



P Finbarr Allen

Gerald McKenna and Nico Creugers

# Prosthodontic Care for Elderly Patients

**Abstract:** For older patients, clinicians should consider maintaining teeth and using functionally-orientated treatment strategies as an alternative to removable prostheses. When the remaining dentition has a poor prognosis, key teeth should be preserved as overdenture abutments and a gradual transition to edentulousness planned. Where complete dentures are provided, these can be retained using dental implants to overcome many of the problems associated with conventional replacement dentures.

**Clinical Relevance:** The elderly population of today is better informed and more demanding of oral healthcare providers than previous generations. Clinicians should be aware of all the prosthodontic treatment options available for older patients.

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The demographics of the adult population, as described in adult health surveys, are changing dramatically. Worldwide, we are predicting longer life expectancies with the most dramatic improvements observed amongst the oldest age groups. In addition, we are seeing adults retaining natural teeth into old age with fewer becoming edentate. Those who lose all their natural teeth tend to do so later in life, when many find the limitations of removable prostheses difficult.

Whilst improvements in the retention of natural teeth represents significant oral and general health benefits for patients, it poses challenges for the dental profession.<sup>1</sup> Increasingly, accessible sources of information have meant that older patients are better informed and less

willing to accept treatment planning based around removal of teeth and complete replacement dentures. New paradigms of care are emerging, and there has been a move towards 'minimally invasive dentistry' and 'functionally-orientated treatment planning' for the elderly patient.<sup>2</sup> These treatment strategies are aimed at maintaining a functional, natural dentition for life without recourse to removable prosthodontics.

However, many older patients still suffer from significant amounts of dental disease. Chronic diseases, such as dental caries and periodontal disease, continue to be a problem as mechanical cleaning ability can decline in combination with high sugar diets and reduced saliva flow (Figures 1, 2). Naturally, in some cases, the long-term prognosis of the natural teeth is uncertain and, when confronted by a dentition with a poor prognosis, the loss of natural teeth is often inevitable. For some patients, consideration must be given to managing a successful transition from the partially dentate to the edentulous state. This depends on careful planning by the clinician and a thorough knowledge of the laboratory procedures involved.<sup>3</sup>

The availability of osseointegrated dental implants has also increased our options for the management



**Figure 1.** Elderly patient maintaining poor oral hygiene resulting in periodontal disease.



**Figure 2.** Extensive caries in an elderly patient.

of partially dentate and edentate elderly patients. The use of dental implants is not applicable in all cases owing to medical contra-indications and financial barriers but, for many patients, providing functional and aesthetic replacement teeth is an option. In particular, for edentulous patients implant-retained lower overdentures have been shown to improve oral health-related quality of life significantly.<sup>4</sup>

In this article, the challenges associated with providing prosthodontic

**P Finbarr Allen**, BDS, PhD, MSc, FDS, FDS(Rest Dent), FFD, Professor of Prosthodontics and Oral Rehabilitation, Restorative Dentistry, **Gerald McKenna**, BDS, MFDS, PgCert T&L, Clinical Fellow, HRB PhD Scholar in Health Services Research, Restorative Dentistry, University College Cork, Ireland and **Nico Creugers**, DDS, PhD, Chair of the Department of Oral Function and Prosthetic Dentistry, University Medical Centre Nijmegen, The Netherlands.

- The health of potential abutment teeth should be assessed using a periodontal and radiographic assessment.
- Primary models should be articulated and analysed using a surveyor.
- A path of insertion should be chosen which differs from the path of natural displacement.
- Along the path of insertion the rigid framework should engage with as many parallel surfaces (guide planes) as possible to gain retention and aid aesthetics. The path of insertion should take advantage of undercuts present on the buccal or lingual/palatal surfaces of abutment teeth.
- When designing saddles to replace missing teeth, bounded saddles should cover as little of the mucosa as possible. Unbounded saddles should be maximized to gain support from the soft tissues.
- Rest seats provide indirect retention and should be placed as close to bounded saddles as possible and as far away from unbounded saddles.
- Undercuts can be maximized on abutment teeth by adding composite resin.
- The number of clasps should be minimized but ideally would incorporate cross-arch bracing where appropriate.
- Major and minor connectors should be designed to minimize unnecessary gingival coverage.
- The dental technician should be sent a detailed laboratory prescription showing the framework design and the surveyed casts indicating the chosen path of insertion.

**Table 1.** Principles for designing a successful cobalt-chromium partial denture.



**Figure 3.** Cobalt-chromium partial upper denture.

care for the elderly will be discussed and strategies aimed at the successful rehabilitation of older patients with missing teeth will be illustrated.

### Partially dentate patients with teeth of good prognosis

As rates of edentulousness decline, clinicians are faced with treating increasing numbers of older partially dentate patients.<sup>5</sup> If prosthodontic replacement of teeth is required, the majority receive removable partial dentures (RPDs) to meet functional and aesthetic demands. There is always a biological price associated with RPD provision, but the risk of disease can be reduced if patients maintain a good

standard of oral hygiene and their previous dental history indicates a low risk of disease. Given the propensity for RPDs to complicate plaque control, it is vital that they are designed using hygienic principles<sup>6</sup> (Table 1). RPDs constructed with a cobalt-chromium framework can be used to minimize gingival coverage and ensure that components do not encroach on root surfaces. Frameworks for dentures should not be overly complicated, and the minimal number of components needed to provide adequate retention and support should be provided<sup>7</sup> (Figure 3). Ideally, unless additions are planned, cobalt-chromium frameworks should be favoured over acrylic baseplates. Acrylic RPDs often gain retention through extending over the soft tissues or engaging with the embrasure spaces of remaining teeth. They can be unhygienic and cause trauma to the soft tissues, thus their use should be limited where possible.

Some researchers have suggested that older adults have different functional needs from young patients and therefore do not need a complete natural dentition.<sup>8</sup> The shortened dental arch concept (SDA) has been successfully implemented in older patients by preserving anterior teeth in preference



**Figure 4. (a–d)** Sixty eight-year-old female patient with an extreme shortened dental arch in the upper jaw with distal extension resin-bonded bridgework and with resin-bonded bridgework replacing lower anterior teeth.

to molars which are more difficult to maintain. Furthermore, the World Health Organization (WHO) suggested that a goal for oral health in the year 2000 should be that adults retain for life a healthy, functioning dentition of at least 20 teeth and do not require an oral prosthesis to

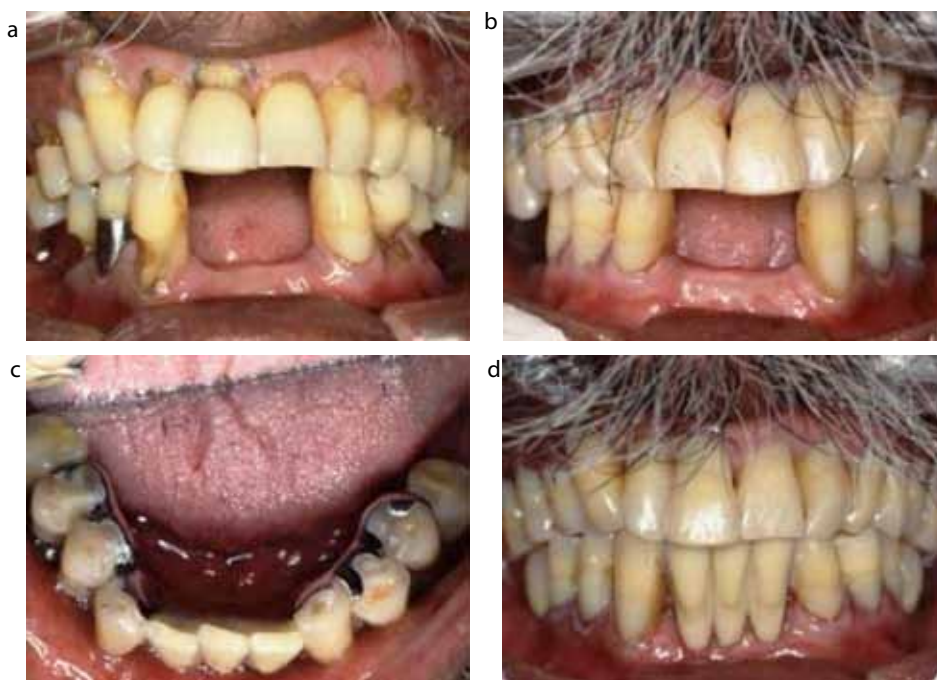
replace missing teeth.<sup>9</sup>

The concept of 'minimally invasive dentistry (MID)' has also been proposed as an effective and acceptable form of dental management for older adults.<sup>10</sup>

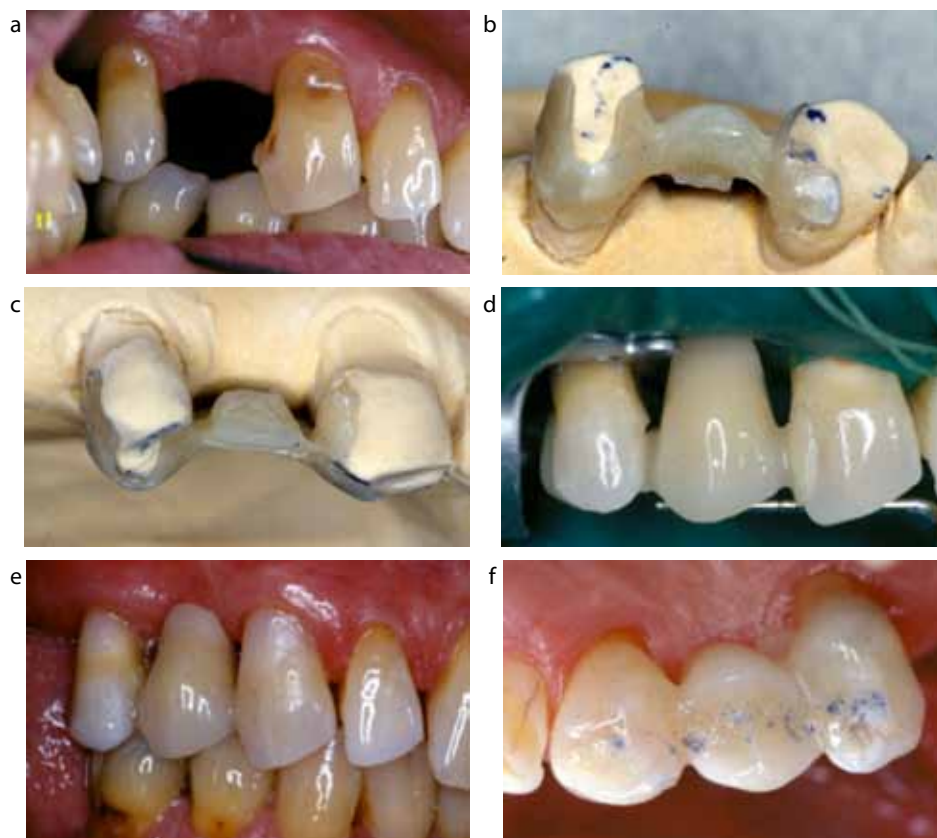
In addition to caries prevention strategies and conservative management of cavities, this strategy also includes the use of resin-bonded or cement-retained bridges to maintain shortened dental arches where anterior teeth are missing. The use of bridgework instead of RPDs in this way has been shown to be an effective means of replacing missing teeth with a reduced maintenance burden<sup>11</sup> (Figures 4, 5). Especially in partially reduced dentitions with (almost) sound remaining teeth, resin-bonded bridges offer a good treatment alternative to RPDs. They are relatively easy to place, are relatively inexpensive and well accepted by the patient. The biological price is low compared to conventional bridges and RPDs.

Glass fibre-reinforced composite bridgework can also be used to restore patients with a shortened dental arch (Figure 6). Fibre-reinforced composite, resin-bonded bridges can be made both directly in the mouth by the clinician or indirectly in a dental laboratory. Moreover, both techniques may be combined so that optimal adaptation to the existing situation can be achieved. Fibre-reinforced composite, resin-bonded bridges in general have a somewhat less favourable prognosis than metal framework resin-bonded bridges. However, for use in the management of partially reduced dentitions in the elderly, this is compensated for by the relative ease with which they can be repaired and extended, if necessary.

These functionally-oriented treatment strategies aim to reduce the burden of maintenance for older adults, and correspond to the WHO recommendation. The key to the successful implementation of these strategies lies in appropriate case selection. It is essential that the remaining natural dentition has a good long-term prognosis, and that the patient is sufficiently motivated (and physically able) to be able to maintain a good standard of oral hygiene and thus reduce the risk of further tooth loss.



**Figure 5.** (a–d) Seventy-year-old male patient with deep non-carious lesions and an interrupted shortened dental arch in the lower jaw before and after treatment. Treatment provided included restoration of the buccal cavities with resin composite and provision of resin-bonded bridgework.



**Figure 6.** (a–f) Sixty seven-year-old male patient with a shortened dental arch and missing first premolar replaced using a fibre-reinforced composite resin-bonded bridge. After laboratory construction the bridge was cemented under rubber dam.



**Figure 7.** Acrylic transitional partial denture incorporating wrought stainless steel clasps.

### Transition to edentulousness, remaining teeth of poor prognosis

In certain clinical situations, it is very likely that the patient will eventually lose all of his/her natural teeth. These situations can include:

- Questionable patient motivation;
- Advanced periodontal disease;
- Poorly controlled caries;
- Advanced toothwear;
- Financial considerations.

It is not desirable that a patient should be rendered edentulous in old age when it is unlikely that they will successfully adapt to wearing complete replacement dentures. Consequently, the clinician should recognize when the long-term prognosis for a dentition is hopeless and plan a gradual transition to the edentulous state, which will increase the chances of successful adaptation to complete dentures.<sup>12</sup>

The goal of immediate denture therapy is to maintain satisfactory appearance and function during the post-extraction phase of treatment. When providing immediate replacement dentures, the clinician must discuss the consequences of tooth loss with the patient and clearly explain the treatment plan. The patient must understand that the tissues will change during the healing period following dental extractions and that frequent adjustment of the dentures may be required. The patient must also be advised that immediate dentures are intended to be temporary, and will probably have to be replaced after 6–12 months.

Provision of transitional

1. Periodontal status.
2. Number and location of abutment teeth: minimum two teeth, evenly distributed around the arch.
3. Integrity of tooth structure.
4. Suitability and need for endodontics.
5. Presence of bony undercuts.
6. Vertical space, especially if opposed by a natural dentition.

**Table 2.** Assessment of teeth for overdenture abutment selection.

removable partial dentures can be used to replace mainly posterior teeth in the first instance. An existing partial denture can be immediately added to or an acrylic prosthesis fabricated (Figure 7). The transitional dentures should be designed carefully to ensure that they are as retentive and stable as possible. The use of sound prosthetic principles, as described in relation to RPDs, applies equally in this situation to minimize unnecessary soft tissue coverage and ensure the prosthesis is cleansable. A poor transitional denture may cause the patient to reject the prostheses.

After a suitable transitional period, six months is usually sufficient, the clinician may convert the transitional partial denture to a complete immediate replacement denture. Occasionally, it is possible to rebase the immediate replacement dentures but, in most cases, new replacement complete dentures would be required after 6–12 months.<sup>7</sup>

### Maintaining key teeth: overdentures

Providing an older person with his/her first complete replacement denture can be a difficult experience for both clinician and patient. One possible alternative to complete tooth loss is the retention of a number of strategically important teeth and the utilization of overdentures. Overdentures have proven to be very successful, especially in the mandible where bone resorption can severely compromise denture stability and retention.<sup>13</sup>

Overdentures convey a number of important advantages:

- Greatly enhance support for the denture.
- By utilizing teeth to retain the prosthesis, alveolar bone is preserved, thus

reducing loss of vertical dimension and lip support.<sup>14</sup>

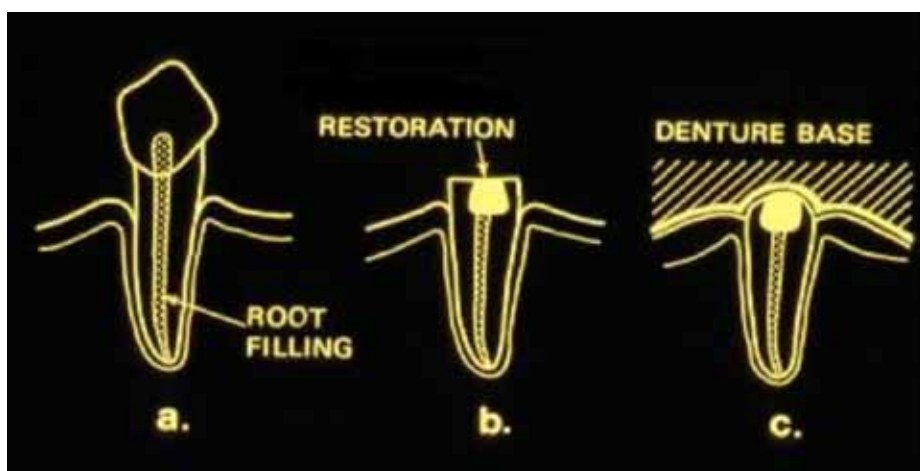
■ Through the retained roots, sensory feedback and proprioception are maintained, helping to provide an awareness of jaw-space relationships and improving chewing efficiency.<sup>15</sup>

■ Saving some of the remaining natural teeth can convey huge psychological benefits to the patient. As well as making the denture feel more secure, patients are comforted by the fact that they still retain some of their own natural teeth.<sup>16</sup>

As the oral health of older adults improves, it seems likely that older adults will be less likely to accept that tooth loss is an inevitable part of the ageing process. Consequently, retaining some portion of their natural dentition will be of great benefit.

Overdentures can be successful in many clinical scenarios, as well as the planned transition to edentulousness where they can be provided as an immediate or replacement prosthesis. They can be useful if partial denture construction is proving difficult, for example in cases with unsuitable abutment teeth or where saddles have conflicting paths of insertion. Overdentures can prove successful in hypodontia cases as well as cleft palate or surgical defect cases. With non-carious tooth surface loss, an increasing problem amongst older patients, overdentures can be used as diagnostic or definitive prostheses to restore teeth.<sup>17</sup>

Planning for overdentures requires the careful assessment of potential abutment teeth (Table 2). The prognosis for the retained teeth should be good, and they should be considered restorable. Teeth affected by root caries or restored below the gingival margin are not considered suitable. A moderate



**Figure 8.** Preparing an overdenture abutment.

degree of mobility is acceptable, as this will decrease when the crown height is reduced but, if bone loss exceeds 30%, the tooth should not be considered for an overdenture abutment.

Following completion of endodontic procedures, if necessary, the abutment teeth should be altered to create a dome shape with a minimum of 3 mm of tooth structure remaining supragingival (Figures 8, 9). The edges of the preparation should be rounded, and the centre of the tooth flattened. It is important not to reduce the abutments to the level of the gingival margin, as this will lead to gingival inflammation when the denture covers the abutments. It is also important not to underprepare abutment teeth, as leaving too much tooth tissue potentially weakens the overdenture. When a regular domed tooth preparation is not possible owing to the presence of a previous restoration or caries, a laboratory-made cast gold alloy coping can be used.

Patients for whom overdentures may be indicated are often not ideal dental patients. They will have lost teeth due to a combination of disease susceptibility and neglect. Vigilance is therefore essential and a programme of intensive maintenance will be required.<sup>18</sup> Unfortunately, caries and periodontal disease are common problems associated with overdenture abutments<sup>19</sup> (Figure 10). In addition, if an adequate thickness of acrylic is not provided over the abutment teeth, the

prosthesis can be susceptible to fracture.

In cases where retention is severely compromised, the clinician can consider the use of precision attachments to enhance denture retention. A precision attachment is an interlocking device, one component of which is fixed to an abutment, while the other is incorporated into a denture or bridge.<sup>20</sup> Precision attachments can be particularly useful when providing elderly patients with a complete denture for the first time. They can also be utilized successfully in patients with poor muscular control, including those suffering from Parkinson's disease or a post-cerebrovascular accident.

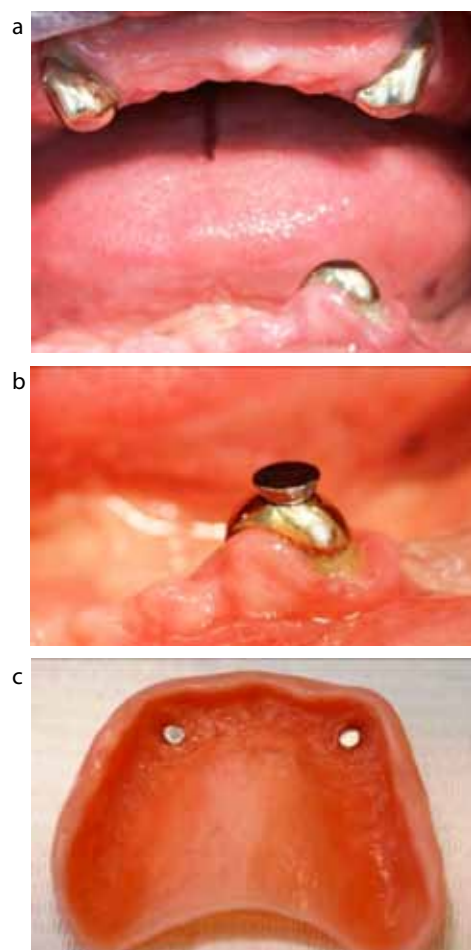
Commonly used precision attachments are bars and ball attachments/press studs. Rare earth magnets can also be used to enhance retention of overdentures (Figure 11). Evidence suggests that each of these mechanisms is equally effective, but some authors indicate that magnets exert least force on the periodontium and should be indicated for patients with reduced periodontal support.<sup>21</sup> When contemplating the use of precision attachments, the clinician should be certain that they are necessary and likely to be of benefit to the patient. They are expensive in terms of financial cost and increase the length of treatment time. They also increase maintenance requirements and exert significant stresses on the abutment teeth.



**Figure 9.** Mandibular canines prepared as overdenture abutments.



**Figure 10.** Poorly maintained overdenture abutments with plaque accumulation causing gingival inflammation.



**Figure 11. (a-c)** Magnetic attachments used in the upper and lower arches. **(b)** The magnetic element adhering to the metallic coping prior to being incorporated into the denture fitting surface with self-curing acrylic.



**Figure 12.** Complete upper and lower replacement dentures.

## Complete replacement dentures and implants

Despite falling rates of edentulousness, many elderly patients still require prosthodontic replacement of all their natural teeth. Successful provision of complete dentures, even for patients with experience of wearing previous prostheses, can be challenging as many have resorbed alveolar ridges and postural jaw relationships. However, many patients can be successfully managed using conventional complete replacement dentures when fundamental prosthodontics principles are applied (Figure 12). Care should be taken to ensure that dentures are well extended, especially in the mandible, to take advantage of retention from the retromolar pads, and that balanced articulation has been achieved.<sup>22</sup> Patients who present wearing existing complete dentures which have proved successful can be candidates for copy dentures, or at least incorporation of the successful features into new conventional dentures.

With the predictability of osseointegration there has been a growing shift towards the routine use of implants to stabilize complete removable prostheses. This is driven by the fact that implants can overcome many of the functional, psychological and physiological consequences of edentulousness. Implants help to preserve alveolar bone and bite force is increased when compared with conventional complete dentures.<sup>23</sup> This may enable the patient to chew food with a higher nutritional value, which is important for general health.<sup>24</sup>

However, providing implant-supported prosthodontics involves more complex and lengthy treatment procedures than conventional care. Prior

to implant placement, careful planning is required to assess the width and height of the alveolar ridge present. Bone augmentation may be required prior to implant surgery if insufficient bone levels are present to support the implants. Patients suffering from any condition that precludes a minor oral surgical procedure, eg poorly controlled diabetes mellitus, blood dyscrasia, immunologically compromised, would be unsuitable for implant placement.

Amongst elderly patients, particular attention should also be paid to any history of head and neck radiotherapy and use of bisphosphonate medications.<sup>25</sup> Whilst not universally considered an absolute contra-indication, patients who smoke should be advised that the failure of implants and post-operative complications are much higher in smokers than non-smokers.<sup>26</sup> In addition, as with other prosthodontic treatment options, implant-retained dentures require careful maintenance from both the patient and clinician.

Implant-retained prostheses have been a major advance in the treatment of patients with denture-wearing difficulties, and offer the possibility of overcoming many of the problems associated with conventional replacement dentures. Evidence suggests that implant-retained mandibular overdentures should be considered as first choice treatment for edentulous patients.<sup>27</sup> However, for many elderly patients who could benefit most from implant-retained prosthodontics, they remain financially prohibitive.

## Conclusion

A better informed, more demanding elderly population is less likely to accept traditional treatment philosophies based around extractions and replacement of teeth with complete dentures. Functionally-orientated and minimally invasive treatment strategies can enable older patients to maintain natural teeth and avoid the need for a removable prosthesis. For those patients who will lose natural teeth, key teeth should be preserved to support overdentures or a careful transition to edentulousness should be planned.

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## Abstracts

### HOW FAST ARE YOUR ALGINATE IMPRESSIONS CAST?

Accuracy and dimensional stability of extended-pour and conventional alginate impression materials. Imbery TA, Nehring J, Janus C and Moon PC. *J Am Dent Assoc* 2010; **141**: 32–39.

As the authors of this very interesting paper observe, dental practitioners have been taught for decades that irreversible hydrocolloid impressions (alginate) should be poured as soon as possible, ideally within 12 minutes, to ensure dimensional stability. In this quite simple experiment, two different alginate materials were used to take an unspecified number of impressions of a modified resin model. These were taken using the exact measurement of materials specified by the manufacturers. The impressions were either poured immediately or stored, again according to the manufacturer's instructions, by wrapping the impression in a paper towel dampened with 12 ml tap water and sealing them in plastic zipper storage bags. A number of impressions was poured each day for the following five days.

The resultant gypsum casts were analysed by measuring key points and comparing these measurements with the master model to assess the dimensional stability of the alginate impression material.

Although dimensional changes were recorded, these were not deemed to

be clinically significant and none was found to exceed the parameter initially laid down of 0.50% dimensional change. At the end of five days no significant differences were found between the casts poured at the six time intervals, or between the two different materials.

Perhaps the most important implication of the paper for the busy general practitioner is that it is recommended that the correct storage method is used in accordance with the manufacturer's instructions. The habit of wrapping impressions in a saturated towel and sealing them in a bag with excess water may well still be detrimental to the final outcome. Train your staff accordingly!

### WILL YOUR NEXT VT BE COMPETENT AT IMPLANT THERAPY?

Outcome of single-tooth implant-supported replacements placed by dental students'. A 10-year clinical and radiographic retrospective study. Bonde MJ, Stokholm R, Isidor F and Schou S. *Eur J Implantol* 2010; **3**: 37–46.

The teaching of implantology to undergraduate dental students is controversial. Some argue that competence in basic restorative treatment must be attained before such advanced procedures can be taught, whilst the opposite view is that such treatment is now part of mainstream dental practice and students

should be taught at least the basic principles, upon which they may build their expertise as with all other dental disciplines.

In this study in Denmark, 51 single tooth implants were placed and restored by undergraduate students under close supervision by dentists and oral/maxillofacial surgeons with a special knowledge of this field. The students were involved in the patient assessment, learning the assessment criteria required; monitored those patients accepted into the study who were cigarette smokers; evaluated the technical problems that arose (two patients reported porcelain fracture and three the loosening of abutment screws, all of which were amenable to treatment); learned the indications for bone augmentation (although where indicated this procedure was carried out by the qualified staff); and audited the eventual survival rate. This was found to be 94% which is comparable to other published work from qualified practitioners.

It is therefore suggested that, with proper supervision, the teaching of implantology may be included in the undergraduate clinical curriculum, provided a focus remains on straightforward cases and substantial supervision by trained dentists.

**Peter Carrotte**  
**Glasgow**