# Complete Dental Prosthetics

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# Complete Denture Prosthetics: A Guide for Students and Practitioners

## Foreward

Teeth are involved in the functions of mastication and speech and strongly influence appearance. When they are lost, it is a tribute to the skills of dentists and technicians that complete dentures act successfully in so many cases. Today, with lower levels of edentulousness, complete denture prosthetics appears a less significant part of dental practice. This is not the case. While fewer conventional complete dentures are being made, the increasing longevity of the population associated with our inability to 'cure' alveolar resorption, means that their complexity has increased. Further, the scope of complete denture prosthetics has expanded and the quality of life of many of our edentulous patients has been improved as implant techniques have been introduced and applied. I suspect that now, of all aspects of dental practice, complete denture prosthetics is most firmly based on an understanding of underlying physical, anatomical, and surgical principles, and puts greatest demands on clinical and communication skills.

The guide is divided into 7 chapters and an appendix, with the order being principally determined by the subject's development. An exception is the chapter on the transition between the dentate and edentulous state. It is placed relatively late, as it demands knowledge of procedures better discussed earlier. I have tried to make each of the

chapters capable of standing alone. For that reason there is a degree of duplication which might be unacceptable in a conventional book. I hope that no one is offended by the lack of citations in the text – references are easily extracted from databases and are all too often introduced to justify the author's own prejudices. I have included a list of references at the end for the more industrious reader. Navigation is simple. Click the link below. Each chapter is linked from the Contents page, and the sections of each chapter are bookmarked. From the first page of each chapter a link returns you to the Contents page.

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# Chapter 1

# Meeting your patient

There are six sections in this chapter. All are important to complete denture prosthetics. They provide the basis for understanding patient needs and the relevance of each will be recognised as your clinical skills mature.


**1. Patient assessment**

**2. Relevant oral anatomy**

**3. Alveolar resorption**

**4. Age changes in the skin**

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# Patient Assessment

## Overview

The aim of the assessment is to collect, record and evaluate information about the patient. To avoid errors the information is written down in standard format. First the patient's personal details are entered, followed by the complaint, the history of the complaint, the medical history, the dental history, and then the findings resulting from the clinical examination. Subsequently a provisional diagnosis is made and then, following any special tests (usually radiographs) required to resolve doubt, a definitive diagnosis is made and a treatment plan drawn up.

The assessment procedure for edentulous patients conforms broadly to that for dentate patients but with differences of emphasis in three major respects: 1. The likely complaints about dentures are limited to pain, looseness, functional disorders, nausea, fracture and poor appearance. 2. An extra area in the mouth must be inspected viz. the denture itself. 3. The average patient is elderly and more likely to have problems of health, mobility and communication.

## Clinical procedure

All aspects of the assessment are important but the following merit special consideration.

### Personal Details

Address and age are particularly important. A patient's address may well determine whether they can attend for the often numerous visits required and their age may indicate potential habituation and communication problems. Elderly patients who have worn their dentures for many years without replacement may be better served if the operator duplicates their present set of dentures rather than

provides a replacement set (see section on 'Denture Copying' in Chapter 6).

Elderly patients may have problems with their sight which prevent them driving; diseases e.g. arthritis, which limit their mobility; or conditions such as angina, which make climbing stairs a problem. The end result is difficulty in accessing dental treatment. Appointments have to be integrated with bus times or availability of carers, and it is often to the patient's advantage if visits to the Dental Hospital can take place on the same day as visits to other hospitals. It is then important that visits commence and finish promptly.

For most patients a visit to the Dental Hospital is to be accomplished as quickly and efficiently as possible. For some, who may have limited social contacts, the chance to talk again to 'their student' is anticipated with some eagerness. Strong attachments can be felt and terminating the visit can be a problem requiring understanding and tact by the operator.

**Present Complaint**

Note down the complaint(s), any associated factors, and the time relations (e.g. recent; of long-standing; continuous; intermittent etc.). When pain is the main complaint and the pain remains after removing the denture, the cause may be more serious and may require treatment on another department. A complaint of denture insecurity should be related to activities such as eating, speaking and smiling, to differentiate between problems of retention and stability (instability is essentially a functional problem). Less standard problems can often be resolved into more basic problems, e.g. 'difficulty in chewing' may be a consequence of pain, denture instability or both, and 'food under denture' the patient's way of expressing an underlying lack of denture retention.

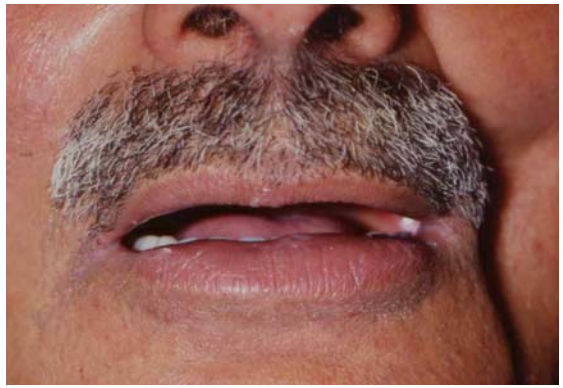
**Medical History**

Never forget to take a medical history. It is easy to forget that some medical conditions affect complete denture prosthetics, either by making it difficult to make, or difficult to wear dentures. They fall into 6 categories.

1. Those diseases that limit access to the mouth e.g. arthritis affecting

the TMJ, submucous fibrosis (Fig. 1), and scleroderma (Fig. 2). In the

**Figure 1**



Submucous fibrosis – effect, on left, of contraction of tight intraoral bands of tissue.

presence of such conditions it may be impossible even place stock trays in the patient's mouth and attempt primary impressions. The maximum that can be undertaken may be duplication of a pre-existing set.

**Figure 2**

Scleroderma – radiating circumoral lines of collagen contraction

2. Those affecting the mucosa, e.g. major aphthous ulceration, pemphigoid, erosive lichen planus. Any dentures exacerbate the condition and cause too much discomfort for them to be worn.

3. Those affecting the bone metabolism or growth e.g. fibrous dysplasia, acromegally. Progressive changes in the shape of the jaws will make any dentures quickly lose their fit.

4. Those affecting neuromuscular control (e.g. Parkinson's, epilepsy). Recording accurate jaw relations for patients with a tremor is difficult. Further, patients with epilepsy may need to be provided with dentures made of radio-opaque resin if there is any chance of them being swallowed (or inhaled).

5. Those affecting saliva production (e.g. Sjorgren's disease, radiotherapy). Without a layer of saliva acting as lubricant, dentures cause generalised soreness – especially if silicone soft liners have been prescribed for pain relief. A drug history is especially important in this context - the elderly take many drugs, or combinations of drugs, which can

cause hyposalivation as a side effect.

6. Those affecting the immunological response (e.g. allergy). While patients will rarely develop an allergic response to polymethyl methacrylate, contact sensitivity to monomer is common and will occur if high levels of residual monomer remain in a denture or reline. Sensitivity to Nickel is common and contraindicates provision of a cast metal base.

To ensure that nothing is missed, carry out your medical history in a thorough, methodical manner. Further, while it is unnecessary to carry out a full medical history at each visit, always remember to confirm that 'your medical history has not changed since last time' at each subsequent visit.

Occasionally you will find that health problems have arisen (e.g. coronary thrombosis) which while not affecting the form of treatment provided, will affect patient management. More rarely you might find that a patient's response to a material used on the previous visit has been unusual (e.g. allergy or sensitivity) and needs to be noted, in order to avoid using the problem material again.

## Dental History

Note the date the patient was made edentulous, the nature of any complications. A history of difficult extractions might make you suspect retained roots or other pathology. The number, history and success of previous dentures are important. Enquire about denture hygiene, giving advice on denture cleansing when necessary.

## Examination

There are three aspects to cover:

Extra-oral

Note any deformity. Before accessing the mouth there are conditions such as developmental anomaly (e.g. cleft, Fig. 3) or

**Figure 3**

Typical cleft of soft palate

trauma (either surgical or accidental) which should be noted

because they might demand treatment by a specialist. In the absence of any abnormality, measure the occlusal and rest face heights. Check for submandibular and cervical lymph node enlargements and TMJ abnormalities.

Measure the face height and confirm the jaw relations of any old dentures.

Intra-oral

Examine the entire mouth in an orderly sequence. In its early stages, cancer of the mouth may resemble an ulcer caused by denture trauma (Figure 4) so be vigilant. The 5-year survival rate for carcinoma of the mouth, excluding the lip is approximately 50% and any suspicious ulcers

**Figure 4**

Squamous cell carcinoma simulating ulcer due to denture trauma

must be diagnosed at an early stage.

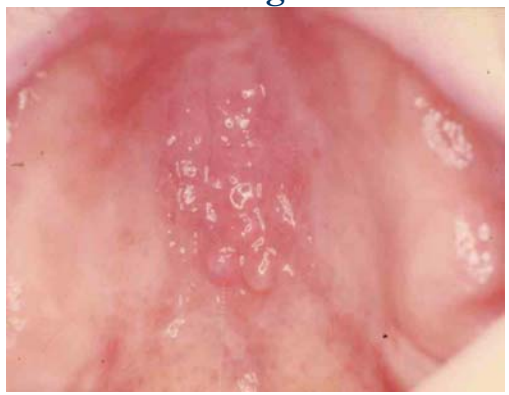
When examining the denture-bearing areas, note any signs of pathology and whether the ridges are well formed, fibrous or atrophic. When the mandibular ridge is atrophic the lower denture is often insecure, being unable to resist lateral forces. While many patients can tolerate the functional compromise resulting from atrophic alveolar ridges, others cannot. A proportion of patients in this latter category can be helped by implant treatment – which includes alveolar augmentation in some cases. For those who are unsuitable, replacement of their existing dentures, even by a specialist, gives little improvement and it is best to ensure that you lower the patient's expectations appropriately.

Some forms of soft tissue pathology, e.g. denture granulomata, papillary hyperplasia of the palate, and denture-associated candidosis are fairly common in association with old dentures and can look alarming. The first of these can often be treated by adjustment of the denture (see section on 'Long-term

Review' in Chapter 3), with surgical excision being necessary only for large cases.

Papillary hyperplasia of the palate (Fig. 5) cannot be reduced by

**Figure 5**



Papillary hyperplasia under ill-fitting denture

alteration of the old denture but, fortunately, its presence has little effect on denture construction.

Denture associated candidosis (Fig. 6) is a consequence of candidal

**Figure 6**

Denture-associated candidosis

infection following poor denture hygiene. Its diagnosis and treatment is more fully explained in the appropriate sections in Chapter 2.

A common developmental anomaly of the palate is palatal torus (Fig. 7). It looks alarming – especially a large one. It has little effect on denture construction but, because the soft tissue covering is thin in relation to the thick mucoperiosteum elsewhere, is

**Figure 7**

Large midline palatal torus

often a source of pain during chewing. Either relieve it after denture construction or instruct the technician to relieve the working model before processing the denture.

## Denture

Examine the occlusion. Relate the observed ridge size to that recorded by the fitting surface of the old denture – which allows you to assess the rate and degree of

resorption as well as giving insight into the degree of ill fit that the patient will tolerate. Assess oral hygiene, note any wear and discolouration of the teeth or base, and assess the occlusal plane and any incisor irregularities. Identify the cause of any denture fracture (usually either fatigue or impact) before making arrangements for repair (see this section in 'Long-term Review' in Chapter 3).

## Special Tests

Radiographs are sometimes needed to exclude residual pathology (which is present in 30% of cases), but should not be prescribed unnecessarily. A half-OPT is especially useful in view of the difficulties encountered in taking periapicals for edentulous subjects.

Swabs and/or samples of saliva may aid diagnosis of candidal infections (see sections 'Denture-associated Candidosis' and 'Angular Cheilitis' in Chapter 2).

## Treatment Plan

Diagnosis is usually straightforward but treatment plans can be complex. Include in the treatment plan any immediate temporary treatment (e.g. application of temporary soft linings, treatment of soft tissue pathology etc.), and provision of temporary appliances (e.g. transitional or immediate dentures, occlusal splints). Indicate clearly if there is need for special techniques (e.g. cast metal strengtheners, duplication, or special occlusal schemes) or special forms of denture base (e.g. Impact-resistant resin).

You will sometimes be expected to provide complete dentures as therapy for TMJ discomfort. Remember, that TMJ dysfunction is uncommon in elderly edentulous patients. However, joint pain is common and often results from arthritic changes. Arthritic TMJ pain is not often cured by making new dentures - no matter how convinced the referrer might be of his diagnosis. Do not expect to make successful new dentures unless the acute TMJ pain can be relieved by simple measures (e.g. splints or exercises), or if there is a fault in the old dentures which would demand renewal

# Relevant Oral Anatomy

## Overview

Teeth serve to incise and comminute food, to aid speech, and by their presence to ensure normal appearance. They are supported by alveolar bone and when lost there is progressive loss of the associated alveolar bone (Fig. 1a). If large amounts of alveolar bone are lost, the functional deficit is marked because the residual alveolar ridges are often unable to contact except in pronounced protrusion. To restore function and appearance a complete denture (Fig. 1b) replaces not only teeth but also the missing alveolar bone (Fig. 1c). Knowledge of the anatomy of the edentulous mouth is essential, not only to ensure that the denture restores all functions but to ensure security by adequate extension of the base of the denture in conjunction with minimum bulk.

**Figure 1a**

The edentulous mouth

**Figure 1b**

Complete dentures

**Figure 1c**

Dentures in mouth

## Structures marking the denture periphery

In the maxilla, note the presence of the foveae palatini (Fig. 2). These

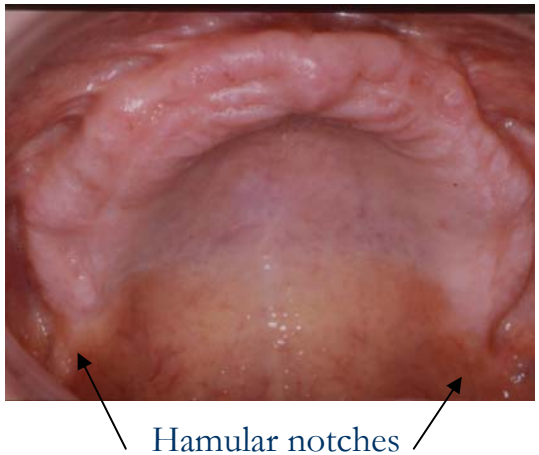
**Figure 2**

Fovea palatini

mark the ducts of two minor salivary glands situated near the midline just posterior to the distal margin of the hard palate. The importance of these structures is that they mark the distal extent of the maxillary denture. Further extension beyond this point is counterproductive as the denture will come into contact with the attachment of the tendon of the tensor palati. In function (swallowing) the denture will either displace or cause pain.

Lateral to the foveae palatini lie the two hamular notches (Fig. 3).

**Figure 3**



Hamular notches

These, too, mark the distal extension of the maxillary denture. Overextension in this region will cause pressure on the tensor palati as it winds around the hamular notch to expand into the soft palate.

An examination of most mouths will show some fraenal attachments. Apart from the maxillary midline where the labial fraenum is often well marked (Fig. 4), they often

**Figure 4**

Labial fraenum

occur in the premolar regions (Fig. 5). Their importance lies in the fact that the denture periphery must be

relieved around them otherwise pain and ulceration follow.

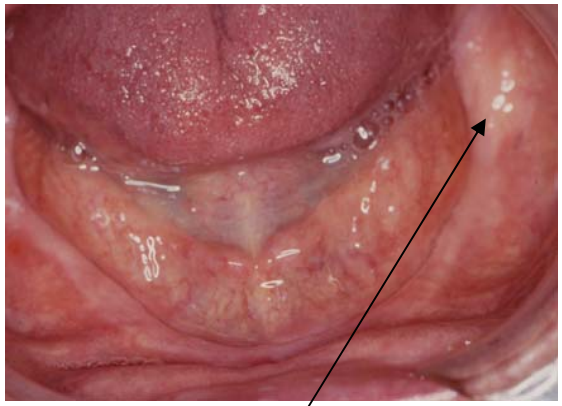
**Figure 5**

Buccal fraenum

In carrying this out the operator must be aware that the 'notching' of the base that results can cause structural weakness.

In the mandible note the retromolar pads (Fig. 6). These are pads of fibrous tissue marking the distal extension of the mandibular denture and once lay distal to the third

**Figure 6**

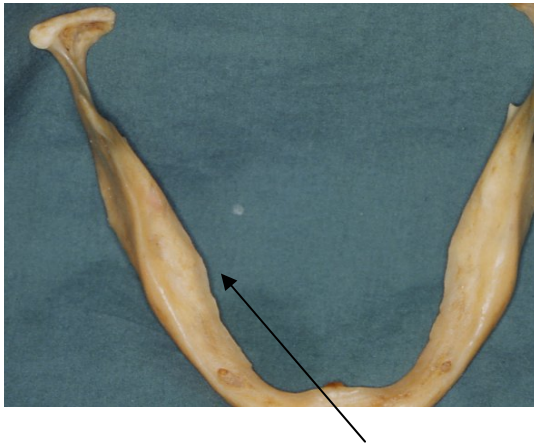


Retromolar pad

molars. Distally, the mucosa is supported by the buccinator muscle laterally and the superior constrictor medially. Denture overextensions cause painful trauma.

More anteriorly, the lateral and medial extents of the denture-bearing surface are determined by the external oblique ridge and the mylohyoid ridges respectively (Fig. 7). Neither may be visible in the mouth (Fig. 8), but both can be

**Figure 7**



External oblique and mylohyoid ridges

**Figure 8**

Intra-oral view

palpated easily through the overlying soft tissues.

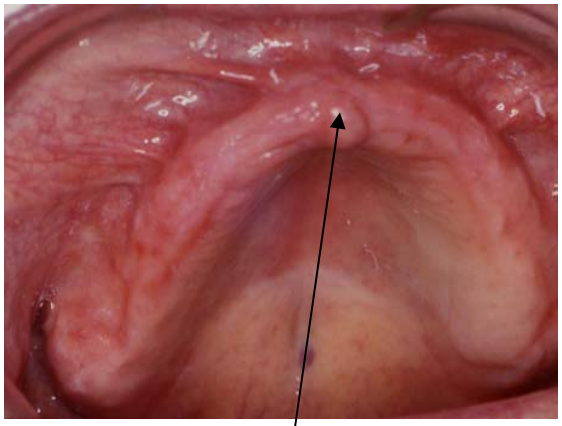
The buccinator muscle gains attachment to the mandible via the external oblique ridge and the adjacent bone. Overextensions of a lower denture are common in this region, either because the impression material is viscous enough to excessively displace the soft tissues, or because the buccinator attachment is more medially than expected. Any such overextension will interfere with the buccinator in function and result in either displacement of the denture or pain from the traumatised mucosa.

On the medial side of the mandible, extensions over the attachment of the mylohyoid can be made, but with care. It is essential that any extension integrates with the direction of insertion of the mylohyoid muscle and is inclined downwards and medially at an angle of approximately 45° to the sagittal plane occupying the cleft between mylohyoid and hyoglossus muscles.

## Structures aiding siting of the artificial teeth.

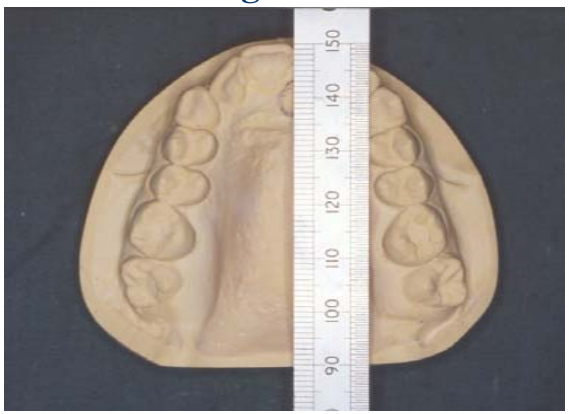
In the maxilla, two structures can often be identified which can aid the siting of the artificial teeth, in that they have an identifiable mean relationship to the natural teeth. The first of these is the incisive papilla (Fig. 9). In the dentate individual the centre of this structure lies 8-10mm distal to the labial surfaces of the central incisors (Fig. 10). The relationship is maintained once the teeth are extracted – although if substantial alveolar resorption has occurred the distance tends to be a little greater

**Figure 9**



Incisive papilla

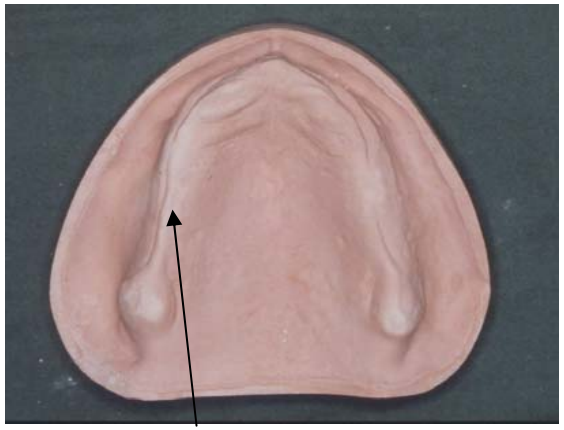
**Figure 10**




Incisive papilla/tooth relationship

due to 'undermining' and backward displacement of the papilla. Careful examination of the alveolar process in the premolar and molar region might show the lingual gingival remnant (Fig. 11). This band marks

**Figure 11**



Lingual gingival remnant

the junction between the remains of the lingual gingivae of the posterior teeth and the scar tissue resulting from extraction. When present it can be a valuable guide to the siting of the lingual margin of the artificial teeth. However, when resorption has been great, it will tend to be undermined buccally by loss of bone and the original relationship modified.

Needless to say, all these relationships are mean relationships and can by applied only to the 'average' patient. Many patients will conflict with them.

## Other structures of significance

Three other structures may complicate complete denture provision, as a result of mandibular alveolar resorption.

Anteriorly, when resorption has been particularly severe, the mentalis muscle insertions can become prominent (Fig. 12) as two elevations on either side of the

**Figure 12**

Mental foveae

midline. The denture must be relieved over, and contoured around them. Extensions beyond their crest will interfere with the mentalis muscle movement and lead to denture insecurity.

On the lingual side of the mandible, also in the midline, the insertion of the genio-glossus into the superior genial tubercle can appear surprisingly large – especially if

there has been considerable alveolar resorption (Fig. 13). Further, the

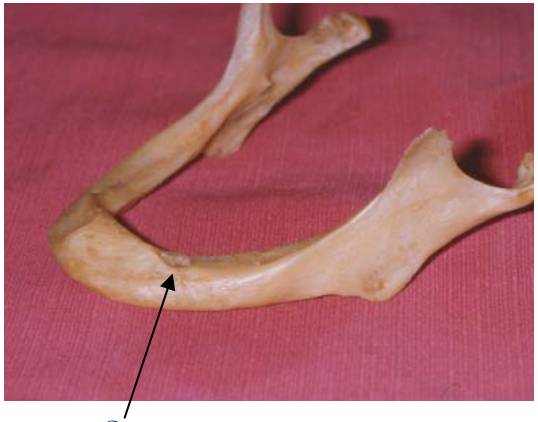
**Figure 13**

Large superior genial tubercle

absence of an adequate alveolus means that antero/posterior movement of the denture is unrestrained and trauma commonly results.

Further distally, the mental nerve can become relatively displaced to become part of the denture-bearing surface and can be palpated at the margin of the denture in the premolar region (Fig. 14).

**Figure 14**



Superficial mental foramen

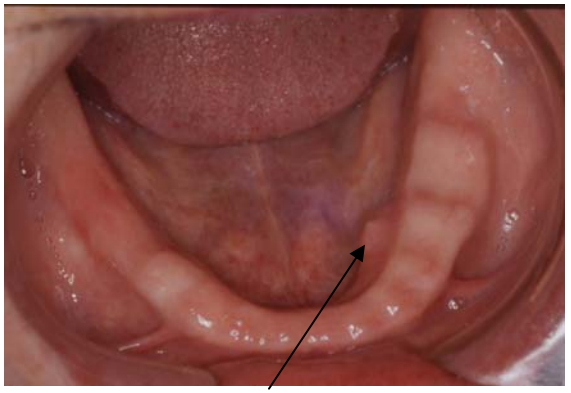
Overextension in this region can result in pain or, more characteristically, numbness.

Finally, bony tori can occur in two characteristic regions; in the midline of the palate (Fig. 15), and lingually in the premolar region of the mandible (Fig. 16).

**Figure 15**

Midline palatal torus

**Figure 16**



Lingual torus

Tori are developmental in origin and comprise dense cortical bone.

Unless the denture is relieved over them, pain will occur when the overlying soft tissues are compressed in function.  When they are large, surgical removal can be indicated.

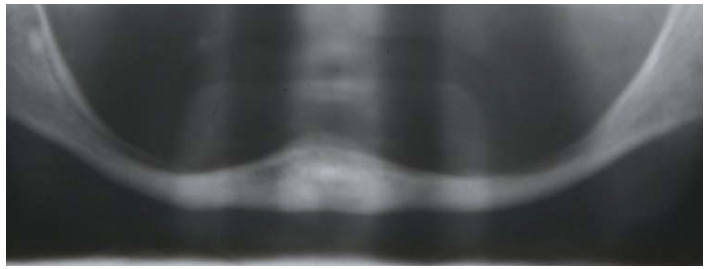
# Tooth Loss and Alveolar Resorption

## Overview

After loss of the teeth the remaining alveolar bone forms the alveolar ridge which gives support to a denture and is part of the denture-bearing area. It is likely, particularly in the case of the lower denture, that a substantial alveolar ridge contributes significantly to denture security.

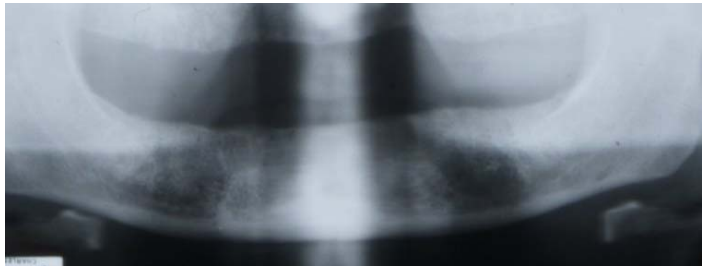
Following tooth loss, alveolar bone resorbs, the rate being rapid at first but decreasing with time (so determining the rate of denture replacement - frequent at first, later at longer intervals). During extractions, good surgical technique (avoiding fragmentation or even loss of the associated bone) is particularly helpful. Investigators have shown that the rate of loss of alveolar bone obeys a power law, becoming less with time but never ceasing until all alveolar bone has been lost. There are individual variations, however, with some experiencing very little loss, and others rapid alveolar atrophy (Fig. 1a and b). In general bone loss is greater in the mandible than the maxilla by a factor of four.

**Figure 1a**



Gross loss after 12 years

**Figure 1b**



Minimal loss after 15 years

## Factors affecting rate of loss

A meta-analysis has, unfortunately, related bone loss to complete denture wearing, although no clinical trial has yet been able to show a relationship between rate or amount of bone loss and the age at which the patient is made edentulous. There is, however, a tendency for women to be more severely affected than men - a tendency blamed on the higher incidence of osteoporosis in post-menopausal women.

It has been postulated that abnormal masticatory function can worsen bone loss and this has been blamed for the fibrous replacement of maxillary alveolar bone that occurs opposite retained mandibular incisors (sometimes called 'Combination syndrome') and for increased loss of anterior mandibular bone when artificial upper incisors are sited lingually. Studies have claimed a relationship between mandibular shape and resorption, one study postulating an inverse relationship between bone loss and the size of the gonial angle! Local loss is often observed to occur where alveolar bone is opposed by natural teeth.

A relationship between predisposition to periodontal disease and excessive alveolar resorption is not fully clear, but when the prognosis for retaining the teeth is poor and periodontal disease is causing rapid bone loss, many prosthetists advise earlier rather than later extraction.

## General pattern of loss

Around individual teeth, resorption is greater where the cortical plate is thinner. In the maxilla, tooth loss leads to greater loss of the buccal plate with gradual reduction in the width and length of the ridge (Fig. 2a and b).

**Figure 2a**

Buc.  Ling.

Residual ridge (dotted) in posterior maxilla

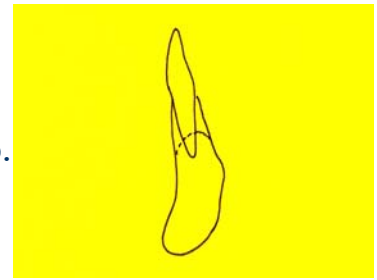
**Figure 2b**

Pal.  Lab.

Residual ridge (dotted) in anterior maxilla.

In the mandible the situation is more complex. Anteriorly the buccal plate is slightly thinner and the residual ridge apparently moves slightly lingually (Fig. 3a).

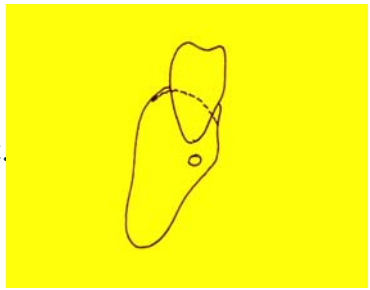
**Figure 3a**

Lab.  Ling.

Residual ridge (dotted) in anterior mandible

In the premolar region the buccal and lingual plates are of equal thickness and the residual ridge maintains its position. In the molar region the buccal plate is reinforced by the external oblique ridge, preferential resorption of the thinner lingual plate occurs and there is apparent movement of the residual ridge buccally (Fig. 3b).

**Figure 3b**

Buc.  Ling.

Residual ridge (dotted) in posterior mandible

## Clinical consequences

Following extraction all dentists hope that sufficient alveolar bone will remain to permit the construction of secure, functional complete dentures. Many clinical problems arising when when making dentures depend on the degree to which resorption occurs. Four outcomes may be identified.

### Too little resorption.

Some degree of alveolar resorption can be beneficial in that it allows sufficient interalveolar space to permit dentures to be provided with adequate bulk for strength. In the absence of adequate interalveolar space (Fig. 4) the

**Figure 4**

Insufficient alveolar resorption

inevitable consequences are either excessive face height due to

insufficient space for two denture bases plus a freeway space (Fig. 5),

**Figure 5**

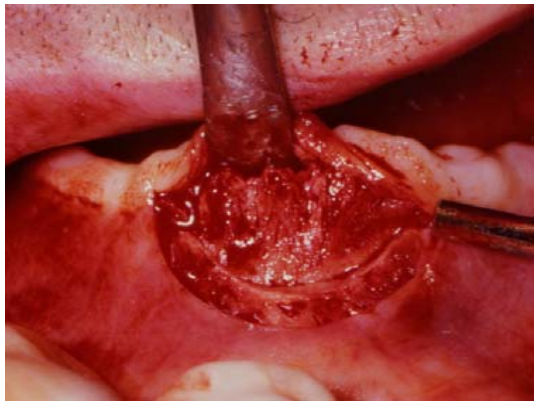
Excess face height, strain of lips to achieve seal

pain from the lower denture-bearing soft tissues, or frequent denture fracture.

**Irregular resorption.**

When resorption is irregular, the mucosa can be 'sandwiched' between the sharp-edged bony margin and the fitting surface of the denture. Typically this is of most significance in the anterior region. Surgical reduction of the 'knife-edge' ridge may be needed (Fig. 6).

**Figure 6**



Knife-edge anterior ridge exposed during surgery

**Excessive resorption.**

When dentures are not replaced at fairly regular intervals (every 5 years is suggested), continuing loss of bone from the superficial aspect of the alveolus beneath the dentures leads to mandibular overclosure. Because the mandibular axis of rotation is posterior and superior to the occlusal plane the overclosure is associated with mandibular protrusion (Fig. 7).

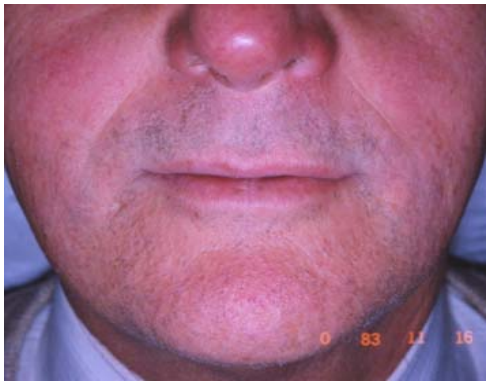
**Figure 7**

Protrusive overclosure

This is, occasionally, the patient's main complaint. Rarely, a patient will also become aware of a change in width of the face, brought about

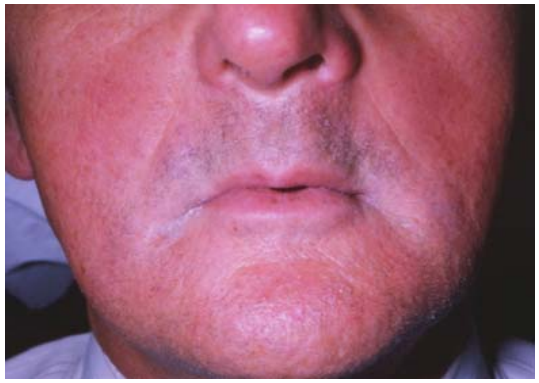
by the loss of buccal bone from the maxilla (Fig. 8a and b).

**Figure 8a**



Patient wearing dentures

**Figure 8b**



Same patient without dentures

Following excessive resorption, a consequence of the jaws' varying patterns of resorption is that the normal class I relationship of the posterior teeth (in which the maxillary teeth lie buccal or labial to the mandibular teeth) is changed. With the increase in width of the mandible posteriorly, a 'posterior crossbite' can be produced with the maxillary molars sited lingual to the mandibular molars (Fig. 9) and the maxillary buccal cusps occluding with the central fossae of the mandibular molars. Anteriorly, where buccal resorption of the maxilla predominates, an edge-to-edge incisor relationship is sometimes the only way to compensate for the destabilizing effect of the change in bony relationships (Fig. 10).

**Figure 9**

Posterior cross-bite

**Figure 10**

Edge-to-edge incisor relationship

The former condition causes few problems, although it can be an annoying cause of cheek biting. The change in appearance brought about by the latter, however, can cause patients to object to the arrangement, and they may need to be counselled by the dentist about the need for compromise between appearance and denture security.

In the mandible atrophy of the alveolus causes the mental foramen to become superficial and form part of the denture-bearing area. Also, the mylohyoid ridge on the lingual aspect of the mandible becomes sharp and prominent. Both may cause pain during denture wear (Fig. 11)

**'Normal' resorption**

The ill-effects of 'normal' resorption are felt in the period

**Figure 11**

Superficial mental foramen and sharp mylohyoid ridge

of rapid resorption following extraction of the teeth. After a few months, the discrepancy between the dentures and the denture-supporting tissues becomes apparent (Fig. 12). Howere, most commonly patients complain of denture insecurity rather than poor appearance. This problem is corrected by prompt reline or denture replacement.

**Figure 12**

Alveolar resorption beneath 'gum-fitted' dentures giving rise to insecurity

## Biometric markers

The changes in alveolar anatomy that take place following tooth loss make it difficult to identify accurately the original site of the natural teeth, and unless the artificial teeth are placed in the same site as the natural teeth, functional stability can result. Fortunately, three so-called "biometric markers" remain (the

incisive papilla, the lingual gingival margin, and the retromolar pad) and give guidance when estimating the site for the artificial teeth (for more full consideration, see the earlier section on 'Relevant Oral Anatomy).

## Prevention

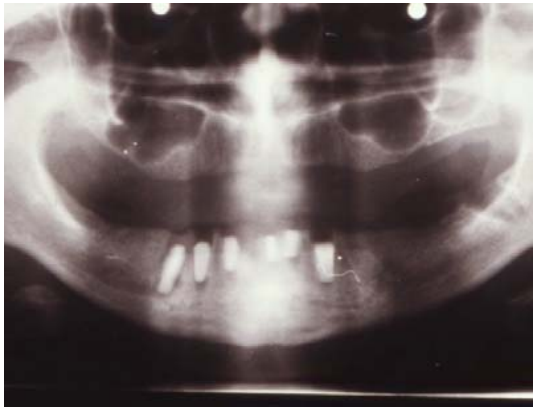
There are few ways in which alveolar resorption can be prevented, apart from ensuring that tooth roots are preserved. In attempts to do this and preserve denture security, 'overdenture' techniques have become popular. In such cases, provided caries is controlled, the preserved roots of strategic teeth retain their associated alveolar bone and provide useful extra support and security (Fig. 16).

**Figure 16**

Alveolar bone retained by preservation of anterior tooth roots

When the caries rate is rapid (or expected to be rapid) then root retention is contraindicated. Experimental studies in the past have shown that for such cases, hydroxyapatite tooth root substitutes can be placed after extractions and some useful alveolar bone retained (Fig. 17).

**Figure 17**

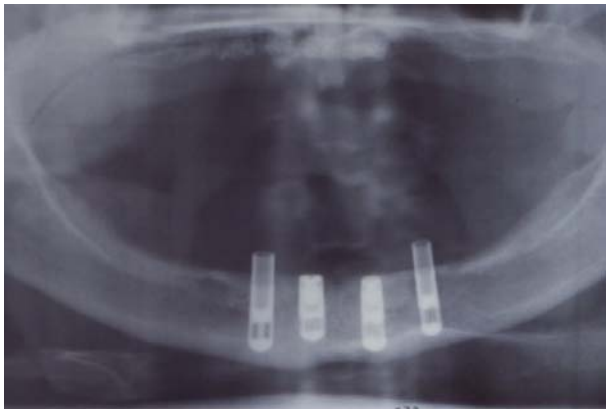


Hydroxyapatite root replacements

A much more secure support for dentures, however, is provided by osseointegrated implants. These, too, are said to preserve the alveolar bone into which they have been placed. Certainly, clinical trials to date show that the loss of bone adjacent to osseointegrated dental implants takes place at a very much reduced rate. It is postulated that this is because they allow masticatory forces to be

resisted in a more physiologically normal way (Fig. 18).

**Figure 18**



Titanium osseointegrated fixtures placed in the anterior mandible.

# Age Changes in the Facial Skin

## Overview

The changes to the skin of the face that take place with time are in part age-related and in part caused by exposure to the physical environment. With increasing age the natural creases of the face deepen - especially the nasolabial and labiomental grooves (Fig. 1). Loss of elastin fibres causes smaller intervening creases to develop. These are more pronounced in individuals who have undergone prolonged exposure to sunlight, and result in radial lines forming around the mouth and eyes. When the normal facial changes occur in association with loss of the teeth, they are further exaggerated and the lip profile, which is normally concave, develops a convex shape as the mouth sinks in.

**Figure 1**

Naso-labial and labio-mental grooves

## Clinical implications

After the age of 60, facial skin thickness decreases markedly and the skin loses both strength and elasticity. There is loss of subcutaneous fat and even when the teeth have not been lost, the drooping upper lip covers more of the upper teeth. Darkening of the skin by deposition of melanin is also common, and this can cause

the appearance to jar if a light tooth shade is chosen.

Many patients attend the dentist with hopes that the changes associated with age can be eliminated by an appropriate prosthesis. When patients have such unrealisable hopes they must be educated to understand that a denture can only be reverse changes resulting from tooth loss, and then only within physiological limits.

Thus, it is possible to reduce the depth of the radial creases, which develop in the upper lip with age (and edentulousness), but only by accurately siting the artificial teeth in the position once occupied by the natural teeth. Thickening of the upper labial flange is, to a considerable extent, counterproductive in that is merely gives an unnatural convex outline to the lip and a strained look. Some thickening of the upper labial flange can be carried out, but only in the canine region, where it can help reduce the depth of the naso-labial groove and be a helpful complementary measure to other measures designed to help clear up angular cheilitis. Reduction of the labio-mental groove is more difficult and any thickening of the labial surface of the lower denture can lead to denture instability.

Elderly patients should be counselled not to request too low a lip line in the pursuit of showing 'more of my teeth'. As mentioned above, with loss of skin elasticity, the elderly show less of their natural teeth and unless this is allowed for when the lip line is agreed at the registration stage an unnatural appearance will result (Fig. 2).

**Figure 2**

Excessive exposure of teeth in elderly patient

To summarise, with an understanding of the skin changes that occur with age, clinicians will not select teeth with inappropriate shades; not produce degrees of tissue support, which ensure destabilisation of the denture; and

not orientate incisal planes in unlikely positions.

# Patient Satisfaction with Complete Dentures

## Overview

Not all patients will be satisfied with their complete dentures. Following treatment, approximately 15% of patients are dissatisfied to a greater or lesser extent, the proportion increasing to 23% by a year after denture provision. It is generally assumed that, as with partial dentures, patients will be satisfied with complete dentures that are well retained, function painlessly and have the desired appearance. Hence, emphasis is usually placed on those clinical stages of complete denture prosthetics which are concerned with accurately recording the denture-bearing area, establishing the correct jaw relations, and recording and reproducing the patient's ideas of pleasing appearance. Satisfaction is a much more complex entity than would appear, however, and is significantly influenced by several less tangible factors.

## Operator-associated factors

### Clinical skills

Obviously, much dissatisfaction is caused by substandard clinical or technical work. Under-extension of the denture bases and errors in the vertical jaw relationships are particularly common.

Nevertheless, despite the best attempts of skilled clinicians and technicians, some patients are not only dissatisfied but remain a permanent source of repeated complaint. As a consequence dentists may be led to seek knowledge of techniques or materials, which they are advised, will resolve their problems. Such techniques or materials may give genuine benefits, but only if the operator ensures that his basic clinical standards are of a high standard.

Assuming an adequate standard of care, few additional clinical or technical procedures have, to date, been proved to have a significant

influence on patient satisfaction. Incorporation of balanced articulation into the set up prior to processing, or variations in the choice of occlusal morphology for artificial teeth, do not provide significant advantages in unselected cases. Indeed, the only clinical or technical procedure proven by clinical study to improve patient satisfaction is the check record or chairside remount, and this is probably effective by eliminating any occlusal errors which have been incorporated during the registration and processing stages.

As a corollary, assessment of denture quality by operator-established clinical standards must be carefully qualified. Even the most astute clinician can be wrong when attempting to grade the quality of dentures by his personal standards of function, security and appearance. Most studies have shown no relationship between the clinical assessment of quality of complete dentures and the degree to which the patient is satisfied with them.

There have recently been some indications that differences in the patient response to various forms of treatment can be measured, but not by conventional means. Promising work has been carried out which measures satisfaction either in terms of improved function (e.g. by recording the patient's own assessment of denture security) or in terms of impact on quality of life (Oral Health Impact Profile). Validation of the effectiveness of different dental techniques will probably await the results of further studies involving these methods.

**Communication skills**

Provided that a dentist carries out sound techniques in a painstaking way, there are few ways in which he can improve the proportion of satisfied patients. Much more scope lies in enhancing the patient's perception of the clinician's skills - perceptions that are enhanced if the clinician possesses high-level communication skills. As might be anticipated, patients whose expectations for the performance of their dentures are unduly high are likely to be disappointed, as are those who decide to have dentures made during a time of emotional crisis e.g. retirement or bereavement. In both these cases, better results are achieved by the good communicator who will recognise the problems during discussion and either provide

counselling for the former group of patients in order to reduce their expectations, or defer treatment for the latter group.

In a similar way, for some patients the ideals of good security, pain-free function and good appearance might be incompatible with one another. For example, to achieve the appearance that a patient desires might involve positioning the teeth outside the neutral zone, so compromising security. Alternatively, the base extension which provides optimum security may involve interference with muscle function and cause pain. We can only try to recognise any likely incompatibility between our ability and the patient's expectations before we start treatment and take steps to inform the patient of the necessary compromises before completion.

Again communication skills are at a premium in explaining this dilemma.

Finally, the fault may lie in the attitude we take to our patients. It has been shown that best results and fewest failures are achieved by non-authoritarian, communicative operators who encourage patient involvement in the clinical stages. The good offices of a well-trained, sympathetic dental nurse are then especially useful.

## Service related factors

### Convenience

A third factor to be taken into account when providing treatment is the degree of inconvenience to the patient. When treatment is being provided in a hospital there are obvious limits to our ability to provide a fully flexible service. But in general practice, satisfaction is promoted by the availability of treatment out of working hours and at sites which are accessible by public transport or have adequate parking. It is also likely that as complete denture patients form an older and older cohort of our patient base, domiciliary visits will become increasingly important for service delivery.

### Costs

In a hospital, treatment costs are not a cause for concern to patients, but in less favoured environments they loom large in determining satisfaction; not so much the magnitude of the cost in itself, but the patient's interpretation of the cost in relation to value. For this reason, costs and communication skills are complementary, with an

advantage going to the clinician who can clearly communicate the size of the fee in advance. Once this has been explained, the adverse effect of high costs tends to diminish with some evidence that patients see costs as an indicator of quality.

**Patient-related factors**

Despite all our efforts, a proportion of patients will be dissatisfied. Anecdotal studies describe well-recognised types. Some present with a long written list of the problems associated with their current, unexceptionable dentures. Others with engineering or draughtsmanship skills may provide detailed diagrams of the precise tooth relationships and shapes that they think will overcome their problems. Alternatively, patients either openly or after questioning produce a bag containing many 'unsatisfactory' dentures. Researchers have devoted much time in attempting to stereotype difficult types of patient so that clinicians might identify them and be prepared for the pitfalls. Unfortunately, attempts at classifications of this type have been only partly successful.

Properly designed clinical studies have shown that those patient factors which we might assume to be of obvious importance are of little significance. Thus despite the commonly held assumption that elderly patients are more difficult to treat, chronological age in the absence of physical ailment, has no relationship to the degree of satisfaction to be expected. Neither have the mental state of the patient, the gender of the patient (despite some claims that women are more difficult to treat), or even (with the exception of one or two studies) the size of the residual ridge.

It has also been shown that some of the factors which do appear to be of significance are ones against which the practitioner can take few precautions - apart from referring the patient for specialist opinion. Thus patients taking numerous drugs are likely to be dissatisfied, probably as a consequence of drug-induced hyposalivation. In support of this hypothesis, patients complaining of dry mouth tend to have many more review visits than control patients

When seeking to identify patients who are likely to give problems, the most helpful clue is contained in the past denture history. Thus a

history of satisfactory dentures provided at 4-5 year intervals is encouraging. On the other hand a history of numerous unsatisfactory dentures provided during the period since the teeth were extracted is ominous – it is likely that at least one will have been correctly made. Once more the solid advantages of good communication skills become obvious. When a good rapport between patient and clinician can be established early on, future problems can be identified and advice on likely outcomes provided prior to treatment.

# Denture Security

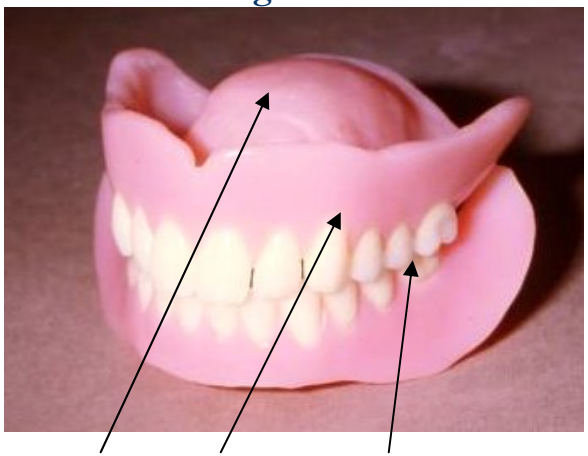
## Overview

Denture security is conventionally divided into two aspects, 'retention' and 'stability'. To aid understanding each will be discussed separately. First, however, it is appropriate to mention the three surfaces of a denture in relation to the integration of denture shape and function. Retention and stability of complete dentures will then be dealt with in turn.

## The three surfaces of a denture

A complete denture replaces lost teeth and alveolar bone. Anatomically, therefore, it is divided into two parts viz., the teeth and the base. From the point of view of function, however, a complete denture has three surfaces (Fig. 1), occlusal, polished and fitting – the buccal and lingual surfaces of the teeth being part of the polished surface.

**Figure 1**



Fitting, polished and occlusal surfaces

Each of these surfaces has a different function and each surface must be shaped accordingly.

The occlusal surface is that part which carries out the function of mastication and is designed to operate in contact with the opposing occlusal surface. For foods that are relatively easily crushed, the degree of comminution of food particles will be proportional to the area of the contacting occlusal surfaces. This surface also has a role to play in stabilising the dentures,

and is shaped to promote occlusal balance. Where balance has not been achieved, occlusal interferences can occur. These may be in the intercuspal position or in lateral excursions, and are a common source of lower denture insecurity. To ensure occlusal balance, it is common to carry out a check record (see 'Denture Placement' section for clinical details) which will remove the discrepancies which occur as a result of errors during the recording of the jaw relations and the processing of the denture.

The polished surface primarily subserves the function of appearance. It consists of the buccal, labial and lingual surfaces of the teeth and the buccal and lingual surfaces of the base. It is designed to achieve good appearance, but must also have a shape which facilitates smooth functioning of the muscles in contact with it. To ensure good appearance and minimal friction with the surrounding tissues it is highly polished. Generally, the polished surfaces are designed to present an overall concave surface to the surrounding musculature in order to enhance stability (see section on 'Stability' below), but may deviate from this ideal if the demand for the teeth to remain in the neutral zone warrants it.

The fitting surface is that part in contact with the supporting denture bearing area and is recorded during the stages of primary and working impressions. The denture is designed to conform to the anatomy of the alveolar ridges sufficiently well to permit the force of 'retention' to operate (see section on 'Retention' below).

## Stability

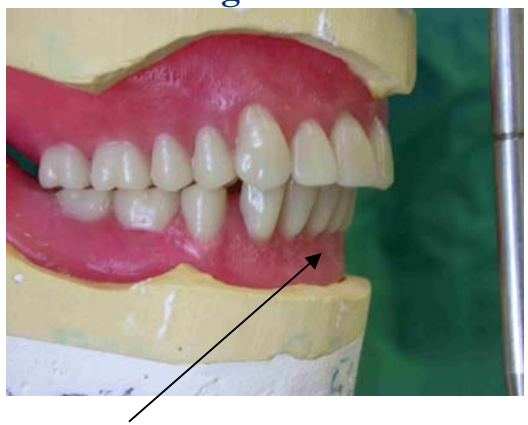
The stability of a denture may be defined as its ability to resist those forces attempting to displace it in directions other than at right angles to the supporting tissues. The most significant of these is the size and form of the residual alveolar ridge. In general a well-formed, firm ridge provides good stability against the displacing forces of occlusion and muscle action. To maximise stability, however, it is of great importance to design the denture so that the influence of the displacing forces is minimised. This involves modifications to the periphery, the occlusal surface and the polished surface.

The working impression of the denture-bearing surface is taken in such a way as to avoid the denture periphery encroaching onto muscle insertions. The most significant of these are the insertions of the buccinator, mylohyoid, and genioglossus, and the muscles of the lip (especially the mentalis). Functional trimming is often carried out when impressions are taken, during which the muscles surrounding the impression are stretched either physiologically or via traction by the clinician. Trimming in this way will ensure the periphery of the final denture does not cover muscle insertions and displacing forces from this source are minimised.

Functional interference between the occlusal surfaces of complete dentures is a potent source of instability. To avoid this it is at least necessary to incorporate occlusal balance into the set-up of the teeth so that interferences in the retruded position are eliminated. Balanced articulation (see definitions in 'Jaw Relations' section in Chapter 3) is probably the ideal to aim for, when interferences in lateral excursions are also removed. However, there is a limit to the accuracy achievable, this limit being imposed by the degree of denture displacement which results from elastic compression under load of the soft tissues of the denture-bearing surfaces.

If the polished surfaces of a denture are generally concave, the action of the surrounding musculature is to stabilise the dentures. This is of special importance in the mandibular labial region (Fig. 2), and if this surface is convex, the lower

**Figure 2**



Concave labial surface of lower denture

denture will tend to be displaced backwards and upwards by the powerful labial muscles.

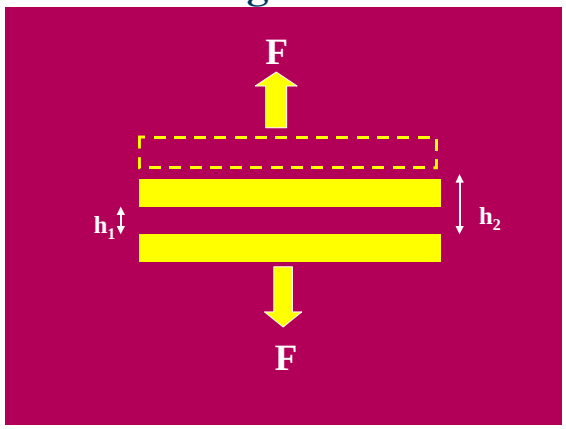
It is sometimes difficult to achieve a concave surface in the maxillary labial region without affecting the appearance adversely. Fortunately, the retention of an upper denture is usually sufficient to resist displacing forces from this source.

In some cases where mandibular alveolar resorption has been excessive, placing the lower molars in the natural place causes the lingual polished surface to be undercut. Tongue movements then destabilise the lower denture. To overcome this problem the undercut can be removed along with the lingual cusps of the lower molars.

## Retention

The base of a well-fitting complete denture remains in close contact with the denture-bearing tissues, and is separated from it by a saliva film which fills the capillary gap between the two surfaces. Applying the analogy of two flat discs separated by a Newtonian fluid which completely fills the intervening gap (Fig. 3), the force

**Figure 3**




retaining the denture in position is time-dependent and can be expressed as;

$$F=3/4.\eta A^2/t(1/h_1^2-1/h_2^2)$$

Where $\eta$ = the viscosity of the saliva, A = the area of the disc (denture), t = time, and $h_1$ and $h_2$ the distances apart of initial and final disc separation.

If $h_2$ is much larger than $h_1$, this can be simplified to:

$$F=3/4.\eta A^2/t.1/h_1^2$$

Clinicians call this force 'retention' and it serves to retain a denture under the influence of displacing forces until sufficient displacement has occurred for the saliva film to shear. At rest, retention of a denture is augmented by the nature of saliva which at low shear rates is non-Newtonian in character, being thixotropic, and forming a weak gel as a consequence of the proteins dissolved in it.

Retention of a denture is said to be supplemented by capillarity. Then, if a meniscus is formed at the periphery of the discs (dentures) the pressure within the film is less than that outside the film. The difference is given by the Laplace formula:

$$p_1 - p_2 = \sigma(1/r_1+1/r_2)$$

Where $p_1$ and $p_2$ = the pressures on the concave and convex sides respectively, $r_1$ = one principal radius of curvature, $r_2$ = the other principal radius of curvature, and $\sigma$ = the surface tension of the liquid.

This can simplified to:

$$p = 2T/h$$

Where p = the reduction in pressure, T = the surface tension of saliva, and h = the distance between the denture and its supporting tissues.

Although of interest, the effect of surface tension is of less certain significance. Except when speaking the mouth does not contain enough air for a continuous meniscus to form around the denture and at essential times, such as when drinking and eating, it will tend to be disrupted

The effect of retention is to maintain a denture in position under the influence of forces tending to displace it at right angles to the denture-bearing area. It is enhanced by the size of the denture in a plane at right angles to the supporting tissues; the closeness of fit of the denture; and the viscosity of the saliva. It is most useful in the case of the upper denture which has a relatively large area, but less useful in maintaining the lower denture which not only has a smaller surface area but, due to the mobility of the surrounding musculature, also offers less opportunity for surface tension to have any effect. Retention is also most effective when a good seal with the soft tissues exists at the denture periphery. Patients who complain of a lack of saliva (hyposalivation) also complain of poor retention of their complete dentures – although this may be of less consequence to them that the discomfort which results from the lack of lubrication.