

# Risk management in clinical practice. Part 6b. Identifying and avoiding medico-legal risks in removable dentures

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## VERIFIABLE CPD PAPER

### IN BRIEF

- Dentures are not just a gap-filling exercise and denture dissatisfaction is not just a technical issue. Making the right assessment for the patient is crucial in denture provision.
- To achieve success in denture construction, appropriate care must be taken in the diagnostic stages.
- Planning for the loss of other teeth in the future at the design stage will save potential grievance later.

The most likely cause of complaint with prosthodontics is a denture that in some way fails to be accepted. A denture that does not perform as the patient expects can give rise to great disappointment and anger. The problem is that acceptance of a denture is not just a technical issue. Success depends on the individual's ability to tolerate and adapt to the denture. It is therefore essential to make the right assessment for the patient from the outset. This includes discovering the patient's priorities and establishing realistic expectations. With the aim of assisting the dental profession in identifying and avoiding medico-legal risks in removable dentures, this article sets out a systematic, diagnostic and collaborative approach to complete and partial denture assessment and treatment.

More than any area of dentistry, success in removable dentures depends on patient acceptance and satisfaction. According to the Adult Dental Health Survey 1998, one in four people in Britain have a removable denture. Studies show that dentists hold negative views about dentures as

prosthodontic solutions, preferring none or fixed options instead.<sup>1,2</sup>

Many people are seriously affected by the difficulties in obtaining satisfactory dentures to replace their missing teeth; financial constraints often preclude fixed alternatives and some, therefore, have to settle for none. Lack of educational experience is blamed for the difficulties and dislike that dentists have for removable dentures.<sup>3,4</sup> The designs of dentures are often left to the dental laboratory, which has to make the most of limited information provided by impressions and records of dubious quality.<sup>5</sup>

This unhappy balance between supply and demand makes removable dentures a potential dento-legal minefield. In addition, the expanding knowledge and treatment choices of the 21st century add to possible debates. For example, can the dentist be blamed for the supervised pressure necrosis under a poorly constructed complete denture that requires an invasive and expensive iliac crest graft in order to place implants? Or can omission of hygienic principles in the design of a partial denture<sup>6</sup> for a patient with a dry mouth be blamed for an increase in caries, periodontal disease and tooth loss?

How does the dental profession best identify and avoid medico-legal risks in removable dentures? With an emphasis on prevention, planning and predictability

this article recommends a modern collaborative approach that recognises the three important factors in achieving success in this discipline: working with the patient to find the best solution; using a diagnostic approach to test the likelihood of success before taking the treatment on; and maintaining effective communication between all parties (patient, clinician and technician) throughout the treatment. Breakdown in any of these areas increases the risk of patient complaint leading to possible legal redress.

### THE CHALLENGE

The aim of removable prosthodontics is to recreate that which has been lost. The magnitude and complexity of the task depends on the extent of loss and the changes in what remains. It also depends on how well the individual is coping with these. Success depends on the individual's ability to tolerate and adapt to the measures required to redress the loss and changes, and on realistic expectations about what can be achieved.

Denture success starts with a thorough understanding of the patient's needs and concerns. A denture is not just a gap-filling exercise and denture dissatisfaction is not just a technical issue.<sup>7</sup> A removable denture is an attempt to restore oral autonomy to an individual and it is essential to discover the individual's priorities at the

### RISK MANAGEMENT IN CLINICAL PRACTICE

1. Introduction
2. Getting to 'yes' – the matter of consent
3. Crowns and bridges
4. Endodontics
5. Ethical considerations for dental enhancement procedures
- 6a. Identifying and avoiding medico-legal risks in complete denture prosthetics
- 6b. Identifying and avoiding medico-legal risks in removable dentures**
7. Dento-legal aspects of orthodontic practice
8. Temporomandibular disorders
9. Dental implants
10. Periodontology
11. Oral surgery

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outset. Aesthetics, comfort and quality of life are important,<sup>8</sup> but functional demands are highly variable and influenced by psychosocial factors.<sup>2</sup> The treatment must manage patients' expectations and include adequate education for them to choose the prosthodontic solution that will suit them best.

**THE RISK**

The most likely cause of complaint is a denture that in some way fails to be accepted. A denture that does not perform as the patient expects can give rise to great disappointment and anger. It is essential to agree realistic expectations before treatment is commenced in earnest.

**INFORMED CONSENT**

Consent in dentistry is described by Dental Protection<sup>9</sup> as a communication process by which patients can give their voluntary and continuing permission for specific treatment based upon a reasonable knowledge of the purpose, nature, likely effects, consequences, risks, alternatives and costs of that treatment. This is a very apt description of the most effective approach to removable prosthodontics. Removable dentures require teamwork and the result benefits from effective communication. The better the collaboration, the more all parties share the responsibility for the result.

**MIMUM STANDARD OF CARE**

A thought provoking and often quoted statement has circulated since 2002: the McGill Consensus Conference<sup>10</sup> concluded that 'the minimum standard of care for the edentulous lower jaw was a complete denture retained by two dental implants'. This kind of statement has huge implications – not least financial – and gives rise to significant concerns: supported by this statement, could a patient be forced into having two implants? Could the retention offered by these two dental implants disguise ongoing ill-effects elsewhere in the jaw from a still poorly constructed complete denture?

As modern medicine moves away from simply telling patients what is best for them the term 'minimum standard of care' becomes less appropriate. Interestingly, a detailed survey of the evidence-based literature published in 2006<sup>11</sup> failed to find

support for the McGill statement and suggested instead that 'choice' might be a more appropriate expression for standard of care.

**GENERAL ASSESSMENT OF ORAL HEALTH**

The general factors in question have been covered by the previous articles in this series. The specific factors to record as a baseline in removable prosthodontics are: presence/absence of clicks in the temporomandibular joints (TMJs); presence/absence of other signs of occlusal disharmony (Table 1); pathology of the denture bearing areas; the state of existing dentures – maybe with photographs; quality and quantity of saliva and medicines that may contribute to a dry mouth; past denture history – success/difficulties; and degree of mobility of remaining teeth and periodontal status of any proposed abutment teeth. Should any of these factors prove significant at a later stage, an entry in the records could pre-empt a dispute.

**COMPLETE DENTURES**

With the aid of the palate and an effective post-dam it should be possible to achieve retention (suction) for an upper denture. In contrast, even correctly extended lower dentures will at best be stable (resist unilateral pressure). Acceptance therefore depends significantly on patient skill, tolerance and adaptability. Most clinicians have experienced patient rejection of a well-fitting denture in a favourable mouth and equally, patient acceptance of a technically unsatisfactory denture in an unfavourable mouth. It is this paradox that makes removable dentures one of the most difficult disciplines in dentistry.

To simply assess the extent of change and loss in the edentulous jaws there is a useful classification for the edentulous mouth (Cawood & Howell's classification from 1991<sup>12</sup>). It describes the extent of residual ridge resorption that has taken place and therefore the degree of anatomical reconstruction required to restore the original. An adaptation of the classification can be seen in Figure 1. At one extreme of the classification the ridges are so well preserved that there is no room for the body of dentures; at the other the dentures are replacing teeth and a significant part of the jaw.

Clenching/grinding
Head/neck/shoulder ache
Clicking/popping/painful temporomandibular joints
Tooth wear/fractures/sensitivity
Localised tooth mobility

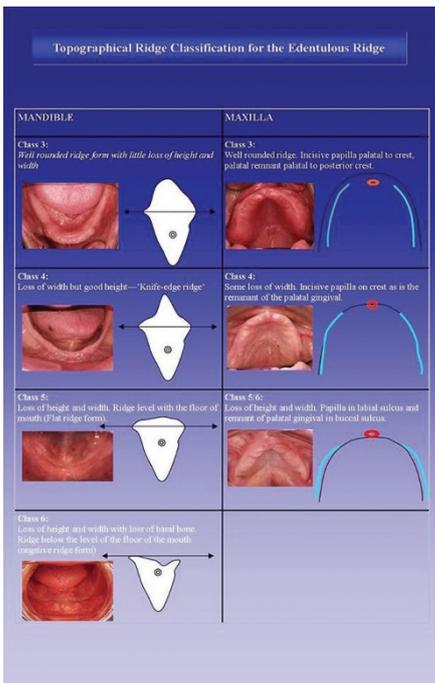


Fig. 1 Adaptation of Cawood and Howell's classification<sup>12</sup>

Something other than a ridge resorption classification is required to assess acceptance and tolerance.

**Diagnostic assessment**

This applies both to patients new to dentures and to patients with denture wearing experience. The diagnostic process aims to establish the likelihood of a successful result; the process is also part of arriving at a diagnosis and possible treatment solutions. It can be part of the initial consultation or be a separate appointment. It is important, however, that the patient understands that treatment has not yet started. This leaves the door open for both the patient and the clinician to decline the treatment or to arrange referral. If both patient and clinician are willing to proceed before the diagnostic process, the prescription for the new denture is in place and the foundation for successful treatment has been laid.

### Patients with existing dentures

Where possible the most expedient route is to use the patient's existing dentures as a baseline for testing improvements and acceptance of changes (the testing is therefore limited to reversible changes only). The diagnostic stages are as follows:

1. The process starts with a list of the patient's wishes and concerns (Table 2). If the main concern is invisible upper teeth and lack of lip support, the first diagnostic step is to add wax (pink plate wax or red ribbon wax) (Fig. 2) to the upper front teeth on the denture. An ALMA Gauge® can be used (Fig. 3) as a quick guide to the original position of the upper central front teeth in relation to the incisal papilla: approximately 9 mm in front and 12 mm below. With the explanation that the wax represents the new position of the teeth, the patient can assess the change/improvement in the mirror
2. Unless the denture base is correctly extended the denture will now be less stable to pressure in the region of the incisors. The next diagnostic step is therefore to test the patient's acceptance of correct extension of the denture base; the posterior border should extend to the vibration line and around the tuberosities into the disto-buccal sulcus to create an effective seal and post-dam. This can also be done using pink plate wax (Fig. 4). It is helpful to explain that the clinician is 'negotiating' with the periphery. If the new denture is to have this increased extension the patient needs to be told that this negotiation will continue into the first period after fitting: a border-seal is based on functional moulding and is likely to require fine tuning once it is in full time use
3. The third diagnostic stage is to add wax to the occlusal table to set up a correct occlusal plane: parallel to the inter-pupillary and ala-tragal lines (Fig. 5)
4. If the patient accepts the changes and the clinician feels confident about making a new denture based on these diagnostic changes, the denture with wax represents a prescription for the new denture. The final step is to make a copy mould of the denture and wax



Fig. 2 Addition of pink wax to increase lip support

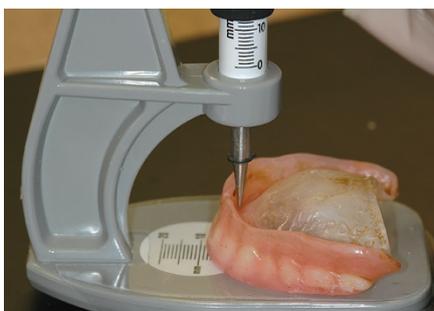


Fig. 3 ALMA gauge to determine tooth positions relative to the incisal papilla



Fig. 4 Addition of diagnostic post-dam in pink wax

changes (Fig. 6). The laboratory will produce a pour copy from this mould that can act as special tray and record rim in one (Fig. 7). The pour copy is not a final prescription and it should be subjected to the same intra-oral verification as a special tray and a record rim.

Any existing denture can be used for this diagnostic test, but it is sensible to use the one that the patient has found closest to what is hoped for. The old denture serves as the base for the dentist to assess the potential for improvement and demonstrate this to the patient. If the patient's main concern is a loose and painful lower denture, the test would start with addition of wax to the periphery: looking for support from areas of non-dental bone on the retro-molar pads and the buccal shelves (Fig. 8). If the existing denture



Fig. 5 Fox's biteplane parallel to the ala-tragal line



Fig. 6 Open copy mould of denture with diagnostic changes

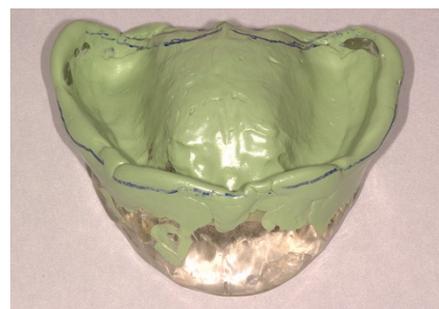


Fig. 7 Pour copy with master reline impression



Fig. 8 Diagnostic wax has been added to the left side of an existing denture, extending it onto the retro-molar pad

Table 2 Common complaints with complete dentures
Sunken profile
Upper lip not showing
Teeth not showing
Denture loose
Denture rocks
Ulcers/soreness
Prominent chin
Over-closed
Pain in temporomandibular joints (usually related to an incorrect occluding vertical dimension)



Fig. 9 Diagnostic addition of wax to occlusal table to increase occluding vertical dimension

already has a correct and optimum peripheral extension, the effect of a soft lining could be tested by adding a temporary silicone lining (for example Fit Checker®). If neither suggests that improvement is possible, the assistance of dental implants, soft lining or use of denture fixative may need to be considered and discussed with the patient.

A list of other common concerns appears in Table 2. The diagnostic test is the same but the starting point varies according to the main concern. Over-closure starts with addition to the occlusal tables (including correction of the occlusal plane) (Fig. 9). If these additions make the dentures less stable, the next step is to counterbalance the increase in height by increasing the support from the denture bearing area by improving the border extension.

An alternative to the silicone reline is to place a temporary lining in the denture (Viscogel®, Coe-soft® or equivalent) and let the patient try the difference over a few days. If the patient reports back satisfied, the lining represents an optimum functional impression and can be used for a permanent reline impression for a hard or soft base. With a hard reline it is wise to warn the patient that the 'adhesive effect' of the temporary lining will disappear; it

Table 3 Optimum criteria for complete dentures
Base extensions to include retro-molar pads, hard palate and coverage of tuberosities to optimise support
Post-dam/border seal – continued around tuberosities
Anterior tooth position/lip support according to original incisal relationship and compatible with speech sounds
Incisal line of upper anteriors parallel to interpupillary line
Occlusal plane parallel to ala-tragal line
Occluding vertical dimension with a free way space of 2-3 mm
Posterior tooth position determined by stability
Balanced occlusion with freedom from centric



Fig. 10 Training base to test tolerance of correct palatal retention; based on a loose, underextended existing denture, teeth poured in A3 acrylic

can be recreated with denture fixative and the new closer fit will optimise the effect of the fixative.

Not infrequently, a patient's reasons for seeking treatment are from significant others, for example 'My daughter is getting married (in two weeks!)', 'My wife complains my face has sunk in', or 'My grandchild asks why she cannot see my teeth'. This diagnostic approach may offer the answer to whether the patient is motivated or merely responding to external pressure!

If the patient simply requests a new set of the same dentures, the pour copy technique is the safest route. Undercuts in the base should be removed before the reline impressions are taken. There can be few more inaccurate objects in dentistry than a wax rim on a wax base used for a full mouth occlusal record. Pour copies carry the considerable advantage that the occlusal record is taken on a rigid base.

#### Patients without existing dentures

When starting from scratch, the treatment should aim for criteria set out in Table 3.

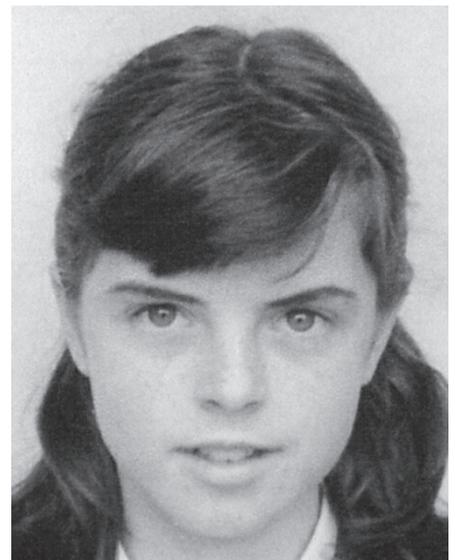


Fig. 11 Close-up photo of a young girl showing the upper central incisors. The patient is now in her fifties and she is hoping for a more realistic appearance in a new complete upper denture

If, however, the clinician has misgivings about the patient's acceptance of, for example, correct border extensions, these can be tested via training bases.

Patients often express concern about having the palate covered. As part of examining the mouth, run a finger gently along the hard palate side of the vibration line: if there is no reaction to this, there should be no problem with placing the post-dam correctly. Previous difficulties can often be explained by movement of the posterior border in an unstable and unretentive denture, alerting the dorsum of the tongue continuously to the presence of the denture and evoking a gag response. It is the clinician's responsibility to map out the post-dam area and depth.

A more definite way of testing the gag reflex is to produce a training base (ideally heat cured) to test the tolerance away from the surgery. For social reasons the training base could have front teeth. The training base in Figure 10 was made as a pour copy of the existing denture. The border had been extended with wax; the teeth were poured in A3 acrylic.

#### Appearance

Photographs of the patient with natural teeth can be a tremendous help. Equally, photographs from all angles and with both open and closed mouth can provide invaluable information about the patient's skeletal and incisal relationship. If the

$$\frac{\text{Inter-pupillary distance in life}}{\text{Inter-pupillary distance in photo}} = \frac{\text{Width in central incisors in life}}{\text{Width in central incisors in photo}}$$

Fig. 12 How to use photographs to calculate the width of the original central incisors



Fig. 13 Originally in pursuit of implants, this patient decided to stay with the new properly extended lower denture (top) and resort to adhesive at critical times



Fig. 14 Pour copy used as stent

photograph (age ten onwards, Fig. 11) is face on with the two upper central incisors visible, it can be used to calculate the width of these incisors in real life (Fig. 12). Details of the original tooth positions can be copied or avoided as preferred.

### Implant assisted complete dentures

For complete dentures that require assistance of dental implants, it is advisable to make dentures that fulfil optimum criteria first. This allows the patient to try out the benefit of the optimum dentures before committing to the dental implants. A significant number of patients do decide to accept the dentures as they are (Fig. 13); some settle for the less expensive, less invasive denture adhesives as added security instead. If the patient does proceed to implants, pour copies of the optimum dentures become the guides for the implant placement (Fig. 14).

When implants are to be used separately, the attachments can be fitted into the base of the complete denture when the implants have integrated. If a more complicated superstructure (telescopic crowns, prefabricated or custom milled bars) is planned, the first optimum denture is critical to correct implant placement. A new version of the denture is required, however, to allow incorporation of strengtheners and housing for bar sleeves and attachments in the denture body (Fig. 15). To avoid discrepancies the second denture could be constructed alongside the first and left

unfinished in readiness for the insertion of the implant components.

### PARTIAL DENTURES

The specific challenge of a partial denture is to reconcile teeth that move in microns with gums that give in millimetres and to achieve a balance between the two. The aim is to restore integrity to the arch and function to the dentition by replacing the necessary missing teeth without the denture's removable status detracting from confidence, acceptance and performance.

As for complete dentures, the most obvious risks are rejection, trauma and fracture. However, the partial denture also has to coexist with teeth and their supporting structures. There are studies that demonstrate that partial dentures *per se* do not increase the risk of caries and periodontal disease. There are also studies that show that, unless the partial dentures follow hygienic design principles, they do. A further factor is that a partial denture that is not correctly integrated with the teeth is quite likely to aggravate occlusal disharmony.

Tooth supported bridges, implant supported crowns/bridges and partial dentures are prosthodontic solutions to replacing teeth. Their planning and provision must therefore be subject to the same careful prosthodontic assessment. To improve assessment, diagnosis and prescription for partial dentures the author published an *aide memoire* (Table 4 and Fig. 16) for



Fig. 15 Second lower complete denture with bar sleeves and internal cast reinforcement

Aide-mémoire for Provision of Modern Hygienic RPDs in Practice  
RPD design

Core Elements	Bounded saddles	Unilateral free-end saddles NB: Extend onto retrorolar pad	Bilateral free-end saddles NB: Extend to vibration line	Rotational path insertion principle
Support				
Major connector				Galvo surfaces
Retention				
Reciprocals				Correct reciprocation
Anti-rotation	UR7 & UL3	Free-end saddle, LL2 & LR4	Free-end saddle, palato & UR3 & UL2	
Hygienic design		3mm space	Composite rest	Ring rest

Fig. 16 Aide memoire for partial denture design

assessment of removable partial denture (RPD) complexity in the *Oral Health Report* in 2007.<sup>13</sup> The *aide memoire* was designed along the lines of other risk assessment classifications to consider both prosthodontic factors and the partial denture itself. These factors are discussed below, including how to avoid potential risks.

### Patient's needs and wishes

If the patient's preference for fixed prosthodontics proves not to be possible, it is important that the patient is adequately educated about what to expect. The positive advantages for partial dentures may help, for example ease of adding future teeth, partial dentures are less invasive to tooth substance than bridges, they do not preclude future use of implants, and have better aesthetics where a carefully shaped and tinted flange allows teeth to 'emerge' realistically compared with the long unsightly necks of bridge pontics (Fig. 17).

Table 4 Aide memoire for partial denture assessment			
	Straightforward	Advanced	Complex
<b>Prosthodontic assessment</b>			
Patient's needs and wishes	Realistic	Specific aesthetic and functional expectations	Preference for fixed (Precision attachments?)
Restorative needs	None or minor	Indirect/cast restorations in same arch as RPD (NB: ALWAYS subject to RPD design!)	RPD part of full mouth rehabilitation
Periodontal status	Good Minimum bone loss	Moderate bone loss Provision for loss of teeth	Advanced bone loss Residual mobility Provision for modification from bounded to free-end saddles
Occlusion	Conform	RPD to make up missing criteria: anterior guidance and/or posterior support	In need of reorganisation including change of vertical dimension and/or provisional phase
TMD	None	Myofascial symptoms	Internal derangement of TMJs
<b>RPD assessment</b>			
Teeth to be replaced	Posteriors Bounded saddles	Anteriors Unilateral free-end saddle	Most anteriors Bilateral free-end saddles
Aesthetic needs	Low lip line	Medium lip line Replacing anterior teeth	High lip line and no visible clasps: guide surfaces or precision attachments Visible anterior flange: tinting
Residual ridge reduction	Minor (Cawood & Howell Class III-IV)	Moderate (Cawood & Howell Class V)	Severe (Cawood & Howell Class VI)
Unwanted tooth movements	None or minor	Twisted and/or tilted	Over-erupted: convert to ODA?
Strategic abutments	Present (Kennedy Class III)	Convert to overdenture abutment (ODA)? One or two missing (Kennedy Class I & II)	Implants as ODAs? (Kennedy Class I, II & IV)
Previous RPD experience	None or good	None or difficulties	Unfavourable
Cost band	Standard fee	Subject to RPD design and laboratory estimate	Subject to full treatment plan, RPD design and laboratory estimate

### Restorative needs

It is imperative that indirect/cast restorations for the same arch are planned in conjunction with the partial denture. They should not be constructed until the final denture design is agreed with both patient and laboratory. Rest seats, undercuts and milled features can be incorporated in the restorations (Fig. 18): they improve the fit and make the denture seem less bulky. They also ensure that forces are transferred correctly down the long axis of abutment teeth. If the partial denture(s) is/are part of full mouth rehabilitation,<sup>14</sup> the overall criteria for this rehabilitation must be in place first. This can be in a diagnostic wax-up/set-up on study casts mounted on a semi-adjustable articulator (in the appropriate jaw relationship). It can also be as provisional restorations in the mouth.

### Periodontal status

It is essential to have a full periodontal record as a baseline. It has a direct bearing on suitability of teeth as abutments, need for provision for additions and use of the partial denture as a semi-permanent splint (Fig. 19). It will also pre-empt a conflict if the patient subsequently claims that deterioration has taken place as a result of the denture.

### Occlusion: changes and disharmony<sup>15,16</sup>

Many partial dentures are used as 'gap-fillers' in arches/dentitions that no longer bear any resemblance to how they started out. Over-closed dentitions with tilted, rotated and over-erupted teeth make for a most unsatisfactory situation. It is to be hoped that most would think twice

about attempting to place implant restorations or fit fixed bridges in such dentitions, but somehow dentures seem exempt from those considerations. They are not. The dentition in Figure 20 is in need of proper assessment and full mouth rehabilitation. This is irrespective of whether the prosthodontic solution is to be fixed or removable. The patient should be fully aware that to proceed without is to ignore the real treatment need. Chances of success are slim, continued decline is certain and risk of fracture is high. The patient should be advised accordingly.

Ideally the occluding vertical dimension should be restored and the new occlusion set up to the criteria of an optimum occlusion (Table 5).<sup>17,18</sup> Remaining teeth in contact might need adjustment (equilibration) to allow closure in centric relation at the



Fig. 17 Tinted flange allows natural emergence of denture teeth



Fig. 18 Crown with milled rest seats and surface for reciprocal arm



Fig. 19 Dental bar used as semi-permanent periodontal splint for the upper anterior teeth



Fig. 20 Dentition in need of full mouth rehabilitation including correction of the occluding vertical occlusion

Table 5 Criteria for an optimum occlusion	
<b>Centric</b>	
CR = MI in manipulated position	
CR = MI without manipulation	
Forces down long axis of posterior teeth	
Alert feeding position – long centric	
<b>Eccentric</b>	
Best teeth available to disclude posterior teeth in lateral excursions	
Anteriors disclude posteriors in protrusive	
(CR = centric relation; MI = maximum intercuspation)	



Fig. 21 Palatal backing on UL5 allows easy addition of heavily restored tooth after anticipated breakage

Table 6 Specific indications for removable partial dentures	
1. Patient preference	
2. Need for flange due to hard/soft tissue defects and arch discrepancy (allowing flexibility in tooth position and emergence)	
3. Limited dentition and limited bone (including free end saddles)	
4. Need for future additions/modifications	
5. Dentition with a range of tooth mobility	
6. Two or more edentulous spaces bounded by sound teeth	
7. Use of teeth as over-denture abutments (ODAs)	
8. Used as an interim solution	

desired vertical dimension. Tilted, rotated and over-erupted teeth could be reduced to over-denture abutments.

### Provision for future tooth loss

If loss of a lateral incisor with a post crown is anticipated, the cast framework can be designed for easy addition to the denture (Fig. 21). Equally, loss of a molar abutment and change from a bounded saddle to a free-end saddle can be anticipated so that retention points for both tooth and flange can be ready.

### Teeth to be replaced

The functional stability of un-restored shortened dental arches (SDAs) is well documented.<sup>19</sup> An SDA is the preferred option if there is no aesthetic reason or functional need to replace the missing teeth in an arch. Stable and un-restored SDAs are not, however, common. The question remains: when to use partial dentures? Analysis of the literature has not resulted in support for specific indications.<sup>20</sup> Clinical experience, on the other hand, suggests that there are eight specific



Fig. 22 Trial set-up to agree realistic appearance at the outset



Fig. 23 Denture teeth customised for use as immediate replacements



Fig. 24 Over-denture abutments. Gold copings have blanks for magnets retained in denture

indications when partial dentures are most suitable. This list is set out in Table 6.

### Aesthetic needs

If the consultation reveals that the patient has high aesthetic expectations, it is wise to address these as soon as possible. Denture teeth set up on a study cast will show both clinician and patient whether they can agree on the result (Fig. 22). For immediate replacement, a patient's apprehension at losing visible front teeth can be alleviated by customising the replacement denture tooth (teeth) in advance with the patient's input (Fig. 23).

### Strategic teeth and over-denture abutments

It is highly advisable to stop and think before removing teeth in a depleted dentition. Unless a tooth is irredeemably mobile (despite being out of occlusal function), it is always worth examining the possibility of recovery. Many a mobile tooth can be saved by simply correcting the traumatic occlusion it is being subjected to. Heavily restored and broken teeth can

## PRACTICE

serve as over-denture abutments (Fig. 24) and molars can be divided to allow one or two roots to be kept for strategic support and bone preservation in the arch.

### Previous partial denture experience

It is possible to make a training base for a partial denture (Fig. 25). In a larger reconstruction, it could take the form of an occlusal appliance; testing the patient's acceptance of a removable object as well as establishing a centric occlusion that coincides with centric relation. Proper extension of free-end saddles can be tested in wax in a similar manner to the diagnostic process described earlier for complete denture extensions.

### Effective design

The core elements of design are set out in Table 7 and the additional elements in Table 8. The designs drawn in Figures 26 to 28 are in a 1:1 format and can be used for discussion with the patient and a basis for informed consent. They address points that may be of potential concern to the patient: visibility of clasps, necessary tooth modifications, coverage of non-dental areas and comparison with existing denture(s).

### Hygienic principles

The advantages of hygienic design are universally accepted. They are backed by evidence in the literature and should be considered a medico-legal requirement. Avoid unnecessary coverage of the gingival tissues. Where this is not possible, it is advisable to design the denture elements so that they impinge as little as possible on the gingival tissues. Hygienic design is shown in Figure 29 and the 3 mm rule for gingival clearance in Figure 30.

### Preparation of the dentition

Rest seats, guide surfaces and a definite path of insertion/removal require tooth modification. These need to be planned and completed before the master impressions. The preparations are usually minor, but they need to be precise (Fig. 31). Composite can be used to create rests and guide surfaces and is a proven method of treatment (Fig. 32).<sup>21</sup>

### THE COMBINATION: COMPLETE DENTURE IN ONE ARCH AND NATURAL DENTITION IN THE OTHER

The combination is an extremely unfavourable dental situation. The challenge is



Fig. 25 Training bases to optimum extension added to cast framework

#### Table 7 Five core elements that apply to all removable partial denture designs

1. Support – optimum use of natural teeth for support of each denture saddle
2. Major connector – rigid and of hygienic design
3. Retention – two clasps at either end of an effective clasp axis
4. Reciprocation – to brace the teeth that are clasped
5. Anti-rotation – strategic points of support to withstand rocking/rotation

#### Table 8 Additional elements in removable partial denture design that may enhance performance

1. Guide surfaces
2. Precision attachments
3. Provision for addition/modification
4. Semi-permanent periodontal splinting
5. Used as part of occlusal contact surface/ anterior guidance

to protect the underlying bone from undue pressure necrosis and reconcile the moveable denture status of one arch with the fixed status of the other. The least unfavourable situation is a full opposing arch with correct alignment, occlusal plane and curves of Monson and Spey (Fig. 33). The most unfavourable is an opposing arch with anterior teeth only.<sup>22</sup>

The combination challenge can be met in three ways: through prevention, 'cure' or management. 'Cure' through dental implants dictates a sufficient number to secure support for the denture (minimum four in the mandible and six in the maxilla). The aim is a fixed or a fixed-removable solution. This is expensive and in the maxilla, in many cases, requires complex bone grafts.

Management is a difficult balancing act. Optimum criteria of the denture from the

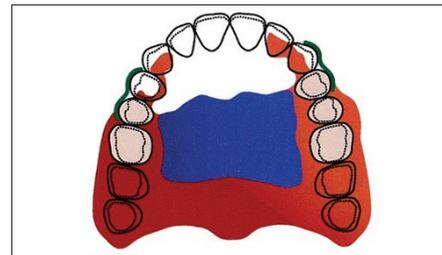


Fig. 26 Bilateral free-end saddle denture where the posterior two thirds of the palate contribute to support

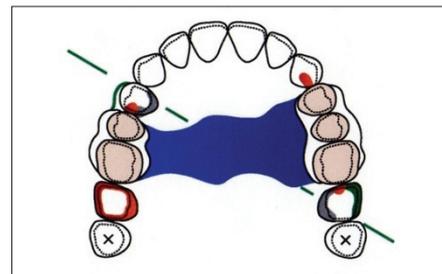


Fig. 27 Tooth supported denture with an effective clasp axis and anti-rotation offered by rests on UR7 and UL3

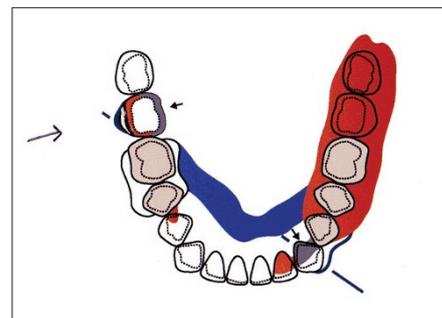


Fig. 28 The denture will have tooth support in three corners; the fourth comes from optimum extension of the free-end saddle base

outset are critical. So is maintenance of the criteria. This requires regular review and it involves ongoing costs. The patient should be advised of this from the beginning.

The patient in Figure 34 is a lifelong bruxist: this takes its toll on the denture bearing area and the denture teeth wear faster. It is best to prevent the combination in the first place. Patients must be advised of the advantages of keeping teeth and roots. They offer support and retention. Roots can be used in a number of ways under dentures: examples can be seen in Figure 24. Equally, mention of strategic implants placed at the time of or soon after tooth removal must be a medico-legal requirement for this group of dental patients.

A complete denture that opposes a natural dentition is under considerable strain and fracture must be anticipated.

The option of reinforcement must be discussed with the patient at the outset. Cast reinforcement can be difficult in an immediate denture and may require a second denture at a later date. A growing number of laboratories are able to cast in titanium. This type of base is considerably lighter than its equivalent in cobalt-chrome and worth looking into. An example is shown in Figure 35 and note that the post-dam and saddle areas are kept in acrylic to allow updating at a future date.

**OPTIMUM RESULT AT EACH STAGE**

It is important to recognise that each stage is only as good as the quality of the previous one. A special tray based on an indifferent primary impression is of limited value because it will require extensive modification to be of use. A casting is only as good as the detail and quality of the master impression it is based on (Fig. 36). The same applies to a set up of teeth: it is dependent on the quality of the occlusal record and the degree of information offered by the occlusal rims.

**INSURANCE POLICY**

Many a potential grievance is prevented if the clinician can spot the need to plan and provide for future events. A backing behind a dubious tooth allows an easy addition. Providing the patient with a set of copy moulds of successful complete dentures is sensible insurance. It is also wise to mention the need for denture adhesive at the outset rather than as a 'desperate' measure after fitting.

**DAY OF FITTING**

With a collaborative approach the patient should know what to expect. Even so, it is wise to remind the patient of the expectations and limitations agreed at the outset. Time must be allowed for verbal advice on care and maintenance, reinforced by written material to take away. The patient should have a follow-up appointment, but for a positive start the patient should be encouraged to seek help even beforehand if necessary.

**CONTINUING CARE**

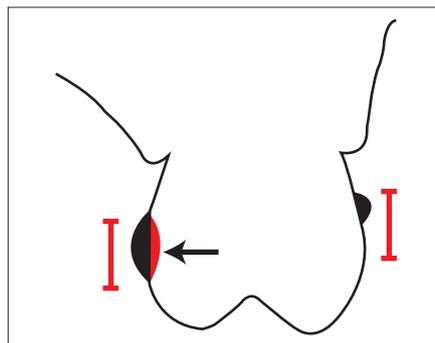
The stability of the finished treatment should be observed over a period of time, together with the patient's ability to maintain the denture environment. Once the patient is comfortable, there should



**Fig. 29** Upper partial denture of hygienic design. The major connector does not cover any of the gingival tissues unnecessarily



**Fig. 30** 3 mm clearance of the gingival margins on LR5 and LR3 by LR4 denture tooth and posterior free-end saddle



**Fig. 31** Precise tooth modification required for effective reciprocation. The palatal surface is prepared to allow the reciprocating arm to maintain contact with the tooth until the clasp clears the undercut



**Fig. 32** Composite rests. Note the vertical aspect must be parallel to the path of insertion



**Fig. 33** The least unfavourable combination. Upper complete against a full lower fixed arch



**Fig. 34** The restorations in the lower arch speak of bruxism. This will not stop simply because the patient is now edentulous in the upper arch



**Fig. 35** Cast titanium palate with acrylic periphery to allow future relining



**Fig. 36** The quality and clarity of the master impression dictates the quality of the cast framework

be follow-up at three, six and twelve months to assess the interval for monitoring and maintenance in the future. Where

possible, it is sensible to include the cost for these follow-up visits in the original fee for the treatment.

## CONCLUSION

This article sets out an approach together with a host of measures to avoid problems, complaints and litigation within the discipline of removable dentures. Treatment in this field is not merely a technical exercise. Combined with an increasing evidence base for current practises in prosthodontics,<sup>23</sup> the described approach is aimed at respecting the needs and wishes of the individual patient and offering choices based on realistic expectations. The measures are aimed at troubleshooting potential problems from the outset. They are diagnostic and practical ways of improving communication between all parties in the treatment team. From a medico-legal aspect, these efforts are as nothing unless they are recorded meticulously in the patient's notes.

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