simply, yet very effectively, clearly stating which units of Occupational Standards each chapter covers. Diagrams, references, shaded areas of importance and bold lettering for emphasis on specific areas of learning, are used throughout. The concise account of each subject area enables the student to use the book in full, or to 'dip in and out'.

Carole Hollins has added activities sections so the student is able to undertake questions and revision at the end of each chapter. The student or tutor can then use these pieces of work in different ways; for example, as evidence in their portfolio of learning, or as revision for theoretical assessments, mock exams or the final Independent Assessment.

The NVQ has developed so rapidly that a textbook such as this can be used by students, tutors and also by employers. For the employer, this text will help clarify the NVQ framework and provide much needed support for the students in the workplace. The dental nurse undertaking a pre-qualification course often struggles between the practical and theoretical elements of the course. This book helps identify and integrate these two areas of training.

Carole has introduced the care units 'communication, motivation, and developing one's own knowledge and practice' extremely well; areas which have previously caused confusion and concern due to their newness and lack of dentally-specific material. This book makes the Knowledge Evidence of the Occupational Standards easy to understand and gives the student an understanding of how to complete these units. Additionally, the glossary of terms at the end of the book is very informative and concise; this section could stand alone as a learning tool for students, tutors and employers.

NVQs for Dental Nurses is not designed as a book to sit 'on the shelf', but rather to be on hand for constant reference. Students can either choose to read one or two chapters or utilise the book throughout their course. I am sure NVQ students will find this book a great asset to their knowledge and a benefit to their career as an oral health professional.

NVQs for Dental Nurses fills a gap in NVQ oral health literature – and does it very well.

Janet Goodwin BA (Hons) RDN
Chairman of the National Exam Board for Dental Nurses

Acknowledgements

Sincere thanks are due to two of my colleagues at the National Examining Board for Dental Nurses, namely Gillian Key and Janet Goodwin. They have both helped and guided me through the writing of this book, and their knowledge and enthusiasm has been awe inspiring. I hope that I have delivered the goods!

How To Use This Book

This book is aimed at all those undertaking dental nurse training with a view to a registrable qualification, in accordance with the National Occupational Standards. It endeavours to provide detailed theoretical knowledge of all areas of general dental practice, although there are areas indicated which are beyond the remit of this book.

Those dental nurses undertaking the National Vocational Qualification in Oral Healthcare (Dental Nursing Level 3) should find that the chapters cover the nine mandatory units and six of the more commonly practised areas of dentistry, from option group A. This book should therefore give the theoretical knowledge for the following units:

Mandatory:
DN01, DN02, DN12, DN13, DN14, DN15, DN16, DN17, DN18

Option group A:
DN19, DN20, DN21, DN22, DN23, DN24

Option group B relates to more specialised areas of dentistry than those routinely carried out in most general dental practices, and are beyond the scope of this book.

The Record of Assessment issued for the NVQ course should be able to be used in tandem with this book, as a written and witnessed record of the evidence collected in relation to each of the units. Each chapter gives the necessary theoretical information for the performance criteria in each element to be understood, over the range stipulated.

For the sake of clarity, the following points should be noted:

- Units DN12 and DN19 have been combined to produce a complete chapter on all aspects of oral health
- Unit DN15 has been divided into two chapters, so that the subjects of oral diseases and tooth restoration can be discussed separately
- Unit DN23 has been condensed and incorporated into Chapter 12, along with the other 'minor oral surgery' information. The more specialised areas of periodontal surgery, namely grafting, pocket eradication and sulcus deepening, are not carried out routinely in general dental practice and were thus considered beyond the scope of this book
- Finally, the initial two chapters, covering biology and physiology, and anatomy, have been included to provide the necessary background information to dental nursing

The introduction to each chapter explains which of the NVQ units the chapter relates to in detail. However, dental nurses should remember that NVQs are a work-based assessment qualification and that the practical skills necessary for dental nursing must be directly carried out as part of the assessment procedure.

At the end of each chapter there is a list of activities to be carried out by the student on completion of the chapter. The activities can be included as a source of evidence in the portfolio, if required.

A glossary of terms used throughout the text has been added for clarification, the definitions given being correct in the context in which the terms have been used within the book.

Chapter One

Applied Biology and Physiology

This chapter gives notes on basic biology and the relevant physiology of the human organism, to provide underpinning knowledge for dental nursing. It is relevant to many of the units throughout the syllabus.

Basic biology

The basic unit of living organisms is the cell.

Many cells specialise to perform certain roles, and when they group together they are called tissues.

Groups of tissues performing different functions are organs, whereas those with related functions are systems.

There are four basic types of cell:

(1) Muscle cells – generate forces and produce motion; they may be attached to bones to allow limb movement, or enclose hollow cavities so that their forces cause expulsion of the cavity contents (as in the digestive tract)
(2) Nerve cells – can initiate and carry electrical impulses to distant areas of the body along their length
(3) Epithelial cells – on the surface of the body or organs, or lining hollow structures within; they act to compartmentalise areas of the body to prevent uncontrolled germ movements
(4) Connective tissue cells – connect various parts of the body together for anchorage and support

The interaction of all the body systems to maintain life allows the continuous production of energy by food digestion.

The energy is then used to:

- Maintain body temperature above that of the surroundings
- Produce movement to allow hunting for food, and the production of more energy
- Allow reproduction to occur, for the survival of the species

The human body has ten organ systems, each with various components and specific functions to allow the continuation of life.

(1) **Circulatory system** – composed of heart, blood vessels, blood.
Functions to allow rapid bulk flow of blood around body tissues
(2) **Respiratory system** – composed of nose, throat, larynx, trachea, lungs.
Functions to exchange oxygen and carbon dioxide
(3) **Digestive system** – composed of mouth, pharynx, oesophagus, stomach, intestines, pancreas, salivary glands, liver, gall bladder.
Functions to digest, process and absorb nutrients, and excrete waste products
(4) **Urinary system** – composed of kidneys, ureter, bladder, urethra.
Functions to regulate plasma and excrete waste products
(5) **Musculo-skeletal system** – composed of cartilage, bone, ligaments, tendons, joints, skeletal muscle.
Functions to support and protect internal organs, and allow movement
(6) **Immune system** – composed of white blood cells, lymph, spleen, bone marrow, thymus gland.
Functions to defend against infection and to produce red and white blood cells
(7) **Nervous system** – composed of brain, spinal cord, nerves, sensory organs.
Functions to give consciousness and to regulate and coordinate body activities
(8) **Endocrine system** – composed of all glands secreting hormones.
Functions to regulate and coordinate body workings
(9) **Reproductive system** – composed of male or female sex organs.
Functions to allow reproduction and continuation of the species
(10) **Integumentary system** – composed of skin.
Functions to protect against injury and dehydration and to maintain temperature

Details of the three main organ systems relevant to dental nursing – the circulatory, respiratory and digestive systems – are given below.

Circulatory system

The main component of the circulatory system is the heart, which is a muscular pumping organ situated in the thorax (chest cavity).

The heart is connected by blood vessels to every tissue in the body, and acts to pump oxygenated blood from the lungs to the body tissue cells, and to collect deoxygenated blood from the body and transport it to the lungs for excretion.

The heart has four chambers within; the upper ones are the atria and the lower ones are the ventricles, and the two chambers on either side of the heart (left and right) are separated by valves (Fig. 1.1). The left and right sides of the heart have no connection between them as the right side holds only deoxygenated blood and the left side holds only oxygenated blood.

Blood enters the two atria from large veins, the right side as deoxygenated

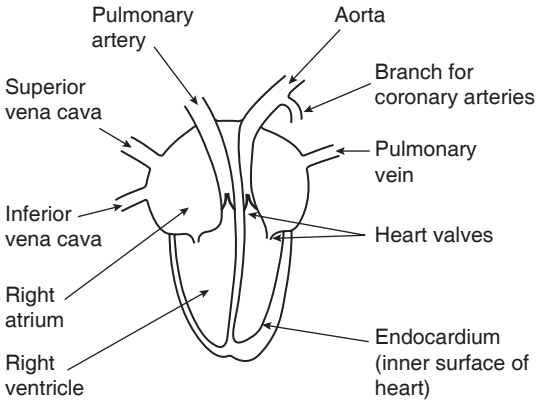


Fig. 1.1 The heart.

blood from the body through the vena cava, and the left side as oxygenated blood from the lungs through the pulmonary vein (this is the only vein that carries oxygenated blood). As the heart beats, the blood is pumped from the atria into the ventricles and then from the ventricles out of the heart.

The right ventricle pumps the deoxygenated blood to the lungs through the pulmonary artery (this is the only artery to carry deoxygenated blood), and the left ventricle pumps oxygenated blood to the rest of the body through the aorta. The first arteries that branch off the aorta are the four coronary arteries, which supply the heart muscle itself.

After each heart beat, the blood is prevented from flowing backwards by the valves within the heart which allow blood flow in one direction only. Once the blood has passed through the valves the pressure closes the flaps of the valve and prevents backflow.

The heart beat itself starts on the top surface of the right atrium in a group of specialised muscle cells called the 'pace-maker'. These cells receive stimulation from two sets of nerves from the brain; one set speeds up the rate of the heart beat and the other set slows it down. In this way the heart rate is regulated to allow both exercise and rest as necessary.

The whole circulatory system is connected together throughout the body, with oxygenated blood flowing from the left heart into large arteries, which become smaller arteries called arterioles and then into microscopic blood vessels only one cell thick called capillaries. It is in the capillaries that the oxygen is released into the surrounding organs and tissues, and carbon dioxide is collected from them. This is called 'internal respiration'. The blood has then become deoxygenated and it passes out of the capillaries into tiny veins called venules, which connect with the larger veins and take the deoxygenated blood back to the right side of the heart. This is the systemic circulatory system (see Fig. 1.2).

Once the deoxygenated blood arrives in the right side of the heart it is pumped to the lungs through the pulmonary artery to be reoxygenated, before passing back to the left side of the heart in the pulmonary vein ready to

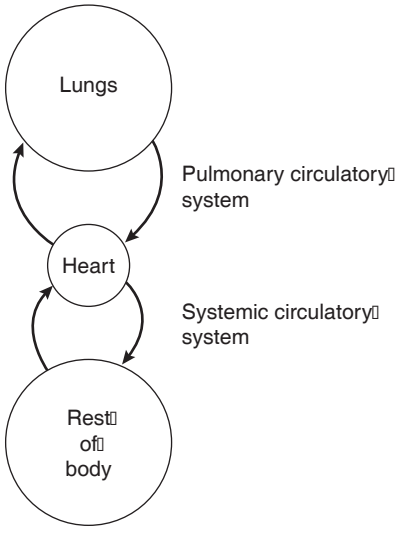


Fig. 1.2 Blood circulation.

be pumped back around the body. This is the pulmonary circulatory system (see Fig. 1.2).

The pumping action of the heart produces pressure that drives the blood around both circulatory systems. The force is greatest in the large arteries close to the heart and gradually diminishes through the capillaries and veins. When a patient has their blood pressure measured, a reading is made of the blood pressure in the arteries when the heart contracts, over that when the heart relaxes. The average blood pressure of an adult at rest is thus recorded as 120/80.

The arteries are elastic so that they can expand as a surge of blood passes through them following each heart beat, and then relax to their usual size again. Where the arteries lie over bone, this surge of blood can be felt as the pulse. In contrast to the arteries, the veins are thinner-walled and less elastic so that blood could flow in either direction if they did not contain one-way valves, like the heart.

The three basic blood cells are:

(1) Red blood cells (erythrocytes), which carry oxygen around the body
(2) White blood cells (leucocytes), which defend against infection
(3) Platelets, which are portions of larger cells called thrombocytes; they help to prevent blood loss by forming clots at wound sites

The following disorders have relevance to the dental nurse as they may occur as medical emergencies. They are discussed further in Chapter 3.

- Coronary artery disease – can be blocked either partially, to give symptoms of angina, or fully to give myocardial infarction

- Cardiac arrest – sudden cessation of heart beat (asystole) or an ineffective beat (fibrillation)
- Rheumatic fever – causes damage to heart valves so that future bacteraemia (bacteria in blood) produces internal heart inflammation (bacterial endocarditis)

Respiratory system

The main components of the respiratory system are the lungs, which are situated in the thorax, the two main bronchi connecting them to the windpipe (trachea), which then connects them to the outside atmosphere (Fig. 1.3).

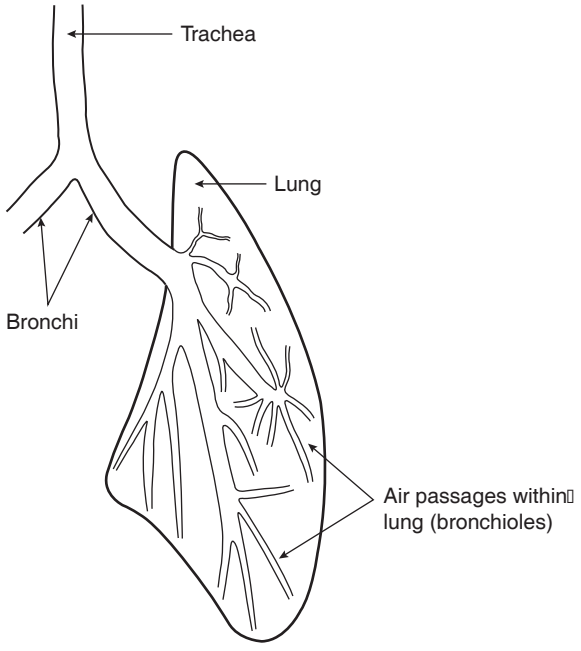


Fig. 1.3 Respiratory system.

By the action of breathing in and out (inspiring and expiring), air, containing oxygen, is drawn into the lungs and is transferred into the circulatory system. At the same time, carbon dioxide passes out of the blood plasma into the lungs and is then expired. This is the waste product produced by the body tissues as they function to maintain life.

The exchange of oxygen and carbon dioxide occurs in the microscopic pouch-like end sacs of the lung tissue, called alveoli. These are just one cell thick and allow the passage of oxygen from the lungs into the capillaries, and carbon dioxide from the capillaries into the lungs. This process is called 'external respiration'.

The lining of the respiratory system before entering the lungs is covered in specialised cells that secrete mucus and have tiny hair-like projections called cilia. The sticky mucus helps to trap dust particles and bacteria before they reach and block the alveoli, and the cilia gently flick the trapped particles back towards the throat, so that they can be swallowed or coughed out.

The movement of air in and out of the lungs is caused by the movement of the ribs and a muscular sheet, which seals the bottom of the rib cage from the abdomen, called the diaphragm. On inhaling (breathing in), the ribs lift up and the diaphragm pulls down, and these two actions expand the size of the rib cage so that air is pulled into the lungs through the nose and mouth. External respiration occurs within the alveoli, and then as the diaphragm and ribs relax the expired air is forced out of the lungs and into the atmosphere.

This process of ventilation occurs approximately 16 times a minute in an adult at rest, exchanging about 0.5 litres of air at each breath. The rate and depth of breathing increase dramatically during exercise.

The following disorders have relevance to the dental nurse because their existence in patients may cause them to have difficulty breathing, or even to stop breathing:

- Inhaled foreign body – can occur during dental treatment, especially if patient is lying supine for treatment
- Bronchitis – inflammation of the bronchi
- Bronchial asthma – a hypersensitivity response to inhaled particles, which compromises the patient's breathing, especially during stressful situations
- Emphysema – inflammation of the lungs

Digestive system

All living organisms need food for the following purposes:

- Growth of the organism
- Replacement of worn and damaged tissues
- As a source of energy to enable chemical reactions to occur in the body

The main components of the digestive system are the stomach, intestines, liver and pancreas (Fig. 1.4). Their purpose is to absorb food products so that they can be processed for use by the body to provide energy for growth and repair of tissues. The waste products can then be excreted to prevent the build up of toxins in the body.

Classes of food

- Carbohydrates, comprising sugars and starches, are the cheapest food source of readily available energy. Sugars can be obtained from fruit, vegetables and processed foods; starch can be obtained from bread, cereals and potatoes
- Proteins, from meat and fish, dairy products, beans and some cereals

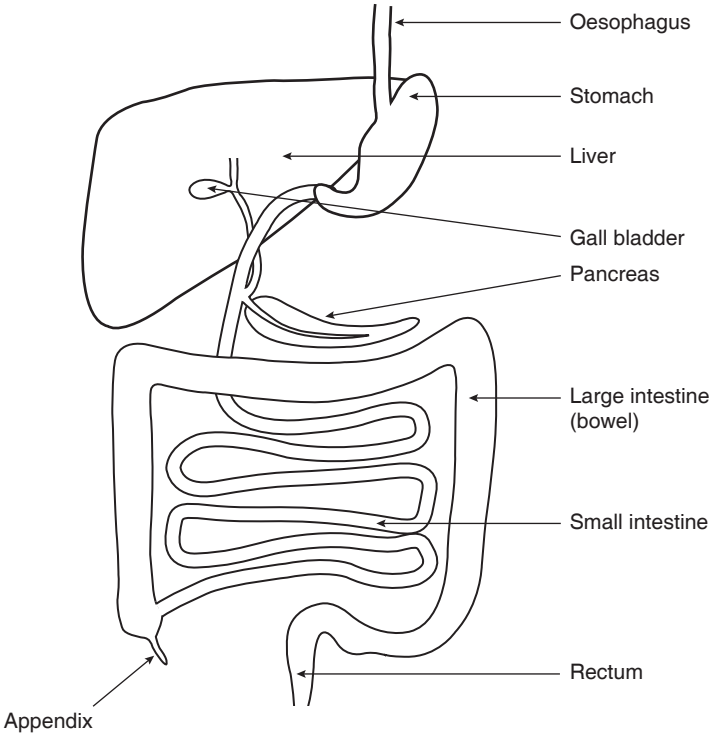


Fig. 1.4 Digestive system.

- Fats, from animals (meat, milk, cheese, butter) or from plants (seed oils, fruit oils)

The following are also required in small quantities for a healthy diet:

- Salts (sodium, fluoride, calcium etc.)
- Vitamins (especially A, B group, C and D)
- Dietary fibre (mainly from fruit and vegetables)

Water is also required for the maintenance of life, although it is not considered a food.

Carbohydrates are of importance in dentistry because those which are added to foods during processing (so they are not present naturally in the food) and which are called non-milk extrinsic sugars, are directly related to the onset of dental caries (tooth decay). The most prevalent one is sucrose.

The digestion of carbohydrates begins in the mouth and the acidic by-products are responsible for attacking the teeth and causing caries.

Important disorders of the digestive system are any illness causing regular vomiting, as the acidic stomach contents will cause tooth erosion. Examples are bulimia, gastric reflux and hiatus hernia.

Activities

- List three other diseases affecting either the circulatory, respiratory or digestive system that you are aware of. You may have a family member or a friend who suffers from a disorder that could be suggested.
- Can you explain the dental relevance of one of the diseases you name?

Chapter Two

Regional and Dental Anatomy

This chapter gives the necessary background knowledge of the anatomy of the skull, the nerve and blood supply to the jaws and the anatomy of the major salivary glands. It is necessary for the dental nurse to have an understanding of these subjects in order to relate them to various aspects of the syllabus, such as local anaesthesia and oral disease.

Detailed anatomy of the structure of the teeth and the periodontium, and tooth morphology are included.

Anatomy of the skull

The skull can be divided into three regions:

(1) Cranium – enclosing the brain
(2) Face – supporting the eyes and nose
(3) Jaws – supporting teeth and tongue, and providing openings for the respiratory and digestive tracts

See Fig. 2.1.

Like most bones in the body, the skull develops in the fetus as cartilage which is gradually converted to bone.

The outer layer of bone is called compact bone. It contains anatomical holes (foramina) to allow the passage of blood vessels and nerves. The inner layer is called cancellous bone, and is of a spongy appearance.

Cranium

The cranium is made up of six plates of bone:

- Frontal bone
- Two parietal bones
- Two temporal bones
- Occipital bone

These bones interlock with each other at the coronal sutures. These are a type of joint between each of the bone plates, which allow growth of the brain during childhood. The cranium is shown in Fig. 2.2.

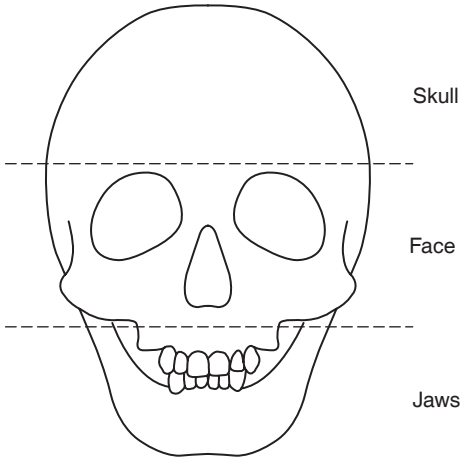


Fig. 2.1 The skull.

The large foramen at the base of the skull is called the foramen magnum. It is where the brain stem becomes the spinal cord within the spinal column.

Face

The face is composed of many bones; the six which are relevant to dentistry are:

- Two zygomatic bones
- Two zygomatic arches
- Two nasal bones

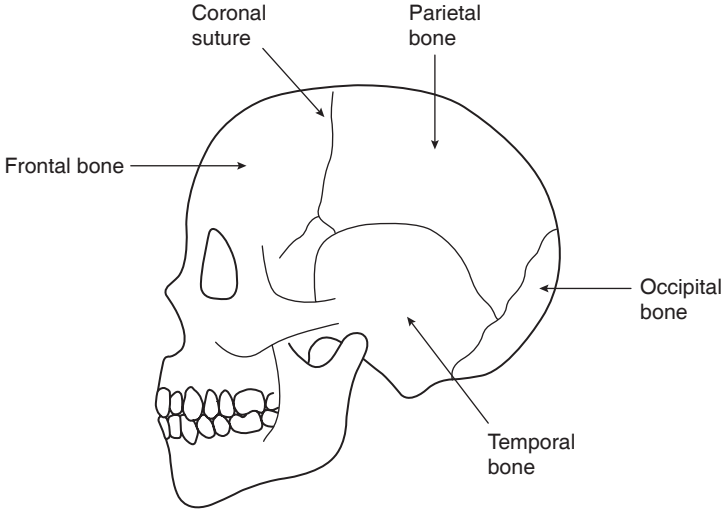


Fig. 2.2 Cranium detail.

These six main bones form part of the orbital cavities, enclosing the eyeballs, and the nasal cavity of the nose, containing the nasal septum and the turbinate bones (Fig. 2.3).

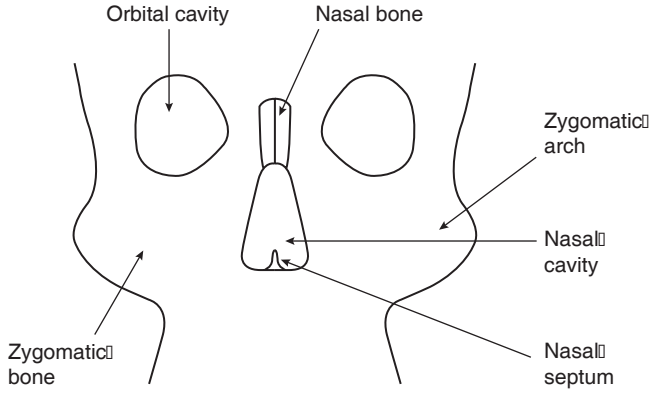


Fig. 2.3 Face detail.

Jaws

The upper jaw is called the maxilla. The maxilla

- Is made up of two bones
- Supports the alveolar process which holds the upper teeth
- Forms the roof of the mouth – the hard palate
- Forms the floor of the nose
- Is hollow, with the air spaces called sinuses, or antra
- Has greater palatine foramina for the exit of the greater palatine nerves
- Has incisive foramina for the exit of the nasopalatine nerves

The two ends of the alveolar process are called the maxillary tuberosities. See Fig. 2.4.

The lower jaw is called the mandible. The mandible

- Is composed of two bones which join at the midline
- Connects with the cranium by two hinge joints – temporomandibular joints
- Supports the alveolar process which holds the lower teeth
- Has the mandibular foramina opening on inner surfaces of the ramus, to admit the inferior dental nerves
- Has the mental foramina opening between lower premolars for the exit of the inferior dental nerves

The junction at the midpoint of the mandible is called the mental symphysis. The ridge of bone running along the inner surface is the mylohyoid ridge. This

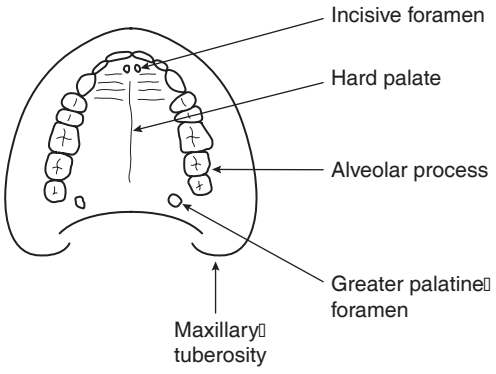


Fig. 2.4 Maxilla in mouth.

supports the mylohyoid muscle which forms the floor of the mouth. See Fig. 2.5.

Temporomandibular joint (TMJ)

The TMJ is the hinge joint between the base of the cranium and the mandible. It allows the mouth to open and close.

The head of the mandibular condyle lies in a groove of the temporal bone called the glenoid fossa, and the articulation of the two bones at this point forms the TMJ (Fig. 2.6).

The front edge of the fossa is raised into a ridge called the articular eminence, and this stops the condylar head from slipping out of joint and dislocating. The two bones are separated by a pad of cartilage (the meniscus) so that they do not grate against each other.

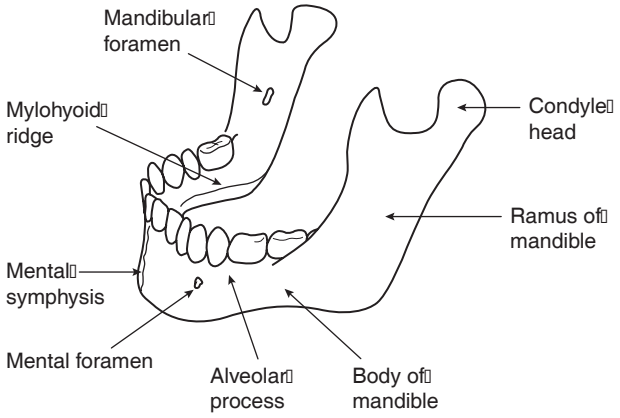


Fig. 2.5 The mandible.

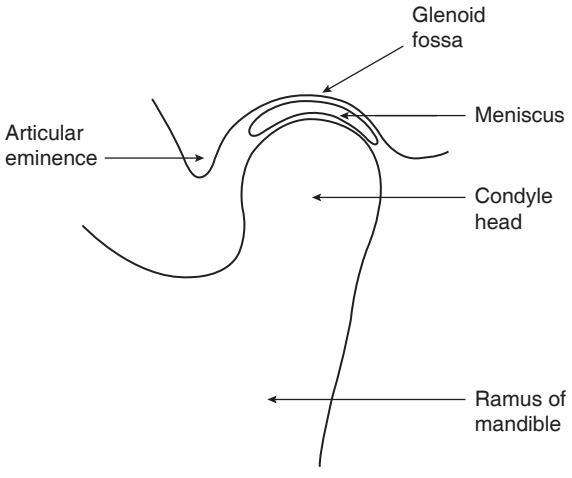


Fig. 2.6 Temporomandibular joint.

Surrounding muscles

- Suprahyoid muscles – those running from the chin to the hyoid bone in the throat; they act to open the mouth
- Muscles of mastication – those running from the cranium to the mandible; they act to close the mouth and effect chewing movements
- Muscles of facial expression – those running in the soft tissues surrounding the mouth, nose and eyes

Nerve supply to the oral cavity

All nerves supplying the oral cavity run directly from the brain as cranial nerves, whereas those supplying the rest of the body run from the spinal cord, as systemic nerves.

The cranial nerves are either sensory (carrying sensory stimuli to the brain), motor (carrying electrical stimulation from the brain to the muscles), or a combination of the two.

Although there are twelve pairs of cranial nerves, only the following pairs are important in dentistry;

- Trigeminal nerve – cranial nerve 5
- Facial nerve – cranial nerve 7
- Glossopharyngeal nerve – cranial nerve 9
- Hypoglossal nerve – cranial nerve 12

Trigeminal nerve

The trigeminal nerve is so called because it splits into three divisions, each of which has several branches:

(1) Ophthalmic division – supplies the soft tissues around the eye and upper face
(2) Maxillary division – sensory supply of upper teeth, maxilla and middle face; it has five branches:
    (a) Anterior superior dental nerve
    (b) Middle superior dental nerve
    (c) Posterior superior dental nerve
    (d) Greater palatine nerve
    (e) Nasopalatine nerve
(3) Mandibular division – sensory supply of lower teeth, mandible and lower face, and motor supply to muscles of mastication; it has four branches:
    (a) Inferior dental nerve
    (b) Lingual nerve
    (c) Long buccal nerve
    (d) Motor branch to muscles of mastication

See Fig. 2.7.

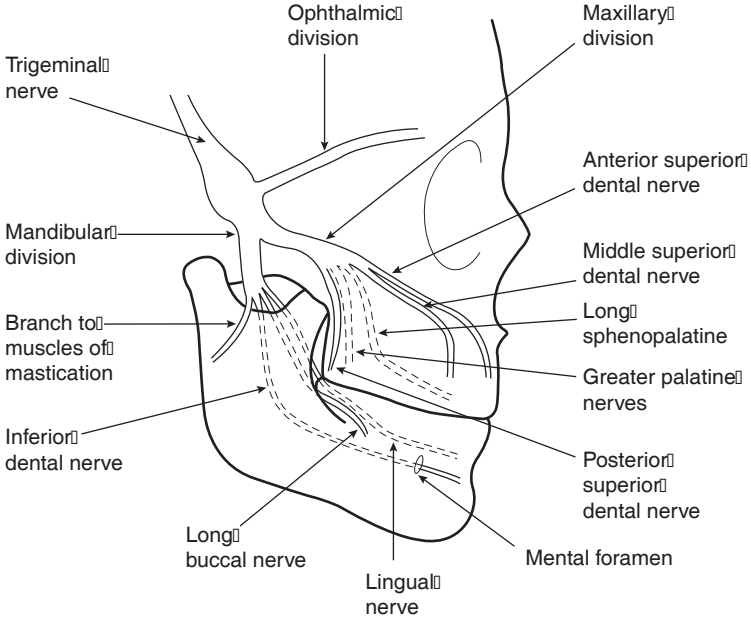


Fig. 2.7 Trigeminal nerve distribution.

Maxillary division

(1) Anterior superior dental nerve supplies incisor and canine teeth and their labial gingivae
(2) Middle superior dental nerve supplies premolars and mesial half of first molar teeth and their buccal gingivae

(3) Posterior superior dental nerve supplies distal half of first molar and second and third molar teeth and their buccal gingivae
(4) Greater palatine nerve supplies palatal gingivae of molars, premolars and half of canine teeth
(5) Nasopalatine nerve supplies palatal gingivae of incisors and half of canine teeth

Mandibular division

(1) Inferior dental nerve supplies all lower teeth, the labial/buccal gingivae of the premolar, canine and incisor teeth, and the soft tissues of the lower lip and chin
(2) Lingual nerve supplies the lingual gingivae of all the lower teeth, the floor of the mouth, and all but taste sensation from the anterior two-thirds of the tongue
(3) Long buccal nerve supplies the buccal gingivae of the molar teeth
(4) Motor branch supplies stimulation to the muscles of mastication

Facial nerve

- The facial nerve supplies the submandibular and sublingual salivary glands
- Motor component supplies the muscles of facial expression
- Sensory component supplies taste sensation from the anterior two-thirds of the tongue

Glossopharyngeal nerve

- The glossopharyngeal nerve supplies the parotid salivary glands
- Motor component supplies the muscles of the pharynx (back of the mouth)
- Sensory component supplies taste and sensation from the posterior third of the tongue

Hypoglossal nerve

- Motor component only, which supplies the muscles of the tongue

Blood supply to the teeth and gingivae

All teeth and gingivae are supplied by branches of the **external carotid artery**.

All the blood vessels run as neurovascular bundles with the nerves supplying the area. The veins draining the area will eventually join the **superior vena cava** and enter the right side of the heart, where the deoxygenated blood will pass to the lungs for reoxygenation.

Salivary glands

There are many small salivary glands within the cheeks and lips, and three pairs of principal salivary glands situated around the oral cavity. Their main function is to secrete saliva into the mouth.

The three principal pairs are:

- Parotid glands
- Submandibular glands
- Sublingual glands

The location of these glands is shown in Fig. 2.8.

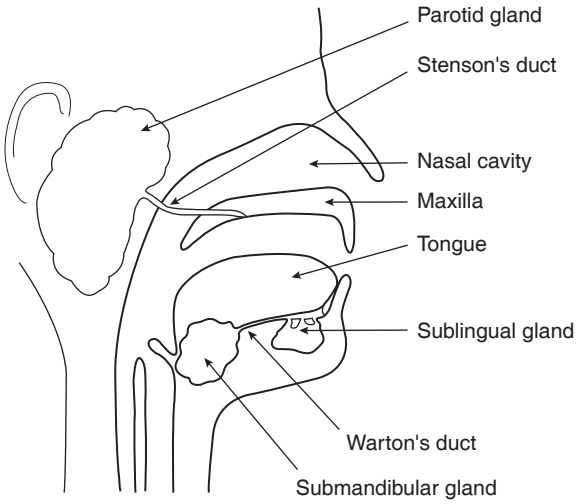


Fig. 2.8 Main salivary glands.

Parotid glands

- Largest of the three glands
- Lie around the ramus of the mandible, in front of the ear
- Connect to the oral cavity via Stenson's duct, which opens against the upper molar teeth
- Only gland affected by the viral infection mumps
- Commonest salivary gland to be associated with benign and malignant tumours

Submandibular glands

- Lie within the horseshoe shape of the body of the mandible, posteriorly and partly beneath the mylohyoid muscle

- Connect to the oral cavity via Warton's duct which opens beneath the tongue
- Is the likeliest duct to become blocked by salivary stones (calculi) because of its length

Sublingual glands

- Lie beneath the tongue, above the mylohyoid muscle
- Have several ducts opening under the tongue into the oral cavity, against the lingual surfaces of the lower incisor teeth

Tongue

The tongue is a muscular organ lying in the floor of the mouth, and has the following functions:

- Speech
- Taste
- Aids mastication by packaging food particles ready for swallowing
- Aids swallowing
- Aids cleansing of the oral cavity

Dental anatomy

The oral cavity contains the teeth, which have the following functions:

- To support the oral soft tissues to enable clear speech
- To cut up and masticate food into a suitable size before swallowing
- By doing this, they expose the food surfaces to enzymes to allow digestion

All teeth are composed of a crown – the portion present in the mouth – and either one, two or three roots which anchor the tooth in the alveolar bone.

The four types of teeth are:

(1) Incisors
(2) Canines
(3) Premolars
(4) Molars

The teeth are shown in Fig. 2.9.

The anatomy of all teeth is the same, but their shapes and number of roots (morphology) vary depending on their function. This will be described later.

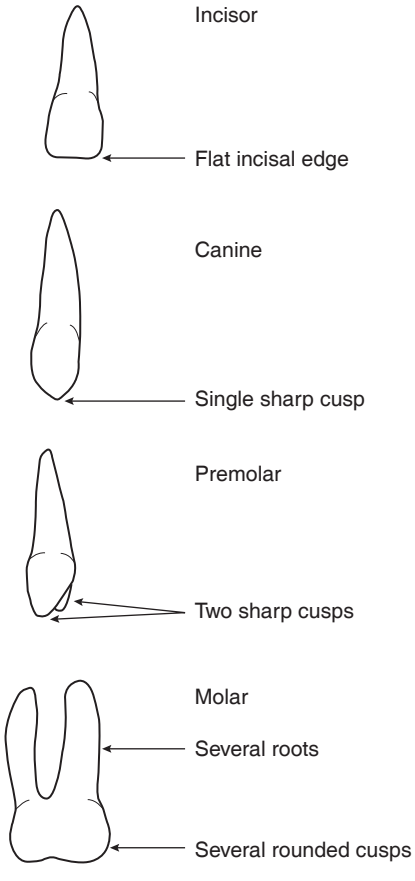


Fig. 2.9 Types of teeth.

Enamel

This is the outer layer of the crown.

- It is harder than bone
- It is made up of 96% inorganic (mineral) crystals arranged as prisms in an organic matrix
- Main mineral crystals are hydroxyapatite
- Prisms lie at 90 degrees to the junction with the next layer, the dentine
- Junction is called the amelodentinal junction
- Contains no nerves or blood vessels and therefore cannot experience sensitivity
- Non-living tissue which cannot grow and repair itself, but it can remineralise after acid attack
- Can exchange minerals, especially fluoride, to form fluorapatite crystals which make the enamel surface harder still and more resistant to acid attack

- Enamel is formed before tooth eruption by ameloblast cells which lie at the amelodentinal junction
- Lies in thickest amount at the occlusal (biting) surface of the tooth, and thinnest at the cervical margin (neck of the tooth)
- Is translucent in appearance

Dentine

Dentine is the layer beneath the enamel in the crown and cementum in the root. It forms the bulk of the tooth.

- It is up to 80% inorganic
- It is composed of hollow tubules containing fibrils, which are sensory endings from the cells forming the dentine
- It is therefore a living tissue, and can transmit sensitivity
- It is formed by odontoblast cells, which lie at the edge of the pulp chamber
- It can repair itself by producing 'secondary dentine'
- Secondary dentine also forms as part of the natural ageing process
- Dentine is yellowish, gives individual teeth their colour, and is slightly elastic
- Caries (tooth decay) progresses rapidly through dentine because of its hollow nature

Pulp

Pulp is the soft tissue within the tooth structure.

- It contains sensory nerves and blood vessels
- It allows the tooth to feel hot, cold, touch, pain by stimulation of fibrils in dentine
- Vessels enter the tooth through the apical foramen, at the end of each root apex
- These tissues are enclosed within the pulp chamber of the tooth
- Chamber is lined by odontoblast cells
- Gradual formation of secondary dentine with age causes pulp chamber to decrease in size and become narrower
- Pulp chamber can also become blocked with pulp stones

Cementum

The cementum is the layer covering dentine of the root.

- It normally lies beneath the gingiva
- It allows attachment of the tooth to the supporting structure of the periodontal ligament

Tooth anatomy is shown in Fig. 2.10.

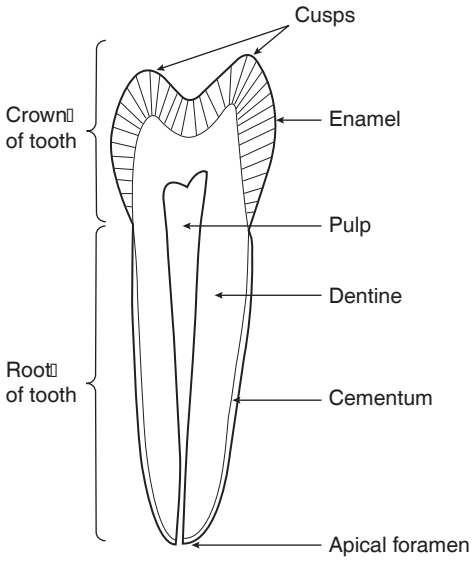


Fig. 2.10 Tooth anatomy.

Anatomy of supporting structures

The supporting structures are those around the roots of the teeth, which hold them in their sockets. Their hold is not rigid, to allow some degree of 'shock absorption' when chewing, thus protecting the tooth from fracture.

Alveolar bone

The bony extensions of the maxilla and mandible, where the teeth are formed and from where they erupt into the mouth.

- Special bone found only in the jaws
- Sole purpose is to support the teeth during their lifetime
- When teeth are extracted, alveolar bone gradually resorbs away
- Outer layer is hard compact bone, with the surface being called the lamina dura
- Inner layer is cancellous bone, sponge-like in appearance to allow blood vessels and nerves to run through
- Bone is covered in specialised alveolar mucosa (soft tissue) to form the gingivae (gums) around the necks of the teeth
- Destruction of the alveolar bone can occur during periodontal disease

Periodontal ligament

This is a specialised fibrous tissue which attaches the teeth to the alveolar bone and the surrounding gingivae.

- Fibres are made up of protein called collagen
- Run in several directions from cementum to alveolar bone and gingivae, and from neck of one tooth to that of its neighbour
- Acts as a shock absorber when tooth undergoes normal chewing movements, so that tooth can 'bounce' a little in its socket and not fracture
- Destruction of periodontal ligament occurs during periodontal disease

Gingivae

This is the correct term for the gums.

- In health, they are light pink in colour with a stippled (orange peel) surface
- Form a 2 mm crevice (gingival crevice) around the necks of each tooth, above periodontal ligament
- Gingivitis occurs when this area becomes inflamed
- Inflamed gingivae are red and shiny, with a swollen appearance

The supporting structures are shown in Fig. 2.11.

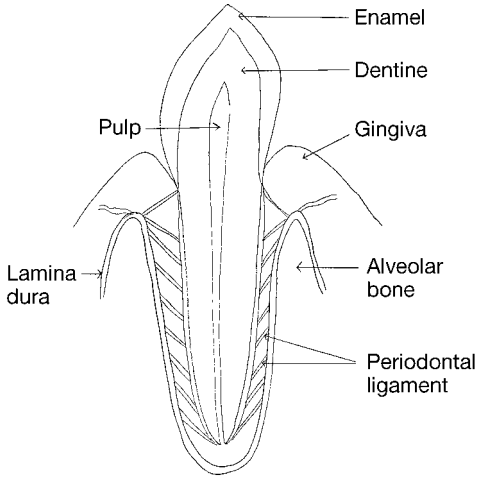


Fig. 2.11 Supporting structures.

Tooth morphology

All people have two sets of teeth – the first, deciduous teeth, and the second, permanent teeth. Deciduous teeth and permanent teeth have different appearances, or morphology, both between sets and within each set, and this is how they can be identified.

Deciduous teeth

These are also called primary teeth, baby teeth or milk teeth.

- Total set of 20, ten in each jaw
- Begin developing in the fetus
- Begin erupting approximately 8 months after birth
- Referred to in dentistry by letter – A, B, C, D, E, starting from the midline
- Smaller than permanent teeth, whiter in colour
- Roots are often partially or completely resorbed due to eruption of permanent teeth from beneath
- Larger pulp chambers than permanent teeth, with thinner enamel
- Roots of deciduous molars are widely divergent because the permanent premolar teeth crowns develop between them

Deciduous teeth are known thus:

A = central incisor
B = lateral incisor
C = canine
D = first molar
E = second molar

Lower As tend to erupt first, and upper Es are usually the last, at around 29 months (Fig. 2.12).

Permanent teeth

These are also called adult teeth or second teeth.

- Total set of 32, sixteen in each jaw if the third molars (wisdom teeth) are present
- Relatively common to have some adult teeth missing, especially third molars
- Referred to in dentistry by number – 1, 2, 3, 4, 5, 6, 7, 8, starting from the midline
- Begin developing around birth, and start erupting at age 6 years
- Three permanent molar teeth develop behind the deciduous teeth in space available as the jaws grow and lengthen
- So deciduous **molar** teeth are succeeded by permanent **premolar** teeth

Permanent teeth are known thus:

1 = central incisor
2 = lateral incisor
3 = canine
4 = first premolar

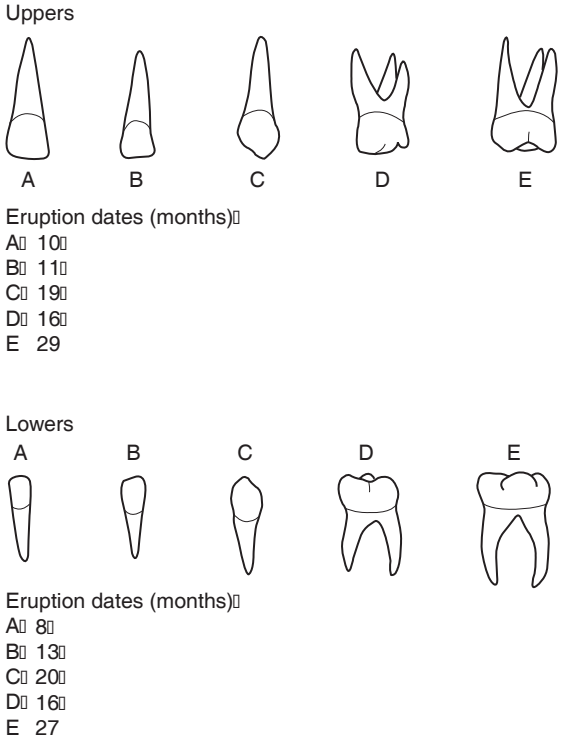


Fig. 2.12 Deciduous teeth.

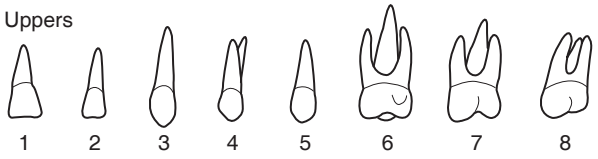
5 = second premolar
6 = first molar
7 = second molar
8 = third molar (wisdom tooth)

Lower 1s and all 6s erupt first, and 8s erupt last at any time from 18 to 25 years of age normally, but they can be later still (Fig. 2.13).

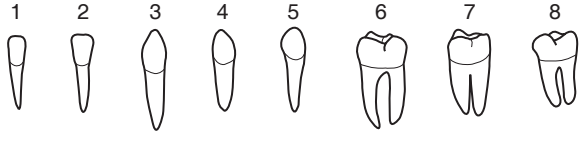
Tooth surface nomenclature

All surfaces are named from the midline backwards, and from the inner to the outer areas of the oral cavity (Fig. 2.14).

- All surfaces towards the midline are **mesial**
- All surfaces furthest from the midline are **distal**
- All lower, inner surfaces (against the tongue) are **lingual**
- All upper, inner surfaces (against roof of mouth) are **palatal**
- All outer surfaces of front teeth (against the lips) are **labial**
- All outer surfaces of back teeth (against the cheeks) are **buccal**



Eruption dates (years)
1 7–8
2 8–9
3 10–12
4 9–11
5 10–11
6 6–7
7 12–13
8 18–25



Eruption dates (years)
1 6–7
2 7–8
3 9–10
4 9–11
5 9–11
6 6–7
7 11–12
8 18–25

Fig. 2.13 Permanent teeth.

Front teeth are incisors and canines, they are referred to as **anterior**, and have incisal edges.

Back teeth are premolars and molars, they are referred to as **posterior**, and have cusps.

Identification of permanent teeth

See Fig. 2.15.

Incisors:

- Flattened crown with one root
- Central incisor larger than lateral incisor
- Incisal edge used to cut food
- Palatal or lingual surface of all has an enamel plateau called the cingulum
- Upper central incisor is largest of all incisors

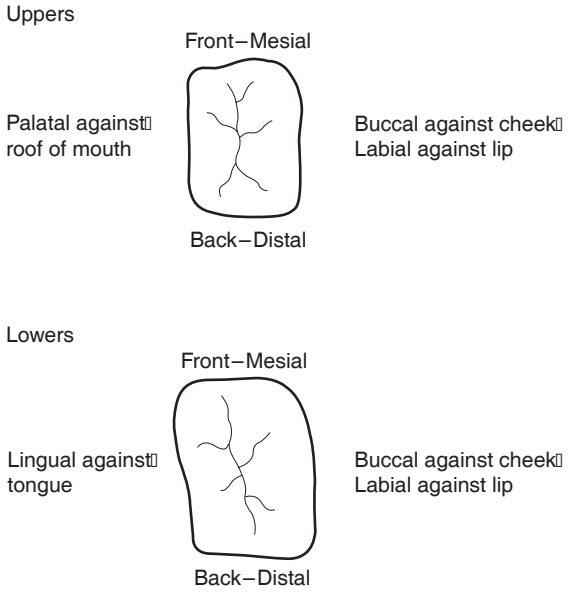


Fig. 2.14 Tooth surface nomenclature.

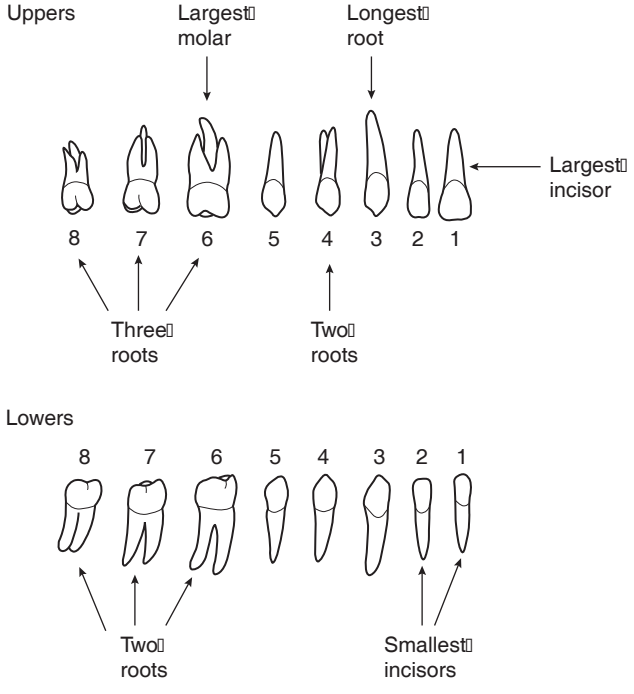


Fig. 2.15 Permanent tooth identification.

Canines:

- Large conical crown with pointed incisal edge and one long root
- Used to cut and tear food
- Upper canines larger than lowers
- Upper canines have longest of all roots

Premolars:

- All have two cusps, equal size in uppers, smaller lingual cusp in lowers
- Upper first premolar has two roots (buccal and palatal), all others have one root
- Used for tearing and chewing food

Molars:

- All have large occlusal surface for grinding and chewing food
- All upper molars have three roots (palatal, mesiobuccal and distobuccal)
- All lower molars have two roots (mesial and distal)
- Upper first molar has five cusps, fifth one called 'cusp of Carabelli'
- Lower first molar has five cusps, three buccal and two lingual
- All other molars have four cusps
- Roots of third molars vary in number, uppers are often fused together

In a normal mouth, all incisal edges and cusps of upper and lower teeth interlock, to give a stable bite (occlusion).

The upper arch is usually wider so that the lower teeth bite into the middle of the upper teeth, or onto the cingulum of the incisors and canines.

Activities

- Think back to when you saw a patient attending the surgery who was diagnosed as having a temporomandibular joint disorder. List the symptoms that the patient complained of.
- Identify four teeth that you have seen undergoing local anaesthesia in the last week and determine which nerves were anaesthetised. State the technique of anaesthesia used for each.
- Over the next few weeks, try to keep a record of the ages of all child patients seen who have a mixed dentition (both deciduous and permanent teeth present). Determine the youngest and oldest ages recorded.

Chapter Three

Health, Safety and Security in Dental Practice

This chapter relates to unit DN01 'Promote, monitor and maintain health, safety and security in the workplace'.

It covers the three elements:

- DN01.1 'Monitor and maintain the safety and security of the work environment'
- DN01.2 'Promote standards of health and safety in working practice'
- DN01.3 'Minimise the risks arising from health emergencies'

The following areas are covered in detail:

- Health and safety legislation in relation to COSHH, RIDDOR, ionising radiation, fire regulations, first aid and medical emergencies, and maintaining security in the workplace
- Legislation governing waste disposal in clinical practice

This chapter also links to unit DN02 'Prepare and maintain environments and instruments for clinical dental procedures'. Unit DN02 is covered in detail in Chapter 4.

Overview of the legislation

All general dental practitioners have responsibilities towards their staff and patients in relation to safe working practices and safety at work. These are governed by the **Health and Safety at Work Act 1974**.

The aim of the Act is to protect all persons at work, and in particular to:

- Provide and maintain safe equipment, appliances and systems of work
- Ensure dangerous or potentially harmful substances are handled and stored safely (see COSHH regulations, later in this chapter)
- Maintain the place of work (including its entrance and exit) in a safe condition
- Provide a safe working environment for employees, with no risks to health and with adequate facilities for their welfare

- Provide necessary teaching, training and supervision to ensure Health and Safety is complied with

All workplaces must also have a current Health and Safety Act poster on display within the premises, for all staff to see.

BUT . . . note that all *employees* are legally required to take reasonable care for their own and others' health and safety, and to cooperate with their employer to this effect.

As the majority of dental nurses training in practices tend to be young persons, the following two sets of regulations are also pertinent to dental practices:

- Health and Safety (Young Persons) Regulations 1997
- Management of Health and Safety at Work Regulations 1992

These regulations stipulate that an assessment of the practice has to be carried out and must take into account the following points:

- The inexperience and immaturity of young persons
- Their lack of awareness of risks to their health and safety
- The fitting and layout of the practice and surgery
- The nature, degree and duration of any exposure to biological, chemical or physical agents
- The form, range of use and handling of work equipment
- The way in which processes and activities are organised
- Any health and safety training given, or intended to be given

Compliance with health and safety law involves all of the following:

(1) Fire regulations
(2) First aid and medical emergencies
(3) COSHH (Control of Substances Hazardous to Health)
(4) RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences)
(5) Safe disposal of clinical and special waste
(6) Ionising radiation legislation
(7) Maintaining security in the workplace

Fire regulations

Fire precautions are governed by **Fire Precautions Regulation 1997**. These require the employer to assess what fire precautions are needed by carrying out a risk assessment of the premises and by complying with the following:

- Emergency routes and exits
  - Must be kept free of obstruction to allow immediate evacuation from the premises (thus, they should *not* be locked during work time)

  - Should lead directly to a place of safety
  - Should be clearly indicated by green 'Fire Exit' signs and pictogram of running man
- Emergency lighting should be provided if necessary
- Emergency doors should open in the direction of escape, and should open immediately (i.e. are *not* electric)
- No sliding or revolving doors should be used as fire exits

The following are also advised by fire safety inspectors:

- Smoke detectors
- Staff trained in use of fire extinguishers
- At least two of the following should be present in dental practices:
  - **Red (water) extinguisher** for use on all fires except electrical
  - **Black (carbon dioxide) extinguisher**, safe on electrical fires
  - **Blue (dry powder) extinguisher**, safe on electrical fires

In institutions such as hospitals, all fire extinguishers tend to be red with coloured labels, as above, whereas in general practice they tend to still be provided with the whole cylinder coloured as above.

Fire extinguishers must be inspected yearly and replaced as necessary, and practices should have a written fire safety policy with which all staff are familiar, so that a set procedure is known and followed by all.

First aid and medical emergencies

The basic requirements for all dental practices are as follows:

- All staff must be trained in basic first aid on an annual basis, in accordance with clinical governance guidelines, and have a nominated first aider
- All practices must have a first aid kit available, besides the emergency drugs box and oxygen cylinder which must be kept too
- All practices must have an accident book, which is used to record all events occurring on the premises, to both staff and patients alike
- Medical emergencies (see below) can occur in dental practice, and the dental nurse may well be the first on the scene, so correct knowledge and procedures are imperative
- The aim of the dental nurse is to reassure and help the casualty until help arrives, including maintaining life if necessary

Basic first aid principles are easily recalled in emergency situations by the following abbreviation:

D.R.A.B.C.

Dangers – assess any likely sources of danger to the first aider, such as chemical spillages, electrical supplies

Responsiveness – call to the victim, shake gently to assess their level of consciousness
Airway – check for blockages and maintain a patent airway to allow respiration
Breathing – if the patient fails to breathe, provide artificial respiration using available masks and correct first aid equipment, rather than mouth to mouth if possible
Circulation – check the pulse; if none is detected then heart massage is required immediately

Full cardiopulmonary resuscitation (CPR) is highly unlikely to be necessary except in the most dire of circumstances. However, its knowledge is useful to all dental nurses.

Cardiopulmonary resuscitation

Clear airway using either suction unit or by carefully hooking a finger around the oral cavity and removing any foreign bodies, pulling the tongue forwards if necessary. Open the airway by tilting the casualty's head back, by lifting either at the neck or at the angles of the mandible.

If the casualty fails to breathe spontaneously, give pulmonary resuscitation:

- Casualty will appear blue or purple, especially at the lips
- Airway must be open to be effective
- Seal resuscitation mask over the casualty's mouth and nose, or pinch the nostrils and seal mouth to mouth
- Give two steady exhalations, and observe the casualty's chest rising with each one
- Check for spontaneous breathing, and check the carotid pulse in the neck

If no pulse is detected then cardiac massage must be carried out:

- Casualty will appear grey in colour
- Heart must be compressed between spine and sternum (breast bone) to produce circulatory flow, at a rate of up to 100 per minute
- Find the base of the sternum and place the heel of one hand two finger widths above it
- Lock hands over this point and press down with a sharp rocking motion
- Check for carotid pulse after 1 minute, then every 3 minutes
- Continue CPR until medical help arrives

The procedure for adult CPR is shown in Fig. 3.1.

Severe bleeding

The first aid principle is to restrict blood flow to the wound and so encourage clotting and reduce blood loss.

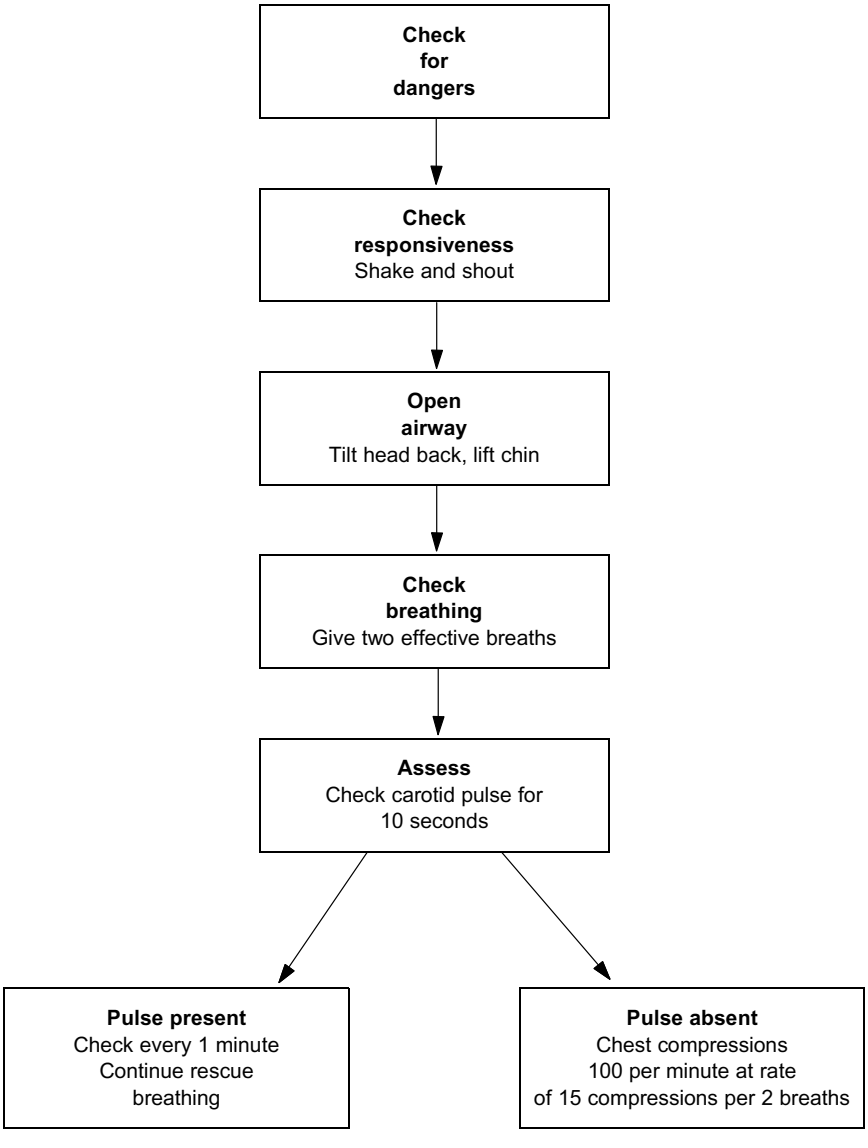


Fig. 3.1 Adult CPR.

Arterial bleeding will spurt rhythmically from a wound and be cherry red in colour. Venous bleeding will gush quickly from a wound and be dark red/purple in colour. Capillary bleeding will ooze slowly from a wound and be dark red in colour.

Treatment

- Raise the injured body part above heart level if possible
- Apply direct pressure onto wound with clean dressing for 5 to 15 minutes
- Do not remove any foreign bodies, such as broken glass, from the wound
- As a last resort, apply indirect pressure for arterial bleeding by compressing the artery against underlying bone, for just 5 to 15 minutes at a time

Burns and scalds

Burns are injuries to body tissues caused by heat, chemicals or radiation. Scalds are wet heat burns, caused by steam or hot liquids.

The first aid principles are to prevent infection of the underlying tissues, which are no longer protected by the skin, and to prevent clinical shock developing due to blood serum loss.

Treatment

- Remove the casualty from sources of danger if safe to do so
- Reassure the casualty, if they are conscious
- Place the injured part under cold water for a minimum of 10 minutes
- Remove any jewellery likely to cause constrictions, before swelling occurs
- Do not remove clothing, as this may be stuck to the skin and cause further tissue damage
- Seek medical help
- Carry out CPR if necessary

Poisoning

The first aid principles are to limit the exposure of the casualty to the poison and to maintain life until medical help arrives.

Treatment

- Consult COSHH documents for first aid advice
- Remove the casualty from the source of poison, if safe to do so
- Do not induce vomiting, under any circumstances
- Maintain the airway and carry out CPR if necessary
- Seek urgent medical help, giving details of the poison if known

Electrocution

This is caused by the passage of an electrical current through the body, which causes burns and can interfere with the heart beat, such that it beats erratically (fibrillation) or actually stops (asystole).

The first aid principles are to stop the electrical current and to maintain life until medical help arrives.

Treatment

- Isolate the electricity source with great care, if safe to do so
- Treat surface burns as above, and minimise the effects of shock
- Give CPR if necessary
- Seek urgent medical help

Fractures

Fractures are usually due to external trauma or falls, especially with elderly patients. The first aid principle is to prevent further damage by restricting movement while medical help arrives.

Treatment

- Do not move the injured part, and restrict any movement by the casualty
- Cover any open skin wounds with clean dressings to prevent infection
- Control bleeding, as above
- Seek urgent medical help

Faint

This is a brief loss of consciousness due to a temporary reduction in oxygenated blood flow to the brain and is the likeliest medical emergency to be encountered in dental practice. The casualty will appear pale and clammy, and have a weak and thready pulse.

The first aid principle is to restore the cranial blood flow immediately.

Treatment

- If conscious, sit with head down, loosen tight clothing and provide fresh air flow
- If unconscious, lay down and raise legs above head
- Maintain airway and loosen tight clothing
- Provide fresh air flow
- Give a glucose drink when consciousness returns, as the casualty often faints owing to lack of nutrients

Epileptic fit

This occurs due to a brief disruption of the normal electrical activity of the brain. Fits can be slight fits (petit mal) where the casualty may appear just to be daydreaming, or major fits (grand mal) where muscle spasms and convulsions occur. The latter occur in two stages and are known as 'tonic–clonic' seizures, where initially the casualty loses consciousness and become rigid, before a period of convulsion occurs.

The fit can last up to five minutes, and the casualty may be dazed afterwards. In some instances, the casualty may become incontinent during the fit.

The first aid principle is merely to allow the fit to progress and ensure the person's safety throughout.

Treatment

- Do not attempt to move the person
- Remove all possible sources of injury from the immediate area
- Keep onlookers away and preserve the person's dignity
- Allow recovery to occur, then arrange escort home
- If recovery does not occur, seek urgent medical help

Anaphylactic shock

This is an overreaction by the immune system to combat exposure to an allergen, such as in allergy to penicillin. It produces sudden onset rash formation and facial swelling, with restricted breathing followed by loss of consciousness. The first aid principle is to maintain life until medical help arrives.

Treatment

- Prevent further exposure to allergen, if safe to do so
- Maintain airway
- Give CPR if necessary
- Seek urgent medical help

Myocardial infarction

This occurs when the blood flow to the heart is obstructed. The person will experience a sudden crushing pain in the upper body, they will become giddy, breathless and lose consciousness rapidly, and they will appear grey.

The first aid principle is to maintain life until medical help arrives.

Treatment

- If still conscious, give aspirin tablet and oxygen
- Do not lay flat back, and restrict all movement by the casualty
- If unconscious, maintain airway and give oxygen
- If cardiac arrest occurs, begin CPR
- Seek urgent medical help

COSHH (Control of Substances Hazardous to Health)

COSHH is a legal requirement whereby all chemicals and potentially hazardous substances used in the workplace are assessed for risk of injury to

staff, so that reports can be written for each and kept updated for quick reference in the case of injury.

The following procedures need to be carried out for each of the substances:

- Identify those substances which are hazardous by reading the manufacturers' leaflets, which should be enclosed with the product
- Identify who may be harmed, usually all persons using the substance
- Identify how they may be harmed – breathing in, irritant to eyes or skin, etc.
- Evaluate the risk of the substance
- Determine whether health monitoring is required (mercury exposure, for example)
- Control the risks, or reduce them as far as possible
- Inform all staff of the risks (show sheets and sign to say they have read and understood them)
- Record the assessment and review and update it regularly

An example evaluation sheet is shown in Fig. 3.2.

Evaluation sheets for all substances used in the workplace should be kept in several folders throughout the premises, for ease of access by all staff. In addition, sheets for substances posing serious harm if misused or involved in spillages should also be kept in an 'emergency file', with medical emergency details included.

RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences)

All workplaces have to report any accidents causing 'major injury' or dangerous occurrences to the Health and Safety Executive. Major injuries are classed as follows:

- Fractures of skull, spine or pelvis
- Fractures of long bones of arm or leg
- Amputation of hand or foot, or loss of sight in one eye
- Hypoxia (lack of oxygen) severe enough to produce unconsciousness
- Any other injury requiring 24 hours hospital admission, unless for observation only

Notifiable dangerous occurrences, which require being reported to the Health and Safety Executive are classed as follows:

- Explosion, collapse or burst of an autoclave or compressor
- Electrical short circuit or overload causing more than 24 hours of stoppage
- Explosion or a fire due to gases or flammable products causing more than 24 hours of stoppage

Name of Substance								
Hazardous Ingredients								
Used for								
By Whom								
Frequency								
Amount								
Nature of Risks	Chemical		Flammable		Poisonous		Biological	
Exposure Limits	OES (MEL if applicable)			ppm		mgm-3		
	Long term – (8 hr TWA)			–				
				–				
Other								
Health Effects								
Eye Contact								
Skin Contact								
Inhalation								
Ingestion								
Precautions for safe handling and use								
Spillage								
Waste Disposal								
Storage								
Control Measures								
Ventilation								
Eye Protection								
Respiratory Protection								
Gloves								
Health Monitoring								
Staff Training								
Other								
First Aid Measures								
Eye Contact								
Skin Contact								
Inhalation								
Ingestion								

Dentists and staff members to sign to confirm these Control Measures are carried out:

1 . . . . . 4 . . . . . 7 . . . . . .
2 . . . . . 5 . . . . . 8 . . . . . .
3 . . . . . 6 . . . . . 9 . . . . . .

Fig. 3.2 Example of evaluation sheet.

- Uncontrolled release or escape of mercury vapour (a major mercury spillage)
- Any accident involving inhalation/ingestion/absorption of a substance causing hypoxia requiring medical treatment
- Any case of acute ill health due to pathogens or infectious materials

All other accidents occurring on the premises, no matter how minor and whether involving staff or patients, should be recorded in the accident book. This also includes any violent assaults or attacks occurring on the premises, and these should also be reported to the police.

Safe disposal of clinical and special waste

There are three types of waste produced by dental practices:

(1) Domestic waste – normal household waste, paper, etc.
(2) Clinical waste – all waste contaminated by body fluids, including saliva and blood
(3) Special waste – specific hazardous waste produced by dental practices:
    (a) Amalgam and amalgam capsules, containing mercury, which is toxic
    (b) Radiograph fixer and developer solutions, which are toxic
    (c) Lead foil from radiograph film packets, which is toxic
    (d) Partially discharged local anaesthetic cartridges, which is a medicine
    (e) Out-of-date emergency drugs, which are medicines

Clinical waste

The definition of clinical waste encompasses all of the following dental waste:

- Extracted teeth
- All disposable items contaminated with saliva or blood
- All disposable items which have come into contact with a patient
- All paper products used to clean the surgery after treating each patient
- All covers used during the treatment of each patient

To ensure safety, it is advisable to treat all waste products produced at the dental practice as contaminated and therefore as clinical waste, except those which are classed as 'special waste' and those which are obviously just office paper waste.

Clinical waste should be disposed of in yellow clinical waste sacks (in England), sealed appropriately to avoid spillage and collected by an authorised clinical waste handler.

Some clinical waste products are hazardous because of their ability to cause injury, especially those which are sharp:

- Scalpel blades
- Suture needles

- Glass local anaesthetic cartridges
- Glass ampoules of drugs

These items must be disposed of in rigid 'sharps bins', and should ideally be placed in these bins by the dentist, rather than the nurse, to avoid cross-infection and injury.

The Environmental Regulations with regard to clinical waste are summarised below:

- Environmental Protection Act 1990 – The duty of care is on the dentist to store clinical waste safely and securely, and to arrange for its correct disposal, by incineration.
- Environmental Protection Regulations 1991 – The collector of the waste must have a certificate of registration, and supply transfer notes which must be signed by both parties. Repeat collections can be covered by one note per year, and the transfer notes must be kept for two years.
- Carriage of Dangerous Goods Regulations 1996 – Updated from 1 January 2002 so that yellow sacks must be stored and transported in UN approved rigid containers, and sharps boxes must comply with BS 7320 standards.

Special waste

All waste classed as special is potentially harmful if not disposed of safely and in an appropriate manner, and further regulations exist in relation to them:

- Consignment notes must be used and signed at each stage of the disposal process
- These notes must be kept for three years
- An additional levy is payable by the producer of the waste, the dentist
- Radiographic developer and fixer may still be disposed of via the sewers with the written permission of the relevant water company
- Waste amalgam and capsules can no longer be posted to recycling companies, but they can still be collected from the dental premises if transfer and consignment notes are produced and signed accordingly, and the collector has the relevant certificate of registration

Ionising radiation legislation

The type of ionising radiation used in dentistry is X-rays, an invaluable tool for accurate diagnosis of some dental problems, but their misuse or overuse can be dangerous to staff and patients alike.

The health and safety regulations governing the safe use of ionising radiation in dentistry are laid out in the following:

- Ionising Radiation Regulations 1999 (IRR99)
- Ionising Radiation (Medical Exposure) Regulations 2000 (IRR(ME)2000)

The points relevant to dental nurses are discussed below.

It is a legal requirement for all dental practices to notify the Health and Safety Executive of the routine use of dental X-ray equipment, when first used as new equipment and on any change of ownership or move to new premises.

Formal appointments

The following appointments must be made in all practices:

- Legal person – usually senior dentist, designated to ensure compliance with both sets of regulations
- Radiation protection adviser – usually the company responsible for routine radiation survey, appointed in writing and available for advice in relation to IRR99 for staff and public safety
- Radiation protection supervisor – usually a dentist or an appropriately trained nurse who can assess risk, ensure precautions are taken to minimise problems, and understands the importance of complying with IRR99

Written rules and procedures

In relation to IRR(ME)2000, patients must be correctly identified as the ones required to undergo the ionising radiation exposure, as authorised by the dentist. This should prevent patient identification errors and can be carried out by all clinical and non-clinical staff.

Local rules

Local rules have been a requirement for many years, and must include all of the following:

- Name of appointed radiation protection supervisor (RPS)
- Identification of each controlled area where X-rays are used
- Warning signs at these areas stating that X-rays are in use
- Summary of working instructions for the controlled areas, especially the designation of 2 metre safety zones away from the X-ray machine tube head
- Summary of any contingency arrangements for machine failure
- Details of the dose investigation level

In accordance with good clinical practice and IRR99, it is now necessary for all practices to have carried out a risk assessment of the use of ionising radiation on the premises, which must be reviewed within a five-year period.

A quality assurance programme must also be in place to ensure that no unnecessary exposure occurs because of poor technique or lack of training.

Staff dose levels

Ideally, the following would be good practice:

- Pregnant staff should not be exposed to radiation during the pregnancy
- Dose levels are recommended to be kept below 1 mSv (millisievert) per year for all other staff
- The use of personal dosemeters should be encouraged as the norm, although they are legally required only if more than 50 OPTs (ortho-pantomographs) or 150 intra-oral exposures are occurring weekly

Patient exposure

- All exposures must be clinically justified, and recorded as such
- Doses must be kept as low as reasonably achievable (ALARA)
- Clinical audit should be carried out every 12 months to ensure these points are being followed

Dental nurses as operators

Nurses are legally allowed to carry out some duties with regard to dental radiography, as follows:

- If a dental nurse holds the Certificate in Dental Radiography, the following are allowed:
  - Select exposure times and doses
  - Position patient and machine for exposure
- If a dental nurse has been suitably trained within the practice (with documented instruction to prove it), or ideally holds the Certificate in Dental Nursing, the following are allowed:
  - Processing of films
  - Quality assurance programme running
  - Pressing the exposure button, in the presence and under the guidance of the clinician

All staff should be formally trained in the practice protocols and policies relating to accidental exposure and malfunction of ionising radiation equipment.

Security in the workplace

Although it is unlikely that dental practices will have just one or two members on the premises during normal working hours, this situation can occur during holiday times or when several staff are attending courses so no patient appointments are set. In the interests of staff safety, it would be advisable for the premises to be locked during these times so that staff are not left vulnerable and open to attack.

The majority of patients attending dental practices are regular attenders and their details will be held by the practice for treatment purposes. It is unlikely that any would risk assaulting staff members and being so easily and positively identified by staff or patients who witnessed anything untoward, but there are always exceptions.

The following points should be considered when attempting to improve the security of the workplace, and the safety of the staff:

- Ensure all staff are trained to be caring and sympathetic towards patients
- All visitors to the workplace should be treated with respect, and spoken to courteously
- Ensure all staff are aware of the practice protocols in relation to assault and violence towards themselves
- Ensure all patients are aware of these too
- Adequate alarm and security systems should be in place anyway because of the nature of dentistry – drugs on the premises, expensive equipment, computers
- No staff should be left alone on the premises unless outer doors are locked
- Keep key holder numbers to a minimum
- Ensure that all staff are made aware of all visitors, besides patients, who will be attending that day
- Ensure that accurate patient appointment lists are available for each day
- Ensure that alarms are set correctly at the end of each day, so that break-ins are detected immediately
- Ensure that all monies are banked daily, to remove the incentive for opportunist burglary

Activities

- Identify where the fire exits are in your practice.
- Determine the number and position of all fire extinguishers on the premises.
- Make a list of the contents of your first aid box. If any items are missing, whom should you tell?
- Make a list of the contents of your emergency drugs box. Try to find out the emergencies for which two items are used.
- Choose a substance commonly used in your surgery and try to fill out a COSHH evaluation sheet for it. Compare your answer to the sheet in the COSHH folder.
- Complete the following table with an X for used waste items in your practice.

	Domestic	Clinical	Special
Office paper			
Fixer solution			
Paper point			
Patient's bib			
Local anaesthetic cartridge			
Sound extracted tooth			
Mouthwash cup			
Suture needle			
Postal waste			
Saliva ejector			
Filled extracted tooth			

- Who is the RPS in your practice and where did you find the information?
- Determine your practice policy for a malfunctioning X-ray machine.
- Identify the methods used in your practice to minimise the risk of violence in the workplace.

Chapter Four

Control of Infection and Maintenance of Sterilisation

This chapter relates to unit DN02 'Prepare and maintain environments and instruments for clinical dental procedures'.

It covers the three elements:

- DN02.1 'Prepare environments for clinical dental procedures'
- DN02.2 'Maintain environments following clinical dental procedures'
- DN02.3 'Sterilise instruments for use in clinical dental procedures'

The following subjects are discussed in detail:

- Cleaning methods in relation to hands, the clinical environment, equipment and instruments, and the use of protective safety wear
- The use and role of disinfectants, autoclaves and sterilisation in dentistry

Basic principles of infection control

Infection control is one of the most important parts of an effective risk management programme to improve the quality and safety of patient care, and the occupational health of staff.

Control of cleanliness in the dental surgery environment is imperative for the following reasons:

- All patients have hundreds of oral bacteria present, even in health
- When diseases are present, they may also have fungi or viruses
- All instruments and equipment coming into contact with these could become contaminated by them
- If the instruments and equipment are not cleaned thoroughly between patients, contamination could easily be passed on to other patients and to staff
- The use of dental air turbines creates an aerosol which falls onto working surfaces and contaminates them

- If staff are also not personally clean but are taking part in close dental procedures, they can contaminate patients

A system of universal precautions has been adopted in healthcare work, which is designed to protect staff from inoculation and contamination risks, and to protect patients from being exposed to the risk of cross-infection. These precautions are summarised below:

(1) Apply good basic personal hygiene with regular appropriate hand washing
(2) Cover existing wounds with waterproof dressings
(3) Do not undertake invasive procedures if suffering from chronic skin lesions on the hands
(4) Wear appropriate gloves at all times when assisting, and discard after single use
(5) Avoid contamination with body fluids by wearing appropriate protective clothing, safety spectacles and masks
(6) Institute approved procedures for decontamination of instruments and equipment
(7) Apply good basic environmental cleaning procedures
(8) Clear up blood and other body fluid spillages promptly
(9) Follow correct procedure for safe disposal of contaminated waste and sharps
(10) Ensure all staff are aware of, understand and follow infection control policies and procedures
(11) Ensure all staff are fully vaccinated against hepatitis B, and that all childhood immunisations are up to date

Definitions of relevant terms

Infection – the communicating of a disease into the body by microorganisms
Pathogenic – capable of producing disease (as in pathogenic organisms)
Non-pathogenic – incapable of producing disease
Cross-infection – the transfer of infection from one person to another, for example from patient to staff and vice versa, and from patient to patient
Social cleanliness – clean to a socially acceptable standard, but not disinfected nor sterilised
Disinfection – the destruction of bacteria and fungi, but not spores or some viruses (technique usually involves use of chemicals)
Sterilisation – the process of killing all microorganisms and spores to produce asepsis (usually involves the use of high temperatures and pressure)
Asepsis – the absence of living pathogenic microorganisms

Introduction to microorganisms

A full understanding of the principles of infection control involves an understanding of the basics in relation to microbiology and pathology. Otherwise the actions of the microorganisms in the way they cause disease, and the body's defence mechanisms against them, cannot be appreciated.

There are four main types of microscopic organism involved in disease:

(1) Bacteria
(2) Viruses
(3) Fungi
(4) Protozoa

Protozoa have little clinical significance in dentistry.

Bacteria

- Bacteria are visible with a light microscope
- They are single cell organisms
- Their rigid wall determines their shape, and therefore their name, so circular bacteria are called 'cocci', rod-shaped are called 'bacilli', spiral shaped are 'spirochaetes' (Fig. 4.1)

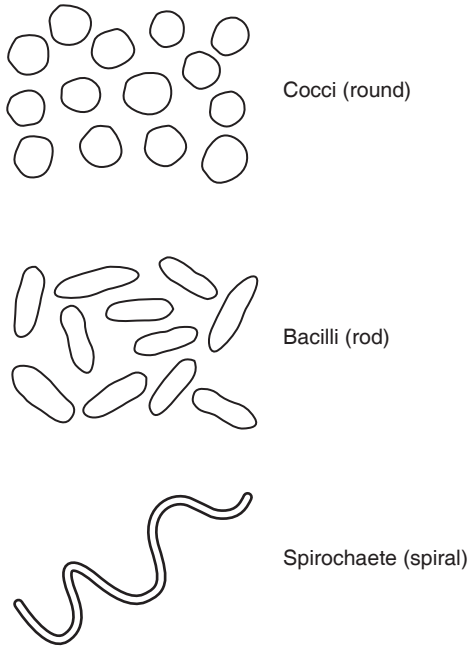


Fig. 4.1 Bacteria shapes.

- Survive as spores in unfavourable environments
- Active bacteria are prevented from reproducing and multiplying by bacteriostatic antibiotics
- They can also be killed by bactericidal antibiotics
- Spores can only be killed by the process of sterilisation

Viruses

- Viruses are so small that they are visible only using an electron microscope (so their correct definition would be an ultramicroorganism)
- They must live within the cells of other organisms (host cells)
- They exist as a protein capsule containing the necessary chemicals to reproduce within the host cell (Fig. 4.2)
- It is this protein capsule which causes our body to react against them, and it is unique for each virus
- Viruses are unaffected by antibiotics, but some can be treated using antiviral drugs
- Vaccines have been developed to provide immunity against some of the more serious viral infections (such as hepatitis, measles, mumps)

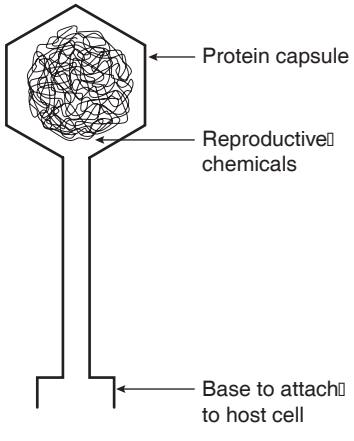


Fig. 4.2 Virus.

Fungi

- Fungi are larger than bacteria but still visible only with a microscope
- They are a type of microscopic plant which reproduces by budding or by spore production
- They grow by producing an extensive branching network across tissues (called hyphae)
- Only one fungus is clinically significant in dentistry, and that is the organism causing oral thrush (*Candida albicans*)
- *Candida albicans* is unaffected by antibiotics but can be treated with antifungal agents

Infections with various organisms which are of importance in dentistry are as follows:

AIDS – viral infection of immune system with human immunodeficiency virus
Chicken pox – viral infection of certain nerves with *Herpes varicella*
Cold sore – viral infection of lip with *Herpes labialis*
Dental caries – bacterial infection of tooth, especially with *Streptococcus mutans*
Glandular fever – viral infection of lymph glands with Epstein–Barr virus
Hepatitis – viral infection of liver with various organisms: hepatitis A, B, C, E or nonA-nonB
Meningitis – bacterial infection of brain coverings with meningococci
Mumps – viral infection of parotid salivary glands with paramyxovirus
Oral thrush – fungal infection of mouth with *Candida albicans*
Periodontitis – bacterial infection of periodontium, especially with *Porphyromonas gingivalis*
Shingles – viral infection of certain nerves with *Herpes zoster*

Response of body to infection

The body has three lines of defence against infection:

(1) An intact skin and mucous membrane to prevent the entry of the organisms initially, with surface secretions to immobilise them
(2) The inflammatory response initiated if the skin or mucous membrane is breached
(3) The immune response if infection takes hold, whereby the body's immune system is activated to fight the infection

If the organisms gain entry to the body, the five classic signs of acute inflammation will be seen:

(1) Heat
(2) Redness
(3) Swelling
(4) Pain
(5) Loss of function of the affected tissue

In fit and healthy patients, the microorganism is usually overcome by the inflammatory response. In very young or old patients, or those who are ill and debilitated, or when the infective organism is very virulent, help is often required to stop the invasion. This is the role of antibiotics, antivirals and antifungals.

Once the body has been exposed to an invasion by a microorganism, its immune system develops antibodies to the microorganism and antitoxins to the poisons it produces. This ensures that the organism and its toxins are

recognised in future, and this is immunity. Immunity can be naturally received from one's mother, or acquired either by vaccination or by exposure during illness.

The control of infection in the dental surgery is determined by the correct methods of carrying out the following:

- Cleaning of hands
- Use of protective wear
- Cleaning of the clinical environment
- Cleaning of equipment, handpieces and instruments

Cleaning of hands

This is the most important method of preventing cross-infection. Nails should be kept short and wounds covered to reduce the number of areas for microorganisms to contaminate. The minimum amount of jewellery should be worn, for the same reason.

The correct procedure for adequate cleaning is as follows:

(1) Turn on tap using foot or elbow control, to prevent contaminating tap
(2) Wet hands under running water of a suitable temperature
(3) Apply 'Hibiscrub' liquid soap from elbow operated dispenser, and wash all areas of hands thoroughly
(4) Nailbrushes are not advised unless they are autoclavable, as they can become contaminated with repeated use
(5) Rinse hands under running water, holding hands down
(6) Dry hands thoroughly, using disposable paper towels for single use
(7) Heavy duty gloves must be worn whenever cleaning of dirty instruments is being carried out
(8) Clinical gloves must be worn whenever patients are being treated, and discarded between patients

Use of protective wear

Protective clothing is worn to prevent staff from coming into contact with blood and other bodily fluids. It is a legal requirement for dental employers to provide the following protective clothing for their staff:

- Gloves, as discussed above
- High temperature wash uniform, to be worn in work area only
- Safety glasses, goggles or visors, to prevent contaminated material entering the eyes
- Face masks of surgical quality should be worn whenever dental handpieces or ultrasonic equipment is in use, to prevent the inhalation of aerosol contamination
- Plastic aprons, to be worn over the uniform when soiling may occur during dental or cleaning procedures, are also advised.

Cleaning of the clinical environment

The whole of the dental practice should be cleaned to a socially acceptable standard, but in clinical areas a far higher standard is necessary because these are the areas where the highest chance of cross-infection can occur. The practice should be kept clean, dry and well ventilated.

A written protocol for surgery cleaning should be available, which lays out the cleaning procedure in a logical manner and details how each item should be dealt with.

- All work surfaces should have the minimum items of equipment out for each procedure, and when these items are not in use they should be stored in drawers or cupboards to prevent aerosol contamination
- Areas should be designated as 'clean' or 'dirty' (zoning) so that dirty instruments after use are not placed where clean items should be
- Work surfaces should be cleaned after each session with a detergent solution or a suitable viricidal disinfectant
- Equipment likely to be contaminated such as chair and light controls, headrests, should be covered with impervious plastic sheets (such as clingfilm) and changed between patients
- Dental aspirators which exhaust externally will reduce the risk of aerosol contamination, they should be used routinely and flushed through daily with a recommended non-foaming disinfectant
- Clinical records should not be handled while gloves are being worn
- All non-metallic equipment should be wiped down at the end of each day with a chlorine release preparation (such as domestic bleach), which is particularly effective against viruses
- All intra-oral radiographs should be wiped with an isopropyl alcohol wipe before being handled with clean gloves and taken for development

Cleaning of equipment, handpieces and instruments

Equipment, handpieces and instruments are potentially the most infective of all items, as they are used in the patient's mouth.

- Wherever possible, disposable items should be used once only
- All items which are not disposable (most instruments, handpieces) should be sterilised in an autoclave
- Instruments should be scrubbed with detergent to remove visible solid debris, then placed in an ultrasonic bath to remove smaller particles
- Only then should these items be autoclaved, as residual solid debris will harbour microorganisms and spores, and shield them from sterilisation
- Handpieces must not be placed in an ultrasonic bath, and the manufacturer's instructions should be consulted regarding advice on oiling after sterilisation

- Sterilised instruments should be stored in lidded trays in cupboards, or in sealed pouches until next used
- All clinical waste should be correctly disposed of, as discussed in Chapter 3

Autoclaves

Autoclaves are invaluable items of equipment in the clinical setting, where some non-disposable items can be sterilised to ensure all pathogenic organisms and spores are killed.

Two types are in regular use, the difference being that some operate under vacuum. 'N' type autoclaves operate thus:

- Heat to 134°C and hold for 3 minutes, under 2.25 bar pressure
- Cycle lasts for 15 to 20 minutes, depending on make
- Suitable for unwrapped, solid instruments
- Can hold several trays of laid out instruments for each cycle
- No vacuum

'S' type autoclaves operate thus:

- Same temperature and pressure
- Suitable for wrapped instruments and those with narrow lumens
- Work under vacuum

An autoclave is illustrated in Fig. 4.3.

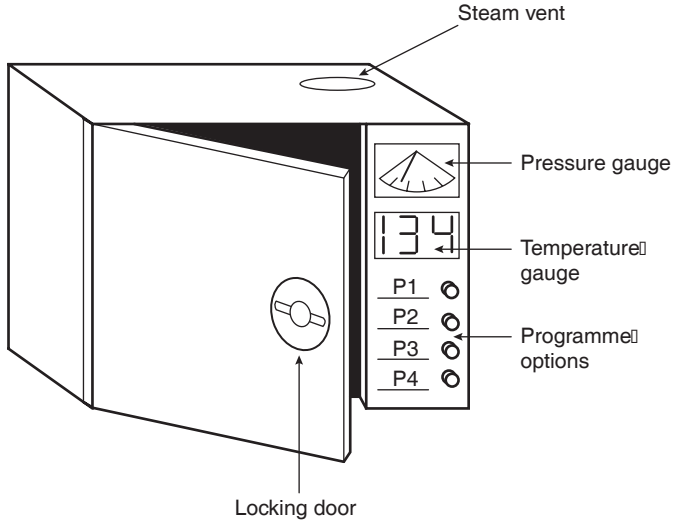


Fig. 4.3 Autoclave.

Whichever type is used, items should have been scrubbed and placed in an ultrasonic bath first to ensure that no infective organisms lie protected beneath any remaining debris. Sterilisation processes may fail otherwise.

Different methods of sterilisation have been tried over the years, such as hot air ovens, water boilers and ultraviolet (UV) lights, but current recommendations do not advise their use in the clinical setting.

Under current health and safety guidelines, the following six tests must be carried out when using autoclaves:

(1) Daily test to be carried out during first cycle of the day, where a log record is kept of temperature, pressure and time intervals of the cycle
(2) Water should be drained from the reservoir chamber daily
(3) Weekly test to inspect door seal and that door safety devices operate correctly, so that door cannot be opened during cycle
(4) Annual test of correct operation by an authorised person
(5) Periodic examination by an authorised organisation to ensure that autoclave conforms to Pressure Systems Safety Regulations
(6) Surgery insurance policy should include third party liability cover for the use of autoclaves

Protection of staff by immunisation

With the close nature of dental treatment, staff are likely to come into direct contact with several serious diseases, some of which can be fatal. It is necessary that all staff are immunised (vaccinated) against the following infections:

Diptheria – normally received routinely during childhood
Hepatitis B – received as occupational hazard, blood test required to prove seroconversion and ensure immunity, boosters required every five years
Pertussis – normally received routinely during infancy
Poliomyelitis – normally received routinely during childhood
Rubella – normally received routinely during childhood, as part of MMR
Tetanus – normally received routinely during childhood, and can be boosted
Tuberculosis – received routinely after negative Heaf test, lasts 15 years

Any staff not immunised against any of the above should not be working in clinical areas with patients.

Needle-stick injury guidelines

Nearly every procedure in dentistry involves the use of sharp items, whether it is local anaesthetic needles, other needles, sharp instruments or scalpel blades. Care during their use is imperative to avoid contaminated sharps injury to a member of staff. A safety protocol, if followed by all, should avoid this type of incident:

- Ideally, the dentist using the sharp instrument should be responsible for its safe placement in a sharps bin
- Local anaesthetic needles should be resheathed using a needle holder
- All other needles should be left unsheathed and placed directly into the sharps bin
- Extracted teeth should also be treated as sharps, and placed in the sharps bin, except those containing amalgam fillings, which should be treated as special waste and placed with all waste amalgam for collection
- Heavy duty gloves and protective clothing should be worn when instruments are being scrubbed prior to being autoclaved

If, despite these guidelines, a sharps injury does occur, then the correct procedure must be followed for the safety of the staff member involved.

The potential seriousness of a sharps injury underlines the importance of having accurate and up to date medical history forms completed by patients at every recall. However, if all patients are assumed to be infective, and cross-infection control is carried out accordingly, a two-tier system is not allowed to develop whereby those known to be infectious are treated with a higher standard of infection control. There is no place in proper infection control standards for a system that knowingly has a 'higher' level of cleanliness for those patients who are known to be infectious, and an accepted 'lower' standard for those who are assumed to be non-infectious.

Sharps injury procedure

(1) Stop treatment immediately and attend to the wound
(2) Squeeze the wound to encourage bleeding, but do not suck wound
(3) Wash area with soap and running water, then dry and cover with a waterproof dressing
(4) Note the name, address and contact details of source patient, so that medical history can be checked immediately
(5) Complete accident book
(6) Report the incident to the senior dentist, and own general practitioner
(7) Consultant microbiologist at local hospital must be contacted immediately if the source patient is a known or suspected HIV carrier, as emergency treatment is required to commence within 1 hour of the injury

Activities

- List the diseases against which you are vaccinated.
- Over a week, list the infections that you have seen identified in the patients attending your practice.
- Choose three cleaning agents used in your practice during infection control procedures and try to find out the active ingredients that they contain.
- Record the operating conditions for all the autoclaves at your practice.
- Identify where the accident book is kept at your practice.

Chapter Five

Oral Diseases

This chapter relates to part of unit DN15 'Provide chairside support during the prevention and control of periodontal disease and caries'. The restoration of cavities is covered in Chapter 9.

The first two elements are covered here:

- DN15.1 'Prepare patients, environments, equipment and materials for the prevention and control of periodontal disease and caries'
- DN15.2 'Provide chairside support during the prevention of periodontal disease and caries'

The chapter gives details of the causes of caries, its relationship to the diet, and its prevention especially in relation to fluoride.

Similarly, periodontal diseases are discussed in relation to causes of the various types, their prevention, and non-surgical and surgical treatment of gingivitis and periodontitis.

A section on oral cancer has been included in this chapter.

Tooth morphology and dental anatomy are covered in Chapter 2, and details of oral health promotion in relation to the prevention of caries and periodontal diseases are given in Chapter 6.

Dental Caries

Dental caries (tooth decay) is a bacterial disease of the mineralised tissues of the tooth, where the strong mineral components are demineralised (dissolved) and the softer organic component is broken down to form cavities.

There are many different types of bacteria normally present in the mouth, some of those associated with caries are:

- *Streptococcus mutans*
- *Streptococcus sanguis*
- Some *Lactobacilli*
- Some *Actinomyces*

These bacteria use foods taken into the mouth as a source for their own nutrition. They digest food debris and produce weak organic acids as a by-product (for example, lactic acid). The acids are responsible for attacking the

mineral structure of the teeth and causing their demineralisation. This can be summarised by the acidogenic theory of caries, which was first described in 1882:

Bacteria and food → Weak organic acids → Demineralisation and cavities → Dental caries

Effect of diet on caries

Certain foods produce more acids than others, the most productive being some types of carbohydrate which are processed during food preparation. These tend to contain non-milk extrinsic sugars (NMESs), which are sugars not naturally present in the food but added during preparation, manufacture or processing for consumption. The commonest ones are sucrose and glucose (sometimes called dextrose).

Other types of sugar, which are harmless are:

- Intrinsic sugars which occur naturally in foods, such as fructose in fruit
- Milk extrinsic sugars, especially lactose

Because carbohydrates tend to be the cheapest food source of readily available energy they are consumed in great quantities in most households. The higher the processed carbohydrate/NMES content of the diet, the greater the tendency to develop caries.

Acidic drinks, especially pure fruit juices and carbonated soft drinks, are the other source of acids and/or NMESs which cause dental caries.

Role of dental plaque

The bacteria are effective at causing tooth demineralisation because they attach themselves to the teeth by incorporating themselves into a sticky protein-containing film called dental plaque. This film forms at the gingival margin and in stagnation areas within two hours of the teeth being cleaned. Its non-removal at the gingival margins is associated with gingivitis and periodontal disease.

The bacteria produce sticky sugars (polysaccharides) themselves during food debris digestion, which are also a source of weak organic acids. However, the process of acid production increases considerably when carbohydrates containing NMESs are taken orally.

Method of demineralisation

The oral cavity is bathed in saliva, which helps to create an environment which is neither acidic nor alkaline. This can be measured as a pH value, where neutral is measured as 7, acidic conditions range from 6 down to 1, and alkaline conditions from 8 up to 14.

- The oral cavity is normally pH 7
- The pH drops as bacterial action produces weak organic acids
- This occurs within minutes of carbohydrates being taken orally
- The critical pH is 5.5, because at this point conditions are acidic enough to cause tooth demineralisation
- It takes up to 2 hours for the pH to rise to 7 again
- This occurs as the minerals contained in saliva neutralise the acids
- So, more frequent carbohydrate consumption will cause longer periods of lowered pH, and more chance of cavities being formed
- Any areas where plaque accumulates and is not removed by the normal self-cleansing actions of saliva and the oral soft tissues, are more prone to prolonged acid attack
- These areas are called stagnation areas, and include occlusal pits and fissures, interproximal areas, and ledges on poor dental restorations

Method of cavity formation

(1) The acid attack follows the prism structure of the enamel, and also any exposed cementum
(2) Demineralisation occurs, and if prolonged or frequent enough to prevent the enamel undergoing remineralisation and repair, the mineral structure is eventually destroyed
(3) Areas of remineralisation and repair are often seen as brown marks at contact points, following the extraction or loss of a neighbouring tooth
(4) Otherwise, caries progresses deeper in the enamel and reaches the amelodentinal junction (ADJ), the point where the dentine layer of the tooth begins
(5) Odontoblast cells at the ADJ react to the advancing bacterial attack by forming 'secondary dentine' in an attempt to protect the underlying pulp of the tooth
(6) However, once the caries reaches dentine, it progresses more rapidly due to the hollow tubular nature of this tissue
(7) The lower mineral content of dentine also makes it less resistant to acid attack
(8) The nerve fibrils lying in the dentinal tubules become stimulated, the pulp becomes inflamed and reversible pulpitis develops
(9) The patient will experience temperature sensitivity and pain associated with chewing
(10) At this point, the caries can still be removed and the tooth restored to full function by placing a filling in the cavity
(11) If not, then the progressing caries front causes the dentine to shrink in on itself, and the overlying enamel becomes brittle and weak as it loses its support
(12) Normal occlusal forces are often enough to fracture pieces off, and a cavity is formed, which exposes more dentine to the oral cavity
(13) Secondary dentine production becomes outstripped now by the speed of the carious attack towards the pulp

(14) The patient will experience more pain and eventually lose the function of the tooth
(15) The pulpitis becomes irreversible once the caries penetrates close to the pulp chamber, the pain becomes constant and tends to disturb the patient's sleep with its severity
(16) Once the pulp chamber is breached, a carious exposure of the contents occurs
(17) The tooth can now be treated only by endodontics or extraction
(18) As the pulp contents become infected and die, necrotic tissue and bacteria flow out of the apical foramen into the surrounding periapical tissue
(19) They become trapped here and develop quickly into an acute periapical abscess, with consequent swelling, severe pain and malaise, or develop slowly into a painless chronic abscess

The process of cavity formation is shown in Fig. 5.1.

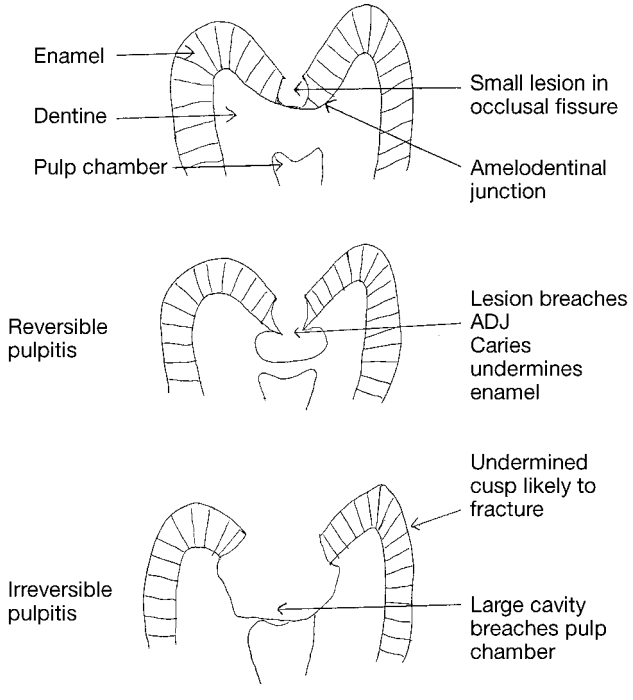


Fig. 5.1 Cavity formation.

Role of saliva in oral health

The oral soft tissues in health are constantly bathed in saliva, a watery secretion from the three pairs of major salivary glands, and also from numerous minor salivary glands present in the cheeks and lips.

Saliva consists of the following:

- Water as a transport agent
- Inorganic ions such as calcium and phosphate
- Digestive enzyme, ptyalin (salivary amylase)
- Antibodies (immunoglobulins)
- White blood cells

These constituents have the following functions:

- The ions are released as required to act as buffering agents to help control the pH of the oral environment by neutralising acids
- High ion content produces thick, stringy saliva which gives teeth good caries protection but allows much calculus formation to occur
- Low ion content produces watery saliva and low calculus formation, but gives poor protection against caries
- The watery nature of the saliva helps the mouth to self-cleanse by dislodging food debris from around the teeth before being swallowed
- It also moistens food and the oral soft tissues, allowing speech and swallowing (deglutition) to occur
- It also allows food ingredients to be dissolved so that they are able to be tasted, as the taste buds on the tongue are stimulated only by dissolved substances
- Both antibodies and white blood cells are present for defence purposes, as they are released to help fight oral infections

Reduced salivary flow

This has important consequences for the oral health team, for the following reasons:

- Reduced self-cleansing and buffering increases the risk of caries and periodontal disease
- Poor lubrication will cause difficulty in swallowing and speaking
- Reduced flow will affect taste capabilities
- Poor self-cleansing will leave food debris to cause halitosis (bad breath)
- Reduced flow will hinder the natural retention of dentures

Reduced salivary flow produces the condition xerostomia, or dry mouth. It can be caused by the following:

- Normal age-related changes to the salivary glands
- Dehydration
- Some autoimmune disorders, especially Sjögren's syndrome
- Several drugs, including:
  - Diuretics
  - Some antidepressants
  - Beta blockers

The opposite condition of excessive saliva production is called ptyalism, and is often seen in patients with periodontal disease. It can also occur during pregnancy and in patients suffering from Parkinson's disease.

Detection of caries

Early detection of caries is of paramount importance if teeth are to have any chance of minimal treatment. Early detection reduces the chance of experiencing dental pain and increases the chances of saving the tooth. Patients are therefore advised to attend for dental examinations at a suitable frequency in relation to their caries experience. The higher their caries incidence, the more frequently they should attend.

Methods of detection

- Close visible inspection by the dentist, using a bright examination light and a mouth mirror to reflect the light onto less accessible areas
- Use of various dental probes to detect stickiness of suspicious tooth areas, especially interproximal areas using a Briault probe
- Periodical horizontal bitewing radiographs to show characteristic shadowing of caries interproximally, beneath restorations, and in occlusal fissures
- Transillumination of anterior teeth using a composite curing lamp shone through the teeth and viewed with a mirror to detect interproximal lesions
- Caries dyes wiped into prepared cavities to stain any residual caries and allow its removal

Prevention of caries

There are three main areas of prevention available:

(1) Modification of diet – to include fewer cariogenic foods and drinks and to reduce their frequency of intake
(2) Control of bacterial plaque – to practise its regular removal by using good oral hygiene techniques
(3) Increase tooth resistance to acid attack – by incorporating fluoride into its structure

The first two areas are dealt with in Chapter 6, but the third area is discussed in detail here.

Fluoride

Fluoride is the single most important salt in strengthening teeth and making them less susceptible to acid attack and damage by dental caries. It occurs naturally in water in some areas, and is controversially added artificially to water supplies in other areas, water fluoridation, to aid in the reduction of caries incidence.

Action of fluoride

- Can be taken into the crystalline structure of enamel to form fluorapatite crystals
- Replaces normal hydroxyapatite crystal structure with fluorapatite crystals
- Fluorapatite can resist acid attack to a greater degree than hydroxyapatite and thereby reduces the solubility of the enamel in acid
- Fluoride also has an inhibitory effect on the feeding rate of oral bacteria
- This effect produces fewer weak acids and polysaccharides to initiate the carious attack

The protective effect of fluoride on the teeth is best after they have formed and erupted into the oral cavity. Many oral hygiene products are now available which contain fluoride to allow their regular use by the general public.

Topical fluorides

These are administered externally to the tooth surface, either by the patient or by the dental team, to provide a continual source of fluoride directly onto the enamel.

For use by the patient:

- Fluoride toothpastes containing either 600 ppm (parts per million) for use by young children, or 1000 ppm to 1500 ppm for use by adults
- Twice-daily brushing is advised to achieve maximum benefits
- Patients should be advised not to rinse out after brushing, as it washes the fluoride away and is less effective
- Fluoride mouthwashes for regular use by those with a high caries risk, and during orthodontic treatment
- Dental floss and tape impregnated with fluoride, for delivery to the interproximal areas

For use by the dental team:

- Fluoride gels applied in trays over all teeth for several minutes, administered at each examination appointment, especially useful for patients with special needs and high caries risk
- Fluoride varnish applied to individual teeth showing areas of previous acid attack

Systemic fluoride

Systemic fluoride is ingested and then taken from the digestive tract to be incorporated into the enamel structure. It can be supplied in the following ways:

- Fluoridated water supplies by the addition of the optimum concentration of 1 ppm to drinking water

- Naturally occurring fluoridated water supplies, in some parts of the world
- Addition of fluoride to table salt, but not in the UK
- Fluoride drops and tablets, available on prescription to children, to be taken daily during the period of tooth development (up to 13 years); doses vary with age and amount of fluoride in water supply
- Systemic fluoride is usually reserved for those with medical or physical conditions which would make dental treatment difficult, or for those whose general health would suffer if caries occurred.

Enamel fluorosis

Enamel fluorosis is a condition which occurs when excessive fluoride is ingested during enamel formation. The teeth erupt with mottled white areas in the enamel surface which vary in severity but can be unsightly. Restorative techniques are available to mask the areas but the condition is prevented by judicious advice regarding fluoride:

- Children below 8 years should have toothbrushing supervised by an adult, to prevent ingestion of toothpaste
- Amount of toothpaste should be kept to a minimum and allowed just twice daily
- Children should spit toothpaste out after use, not swallow it
- Fluoride supplements should be prescribed only as necessary, and at the correct dosage dependent on local water fluoridation levels
- Knowledge of any local water fluoridation levels

Periodontal disease

Periodontal disease is the second commonest disease affecting the oral cavity, the first being dental caries. The term 'periodontal disease' covers a group of diseases which affect the supporting structures of the teeth, known as the periodontium:

- The gingivae (gums)
- The periodontal ligament
- The alveolar bone

Periodontal disease is the main cause of tooth loss in adults.

Periodontium in health

- Tooth sits in socket of alveolar bone, which surrounds the roots of all teeth
- Tooth attached to bone by the fibres of the periodontal membrane (ligament), running from bone to cementum overlying root dentine
- Bone and periodontal membrane covered by the mucous membrane of the gingivae lining the alveolar ridges

- Gingivae is attached to neck of tooth at a specialised site called the junctional epithelium
- In health, a gingival crevice no deeper than 2 mm exists, to form a 'gutter' around each tooth
- Other periodontal membrane fibres run from the bone crest to the neck of the tooth, and from the neck of the tooth into the gingival papilla
- Appearance of healthy periodontium thus:
  - Pink colour, often stippled like orange peel
  - Tight gingival cuff around tooth
  - Gingival crevice present, no deeper than 2 mm
  - No bleeding occurs when crevice is gently probed during dental examination
  - Knife-edge papillae between teeth
- Subgingivally, periodontal ligament and alveolar bone are intact

The periodontium in health is shown in Fig. 5.2.

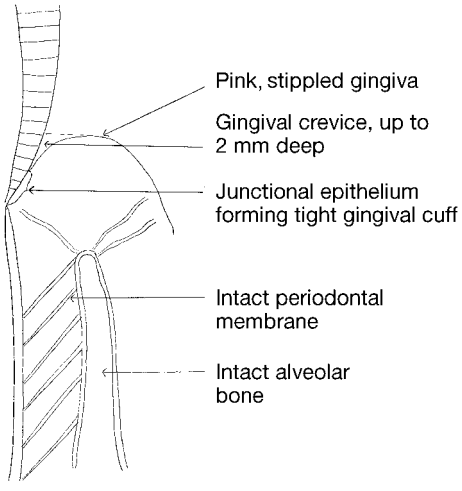


Fig. 5.2 Periodontium in health.

The sole cause of periodontal disease is the presence and accumulation of dental plaque around the gingival margins of the teeth.

Dental plaque is a combination of saliva and oral bacteria, which form a sticky film on the tooth surface and allows food debris to become incorporated into its structure. It tends to form initially at the gingival margin because this area is not easily self-cleansed by salivary flow, or by the tongue and soft tissue movements.

Sequence of events leading to gingivitis

(1) Bacteria within plaque use food debris to nourish themselves and allow the colony to increase in size

(2) Bacteria produce toxic by-products as they digest food
(3) These irritate the gingivae in direct contact, and cause inflammation (chronic gingivitis)
(4) The inflamed gingivae swell and become reddened, and form false pockets around the necks of the teeth
(5) False pockets allow more plaque to develop as self-cleansing becomes impossible, and the plaque then extends below the gingival margin
(6) The continued action of saliva on plaque allows inorganic ions to be incorporated into the plaque structure, and dental calculus (tartar) forms
(7) Calculus formation can occur above the gingival margin, and is called supra-gingival calculus which is yellow in colour
(8) It can also occur below the gingival margin, and is then called sub-gingival calculus, which is brown/black in colour owing to the incorporation of blood pigments
(9) The calculus has a rough surface, allowing more plaque to form over it, and also irritating the gingivae further
(10) The abrasion of the calculus and the chemical action of the toxins causes painless micro-ulceration of the gingivae, and they will then bleed on touching or dental probing
(11) The visible appearance and bleeding on probing of the gingivae are the classic diagnostic signs of chronic gingivitis (Fig. 5.3)

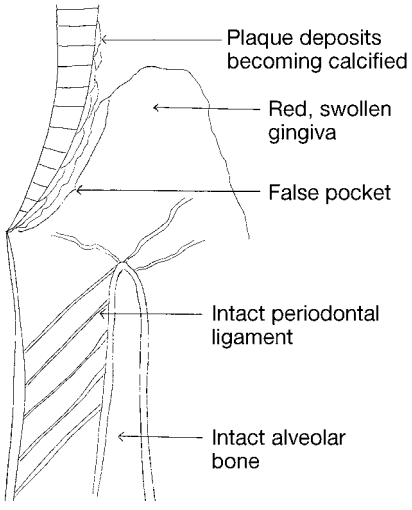


Fig. 5.3 Chronic gingivitis.

Sequence of events leading to periodontitis

- Non-treatment of chronic gingivitis allows the toxins to build up and eventually enter the underlying gingivial tissues through the micro-ulcerated areas

- The toxins then gradually destroy the periodontal ligament so that a true pocket forms, as the periodontal attachment to the tooth is lost from the neck of the tooth and down the side of the root
- Further plaque develops and becomes mineralised, causing further irritation and more toxin infiltration
- The toxins eventually begin destroying the alveolar bone, and the tooth loosens in its socket and is eventually lost (Fig. 5.4)

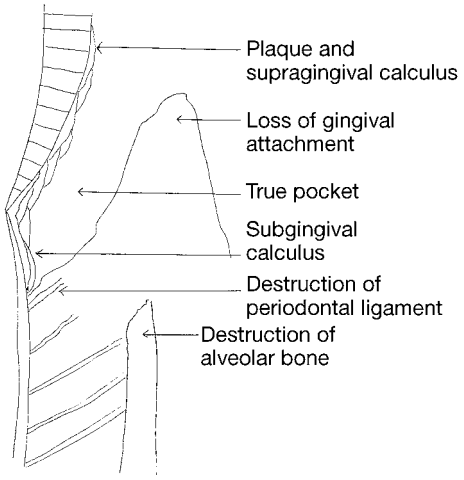


Fig. 5.4 Chronic periodontitis.

Gingivitis can begin in childhood, but periodontitis can take many years to result in tooth loss. It is usually painless and therefore can be present undetected for years by the patient unless it is diagnosed by a dentist.

Periodontal disease also tends to have active phases, where much tissue destruction occurs, and quiescent phases with little destructive activity.

Plaque retention factors

Dental plaque forms in all mouths within hours of the teeth being cleaned. Periodontal disease is caused by plaque action on the periodontium, but its accumulation can be exacerbated by several factors:

- Poor oral hygiene due to apathy
- Malaligned teeth causing stagnation areas
- Mouth breathing or incompetent lip seal, allowing drying of oral soft tissues
- Small oral aperture, making adequate toothbrushing difficult
- Poor dentistry, with overhanging restorations and inadequate contact points creating stagnation areas
- Poorly designed orthodontic or prosthetic appliances, causing stagnation areas

Once present, the extent of the periodontal disease can be exacerbated by any of the following factors:

- Smoking
- Hormonal imbalances such as pregnancy and puberty
- Medical conditions which compromise a patient's immune response, such as:
  - Diabetes
  - Vitamin C deficiency
  - Leukaemia
  - Blood disorders
  - Stress
- Drugs which cause overgrowth of the gingival tissues (gingival hyperplasia), such as:
  - Phenytoin for the control of epilepsy
  - Nifedipine for the control of hypertension
  - Cyclosporin for the prevention of organ transplant rejection

Diagnosis of periodontal disease

As with all dental conditions, a thorough and accurate medical history is imperative. There are many clinical warning signs which should be looked for at routine dental examinations to determine the presence of chronic gingivitis or periodontitis.

Chronic gingivitis

Early onset:

- Gingivae bleed on brushing
- Gingivae red and swollen (hyperplastic)
- Plaque visible at gingival margins
- Also detected by use of disclosing solution
- Halitosis (bad breath)

Established:

- Pus can be expressed from gingival crevice

Chronic periodontitis

- Periodontal probing detects pockets deeper than 2 mm
- Presence of supra- and subgingival calculus
- Radiographic evidence of alveolar bone loss, and deeper periodontal pockets
- Mobility of teeth

The periodontal pockets can be probed by several types of graduated

instrument, to record the depth in millimetres of any pockets present. Usual instrument types include:

- CPITN probe (Community Periodontal Index of Treatment Need)
- WHO probe (World Health Organisation)
- Pocket measuring probe (Fig. 5.5)

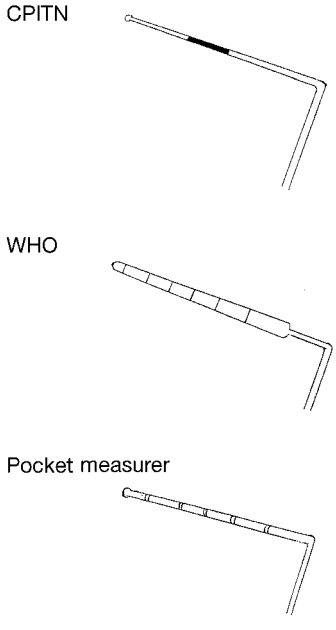


Fig. 5.5 Periodontal probes.

Non-surgical treatment of periodontal disease

Prevention is always better than cure, so sound oral health instruction to prevent plaque accumulation in the first instance is by far the best course of action. Plaque suppressants are available, the commonest being chlorhexidene, but its use is advised only on a short-term basis owing to its staining capabilities. With chronic gingivitis, the removal of all plaque and the reinforcement of oral hygiene instructions should bring about a complete resolution of the problem. See Chapter 6 for details.

The oral health message needs to be reinforced regularly if problems persist, and the advice given will be different for different age groups.

Supra-gingival calculus

If calculus is present, it needs to be professionally removed by either the dentist or the hygienist to allow healing of the periodontium. This is achieved for supragingival calculus by scaling and polishing.

A variety of hand scaling instruments are in use to remove supragingival calculus:

- Sickle scaler
- Cushing's push scaler
- Jaquette scaler (Fig. 5.6)

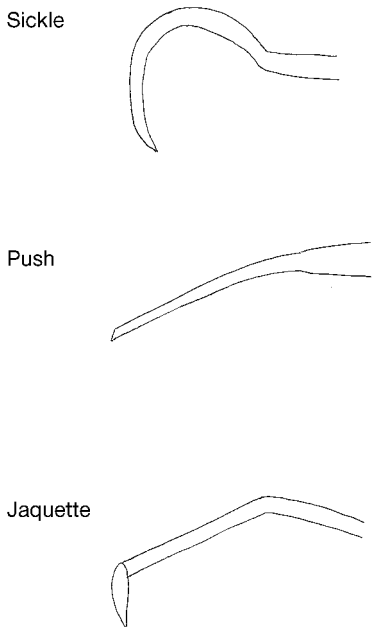


Fig. 5.6 Hand scalers.

Ultrasonic scalers are also available with differing tips.

All these instruments are used to dislodge calculus from the tooth surface. Scaling by hand is tiring for the operator but gives superb tactile sensation, so specks of residual calculus are detectable.

The use of an ultrasonic scaler is less tiring and faster, but the cold water spray required for its action can be uncomfortable for patients with sensitive teeth.

Once all the calculus has been removed, the teeth are polished with prophylactic paste and a rubber polishing cup in the slow handpiece. This gives a smooth tooth surface and therefore slows down further plaque accumulation.

Subgingival calculus

With chronic periodontitis, any bone loss is permanent, but if subgingival calculus is removed thoroughly and good oral hygiene is then maintained, there is every chance that the periodontal ligament will reattach and periodontal pockets will heal.

Again, several instruments are available for subgingival calculus removal:

- Subgingival curette
- Periodontal hoe
- Ultrasonic scaler (Fig. 5.7)

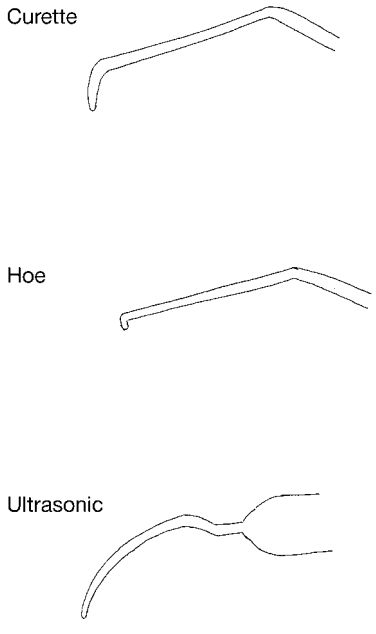


Fig. 5.7 Subgingival instruments.

The shanks of the curettes and hoes are long enough to pass deep into periodontal pockets and reach the subgingival calculus. This and the contaminated layer of cementum beneath are then scraped off and removed from the pockets by both aspiration and irrigation. This is called subgingival debridement. Healing of the periodontium can then occur, with reattachment of the junctional epithelium and the elimination of periodontal pockets.

Scaling subgingivally sometimes has to be carried out under local anaesthesia, as the procedure can be quite painful for some patients.

Continued periodontal health is dependent to a large degree on the cooperation and motivation of the patient to maintain a good standard of oral hygiene. Of all the exacerbating factors, smoking plays the largest part in the failure of periodontal treatment and the ultimate loss of teeth.

Surgical treatment of periodontal disease

Gingivectomy

Sometimes, successful treatment of periodontal disease is hindered by the failure of established false pockets to be eliminated. These can be surgically

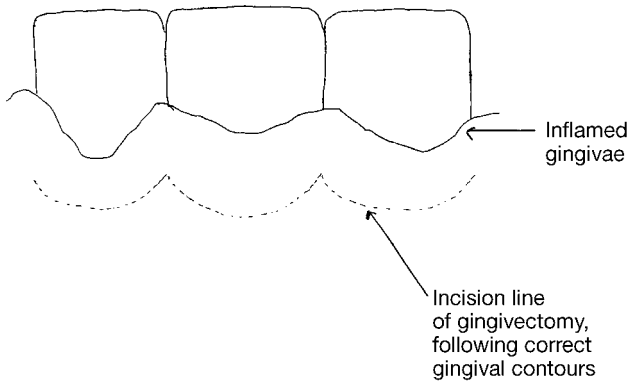


Fig. 5.8 Gingivectomy.

eliminated by cutting off the hyperplastic gingivae level with the point of epithelial reattachment, a procedure called gingivectomy (Fig. 5.8).

The point of reattachment is marked on the gingivae, then all hyperplastic tissue is removed with a Blake's knife. This leaves a raw wound which is covered with a zinc oxide and eugenol dressing (such as Coepak®), to aid healing.

Gingivectomy allows thorough cleaning of the teeth surfaces once exposed, and thus prevents further plaque accumulation and calculus formation. The procedure is often carried out to remove drug-induced hyperplastic tissue too.

Surgical recontouring of the gingivae can also be carried out once periodontal health has been achieved, to aid thorough cleansing of the area. This is called gingivoplasty and is often carried out using an electrosurgery unit, which coagulates cut blood vessels at the same time.

Flap surgery

Often, only certain teeth are affected by periodontal disease, rather than the whole dentition. These localised areas of disease can be individually investigated by raising a part or full thickness surgical flap of mucoperiosteal tissue, to expose the persistent periodontal pockets to direct vision and cleaning. Any granulation tissue present, due to the body's attempts to heal the area itself, is also removed.

Contaminated cementum, subgingival calculus and toxin-impregnated soft tissue are all removed before the flap is sutured back into place to allow full healing (Fig. 5.9).

Some operators make use of local delivery antibiotics in these areas to destroy bacteria and aid healing. These are available as gels (such as minocycline) which are squirted into the pocket bases, or more long-term products with cellulose chips impregnated with slow-release antibiotics (such as Periochip®).

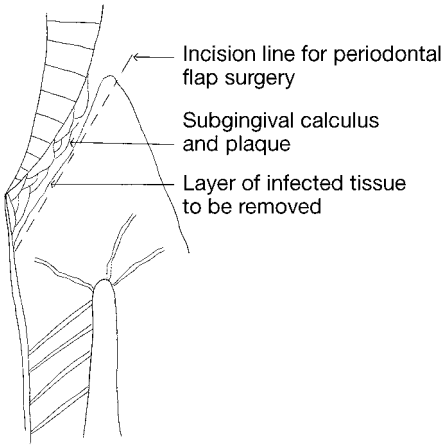


Fig. 5.9 Flap surgery.

Other periodontal conditions

Acute necrotising ulcerative gingivitis

- Often occurs in teenagers and young adults
- Directly related to poor oral hygiene
- Sudden onset
- Very painful gingivitis
- Ulceration of gingival papillae
- Halitosis
- Is a specific infection with either *Treponema vincentii* or *Bacillus fusiformis*
- Treated with antibiotic metronidazole
- Followed by thorough scaling and oral hygiene instruction
- Short course of chlorhexidene mouthwash

Lateral periodontal abscess

- Acute abscess formation in an existing periodontal pocket
- Occurs on the side of the root, that is laterally, of a vital tooth
- Treated by draining the pus present
- Thorough scaling of the area
- Local administration of metronidazole into pocket
- Oral hygiene instruction

Sub-acute pericoronitis

- Infection of the operculum (gum flap) of a partially erupted tooth
- Especially occurs with lower third molars

- Due to poor oral hygiene of the operculum, often coupled with trauma from the opposing tooth
- Treated by irrigating food debris from under operculum
- Oral hygiene instruction and advice on use of mouthwashes
- Broad spectrum antibiotics if patient has raised temperature
- Operculectomy if recurs (surgical removal of operculum)
- Or extraction of the opposing tooth to prevent further soft tissue trauma

Oral cancer

Cancer can occur in the soft tissues of the mouth, in the salivary glands, or in the bones associated with the oral cavity. Ninety per cent of oral cancers affect the soft tissues of the mouth, predominantly as **squamous cell carcinoma** (SCC).

The suggested causative factors of SCC are:

- Tobacco habits, as all contain chemicals which can cause cancer (carcinogens)
- High alcohol consumption, as alcohol acts as a solvent for the carcinogens and allows easier entry into the tissues
- Smoking and alcohol together are the highest risk factors possible
- Sunlight, in fair skinned people, can cause cancer of the lower lip
- Research is ongoing into the effects of diet on oral cancer, especially in relation to low vitamin A and iron intake, high fat and red meat intake
- Genetic predisposition to cancer

The effects of smoking on general health are well known, and include increased risk of several types of cancer, and heart disease, but the effects on oral health are not so well advertised. They are:

- 2500 new cases of oral cancer per year in the UK
- Development of oral white patches (leukoplakia) which are capable of becoming malignant
- Periodontal disease and tooth loss
- Impaired oral wound healing
- Tendency to post-extraction infections ('dry socket')
- Stained teeth

Smoking causes 20% of all deaths in the UK (Department of Health, 1998) and there is evidence to suggest that more women and more teenagers are starting to smoke nowadays. Ethnic groups also chew tobacco paan and betel nuts, both habits having a known link to oral cancer.

Signs and symptoms of SCC are:

- A painless ulcer or lump in the mouth which fails to heal within 3 to 6 weeks

- Usually associated with the tongue or the floor of the mouth
- A white or red patch on the buccal mucosa or tongue

A blue dye is being developed which stains cancerous lesions and is invaluable for detecting early lesions which are often invisible to the naked eye. Early detection and referral for treatment increases the survival rate, but even then there is only a 55% five-year survival rate.

Thus, as with all cancers, prevention is better than cure and the dental team has an important role to play in the education of high-risk patients.

Reference

Department of Health (1998) *Smoking Kills*. White Paper. London: The Stationery Office.

Activities

- Keep a record for 1 day of all that you eat and drink, and determine how many 'acid attacks' you experienced.
- Use a disclosing tablet on yourself and a colleague to determine any areas of plaque accumulation that you both have. Determine how you will reduce your plaque experience.
- Think back to any patients you have seen who suffer from reduced salivary flow. Determine if any instances could be drug related.
- Identify the caries detection methods that you have seen used in your practice.
- List the various fluoride-containing products that you have seen in your practice.
- Identify the methods used to record the incidence of periodontal disease for your practice patients.
- List the instruments that you have seen used for calculus removal.
- Think back to a case of subacute pericoronitis that you have seen. Record the patient's age, which tooth was affected and what treatment was provided.
- Make a list of the points of advice that your practice gives to patients in relation to oral cancer.

Chapter Six

Oral Health Motivation, Protection and Promotion

This chapter relates to unit DN12 'Offer information to patients on the protection of their oral health and support them in doing so', and to unit DN19 'Enable patients to protect their oral health'.

It is separated into the four elements:

- Section 1 'Offer information to patients on the protection of their oral health in the context of their general health'
- Section 2 'Evaluate the knowledge, skills and motivation of the patients to protect their oral health'
- Section 3 'Support the development of these skills and abilities, and improve the patients' motivation'
- Section 4 'Review the patients' progress towards promoting good oral health'

The following points are covered in detail:

- The effect of general health on oral health
- Nutrition in relation to sugars
- Promotion of oral health using cleaning aids and giving dietary advice
- The effects of ageing on the oral tissues, and the needs of the elderly dental patient

The main oral diseases of dental caries, periodontal disease and oral cancer, and the role of saliva in oral health are covered in detail in Chapter 5.

Main oral diseases

- Gingivitis – inflammation of the epithelium and connective tissue (gingivae) at the neck of the tooth
- Periodontitis – inflammation of the supporting structures of the teeth (alveolar bone, cementum and fibrous tissue)
- Caries – bacterial infection of the mineralised tissues of the teeth

The causes of gingivitis and periodontitis are summarised as:

- Poor oral hygiene
- Existence of stagnation areas allowing dental plaque to accumulate around the necks of teeth initially, so that gingivitis develops
- Failure to eradicate gingivitis, allowing inflammation of the periodontium to occur

The causes of dental caries are summarised as:

- Diet, in relation to amount and frequency of sugar and acid consumption
- Bacterial activity converting sugars into acids
- Demineralisation of enamel due to this acid attack, causing cavities to develop
- Direct demineralisation by acidic drinks, especially carbonated drinks and pure fruit juices

Section 1: Effect of general health on oral health

It is essential to understand that oral health is not a separate issue from general health, and this is illustrated by the following points:

(1) Several chronic diseases have the same risk factors as oral diseases:
   (a) Association of smoking and other tobacco habits with heart and respiratory disease, periodontal disease and cancers such as oral cancer
   (b) High sugar diets and those containing many processed meals are linked to dental caries, obesity and increased risk of heart disease
   (c) Excessive alcohol consumption is associated with liver disease, periodontal disease, dental trauma and several cancers including oral cancer
   (d) Eating disorders, such as anorexia nervosa and bulimia, are associated with general ill health and acid erosion of the enamel of teeth
   (e) People with diabetes suffer from poor wound healing generally, which also affects the oral soft tissues

(2) Physical disabilities, such as rheumatoid arthritis and those caused by drugs (like thalidomide), will prevent adequate toothbrushing and exacerbate periodontal disease

(3) Mental disabilities will make oral health messages difficult to understand and interpret for some patients

(4) People from low socio-economic groups generally suffer more from several chronic illnesses (often associated with alcohol and tobacco consumption) and also experience more dental caries and periodontal disease

(5) Certain commonly prescribed drugs reduce saliva flow, therefore limiting its oral cleansing effects and increasing the risk of dental caries (such as some antidepressants, some heart drugs)

(6) Some medical conditions also reduce saliva flow, with similar results (such as Sjögren's syndrome)
(7) Some drugs cause overgrowth of the gingivae as a side effect, and this tends to prevent adequate oral hygiene measures from being maintained (such as phenytoin for people with epilepsy, cyclosporin for transplant patients, nifedipine for heart problems)

Item 4 is in accordance with the Black Report of 1980, which relates to nearly all kinds of illness and disability, and which discovered that those in higher social classes had a better chance of avoiding illness and staying healthy. It concluded that this is because social and economic disadvantage tend to be associated with poor housing, unemployment, stress, poorer nutrition and less social support.

The effects of ageing on the oral tissues are relevant at this point. A greater proportion of the population is being made up of those over the age of 65 years – the elderly. Dentally, as oral health has become understood and methods of maintaining good oral health have been developed, these patients are also keeping their natural teeth for longer, but because of age-related changes to the oral tissues, the dental treatment for these patients is different in some aspects, and is classed separately as 'gerodontology'.

The changes to the oral tissues with age, and their relevance to dentistry, are summarised thus:

Skin:
- Less fat and elasticity
- Gives increased tissue fragility and likelihood of bruising post-operatively

Bone:
- More brittle
- More likely to fracture during extraction

Mucosa:
- Thinner and less elastic
- Easier to traumatise during treatment
- Less tolerant of dentures

Salivary glands:
- Alteration of components and volume, especially with certain drugs
- Dry mouth
- Increased caries rate
- Problems with swallowing, speech and denture retention

Teeth:
- Colour changes, narrower pulp chamber
- Difficult to colour match restorations
- Difficult to gain access to pulp for endodontics
- Reduced sensitivity

Oral health and diet

Sugar consumption is particularly pertinent when considering oral health and diet.

Caries is caused by the action of dietary acids (either directly or by bacterial digestion of sugars to form acids) on the tooth, and these sugars come from carbohydrates. Those which are added to foods artificially during processing are directly related to dental caries. They are called non-milk extrinsic sugars (NMESs). So higher dietary carbohydrate intake produces more sugars, which increases the risk of dental caries. Fruit juices and carbonated drinks are acidic, and their regular intake also increases the risk of dental caries.

If carbohydrate and acid intake is confined to mealtimes, rather than taken between meals, the acids are neutralised to some extent by saliva so that the amount of demineralisation occurring is reduced, and therefore the potential to cause caries is reduced. Otherwise, the acid attack can last anything from 20 minutes to 2 hours.

Similarly, if these types of food and drink are taken frequently as snacks between meals, there is an increased risk of caries because the teeth are being exposed to more frequent acid attacks, without the full benefit of neutralisation by saliva.

Good snacks:

- Non-citrus fruit, such as apples, pears, peaches, bananas
- Vegetables such as carrots and celery
- Plain crisps
- Low fat cheese
- Unsweetened yoghurt

Bad snacks:

- Sweets and other confectionery
- Biscuits and cakes
- Carbonated drinks and pure fruit juices
- Tea and coffee with sugar
- Citrus fruits such as oranges, clementines, grapefruits, satsumas
- Foods containing hidden sugars such as baked beans, flavoured crisps

Section 2: Evaluation of knowledge, skills and motivation

The patient's knowledge and skills in relation to oral health are evaluated by adequate communication with them, and the aim is to identify what the problems are for each individual – what is preventing them from achieving and maintaining good oral health.

Take into account the following points:

- Do they need just direct advice, help and support to achieve good oral health, such as one-to-one oral hygiene instruction?

- Are factors involved which prevent them from achieving good oral health, such as a disability or a diet/habit-related problem?
- Are they simply disinterested in their oral health, or are they unaware that they have a problem?
- Are general health factors involved which either exacerbate or actually cause the oral health problem?
- Is a serious general health problem present which overrides their oral health problems?

Following the evaluation of each patient, their individual problems should have been identified and help can then be given by the dental team to aid the patient in achieving a better standard of oral health.

Any risk factors involved need to be discussed.

Adults

- Smoking and drinking habits should be discussed in relation to oral health, but in a non-patronising manner. Information should be given on the links between these risk factors and both general and oral health problems associated with them
- Some may require referral to their dental or medical practitioner for individual advice on aids to stop smoking, such as nicotine patches and substitutes
- Similarly, excessive alcohol intake should be discussed, but always remember that it is a patient's right not to act on the advice given
- Diet should be discussed in detail, if necessary using accurate diet sheets filled in by the patient to identify any hidden dietary problems
- Again, diet should be linked to general health effects too

Young people

This group of patients will require a quite different approach to support and motivation in relation to oral health, for the following reasons:

- They have a different outlook on life from adults and different priorities
- They are likely to have little, if any, experience of long-term oral and general health problems and will therefore require convincing that a problem exists
- They are likely to require evidence of a problem rather than just accept it, so the use of disclosing tablets and audiovisual aids is invaluable
- Some may already be experimenting with alcohol and tobacco usage
- Some may not wish to accept responsibility for maintaining their own oral health yet, remember, females usually mature earlier than males
- Parental influence will be greater for some young people than others
- Parental support will differ similarly

Children

The oral health of this group depends very much on their parental influence and support, especially for younger patients. Parents who have little interest in their own oral and general health are unlikely to instil high levels of interest and motivation in their children, although exceptions do occur.

The following points are relevant:

- Wherever possible, parents should be included in their child's oral health education, and their support should be gained
- The oral health messages given can then be reinforced at home
- A suitable vocabulary should be established for each child; if it is aimed too high they are unlikely to understand, but if too low they will be insulted by being treated childishly
- A friendly, non-threatening approach is required so that their trust is gained
- The patient should also feel comfortable when asking questions, so the oral health team should develop an open, frank manner
- Oral health messages need to be fun so that interest is maintained
- The use of games, drawings and competitions should be considered wherever possible

Motivation can be thought of as the act of persuading people to do something for their own benefit. When there is a lack of motivation by patients to take an interest in their oral health, it needs to be established as to whether this is due to lack of knowledge, to disinterest, or because of the presence of previously unrealised risk factors.

Once these points have been understood, priorities and goals can be set out for each patient and the role of the dental team can be established.

Section 3: Support the development of these skills and improve motivation

Having established the different groups requiring oral health advice, and the factors that can affect both oral and general health, the various methods available now need to be considered in detail, in relation to caries and periodontal disease.

The oral health message can be communicated to adults in various ways:

- Use of specific oral health leaflets from dental suppliers
- One-to-one discussions of relevant oral health issues, in a non-patronising manner
- Non-use of dental jargon unless appropriate, but without condescension
- Adoption of an attentive manner, so that the patient's own difficulties and problems relating to oral health maintenance are listened to and understood

- Any queries raised need answering at a level that the patient will understand
- Eye contact should be maintained
- Reflective replies should be given, which relate to the patient's individual experiences

The more mature young people can be approached in a similar fashion, but less mature patients will require an individual approach aimed at their level of understanding. Pubescent teenagers may even take offence at the implication that they have a 'dirty' mouth, and act quite negatively during this time. This tends to be especially true for male teenagers. The more rebellious young people will be determined not to make efforts to improve their oral health, enjoying the 'shock tactic' approach on both the dental team and their parents. Most grow out of this phase as they mature.

Oral health messages can be communicated to young people thus:

- Relevant leaflets and dental literature
- A one-to-one approach for those easily embarrassed
- Others tend to react well in small groups, especially with similarly aged siblings or friends
- Authority and control of the situation need to be maintained by the dental team throughout, but in a friendly manner
- The dental team should never lose patience with these individuals, no matter how obstreperous they become
- Good patient management at this age should produce attentive and responsible adults in the future

Children tend to respond best to group approaches, but their interest in a subject can soon wane or be easily distracted. Consequently, short and interactive sessions are best, with plenty of opportunities for individual involvement:

- Use of disclosing tablets to show plaque
- Individual attempts at toothbrushing
- Relevant games to play, especially involving current television or film characters
- Parental involvement wherever possible, as they need to maintain and promote the oral health messages discussed at home

Now the oral health messages to be promoted can be considered.

Caries

Caries is caused by demineralisation of the tooth tissue by the effect of acids on the teeth. The acids come directly from the diet, or are formed as by-products by oral bacterial activity on sugars.

A patient's caries experience is affected by the following:

- Reducing the amount of sugar and acid in the diet
- Increasing the tooth's resistance to attack by acid
- Reducing the number of stagnation areas on the tooth

Reducing sugar and acid intake

Although the incidence of caries is gradually reducing in the UK, it remains a major health problem. It is most prevalent in younger age groups, so parental support is imperative if oral health messages are to be successful. The following dietary advice should be given:

- Eat a healthy diet with foods of low cariogenic (caries-causing) potential
- Follow the 'good snacks' list given on page 76
- Limit any cariogenic foods to mealtimes, so that they can be neutralised by saliva
- Avoid carbonated drinks and confine fruit juices to mealtimes only
- Use diet sheets to determine any hidden sugars being taken
- Advise mothers about the damage caused by using cariogenic drinks in baby feeders
- Parents should be encouraged to request sugar-free medicines whenever possible

Increasing tooth resistance to acid attack

The outer layer of teeth, enamel, is a crystalline structure made up of minerals which varies from person to person, and whose chemical composition is determined largely by genetics (that is, inherited).

The most important chemical, which can alter the resistance of teeth to acid attack, is fluoride. Fluoride is available to patients for self-administration as:

- Toothpastes
- Fluoride mouthwashes
- Dental floss and tape impregnated with fluoride
- Fluoride drops and tablets

Fluoride can also be professionally administered at the dental practice, as topical gels and varnishes, to those patients considered to be in a high caries risk group. Some areas of the UK also have fluoridated water supplies, and caries experience tends to be less in these areas.

Reducing the number of stagnation areas

A stagnation area is one where self-cleansing does not naturally occur so that plaque can easily accumulate on the tooth surface. They can be natural or iatrogenic (caused by the dentist). Examples of each are listed below.

Natural:
- Occlusal pits and fissures
- Irregular tooth positions (especially crowded and overlapping teeth)
- Interproximal areas, where teeth contact each other

Iatrogenic:
- Overhanging fillings
- Overhanging margins of crowns and bridges
- Badly designed dentures
- Lack of oral hygiene advice to patients with prosthetic and orthodontic appliances

The reduction of naturally occurring stagnation areas can be achieved by the following methods:

- Occlusal pits and fissures can be sealed over with plastic coatings (fissure sealants), which eradicate the stagnation area and prevent plaque accumulation
- Tooth positions can be altered by orthodontic therapy, with or without tooth extraction
- The use of dental floss and tape in interproximal areas will help to remove plaque from these difficult-to-brush regions, but instruction in their use is required for maximum effectiveness

The elimination of iatrogenic stagnation areas is simply a case of providing good standards of clinical dentistry, and ensuring that patients receive thorough oral hygiene instruction once provided with prosthetic or orthodontic appliances.

The use of disclosing tablets by patients and the dental team to determine the presence of plaque is invaluable. Disclosing tablets contain a simple vegetable dye which stains plaque deposits to the colour of the tablet. Its presence is then obvious and thorough oral cleansing can commence to remove the dye, and hence the plaque.

Periodontal disease

Gingivitis is caused by the accumulation of plaque at the gingival margins of the teeth, and a failure to remove the plaque because of poor oral hygiene techniques such that the condition worsens and periodontitis develops.

All individuals will experience plaque in their mouths, even oral health workers, but whether damage occurs and the severity of that damage depend on two factors:

- Plaque retention factors
- Modification of the host response

Plaque retention factors

Plaque forms within hours on newly cleaned tooth surfaces, owing to the action of oral bacteria on foods. Stagnation areas of teeth will allow caries to develop, as discussed previously. Plaque which collects around the necks of teeth, in their gingival crevices, is in contact with the gingivae. Unless it is removed regularly it will cause an inflammatory response, that is, gingivitis. If allowed to remain for long periods so that calcification and the formation of calculus (tartar) occur, then periodontitis will develop.

Plaque can be easily and regularly removed by the following:

Toothbrushing:

- Manual toothbrushing on a twice daily basis, to remove plaque accumulations at the gingival margins
- Several methods are recommended but the technique is irrelevant as long as it achieves the aim of plaque removal, without being so vigorous that gingival or tooth damage occurs (such as toothbrush abrasion)
- Many electric toothbrushes are available, and these are of great value to those with physical disabilities or difficult to reach oral areas
- Different head sizes are available; obviously, children require smaller-headed toothbrushes than adults
- Several interdental toothbrushes are also available and invaluable for cleaning plaque from necessary stagnation areas, such as fixed orthodontic appliances, but on the whole they are too bulky for actual interproximal cleaning unless the teeth are spaced
- Parents will need to carry out effective toothbrushing for children under 8 years of age, by standing behind them and brushing all areas of the mouth thoroughly, while allowing the child to watch in a mirror if possible (Fig. 6.1)

Fig. 6.1 Parents will need to carry out toothbrushing for children under 8 years old.

Toothpastes:

- A huge variety of toothpastes are available, from shops' own brands to specialised ones with ingredients to fight against all aspects of common oral disease
- Over 95% of toothpastes available in the UK contain fluoride, as sodium monofluorophosphate and sodium fluoride
- Several contain ingredients to slow down calculus formation
- Many now contain the substance triclosan combined with zinc, which acts as an antiseptic plaque suppressant
- Some toothpastes are specifically formulated to help relieve sensitivity, and contain stannous fluoride
- Others are advertised as 'whitening toothpastes' and act to remove surface tooth staining by the use of abrasives, or more recently with biological enzyme systems

Interdental cleaning (Fig. 6.2):

- As mentioned above, interdental toothbrushes are available
- Dental floss and dental tape are widely used by many patients to achieve interdental plaque removal; however, correct usage depends to some extent on manual dexterity and on sound oral health instruction
- Handles which hold pieces of floss for the patient make its use less difficult, especially for posterior teeth where access is difficult for all
- Woodsticks are also available to dislodge food debris from interproximal areas, preferably before plaque has been allowed to accumulate

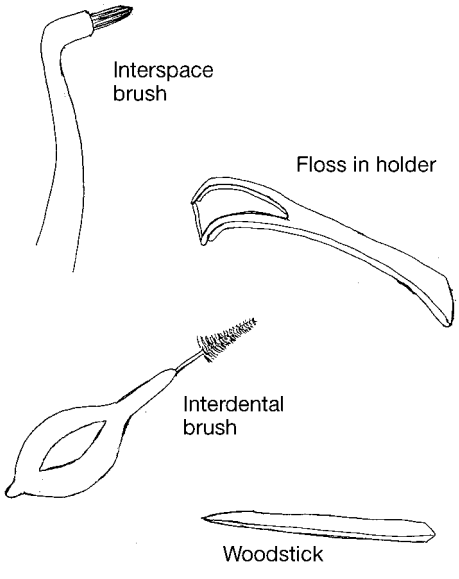


Fig. 6.2 Interdental cleaning.

- The use of woodsticks should be restricted to competent adults whenever possible, as they can easily be stuck into the gum and cause problems if used incorrectly or by the inexperienced

Mouthwashes:

- A vast array of mouthwashes to aid oral health are available
- Many supermarkets have their own brands for general use, but dental advice should be given to each patient for their specific oral problems
- General use mouthwashes contain various ingredients to promote good oral hygiene, including sodium fluoride or triclosan
- Others are specialised for sensitive teeth, or as a first aid measure for oral soreness
- Specialised ones containing chlorhexidene, which is an antiseptic plaque suppressant

Armed with all the available oral health advice given by the dental team, the patient should be able to determine whether they are now motivated and willing to improve their oral health.

A gentle reminder of the reasons why good oral health may be required could be given at this stage:

- To avoid the embarrassment of having halitosis (bad breath)
- To avoid the embarrassment and pain of having carious teeth
- To avoid tooth loss due to periodontal disease or caries
- To avoid the need for fixed or removable prostheses, and their expense

Section 4: Review the patients' progress

The patient will need to be seen on a regular basis to determine whether progress has been made towards improving their motivation and skills to maintain good oral health. The success or failure of promoting and maintaining oral health depends on an understanding of the determinants of oral health:

- Social factors
- Environmental factors
- Economic factors
- Patient's knowledge
- Patient's skills

Oral health education should aim to modify any damaging behaviour, rather than try to reverse this behaviour, and oral health educators need to have an understanding of why the damaging behaviour occurs. For example, lower socio-economic groups tend to use sweets as treats, or even bribes, for their children, because sweets are cheap to buy. The finances of these families cannot be changed, so it would be unrealistic (and unpopular) to try to stop the

parents buying sweets for their children under these circumstances, and the oral health promotion would fail. It would be more sensible to educate the parents to restrict sweets consumption to mealtimes, so that the frequency of acid attacks on their children's teeth is minimised, and hopefully their caries experience will be reduced or even eradicated.

Similarly, it would be unrealistic to expect older smokers to give up without much encouragement and support from the dental team, as nicotine is addictive and the longer the patient has smoked, usually the harder they will find it to stop. Advice about current aids to help to stop smoking, such as nicotine patches or chewing gum, can be given. Indeed, the latter can even be sold over the counter at the dental practice.

Teenage smokers may be easier to re-educate, as they often smoke only to appear socially acceptable or because of peer pressure. Advice regarding the overall damage to health caused by smoking, given in an informed but friendly manner, can often be the first step in their re-education.

With these points in mind, the dental team needs to decide what each patient's outcome has been at their review appointment:

- Has progress been made, resulting in a higher standard of oral hygiene?
- Has the original oral hygiene status been maintained, but with no improvement?
- Has the oral hygiene status deteriorated, such that more damage has occurred?

When the first event has occurred, the patient should be congratulated and encouraged to maintain this raised standard of oral hygiene. Children can be given stickers, badges or certificates – all of which are available from oral hygiene product distributors.

It should be remembered that oral health promotion is a long-term process so regular monitoring will still be required for some time, although if the higher standard of oral hygiene becomes consistent, then review appointment intervals can be gradually lengthened.

Dental examination recall intervals depend on several factors for each patient:

- Caries experience
- Periodontal experience
- State of general health
- Any controllable risk factors, such as smoking, alcohol consumption, sugar intake
- Medical risk factors
- Social risk factors, such as finances, peer pressure, lifestyle
- Children with developing dentition

These will cause variation in the frequency of dental attendance, but all patients should be seen at least on a yearly basis.

When the second event has occurred, the patient should still be con-

gratulated on the fact that their oral hygiene status has not relapsed, and encouragement to try harder should be given.

These patients tend to have considered the financial and emotional costs and benefits to themselves of changing their oral hygiene status, and decided that the costs outweigh the benefits. All is not lost, as this decision may be transitory, due, say, to a particularly stressful period in their lives at present, so they feel unable to attempt change now. Once this period is over, however, they may be receptive to further attempts by the dental team to promote oral health. The goals set by the dental team are not achievable, or are felt to be unrealistic for now. These patients should be reviewed regularly and supported until they feel able to try again.

The patients who have undergone deterioration in their oral health may need referral to the dentist or hygienist for specialist input and reinforcement. However, reflection still needs to determine whether the goals set were unrealistic for that particular patient. If so, then new ones will need to be discussed and agreed upon with the dental team.

Frustrating though it is, some patients really do not wish to change their lifestyle, nor do they accept the consequences to their oral health that may occur, as indicated by the dental team. Regular monitoring and review is all that the dental team can hope to achieve for these patients, although they should stay alert to any indication by the patient that they are willing to try again. The patient's right to choose not to accept the oral health advice given by the dental team should not be forgotten, or ridiculed.

Reference

Black, D., Morris, J.N., Smith, C., Townsend, P. *Inequalities in Health*. The Black Report. The Health Divide. London: Penguin Books Ltd. 1992.

Activities

- Consider all of the foods that you have eaten over the past week and determine how many of them contained non-milk extrinsic sugars.
- List the advice that your practice gives to smokers in relation to their oral health.
- Develop a patient information leaflet about cigarette smoking that is aimed at teenagers.
- Identify the activities that you could devise to help promote oral health to younger children. Determine the age range that you are considering.
- If your practice sells oral health products, list the toothpastes stocked and their fluoride content. Determine why any differences in content may occur.
- List the various mouthwashes that you have seen being recommended to patients. Choose one and determine why it was recommended over others.
- Determine your practice policy in relation to toothbrushing advice, and try to promote it to a member of your family. Record your results.
- List the different methods of interdental cleaning that you are aware of, and try to demonstrate the use of one to a colleague. Record your results.
- Think back to two patients who have received oral hygiene advice at your practice, one of whom failed to heed the advice. Identify any factors that may have contributed to this failure. Contrast these factors to the other patient who did heed the advice.

Chapter Seven

Support of Clinical Assessment of Oral Health

This chapter relates to unit DN13 'Provide chairside support during the assessment of patients' oral health'.

It covers both elements:

- DN13.1 'Prepare equipment, instruments, materials and medicaments for assessing patients' oral health'
- DN13.2 'Provide close support during the assessment of patients' oral health'

The following areas are also covered:

- The assessment of oral health in relation to the soft tissues, both the deciduous and permanent dentitions, and the periodontal tissues
- The methods used to carry out these assessments
- Tooth and periodontal charting, record keeping and medical history taking, including examples of various paper records

Frequency and purpose of clinical assessment

Clinical assessments are carried out each time a patient attends the dental practice. Some patients attend more frequently than others by choice, and some require more frequent attendance than others, in the dentist's professional opinion. The dentist's opinion is based on the known risk factors of oral disease, and the patient's frequency of exposure to these risk factors.

Assessment of oral health is carried out in the following areas:

- Extra-oral soft tissues
- Intra-oral soft tissues
- Deciduous and mixed dentition of children
- Permanent dentition
- Periodontal tissues

The main purpose is to promote the prevention of oral diseases by regular examination, and education in the prevention of disease to the patient. If

disease is already present, regular oral assessment will detect it at an earlier stage and full recovery will be more likely.

Extra-oral soft tissue assessment

The following will be examined and assessed for any abnormality:

- External facial signs – skin colour, facial symmetry, presence of blemishes, especially moles
- Lips – change in colour, and felt for any abnormalities, presence of any blemishes
- Lymph nodes – under the mandible and in the neck, will be palpated for any swellings or abnormalities

Variations in skin colour do occur: some patients are naturally pale and others are naturally ruddy. However, an unusual facial appearance can sometimes indicate problems, such as nervous patients becoming pale and clammy as they are about to faint, or the unnatural ruddiness of a patient with hypertension.

Facial asymmetry (where one side of the face is shaped differently from the other) could indicate the presence of swelling or problems with nerve supply or muscular control, all of which require further investigation.

The sudden appearance of unusual skin blemishes, especially moles, may indicate the presence of an early skin cancer (melanoma), which will need urgent treatment.

Similarly, the lips are examined and details recorded of blemishes, such as the presence of a 'cold sore' indicating infection with *Herpes labialis*, or the presence of minor salivary gland cysts (mucoceles).

Lips tinged bluish-purple indicate some degree of chronic heart failure, which needs noting before local anaesthesia and traumatic dental procedures are carried out.

Lymph nodes are part of the body's immune system, and any enlargement of these indicates that the body is fighting infection or some other disease process, and requires further investigation.

Intra-oral soft tissue assessment

Intra-oral soft tissue assessment is carried out at each dental examination and in a systematic manner, so that no areas are left un-investigated:

- Labial, buccal and sulcus mucosa – colour and texture, moisture level
- Palatal mucosa – hard and soft palates, oropharynx, tonsils (if present)
- Tongue – colour and texture, symmetry, mobility, all surfaces especially beneath
- Floor of mouth – colour and texture, presence of swellings

Low moisture levels can indicate salivary gland problems, especially in the elderly and those taking certain medications. Saliva has important functions with regard to defence, cleansing and dental disease initiation.

The commonest areas for oral cancers to develop are on the borders or beneath the tongue, and in the floor of the mouth, and these areas will be particularly well examined in patients with known risk factors.

A soft tissue assessment sheet is shown in Fig. 7.1.

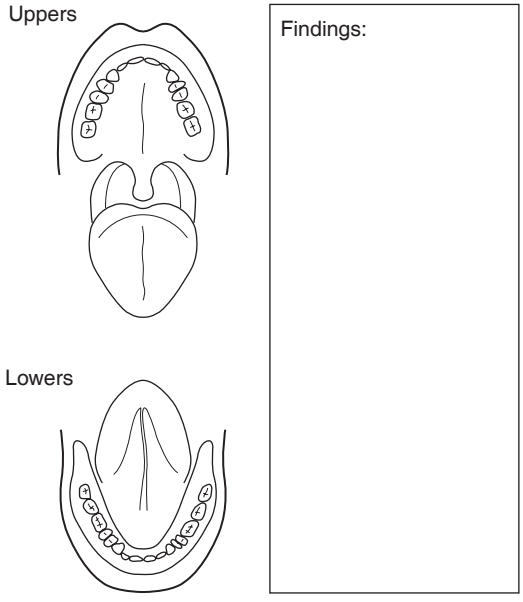


Fig. 7.1 Soft tissue assessment sheet.

Tooth charting

For ease of recording, a system of charting of the teeth has been developed which is universally recognised by all those in the dental profession. It allows a speedy but accurate record of an individual's dentition to be produced, which can be clearly read and understood by other dental professionals.

The initial system was to divide the mouth into quadrants: upper right, upper left, lower left and lower right. Each anterior tooth has four surfaces and an incisal edge or canine cusp, and each posterior tooth has five surfaces (see Chapter 2).

The shapes of the teeth can be simplified and drawn to show all of these surfaces with each tooth referred to as its corresponding number (for permanent teeth) or letter (for deciduous teeth), as shown in Fig. 7.2. The teeth are recorded from the centreline backwards for both the deciduous and permanent dentition.

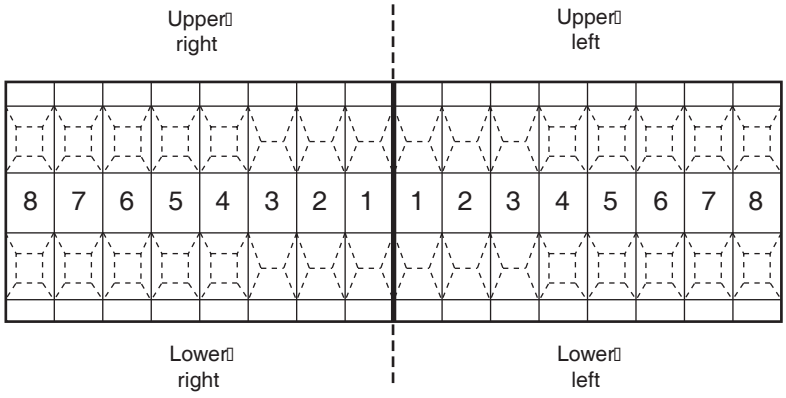


Fig. 7.2 Tooth chart.

The condition of the teeth and the presence of any restorations can then be charted in a code form, using recognised notations, examples of which are:

UE unerupted
PE partially erupted
__ missing
X recently extracted
→ space closed
tooth fracture
PJC porcelain jacket crown
FBC full bonded crown
FGC full gold crown
SSC stainless steel crown
AJC acrylic jacket crown
CV composite veneer
PV porcelain veneer
I implant
FS fissure sealed
FF fissure filled
GI gold inlay
CI composite inlay
PI porcelain inlay
DRESS dressing present
RF root filled
RCT requiring root canal therapy

Restorations are charted by shading in the sides of the tooth which they involve, and the need for their replacement is indicated by circling the restoration. So, for example, a cavity or restoration involving the mesial and occlusal surfaces of a tooth are coded to 'MO', and so on as illustrated in the example in Fig. 7.3.

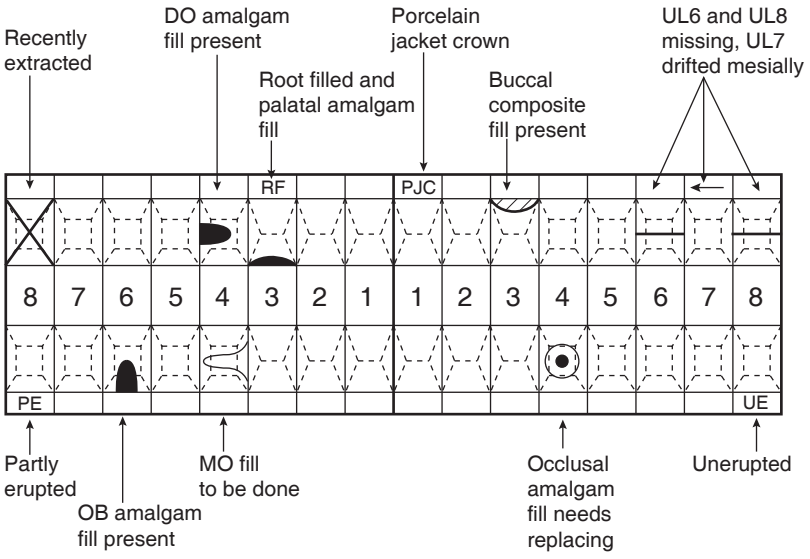


Fig. 7.3 Examples of charting.

The problem with this system is that the growing use of computers in dental practice makes the accurate recording of these items more difficult as the notations are not present on a computer keyboard, and it varies with the computer software used too. A more modern approach is the two-digit FDI system (International Dental Federation) whereby each quadrant, as well as each tooth, is numbered thus:

- Upper right quadrant of adult is 1
- Upper left quadrant of adult is 2
- Lower left quadrant of adult is 3
- Lower right quadrant of adult is 4
- Upper right quadrant of child is 5
- Upper left quadrant of child is 6
- Lower left quadrant of child is 7
- Lower right quadrant of child is 8

These quadrants are set out in Fig. 7.4.

Deciduous teeth are then numbered 1 to 5, from the midline.

This means that the tooth notation of the:

- Upper right first molar is either UR6 or 16 (pronounced 'one–six')
- Upper left second premolar is either UL5 or 25 (pronounced 'two–five')
- Lower left deciduous canine is either LLC or 73 (pronounced seven–three')
- Lower right second deciduous molar is either LRE or 85 (pronounced eight–five')

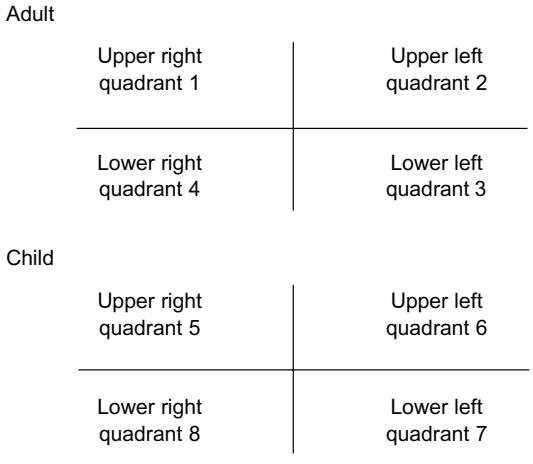


Fig. 7.4 FDI charting.

- Lower left first premolar is either LL4 or 34 (pronounced 'three–four')
- Lower right second molar is either LR7 or 47 (pronounced 'four–seven')

and so on (see Fig. 7.5)

The instruments used to carry out the tooth charting assessment are:

- Mouth mirrors – to reflect light onto the tooth surface, to retract soft tissues for clear vision, to protect the soft tissues
- Angled probe – to detect soft tooth surfaces, to detect margins on existing restorations
- Briault probe – specially angled to detect interproximal caries

These are illustrated in Fig. 7.6.

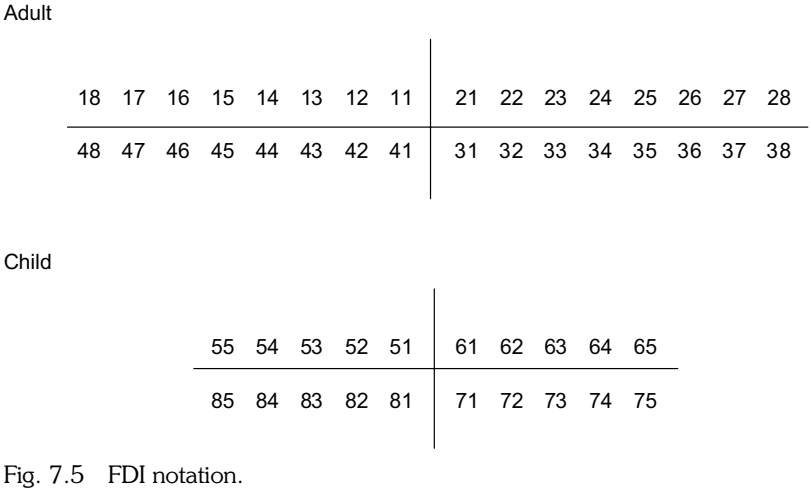


Fig. 7.5 FDI notation.

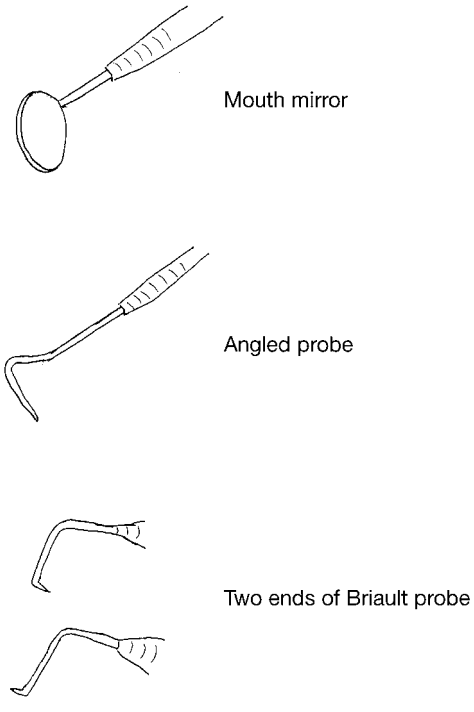


Fig. 7.6 Assessment instruments.

Eruption dates of deciduous and permanent teeth

Each tooth normally erupts into the mouth within a particular age range, and knowledge and recording of the teeth present at each oral assessment help to determine whether younger patients are likely to require dental intervention during the 'mixed dentition' stage, when both deciduous and permanent teeth are present. Permanent teeth erupting later than normal can cause crowding problems, for instance.

Deciduous teeth begin erupting at around 6 to 8 months of age, and are usually all present by 29 months of age. Permanent teeth begin erupting at around 6 years of age, and are usually all present by 13 years of age, except the third molar, which tends to erupt any time after 18 years of age. The eruption dates for the two sets of teeth are set out in Tables 7.1 and 7.2.

Periodontal tissue assessment

The periodontal tissues are those acting as supporting tissues around the tooth – the gingivae, the periodontal ligament and the underlying alveolar bone forming the tooth socket. These tissues can undergo disease processes

Table 7.1 Eruption dates for deciduous teeth.

	Upper deciduous	Lower deciduous
A	10 months	8 months
B	11 months	13 months
C	19 months	20 months
D	16 months	16 months
E	29 months	27 months

Table 7.2 Eruption dates for permanent teeth.

	Upper permanent	Lower permanent
1	7–8 years	6–7 years
2	8–9 years	7–8 years
3	10–12 years	9–10 years
4	9–11 years	9–11 years
5	10–11 years	9–11 years
6	6–7 years	6–7 years
7	12–13 years	11–12 years
8	18–25 years	18–25 years

to varying degrees, and in the worst case healthy teeth can be lost owing to periodontal disease.

Periodontal disease is often painless and can remain undetected for many years if thorough oral assessments are not carried out. As with tooth charting, a system has been developed whereby the presence of periodontal disease can be quickly recorded during routine oral assessment, by dividing the mouth into sextants and recording the presence of any periodontal pockets down the side of the teeth. This is called a BPE assessment – a Basic Periodontal Examination. It is recorded on a chart like that shown in Fig. 7.7.

A special periodontal probe (see Chapter 5) is used which has graduation marks so that the depth of the pocket in millimetres can be measured. This is then coded depending on the depth of the pocket:

Upper teeth

18–14	13–23	24–28
48–44	43–33	34–38

Lower teeth

Fig. 7.7 BPE chart.

- Code 0 – healthy gingival tissues, no bleeding
- Code 1 – coloured area of probe visible, no calculus or defective margins present, bleeding on probing (pocket less than 3.5 mm)
- Code 2 – coloured area visible, plaque retention factors detected (pocket less than 3.5 mm)
- Code 3 – coloured area partly visible (pocket less than 5.5 mm)
- Code 4 – coloured area not visible (pocket more than 6 mm)
- Code * – furcation involvement, or recession and pocket depths 7 mm or more

Higher codes, then, indicate serious periodontal disease. An example of a completed BPE chart is shown in Fig. 7.8.

2	0	4
2	1	3

Fig. 7.8 Completed BPE chart.

Patients with scores of code 3 maximum, or codes 4 or * anywhere, require individual pocket depths to be recorded in full, so that intensive periodontal treatment can be initiated.

The oral health status can also be noted during periodontal assessment, such as the presence and extent of dental plaque. Therefore the standard of oral hygiene can be graded as excellent, good, fair or poor.

Several different styles of full periodontal chart are available, and an example is shown in Fig. 7.9 which also records tooth mobility. This is graded as:

- I for side to side movement of less than 2 mm
- II for side to side movement of more than 2 mm
- III for vertical movement as well

Methods used to carry out oral assessments

The main methods of carrying out oral assessments, as discussed previously, are:

- Visual inspection to detect visible problems
- Manual inspection to feel abnormalities
- Use of mouth mirrors for intra-oral and tooth assessments
- Use of various probes for tooth inspections
- Use of periodontal probe for periodontal assessment

Patient: _____ Date: _____

Mobility																
Plaque																
Gingival bleeding																
Pocket depth																
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Pocket depth																
Gingival bleeding																
Plaque																
Mobility																

Fig. 7.9 Example periodontal chart.

- Use of transillumination of anterior teeth to detect interproximal cavities (bright light such as curing lamp is shone through tooth, cavities show as dark lesions)

In some situations the dentist is unable to make a full assessment without the use of other means, mainly the use of radiographs and by testing the vitality of the tooth. Radiographs are discussed in full in Chapter 8.

Vitality tests can aid in determining whether a tooth is vital (alive) or non-vital (dead).

Tests available are:

- Cold stimulus with ethyl chloride
- Hot stimulus with warmed gutta percha
- Electrical test with electric pulp tester

The first two are used to diagnose toothache where the symptoms include pain with cold or heat.

Electric pulp testers are more accurate in determining the 'degree' of vitality of a tooth thus:

- Normal response – healthy pulp
- Increased response – early pulpitis present
- Reduced response – pulp is dying, or tooth has heavily lined deep restoration present so voltage cannot be adequately transmitted
- No response – pulp tissue is dead

Patients will vary in their response to electric pulp testers, so it is always advisable to test several apparently healthy teeth to establish what their 'normal' response is, before testing the suspect tooth.

Electric pulp testers are either battery operated or mains operated, and they work by sending an increasing voltage into the tooth until the patient is aware of a sensation. The point at which the patient indicates a sensation is recorded numerically on a scale, so that the degree of vitality can be determined in relation to test (healthy) teeth.

Study models

In some situations, it is necessary for the dentist to consider the patient's occlusion before being able to decide on any treatment necessary, so impressions are taken of both dental arches using alginate impression material and then cast up to produce a set of study models (see Chapter 10).

Study models are useful in the following cases:

- Occlusal analysis in complicated crown or bridge cases
- Orthodontic cases, to determine if extractions are required and which type of appliance is necessary
- Occlusal analysis where full mouth treatment may be necessary, to determine the functioning of the dentition
- Where tooth surface loss is evident, either by erosion from acidic foods and drinks, or by attrition due to tooth grinding, so that the progression of the tooth wear can be monitored and treatment determined

Photographs

Photographs can be taken to record various aspects of the dentition or soft tissues, for future reference. These can be taken using conventional cameras (especially Instamatic types), or by using intra-oral cameras using digital photography. Specialised computers and equipment are required for this technique.

Photographs are useful for the following:

- To record soft tissue lesions to aid diagnosis
- To record the extent of injury following trauma
- To record before and after views of dental treatment

Provision of support during oral health assessment

The regularity of attendance for dental examinations puts the dentist in a unique position to monitor normality and detect abnormality at an early stage. Patients tend to seek medical advice only when they detect a problem, and this is often when a medical condition has existed for some time and is therefore quite likely to be more advanced and serious in nature.

Thorough and accurate recording of findings at these dental examinations is thus of paramount importance.

The nurse's role during clinical assessment is to:

- Support and reassure the patient throughout
- Have all necessary instruments and equipment ready for use
- Be able to make accurate clinical records as required
- Be proficient in the use of soft tissue record sheets, if used
- Be proficient in the charting of teeth
- Be proficient in recording periodontal conditions
- Be able to complete a full medical history form, with the patient
- Assist the dentist as necessary throughout

Clinical notes are taken either in writing or entered into a computer system. Many dentists write their own notes, for medico-legal reasons, to ensure that everything said and done is recorded accurately, but many other dentists rely on the dental nurse to 'take notes'. It is imperative that these are full, concise and accurate, and include details of verbal discussions too. When legal problems arise, the production of full and contemporaneous notes ensures that any investigations and complaints can be dealt with correctly.

Full clinical notes should include all of the following, as appropriate:

- Name, address, telephone numbers, and date of birth
- GP's details
- Medical history (see later)
- Dental history
- Contemporaneous clinical notes of each attendance
- Tooth and periodontal chartings
- Soft tissue assessments
- Details of all appointments with others, such as hygienist
- Consent forms, and all legally required NHS or private paperwork
- Copies of all referral letters
- Radiographs, correctly mounted as necessary
- Copies of any laboratory slips
- Records of all payment transactions
- Copies of any letters sent to patient, especially account letters

Medical history forms should be completed at every oral assessment session, and it should be verified at each attendance whether changes have occurred or not. The patient should sign and date the form when each update is recorded.

The pertinent questions which need to be asked when taking a medical history are: Are you or do you have . . . ?

- Attending or receiving any medical treatment currently
- Taking or taken steroids in past two years
- Taking any other medications, including those bought over the counter
- Any known allergies
- Currently a pregnant woman or nursing mother
- HIV positive status
- History of rheumatic fever

- History of liver, jaundice, hepatitis, kidney disease
- Any history of heart murmur, angina, high blood pressure
- Any history of other heart problems
- History of bad reaction to local or general anaesthetic
- Any history of arthritis
- Any history of diabetes, self or family
- Any history of respiratory disease, including asthma
- Any history of epilepsy or fainting
- Any medical warning cards carried
- Any other medical conditions or concerns to be disclosed
- Smoker or non-smoker; how many per day
- Average daily alcohol consumption

Details can then be given for any positive responses.

Various styles of medical history form are available, or the practice can issue its own.

Materials used in oral assessment

Details of the materials used to carry out oral assessments are as follows:

- Ethyl chloride – a liquid which vaporises easily and produces a cold sensation on doing so, can be applied to teeth as an aid to detecting dental problems
- Gutta percha – a stick of green composition which can be heated and applied to a tooth to aid detection of dental problems
- Alginate – an impression material consisting of calcium and alginate salts which are mixed with water at room temperature and loaded into trays for insertion into the mouth, so that accurate impressions can be taken
- Dental stone – a hardened calcium sulphate plaster mixed with water and used to produce a study model cast
- Dental plaster – a calcium sulphate plaster mixed with water and used to make a base for the dental stone cast

Activities

- Practise your charting skills with a colleague by having them read out anonymous charts for you to complete. Identify any recurrent problems and discuss them with an experienced colleague.
- Think back to any dental problems that you have experienced. Identify the methods used to assess your problem and diagnose it.

Chapter Eight

Dental Radiography

This chapter relates to unit DN14 'Process dental radiographs and support their production'.

The three elements covered here are:

- DN14.1 'Prepare equipment, materials and patients for dental radiography'
- DN14.2 'Process and mount dental radiographs'
- DN14.3 'Assure the quality of processing dental radiographs'

The following subjects are also covered:

- The physics of radiography
- Radiation protection
- Types of radiograph and their dental uses
- Developing, mounting and filing radiographs
- Faults encountered in relation to a quality assurance system

Uses of radiographs in dentistry

Dental radiography is an important aspect of dentistry with regard to diagnosing the cause of dental problems. Radiographs are used for the following reasons:

- To detect dental caries
- To detect levels of bone loss in periodontal disease
- To detect periodontal and periapical abscesses
- To detect cysts affecting the dental tissues
- To detect iatrogenic problems (that is, those caused by the dentist), such as overhanging restorations, perforations
- To aid in endodontic treatment
- To determine the number and position of tooth roots before extraction
- To detect supernumary teeth and unerupted teeth
- To diagnose hard tissue lesions, such as bone cysts and tumours, salivary calculi, jaw fractures

Nature of ionising radiation

X-rays are a type of electromagnetic radiation, as are ultraviolet (UV) light and visible light. They differ from each other in the amount of energy they possess, X-rays having more energy so that they are capable of passing through matter. They can pass between atoms of matter (including human tissues) or hit atoms and interact with them to be either scattered or absorbed.

With larger atoms of matter, such as some metals (including calcium), most of the X-rays are absorbed or scattered, and these are radiopaque substances. Those which allow the majority of the X-rays to pass through unaffected are called radiolucent substances. As enamel contains a high calcium content, it is radiopaque to X-rays, as dentine and cementum are, to a lesser extent.

Effect of ionising radiation on human tissue

When a beam of X-rays hits human tissue it can do one of three things:

(1) Pass through unchanged and become absorbed by the surroundings
(2) Hit atoms of the tissue and become scattered, releasing energy as it does so
(3) Hit tissue atoms and become absorbed, again releasing energy

The energy released is capable of causing tissue damage, and it is this effect which requires that X-rays are used only as necessary and at the lowest dose possible, to reduce the amount of energy released and therefore reduce the amount of tissue damage which occurs.

The tissue damage can occur in the chromosomes of the cell affected, causing it to die when it next attempts to divide. This is the principle behind the use of radiotherapy in the treatment of cancer: high doses of X-rays bombard the cancer cells and cause their death, so destroying the cancer or shrinking it to a size which is operable. However, the chromosome damage can also occur in normal tissue cells, especially those which divide frequently such as skin and digestive tract cells. These are therefore more likely to suffer damage to the chromosomes, such that they mutate as they divide, and become cancer cells.

Patients treated with radiotherapy often develop a skin reaction similar to sunburn, as a side effect of the radiation.

It is imperative then that all dental radiographs have a sound clinical reason for being taken, but it should be remembered that with modern machines and techniques, the dose of radiation received during one dental exposure is equal to that received from natural background radiation in a day.

Principles of dental radiography

As stated previously, there are many sound reasons for dental radiographs to be taken. However, to avoid their indiscriminate use, guidelines have been

drawn up by the Faculty of General Dental Practitioners for the safe prescription of dental radiographs in general dental practice thus:

- A history and a clinical examination must be performed before any radiograph is taken
- Only new patients with clear evidence of some dental disease should have full mouth radiographs taken
- Regular child patients in the mixed dentition stage who have orthodontic problems developing can be radiographed as necessary
- Recall patients with a low caries risk should be radiographed no more frequently than every 18 months
- Those with a moderate caries risk should be radiographed every 12 months
- Those with a high caries risk should be radiographed at six monthly intervals, gradually reducing this rate as the caries is brought under control
- Patients exhibiting evidence of periodontal disease can have selective radiographs, as necessary
- Edentulous patients should only have selective radiographs taken if there are any clinically suspicious areas (retained roots, hard tissue lesions)

Types of view used in dental radiography

Once the need for a dental radiograph has been determined to outweigh the possible harmful effects of its production, the dentist must decide which view will give the maximum diagnostic information at the minimum exposure of X-rays to the patient.

Intra-oral views (Fig. 8.1):

- Horizontal bitewing – shows molar and premolar teeth, used to detect interproximal caries, residual caries, secondary caries beneath existing restorations, bone levels
- Vertical bitewing – used to show extent of posterior periodontal disease and bone loss
- Periapical – of any tooth, used during endodontic treatment, to diagnose periapical and periodontal abscesses, and to diagnose root fractures
- Anterior occlusal – used to determine position of unerupted canine teeth and to search for supernumary teeth

Extra-oral views:

- Orthopantomographs – commonly referred to as OPT or OPG, and give a full view of both jaws to show:
  - All teeth and their associated periodontium
  - All restorations present
  - Periodontal bone levels
  - Pathology associated with teeth
  - Pathology of hard tissue of jaws

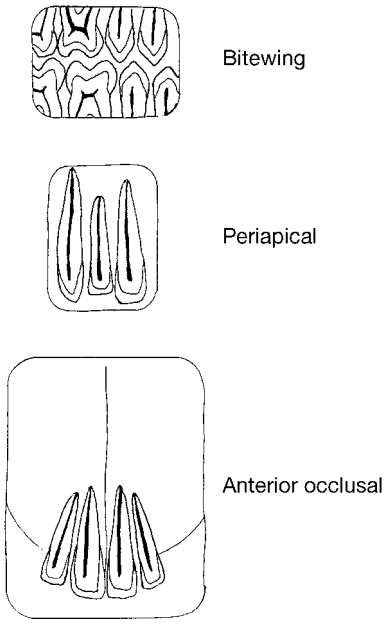


Fig. 8.1 Types of view.

  - Temporomandibular joints
  - Unerupted and impacted teeth
  - Surrounding bony structures
  - Inferior dental nerve canals and position of mental foramina
  - Maxillary antrums
- Lateral obliques – have limited diagnostic value as there is often so much superimposition of the radiographic image; used to determine position of unerupted third molars
- Cephalostats – as an addition to OPT machine for specialist orthodontic use, to determine severity of jaw malocclusions

Radiographic techniques

Intra-oral radiographs can be exposed in two ways, depending which is the best for the given clinical situation. They are called the 'paralleling technique' and the 'bisecting angle technique'.

The paralleling technique holds the film exactly parallel to the long axis of the tooth being exposed, so that the image produced is the same size as the actual tooth (see Fig. 8.2). This is especially important during endodontic procedures, when the correct diagnostic length of the tooth has to be ascertained to ensure accurate root filling of the canal.

Sometimes the film cannot be placed parallel to the tooth, because of size restriction of the patient's mouth. In these situations the bisecting angle

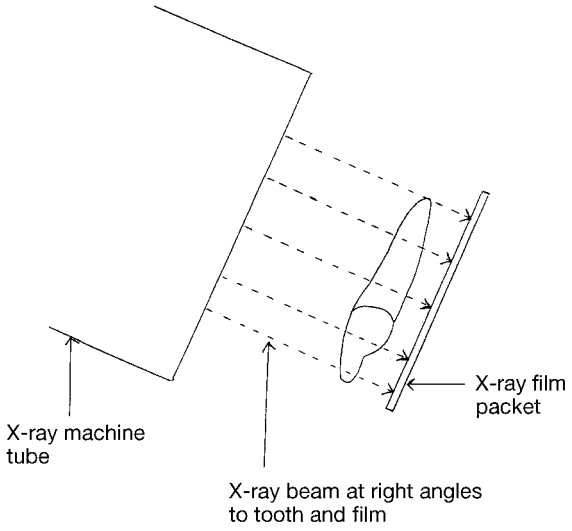


Fig. 8.2 Paralleling technique.

technique is used. The film is placed intra-orally and the angulation of the long axis of the tooth against the film is determined by the operator. This angle is then halved (bisected) and the tube head is angled to be at right angles to it, before the film is exposed (Fig. 8.3).

OPTs and cephalostats are held in special radiograph machines while the film is being exposed.

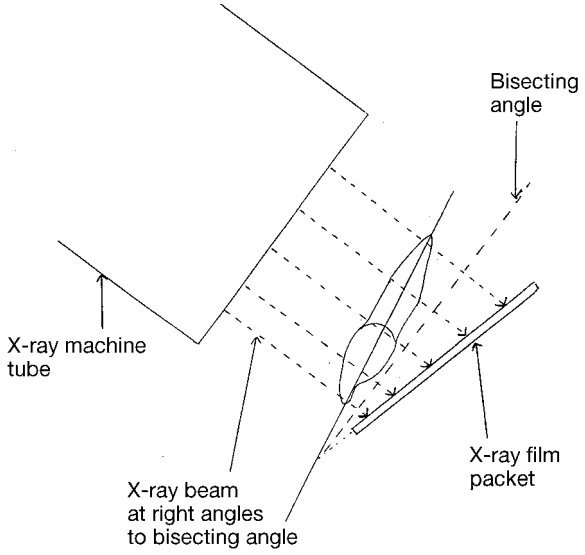


Fig. 8.3 Bisecting angle technique.

Lateral oblique views are taken with the patient holding the film cassette against the side of the face, and tilting the head to that side so that the tube head can be angled upwards at the mandible from the opposite side. Skill is required to produce images of diagnostic quality using this technique.

Formation and processing of the image

An intra-oral X-ray film packet contains a celluloid film coated with light-sensitive silver bromide salts in an emulsion, surrounded by black paper to protect it from unwanted light, and enclosed in a waterproof plastic packet. On one side of the film is a lead foil which prevents the emulsion coat being exposed twice, by absorbing scattered radiation during the exposure (Fig. 8.4).

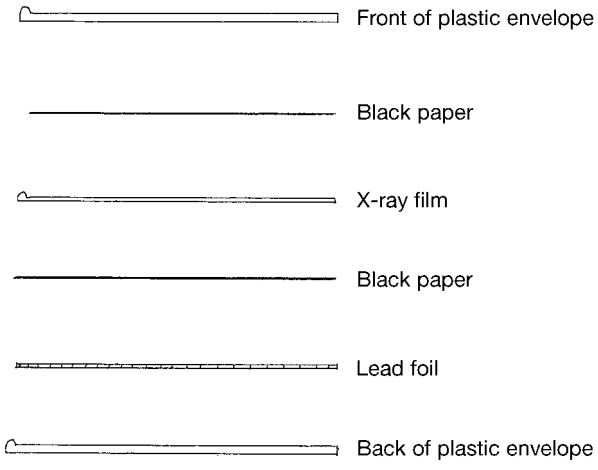


Fig. 8.4 X-ray film packet.

When exposed to X-rays, the crystals form a latent image (that is, one that is hidden) in the emulsion. The film must then be processed to develop the image.

Extra-oral dental films are much larger and the radiation dose required to produce an image would be bordering on dangerous, so these films are used in special cassettes. The cassette is light-tight, and has intensifying screens within, which increase the speed of the system and can therefore be used with a lower dose of radiation. The screens are coated with either rare earth elements or calcium tungstate, which absorbs the X-rays and then glows to expose the film so that a latent image is formed (Fig. 8.5).

The packet or cassette is then taken to a light-tight darkroom fitted with a red safety lamp. Red light allows the nurse to see what they are doing without exposing the film to other light, which will destroy the image.

Some dental practices use automatic developers, but a manual method is

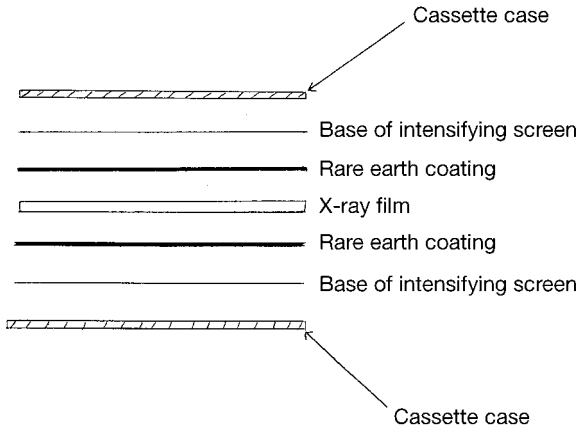


Fig. 8.5 Extra-oral cassette.

described here. The exposed film is fastened to a hanger and immersed in an alkaline developing fluid for one minute, which converts the exposed crystals to silver and produces a permanent image that is the exact replica of the latent image. The unexposed crystals dissolve in the solution.

Washing in plain water removes any unused developer solution. The film is then immersed in an acidic fixer solution for at least one minute. This permanently fixes the image onto the celluloid base of the film, to produce the radiograph.

The film is then washed again to remove unused fixer solution, before being dried and mounted for viewing. The ideal darkroom layout is illustrated in Fig. 8.6.

A chemical reaction occurs during each film processing, and the optimum temperature range is 18–22°C for both solutions.

As the solutions are used they will become weaker in strength, and require changing on a regular basis. In addition, the developer oxidises in air and must have a lid over the tank to prevent this when not in use, otherwise the solution will change chemically and will not produce radiographs.

Intraoral films have a raised pimple in one corner, which signifies that the film should be viewed with the pimple facing the viewer. This ensures that they are viewed the correct way around so that treatment required on the patient's left side is not inadvertently carried out on teeth on the right side.

Extra-oral cassettes are marked within with an 'L' to signify which is the patient's left side. Unless the cassettes are placed upside-down in the machine, no problems should be encountered with this technique.

Faults occurring during exposure

The following exposure faults can occur due to operator error:

- Elongation of image, due to too shallow a tube head angle to the film (see Fig. 8.7)

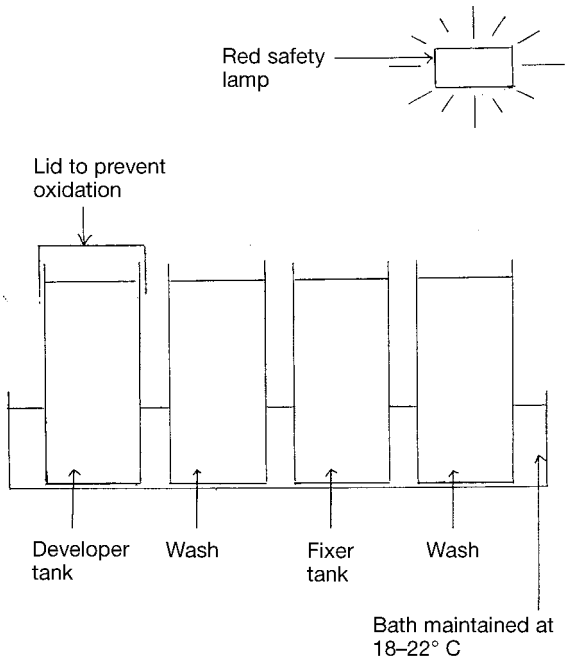


Fig. 8.6 Darkroom layout.

- Foreshortening of the image, due to too steep a tube angulation (see Fig. 8.7)
- Coning of film, due to tube head not being centralised correctly onto film (see Fig. 8.7)
- Blank film, due to film packet being placed with pimple away from tube head (that is, back to front) so that lead foil prevents film exposure
- Faint image, due to use of badly stored or out-of-date film

A blurred image can also be produced, by either the patient or the tube head moving during exposure.

Faults occurring during processing

The following processing faults can all be due to operator error:

- Dark film, due to overdeveloping (temperature or time too high, or developer too concentrated)
- Fogged film, due to daylight exposure before developing
- Blank film, due to being placed in fixer before developer
- Partly blank film, due to not being fully immersed in developer

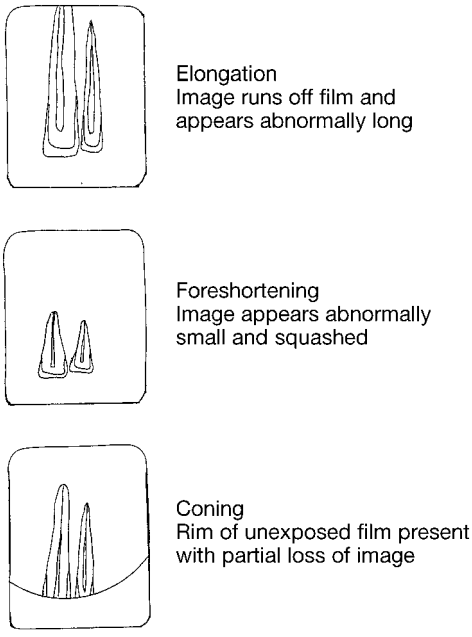


Fig. 8.7 Some exposure faults.

- Faint image, due to underdeveloping (temperature too low or time too short, or developer too weak)
- Fading image, due to insufficient time of fixing
- Blank spots on film caused by contamination with splashes of fixer
- Brown or green stains, due to being incompletely fixed
- Crystal contamination, due to insufficient washing after fixing
- Scratches or fingerprints on film, due to poor handling technique
- Black line across film after being folded during processing
- Cracked or crazed film, due to being dried quickly over a heat source

The potentially dangerous nature of X-rays is recognised in dental practice, and accordingly dentists have to follow intensive legislation and guidelines to ensure the safety of the public and the staff. The ionising radiation legislation is covered briefly in Chapter 3, and the following points are also considered best practice and necessary to ensure that exposures to patients are kept as low as reasonably achievable (ALARA):

- All radiographs taken should be clinically justified
- Only qualified personnel may take radiographs
- A quality assurance system should be in place to ensure a consistently good quality of radiographs is produced, so that repeat exposures are avoided
- The fastest speed of film is used, to reduce exposure
- All staff processing radiographs are correctly trained to do so

- Regular analysis of rejected films is undertaken, to discover where errors lie so that procedures can be modified
- A system of reporting machine breakages should be in place, so that unknown or inadvertent exposure is avoided
- A clinical audit programme should be carried out, so that radiographs and techniques are constantly monitored and improved upon as necessary
- Ideally, all clinical staff should wear monitoring badges so that inadvertent exposure or faulty machines are detected early
- The use of lead aprons is not normally necessary for dental radiography unless the pelvic area is in the main beam of the X-rays (usually occurs only during a specialised view called a vertex occlusal radiograph)

Quality assurance procedures are recommended for all of the following, and should be kept in writing as evidence of compliance:

- Equipment
- Darkroom and films
- Processing procedures
- Working procedures
- Training
- Image quality
- Audits

As the developer and fixer solutions are toxic and classed as special waste, the dental nurse should take the necessary precautions when handling them:

- Wear gloves when handling either solution, including the development of exposed films, to avoid skin contact
- Ensure adequate ventilation in the darkroom, to avoid unnecessary inhalation of fumes
- Wear a plastic apron to avoid splashes onto uniform
- Take adequate care when replenishing or changing the developer and fixer tanks
- Follow the practice policy for the storage and disposal of both solutions; normally they are stored in drums provided by a special waste contractor and collected accordingly when spent
- The solutions can be disposed of into the sewage supply only with the written permission of the water supplier to the area
- All spillages must be cleaned away immediately
- Any suspected medical problems related to either solution, such as skin irritation or breathing difficulties, must be reported to the dentist immediately
- If an accident does occur, the information and advice provided on the relevant COSHH risk assessment sheet must be followed

Activities

- Determine what kV and mA stand for on your X-ray machine.
- Identify three dental radiograph views that you have seen and state why each was taken.
- Think back to three faults that you have seen on radiographs, and determine how each occurred.
- Explain to a colleague how you would go about manually developing an exposed dental film.

Chapter Nine

Tooth Restoration

This chapter relates to the restorative part of unit DN15 'Provide chairside support during the prevention and control of periodontal diseases and caries and the restoration of cavities'.

It specifically relates to the third element:

- DN15.3 'Support the oral healthcare team in the preparation and restoration of cavities'

The following subjects are covered in detail:

- The aims of tooth restoration, methods used to control moisture during restorative procedures, local anaesthesia, cavity preparation, and restorations
- The materials and mixing techniques for temporary restorations, linings and bases, and permanent restorations; a large section on the safe handling of mercury is included in the latter

Aims of tooth restoration

A large part of dental surgery time is involved in tooth restoration in one form or another. The aims of tooth restoration can be summarised thus:

- To restore the tooth to its normal shape and prevent stagnation areas developing, so that the accumulation of food debris and plaque is avoided
- To restore the function of the tooth for adequate mastication
- To restore the retentive shape of the tooth, if acting as a bridge retainer or a denture abutment
- To restore aesthetics
- To treat any symptoms before restoration, so alleviating discomfort or pain

Role of the dental nurse

The role of the dental nurse is of paramount importance to the dentist during tooth restoration, if the procedure is to be carried out painlessly and accurately. No matter what procedure is being undertaken, the role of the

dental nurse is basically the same and can be adapted for each surgery procedure accordingly. The role during tooth restoration can be summarised as:

- To have all relevant patient records available
- To have all necessary equipment sterile and ready for use
- To greet the patient and place protective bib and safety glasses, once seated
- To have the correct local anaesthetic equipment set up and ready for use, and to pass correctly and safely to the dentist as required
- To monitor and reassure the patient throughout the procedure
- To provide good moisture control throughout the procedure
- To protect the patient's airway from foreign objects
- To anticipate the dentist's needs with regard to equipment and materials required
- To know the correct mixing methods of the various restorative materials, and to be proficient in their handling
- To debride all used instruments before sterilisation after the procedure, or to dispose of those which are single use correctly, in accordance with hazardous waste disposal legislation
- To ensure the surgery is correctly cleaned after each procedure, to prevent cross-infection
- To ensure that clinical notes are fully and accurately completed, and returned to reception for filing
- To lay out the surgery correctly for the next patient and procedure

Local anaesthesia

The term 'anaesthesia' is defined as 'the loss of all sensation', but in dentistry when local anaesthetics are given, they produce the loss of the sensation of pain only. They would be more correctly termed 'local analgesics'.

Teeth and their surrounding periodontium are highly innervated with a sensory nerve supply which responds to temperature, pressure and pain. If dental treatments were carried out without administering local analgesics by injection first, many procedures would be extremely painful for the patient.

The analgesics act by blocking the nervous impulses from the source of the stimulation (the tooth or surrounding periodontium) so that the information that a painful procedure is being carried out does not reach the brain. The patient is fully aware of the treatment, as they are conscious, but can feel no painful stimuli.

Dental local anaesthetics

Dental local anaesthetics are supplied in 2.2 ml cartridges with the following constituents in most:

- Sterile water, as a carrying solution
- Buffering agents, to maintain neutral pH
- Preservative, to give adequate shelf-life
- Anaesthetic solution
- Possibly a vasoconstrictor, to give adequate duration of analgesia

The constituents which vary between different makes of cartridge are the anaesthetic agent and the vasoconstrictor.

Vasoconstrictors act by narrowing the blood vessels in the immediate vicinity of injection so that the solution is not carried away too quickly. This then acts to prolong the duration of the anaesthetic and allow adequate time for the dentist to carry out the procedure, without the patient feeling any painful sensations.

Commonly used local anaesthetics are:

- Lidocaine – 2% lignocaine hydrochloride with 1:80 000 adrenaline
- Prilocaine – 3% prilocaine hydrochloride with 0.03 IU felypressin
- Mepivacaine – 3% mepivacaine hydrochloride

Adrenaline is the commonest vasoconstrictor used, but this is a potent cardiac stimulant, which acts to increase the rate and depth of the patient's heart beat generally, so caution is necessary with the following medical conditions to avoid adverse cardiac effects:

- Hypertension (high blood pressure)
- Cardiac disease
- Hyperthyroidism (overactive thyroid gland)
- Elderly patients with complicated medical histories
- Patients receiving hormone replacement therapy, as hypertension may be present

The following drugs were once thought to be affected by adrenaline, but this is considered to be a theoretical problem only, nowadays:

- Tricyclic antidepressants
- Monoamine oxidase inhibitors

However, elderly patients taking several drugs should still be treated with caution, as interactions are difficult to predict.

Similarly, felypressin-containing local anaesthetics should be avoided in pregnant women, as, in theory, felypressin may induce womb contraction and cause the onset of premature labour.

Local anaesthetic equipment

Various designs of syringe are available, some side-loading and some breech-loading. The majority are metallic and autoclavable, although it is possible to purchase disposable syringes.

The plungers of some syringes are adapted to be used with an aspirating technique, for safety reasons, by either screwing into the cartridge bung or being designed to press onto special bung diaphragms, without actually administering the contents (Fig. 9.1).

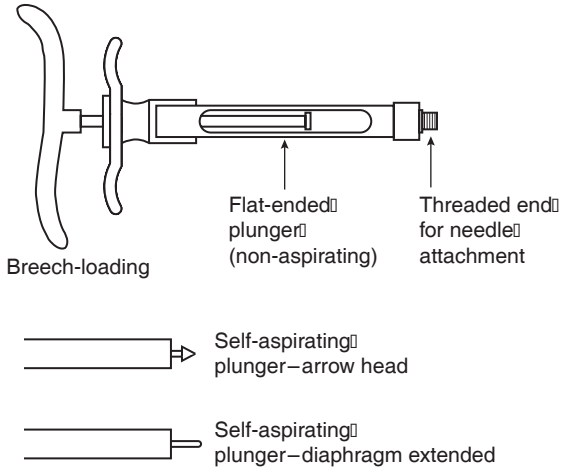


Fig. 9.1 Syringe types.

All designs have a universal-sized threaded end for the needle to be positioned, and various sizes, or gauges, of needle are available. Smaller sizes are less painful to use but are too fine for some sites of injection in the mouth, especially when having to pass through muscle.

Administration techniques

There are four methods of administering local anaesthetics in dentistry:

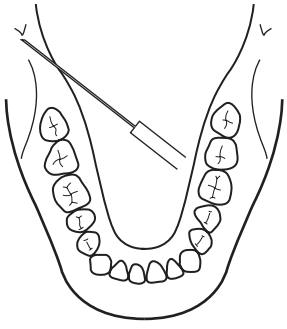
(1) Infiltration
(2) Nerve block
(3) Intraligamentary
(4) Intra-osseous

Infiltration injections place the local anaesthetic solution just under the mucosal surface of the oral cavity, where it penetrates the pores of the alveolar bone so that the nerve endings in the immediate vicinity are affected. It is a technique used to anaesthetise all the gingivae, all the upper teeth and the lower incisor teeth.

Nerve block injections act by anaesthetising the main nerve trunk either before it enters bone or after it leaves it. The commonest nerve block injections are:

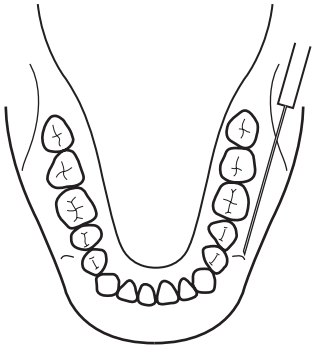
- Inferior dental nerve block – to anaesthetise the whole of the inferior dental nerve trunk, before it enters the mandible through the mandibular foramen (Fig. 9.2)
- Mental nerve block – to anaesthetise the end portion of the inferior dental nerve, as it leaves the mandible through the mental foramen (Fig. 9.3)
- Posterior superior dental nerve block – to anaesthetise this nerve before it enters the maxillary antrum

Thus, the inferior dental nerve block anaesthetises all lower teeth and their lingual gingivae, and the buccal or labial gingivae of all these teeth except the molars. The mental nerve block anaesthetises the premolar, canine, and incisor teeth and their buccal or labial gingivae. The posterior superior dental



Needle positioned close to mandibular foramen, from opposite side of mouth, and just above occlusal surfaces of lower teeth

Fig. 9.2 Inferior dental nerve block.



Needle positioned next to mental foramen, in an upright direction

Fig. 9.3 Mental nerve block.

nerve block anaesthetises the upper second and third molar teeth and their buccal gingivae, and part of the first molar tooth.

The nerve block technique is useful when an infection is present around a tooth which requires treatment, producing anaesthesia without risking the spread of the infection by being able to place the injection at a distance from the tooth involved.

However, all nerve trunks run in close proximity to blood vessels, and great care is required in avoiding an intravascular injection when nerve blocks are administered. An aspirating type of local anaesthetic syringe and cartridge are used, whereby once the needle point is positioned the dentist can aspirate and detect if a blood vessel has been pierced, as blood will flow back into the cartridge. If so, the needle point can be repositioned before the local anaesthetic is administered.

Intraligamentary injections tend to be used in conjunction with either infiltration or nerve block techniques, to produce deeper anaesthesia around hypersensitive teeth. Various specialised syringes are available, and one called the Ligmaject is shown in Fig. 9.4.

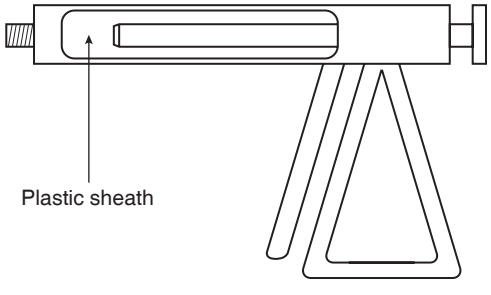


Fig. 9.4 Ligmaject system.

The local anaesthetic is administered into the periodontal ligament around the tooth, and requires relatively high force to be given, so the cartridge tends to be enclosed in a plastic sheath for patient protection, in case it shatters during use. The gingivae around the tooth can be seen to blanch as the anaesthetic is given, but the force required to administer it often produces some degree of post-operative soreness.

Intra-osseous injections are given through the outer cortical plate of the alveolar bone, directly into the cancellous bone where the nerves run. It produces profound anaesthesia of the immediate tooth, with no generalised soft tissue effects, and is therefore better for the patient.

Specialised burs to gain access through the bony plate, and then needles of the same size, are required, but they can be used with normal syringes and cartridges (Fig. 9.5).

The technique can be used for all teeth, but the area of the mental foramen is best avoided, to prevent nerve damage to the mental nerve as it exits the mandible at this point.

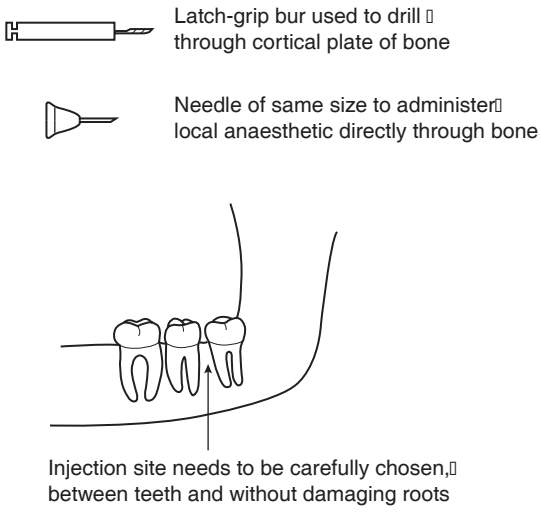


Fig. 9.5 Intra-osseous system.

Nurse safety after injections

Once the local anaesthetic has been administered, the needle is a very real source of cross-infection, as it has pierced the patient's tissues and will be contaminated with blood, no matter how small the amount.

Resheathing of the needle is the commonest cause of needle stick injuries to dental staff, and various needle guard devices have been developed to lower the incidence. Ultimately, the needle sheath should be placed in any container that will hold it firmly upright, so that the syringe can be held by its back end while the needle is resheathed. In this way, fingers are kept well away from the dirty needle and injury is unlikely. Ideally, the needles should be resheathed by the dentist after use, rather than passed to the nurse, as then the potential number of injured persons is reduced.

Dirty needle-stick injury

The real causes for concern are from those patients infected with blood-borne viruses for which there is no protection, such as human immunodeficiency virus (HIV). In the event of a dirty needle-stick injury, the following should be carried out immediately:

- Pricked area should be squeezed immediately, to encourage bleeding
- Under no circumstances should the wound be sucked
- Area should be flushed with alcohol, dried and covered with a waterproof dressing
- Dentist should be informed immediately
- Patient's medical history form should be checked for known cross-infection risks

- Matter should be reported to local occupational health adviser (OHA), based at the local hospital
- Any advice given by the OHA should be followed immediately
- The incident should be recorded in the accident book

Advice to patients after receiving local anaesthetic

Patients need to be informed of the effects of local anaesthesia, especially if receiving it for the first time, so that they are not unduly concerned and do not injure themselves. It is often the dental nurse who imparts this information, which will include:

- Sensation will be lost in the area for several hours
- No eating or drinking must occur until sensation has returned, as they may bite or burn themselves
- Chewing should be avoided directly on teeth restored that day, to prevent damaging new restorations (not necessary for light-cured restorations)
- A tingling sensation indicates that the anaesthetic is wearing off (paraesthesia)
- Nerve blocks may produce tenderness locally for the day
- Intraligamental injections may cause soreness in the surrounding gums

Moisture control during tooth restoration

Adequate moisture control during restorative procedures is one of the most important duties of the dental nurse. It is so vital for the following reasons:

- To protect the patient's airway from inhalation of fluids
- It is uncomfortable for the patient to be supine, with fluids in their mouth
- The dentist's ability to see in the mouth is reduced, and injury to the patient may occur
- The setting of dental materials is adversely affected by moisture contamination
- Cements and linings do not adhere to moist tooth tissue
- Materials applied to the tooth are washed off; this is especially undesirable with acid etchants as they can cause soft tissue burns

Many methods of moisture control are available:

- High speed aspiration – suction with a wide bore tube
- Low speed aspiration – saliva ejector placed in the floor of the mouth
- Rubber dam – an isolating sheet of rubber with just the tooth being restored projecting through (Fig. 9.6)
- Cotton wool rolls – placed anywhere in the mouth to absorb pools of moisture
- Cotton wool pledgets – small balls used to dab cavities dry
- Dryguard® – special discs containing absorbent material and placed over parotid salivary gland duct

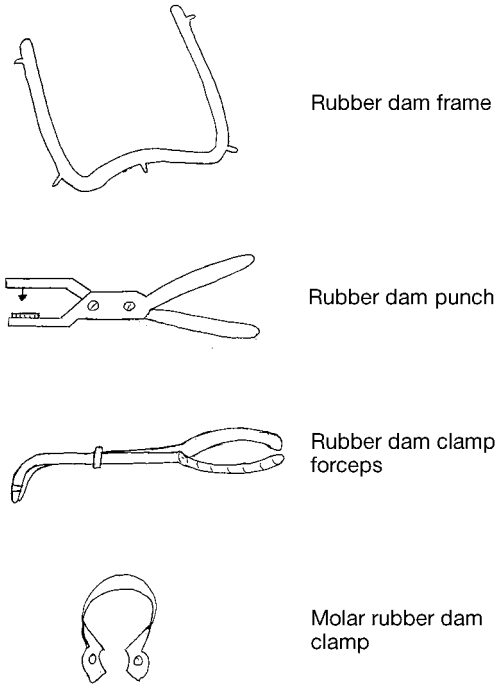


Fig. 9.6 Rubber dam equipment.

- Compressed air – from triple syringe of dental unit, used to blow cavities and teeth dry

Cavity preparation

A cavity is an abnormal hole in the hard tissues of the tooth, caused by caries. It is important that cavities are eliminated, as otherwise the caries would continue to invade the tooth until the pulp was breached. The tooth will then die and have either to be extracted or to undergo endodontic treatment in an attempt to save it.

A cavity can exist on any surface of the tooth, and they have been classified into groups depending on which surfaces of which teeth are affected. This is to enable the cavity to be recorded accurately while charting (see Chapter 7).

The aims of cavity preparation are:

- To eliminate all caries from the cavity
- To remove minimal tooth tissue while doing so
- To avoid breaching the pulp chamber while doing so, unless already breached by caries
- To protect the pulp, using linings and bases, and so reduce the risk of post-operative symptoms

- To produce a retentive cavity for restoration, as necessary
- To restore the tooth to adequate function and appearance

The basic instruments required are those usually set up as a standard 'conservation tray', although dentists have their own preferences. The selection shown in Fig. 9.7 includes the following:

- Mouth mirror – for vision, to reflect light onto tooth, to retract and protect soft tissues
- Right-angle probe – to feel cavity margins, to detect softened dentine, to detect overhanging restorations
- Excavators – small and large, to spoon out softened dentine
- Amalgam plugger – to press plastic filling materials fully into prepared cavities, to ensure no air spaces remain and to remove excess mercury from amalgam mix
- Burnisher – ball or pear shaped, to ensure margins are fully adapted to the cavity walls, to prevent leakage under the restoration
- Flat plastic – to adapt plastic filling materials to cavity walls, to remove excess filling material before setting, to ensure a smooth marginal contact from restoration to tooth
- College tweezers – to hold and carry various items

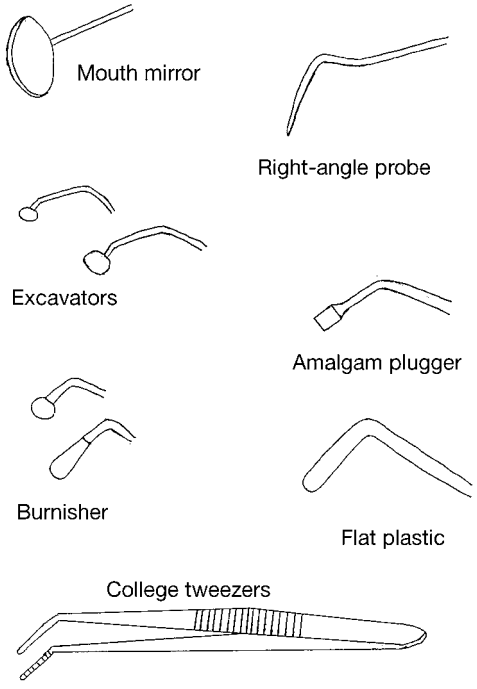


Fig. 9.7 Conservation tray.

The carious tooth tissue is removed in bulk by the use of various burs, in both the air turbine handpiece or the slow contra-angle handpiece (Fig. 9.8). The air turbine operates at speeds around 500 000 rpm and uses friction grip diamond or tungsten carbide burs to cut easily through both enamel and dentine. The slow handpiece operates at around 40 000 rpm and uses latch grip stainless steel burs to remove softened dentine. The tactile sensation with the latter is such that the dentist can detect any change in hardness of tooth tissue, and then avoid inadvertently drilling into the pulp chamber.

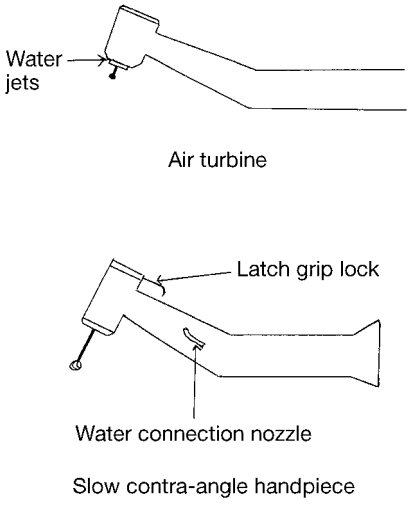


Fig. 9.8 Dental handpieces.

Final cavity preparation to remove unsupported enamel and give stable cavity margins can then be carried out with hand instruments, such as excavators, gingival margin trimmers and enamel chisels (Fig. 9.9).

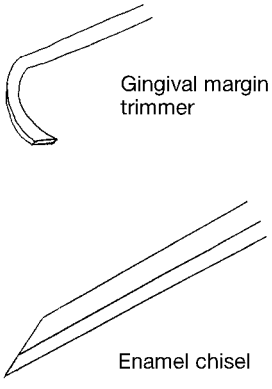


Fig. 9.9 Cavity preparers.

Restorations

Plastic restorations, which are inserted at the chairside are composed of the following:

- Temporary restorations
- Linings and bases
- Permanent restorations

Temporary restorations

Temporary restorations are those placed as a temporary measure, before the tooth is restored permanently, and are used for a variety of reasons:

- As an emergency measure to seal a cavity and prevent carious ingress
- During endodontic treatment, as repeated access may be required to the pulp chamber over several appointments
- During inlay construction to seal the preparation while the permanent inlay is constructed
- To allow a symptomatic tooth to become symptom-free, before being permanently sealed

A variety of materials are available, under many tradenames, but temporary restorations can generally be categorised into one of the following groups:

- Zinc oxide and eugenol
- Zinc phosphate
- Zinc polycarboxylate
- Gutta percha

Zinc oxide and eugenol

- Preparation as zinc oxide powder and eugenol liquid
- Mixed by spatulation on glass slab with metal spatula
- Used as temporary filling, lining in deep cavities, root filling and as sedative dressing
- Advantages – sedative to symptomatic pulp, cheap
- Disadvantages – reacts with composites and prevents their setting, and eugenol can burn soft tissues

Zinc phosphate

- Preparation as zinc oxide powder and phosphoric acid liquid
- Mixed by spatulation on cool glass slab with metal spatula
- Used as temporary filling, lining, luting cement and for endodontics
- Advantages – sets quickly to a good hardness, is adhesive to dentine
- Disadvantages – irritant to pulp in deep cavities, moisture sensitive

Zinc polycarboxylate

- Preparation as zinc oxide and polyacrylic acid as powder, and sterile water as liquid
- Mixed by spatulation on glass slab with metal spatula
- Used as temporary filling, luting cement, lining and for endodontics
- Advantages – is most adhesive of these cements
- Disadvantages – sticks easily to instruments

Gutta percha

- Prepared as pre-formed cones or sticks of rubber
- Only requires heat to become plasticised
- Used as temporary filling with zinc oxide, and in endodontics and vitality testing
- Advantages – none over other temporary filling materials
- Disadvantages – messy technique, poor margin adaptation to cavity

Linings and bases

Linings and bases are materials placed in the deepest part of the cavity, over the pulp chamber, before a restoration is placed. Their aim is to protect the pulp from thermal and chemical shock, by providing a barrier between the permanent restoration and the living pulp tissue, so that temperature fluctuations in the mouth are not transmitted, nor is adverse chemical stimulation from restorations.

Zinc oxide and eugenol can be used as a sedative base beneath permanent restorations if allowed to set fully before the restoration is placed, and if an adequate thickness of the base can be placed.

Zinc polycarboxylate and zinc phosphate can be used as bases too, but the acidic nature of the latter requires that a lining of calcium hydroxide is placed beneath it to further protect the pulp. Again, space is required for an adequate thickness of the base to be placed.

Calcium hydroxide

- Preparation as calcium hydroxide and resin in a solvent
- Usually supplied in ready-mixed paste form
- Used as lining under other materials, in pulp capping and endodontics
- Advantages – alkaline so counteracts acidic zinc phosphate, and kills bacteria in caries
- Disadvantages – soluble in water, and not strong enough to use alone except as a thin liner in shallow cavities

Modern calcium hydroxide cements are available as light-cured liners, which are quick and easy to apply and can be set in seconds.

Permanent restorations

Permanent restorations are those materials placed to restore the tooth to its full function. They must all have the following properties:

- Set to a hard enough degree to allow normal masticatory function to occur
- Remain undissolved in the oral cavity over time
- Biologically safe
- Able to be applied to the tooth using normal conservation instruments, in a straightforward manner
- Ideally, to be aesthetically acceptable

A normal conservation tray is required for their placement.
The three materials used commonly are:

- Amalgam
- Composite
- Glass ionomer

Amalgam

Amalgam is the commonest permanent restorative material and has been used since the mid-nineteenth century. It is supplied as powdered alloy containing:

- Silver up to 74%
- Variable quantities of tin
- Variable quantities of copper up to 30%
- Small quantities of zinc

Varying the alloy constituent gives amalgam, when mixed with mercury, which has varying degrees of marginal ditching and discolouration. Modern amalgams tend to be 'high copper' to reduce these unwanted effects as much as possible.

Amalgam can be supplied either as alloy powder and mercury liquid, which are loaded into the reservoirs of an amalgamator, so that measured doses can be mixed, or in a capsular form containing measured doses separated by a rubber diaphragm, which is dislodged on mixing in an amalgamator (Fig. 9.10). The capsular type is safer, as no contact with the constituents is necessary.

When used to restore class II cavities, a metallic matrix band and retainer (such as a Siqveland type) are required to prevent the amalgam mix being squashed out of the cavity interproximally, as it is packed occlusally. Better adaptation to the tooth shape is achieved using wooden wedges inserted against the deeper edge of the matrix band (Fig. 9.11).

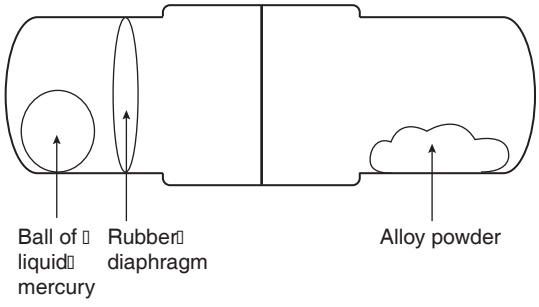


Fig. 9.10 Amalgam capsule.

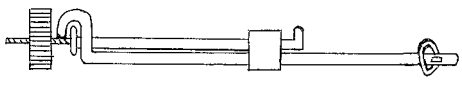


Fig. 9.11 Siqveland matrix retainer.

The advantages of amalgam are:

- Easy to use
- Relatively cheap
- Good strength when set and easily able to withstand normal occlusal forces
- Excellent longevity, lasting many years under normal conditions

The disadvantages of amalgam are:

- Mercury is toxic
- Non-retentive to tooth tissue, so undercut cavities are required
- Metallic, so liners and/or bases are required to prevent thermal shock
- Dependent on correct constituents and mixing times for ideal dimensional stability when set
- Poor aesthetics

Safe handling of mercury and amalgam

Mercury is a liquid metal, which is toxic in the following ways:

- Inhalation of the vapours
- Absorption through the skin

As all amalgam systems contain mercury, precautions are required for its safe use:

- Good ventilation in surgery to ensure mercury vapour does not accumulate over time

- Wearing of protective gloves, mask and safety glasses by all members of the dental team, to avoid skin absorption
- Use of capsular amalgam, to avoid having to come into contact with mercury liquid when loading amalgamator
- Adherence to health and safety policy to avoid spillages
- Presence of mercury spillage kit in surgery, so that spillages can be dealt with quickly and safely

Both mercury and amalgam release mercury vapour at ordinary room temperature, and the higher the temperature, the more vapour is released. Mercury vapour is invisible and odourless.

The main production of waste amalgam is during the removal of old fillings, when an aerosol of amalgam is produced which can be inhaled and absorbed by dental staff if the correct protective items are not worn. Good, high speed aspiration by the dental nurse is imperative to reduce the immediate level of contamination.

All waste amalgam is classified as special waste and has to be collected and disposed of by specialist waste companies. Before collection, it has to be stored at the dental practice in special waste containers which contain chemicals to absorb mercury vapour, and away from heat sources to reduce the amount of vapour given off.

Mercury spillage

If health and safety policies are followed, spillage should rarely, if ever, happen. If it does:

- Report incident to dentist immediately
- Small mercury spillages can be collected by sucking mercury droplets into an intravenous syringe, and placing the collection into the correct storage container
- Waste amalgam can be gathered up with damp paper towels before being transferred to the storage container
- Larger spills of mercury should be covered with a mercury absorption paste of calcium hydroxide and flowers of sulphur, mixed with water – these are in the mercury spillage kit, which all practices should possess
- When the paste is dry it is gathered up with damp paper towels and transferred to the storage container
- Large spillages require the evacuation of the premises, sealing of the area, and the involvement of the environmental health department to remove the contamination as a specialist procedure
- The Health and Safety Executive must be notified, so that an investigation can be carried out to determine if the practice procedure needs to be changed to prevent recurrence

Mercury poisoning

Early stage symptoms are:

- Fatigue
- Headache
- Nausea
- Irritability
- Diarrhoea

Later stage symptoms are:

- Hand tremors
- Visual disturbance

End stage will be kidney failure and death if untreated.

Monitoring devices are available, and blood and urine tests can be carried out on staff to detect abnormal levels of mercury in the body.

If sound health and safety policies are followed at all times, there should be no cause for concern unless a large spillage occurs.

The procedure for the placement of an amalgam restoration is as follows:

(1) The cavity will have had all caries removed, without breaching the pulp chamber
(2) This will have been achieved using the air turbine and slow handpiece, and various burs
(3) Hand instruments may have completed the cavity preparation, as mentioned previously
(4) A suitable lining or lining and base will have been placed, depending on the depth of the cavity
(5) A matrix band and wooden wedge will be placed if a class II cavity is involved, to ensure that no amalgam can be pushed out of the cavity during placement
(6) The amalgam is mixed and placed in a suitable pot, and then an amalgam carrier will be pushed into the mix so that it loads increments of amalgam
(7) The loaded carrier is placed in the cavity and the amalgam is released
(8) The dentist condenses the mix using an amalgam plugger, starting at the deepest part and working out
(9) Enough increments are placed to overfill the cavity, and then it is shaped using burnishers and a Ward's carver, to produce a tooth surface shape similar to a sound tooth
(10) The nurse uses high speed aspiration to collect the waste amalgam as it is removed
(11) The matrix band is carefully removed and the restoration margins are checked for overhangs
(12) The occlusion is checked to ensure that there are no premature contacts, as these would cause pain
(13) The patient is told not to chew on the restoration for several hours, while it hardens

Composites

Composites are tooth-coloured restoratives containing inorganic particles of silica suspended in a resin binder. The particle size can be varied to produce 'microfine' composites which are easily polished, for anterior restorations, or 'hybrid' composites containing different sized particles, with higher strength and wear resistance, for posterior restorations.

Modern composite materials are cured (or set) by exposure to a blue curing lamp, without the need for any mixing to occur.

The contents of a normal conservation tray (see Fig. 9.7 above) are the only other instruments required for placement of composites, although some items can be ceramic tipped rather than the usual stainless steel, to discourage sticking of the material to the instruments.

Celluloid matrix strips can be used in class III and class IV cavities, to ensure good contact points are produced.

Posteriorly, the material is used in wedge-shaped increments to ensure adequate curing occurs to the full depth of the restoration (Fig. 9.12).

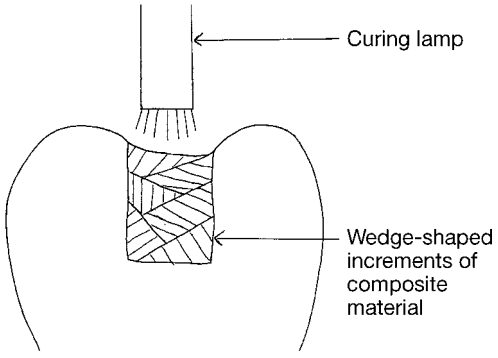


Fig. 9.12 Composite technique.

Composites are adhesive to enamel following the chemical roughening of the enamel surface by acid etchant, as 33% phosphoric acid. This allows the binding of the resin to the enamel mechanically and chemically, and thus the binding of the composite to this marginal layer of resin.

Modern composites also incorporate a primer to allow dentine bonding to occur too, so that marginal leakage of the restoration is practically eliminated.

The advantages of composite are:

- Superior aesthetics, as presented in many tooth shades
- Adhesive to tooth, using etch and primers, so no undercutting of cavity required
- Marginal leakage therefore reduced to a minimum
- Sufficient pulpal protection with lining of calcium hydroxide only
- Sufficient strength for small posterior restorations

- Can be used in indirect inlay technique for larger restorations
- Light-cured to set, so no caution required for patient after placement
- Available in pre-mixed compoules supplied with gun, for direct insertion into cavity

The disadvantages of composites are:

- More technique-sensitive approach required
- Longer procedure
- More expensive, and require purchase of curing lamp
- Not as strong as amalgam
- Resin used is undergoing medical investigation for hormone content and possible consequences thereof
- Reacts with base materials, so glass ionomer cement required in deep restorations
- Etchants are strongly acidic and need to be used with caution to prevent patient injury to soft tissues
- Curing lamps can cause retinal damage if orange-coloured shields are not used to view through

The procedure for the placement of a composite restoration is as follows:

(1) Cavity will have been prepared using air turbine and slow handpiece with a selection of burs
(2) Final adjustments may have been made using hand instruments
(3) A calcium hydroxide lining or glass ionomer base will have been placed
(4) An acid etchant gel is carefully placed onto the cut enamel, and removed by washing with water in accordance with the manufacturer's recommended timing
(5) This is carefully aspirated away by the nurse, using high speed suction
(6) A dentine primer may also be used at this point, materials vary
(7) A resin is carefully placed onto the etched enamel surface using an applicator, and cured following the manufacturer's instructions
(8) A celluloid matrix strip is used in class III and class IV cavities, to isolate the cavity from the adjacent teeth so that the restoration does not stick them together
(9) Composite is placed in the cavity to fill it completely, without leaving any spaces, and the matrix strip is held tightly while the restoration is cured
(10) Careful inspection will reveal any overhanging margins to be removed, and occlusal indicator paper is used to ensure the restoration is not proud
(11) A final coat of resin can be placed and cured to produce a smooth finish, once adjustments are completed

Glass ionomers

Glass ionomers are different from composite materials, in that they are naturally adhesive to enamel, dentine and cementum, but their aesthetics are not as good as composites. Glass ionomers consist of powdered glass and poly(acrylic acid) powder mixed with clean water, or more recently as pre-mixed compoules combined with composite, to produce compomers for immediate insertion.

As the chemical reaction involved is dependent on water being incorporated in the mix, replacement of the bottle lid is imperative to prevent contamination of the material before use.

A normal conservation tray (see Fig. 9.7 above) is all that is required for the use of glass ionomers, unless they are light cured with the blue curing lamp. However, if the material is to be mixed, an abrasion-resistant spatula is required (non-metallic), to prevent damage from the acid.

The advantages of glass ionomer are:

- Adhesive to enamel, dentine and cementum, so minimal cavity preparation required
- Ideal for use in class V cavities
- Excellent marginal seal produced, as material adheres chemically to tooth
- Marginal seal can be further enhanced by use of 'conditioner' of either poly(acrylic acid) or tannic acid
- Releases fluoride over time, which can be incorporated into tooth structure as fluorapatite
- More modern materials have been strengthened for use in core build-up by the addition of metal powder, to produce 'cermets'
- Better aesthetics than amalgam

The disadvantages of glass ionomer are:

- Low strength compared with amalgam and composite, so not suitable for many restorations
- Critical handling necessary on restoration placement to prevent failure
- Needs pulpal protection from acid content, so thin calcium hydroxide lining advised
- Distorted by moisture contamination, so dry field during placement is imperative
- Take many hours to set fully, so surface requires protection from moisture by use of petroleum jelly, varnish or, ideally, a set layer of light-curing resin
- Technique sensitive as regards mixing; exact proportions of powder to liquid are required to produce optimal setting

The procedure used to place a glass ionomer restoration is similar to that for a composite restoration (see above), except that no enamel etching is required.

For class V cavities, a cervical matrix foil can be used to ensure the

restoration is well adapted to the tooth, and the excess material can be removed with hand instruments.

Glass ionomer cements are not suitable for adjustment after setting as the surface becomes chalky. The restoration is coated with a varnish once initially set, to avoid moisture contamination.

Activities

- List the types of local anaesthetic solution used in your practice. Identify when each is used.
- Think back to when you have had local anaesthetic for dental treatment. Describe to a colleague the effects you felt.
- Identify your practice policy for a sharps injury.
- List the methods of moisture control used in your practice.
- Identify all of the temporary filling materials used in your practice. Explain the reasons for the use of three of them.
- Explain to a colleague how you would deal with a small spillage of mercury.

Chapter Ten

Prosthetic Dentistry

This chapter relates to unit DN20 'Provide chairside support during prosthetic dental treatment'.

It covers the three elements:

- DN20.1 'Prepare patients, environments, equipment and materials for prosthetic dental treatment'
- DN20.2 'Facilitate the preparation and fitting of fixed prostheses'
- DN20.3 'Support the oral healthcare team in the design, construction and fitting of removable prostheses'

The equipment, materials and methods, laboratory role, dental nurse support and oral health information is given for the following fixed prostheses:

- Temporary and permanent crowns
- Temporary and permanent bridges
- Veneers
- Inlays

The same information is given for the following removable prostheses:

- Acrylic full and partial dentures
- Chrome cobalt full and partial dentures
- Immediate replacement dentures

Scope of prosthetic dentistry

Prosthetic dentistry is concerned with fixed prosthetics and removable prosthetics, as follows:

Fixed prosthetics covers:

- Crowns and temporary crowns
- Bridges and temporary bridges
- Veneers
- Inlays

Removable prosthetics covers:
- Acrylic dentures
- Chrome dentures
- Immediate replacement dentures

Fixed prosthetics

All of those to be described are provided for varying reasons but involve the use of similar materials and similar instruments.

Crowns

Crowns are fixed prostheses cemented permanently to individual teeth when:

- Underlying tooth is heavily restored (filled) and showing signs of failure, such as cracked cusps and repeated filling fracture
- Root filled teeth, which tend to become brittle with time
- Aesthetic reasons, when tooth is malaligned, discoloured, wrong shape
- Shape change to make a more retentive abutment tooth for a removable prosthesis (denture)

Several types of crown are available. Anteriorly they tend to be tooth coloured, but posteriorly they are often fully metallic. Anterior crowns include:

- Porcelain jacket crown
- Bonded porcelain to metallic substructure crown
- All-ceramic crown

Of these three types, porcelain jacket crowns are the weakest and least likely to be used, unless the patient has a low occlusal force.

Posterior crowns include:

- Non-precious metal alloy crown
- Precious metal alloy crown
- Bonded porcelain to metallic substructure crown

These three types are similarly strong, but porcelain can be cracked off the metallic substructure of the third type, especially with patients who have strong occlusal forces.

Instruments

The instruments required for a crown preparation are a normal tray set up for conservation procedures (Fig. 10.1).

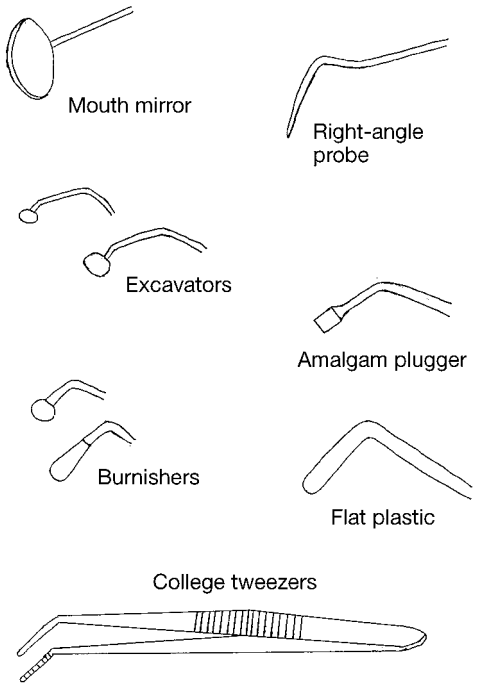


Fig. 10.1 Conservation tray for a crown.

The instruments have the following functions:

- Mouth mirror – for vision, to reflect light onto the tooth, and to retract and protect soft tissues
- Right-angle probe – to feel cavity or preparation margins, to detect softened dentine, to detect overhangs of fillings
- Excavators – small and large, to spoon out softened dentine
- Amalgam plugger – to press amalgam (and other plastic filling materials) fully into prepared cavities, to ensure no air spaces remain and to remove excess mercury from the amalgam mix
- Burnisher – ball-ended or pear-ended, to ensure margins of fillings and gold crowns are fully adapted to the tooth preparation, to prevent leakage under the restoration
- Flat plastic – to adapt plastic filling materials to cavities and preparations, to remove excess filling material before setting, to ensure a smooth marginal contact from restoration to tooth
- College tweezers – to hold and carry a multitude of things, such as cotton wool pledgets, sponges, endodontic materials, and so on

This is the basic set up for a conservation tray, but dentists will differ in their individual requirements.

Impression materials

The technique of crown construction is an indirect one, whereby the dentist prepares the tooth and then sends a copy of it to a technician (using impression materials) for the crown to be custom made. The crown is then supplied to the dentist for fitting to the patient's tooth. An impression of the opposing arch of the teeth is also sent so that the technician can ensure that the crown will not alter the patient's bite, once fitted.

The variety of impression materials available is vast, but all have to have the following properties:

- To be easily mixed
- To be cost effective
- To have an adequate working time before setting
- To have a relatively short setting time, for patient comfort
- To record tooth details accurately
- To be stable when set so that models cast from the impression are accurate and not distorted
- To be elastic so that tearing on removal does not occur, and so that the impression maintains the details recorded accurately
- To be able to be disinfected without affecting the accuracy of the details recorded, as a cross-infection precaution

The more commonly used elastic types of impression materials fall into one of the following categories:

- Irreversible hydrocolloids – alginate
- Addition silicones, from heavy-bodied putty to light-bodied paste
- Polyethers

Alginate

Alginate is the most commonly used impression material in dental practice, as it is easy to mix and relatively cheap. It is suitable for producing impressions for models for the following:

- Opposing arch models for crown, bridge, inlay and veneer construction
- Models for the construction of full and partial acrylic dentures
- Models for the construction of removable orthodontic appliances
- Study models
- Models for the construction of special trays, bleaching trays and orthodontic retainers

However, it is not accurate enough to be used to take the working model for crown, bridge, veneer or inlay construction.

Alginate is presented as a dry powder of calcium salt, alginate salt and filler, with a measured scoop, which is mixed with water at room temperature using

a similar measuring cup. Once the container has been shaken to ensure even distribution of the constituents, and then measured out, it is mixed in a plastic bowl with a large spatula, by folding the powder into the water initially, then vigorously spreading it against the bowl side (spatulating). The mix needs to be spatulated thoroughly to be free of air bubbles, to create a stiff and creamy consistency.

The mix is then loaded into an impression tray before insertion into the patient's mouth.

Impression trays are available as the following:

- Plastic disposable or plastic/metal reusable (which need to be autoclavable)
- Upper or lower
- Variety of sizes from child to large adult
- Stock trays which are mass produced, or special trays which are made individually from patient's first model
- Boxed for dentate patient, or ridge shaped for edentulous patient (those with no teeth)
- Perforated or requiring an adhesive, to prevent impression material pulling out of tray while being removed from mouth

For a single crown, inlay or veneer preparation, a system of 'triple tray' can be used which records the prepared tooth, the opposing teeth, and the patient's correct occlusion in one stage. These are single use, disposable trays made of a plastic frame and cloth infill, which save considerably on the more expensive types of impression material, as they do not require full arch impressions to be taken (Fig. 10.2).

The working time of alginate is affected by the temperature of the mixing water used, and the setting time is affected by the room temperature. In both cases, the higher the temperature, the less time is required.

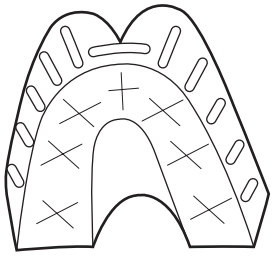
There are also 'chromogenic' alginate materials available which change colour during the mixing and setting stages, for ease of use and accuracy of set.

Once set, the impression can be removed from the patient's mouth and rinsed under cold running water to remove saliva, blood and other debris, before being soaked for up to 10 minutes in a 1% sodium hypochlorite (bleach) solution to disinfect it. It is then rinsed and wrapped in damp gauze and placed in an airtight bag to prevent drying out, as this would distort the impression.

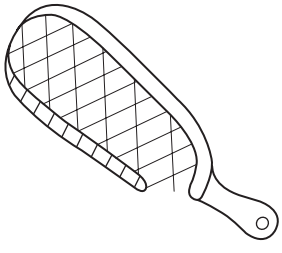
Ideally, the impression will be received within 24 hours by the technician, who will then cast up a model from it using dental stone.

Addition silicones

Addition silicones are highly accurate impression materials used specifically for fixed prosthetic work and some removable prosthetic work. They have a variety of presentations:



Upper perforated boxed tray



Posterior 'triple tray'

Fig. 10.2 Impression trays.

- Tubs of heavy-bodied putty with liquid or paste activator (chemical which actually starts the reaction to produce the impression material)
- Tubes of light-bodied paste with liquid or paste activator
- More recent preloaded gun syringes which mix the constituents automatically

Again, measures are provided for accurate mixing, but it should be noted that it is possible for the mixing and setting times to be affected by some types of rubber gloves used. If mixing is to occur by hand, it is advisable to wear vinyl gloves as other types may affect the setting of the silicone impression.

As each component is usually highly coloured, adequate mixing can be seen to have occurred when a non-streaky mix is produced. Silicones are not affected by temperature.

The silicones can be used either in a one-stage technique (using addition-cured silicones) or two-stage technique (using condensation-cured silicones). With the former, both the heavy-bodied putty and the light-bodied paste are mixed at the same time. The putty is loaded into the impression tray while the paste is either syringed onto the prepared tooth or placed onto it using a flat plastic instrument. Both materials then set and are removed together.

With the two-stage technique the putty is mixed, loaded into the tray, inserted into the mouth and allowed to set first. It is then carefully removed and spaced in the area of the preparation while the mixed paste is syringed or wiped onto the tooth. The set putty and tray are reinserted and the whole is removed when the paste has set.

While the one-stage technique is quicker, the two-stage ensures that

adequate paste remains around the prepared tooth during tray insertion and gives a very accurate impression, whereas it can be displaced by the putty during tray insertion in the one-stage method.

Adhesive is usually supplied by the manufacturer, but perforated trays can also be used.

Setting time is usually 4 minutes or more, so moisture control and patient comfort are of paramount importance.

Following removal from the mouth, the impression is again rinsed in cold water then immersed in 1% sodium hypochlorite solution, but only for 1 minute. It is then rinsed again and, unlike alginate, the impression is blown dry (using a triple syringe) before being sealed in an airtight bag and despatched to the laboratory, ideally within 24 hours.

Polyethers

Polyethers are also highly accurate impression materials, used specifically for fixed prosthetic work and certain removable prosthetic work. They are presented as two pastes which are usually different colours to ensure uniform mixing occurs. They are mixed in equal proportions by spatulation on a waxed paper pad, and then collected into special syringes for administration to the prepared tooth (Fig. 10.3). The remaining material is loaded into the impression tray. Again, adhesive is supplied by the manufacturer.

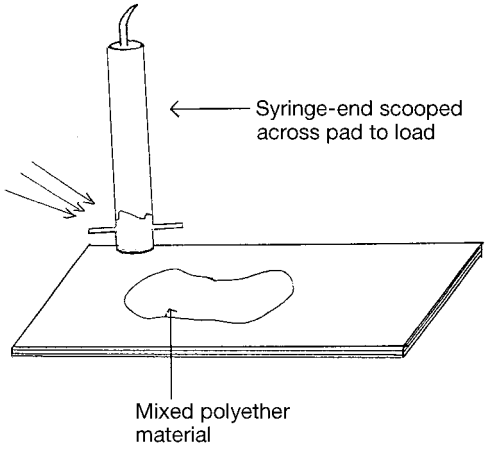


Fig. 10.3 Polyether technique.

Polyethers have a similar setting time to silicones. They set more stiffly than other elastomers, and therefore need to be removed with a sharp displacing action from the mouth, otherwise they can be difficult to remove.

Disinfection is carried out in a similar manner to silicones, but polyethers are more dimensionally unstable if moist, so the impression must be

thoroughly dried before sealing in an airtight bag and despatching to the laboratory, again preferably within 24 hours.

Surgery procedure for crown preparation

Regardless of which tooth is being prepared to receive a crown, the procedure is basically the same. As with all clinical procedures, the role of the dental nurse can be summarised thus:

(1) Ensure the surgery is clean and ready to receive the patient
(2) Have all the correct clinical records, including radiographs and study models, available for the relevant patient
(3) Welcome the patient into the surgery
(4) Have appropriate local anaesthetic equipment set up for use, and pass to the dentist as required
(5) Have all sterile instruments and equipment set up ready for use, and pass to the dentist as required
(6) Provide good aspiration, moisture control and tissue retraction as required
(7) Mix the required materials correctly and pass to the dentist as required
(8) Provide suitable support to the dentist during the finishing of the procedure
(9) Monitor the patient throughout the procedure to ensure they are comfortable and not distressed
(10) Help the patient to rinse out and clean up as necessary
(11) Give relevant and accurate post-operative instructions to the patient as required
(12) Escort the patient safely to the reception area
(13) Clean all dirty instruments and sterilise appropriately, or dispose correctly of single use items
(14) Clean surgery correctly and prepare it for the next patient and procedure
(15) Ensure the clinical notes are correctly written up and that any charting is completed

Adapting this procedure for a crown preparation, the actual surgery procedure can be summarised thus:

(1) Unless the tooth is non-vital, local anaesthetic will be necessary
(2) An alginate impression of the opposing arch is taken, using the appropriate impression tray
(3) An occlusal registration is often taken, especially in complicated cases, using either softened wax which the patient bites into, or using face bows for articulation of the models at the laboratory
(4) The tooth is prepared by reducing its overall dimensions by 1 mm for metallic or ceramic crowns, or 1.5 mm for bonded crowns, using diamond burs which produce near-parallel sides to provide optimum retention, but without producing undercuts (Fig. 10.4).

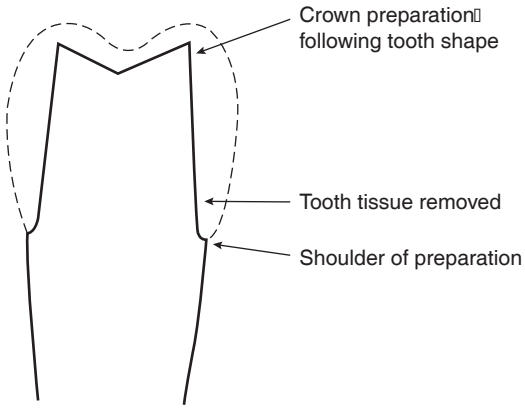


Fig. 10.4 Crown preparation.

(5) To ensure accurate recording of the crown preparation margins, gingival retraction cord can be pushed into the gingival crevice and removed immediately before the impression is inserted
(6) This is cord soaked in either adrenaline or alum, both of which cause the gingivae to retract and pull away from the tooth, thus allowing impression material to flow in and accurately record the margins
(7) An elastomer impression is then taken of the working arch, as described
(8) When satisfactory impressions have been produced, a temporary crown is made at the chairside and cemented temporarily to the prepared tooth
(9) A shade of the tooth is taken, to match accurately the adjacent teeth including any darkening towards the root, or hypomineralised areas
(10) All relevant details are accurately recorded on the laboratory slip, which is sent to the laboratory with the impressions and occlusal registration for construction of the permanent crown
(11) A correct return date should be given, to coincide with the patient's next appointment for fitting of the crown

Temporary crowns

Temporary crowns are provided for aesthetic reasons, to prevent over-eruption of the prepared tooth, and to avoid sensitivity problems in the prepared tooth while the permanent crown is being constructed.

Temporary crowns can be hand made at the chairside:

- An alginate impression of the tooth is taken before crown preparation begins
- A cold cure acrylic material is then mixed and placed in the impression after crown preparation, and reinserted into the mouth

- This takes just minutes to set, and produces a temporary crown of exactly the shape of the original tooth
- Shades are rather restricted, so colour matching is as accurate as can be expected

Temporary crowns can also be provided by mass production in various sizes, for each tooth shape. These can be cut and trimmed at the chairside to fit any prepared tooth, using either acrylic trimming burs, or Beebee crown shears to ensure accurate marginal fit (Fig. 10.5). They are then temporarily cemented to the tooth, using a zinc oxide and eugenol temporary cement, while awaiting the permanent crown construction.

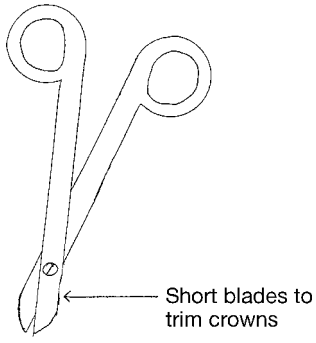


Fig. 10.5 Beebee crown shears.

Surgery procedure for crown fitting

Laboratories vary in the time required for the crown to be custom made. Accurate and detailed information provided on the laboratory slip will ensure that unnecessary delays are avoided, and a professional and trusting relationship between the practice and the laboratory technician often allows for speedier completion on occasion.

Again, the nurse's role is as detailed in the previous section, and the fitting procedure can be summarised thus:

(1) Local anaesthetic may or may not be required
(2) A full conservation tray is set out
(3) Temporary crown is removed, using either a flat plastic or an excavator at the margin to dislodge it, or by cutting it off carefully with burs
(4) The latter may be necessary with custom made temporaries, as their acrylic content shrinks on setting and often produces extremely tight-fitting temporary crowns
(5) With suitable airway protection (either rubber dam or gauze sheets laid behind the prepared tooth) to prevent loss of the crown accidently, the crown is tried onto the clean tooth preparation
(6) The marginal fit, occlusion and shade are all checked for accuracy, and minor adjustments can be made

(7) Articulating paper held in Miller's forceps is the usual method used for checking of the occlusion
(8) If the marginal fit is inaccurate, saliva and bacteria can leak under the crown and caries will occur or the fitting cement will dissolve and the crown will come off
(9) If the occlusion is incorrect the patient will experience pain and discomfort from the tooth, and the tooth may become dislodged
(10) If the shade is incorrect, the crown will need to be remade
(11) Once both the dentist and patient are happy with the crown, it can be permanently cemented using one of a variety of luting cements

Luting cements

Luting cements are cements which adhere to tooth tissue and the inner surface of the crown either chemically or mechanically, thereby holding the crown firmly onto the tooth. A variety of different types are available:

- Zinc phosphate cement which relies on the microscopic roughness of the prepared tooth and the inner surface of the crown for cementation
- Polycarboxylate cement which chemically bonds to enamel, dentine and metal
- Glass ionomer cement which also chemically bonds to enamel, dentine and metal
- Polyester resin cement which is also chemically adhesive and is highly resistant to dissolving in oral fluids
- Self-curing resins which form bonds between the tooth and the crown
- Light-curing resins which act the same as self-curing resins but are set using the curing light
- Dual-curing resins which are a combination of the previous two

Modern types of cement tend to be provided in double syringe form with no mixing necessary, but older types (such as phosphate, polycarboxylate and glass ionomer cements) require correct proportioning and thorough mixing before use.

All can be mixed on a cool glass slab with a small spatula, by incorporating increments of powder into the relevant liquid and spatulating thoroughly until a smooth, creamy mix is produced.

Working and setting times vary among products, and need to be followed closely for accuracy. If the mix is too stiff, the crown will be unable to be seated fully so that the occlusion will be incorrect. If the mix is too runny, the setting time will be prolonged and the cement will not set consistently throughout, so that loss of the crown is likely.

Post-crowns

Post crowns are crowns cemented onto a metallic post and core, which has been inserted into the empty root canal of a non-vital tooth (Fig. 10.6).

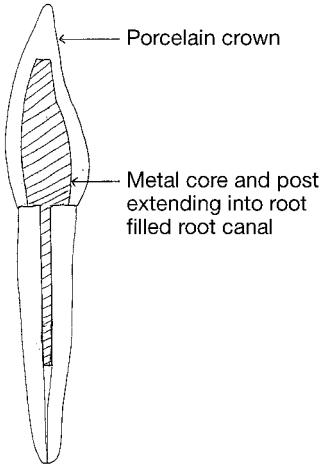


Fig. 10.6 Post crown.

Often, root filled teeth become brittle with time and sometimes snap off at the gingival margin, leaving just the root of the tooth in the dental arch. Post crowns provide a permanent method of restoring them:

(1) The remaining root face is shaped as for the margins of a crown preparation
(2) The root filling material is removed to a suitable depth from the root canal, using Gates–Glidden burs (Fig. 10.7)
(3) The empty canal is widened using a post preparation system, such as Parapost®, which produces parallel-sided post holes for maximum retention

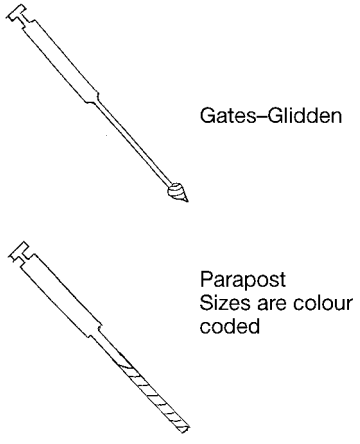


Fig. 10.7 Post crown burs.

(4) Either a prefabricated metal post or a carbon fibre post is then cemented in, or an impression of the preparation is taken, incorporating a wax post which will accurately record the post hole
(5) If the former, then a core can be built onto the protruding end of the post so that a conventional crown impression technique can be followed
(6) If the latter, then the post and core will be custom made as one by the laboratory
(7) This can then be cemented permanently at the crown fit stage, using one of the luting cements described

Oral hygiene instruction for crowns

No matter how well fitting the crown is to the tooth, microscopically the junction between the two is a potential stagnation area for plaque to gather. Thorough brushing at the margins of the crown will ensure that plaque does not accumulate and cause recurrent caries or periodontal problems.

The oral health messages to be relayed to the patient are:

- Regular and thorough toothbrushing daily
- Use of fluoride toothpaste and medium-textured toothbrush
- Regular flossing to clean crown margins interproximally
- Careful use of floss so as not to dislodge crown
- Attend for dental examinations so that margins can be checked professionally
- Sensible diet, low in non-milk extrinsic sugars
- Regular use of good quality mouthwash, to reinforce plaque control

Bridges

A bridge is a type of fixed prosthesis which is used when a patient has one or more missing teeth in a dental arch and does not wish to have them replaced by a denture. Missing teeth can also be replaced by titanium implants, which are surgically placed into the alveolar bone, but they are a specialist technique practised in few general dental practices, and are beyond the remit of this book.

Bridges have several advantages over removable prostheses:

- There is no embarrassment of a loose prosthesis falling out, as bridges are fixed to the teeth permanently
- On the whole, their aesthetics are superior to dentures
- They are more hygienic than dentures, because there is no involvement of any teeth except the retainers and therefore fewer stagnation areas
- Usually only two appointments are required for their provision
- The materials used in their construction are better able to resist occlusal forces than acrylic
- The shades available can be customised in any way by the laboratory technician to mimic the patient's other teeth, whereas those available for dentures are mass produced and unalterable

- They solve the problem of patients with a strong gag reflex who require tooth replacement, and who usually cannot cope with a denture
- They are also better tolerated because of the minimal amount of soft tissue coverage involved

The need for good oral hygiene control post-operatively is of paramount importance, as bridges produce stagnation areas unlike any others in the mouth (that is, under the pontics), and require special techniques for effective cleaning.

Several different types of bridge have been developed, but all designs rely on retaining teeth (abutments) to hold the bridge permanently in place, and they are joined to the missing teeth (pontics) in one structure thus:

- Fixed–fixed bridge where retaining teeth are involved to either side of the missing teeth, as one solid design (Fig. 10.8)
- Fixed–moveable bridge where a joint is incorporated in the design to allow some degree of flexibility to the bridge (Fig. 10.9)
- Cantilever bridge, either simple design where retaining teeth are those immediately to one side of the pontic only (Fig. 10.10), or spring design where the retaining teeth are to one side but several teeth away from the pontic (Fig. 10.11)
- Adhesive bridge where retaining teeth undergo minimal tooth preparation and retention is provided by metal wings only (Fig. 10.12)

The choice of which type of bridge is used depends on several factors:

- Whether an anterior or a posterior tooth is being replaced, as the latter usually undergo heavier occlusal forces, so full crown retainers are generally required

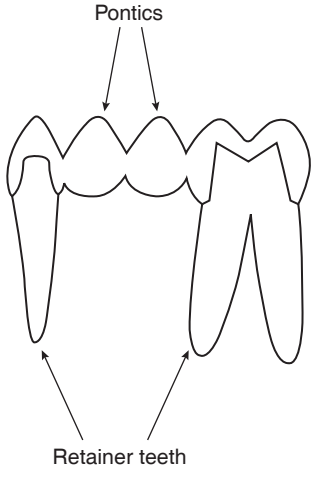


Fig. 10.8 Fixed–fixed bridge.

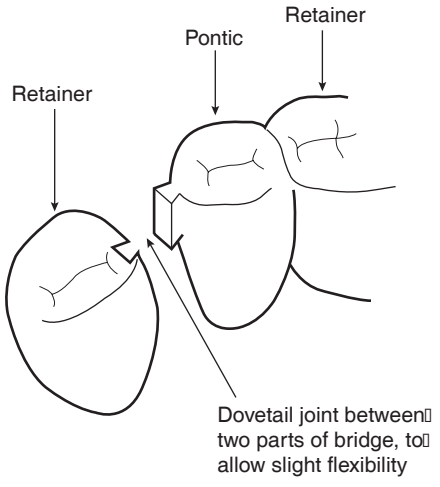


Fig. 10.9 Fixed–moveable bridge.

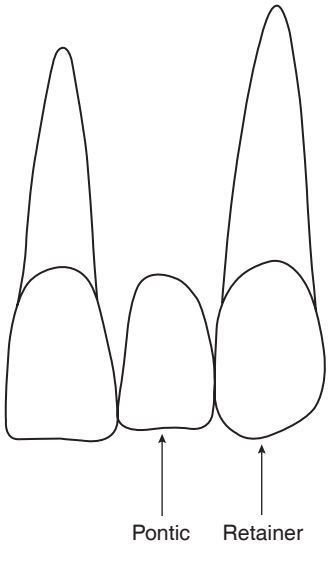


Fig. 10.10 Simple cantilever bridge.

- Like crowns, bridges can be constructed of all-metal or ceramic materials (the former would not be provided anteriorly)
- Fixed–fixed bridges tend not to be used nowadays, as their inflexibility during use can cause damage to retaining teeth
- Wherever possible, adhesive bridges are used, as they involve minimal tooth preparation

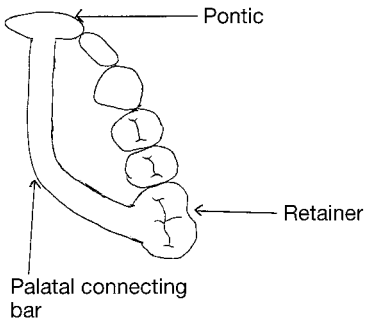


Fig. 10.11 Spring cantilever bridge.

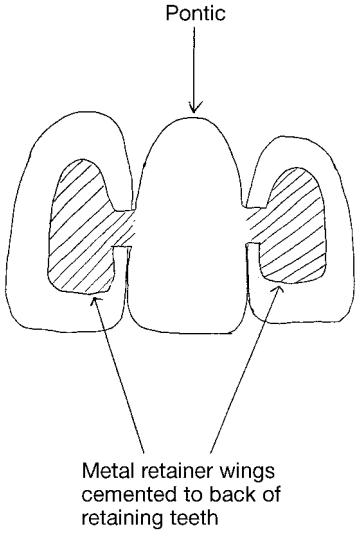


Fig. 10.12 Adhesive bridge.

- If a patient has natural spaces between the teeth, only a spring cantilever design can be used so as to maintain the spaces and give good aesthetics
- The health of the retaining teeth is of paramount importance to the success of the bridge, and if there is any cause for concern, an adhesive type of bridge is advisable so that any problems would result in its dislodgement rather than causing damage to the retainers

All types of bridge except adhesive ones rely on the retaining teeth being of full crown coverage; indeed, the tooth preparation is exactly the same as for a single crown, as are the instruments and the impression materials used.

Temporary bridges

Temporary coverage of the prepared abutments is necessary as for crowns, the missing tooth or teeth being replaced temporarily either by a pre-existing

denture or not at all. Alternatively, the missing tooth and the retainers can be covered by a temporary bridge.

Temporary bridges can be made in the laboratory, before tooth extraction, or at the chairside in a similar fashion to temporary crowns using an alginate impression taken before tooth extraction. Their functions are:

- To provide reasonable aesthetics while the extraction site heals
- To provide reasonable aesthetics while the permanent bridge is constructed
- To hold the extraction space open, as teeth can drift naturally and close the space, or tip into it
- To maintain the occlusion
- To prevent sensitivity of the prepared abutment teeth

Once the permanent bridge has been constructed, any temporary bridge present can be removed in the same way as for a temporary crown. The same fitting checks are made before permanent cementation, using the same luting cement options as for crowns, except for adhesive bridges. Adhesive bridges require special dual curing resin cements with primers, to provide a strong chemical bond between the retaining teeth and the metal wings of the bridge. There is little retention provided by tooth preparation with these bridges. Their use is generally restricted to areas of low occlusal force to prevent dislodgement, although new luting cements are being developed constantly to attempt to overcome this problem.

Oral hygiene instruction for bridges

Bridges provide a challenge to the patient with regard to adequate oral hygiene, as they are fixed prostheses producing stagnation areas actually beneath the pontics. As well as the oral hygiene instructions for crowns, patients with bridges need to be instructed in the use of Superfloss® (Fig. 10.13). This is a type of dental floss with a stiff end, which can be threaded under the pontic by the patient, and then drawn through to a sponge part which is used to clean beneath the pontic. When used regularly, it keeps this region of the bridge free of plaque and prevents caries undermining the retainers, with catastrophic consequences.

More recently, the use of sonic toothbrushes has been shown to provide excellent cleaning in these areas, without dislodging the bridge, and these are being recommended more frequently in these cases.

Veneers

Veneers are either a composite or porcelain facing made to cover the labial surface of anterior teeth. They are used in the following situations:

- To mask a discoloured tooth (such as with tetracycline staining)
- To mask a darkened, root filled tooth
- To close diastemas (gaps) between teeth

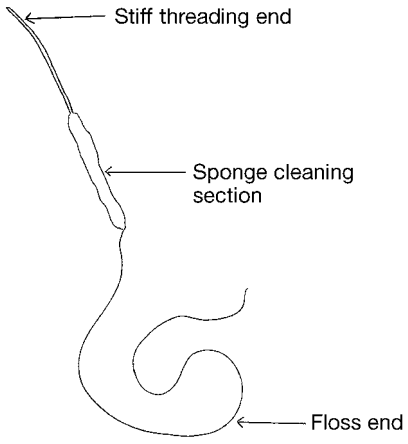


Fig. 10.13 Superfloss®.

- To change the shape of rotated teeth so that they appear aligned
- To change the shape of malaligned teeth so that they appear aligned
- To correct poorly shaped teeth, such as peg laterals
- As a cosmetic procedure, to lighten the whole labial segment

Veneers are fragile once constructed, and can break if the patient is careless with them. Ideally, they are only fitted to patients with low incisal edge forces and they are constructed so as not to cover the incisal edge of the tooth. This then gives the unlikeliest conditions for the veneer to fracture during normal use.

The instruments and impression materials are the same as for crowns and bridges, but often no opposing arch impression is required as veneers rarely encroach on the occlusion.

Surgery procedure for veneer preparation

(1) The role of the dental nurse is as summarised for crown preparation
(2) Unless the tooth is non-vital, local anaesthetic will be required
(3) On the rare occasion that an opposing arch impression is required, this is taken in a stock tray using alginate
(4) The labial surface of the tooth is prepared by removing enough enamel to allow the technician to construct the veneer, this is especially important if the veneer is to give the appearance of alignment to the tooth (Fig. 10.14)
(5) An impression is taken of the labial segment using one of the highly accurate elastomer materials, as for crowns and bridges
(6) The prepared tooth is covered temporarily for appearance and sensitivity reduction, using composite material etched just to the centre of the tooth, so that it can be removed easily at the veneer fit appointment

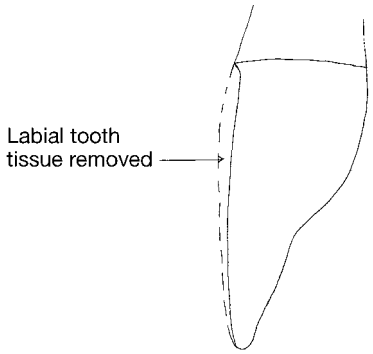


Fig. 10.14 Veneer preparation.

(7) An accurate shade is taken, recording all tooth characteristics for the technician, as for crowns and bridges

Surgery procedure for veneer fitting

As with all fixed prostheses, veneers are custom made in the laboratory by a highly skilled technician. The shades taken in the surgery will be accurately replicated as the veneer is constructed from porcelain, before having the final firing in an oven to produce the surface glaze. The fitting surface of the veneer will be abraded in the laboratory, to produce a rough surface for cement adhesion. The finished product is then carefully returned to the surgery for fitting.

(1) Local anaesthetic may be required
(2) The temporary veneer is removed by flicking it off carefully with a hand instrument, such as a flat plastic or an excavator
(3) The veneer is carefully tried onto the tooth and the fit and shade are checked
(4) If satisfactory, the fitting surface of the veneer is coated with a silane agent which allows the dual cure resin cement to chemically bond to it for good adhesion
(5) The tooth is isolated with either rubber dam or celluloid matrix strips, and then etched, washed and dried
(6) The dual cure resin bond and cement are applied to the tooth and the veneer is carefully pushed onto it, in the correct position
(7) Excess cement is removed before light curing occurs
(8) Flecks of cement trapped interproximally can be removed using abrasive diamond strips, otherwise they will act as stagnation areas and hold plaque

Alternatively, composite veneers can be made at the chairside by the dentist. Good isolation of the adjacent teeth is of paramount importance,

otherwise etch, resin and cement will adhere to these teeth and the patient will be unable to clean correctly.

The shades available for composite veneers are inferior to those for porcelain veneers, but the former are far cheaper to provide than the latter.

Inlays

Inlays are a fixed prosthesis constructed indirectly at a laboratory rather than placed directly into the tooth, as a filling would be (although a direct technique using wax patterns used to be carried out years ago, but is rarely seen nowadays).

Inlays are constructed of either gold alloy, porcelain or a special type of composite which contains more filler than usual and which is therefore stronger than conventional composites.

The purpose of inlays is to produce a restoration of higher strength than the plastic materials, and of a more permanent nature, although with the continual improvement of filling materials, gold alloy inlays are being provided less frequently nowadays.

As the inlay is inserted into the tooth rather than cemented onto it, less tooth preparation is also necessary than for a conventional crown. The equipment, materials and impression techniques are the same as for other fixed prostheses.

Inlay preparation is as for a conventional filling, with the full removal of all carious tooth tissue to sound dentine, but then the cavity preparation is adjusted to ensure that the sides are not undercut but parallel (Fig. 10.15). This allows:

- The inlay to be inserted fully, without becoming stuck on an undercut
- The maximum retention possible is produced, by ensuring that the inlay fits snugly against all the cavity walls
- Only a fine cement layer will then be required, which reduces the risk of cement dissolution

Once the cavity has been prepared suitably and the necessary impressions and occlusal registrations have been taken, the tooth is restored with a temporary filling.

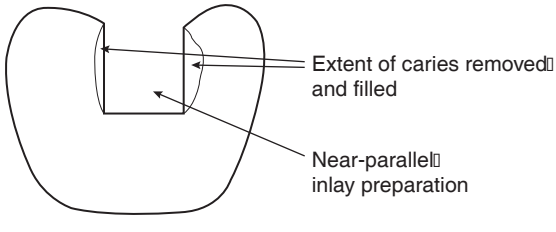


Fig. 10.15 Inlay preparation.

At the fit of the inlay, the occlusion is checked as for crowns and, when correct, the inlay is cemented using one of the luting cements available, as for crowns. Gold alloy inlays have their margins well adapted to the tooth by burnishing at the fit stage, so that the wafer thin edge of the inlay is pressed firmly against the cavity wall. This prevents ingress of saliva and reduces the possibility of the cement being dissolved out (dissolution), with subsequent loss of the inlay.

Removable prosthetics

Removable prostheses are all types of dentures, appliances which are made in the laboratory in various stages to replace missing teeth. They can be removed from the mouth by the patient, for example for cleaning, and re-inserted easily, without the use of cements. Generally, they are made to replace several missing teeth rather than just one or two, as bridges do, or even to replace all the teeth in edentulous patients.

When several teeth are missing, their replacement is necessary to:

- Prevent excess masticatory forces on the remaining teeth, which may cause their eventual fracture
- Prevent overeruption of opposing teeth, which can cause occlusal problems
- Prevent tilting of adjacent teeth into the edentulous spaces, which disrupts the occlusion and creates stagnation areas
- Prevent soft tissue trauma to the alveolar ridges during mastication
- Allow adequate mastication and avoid digestive problems, especially in the elderly
- Provide good aesthetics, especially if anterior teeth are missing

Full and partial acrylic dentures

Acrylic dentures are the commonest types of denture produced, full ones for edentulous patients and partial ones for any number of missing teeth.

As dentures are removable prostheses, their retention in the mouth relies not on cements, as for fixed prostheses, but on the following:

- A suction film of saliva developing between the denture and the patient's soft tissues
- A post dam along the back border of the denture, to help the suction film to develop
- An accurate design and fit of denture, to allow the film to develop adequately
- Use of any natural undercuts in the patient's mouth, such as the alveolar ridges or any natural teeth
- Use of stainless steel clasps around standing teeth, to increase retention

Sometimes, the patient's own teeth are adjusted to provide undercuts, in the following ways:

- Use of a crown to change the overall shape of the tooth
- Use of composite build-ups to provide a retentive area for clasps to engage
- Shape change of an existing restoration for similar reasons

With edentulous patients, the alveolar ridges can be changed surgically, to improve retention and comfort:

- Gross undercuts which would prevent the denture being seated can be removed
- Flat ridges can be built up by the addition of bone substitutes to increase natural retention
- Sharp ridges can be smoothed to allow comfortable wearing of the denture (alveolectomy)

Not all patients are suitable for treatment involving the use of dentures, and the following points need to be considered for every case before treatment commences:

- Is there any previous denture experience, and was it successful?
- If not successful, is there a cause which can be remedied?
- Is the shape of the patient's mouth naturally retentive for full dentures, with good ridges and a high palate, or might pre-prosthetic surgery be necessary?
- Are there any potential retention problems for partial dentures? If so, can they be remedied by tooth shape adjustment?
- Might the patient's occlusion cause problems with the provision of a denture? Is there enough clearance without premature contact onto the denture?
- Are there any medical contraindications to dentures, such as epilepsy or an adverse reaction to the acrylic material?
- Are there other dental problems which need addressing first, such as caries or periodontal disease?
- If the teeth have been lost within the previous six months, bone resorption is likely to occur and this will adversely affect the fit of a denture
- Good cooperation and perseverance by the patient are paramount to the success of dentures; if there is any doubt about these then treatment is likely to fail
- Is the treatment affordable to the patient?

Denture construction

Usually, acrylic dentures are made in five stages, with each stage having to be returned to the laboratory between appointments. The construction of the denture is summarised thus:

(1) **Initial impression** – taken in either a boxed stock tray for dentate patients, or an edentulous stock tray as necessary and using alginate as the impression material. The shade and mould of teeth are also chosen
(2) **Laboratory** – models are cast in plaster and special trays are constructed so that accurate second impressions can be taken, made of acrylic or shellac
(3) **Final impression** – taken using the constructed special trays and either alginate or one of the more accurate elastomer materials for dentate patients, or using impression composition or impression paste for edentulous patients with no large undercuts: these stiffer materials tend to squash the soft tissues and produce tight fitting dentures
(4) **Laboratory** – final models are cast in dental stone and wax occlusal rims are made
(5) **Bite registration** – the occlusal face height of the patient is recorded using a Willis bite gauge for edentulous patients, so that, with the wax rims in place, they are neither overclosed nor propped open, and with dentate patients their remaining teeth are used as a guide to the correct bite. A Fox's occlusal plane guide can also be used with edentulous patients to record the correct plane from left to right, and antero-posteriorly, to ensure that the denture teeth are set correctly (Fig. 10.16). The final bite is recorded by either the warmed wax rims sticking together, or by using bite registration paste to provide a reproducible position of the rims once out of the mouth

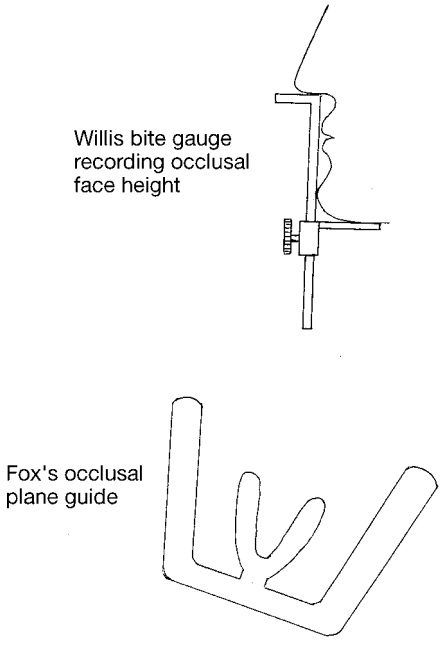


Fig. 10.16 Bite gauge and plane.

(6) **Laboratory** – the joined wax rims and the underlying models are mounted onto an articulator which mimics the jaw movements, so that the technician can construct a wax-based try-in denture with teeth of the chosen shade set accurately into position, with no interferences on jaw movement
(7) **Try-in** – these are inserted and checked in the patient's mouth for accuracy of occlusion, shade and fit onto the soft tissues, and any minor adjustments are easily made to the wax bases. If major adjustments are required, then a retry is usually carried out
(8) **Laboratory** – the try-ins and the stone models are sealed into flasks and the wax is removed by boiling water, the space left between the models and the teeth is then filled in with heat-curing acrylic to form the denture bases. If clasps are being used for dentate patients, they are added at this point. The dentures are then cleaned and polished
(9) **Denture fit** – the dentures are inserted and checked for comfort, accuracy of fit and retention, and appearance, and instructions are given on their wear

Instructions to patient at fitting stage

- Wear denture daily to allow tissues to acclimatise to it
- Leave out at night to allow soft tissues to recover
- Failure to do this can allow a fungal growth of *Candida albicans* to contaminate the denture, causing denture stomatitis (inflamed soft tissues immediately beneath the denture)
- This condition will require treatment with antifungal lozenges, and re-inforcement of denture hygiene
- Clean with toothbrush and toothpaste, over a bowl of water to prevent breakages if dropped
- Can use proprietry denture cleaners if patient wishes, too
- Demonstration of how to insert and remove partial dentures, especially if clasps have been used
- Eat soft foods initially, until used to denture
- Rinse mouth with hot salt water to ease initial soreness
- Return to surgery for denture ease if problem persists or ulcers develop
- Above all, patient must persevere with denture wearing, as acclimatisation can be prolonged

Dental nurse's role and surgery set-up for each stage

The nurse's role for all dental procedures is as detailed previously. Specific points and specialised equipment and instruments are as follows:

First impressions:
- Alginate and necessary mixing bowl and spatula
- Necessary stock trays, with adhesive if not perforated
- Impression material mixed accurately and trays loaded as required

- Usual impression disinfection procedure followed, with correct bagging of impressions afterwards
- Patient's details and correct shade and mould recorded on laboratory ticket, along with the denture design and material of construction, and the date that next stage is required by

Final impressions:
- Special trays available, with adhesive if necessary
- Impression material of choice, with correct mixing implements
- Mix impression material accurately and load trays as required
- Usual impression disinfection procedure followed, with correct bagging of impressions afterwards
- Laboratory ticket completed fully, as above

Bite registration:
- Wax rims on models available
- Heat source, such as gas burner, with matches and extra sheets of pink wax
- Wax knife, plaster knife and Le Cron carver set out (Fig. 10.17)
- Willis bite gauge and facebow set out, if edentulous patient
- Bite registration paste, if required
- Wax knife and Le Cron carver are used to adjust wax rims as necessary
- Plaster knife may be required to trim heels of models, so that rims sit correctly
- Make note of occlusal face height determined using bite gauge
- Ensure laboratory ticket is correctly filled in, as above
- Ensure that rims are not dislodged from each other during bagging

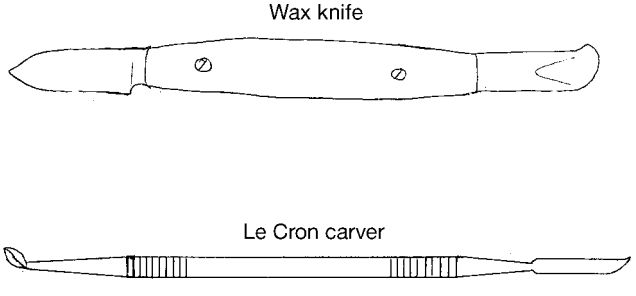


Fig. 10.17 Wax instruments.

Try-in:
- Try-in available
- Heat source, matches and sheets of pink wax available, in case wax adjustments are necessary
- Wax knife and Le Cron carver, as above
- Articulating paper so that occlusion can be checked if necessary

- Hand mirror so patient can view try-ins
- Ensure laboratory ticket is correctly filled in, as above

Fitting:
- Dentures available
- Straight handpiece with selection of acrylic trimming burs, and polishing stone
- Articulating paper or occlusal indicator wax, so that occlusal interferences can be detected and removed
- Pressure relief paste to detect high spots on the fitting surface which will cause discomfort if not removed
- Hand mirror for patient viewing of completed dentures

Full and partial chrome cobalt dentures

Chrome cobalt can be used as the base of the denture, rather than acrylic, but the teeth still need to be attached to this metal base by acrylic on the ridges. Metal-based dentures are more difficult to construct and cost more than acrylic ones, but the advantages are:

- A much thinner palatal covering is possible, which makes the denture more tolerable to patients with a strong gag reflex
- Overcomes any tissue reaction to acrylic monomer, as some patients are sensitive to it
- Denture base is far stronger and less likely to break
- Allows patients with deep overbites onto their palate to be able to wear denture
- Can design partial dentures as 'skeletons' giving minimal tissue coverage and making the denture more tolerable for the patients (Fig. 10.18)
- As less tissue coverage is involved, chrome dentures tend to be more hygienic than acrylic ones

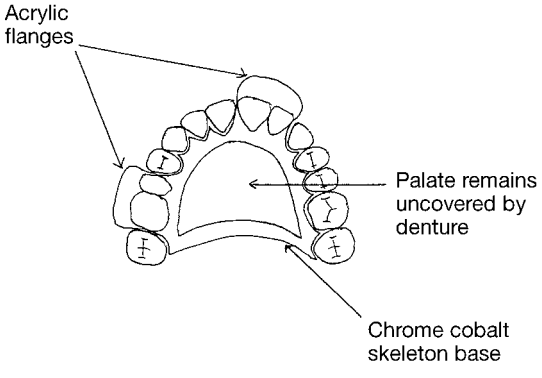


Fig. 10.18 Skeleton denture design.

If the whole palate is covered by a chrome base, then retention is provided by the saliva suction film, as for acrylic dentures. However, if a skeleton design is used then clasps must be placed to retain the denture, so an adequate number of healthy and well-positioned teeth are required.

The clasps will be part of the chrome base, and tooth adjustments can be carried out to provide undercuts, as for stainless steel clasps on acrylic dentures.

Denture construction

The surgery stages are as for acrylic dentures, the only differences being:

- Final impressions are often taken in a highly accurate elastomer material, rather than alginate
- The chrome cobalt base is then made on the final model as a wax pattern by the technician, before being cast in a special furnace
- The casting of the metal base is sometimes carried out at specialised laboratories, so extra time between appointments may be necessary
- A try-in of the metal base only is often carried out, to ensure it is accurate
- A second try-in is then performed, with the teeth added and held by wax
- No adjustment of the metal base can be made in the surgery, once constructed, except minimal easing using a pink stone in the slow handpiece

Instructions to patient on fitting denture

- All instructions as for acrylic dentures except that bleach-based cleaners must not be used, as these will corrode the metal base of the denture
- Demonstration of how to insert and remove partial metal dentures may take some time, as some designs can be quite tricky

The nurse's role and surgery set-up for each stage of the metal denture construction is as for acrylic dentures, except for the use of the pink stone for minimal eases, if necessary.

Immediate replacement dentures

The ideal way of providing dentures for a patient is to allow a minimum of six months to elapse between tooth extraction and denture provision. This allows enough time for the majority of the inevitable bone resorption, which the alveolar ridges undergo after tooth extraction, to occur. The dentures then constructed will be more accurately fitting and comfortable for the patient.

When anterior teeth are to be extracted, however, it is unreasonable to expect the patient to have visible spaces in their mouth for this length of time. Consequently, the patient is provided with acrylic immediate replacement dentures. These are made before the patient undergoes tooth extraction, and are completed and ready to be fitted on the day that the extractions take place. The advantages are:

- No time lapse between extractions and denture fitting
- Patient therefore maintains their appearance, with no visible spaces
- Occlusion and adequate mastication are maintained
- Protects extraction sockets during healing
- Aids compliance with denture wearing, especially when anterior teeth are replaced, as patient is unlikely not to wear immediate dentures, for appearance's sake

The one major disadvantage of immediate replacement dentures is that as bone resorption occurs, the dentures lose their fit and become slack and non-retentive. They also sink further into the tissues as bone is lost, and anterior teeth especially will then appear to be malaligned with the surrounding natural teeth. For this reason, immediate replacement dentures can only be constructed from acrylic, not chrome cobalt.

If just one anterior tooth is to be replaced in this way, the denture is often constructed in a 'spoon' design, so that the gingival margins of other teeth are not covered by acrylic (Fig. 10.19).

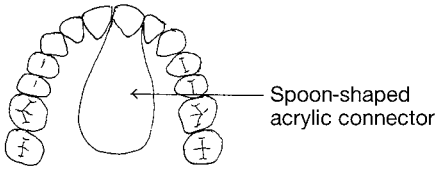


Fig. 10.19 'Spoon' denture.

Denture construction

(1) **Impression** – taken in a boxed stock tray and using alginate. Final impressions are rarely taken, as the model produced is to be altered at the laboratory during denture construction anyway, so accuracy is already compromised. The shade and mould are taken as usual
(2) **Laboratory** – models are cast in plaster, and if enough natural teeth are not present for the technician to assess the patient's usual bite easily, then wax rims are constructed for bite registration
(3) **Bite registration** – as for acrylic and metal dentures, if necessary
(4) **Laboratory** – a wax try-in is constructed of any teeth already missing. However, if the teeth being replaced are only those to be extracted, then a try-in will not be possible
(5) **Try-in** – as for acrylic and metal dentures, if possible
(6) **Laboratory** – the teeth being replaced immediately are carefully cut off the model by the technician, and then individually replaced on the denture in the chosen shade and mould. The denture is then inserted in the flask and the acrylic denture is constructed as usual, with or without stainless steel clasps
(7) **Denture fit** – on ensuring that the denture has been completed as

required, the necessary teeth are extracted and the denture fitted in the usual way

Dental nurse's role and surgery set-up

The nurse's role for all dental procedures is as detailed previously. Specific points and specialised equipment and instruments are as follows:

- At the denture fit stage, it is imperative that the appliance is checked for correct completion, before extractions are carried out
- Suitable extraction instruments will be required
- Bite packs and/or suturing instruments may be required
- Extraction post-operative instructions will be necessary, as well as denture instructions

Instructions to patient on fitting denture

- Denture not to be removed for 24 hours if possible, to avoid disturbing the extraction sites
- On initial removal, and for several times each day thereafter, the patient is to perform hot salt water mouthwashes to aid healing of the extraction sites
- If sutures have been placed which are not resorbable, an appointment will be necessary for their removal
- As bone resorption occurs, the patient may need to reattend for relining of the denture

Hard and soft relines

With bone resorption occurring under immediate dentures especially, the poor fit will eventually need addressing. Acrylic dentures tend to serve their purpose adequately for at least five years (considerably longer in many cases), so remaking the denture at this stage is not feasible.

Retention and full function can be restored by replacing the resorbed bone with more acrylic, a procedure known as hard relining. Hard relining can be carried out either at the chairside or in the laboratory, but in the latter case the patient would have to be without the denture for some time.

Chairside hard reline procedure

(1) Analysis of the denture determines where resorption has occurred
(2) The patient's lips and other teeth have a lubricant such as petroleum jelly applied, to prevent the reline acrylic sticking to them
(3) A cold curing acrylic is mixed at the chairside, by adding powder to the monomer liquid until a creamy consistency is achieved
(4) This is loaded into the relevant areas of the fitting surface of the denture and inserted into the patient's mouth

(5) Excess material is quickly removed, before being allowed to set
(6) It is held in place by the patient biting normally together, until the acrylic just begins to set and then swiftly removed from the mouth before it hardens too much to be removed
(7) Full curing can then occur in a bowl of hot water at the chairside
(8) The additional acrylic can be trimmed and polished, before reinserting in the patient's mouth and checking for fit and retention

Laboratory hard reline procedure

(1) A thin wash impression of the fitting surface of the denture is taken, using a material such as silicone wash impression which is highly accurate and elastic
(2) The mixed material is loaded into the denture, which is then inserted into the patient's mouth and held in the normal occlusion
(3) Once set, the denture is removed, disinfected as usual and sent to the laboratory
(4) The denture is flasked and heat-curing acrylic is added in the usual way, to replace the space taken by the impression material
(5) The denture is returned to the surgery for fitting at a later date

Soft relines

As bone resorption occurs following tooth extraction, the alveolar ridges become flatter with less cushioning support from the soft tissues. In elderly patients especially, this can become uncomfortable, if not painful, with time, so that dentures can no longer be worn without causing great discomfort. A soft lining can be used to artificially cushion the fitting surface of the denture, by replacing the lost gingival support and making the dentures comfortable to wear again.

An adequate thickness of the material is required to be effective, so the borders and fitting surface of the denture must be reduced to accommodate it. A wash impression is then taken within the denture before being sent to the laboratory for the soft lining to be added.

The rubbery material of the soft lining is not naturally adhesive to acrylic, and can begin peeling off with time, so the procedure often has to be repeated. The soft lining also hardens with age, and especially in the presence of bleach-based denture cleansers, which are therefore contraindicated.

Tooth additions

For various reasons, the occasional tooth may require extraction and can then be added to a pre-existing denture. This can be carried out post-extraction, or as a single-tooth immediate replacement.

(1) Patient attends with pre-existing denture and a shade of the tooth to be replaced is taken

(2) An alginate impression is taken over the denture in the patient's mouth
(3) This is sent to the laboratory for a heat-curing addition of the tooth, with an acrylic connection to the base of the denture
(4) Once returned to the surgery, the denture can be inserted immediately and checked for fit, or the tooth can be extracted and then the denture can be inserted and checked for fit
(5) In the latter case, the post-operative instructions are as for an immediate replacement denture

As with all surgery procedures, a full working knowledge of health and safety regulations, especially COSHH in relation to dental materials and cross-infection control policies, is imperative for the dental nurse to work safely in the surgery while prosthetic treatment is being carried out.

Activities

- List all of the fixed prostheses that you have seen in your practice.
- Identify the reasons why the last four teeth that you saw being prepared for crowns were necessary.
- List the information that is required on a lab docket for a fixed prosthesis construction.
- Identify all the impression materials used in your practice, and determine what type of material they each are.
- List all the luting cements used in your practice. Find out the recommended working and setting times for two of them.
- Identify the oral hygiene instructions that would be given in your practice to a patient having their first bridge fitted.
- List the various types of removable prosthesis that you have seen.
- If any member of your family wears a denture, ask them to explain to you how it feels.
- Think back to any hard or soft relines that you have seen. Determine their necessity to the patient.
- List the oral hygiene instructions given in your practice to a patient wearing a partial acrylic denture.

Chapter Eleven

Non-surgical and Surgical Endodontics

This chapter relates to unit DN21 'Provide chairside support during endodontic treatment'

It covers the three elements:

- DN21.1 'Prepare equipment, instruments, materials and medicaments for endodontic treatment'
- DN21.2 'Provide chairside support during non-surgical endodontic treatment'
- DN21.3 'Provide close assistance to the team and support patients during surgical endodontic treatment'

The following topics are also covered:

- The various types of non-surgical endodontic treatment – root canal therapy, pulp capping and pulpotomy
- The surgical technique of apicectomy
- Pre-operative and post-operative advice to patients
- Dental radiography in relation to endodontic treatment

Aims of endodontics

Endodontics, or root canal therapy, is a procedure carried out within the tooth to achieve the following aims:

- Shaping of the root canal to allow thorough irrigation
- Irrigation with antibacterial disinfectants to eliminate bacteria from the canal
- Removal of irritants and bacteria from the canal
- Filling of the canal with a non-irritant, impermeable material
- This then entombs any residual bacteria within the canal, and cuts off their food supply from periapical tissue fluids
- Restoration of the tooth to full function and appearance

The need for endodontics

The need for endodontics occurs following injury to or infection of the pulp, which in soft tissues would resolve rapidly after a period of swelling and possibly bruising, but in the closed chamber of the root canal any swelling cuts

off the apical blood supply to the tooth, and pulp death occurs. This eventually leads to a non-vital tooth and periapical infection.

The patient often presents initially with pain, swelling and sometimes a sinus tract with pus present at its opening.

Inflammation of the pulp – pulpitis – can occur due to the following:

- Deep caries which lies close to, or actually exposes, the pulp
- Thermal injury, by heat transmission through unlined restorations, or inadequate cooling of air turbine during treatment
- Chemical irritation from restorative materials
- Fracture following trauma, possibly causing pulp exposure
- Irritation from very deep fillings, over time

Once the tooth experiences irreversible pulpitis, only endodontic treatment can save it from extraction, as at this point the pulp will either be inflamed and about to die, or have died already.

The vitality of the tooth (that is, whether it is alive, dying or dead), can be checked by the dentist using the following techniques:

- Stimulation of the tooth by temperature:
  - Hot gutta percha (as greenstick compound) onto the tooth
  - Cold ethyl chloride sprayed onto a cotton pledget and placed onto the tooth
- Stimulation of the tooth by an electric current, using an electric pulp tester:
  - Pen type, with digital numerical scale which gradually increases as current increases until patient indicates tingling sensation in tooth. Higher scores indicate loss of vitality
  - Older types with box and wand applicator, applied as above

  All electric pulp testers depend for function on being applied to a dry tooth surface, and for an electrical circuit to be made between the patient, the dentist and the machine. Their use is not advised for patients who have cardiac pacemakers fitted, as they could interfere with the function of these devices
- Radiographs, usually a periapical view showing a widened periodontal ligament around the suspect tooth root, or an actual radiolucent periapical area

The symptoms of acute irreversible pulpitis are:

- Patient experiences spontaneous intermittent spasms of pain
- Pain becomes throbbing and continuous with time
- No longer caused by hot, cold or sweet stimulation
- Tooth becomes hypersensitive to vitality testing, but is not tender to percussion (TTP)

The severity of the tooth and pulp damage, and previous treatment undertaken, will all determine which form of endodontic treatment is undertaken in each case, thus:

- *Non-surgical endodontics*:
  - Pulp capping – carried out when a small exposure of the pulp chamber occurs in an asymptomatic tooth
  - Pulpotomy – carried out on an immature permanent tooth with an open apex, and no signs of infection
  - Pulpectomy – or root canal therapy, carried out in an effort to save an exposed and infected tooth, and involving the placement of an orthograde root filling from the crown of the tooth

- *Surgical endodontics*:
  - Apicectomy – the surgical amputation and removal of the root apex, with any attached pathology, sometimes in a previously root filled tooth, and the placement of a retrograde root filling to seal the stump

It can be seen, then, that endodontics can be carried out before, during or after tooth restoration, depending on each clinical situation.

The decision by the dentist to perform endodontics to try to save the tooth, rather than to extract it, depends on several points:

- Feasibility of restoring tooth to function, little point carrying out endodontics if no tooth left to restore
- Medical history of patient
- Usefulness of the tooth in occlusion
- Patient's wishes, especially where costs are involved
- Dental health of the patient, if this is poor then advanced dental treatment is contraindicated

Importance of medical history

Endodontics should be carried out with great caution in patients with several medical conditions, because of the risk of producing a bacteraemia (bacteria in blood stream) during the treatment, which could cause the patient to develop the life threatening condition of infective endocarditis:

- Acquired valvular heart disease
- History of rheumatic fever
- Wearing of a pacemaker
- Congenital heart defects

It would be prudent for these patients to receive prophylactic antibiotics as a precaution.

People with diabetes should also be treated with caution because of their tendency to exhibit poor wound healing and to be prone to infections.

Conversely, extractions are contraindicated in some medical conditions:

- Epilepsy, as these patients should not wear dentures if at all possible
- Bleeding disorders, especially clotting disorders where haemostasis may be difficult to achieve
- Cleft palate

Patient consent

The patient cannot give informed consent to endodontic treatment until they have been made aware of any risks and complications involved, and been given the full procedure details:

Complications

- The procedure carries a 70–80% chance of success, so extraction may still be necessary in some cases
- Teeth treated endodontically become brittle with time, so long-term restoration is likely to be a crown
- If the root apices are close to underlying nerves, there is a possibility of nerve damage from overinstrumentation or from medicaments used
- If the root apices are close to the floor of the maxillary antrum, there is a risk of creating an oro-antral fistula

Procedure details

- Often one or two long appointments, where full mouth opening will be necessary
- Local anaesthesia will usually be required initially
- Rubber dam will be used, which may be a new experience (see below)
- Antibiotics may be required to control infection
- Temporary dressings may be used, and care will be required not to dislodge them
- Post-operatively, anti-inflammatories may be recommended
- Patient may experience some tenderness and may need to contact the surgery if this worsens

Use of rubber dam in non-surgical endodontics

The use of rubber dam during endodontic procedures is now routine. It is a sheet of rubber which is pierced and placed over the tooth to be treated, so that it is effectively separated from the rest of the mouth. The technique is used to:

- Isolate the tooth to avoid contamination from the oral cavity
- Protect the patient's airway from endodontic instruments
- Protect the oral cavity from endodontic medicaments
- Allow good vision for the dentist
- Allow good aspiration by the nurse

Special instruments are required to use rubber dam, as shown in Fig. 11.1. They include:

- Rubber dam sheet
- Hole punch, to create the hole through which the tooth will project during treatment

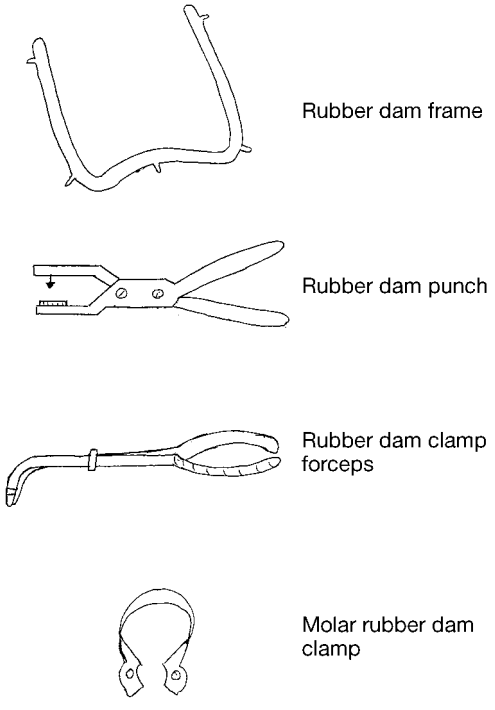


Fig. 11.1 Rubber dam equipment.

- Rubber dam clamp to hold the dam tightly around the neck of the tooth during treatment. They are available in different forms depending which tooth is undergoing treatment
- Clamp forceps to hold the clamp during its placement on the tooth
- Rubber dam frame which holds the sheet taut over the lower face, for ease of application

There are several different techniques for applying the rubber dam to the tooth, and each dentist will use the one with which they are most familiar and successful. As long as the dam is applied correctly and causes no trauma or discomfort to the patient, the technique is irrelevant.

Non-surgical endodontic techniques

Pulp capping

Pulp capping can be used in the following situations:

- Minimal traumatic exposure of the pulp during treatment, in a caries-free cavity
- Ideally in a young patient, or in a multi-rooted tooth, as under these circumstances the tooth has the best chance of repair

- When conventional endodontics cannot be carried out at the time of presentation of the exposure

Technique

(1) Tooth is isolated and no further instrumentation occurs, to avoid contamination of the exposure site
(2) Cavity is rinsed with sterile saline solution and dried with sterile cotton wool
(3) Calcium hydroxide dressing is placed over the exposure and covered with a cap made from a cervical matrix
(4) Calcium hydroxide will allow the tooth to repair the exposure site with reparative dentine formation
(5) Cap covered with sedative zinc oxide cement, then tooth restored as usual
(6) Reviewed at three-monthly intervals

Pulp capping is illustrated in Fig. 11.2.

If the procedure is carried out as a temporary measure before conventional endodontics occurs, the cavity is cleaned and dressed with calcium hydroxide and a sedative dressing only, until a later date.

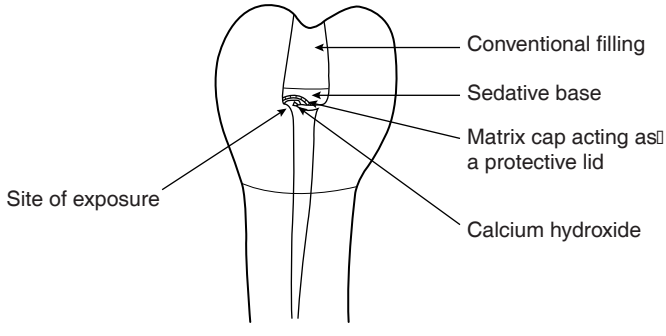


Fig. 11.2 Pulp capping.

Pulpotomy

Pulpotomy is used when immature permanent teeth are exposed. The apical foramen takes three years to close after tooth eruption, so trauma to teeth at this time ensures a good blood supply through the open apex, and therefore a good chance that the exposure can heal without loss of vitality of the tooth.

Technique

(1) Administer local anaesthetic
(2) Relieve occlusion, if heavy onto the affected tooth, otherwise symptoms will persist

(3) Remove all caries and restore tooth so that rubber dam can be applied
(4) Remove coronal pulp using a sterile slow bur
(5) Achieve haemostasis with sterile cotton wool pellets
(6) Top of radicular pulp is covered with calcium hydroxide paste and sealed
(7) Calcific barrier should then develop over vital radicular pulp and tooth should retain its vitality

If the permanent tooth loses vitality in a young patient, conventional orthograde root treatment is not an option until the apex has closed, as any attempt at inserting gutta percha will ensure its passage through the apex and into the periradicular tissues. Under these circumstances, a non-setting calcium hydroxide cement (such as Hypocal®) can be used to fill the whole canal, and then left in situ while an apical calcific barrier forms and the apex closes. Progress can be monitored with periapical radiographs, and once the apex has closed conventional orthograde root canal therapy can be carried out.

Root canal therapy

Root canal therapy is conventional endodontic treatment, carried out to save a dead or dying infected tooth from extraction. It is often carried out in one appointment to prevent reinfection of the tooth between visits, unless the tooth is heavily infected and pus is present in the root canal.

A variety of special instruments are required to carry out endodontics successfully, besides the usual full conservation tray, and these are described below:

- Plain broach, to locate the entrance to the root canals
- Barbed broach, to hook into the pulp and remove it as the instrument is withdrawn from the canal
- Selection of hand files in varying sizes, to draw against the inner walls of the canal and remove infected dentine, while widening and shaping the canal
- Endodontic irrigation syringe, with a side bevel to prevent solutions being injected through the apical foramen
- Spiral paste filler, used in the slow handpiece to spin sealer into the canal
- Apex locater, an electrical device which uses a numerical or audible scale to indicate when the tip of the file is within 1 mm of the apex of the canal, but some older designs are inaccurate because they give false readings if the canal contains any moisture
- Lateral condenser, finger spreader – both used to condense the root filling material laterally in the canals to allow more to be squeezed in and fill all available spaces within the canals

Hand reamers are little used nowadays, with the advent of the more flexible hand files which can be used effectively in all canal shapes, including curved apices. However, files are also being superseded by rotary nickel titanium

instruments which clean and shape canals in a fraction of the time, and, when used correctly, thoroughly too.

A variety of hand instruments are shown in Fig. 11.3.

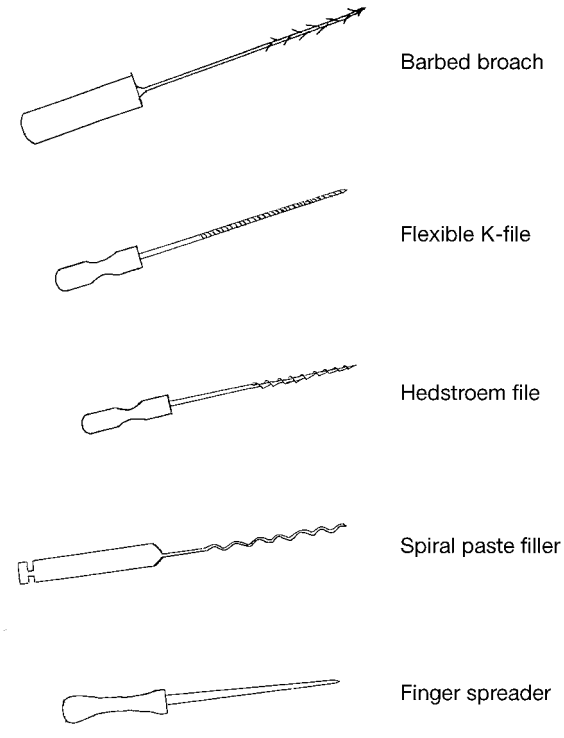


Fig. 11.3 Endodontic hand instruments.

Technique

(1) Administer local anaesthetic
(2) Check occlusion and relieve heavy contact to allow symptoms to settle
(3) Remove caries and restore crown if necessary to enable rubber dam to be applied
(4) Root canal(s) are accessed through occlusal surface of posterior teeth, and lingually or palatally through anterior teeth
(5) Straight line access is achieved wherever possible, so that instruments are not bent during use, as they are likely to fracture
(6) Plain broach is used to locate the entrance to all root canals
(7) Pulp contents and any solid debris are extirpated using a barbed broach
(8) Canal walls are systematically widened from the crown towards the apex and smoothed using either hand files (especially Hedstroem or K-files), or rotary nickel titanium instruments (such as Profile®) using a special slow handpiece
(9) Canals must be copiously irrigated throughout this part of the

procedure to prevent instruments jamming and to flush out any loosened debris

(10) Usual irrigants are household bleach (sodium hypochlorite, 5%), chlorhexidene mouthwash, local anaesthetic solution, hydrogen peroxide

(11) The former is the most beneficial as it dissolves solid debris as well as being a good antibacterial disinfectant

(12) All solutions must be applied to the canals using special endodontic syringes to prevent injection of the contents through the apex and into the periapical tissues

(13) Ultrasonic scaler with tip inserted into the canal can also be used to produce loosening and flushing of debris

(14) Length of the canal to 1 mm of the apex (the working length) is then determined by using either an apex locater, or by inserting a known length of hand file to the perceived working length, and determining it accurately from a paralleled periapical radiograph (the diagnostic radiograph)

(15) Once this has been determined, the canal can either be dressed with antiseptics as a temporary measure, or it can be root filled at this appointment

(16) If dressed, the antiseptic (usually cresophene) is soaked into paper points which are sealed into all canals with a temporary dressing over

(17) In multi-rooted teeth, it is advisable to use separate instruments for each canal to avoid contamination of all

Technique of root filling

(1) No local anaesthetic should be necessary if this procedure is being carried out in a second visit

(2) Rubber dam is applied

(3) Access is gained to the canals by complete removal of the temporary dressing

(4) Paper points are removed by hooking with barbed broaches if soggy, or using tweezers if not

(5) Any signs of residual infection will appear as blood, pus, or foul smelling paper points

(6) If any infection is present, the debridement of the canal must be repeated

(7) A sealing cement (such as Tubliseal® or Apexit®) is smeared around the outer walls of the canal using a spiral paste filler

(8) Root filling is carried out using either cold gutta percha points to the same diameter and working length as hand files, or by using special warmed gutta percha (such as System B®, Alphaseal) which is condensed under pressure into the canals

(9) Whichever technique is used, the objective is to obliterate any spaces within the canal system where bacteria could lurk to reinfect the tooth

(10) This becomes more difficult when canals are curved, or have unusual

anatomy, or where the root has lateral canals, and the warmed gutta percha technique has a better chance of success in these difficult cases because it tends to extrude into all the 'nooks and crannies'

(11) With the gutta percha points technique, a main point is inserted to the working length and of the diameter of the file at this length, and the canal is then filled laterally using accessory points with space being made before each insertion using a finger spreader or lateral condenser

(12) All spare cement and protruding gutta percha is removed from the access cavity, and the tooth is then sealed using a permanent restoration

(13) A final periapical radiograph is then taken to ensure the canal is completely filled and that no apical perforation has occurred

Other root filling materials, such as acrylic points and silver points, are little used nowadays.

Endodontic medicaments

- Pulp capping and pulpotomy – calcium hydroxide which provides odontoblasts with available calcium to form repairs to the pulp chamber, thereby maintaining the vitality of the tooth, it also has antibacterial properties
- Irrigants – sodium hypochlorite particularly; it is antibacterial and a tissue solvent, and there is also a chelating agent called EDTA which dissolves small pulp stones to allow full access to the canal system
- Antiseptics – medical creosote ('cresophene') which helps to kill residual bacteria before root filling, older versions were Kri liquid and PCP
- Paste fillers – several available, containing a variety of ingredients to aid in success, such as antimicrobials, steroids, anti-inflammatories

Surgical endodontic techniques

As a last resort to save a tooth, when conventional root canal therapy has failed on several occasions following reroot treatments, apicectomy may be required.

A conventional root canal therapy is considered to have failed if any of the following occur:

- Continued pain and infection after treatment
- The continued presence of a sinus
- An enlarging periapical area on radiographs

Apicectomy is a last resort before the extraction of the tooth, and is indicated in the following circumstances:

- A persistent apical area following reroot filling to the operator's best ability

- To remove excess root filling material from the periapical area
- To eliminate curved or fractured root apices
- In the presence of periapical infection on a post-crowned tooth which cannot be removed
- To bypass pulpal blockages, such as fractured instruments

The procedure is a surgical technique, using the instruments shown in Fig. 11.4.

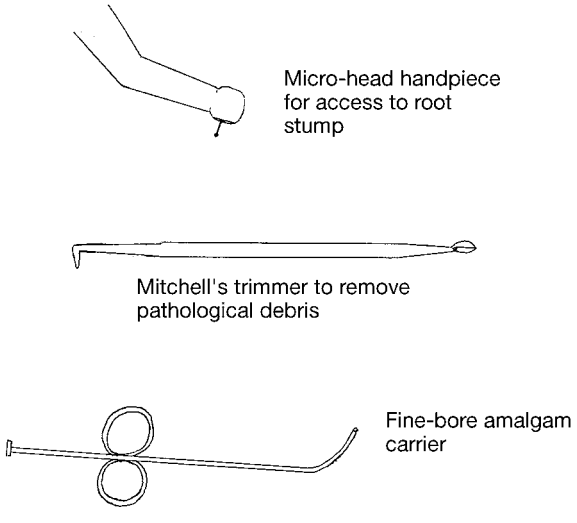


Fig. 11.4 Special apicectomy instruments.

Technique

(1) Local anaesthetic is applied both labially and palatally
(2) A three-sided surgical incision is made from the sulcus, around the gingival margin of the tooth and back into the sulcus using a sterile scalpel blade and handle
(3) The flap is raised off the underlying periosteum using a Mitchell's trimmer and then a Howarth's periosteal elevator
(4) The apex of the tooth is located by drilling away a window of alveolar bone in the apical area, using slow surgical burs and plenty of sterile saline irrigation
(5) The apex of the root is amputated and removed along with any associated pathology (such as cysts)
(6) The bone cavity remaining is curetted with a Mitchell's trimmer so that all soft tissue pathology is removed
(7) A retrograde root filling is placed (amalgam or reinforced zinc oxide and eugenol cement)
(8) The surgical site is cleaned of any debris with sterile saline
(9) The periosteal flap is replaced and sutured into place

(10) The tooth is radiographed and then reviewed periodically
(11) Normal post-operative surgical instructions are given to the patient

Nurse's role during endodontic procedures

(1) Ensure that all patient's records are available and up to date
(2) Ensure the surgery is disinfected, and all instruments necessary are sterile
(3) Greet and seat the patient
(4) Assistance during administering of local anaesthesia, with reassurance of patient as necessary
(5) Assistance during application of rubber dam
(6) Efficient aspiration during procedure
(7) Handing over of correct instruments, in correct order, to the dentist as necessary
(8) Correct mixing of any endodontic medicaments as necessary
(9) Giving of post-operative instructions to patient, both verbal and written
(10) Thorough cleaning of surgery and sterilising/disposal of instruments as necessary before next patient is seen
(11) Ensure that dentist has written notes up correctly and completely before the next patient is admitted

Use of antibiotics in endodontics

The aim of endodontic treatment is to attempt to save the tooth from extraction. When a patient presents with obvious signs of acute infection, a course of antibiotic therapy may be required before treatment of the tooth can commence.

Signs of infection are:

- Presence of pus
- Raised body temperature (pyrexia)
- Obvious debilitation of patient
- Severe pain and loss of function of the affected tooth
- Swelling, either intra-orally or extra-orally

The dentist will attempt to begin treatment and alleviate the symptoms if possible, by either lancing intra-oral abscesses or opening the root canal and placing on open drainage, at the same time as prescribing antibiotics thus:

- Amoxycillin or erythromicin (if patient is allergic to penicillins) 250 mg four times daily
- Metronidazole 200 mg three times daily for three days given concurrently, if a severe infection is present

Activities

- Describe the technique of root canal preparation used in your practice.
- List the methods of vitality testing that you have seen.
- Explain how you would describe the procedure of root canal therapy to a patient.
- Think back over the past month to any teeth you have seen root treated or extracted. Identify what determined which procedure was carried out in each instance.
- Describe how rubber dam is applied to a tooth in your practice.
- List any materials used in your practice as canal paste fillers. Identify the constituents of each one.

Chapter Twelve

Extractions and Minor Oral Surgery

This chapter relates to unit DN22 'Provide chairside support during the extraction of teeth and minor oral surgery'.

It includes all four elements:

- DN22.1 'Prepare patients, environments, equipment and materials for the extraction of teeth and minor oral surgery'
- DN22.2 'Provide close assistance to the team and support patients during the extraction of erupted teeth'
- DN22.3 'Provide close assistance to the team and support patients during oral surgery to remove roots, buried and unerupted teeth'
- DN22.4 'Provide close assistance to the team and support patients during investigations of soft tissue lesions and pathology'

Details are given of equipment, instruments, methods, and preoperative and post-operative advice for the following:

- Simple extractions
- Surgical extractions
- Soft tissue surgery
- Biopsies

The soft tissue surgical techniques discussed are:

- Operculectomy
- Alveolectomy
- Gingivectomy and gingivoplasty
- Periodontal flap surgery

Types of minor oral surgery

Many procedures carried out in daily dental practice can be collectively termed 'minor oral surgery', and those to be discussed are:

- Simple extractions – of roots or whole teeth, where no soft tissue or bone removal is required

- Surgical extractions – of roots or whole teeth, where soft tissue alone, or with bone, has to be removed to gain access to the root or tooth
- Operculectomy – the surgical removal of the gingival flap overlying a partially erupted tooth, especially a lower third molar
- Alveolectomy - the surgical adjustment and removal of bone spicules from the alveolar ridge after tooth extraction, to produce a smooth base for denture seating
- Gingivectomy and gingivoplasty – periodontal soft tissue surgery to adjust the shape of the gingivae to aid oral hygiene measures
- Periodontal flap surgery – the surgical raising and replacing of surgical flaps, to enable subgingival debridement to be carried out
- Soft tissue biopsies – the partial or complete removal of soft tissue oral lesions, for pathological investigation and diagnosis

Arguably, these procedures constitute those most worrying to the patient, as bleeding and possible post-operative pain are quite likely to occur. The dental nurse has an important role in the reassurance and monitoring of the patient during these procedures, so that the patient remains less anxious and cooperative throughout. As always, health and safety and infection control procedures must be strictly adhered to before, during and after the surgical procedure.

Simple extractions

Both deciduous and permanent teeth may require extraction, usually because the patient is experiencing pain and has an infection present, but also for the following reasons:

- Gross caries such that the tooth is unrestorable
- Severe periodontal disease where the tooth is mobile and the patient's oral hygiene is unlikely to be sufficiently improved to save the tooth
- Prosthetic reasons, where the tooth is tilted and prevents the placement of a removable or fixed prosthesis
- Malalignment of a tooth such that it cannot be orthodontically repositioned
- To create space in a crowded dental arch so that orthodontic treatment can be carried out
- Partially erupted and impacted teeth which suffer continual infection because of food trapping and stagnation
- Deciduous teeth which have not exfoliated at the normal age can be extracted to encourage the eruption of their permanent successors
- Deciduous teeth can also be serially extracted when crowding of the permanent dentition is likely, so that permanent successors erupt into more acceptable positions
- Continual chronic periapical infection, where attempts at reroot treatment and apicectomy have failed

Simple extractions are carried out using a combination of extraction forceps and elevators, although dentists often have their preferred instruments with which they can extract the majority of teeth.

Forceps are used by being pushed along the sides of the root to sever the periodontal membrane. Once a reasonable position has been achieved, the root is gripped and gentle wrist movements are employed to gradually loosen the tooth in the socket. The forceps are gradually worked further towards the apex of the tooth until it is loose enough in the socket to be removed.

Unnecessary force during extractions often results in tooth or root fracture, although this can occur anyway with grossly carious teeth.

Forceps are designed in various patterns, to be used individually for each type of tooth. Upper tooth forceps tend to have their handles and blades roughly in line with each other, whereas lower tooth forceps tend to be at right angles to each other for ease of access (Fig. 12.1).

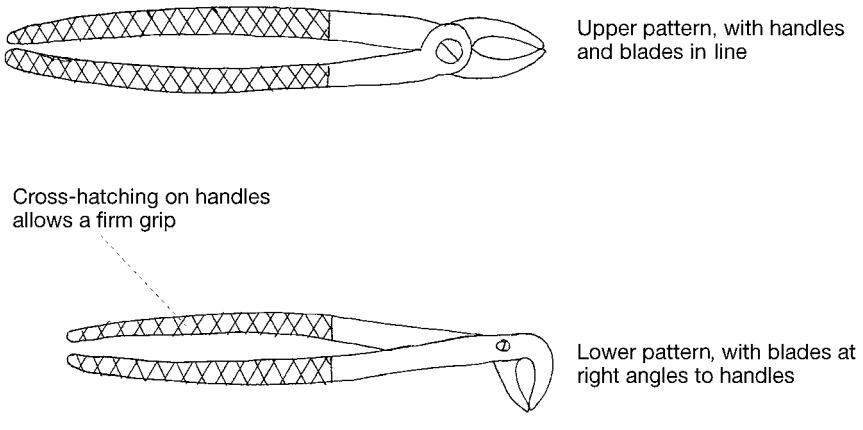


Fig. 12.1 Upper and lower patterns of forceps.

Multi-rooted molar tooth forceps have blades, which are shaped as beaks so that they can grip the furcation area between the roots, but single-rooted tooth forceps are smooth (Fig. 12.2).

The commonest patterns of forceps used are shown in Fig. 12.3. They are:

(1) Upper incisor and canine forceps are straight with single rounded blades and have both wide and narrow patterns
(2) Upper root forceps are similar in appearance, with narrow, straight blades
(3) Upper premolar forceps have slightly curved handles and single rounded blades
(4) Upper left molar forceps have curved handles and a beaked blade to the right, a rounded blade to the left to grip the buccal roots and the palatal root respectively

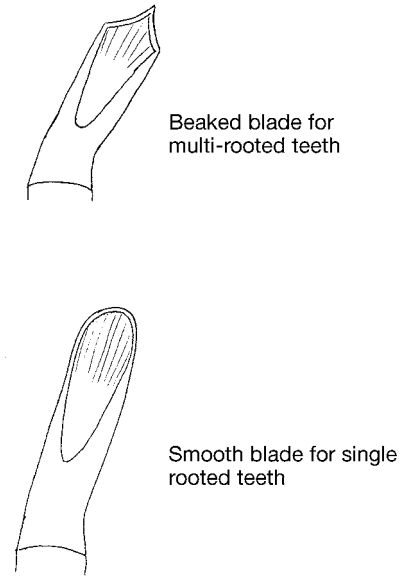


Fig. 12.2 Blade patterns of forceps.

(5) Upper right molar forceps have curved handles and the beaked blade is to the left
(6) Upper bayonet forceps have extended handles to gain access to third molars
(7) Lower anterior forceps have single, rounded blades at right angles to the handle
(8) Lower root forceps are similar, with narrow and straight blades
(9) Lower molar forceps have beaked blades at right angles to the handles, to grip the furcation of the two roots
(10) Lower 'cowhorn' forceps have curved and pointed blades at right angles to the handles, to grip the furcation of lower molar teeth
(11) Smaller versions of most patterns exist, for deciduous tooth extractions

Similarly, elevators are available in a variety of patterns and are used to gradually sever the periodontal membrane and loosen the tooth in the socket (Fig. 12.4).

- Cryer's elevators are available as left and right patterns, but can be used on either side of the mouth, depending whether they are engaged mesially or distally
- Winter's elevators have a similar blade design as Cryer's, but have a corkscrew style handle to give more leverage
- Warwick James' elevators are available as left, right and straight patterns

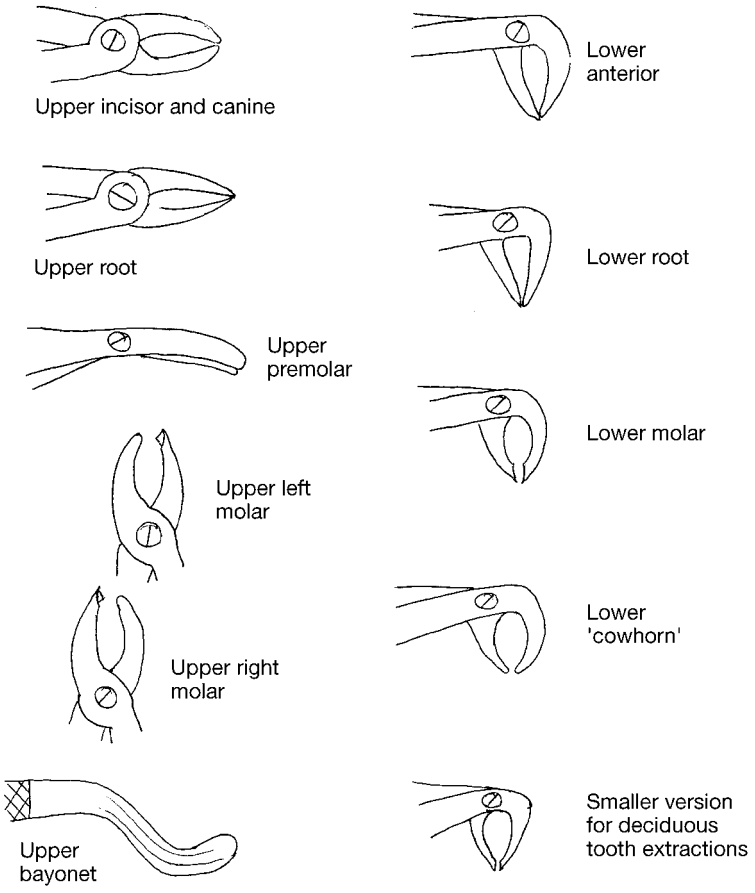


Fig. 12.3 Common patterns of forceps.

A single-bladed chisel is also available for splitting multi-rooted teeth, called a Coupland's chisel and available in three sizes. Some dentists use these as elevators or luxators to extract roots and single-rooted teeth.

Difficult extractions can be quite exhausting for the dentist and the patient, and it often helps both if the dental nurse physically supports the patient's head or mandible during the extraction. In this way, the dentist is not wasting energy by rocking the patient's head rather than loosening the tooth, and it also allows the patient to relax more, rather than trying to hold their head still for the dentist.

The dental nurse's role during all extractions and minor oral surgery procedures is as follows:

(1) Have the full and correct patient's records to hand, especially radiographs
(2) Have the surgery clean and fully set up for the procedure, including necessary local anaesthesia, but out of the patient's view

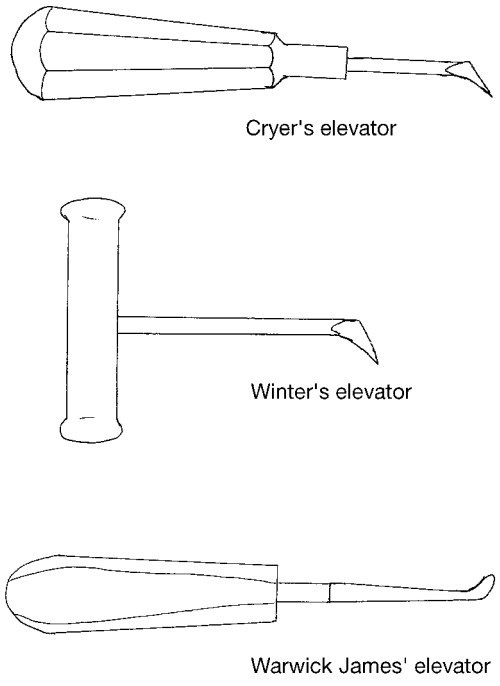


Fig. 12.4 Elevators.

(3) Welcome the patient into the surgery, seat them and place protective items
(4) Reassure the patient throughout, in a relaxed and friendly manner
(5) Assist the dentist during the administration of local anaesthesia
(6) Provide adequate suction so that good visibility is maintained at all times, and for the patient's comfort
(7) Retract tissues as necessary
(8) Pass correct instruments as necessary
(9) Irrigate the area as necessary
(10) Have wet bite packs available to place over the socket once the extraction is completed
(11) Have suturing instruments ready for use, and pass in the correct order as necessary
(12) Be ready to cut the suture ends if required
(13) Ensure the patient is cleaned of any blood and debris after the procedure
(14) Give post-operative instructions to the patient, both written and verbal, as required
(15) Ensure the patient is fit to leave the surgery, once the dentist has checked that haemostasis has been achieved (that is, that the socket has stopped bleeding)

(16) Clean and sterilise all necessary instruments, and dispose correctly of those which are single use
(17) Prepare the surgery for the next procedure
(18) Ensure that the patient's records have been fully completed

Often, the patient will request information regarding the procedure itself in advance, and again the dental nurse is ideally suited to allay their fears thus:

- Local anaesthesia will always be necessary
- The procedure will not be painful, as adequate local anaesthesia will be given
- If a surgical procedure is being undertaken, sutures will be necessary
- Patient must take all medication as normal before the procedure unless the dentist informs them otherwise, except for aspirin which prevents blood clotting and could cause post-operative bleeding
- Patient must have a light snack two hours before procedure, to avoid fainting
- Full post-operative instructions will be given in writing, so the patient does not have to remember them
- If the patient is nervous, or a child, they should be escorted by a competent adult

Similarly, after the procedure a full list of post-operative instructions should be given in writing. It is important that the patient understands that most post-operative complications occur because of disturbance to the blood clot which forms in the area, and that they should avoid causing this to happen wherever possible:

- Patient may experience pain, swelling or bruising post-operatively, especially if a surgical procedure has occurred
- Anti-inflammatory analgesics are recommended, to be taken before the local anaesthesia has worn off
- Alcohol and hot drinks should be avoided on the day of the procedure
- Exercise should be avoided for the day
- The mouth should not be rinsed to remove blood, this should just be spat out
- If bleeding does occur, the patient must bite on a clean cotton cloth for 15 to 30 minutes, to allow a clot to form again
- Hot salt water mouthwashes should be carried out at least four times daily for a week, starting the day after the procedure, to remove any trapped food and to promote healing
- Arrange an appointment for suture removal, if necessary
- Ensure the patient has an emergency contact telephone number for the practice

Surgical extractions

Under certain circumstances, a simple extraction cannot be carried out and either soft tissue alone, or soft tissue and alveolar bone have to be removed so that the dentist can gain access to a tooth or root. This may be the case when:

- Previous attempts at tooth extraction have left a retained root in the alveolar bone
- A tooth is so grossly carious that attempts at simple extraction are impossible
- The morphology of the roots makes it unlikely that the whole tooth can be removed simply, especially when the roots are curved
- The tooth is only partially erupted and impacted, so that full eruption cannot occur
- The tooth is unerupted and has associated pathology, such as a cyst
- The tooth is unerupted and likely to cause future problems with either prostheses or orthodontic treatment
- A deciduous tooth has failed to exfoliate because the root has become cemented to the alveolar bone (ankylosis) and natural loss cannot occur

The pre-operative and post-operative instructions given to the patient are as detailed under 'simple extractions' above, as is the dental nurse's role during these procedures. What differs from simple extractions is the list of instruments that may be necessary to allow the dentist to gain access to the tooth or root.

Teeth lie in sockets of alveolar bone, with a covering of mucoperiosteum over the bone which runs into the gingivae around each tooth. The mucoperiosteum is tightly held onto the bone, and has to be cut and separated to full thickness before bone removal can be carried out (Fig. 12.5). The flap thus

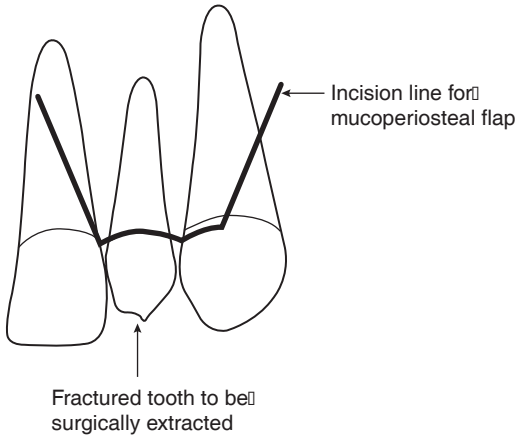


Fig. 12.5 Surgical flap design.

raised has to have a wide base to ensure a good blood supply, so that full healing occurs once the procedure has been completed. The flap has to be sutured accurately back into place for long enough so that reattachment can occur.

Special surgical instruments are required and used in a set order:

(1) Scalpel blade and handle – to make initial cuts through full thickness of mucoperiosteum and around necks of teeth as necessary (disposable type tend to be used for infection control purposes)
(2) Mitchell's osteotrimmer – to raise the corner of the mucoperiosteal flap off the bone
(3) Periosteal elevator – to complete the elevation of the flap and expose the underlying alveolar bone
(4) Straight slow handpiece and surgical burs – to remove alveolar bone and gain access to the tooth or root
(5) Water syringe – to provide irrigation of the site during bone removal and aid debris removal (disposable type are used)
(6) Austin and Kilner retractors – to retract lips, tongue and cheeks to aid visibility and prevent tissue damage
(7) Rake retractor – to retract mucoperiosteal flap, as above
(8) Bone rongeurs – to nibble off bone spicules and allow comfortable healing (bone chisels, bone mallet and bone files can also be used, but are more for unconscious patients)
(9) Dissecting forceps – also called 'rat-toothed' forceps, to hold the loose edges of the flap taut while suturing takes place
(10) Needle holders – to hold the pre-threaded needle firmly while suturing; a variety exist
(11) Suture – half-moon needle with either black braided silk suture or resorbable material

Some of these instruments are shown in Fig. 12.6.

High-speed aspiration is used while irrigating, otherwise fine bore surgical aspirators are used, which can be placed directly into the surgical area to maintain visibility at all times. As they are narrow, they can easily become blocked by tooth and bone debris. They should always be single use disposable type, as sterilisation of the narrow lumen is unlikely to occur and infection control procedures would then fail.

The most usual teeth to become impacted are the lower third molars, or 'wisdom' teeth. These are the last permanent teeth to erupt, and are often short of space to do so. The type of impaction that occurs will affect the difficulty of the removal of the tooth thus:

- Vertical impaction – tooth is upright but impacted into the ramus of the mandible
- Horizontal impaction – tooth is lying on its side, facing forwards, backwards or even across the dental ridge
- Mesioangular impaction – tooth is tilted forwards into the distal aspect of the second molar

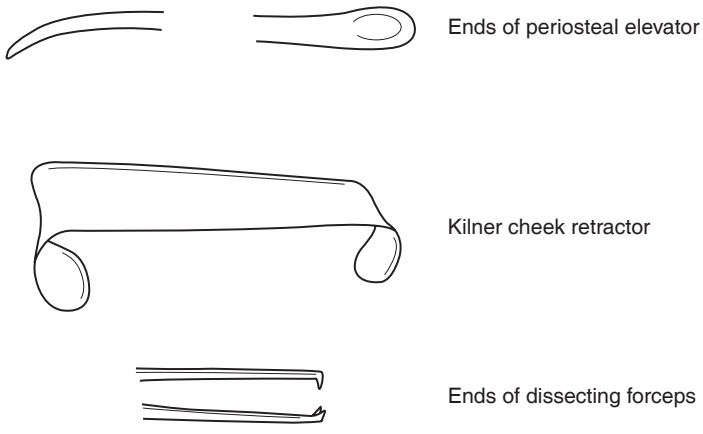


Fig. 12.6 Some surgical instruments.

- Distoangular impaction – tooth is tilted backwards into the ramus of the mandible

Some dentists will refer patients with the more difficult types of impaction to a specialist oral surgeon for extraction, if the teeth are persistently infected or are causing food trapping and caries in adjacent teeth. However, if the impacted tooth is causing no problems (that is, it is asymptomatic) then it is usual for it to be left *in situ* rather than extracted, as there are risks involved in having the tooth surgically extracted:

- Extensive bone removal can weaken the mandible
- Post-operative pain and swelling are likely to occur after a full surgical procedure
- The inferior dental nerve and lingual nerve lie close to the operation site, and temporary or even permanent damage can occur to them
- Limited mouth opening (trismus) can occur temporarily after surgery, and this will make eating and talking difficult

Patients must be warned of all these possible complications before undergoing the procedure.

Complications of extraction

Even with the most well-planned procedures, sometimes complications do occur. They can be separated into those that develop during the extraction:

- Fracture of the tooth
- Perforation of the maxillary sinus
- Loss of tooth into surrounding soft tissues

and those that occur some time later:

- Bleeding
- Localised infection ('dry socket')

Tooth fracture

A grossly carious or heavily filled tooth is likely to fracture during extraction attempts, and the dentist should be aware of the possibility and warn the patient regarding progression to a surgical procedure if necessary. This is likely to occur when the fracture extends sub-gingivally, as adequate access to the roots may be difficult.

If, however, small apical pieces of root fracture during extraction, they can be left in situ either to rise to the ridge surface themselves, over time, and be more easily removed, or to remain buried and cause no further problem.

Whichever occurs, the patient must always be informed and a full explanation given.

Perforation of maxillary sinus

Perforation of the maxillary sinus is a complication of the extraction of upper premolar and molar teeth only, as the maxillary sinus lies over their roots. An inappropriate extraction technique can sometimes push the root into the sinus, where it will act as a foreign body and cause infection. The patient is best referred to a specialist oral surgeon for its removal.

Long-rooted upper molar and premolar teeth sometimes impinge into the sinus naturally, and when they are extracted, an opening will be created between the antrum and the oral cavity. This is called an oro-antral fistula, and, if small, it will close naturally. Large openings require surgical repair by either direct suturing, or by raising a gingival flap off the palate and swinging it across to seal the fistula.

The presence of a fistula can be confirmed by the appearance of air bubbles in the socket when the patient blows their nose. Again, the patient should be informed immediately, and told not to blow their nose until healing of the fistula has occurred.

Loss of tooth

The tooth can be dropped during its removal from the mouth, or the force exerted during extraction can cause it to dislodge rapidly from the socket, before a firm grip has been achieved.

If the tooth is swallowed, it poses no problem and should be allowed to pass naturally. However, if the tooth is inhaled the patient should be sent to hospital immediately for chest and abdominal radiographs, to locate the tooth, as it could cause a serious respiratory infection. It may be removed using a bronchoscope if lodged in the main bronchi, but if the tooth has descended

further into the respiratory tract, thoracic surgery may be necessary to remove it.

Bleeding

Haemorrhage during extraction is a natural occurrence, as blood vessels in the periodontium are torn during the procedure. This usually stops within five minutes of completion of the extraction, and is called primary haemorrhage.

The blood clots in the following way:

(1) Torn blood vessels constrict to slow blood flow
(2) Platelets circulating in the blood are exposed to air at the wound site
(3) This causes them to become sticky, and to clump together
(4) Two complicated clotting mechanisms ensue, resulting in the protein fibrinogen being converted to fibrin
(5) Fibrin chemically seals the cut vessels, and the haemorrhage ends

Bleeding which occurs several hours after the extraction is called reactionary haemorrhage, and is usually caused by the patient not following the post-operative instructions accurately and disturbing the blood clot.

In healthy patients, reactionary haemorrhage is easily controlled by reapplication of pressure to the socket, reiteration of the post-operative instructions, or by suturing of the socket to compress the wound edges and promote clotting again.

In patients taking anti-clotting medication such as aspirin, warfarin or heparin, clotting will not occur so readily and the patient may need hospital treatment. Patients with haemophilia are lacking one of the vital components of the clotting mechanism, and could bleed to death after such a simple procedure as tooth extraction, and must therefore only ever be treated in hospital. These patients should have been identified by a thorough medical history assessment, so that the complication need not arise.

The third type of bleeding complication is secondary haemorrhage, where the blood clot is lost early and the socket subsequently becomes infected, with breakdown of the healing mechanism. This occurs after 24 hours of the extraction being carried out.

Infection

Once the blood clot has been lost from the socket, the bone walls are bare and can become inflamed and subsequently infected from any of the bacteria normally present in the mouth. This is called localised osteitis ('dry socket') and occurs 2 to 3 days after the extraction. Patients with poor oral hygiene and smokers are particularly affected, although it can also occur after a difficult extraction, or where the patient has touched the socket with dirty fingers.

Any food debris or necrotic clot tissue is removed then a sedative dressing is carefully placed (such as Alvogyl®). The pain experienced by the patient can

be relieved with the usual anti-inflammatory analgesics, and it is best if the post-operative instructions are reiterated.

Operculectomy

When a third molar tooth is erupting, the flap of gingivae (the operculum) covering it should gradually regress until the whole occlusal surface of the tooth has erupted. However, as the tooth erupts it tends to push the flap upwards so that it is constantly being bitten by the opposing tooth. This causes inflammation and swelling, and the operculum becomes more traumatised.

The soreness experienced will tend to prevent the patient from cleaning the area thoroughly, and infection will occur. Thorough oral hygiene measures and hot saline mouthwashes will alleviate the symptoms in most cases, but sometimes antibiotics will be required.

A simple solution is to surgically remove the operculum so that the occlusal surface of the tooth is uncovered. This is an operculectomy. It can be carried out either by just cutting the flap off with a scalpel blade and then cauterising the raw wound edges to prevent bleeding, or by the use of an electro-surgery unit, which will cut and coagulate at the same time. No sutures are required, and good oral hygiene measures will ensure uneventful healing.

As the electro-surgery unit uses pulses of electricity during operation, it cannot be used safely on patients with heart pacemakers fitted. A thorough medical history must be taken to avoid unnecessary complications.

Alveolectomy

Alveolectomy is carried out immediately after tooth extraction. When several teeth have been extracted at the same time, the socket edges will project proud of the alveolar ridge. If a removable prosthesis is to be made, these bone spicules need to be removed otherwise the prosthesis will rest directly onto them. This will be extremely uncomfortable for the patient, making it unlikely that the prosthesis will be worn.

At the time of the surgical extractions, therefore, bone rongeurs or the surgical handpiece and burs can be used to trim the alveolar ridge surface and produce a smooth outline (an alveolectomy). Following bone resorption post-operatively, a rounded ridge shape will remain which will support a removable prosthesis painlessly.

Gingivectomy and gingivoplasty

When a patient has periodontal disease, which is eventually being managed by good oral hygiene and professional scaling, the hyperplastic (overgrown) gingival papillae that sometimes remain will form false pockets. These can continue to cause problems by retaining plaque, so the hyperplastic gingivae

can be surgically removed to eliminate the false pockets. This is a gingivectomy, and when the gingival outline is selectively shaped during the surgical procedure, it is called gingivoplasty.

Both procedures used to be carried out extensively, but more recently gingivectomy has tended to be carried out just to remove the hyperplastic tissue which develops due to certain drug regimes. Patients with epilepsy who are prescribed the drug phenytoin, and transplant patients prescribed cyclosporin to prevent transplant rejection, both tend to suffer gingival overgrowth as a side effect. An electro-surgery unit can be used to remove the tissue and coagulate cut blood vessels at the same time, or a special Blake's knife can be used (Fig. 12.7).

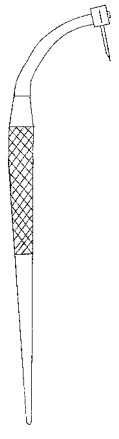


Fig. 12.7 Blake's knife.

The overgrown tissue is cut off in line with the natural gingival margin of the teeth, and no deeper than the false pocket (Fig. 12.8). Protective zinc oxide and eugenol packs can be placed over the raw wound to promote healing, but if an electro-surgery unit is used this tends not to be necessary.

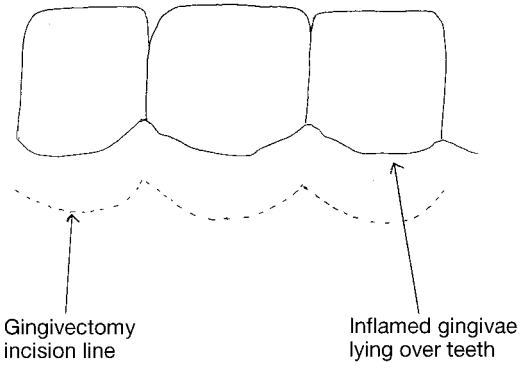


Fig. 12.8 Gingivectomy.

Periodontal flap surgery

Periodontal flap surgery tends not to be carried out as frequently as it used to be. The resistance of isolated areas of the periodontium to all attempts to promote healing following good oral hygiene measures and professional debridement may be due to the presence of a subgingival local factor allowing plaque retention to continue, such as a root defect or a foreign body lodged deep beneath the gingival tissues. Healing will not occur until the plaque retention factor has been eliminated, so the dentist needs to visibly access the site and treat accordingly.

This is done by raising a periodontal flap in a similar fashion to a mucoperiosteal flap, except that the cut is made just partly through the mucoperiosteum, not full thickness. This tends to separate the inner surface of the flap, which is contaminated by bacteria and toxins, from the outer surface. The inner surface is removed during root debridement using curettes, and the healthy flap remaining is sutured back into position as for a mucoperiosteal flap (Fig. 12.9).

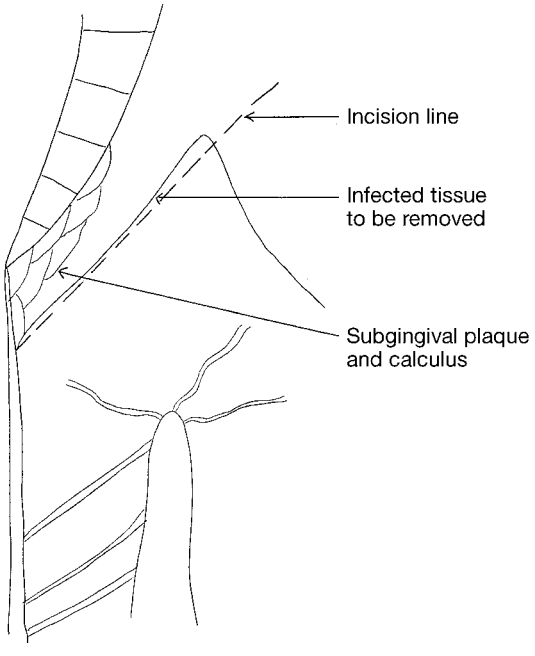


Fig. 12.9 Periodontal flap surgery.

Once the plaque-retentive factor has been removed, healing should occur and the periodontium can be maintained with good oral hygiene and regular periodontal monitoring.

Soft tissue biopsies

Large soft tissue lesions, and those which resemble any possibility of squamous cell carcinoma, are best referred to specialist oral surgeons in hospital departments for investigation. However, the dentist does have a role to play in the removal of commonly occurring benign lesions, such as cysts and polyps, but these are still routinely sent for pathological investigation.

The usual type of procedure performed in dental practice is called an excision biopsy, where the whole lesion and a halo of healthy tissue is removed, and the wound remaining is sutured together to allow healing to occur (Fig. 12.10). Incision biopsies, where just a section of the lesion is removed, is a more specialised technique carried out in hospitals.

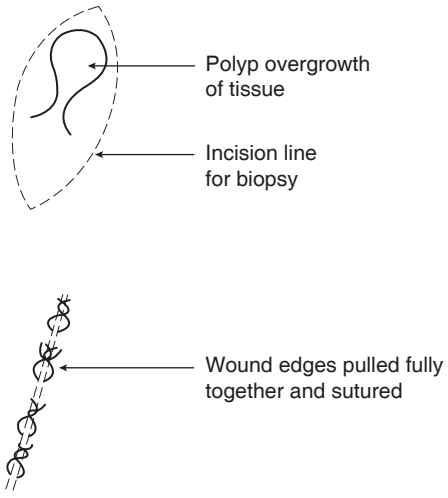


Fig. 12.10 Excision biopsy.

Once the lesion has been removed, it should be placed in a histology specimen pot, provided by the local hospital pathology department, and transported there for investigation within the day. The pots are provided with report cards, which need to be accurately completed (ideally by the dentist) and accompany the specimen. A pathology report will be issued to the dentist, with a diagnosis of the lesion, and unless there is an unexpected finding all should be well.

Use of antibiotics with minor oral surgery

As previously stated, many extractions are carried out because the patient presents with the pain of an acute infection. Previously, antibiotics were often prescribed for these patients as the first line of treatment (especially if the

patient attended without an appointment), and the dental problem would be dealt with at a later date.

Current thinking is that antibiotics:

- Are an adjunct to treatment
- Should be given only if there is evidence that the infection is spreading locally
- Should be given only if:
  - There is evidence of systemic involvement (raised body temperature is a good indicator)
  - The patient has a predisposing medical condition which necessitates antibiotics during treatment

The routine use of antibiotics is contraindicated for the following reasons:

- The source of the infection is better removed by extracting the tooth, or by lancing any abscess present
- Resistant strains of bacteria are more likely to develop if antibiotics are overprescribed
- The long-term consequences to the normal bacterial flora in the body, of a single course of antibiotics can last for months
- The dangerous potentiating action that antibiotics have on several drugs, especially oral anticoagulants
- The possibility of other drug interactions, especially with oral contraceptives and alcohol
- The development of hypersensitivity to the antibiotics by the patient, preventing their use in future
- All drugs should be avoided wherever possible during pregnancy

If antibiotics do need to be prescribed, the following are the recommended choices:

(1) First choice – amoxycillin 250 mg, three times daily for 5 days
(2) Second choice – metronidazole 200 mg three times daily for 3 days
(3) Third choice – erythromycin 250 mg three times daily for 5 days

In severe infections, amoxycillin and metronidazole can be given together.

The patients who are usually prescribed antibiotics for dental treatments likely to cause bacteria invasion into the blood are those at risk of developing infective endocarditis. This is a microbial infection of the inner surface of the heart, especially the valves.

When bacteraemia occurs following dental treatment, patients at risk of further damage to the heart are those who have:

- A history of infective endocarditis
- Valvular defects of the heart
- Acquired valvular disease, especially rheumatic fever

- Persistent heart murmur
- A prosthetic heart valve in place

The recommended antibiotic prophylaxis for these patients is either:

- Amoxycillin 3 g one hour before dental procedure, or
- Clindamycin 600 mg one hour before dental procedure, if patient has allergy to penicillin

Children under 10 years old should have half these doses. All other categories are classed as special risk, and should be treated in hospital

Activities

- Over the next month, keep a list of all the teeth that you see being extracted. Make a note of why they were extracted, and determine which nerves were anaesthetised.
- List the elevators that you have in your practice.
- Explain to a colleague the post-operative instructions that you would give to a patient after they have had a simple extraction.
- Besides a simple extraction, write short notes on one surgical procedure that you have seen in your practice.

Chapter Thirteen
Orthodontics

This chapter relates to unit DN24 'Provide chairside support during the fitting, monitoring and adjustment of orthodontic appliances'.
All three elements are covered:

- DN24.1 'Support and encourage patients during programmes of orthodontic treatment'
- DN24.2 'Prepare patients, environments, equipment and materials for orthodontic treatment'
- DN24.3 'Assist in the monitoring and adjustment of orthodontic appliances'

The subject of tooth movement through bone is discussed briefly.
The following subjects are covered in detail:

- Occlusion and malocclusion
- Aims of orthodontic treatment
- Oral hygiene instruction
- Patient support and encouragement
- The equipment and instruments used for removable, fixed and functional appliances

Classification

Orthodontics is the study of the size and position discrepancies which occur between the teeth and the jaws, and the treatment carried out to resolve these discrepancies.

With the mouth closed and the teeth touching together, the teeth are said to be in occlusion, and ideal occlusion is determined by the position of the first molars and the canines to each other. This is known as Angle's Classification.

More recently, the relationship of the buccal teeth to each is overridden by the position of the central incisors, so the position of the first molars may determine one classification of occlusion but will be dominated by that indicated by the central incisors.

Ideal occlusion is denoted as **class I**, where the mesiobuccal cusp of the upper first molar lies in the buccal groove of the lower first molar. The tips of

the upper central incisors project forward from the labial surface of the lower central incisors by between 2 mm and 4 mm – this is called the **overjet**. The upper central incisors cover the labial surface of the lower central incisors by 50% – this is called the **overbite** (Fig. 13.1).

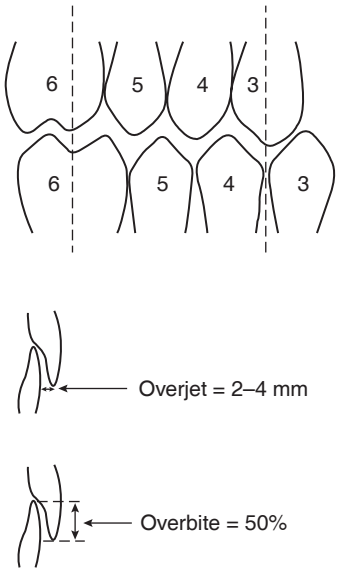


Fig. 13.1 Class I occlusion.

When the lower jaw develops further back than normal, the relationship of the first molars to each other will be incorrect, so that the upper mesiobuccal cusp lies in front of its normal position, and this is **class II** malocclusion.

If the upper central incisors escape the confines of the lower lip as they erupt, they will tend to develop sticking out, or **proclined**, and the overjet will measure more than 4 mm – this is called **class II division 1** (Fig. 13.2).

If the upper central incisors remain inside the lower lip as they erupt, they tend to be tipped upright or even backwards by the strong muscular force of the lower lip, and appear **retroclined**. This tends to allow the lower incisors to erupt past their normal position onto the cingulum of the upper incisors, and the overbite will be greater than 50% – this is called **class II division 2** (Fig. 13.3).

When the lower jaw develops further forwards than normal, the relationship of the first molars will again be incorrect, with the mesiobuccal cusp of the upper being behind the buccal groove of the lower, and this is called **class III** malocclusion.

The upper central incisors may develop with a reduced overjet, or bite edge to edge, or there may even be a reverse overjet because the upper central incisors are behind the lower central incisors – this is called a **negative overjet**.

The overbite tends to be less than 50%, or zero if the incisors bite edge to

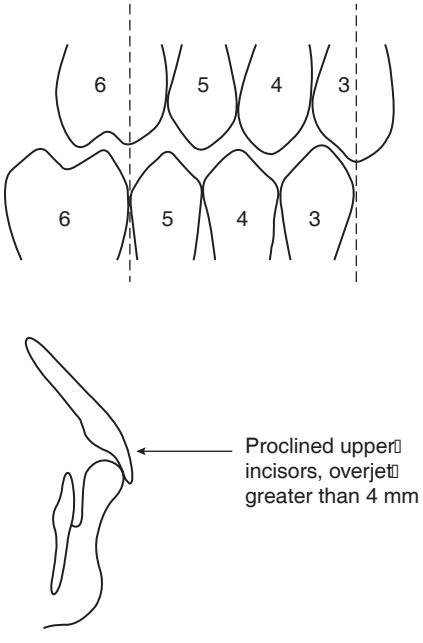


Fig. 13.2 Class II division 1.

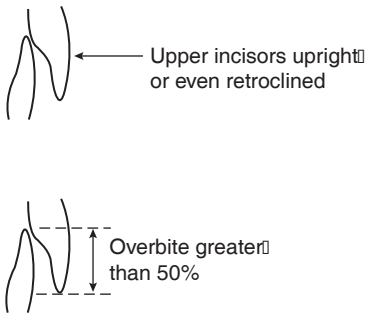


Fig. 13.3 Class II division 2.

edge, or they may not even meet – this is called an anterior open bite (Fig. 13.4).

Causes of malocclusion

As indicated above, the developmental position of the mandible in relation to the maxilla determines the classification of malocclusion, so the majority are genetic in origin. It is quite common to see malocclusions exhibited by adult patients appearing in their children.

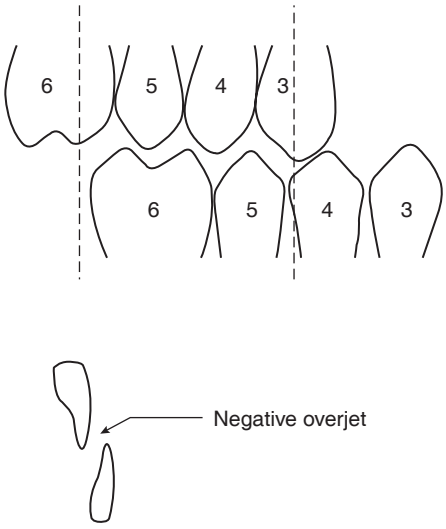


Fig. 13.4 Class III malocclusion.

- **Jaw-to-jaw discrepancy** – where either the maxilla is normal sized and the mandible is small or too far back, giving a class II malocclusion, or the maxilla is small and the mandible is normal or too far forwards, giving a class III malocclusion. These are known as **skeletal discrepancies**
- **Jaw size to tooth size discrepancy** – usually the teeth are normal sized erupting into small jaws so that too little space is present and the teeth are crowded. The commonest teeth affected are the canines because they erupt at the 'corner' of the dental arches and are easily pushed out of line
- **Microdontia** – abnormally small teeth erupting into normal sized jaws will result in spacing in the jaws
- **Megadonts** – abnormally large teeth erupting in normal sized jaws will result in crowding
- **Supernumary teeth** – these are not 'extra' teeth (they are called supplemental teeth) but are tooth-like structures occurring anywhere in the jaws, but usually developing in the midline of the maxilla and can prevent the eruption of one or both central incisors. These are called **mesiodens**
- **Congenitally absent teeth** – patients may be born without the tooth germs present for certain teeth, resulting in less than the usual 32 adult teeth being present once eruption is complete. This is called **hypodontia**, and tends to affect the third molars, the upper lateral incisors, the second premolars and the lower central incisors
- **Localised crowding** – occurs owing to a variety of factors:
  - Early loss of deciduous teeth, allowing drifting of neighbours
  - Retention of deciduous teeth so that permanent successors erupt out of line
  - Late eruption of permanent teeth into crowded arches so that they are pushed out of line

- **Soft tissue habits** – especially thumb or finger sucking, which prevents the permanent teeth from erupting correctly because of the abnormal forces acting on them, this can result in the following problems:
  - Upper incisors proclined
  - Lower incisors retroclined
  - Reduced incisal contact, or an anterior open bite
  - Unilateral or bilateral cross-bite, where the upper buccal teeth lie inside the lower dental arch because of the muscular force of the cheeks acting on them during sucking movements

Aims of orthodontic treatment

The usual reason for patients seeking orthodontic treatment is to improve their facial appearance, but there are also good dental reasons to carry out treatment to straighten teeth:

- To restore the occlusion to its proper function – this is especially important in severe cases where skeletal discrepancies can cause problems with mastication or speech. Very severe cases often need jaw surgery to correct the discrepancy
- To remove stagnation areas – these are created by malaligned teeth, and increase the risk of dental caries and periodontal disease occurring
- To reduce the risk of trauma to the teeth – trauma is especially common in class II division 1 malocclusions with proclined upper central incisors
- To give a feeling of psychological wellbeing – children with obvious malocclusions are often bullied or teased at school, and treatment to correct these cases increases the patient's self-esteem

The timescale required to achieve adequate orthodontic results depends on the severity of the malocclusion and the cooperation of the patient.

The aims of orthodontic treatment are achieved by either moving the malaligned teeth through the jaws to a more correct position, or by correcting the skeletal discrepancy. Mild class II skeletal discrepancies can be corrected using functional appliances, more severe class II and class III discrepancies may require a combination of surgery and appliances to correct them.

Tooth movement through bone

A simplified explanation of how teeth can be moved through bone is given.

- The mechanical forces produced by orthodontic appliances acting on the teeth are transmitted to the surrounding periodontium
- In the alveolar bone, which forms the tooth sockets, this induces remodelling of the bone which therefore allows tooth movement to occur
- In areas where pressure occurs, osteoclast cells eat away bone so that the tooth root can move in this direction

- In areas of tension, osteoblast cells lay down bone so that the space previously occupied by the root is filled in
- The whole process is controlled by osteoblast cells, which therefore control bone resorption and tooth movement
- The process occurs more rapidly in younger patients, so the ideal time for orthodontic treatment to be carried out is the early teenage stage when all the permanent teeth have erupted (except the third molars)

Risks of orthodontic treatment

All orthodontic treatment involves the patient wearing some kind of orthodontic appliance in their mouth, usually for 24 hours a day and often for many months or even years.

The oral hygiene of these patients must be meticulous throughout the course of treatment, and their diet must be well controlled in relation to non-milk extrinsic sugars and acidic drinks, otherwise the following may occur:

- Decalcification of enamel and eventual development of carious lesions, which will require permanent restoration
- In adult patients, pre-existing periodontal problems will be exacerbated unless treated to achieve a good periodontal status before orthodontic treatment commences
- Root resorption can occur following orthodontic treatment, especially of incisor teeth, but the risks are increased when:
  - Roots are abnormally shaped
  - There is a history of tooth trauma
  - There is a history of endodontic treatment
- Teeth which are heavily restored are more prone to fracture when fixed appliances are removed, especially where large anterior acid-etched restorations are present
- Patients suffering from temporomandibular joint dysfunction should ideally be referred before orthodontic treatment commences, as the relationship between the two is not clear

Orthodontic diagnosis

The determination of the need for orthodontic treatment is achieved by the recording of the following clinical records:

- A full orthodontic examination and recording of all relevant information
- A set of accurate and up to date study models
- Suitable radiographs showing details of all unerupted teeth

Full orthodontic examination

A full orthodontic examination is carried out by a dental surgeon to record the following points:

- Buccal and incisal classification of malocclusion
- Overjet measurement
- Overbite measurement
- Presence in each arch of any crowding, its severity (mild, moderate, severe) and whether occurring labially or buccally
- Presence of any retained deciduous teeth
- Presence of any tooth rotations
- Presence of unilateral or bilateral crossbites
- Presence of upper or lower centreline shifts, and whether to right or left of normal

The severity of malocclusion can then be determined by taking the worst feature and scoring it in accordance with the IOTN clinical score. IOTN is an acronym for Index of Orthodontic Treatment Needs, and it is not necessary for dental nurses to have an in-depth knowledge of its use. Suffice it to say that the higher the number scored from 1 to 5, and the closer the letter to the start of the alphabet, then the worse the malocclusion.

Study models

Study models are accurate models of both arches produced by taking alginate impressions and a wax bite of the patient (see Chapter 10 for details of material and mixing techniques). They are cast in dental stone, and articulated by hand and trimmed so that the malocclusion present is correctly reproduced. Their use allows the dentist to study the malocclusion from all angles.

Radiographs

The basic radiographic view required is ideally an orthopantomograph (OPT), or bilateral oblique views (see Chapter 8 for details). These should show all of the following:

- Presence or absence of any unerupted teeth
- Positions of unerupted teeth
- Presence of any supernumary teeth
- Presence of any pathological lesions, such as cysts, caries, periodontal disease
- Presence or absence of third molar teeth, and their positions

Often, a naso-occlusal or maxillary occlusal view is also taken to show the following:

- Shape of incisor roots
- Any pathology associated with the incisor roots
- Presence of any supernumaries, and their relationship to the incisors
- Presence and extent of any root resorption of incisors

The two radiographs together can then be used to determine the position of any unerupted and impacted teeth, by the process of parallax. This technique is especially useful when determining the position of unerupted upper canine teeth.

Treatment of malocclusion

Once the malocclusion has been determined, there are several options for its treatment, which depend on the type of malocclusion, its severity, and the likelihood of cooperation by the patient during treatment. The options can be summarised as:

- Leave untreated, as the malocclusion is too mild or the patient cooperation is likely to be poor
- Extract teeth only, to alleviate simple crowding, especially with impacted canines which can be improved by extraction of the first premolar before full eruption of the canine, which can then spontaneously erupt into an acceptable position
- Extractions followed by appliance therapy, where the teeth need help to align satisfactorily into ideal positions
- Removable appliance therapy to correct one or a few teeth positions
- Fixed appliance therapy to correct more complicated tooth positions, especially rotations
- Functional appliance therapy to correct class II division 1 malocclusions while the patient is still growing

Removable appliances

Removable appliances have an acrylic base, like dentures, and stainless steel components to hold the appliance firmly onto the teeth, and others to apply forces to the necessary teeth to effect movement. The appliance is usually retained by Adam's cribs around the first molars and premolars, and/or by Southend clasps around incisors (Fig. 13.5).

Movement of teeth is achieved by stainless steel springs of various designs, which are distorted out of shape during activation by the dentist, so that as they move back to their original shape, they pull or push the malaligned teeth with them.

The acrylic components of the appliance are adjusted using a straight handpiece and acrylic trimming bur, as with removable prostheses. The metal components are adjusted using a pair of Adam's, or universal, pliers (Fig. 13.6).

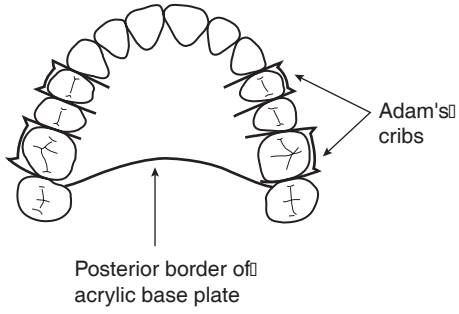


Fig. 13.5 Upper removable appliance.

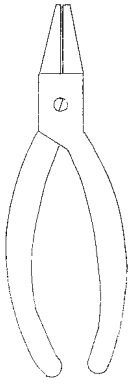


Fig. 13.6 Adam's (universal) pliers.

No other specialised equipment is required for the use of removable orthodontic appliances.

Types of spring

- Palatal finger springs retract teeth, especially canines and premolars (Fig. 13.7).
- 'Z' springs and 'T' springs procline teeth, to correct negative overjets of incisors and correct crossbites of canines (Fig. 13.8).
- Buccal canine retractors pull canines into the space provided by the extraction of first premolars (Fig. 13.9).
- Robert's retractors are used to reduce a large overjet involving all incisors (Fig. 13.10).

A midline expansion screw is used to correct crossbites. It is turned twice weekly with the aid of a key.

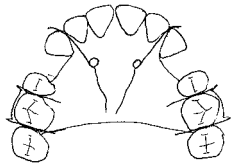


Fig. 13.7 Palatal finger springs.

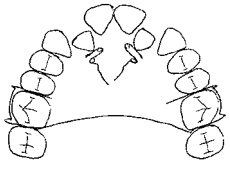


Fig. 13.8 'Z' springs.

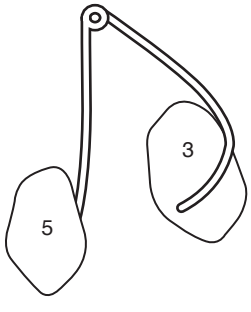


Fig. 13.9 Buccal canine retractor.

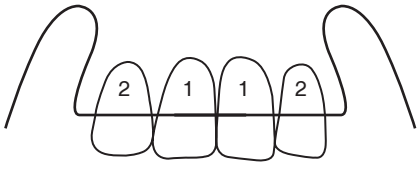


Fig. 13.10 Robert's retractor.

Patient advice for removable appliances

As with removable prostheses, orthodontic appliances are capable of acting as stagnation areas and holding food debris and plaque against the teeth and gingivae, unless a good standard of oral hygiene is maintained.

Although some dentists prefer patients to wear appliances during meals, it is possible that more acrylic breakages will occur if this is the case. The

instructions necessary for patients wearing removable appliances are as follows:

- Wear as directed by the dentist
- Clean appliance and teeth after each meal, using a toothbrush and toothpaste
- Avoid cariogenic foods and drinks, as advised
- Attend all dental appointments for necessary adjustments
- Contact the surgery immediately if any breakages or loss of the appliance occur
- Expect the appliance to feel tight initially after each adjustment
- Contact the surgery if any prolonged or excessive symptoms occur
- If the appliance is to be removed for meals, ensure it is placed safely in a rigid container to avoid breakages

Fixed appliances

Fixed appliances consist of brackets or bands which are cemented onto each individual tooth, and then connected by one of a variety of archwires, which are pre-formed to the ideal arch shape.

The distortion of the archwire while being tied to each bracket or band provides the force required to move each tooth to the ideal position while the archwire reforms (Fig. 13.11).

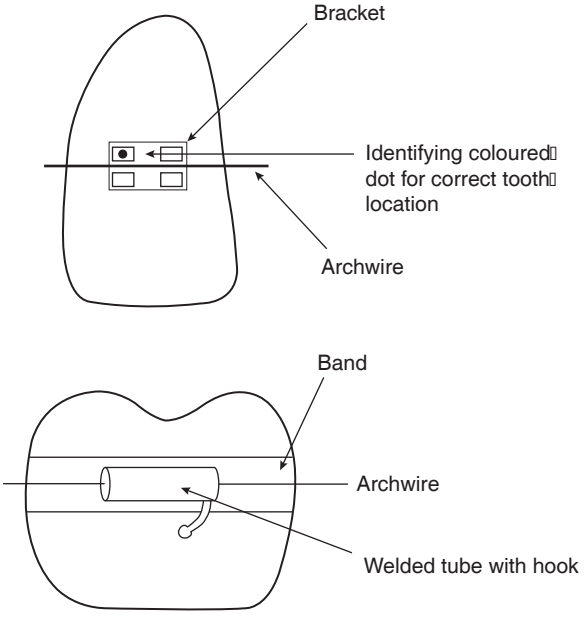


Fig. 13.11 Brackets and bands.

Greater forces can be applied, including those necessary to de-rotate teeth, than are produced by removable appliances, so the treatment use of fixed appliances is much wider.

Each bracket or band is designed specifically to move that tooth to an ideal occlusion, so great care is required when choosing and setting up the components to be applied.

Several particular instruments are necessary for the appliances to be placed and adjusted during the treatment:

- Bracket holders, used while cementing the appliance initially
- End-cutting pliers, to cut off excess lengths of archwire
- Ligature, or alastik, holders to apply the alastiks to each bracket and stabilise the archwire (Fig. 13.12)

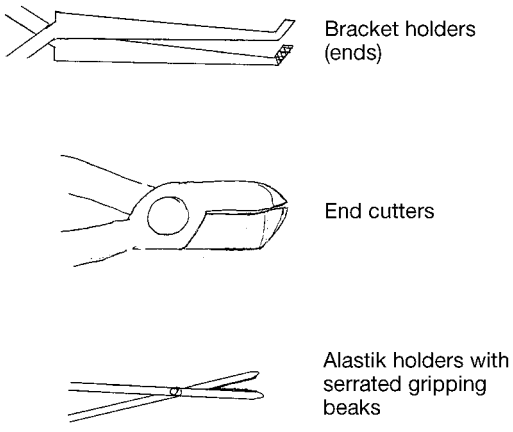


Fig. 13.12 Fixed instruments.

At the end of treatment the appliance is carefully removed from each tooth using either bracket removers, or band removers (Fig. 13.13).

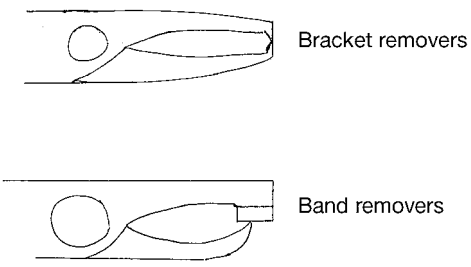


Fig. 13.13 Removers.

Patient advice for fixed appliances

Every tooth is incorporated into a fixed appliance, so the number of stagnation areas, and the potential for oral damage to occur, is great. Routine toothbrushing twice daily is insufficient to ensure good oral hygiene standards are maintained, so besides all other instructions as applicable to removable appliances, special oral hygiene instructions are recommended for patients undergoing fixed therapy:

- Careful manual toothbrushing should be carried out after each meal
- Use of fluoridated toothpaste
- Use of interdental brushes daily to clean around each bracket individually
- Avoidance of cariogenic food and drinks, for full length of treatment
- Use of fluoride mouthwash daily, to minimise risk of decalcification
- Regular use of disclosing tablets, to highlight problematic areas

Functional appliances

Functional appliances are a specialised type of removable appliance made of acrylic and stainless steel components, and worn in both arches at the same time (Fig. 13.14), the commonest one currently being a Twinblock.

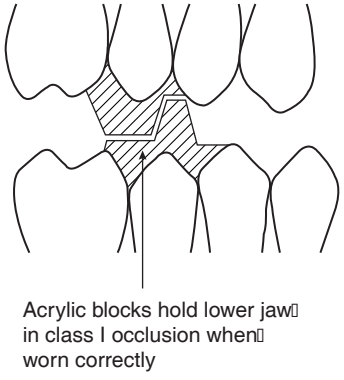


Fig. 13.14 Functional appliance.

The appliances are used to correct skeletal class II discrepancies, by holding the mandible forwards in the ideal class I position and allowing mandibular growth to occur and correct the malocclusion.

As their success depends on the growth of the mandible, they can only be used while the patient is still growing but after the premolars have erupted, so the ideal age is up to 14 years old.

The materials, instruments, and patient advice are as for removable orthodontic appliances.

The wearing of any type of orthodontic appliance demands a high level of motivation and cooperation from the patient. Their diet has to be restricted to minimise the risk of caries developing, and in the teenage years this is often unacceptable, and motivation will wane. This is more likely for prolonged courses of treatment.

Cooperation and levels of motivation need to be assessed at each adjustment appointment, and reinforced as necessary by both the dental nurse and the dentist. Warning signs include the following:

- Failed appointments
- Recurrent breakages
- Reporting of problems wearing appliances, which have resulted in non-wear
- Falling standards of oral hygiene
- Obvious disinterest during adjustment appointments
- Requests for early removal of fixed appliances
- Failure to wear removable or functional appliances during daytime

Any combination of these signs should alert the oral health team to reinforce cooperation, for the patient's benefit, or failure of treatment is likely to occur.

A system of discontinuation of treatment must be in place, so that patients are aware that failure to comply will result in the early removal of the appliance and incomplete treatment. This may mean that malocclusions remain for life, with all of the consequences that that will imply.

If a patient persistently fails to wear the appliance or to attend appointments for adjustment and review, treatment is best discontinued at an early stage before too much surgery time has been wasted.

Patients who have discontinued treatment once and then re-present for continuation should be treated with great caution, as the likelihood of a second failed course is greater still.

The dental nurse's role during the provision of orthodontic treatment is as for all other clinical procedures, as detailed in Chapter 9.

Activities

- Using a mirror, classify your own occlusion.
- Do the same with a colleague.
- Make a list of the foods and drinks to be avoided during orthodontic treatment.
- List the main oral health messages that you would give to a patient about to embark on orthodontic treatment.

Chapter Fourteen

Communication, Confidentiality and Patients' Rights

This chapter relates to unit DN16 'Promote people's equality, diversity and rights' and unit DN17 'Promote communication with individuals where there are communication differences'.

All three elements of unit DN16 are included:

- DN16.1 'Promote people's rights and responsibilities'
- DN16.2 'Promote equality and diversity of people'
- DN16.3 'Promote people's rights to the confidentiality of information'

Both elements of unit DN17 are included:

- DN17.1 'Determine the nature and scope of communication differences'
- DN17.2 'Contribute to effective communication where there are communication differences'

Several aspects of good communication skills are discussed in detail in Chapter 6 too.

The following areas are covered in detail:

- The concept of consent to dental treatment
- The maintenance of patient confidentiality
- Patient complaints
- Details of compliance with current General Dental Council regulations

Establishing a good relationship with the patient

Good communication with patients is imperative if they are to take an active role in determining their oral health, by giving valid consent to dental procedures deemed necessary by the dentist. But it must also be understood by all that the patient has the right to refuse treatment if they so wish.

The basic rights of the patient can be summarised thus:

- To be treated with respect and honesty
- To be kept fully informed of their oral health needs
- To be recognised as having a role in the management of their oral health needs

Ensuring that patients are kept fully informed at all times forms the basis of the desired open and honest relationship between all members of the practice and the patient. The dental nurse has no less a role than the dentist in this respect, especially as patients often choose to discuss their concerns and queries with the nurse rather than the dentist.

This open relationship between the practice and the patient hinges on the following points:

- Openness between the parties will lead to trust
- Information therefore has to be given honestly and on a regular basis
- All aspects of risk and uncertainty about dental procedures should be discussed
- Providing information to patients about their oral health should be a matter of routine

Communication

There are various ways in which to communicate with patients and with each other, both verbally and non-verbally, and misinterpretation of information being given can have catastrophic consequences for all.

Communicating means to give or exchange information, and in the dental setting full communication is the only way in which patients can give informed consent for their dental treatment. If they are not given all the necessary information regarding, say, endodontic treatment, either deliberately by exclusion or accidentally by misinterpretation, then they cannot understand all the pros and cons of the treatment and therefore cannot give informed consent.

Methods of communicating are:

- Talking
- Written explanations
- Information leaflets and posters
- Body language
- Eye contact and facial expressions
- Body position, such as sitting or standing
- Touching, to reinforce points

In our modern, multi-racial society there are bound to be patients whose first language is not English, and who will then be at a disadvantage with regard to interpreting information. In these situations, patients should be encouraged to bring a responsible interpreter to their dental appointments, so that full

communication occurs and the patient is fully informed before undergoing any dental procedure.

The National Health Service issues patient information leaflets in various languages and it would be advisable for practices with a large ethnic minority patient base to have them to hand as required.

Dental staff should also be aware of cultural differences between ethnic groups, and accept and deal with them in an appropriate manner. Religious beliefs may prevent oral examination and dental treatment occurring at certain times, and these facts should be accommodated and handled sympathetically as far as possible, rather than being seen as an unnecessary hindrance to the running of the practice.

Religion probably plays the most important role in the differences encountered amongst many ethnic groups, both in their culture and in their daily lives, including their diet and eating habits. Several points of interest for dental staff are summarised below.

Hindus:
- Many vegetarian, some vegan, no beef in diet
- Fast days are common
- Diet tends to be very high in saturated fats, and often expensive

Sikhs:
- Eat more dairy products than other ethnic groups
- Often vegetarian
- Otherwise no beef or pork; other meats acceptable

Moslems:
- Have strict food laws, even including methods of animal slaughter
- No alcohol or pork
- Ramadan – period of fasting during daylight for one month per year
- Eat lots of fish

All Asian groups tend to breast feed their babies for up to two years and sugar is routinely added to feeds, especially as milk-based additions which are consequently cariogenic and have low nutritional value.

Similarly, there is a wide diversity of socio-economic classes in most dental practice areas, and assumptions should never be made about a patient and the role that they wish to take with regard to their own oral health. A common occurrence is for those in the lower social classes to be believed to be unable to afford expensive treatments, such that full information regarding proposed treatment is denied them and consequently they cannot give informed consent.

All of these situations, if handled badly, could result in claims of discrimination.

Non-verbal communication is just as important to ensure that patients are kept fully informed. Staff who have a defensive style of body language, such as standing with their arms folded when talking to patients, give the impression

that they are unapproachable and likely to refuse help to the patient if asked. Failure to make eye contact when addressing a patient gives the impression of disinterest, as well as being rude.

Obvious differences in patient management between males and females, and between people with and without disabilities is blatantly discriminatory, and must be avoided at all costs. Some patients also find that close proximity between themselves and staff during discussions of their oral health is intimidatory, and feel that they are being pressurised into accepting treatment when they do not wish to proceed. Older patients may also find unnecessary physical contact between themselves and staff offensive, especially between female patients and male staff. Many areas run courses on these subjects, and dental nurses may wish to attend them when available.

Disability comes in many forms, and can be either mental or physical in its effect on the patient. Patients with a mental disability range from those with minor learning disabilities, through the elderly suffering from various forms of dementia, to those with congenital problems, such as Down's syndrome. The dental care of these patients can be very demanding and time consuming for the dental team, but also challenging and rewarding. Whatever the disability, the patient has the same rights as all others, including access to full dental care. Obviously the ability of some to be able to comprehend and accept more complicated forms of treatment may be limited, and personal assistants and family should be kept fully involved by the dental team at all stages of treatment.

These patients do have special needs, but this should not mean that the standard of their dental care should suffer as a result.

Similarly, patients with physical disabilities range from those who are deaf or blind through to those with limited body movements or who are confined to a wheelchair. Again, they are patients with special needs who may require more time and the delivery of dental treatment at a slower pace than those patients who are without disabilities, but the standard and extent of that care should be no different.

Deaf patients will appreciate being spoken to by the dental team with no mask blocking their view of the lips, as many can lip read. Blind patients will appreciate being allowed to handle instruments before their use, and having clear and detailed explanations of the noises they will hear in the surgery so that they are not startled. Just a little thought about these matters can make the world of difference to these patients.

Good oral care depends on the patient having a certain level of manual dexterity, and there are many ideas and devices available that could be recommended by the dental team.

Angled toothbrushes, or even children's sizes rather than adult size, can make access to the teeth so much easier, either for the patient themselves or for their personal assistant. Electric toothbrushes, when used correctly, can ensure a good standard of oral hygiene, although battery operated designs are not particularly recommended as they can loose their charge with time and become quite inefficient at plaque control.

Several floss holders are available to allow efficient interproximal cleaning;

indeed, even manually dextrous patients may find these less cumbersome than the traditional method of wrapping floss around the fingers.

Many of these points will also apply to elderly patients, especially those who are becoming infirm and unsteady. More of the population in Britain is composed of elderly patients now than ever before, and their dental care raises new challenges for the dental team. More retain their natural teeth for longer rather than having a dental clearance and full dentures, and the treatment of these patients has developed into a new speciality of dentistry called gerodontics.

A caring dental team member who aids an elderly patient who is unsteady on their feet will go a long way to persuading these patients that they are not nuisances who are in everybody's way, but are a respected and valued member of the community.

Consent

The aim of good communication is to fully inform the patient of their proposed treatment needs, including the risks and possible complications, so that they can give valid and informed consent to the dentist.

For the consent to be valid it must:

- Be given voluntarily
- Be fully informed and specific to the particular treatment for that patient
- Be either oral, written or implied consent (such as sitting in the dental chair)
- Include details of cost, and agreement to pay these costs when requested to do so
- Be specific for any necessary changes to the original treatment plan

By law, consent is deemed to be valid and informed if given by:

- Patients over 16 years old, of sound mind
- Patients under 16 years old who are deemed able to understand the information given ('Gillick competent')
- Written consent of parent or guardian for other patients under 16 years old

The following must, by law, also hold true:

- Patient understands pros and cons of each option, and why final choice is recommended
- Patient can make an informed decision, once all the information has been given
- Patient understands and accepts any risks involved
- Patient has realistic and achievable expectations
- Patient has given consent directly to the dentist offering the treatment
- Written consent is given for extensive and costly courses of treatment

However, the law is equally specific on the following points:

- No person can give consent on behalf of an incompetent adult
- These patients must be assessed by the dentist as to whether any consent given is valid
- A second professional opinion may be necessary
- Dentist must always act in the best interests of the patient, after undertaking a risk versus benefit analysis
- Any actions taken by the dentist must be justified, if necessary

To summarise, then, good communication skills practised by all the dental team revolve around their ability to listen to the patient, to communicate at a level appropriate to each patient (which often means the avoidance of dental jargon), never make incorrect assumptions about a patient, and always be open and honest with them.

Confidentiality

Patients have a right to expect that their dental records will not be disclosed to a third party without their permission, and all dental staff are bound by this duty of confidentiality.

Dentists have vicarious liability for the acts and omissions of their staff – this means that the dentist is wholly responsible for any mistakes made by the staff, and it is therefore the dentist's responsibility to ensure that all staff are made aware of this fact and that they are all trained in correct practice protocols and procedures accordingly. This training should incorporate the seriousness of a breach of confidentiality, as the dentist is likely to be accused of serious professional misconduct.

Information about a patient can only be disclosed to a third party with the patient's written consent. However, there are some circumstances under which the dentist has a statutory obligation to disclose information, such as:

- To assist in the identification of a driver involved in a road traffic accident, under the Road Traffic Act 1988
- When requested to do so by the Dental Practice Board
- To provide information about a child to their parent or legal guardian
- When it is in the public's interest, as with suspected criminals
- When requested by a court order from the police, under the Prevention of Terrorism Act 1974, 1989, or the Police and Criminal Evidence Act 1984

General confidentiality in the dental practice should be observed at all times, including the secure storage of all patient records under the Data Protection Act 1998. The following points should also be borne in mind:

- Patients should not be discussed amongst staff within earshot of others
- All conversations with patients about personal matters should be done in private

- Even the fact that a patient has attended the practice on a certain day, or that they are a patient at the practice, is confidential
- This means that schools and employers have no legal right to know whether a patient has attended at any time
- All written communications with patients, including recall notification, should be sent in sealed envelopes
- All dental records have to be kept for 11 years or until the patient is 25 years old, whichever is the longer
- Therefore, under no circumstances must a dental nurse destroy any portion of a patient's records

Patients have the right of access to their own manual and computerised health records, under the Access to Health Records Act 1990 and the Data Protection Act 1998:

The following conditions apply:

- Only the record holder (that is, the dentist) can approve access
- Patients have to make their request in writing
- The dentist must respond within 40 days
- The dentist must check the identity of the person making the disclosure request, prior to releasing the records
- Patients have the right to request amendments to their records, once viewed
- Disclosed data should be provided with an explanation of the terms used

The dentist can legally refuse to disclose some or all of the records if:

- Disclosure would cause serious harm to the patient
- Another person (other than healthcare workers) is mentioned in the records, and they have not given consent to be involved
- Deceased patient's records include notification that access is not to be granted after their death

Complaints

All dental practices and their staff aim to provide the best possible care for their patients at all times, in a professional and courteous manner, and with the best of intentions to prevent both oral disease and injury to the patient. However, the patient has the right to complain about any aspect of the practice if they wish, from staff attitudes to the dental treatment received. The best policy for all staff is to adhere to their own dental practice written policies at all times, with the aim of minimising any grounds for complaint in the first instance.

The General Dental Council requires all dental practices to have an in-house policy for handling complaints, which should aim to fully resolve any complaint received to everyone's satisfaction, as quickly as possible and without the need for others to be involved.

Dental practices are advised to use any patient complaints received as an opportunity to review practice procedures and to change them if necessary, with the aim of improving the standard of the service being offered to their patients.

National criteria dictate that the complaint system follows set rules:

- Its existence should be advertised to the patients, so that they are aware of it
- A specific person is designated to deal with complaints (usually the dentist or practice manger), with a designated second person as a deputy
- All complaints must be acknowledged, in writing if written ones are received, within 10 days of being received
- Information received should be held in confidence

As always, good communication skills and an honest, open approach are paramount in helping to deal with the complainant in a sympathetic and understanding manner. All complaints are best resolved at the earliest possible opportunity, and often all that is required is an apology. This can be given without fear of admitting liability or negligence.

Procedure for handling a verbal complaint

(1) Conduct all discussions in private, away from other patients
(2) Use good body language and facial expressions to show the complainant is being listened to actively
(3) Allow patient to express their views, without interruption
(4) Take notes if necessary, then summarise and confirm the problem
(5) Apologise if appropriate
(6) Discuss what action is intended, and inform them when this has been carried out

Procedure for handling a written complaint

(1) Acknowledge receipt of the complaint within two working days
(2) Investigate the matter thoroughly
(3) Send a written report of investigations within 10 working days
(4) Do not apportion blame and make no personal comments or express any opinions
(5) Be open and sympathetic in the response, not defensive
(6) Offer an apology and the opportunity to discuss further if required

Sometimes, the patient will be dissatisfied with the result of their complaint, and will wish to take the matter further. An offer to refund any dental fees can then resolve the complaint, and this will be offered as a gesture of goodwill only, not as an admission of liability. If the complaint is with regard to NHS treatment, the patient may contact the local primary care trust (previously the area health authority) and request that they conciliate or even order an independent review of the situation.

In more serious cases, especially if they involve professional conduct issues, the patient may choose to ask the General Dental Council to review the matter and determine whether serious professional misconduct may have occurred. Complaints of this nature are beyond the scope of the practice complaints procedure, and resolution of the issue often comes down to accurate and full dental records, so their importance must never be underestimated.

Activities

- Ask an elderly member of your family if they have experienced discrimination at any time because of their age, and identify the results of that discrimination to them.
- Look through the complaints log in your practice and identify the methods used to deal with the complaints.
- Make a list of any special adaptations to oral hygiene products that are recommended in your practice.

Chapter Fifteen

Development of Knowledge and Practice

This chapter relates to unit DN18 'Develop one's own knowledge and practice'

Both elements of the unit are included:

- DN18.1 'Reflect on and evaluate one's own values, priorities, interests and effectiveness'
- DN18.2 'Synthesise new knowledge into the development of one's own practice'

Subjects discussed include:

- Reflection and self-evaluation
- Staff appraisals
- The concept of lifelong learning

Current career pathways available for dental nurses are indicated, but it is expected that these opportunities will be expanded upon by various bodies, with time.

The changing scene

The dental profession is undergoing reform with a view to regulation of all members of the dental team, including dental nurses. All members other than dentists are now known as Professionals Complementary to Dentistry or PCDs, and compulsory registration with the General Dental Council will be the norm, once qualification has been achieved.

However, as with dentists, all PCDs will be expected to develop a system of lifelong learning and continuing professional development, so that as dentistry and dental nursing evolves, new skills and information will need to be understood and practised by all. Qualification and compulsory registration will be the basics required by dental nurses, rather than their end goal of achievement.

With these points in mind, the dental nurse needs to be capable of recognising their own limitations and effectiveness at all dental nursing skills, so that shortcomings can be addressed and acted upon. Under no circumstances must a dental nurse ever act beyond the legal limits of their qualification,

otherwise disciplinary procedures are likely to be evoked by the General Dental Council.

Reflective practice

One of the best ways of recognising one's own shortcomings and acting upon them is to become a 'reflective' professional. The aim is to constantly look back (reflect) upon aspects of your clinical practice in order to try to improve it by constantly analysing, constructively criticising and evaluating your own performance. Areas of reflection should include your decision making and your interactions with patients and other dental team members.

If this process of reflection is done regularly, and preferably constantly, learning opportunities will be created from all aspects of your daily work. This then means that your skills as a dental nurse and dental team member are open to constant improvement.

Two broad types of reflection are recognised: those that occur as a situation happens, known as reflection in action, and those that occur after the event known as reflection on action. The latter is often referred to as 'hindsight'.

Reflection in action occurs by having the knowledge, skills and experience before the event happens, therefore enabling sound clinical decisions to be made at the time for a successful outcome. An example in the dental nurse context is as follows. Compare the competence of a dental nurse when nursing for a certain procedure for the first time with their competence when nursing for the same procedure for the fourth or fifth time. They will undoubtedly feel more comfortable as experience is gained, because sub-consciously their own techniques are bettered after each event. In other words, 'practise makes perfect'. If, say, that procedure is aspirating for oral surgery, the first time the following may occur:

- Not sure of all instrument identifications
- Aspiration is not fully effective
- Hesitant when handling some instruments
- Concentrating so much on the procedure that the patient is forgotten

By the fourth or fifth time, however:

- Instruments are now known because they are more familiar
- Aspiration is more effective, perhaps by learning from the first patient choking and the dentist being unable to see clearly
- Confident when handling instruments because they are more familiar
- Able to monitor and reassure patient at the same time

Reflection on action occurs by being able to think back over the procedure at a later date. This allows realisation and identification of any problems encountered with the natural continuation of thought being to recognise how to improve next time.

Most of us carry out this second type of reflection on a regular basis, for example when driving home from work and going over the days events in our minds, or by discussing our day with a family member, friend or colleague. However, we often forget the full impact of our thoughts unless we write them down at the time, and review them at a later date. Therefore, it would be prudent for the dental nurse to keep a diary, or portfolio, on a daily or, at least, weekly basis. This helps to organise and clarify thoughts, so that the reason why problems occurred can be discovered, and action plans can be developed to prevent their recurrence.

A suggested layout of a diary could be:

- Describe the event
- Record your emotions and thoughts
- Evaluate the event – give both good and bad points
- Critically analyse the event – why did it happen?
- Reach a conclusion – what could have been done differently?
- Develop an action plan – what will be done differently next time?

After going through this process, determine whether a gap in your knowledge has been identified.

It should be noted, however, that private reflection can be distorted, because by definition it is our own perception of ourselves. Consequently, rather than reflecting alone, a colleague could be asked to assist, especially one who is more experienced and may have undergone the same process previously.

In this way, a natural progression would be to develop a staff appraisal system, where a senior colleague could act as a facilitator or mentor to a more junior dental nurse. One of the best ways of facilitating is by a more experienced colleague observing the dental nurse during a set task or even during a normal working day. This process may expose aspects that were not self-evident initially.

Reflection, then, enables us to think about how we learn, especially from experience, so that the process of learning is made more effective. It produces thinking professionals who can react effectively and appropriately in any given clinical situation, and as the dental nurse course is designed as a work-based assessment qualification, this must be the set goal.

All members of the dental team will simultaneously be undergoing this process of self-evaluation, and it is the duty of the practice to ensure that written policies and protocols in relation to dentistry are updated as necessary, for the benefit of the whole dental team. The dental nurse's responsibility is to ensure that these policies and protocols are read, understood and adhered to at all times.

Self-evaluation is a process of reflection, whereby once a task or procedure has been completed the dental nurse can look back on how successful the outcome was, and whether their role was adequate or whether it could be improved upon.

Sometimes, the dental nurse may discover that their personal beliefs or

culture are inadvertently seeping into their own practise. Reflection will identify this so that the matter can be explored and addressed appropriately. As discussed previously, good communication skills and respect for patients' rights are paramount to a successful dental practice, and there should be no tolerance of any member of the dental team who judges others purely on their own values and priorities.

To be a valuable member of the dental team, the dental nurse must ensure that the following principles of good practice are achieved:

- Promote equality, diversity and anti-discriminatory practice at all times
- Respect patients' rights at all times
- Promote, develop and maintain effective working relationships with other team members
- Never stray outside the legal limits of their qualifications
- Take an active part in continuing professional development
- Ensure that all changes to effective dental nursing are known and acted upon, so that the concept of best practice is always attained

Many dental practices operate a system of regular staff appraisal and this is to be encouraged as there are several advantages for all to be gained:

- Identifies strength and weaknesses of the staff member
- Also identifies strengths and weaknesses of the running of the practice, and gives valuable information for good practice development
- Discloses any barriers to efficient working
- Improves communication amongst the dental team
- Encourages problem solving
- Reduces any negative tensions between staff members
- Improves practice morale

The purpose of appraisal (or performance review) is to reflect on past performance and achievements, with the aim of developing future goals and a system for how those goals can be achieved. When carried out correctly, it should identify any training needs of the staff member, which, when addressed, should enhance the member's performance in future.

All staff members are likely to achieve more if constructive feedback is given on their performance, so that they not only have aims to work towards but have an opportunity to help to set those aims too.

Common areas of appraisal in dental practice could include the following:

- Personal – hygiene, attitude, punctuality, dress code
- Administrative – policies and protocols, regulations, filing, knowledge of paperwork
- Clinical – infection control, mixing techniques, nursing skills, patient management
- Teamwork – ability to function as team member, acceptance of authority, ability to take responsibility

- Communication – interpersonal, telephone manner, patient management
- Development – self-evaluation, self-study, attendance at courses, learning by experience

Once the relevant areas to be appraised have been selected, discussed and agreed upon, an appraisal sheet (Fig. 15.1) can be drawn up which gives the dental nurse the opportunity to self-evaluate, before being compared with the practice evaluation.

Differences can be explored and resolved, and then an action plan can be developed to determine future goals and aims. All details should be recorded

Areas of appraisal	**Self-appraisal**	**Practice appraisal**	**Notes**
Personal hygiene Dress Punctuality			
NHS procedures Rules/regulations Medico-legal knowledge			
Materials techniques Infection control Patient management X-ray procedures Equipment handling			
Courses of study Self-study Experiential learning Problem-based learning Peer group learning			
Teamwork experience Innovation Originality			
Communication skills Interpersonal skills Administrative accuracy Telephone manner Complaints handling			
APPRAISAL SUMMARY Signed ..... Signed ..... Date			

Fig. 15.1 Example appraisal sheet.

on the appraisal sheet and then copied so that both the nurse and the practice can refer back to it to assess the level of success of that appraisal.

The appraisal sheet should also serve as a record of the dental nurse's self-development and progression within the practice, and expose any areas which continue to cause problems in future appraisals.

The areas of appraisal can be adjusted to suit individual practices. The frequency of appraisal will also differ between practices as well as for different staff members. Younger, less experienced staff members are likely to require more frequent appraisal while learning all the relevant practice policies and protocols, and how to put them into practice. More experienced staff will need to be supportive and non-judgemental during this period.

Whenever possible, the dental nurse should attend courses to become aware of changes in dental technology, legislation reviews, clinical updates, and advances in materials science. Interesting courses are also run routinely on subjects such as patient management, violence in the workplace, improving communication skills, and others which help to promote a better working environment for all.

More formal study and further qualifications are available in several areas of dental practice for the dental nurse, including oral health education, dental sedation, orthodontics, special care dental nursing and dental radiography. Once qualified, the dental nurse can also progress to train as a hygienist or a dental therapist too. The dental nurse should join any relevant associations or societies to stay abreast of these career opportunities.

Career pathways are available for dental nurses to advance their experience and achievements as they wish, and it is likely that more options will be developed with time. Whatever pathway is taken, the dental nurse will remain a valuable, if not indispensable, member of the dental team, and well-qualified and experienced ones will continue to be lynchpins in the development of successful dental practices.

Activities

- Draw up two pages of a reflective log, and record your experiences for the first and the fifth times that you carried out a particular procedure. Compare the logs and discuss with your colleagues.
- If your practice does not have a staff appraisal system in place, try to develop one.

Glossary of Terms

Many words and phrases have been used throughout the text, whose meanings may not be clear to all, or which have pertinent meanings in the context in which they have been used. This glossary has been compiled to give readers a clearer understanding of such terms. The descriptions given are correct for the context in which they have been used in the text.

A

Abscess – a collection of pus and dead microorganisms which forms in tissues, following infection of the tissues with the microorganism

Aesthetics – relating to a pleasing appearance, as in the aesthetics of a crown or other prosthesis

AIDS – acquired immune deficiency syndrome, the disease process produced following infection with human immunodeficiency virus, or HIV

Alastik – a loop of elastic material used in fixed orthodontic appliances, to tie the archwire into the bracket

Allergen – a substance which produces an allergic reaction in the patient, such as pollen in hayfever sufferers, or penicillin in medicine

Analgesic – a drug which has the action of relieving pain

Antibody – a naturally occurring, or artificially introduced, substance in the blood which acts to destroy infectious microorganisms in the body. They are artificially introduced by the process of immunisation

Anti-inflammatory – a drug which acts to reduce the effects of inflammation in the tissues

Apex locator – an electronic device used in endodontics, which is used to determine the position of the root apex of a tooth, so that a diagnostic working length can be determined during root canal therapy

Apical foramen – the hole at the end of the tooth root through which the blood vessels and nerve tissue enter and leave

Aspiration (injection) – the technique used to 'draw back' during the administration of a local anaesthetic, to ensure that a blood vessel has not been penetrated. It is a safety technique carried out to prevent intravascular injection of local anaesthetic solution

Aspiration (suction) – the use of high and low speed suction equipment during dental procedures, to remove fluid and small solid debris from the oral cavity

Asymptomatic – without symptoms, so used in dentistry as a description of a tooth with which the patient is experiencing no pain or sensitivity problems

Autoclave – an electrical device used to sterilise dental instruments, by the

application of heat under pressure to produce steam, which kills all micro-organisms and spores
Autoimmune disease – one which acts to destroy body tissue, by the action of antibodies produced by the patient's body itself

B
Bacteraemia – the condition of having bacteria in the blood stream, as often occurs after dental treatment such as scaling, extractions and endodontic procedures
Bone resorption – the natural action of osteoclast cells to eat away and reduce the alveolar bone, especially after extractions, to produce shape changes and reduction to the alveolar ridge
Bronchoscope – a medical device used to enter and view the bronchi of the respiratory system, often to take tissue for biopsies or to remove inhaled foreign bodies
Buccal – the surface of a posterior tooth (premolar or molar) which is against the cheek, or buccinator muscle

C
Cancellous bone – that which forms the open, sponge-like interior of bone, such as in the alveolar bone of the jaws, and through which blood vessels and nerves run
Cariogenic – a food or drink substance which is capable of producing caries in a tooth, and therefore is either acidic or containing a non-milk extrinsic sugar
Cermet – a dental material used for restorations, which contains glass ionomer cement with metal particles incorporated into it, for added strength. They are especially used in the build-up of cores before a tooth is restored with a crown
Chromosome – a microscopic constituent of the nucleus of a cell, which contains the genetic material of the organism
Clinical audit – the systematic critical analysis of the quality of care in the clinical environment, such that techniques and procedures are constantly scrutinised, evaluated and improved upon where necessary, for the benefit of the patients
Contemporaneous notes – clinical notes which have been written on the date specified, and which are unalterable so that they represent a true account of events. All clinical records should therefore be contemporaneous, to avoid medico-legal challenges as to their accuracy and truthful content
Cross-bite – a description especially used in orthodontic diagnosis, whereby the upper posterior teeth occlude (bite together) inside the lower teeth, rather than outside them, as they do in normal class I occlusion
Cyst – an unnatural, fluid-filled sac within the tissues of the body. They sometimes develop on the apex of a tooth due to a chronic infection of that tooth

D

Debility – to be in a state of poor or weakened health

Demineralisation – the action of weak organic acids on the enamel of the tooth, to produce areas where the mineral content is reduced and therefore more prone to attack by caries

Dentate – the condition of having some natural teeth present in the mouth

Diagnostic radiograph – the radiograph taken during root canal therapy whereby the length of the root is accurately determined so that canal preparation can be carried out to this established working length. In this way, underinstrumentation or apical perforation are avoided

Diastema – a natural space present between erupted teeth. When occurring between the upper central incisors it is called a median diastema

Direct restoration – a restoration made at the chairside by the dentist, rather than one which is produced in a laboratory by a technician, using models of the patient's teeth

Disclosing tablet – a chewable tablet of vegetable dye, which stains plaque to make it easily visible to the naked eye. They are used as an important oral health motivator, especially with children and young people

Distal – the surface of a tooth which is furthest away from the midline of the dental arch, in other words, the 'back' of the tooth

Dysfunction – implying poor or unnatural function of a body part, as in the impaired function of the temporomandibular joint in patients who clench and grind their teeth

E

Edentulous – the condition of having no natural teeth

Eruption – the movement of the teeth through the alveolar bone and mucosa into the oral cavity

Exfoliation – the natural shedding of the deciduous teeth during childhood

F

Fluorapatite – a crystal structure of the enamel of teeth, whereby fluoride has been incorporated into normal enamel to produce this hardened structure, which is more resistant to attack by acid and therefore less likely to allow cavities to develop

Foramen/foramina – a natural anatomical opening, especially in bone, through which blood vessels and nerves can pass

Furcation – the natural point at which the roots of a multi-rooted tooth separate. It is therefore the point at which the tooth is usually held during extraction

G

General Dental Council – the governing body of the dental profession, with the power to ensure that professional standards are maintained, and to suspend or remove a dentist from the register of dental practitioners if they are found guilty of misconduct. It is in the process of introducing compulsory registration for Professionals Complementary to Dentistry

Gingival crevice – a 2 mm deep crevice around the necks of all healthy teeth, where plaque can accumulate when oral hygiene standards are poor
Grand mal – a serious type of epileptic fit, where the patient undergoes the convulsions of 'tonic–clonic' seizures

H
Haemostasis – the arrest of a flow of blood, especially after tooth extraction
Health and Safety Executive – a government body concerned with ensuring that all employers comply with the Health and Safety Act 1974 to maintain the health, safety and welfare of employees and members of the public. They must be notified when serious accidents and dangerous occurrences risk the safety of others, and they will carry out an investigation to determine the cause of the accident or occurrence
Hydroxyapatite – the usual crystal structure of enamel, and which can have fluoride incorporated to produce fluorapatite
Hypoxia – the condition of a lack of oxygen to the body tissues, and when occurring to the brain it usually results in a faint

I
Impaction – the condition of an unerupted, or partially erupted, tooth whereby its full eruption is prevented by being lodged against an adjacent tooth or a section of alveolar bone
Indirect restoration – a restoration produced by a technician in a laboratory, from models provided by the dentist of a patient's tooth (especially inlays)
Inoculation – the introduction of a microorganism into the body tissues to cause a mild form of the disease, with the aim of producing immunity to that disease
Inorganic – not having the structure of a living organism, as in the mineral crystals which make up the non-living structure of enamel
Interproximal – the area between the mesial surface of one tooth and the distal surface of the tooth directly in front of it, as in interproximal caries
Irreversible pulpitis – inflammation of the pulp of a tooth which has progressed too close to the pulp tissue to be reversed by simple restorative treatment alone

L
Lancing – of an abscess, whereby the point of the infection is surgically pierced to allow the enclosed pus to be released, so that the infection can be dissipated and healing can begin
Lateral canal – a minor canal in the root of a tooth, running off the main pulp chamber usually to the root surface, the presence of which often causes failure of root canal therapy due to its inaccessibility to endodontic treatment
Lingual – the surface of all lower teeth closest to the tongue
Lymph node – a mass of tissue lying along the lymphatic vessels of the body, which are concerned with defence against infection and which are often felt as swellings (in the neck) when infection is present. Their enlargement can also

indicate tumours associated with the lymph system, so they are checked for normality during routine dental examinations

M

Malaise – a general feeling of being unwell, or ill

Marginal leakage – an unwanted phenomenom which can occur down the sides of restorations, such that oral fluids penetrate microscopic gaps beneath restorations and either cause caries or dissolve any cements present so that the restoration is lost

Mastication – the correct term for the act of chewing

Maxillary antrum – the natural air-filled space within the maxillary bones, where various branches of the trigeminal nerves run

Meniscus – the pad of cartilage which lies between the head of the condyle of the mandible and the glenoid fossa of the skull in the temporomandibular joint. It acts as a protective cushion between the two bones

Mental symphysis – the joint between the two halves of the mandible, lying in the midline of the most anterior part of the lower jaw

Mesial – the surface of all teeth closest to the midline, in other words, the 'front' of the tooth

Mixed dentition – the stage in childhood where both deciduous teeth and permanent teeth are present in the mouth at the same time. It usually starts around 6 years of age and ends at around 12 years of age

Mucoperiosteum – the layer of tissue covering the alveolar bone, which consists of the alveolar mucosa, tightly attached to the underlying periosteum, which covers the bone surface

Mucous membrane – the covering epithelial surface of the soft tissues of the oral cavity

N

Necrosis – a section or area of dead tissue, as in necrosis of the pulp when a tooth has died

O

Occlusal – the surface of all posterior teeth (premolars and molars) which bite together in occlusion

Open drainage – the procedure whereby access has been gained to a necrotic pulp during endodontic treatment, and then the access hole has been left open to allow the necrotic contents (especially pus) to drain out of the tooth

Operculum – the flap of mucosa, which lies over partially erupted teeth, and which can become inflamed when third molars erupt. This is called perio-coronitis

Opposing arch – during fixed restorative procedures, this is the arch which is not to receive the fixed prosthesis. An impression of the opposing arch will be taken so that the technician can determine the correct occlusion of the patient, so that the fixed prosthesis does not alter it in any way

Organic – a substance derived from living cells

Orthograde root filling – a root filling placed conventionally, through the crown of the tooth

P

Palatal – the surface of upper teeth closest to the hard palate, or roof of the mouth

Paraesthesia – the tingling sensation experienced as local anaesthetics wear off, and sensation is returning to the affected area

Parallax – a radiographic technique whereby the same object is exposed to X-rays from different angles, so that the buccal or palatal position of unerupted teeth can be identified

Parkinson's disease – a progressive disorder of the brain, characterised by uncontrollable tremors

Peg lateral – an abnormally small upper later incisor tooth, said to be shaped like a 'peg'

Petit mal – a mild form of epilepsy where the sufferer often appears just to be daydreaming

pH – a measure of acidity, expressed as a value from 1 to 14, where 1 is strongly acidic, 7 is neutral (neither acidic nor alkaline), and 14 is strongly alkaline

Polyp – an overgrowth of mucous membrane tissue, which is attached by a stalk to the mass of tissue from which it originates

Post-dam – the most posterior border of a denture, which is raised into a ridge to aid the formation of the suction film of saliva necessary for good retention

Potentiation – the action of one drug increasing the effects of another drug, when both are given to a patient together. The increased action of anti-coagulation drugs caused by antibiotics, for instance, can have serious consequences for the patient

Proclined – in orthodontics, the angulation of the upper central incisor teeth in class II division 1 whereby they protrude forwards from the mouth. The overjet will be increased

Prophylactic paste – a paste of pumice slurry used by dentists and hygienists to remove surface stains from the teeth, following scaling

Prophylaxis – the giving of antibiotics to susceptible patients to prevent disease, as in patients with a history of heart valve disease who are susceptible to bacterial endocarditis following dental treatment

Q

Quality assurance – a system to ensure that a consistently high standard of treatment or practice management is achieved

R

Radicular pulp – that part of the pulp tissue which lies within the root of the tooth, as opposed to that which lies in the crown of the tooth, in the pulp chamber

Radiolucent – a substance which does not absorb x-rays when exposed to them, so that its image appears dark on the developed radiograph
Radiopaque – a substance which absorbs x-rays when exposed to them, so that its image appears light on the developed radiograph
Remineralisation – the action where fluoride is taken into areas of enamel which have been attacked and demineralised by acid, so that the crystal structure of the enamel is reformed and repaired
Resorbable suture – sutures (stitches) which are made from a material that gradually dissolves in the body tissues, so that they do not have to be removed at a later date
Retraction – the action of holding back soft tissues from a surgical site with special instruments called retractors, so that good vision and access are possible
Retroclined – in orthodontics, the angulation of the upper central incisor teeth in class II division 2 cases, where they slope backwards into the mouth and the overjet is reduced
Retrograde root filling – a root filling which is placed from the root end of the tooth, during an apicectomy, rather than more conventionally from the crown end
Reversible pulpitis – inflammation of the pulp which can be resolved by the removal of caries and the restoration of the tooth, without the need for endodontic treatment
Risk assessment – a method of measuring the risks of injury during a procedure, or when using chemicals, so that a safe method can be developed to minimise the risks of injury to all

S

Serial extraction – in orthodontics, the technique of extracting certain deciduous teeth in a set order, to allow the eruption of the permanent successor into an acceptable position in the dental arch, to relieve crowding. Sometimes, the permanent teeth are extracted too, to allow eruption of other permanent teeth
Shellac – in removable prosthetics, a resinous material used warm and moulded into special trays over a patient's initial models
Silane agent – in fixed prosthetics, a coupling agent which allows resins to chemically attach to ceramics and metals, so that better adhesion is gained during the cementation of the prosthesis
Sinus tract – a suppurating connection from an infected area to the oral cavity, especially from a chronic periapical abscess
Sjögren's syndrome – an autoimmune disorder where the patient experiences reduced salivary flow, reduced tear flow, and rheumatoid arthritis
Stagnation area – any area of the mouth or of a prosthesis which prevents self cleansing to occur, so that plaque accumulates
Stenson's duct – the salivary gland channel connecting the parotid gland to the oral cavity. It opens against the buccal surfaces of the upper first and second molar teeth

Subgingival – beneath the gingival margin of the teeth, as in subgingival calculus
Supernumary tooth – an additional tooth-like structure, often found on radiograph, lying between the roots of the upper central incisors. It can sometimes prevent their eruption
Supragingival – above the gingival margin of the teeth, as in supragingival calculus
Suture – a surgical stitch, used to close the edges of wounds following surgery or trauma, and can be made of various materials including silk

T
Tetracycline – an antibiotic which used to be given to alleviate the symptoms of acne, but which was found to be taken into the tooth structure of permanent teeth and produce unsightly staining
Transillumination – the technique of shining the blue curing lamp through anterior teeth, to detect interproximal cavities
Trismus – the inability to fully open the mouth, owing to swelling or inflammation of the surrounding muscles and soft tissues. This is often seen in patients suffering from pericoronitis
Tumour – an unnatural swelling of a body tissue which is not due to inflammation, and which serves no purpose to the body. They can be benign (harmless) or malignant (cancerous)

U
Undercut cavity – one produced by the dentist during restorative procedures, whereby the inner surface is wider than that at the opening of the cavity. It is deliberately produced to aid the retention of non-adhesive filling materials, such as amalgam

V
Vaccine – a preparation of dead or harmless microorganisms injected into the body to produce an immune response, and thus protect the patient from suffering from the disease at a later date
Vasoconstrictor – a substance added to local anaesthetic cartridges and which acts to close the localised blood vessels both to prolong the anaesthetic and also to reduce bleeding in the immediate area

W
Warton's duct – the channel connecting the submandibular salivary gland to the oral cavity. It opens beneath the tongue, at the front of the mouth

Z
Zoning – the technique of separating clinical areas in the dental surgery into 'dirty' and 'clean' zones, so that dirty instruments are not inadvertently placed where clean ones are, to prevent cross-infection and contamination

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