

# Restorative dentistry for the older patient cohort

R. Y. Jablonski\*<sup>1</sup> and M. W. Barber<sup>2</sup>

## IN BRIEF

- Describes trends in population ageing and prevalence of dental disease.
- Discusses the impact of key medical and social factors on the provision of dental care for the older patient cohort.
- Reviews patient management from a restorative perspective and highlights important conservative, periodontal, endodontic and prosthodontic considerations.

The ageing UK population presents a number of challenges to the restorative dentist as a result of complex treatment needs and a significant maintenance burden. This paper discusses how ageing may influence the provision of dental treatment and outlines a variety of conservative, periodontal, endodontic and prosthodontic considerations that are important in the management of the older patient cohort.

## INTRODUCTION

### Population ageing in the UK

The UK population is ageing, demonstrated by a rising median age and a higher proportion of older people. Between 1985 and 2010, the median age rose from 35.4 to 39.7 years and is projected to further increase to 42.2 years by 2035.<sup>1</sup> Similarly, the proportion of people aged 65 and over has increased from 15% to 17% within the same time period and projections suggest this will rise to 23% by 2035.<sup>1</sup> This ageing population has been attributed to a decline in mortality rates resulting from improved health and social care services.<sup>1</sup>

### Trends in oral health

The Adult Dental Health Survey (ADHS) shows a number of important oral health trends from its first survey in 1968 to the most recent in 2009. Primarily, the overall proportion of edentulous adults is declining. In England this has fallen from 28% in 1978, to 6% in 2009 and age-related improvements can be clearly seen.<sup>2</sup>

Trends in the number of teeth retained are also positive. In England, the proportion of adults maintaining 21 or more natural teeth has improved from 74% in 1978 to 86%

in 2009, with more pronounced improvements evident in the older age groups.<sup>2</sup> Furthermore, the percentage of dentate adults with 18 or more sound, untreated teeth has improved across all age groups.<sup>2</sup> These positive developments suggest that more adults will be able to preserve a functional dentition throughout life.

Patient attitudes towards dental health are also becoming more positive and it appears that there is a greater enthusiasm for dental preservation across today's patient base. Patients demonstrate an increasing preference for restorative treatment instead of extractions, with an increase in tooth brushing and use of additional oral hygiene aids.<sup>3</sup> Moreover, an increasing proportion of patients have negative attitudes towards dentures which strengthens the drive to maintain their natural dentition.<sup>3</sup>

Although positive changes are evident with tooth retention, older adults have increasingly complex oral health needs due to the cumulative and progressive nature of oral diseases. The 2009 ADHS attempted to provide an overall indication of patient complexity by combining eight different criteria (relating to active disease, existing restorative treatment and impact on daily life) and found a marked difference in the level of complexity for adults over 45 years.<sup>4</sup> Management of the older patient cohort will therefore present a number of restorative challenges in terms of treatment planning, provision of restorative care and maintenance of these complex dentitions.

## MEDICAL AND SOCIAL CONSIDERATIONS

The provision of dental care for the older patient may be influenced by a number of

different factors and therefore a holistic approach to treatment planning is crucial. Some of the factors that may influence patient management and treatment planning are explored below.

### General health

The prevalence of chronic illness increases with age. In Great Britain in 2012, 57% of those aged 65–74 and 67% of those over 75 years had a longstanding illness or disability, with 31% and 48% respectively suffering from a condition which limited their activity.<sup>5</sup> Diabetes, cancer, cardiovascular disease, arthritis, chronic obstructive airways disease and neurological conditions such as dementia are more prevalent in older age groups.<sup>6–9</sup> A thorough medical history will help identify important medical conditions and comorbidities which could influence the provision of dental treatment or increase the patient's risk of oral disease.

Polypharmacy describes the simultaneous use of multiple medications and can be a complex issue for the older population due to non-concordance with drug regimens and an increased risk of drug interaction.<sup>10</sup> A number of common medications prescribed in the older population can additionally result in oral side-effects. For example, those prescribed for cardiovascular disease can cause xerostomia, gingival enlargement, oral ulceration, lichenoid reactions and taste disturbance.<sup>11</sup> These adverse effects may be managed through correspondence with the patient's general medical practitioner or by referral to specialist services.

### Communication

Communication may be less effective with the older population and sensory, motor and

<sup>1</sup>Dental Core Trainee in Restorative Dentistry, Charles Clifford Dental Hospital, 76 Wellesley Road, Sheffield, S10 2SZ; <sup>2</sup>Senior Clinical Teacher/Honorary Consultant in Restorative Dentistry, School of Clinical Dentistry, University of Sheffield, Claremont Crescent, Sheffield, S10 2TA

\*Correspondence to: Miss Rachael Jablonski  
Email: rachaeljablonski@gmail.com

#### Refereed Paper

Accepted 18 February 2015

DOI: 10.1038/sj.bdj.2015.197

©British Dental Journal 2015; 218: 337–342

cognitive impairments may all play a role. Therefore, a variety of methods should be employed to overcome these challenges and ensure effective communication. For example, the use of large fonts on instruction leaflets may be helpful for patients with visual impairments. Those with hearing impairments may benefit from audio induction loop systems and lip reading can be facilitated by sitting directly in front of the patient, removing face-masks or using full face visors. Additionally, close working with family or carers and use of appropriate language will help support patients with cognitive impairment.

### Oral risk factors

Older adults may have a number of risk factors for poor oral health including cariogenic diets, xerostomia, lack of manual dexterity and systemic disease.<sup>7</sup> The prevalence of xerostomia increases with age<sup>12</sup> and it commonly occurs as a side effect of medication of which several hundred have been associated.<sup>13</sup> Radiotherapy to the head and neck region or systemic conditions such as diabetes and Sjögren's syndrome can also contribute to reduced salivary gland function.

Xerostomia can have a significant impact on oral health with an increased risk of caries, periodontal disease and recurrent candidal infections.<sup>14</sup> It may also cause a number of functional problems including dysphagia and difficulty with removable prostheses.<sup>14,15</sup> Simple lifestyle modifications such as taking regular sips of water, sugar-free gum and saliva substitutes can be suggested to reduce the impact of the condition.<sup>16</sup>

Reduced manual dexterity, arising for example from rheumatoid arthritis or stroke, may cause difficulty in oral hygiene measures and subsequently impact on the maintenance of restorative treatment. This may be further compounded by visual or mobility impairments. Simple personalised advice with adaptation of tooth brushes and appropriate supervision or intervention by carers may be beneficial in these circumstances.

### Access

The main barriers to dental care faced by older patients have been summarised as the cost of treatment, anxiety, lack of perceived need, characteristics of the dentist, availability and accessibility of dental services.<sup>17</sup> Patients with mobility issues may require additional assistance to access the surgery or transfer to the dental chair. Lengthy procedures can be difficult to tolerate for those patients with musculoskeletal or respiratory problems and shorter appointments or treatment in the upright position may be preferable in these circumstances. Appointments should also be arranged around their

personal circumstances when they may be better able to cope with dental treatment or have more support from carers.<sup>18</sup> Those with more severe restrictions may need additional support such as domiciliary care.

### Consent

In order to give valid consent for treatment, a patient must be able to understand information relevant to the decision, retain that information, consider the information as part of the decision making process and communicate their decision by any means.<sup>19</sup> Therefore, the majority of older adults will be able to give valid consent if information is communicated in a way that is sensitive to their circumstances.

Dementia now affects approximately 7% of those over 65 years, and 17% of those over 80 years and is a progressive condition which results in a decline in memory, reasoning and communication skills.<sup>9</sup> Not all patients with dementia will lack capacity and therefore every reasonable effort should be taken to enable patients to make their own decisions about their care.

Where a patient is unable to make a decision for themselves, best interest principles should be followed. This involves considering whether the person is likely to have capacity in the future, encouraging participation in the decision, considering their past and present wishes, beliefs or values and consulting appropriate persons as outlined in the Mental Capacity Act.<sup>19</sup>

## CONSERVATIVE CONSIDERATIONS

### Coronal caries

According to the 2009 ADHS, coronal caries affected 29% of all dentate adults but was most common in the 25–34 and 75–84 year age groups.<sup>20</sup> The survey also identified that primary coronal caries was most prevalent in the younger age groups. Conversely, secondary coronal caries was most common in the 75–84 year age group with 10% affected.<sup>20</sup> This is likely to relate to an increased prevalence of restorations in the older population.

Older adults often have a number of risk factors for dental caries including cariogenic diets, xerostomia and reduced manual dexterity.<sup>7</sup> Therefore, a caries risk assessment should be completed to help the practitioner determine the frequency of routine radiographs, level of preventative care required and when to intervene with carious lesions.<sup>21</sup> Additionally, older patients with previous caries experience may present with large restorations resulting from repeated replacement throughout the restorative cycle.<sup>21</sup> Practitioners should therefore consider adopting a more conservative approach

and repair or refurbish restorations when appropriate in order to prevent further loss of tooth structure.<sup>22,23</sup>

### Root caries

The prevalence of exposed root surfaces increases with age partly resulting from the cumulative nature of gingival recession and the loss of attachment through periodontal disease.<sup>20</sup> The exposed cementum and dentine are more susceptible to caries compared with enamel due to a lower mineral content and higher critical pH. Root caries is therefore common in the older population with 20% of 75–84-year-olds across England, Wales and Northern Ireland showing active disease.<sup>20</sup>

Root caries most commonly develops supragingivally, at or near the cemento-enamel junction,<sup>24</sup> and poor denture design can increase the prevalence.<sup>25</sup> Early lesions will present as a slight discolouration or softening of the root surface and are frequently hidden beneath a layer of plaque. Detection is therefore challenging and requires a thorough visual examination.<sup>26</sup> Early lesions develop into extensive discoloured soft areas which may encircle the entire root surface and more advanced lesions will progress towards the pulp. It is important to remember that the colour of the lesion does not represent a reliable indicator of lesion activity.<sup>27</sup>

Appropriate preventative care should be provided based on a patient's risk of developing the disease. Adoption of good dietary habits, adequate oral hygiene and the use of topical fluoride (including daily mouth rinses, high fluoride toothpaste and regular fluoride varnish application) are recommended in the literature.<sup>26,28,29</sup> Additionally, some studies suggest that calcium and phosphate containing pastes are a promising adjuvant to fluoride in the remineralisation of early carious lesions.<sup>30,31</sup> Surface modification can also be beneficial where lesions have plaque retentive areas in order to produce a cleansable surface and some studies demonstrate the effective use of ozone in reversing early root caries.<sup>32,33</sup> Arrested lesions will present as hard, shiny, brown-black areas on the root surface.<sup>34</sup>

Restoration of root caries presents challenges in achieving adequate moisture control, predictable bonding to dentine and access if interproximal or furcation areas are involved. There are many options advocated for the preparation and restoration of these lesions. Conventional preparation may be completed with rotary instruments or alternatively, the soft infected carious dentine may be removed with hand instruments in an atraumatic restorative treatment (ART) approach.<sup>35</sup> ART may be a useful technique

for the older patient cohort as it is often accepted well, does not routinely require local anaesthetic and can be readily completed in a domiciliary setting.<sup>35</sup>

Adhesive restorations are most frequently used to restore these lesions although historically amalgam was commonly used. Glass-ionomer and resin-modified glass-ionomer cements demonstrate a number of desirable properties for restoration of these cavities including fluoride release, adhesion to dentine and low technique-sensitivity and as a result are useful restorative materials for high-caries risk patients.<sup>36</sup> Conversely, a well-placed composite resin restoration may be more appropriate for low-caries risk individuals with good oral hygiene.<sup>36</sup> It is important to contour restorations appropriately to produce a cleansable surface and prevent further plaque accumulation.

### Toothwear

Toothwear (or tooth surface loss) is becoming an increasingly important issue when dealing with the older patient cohort. Experience of toothwear accumulates throughout life and with the population increasingly retaining teeth into later adulthood it is consequently a common challenge faced by the restorative dentist today. The 2009 ADHS demonstrates the prevalence of the problem: 95% of dentate 75–84-year-olds show signs of wear, with 44% and 6% respectively showing moderate or severe wear.<sup>20</sup>

Toothwear is usually a multifactorial process involving attrition, erosion and abrasion. Physiological tooth wear describes the loss of tooth structure associated with ageing and with no associated pathology.<sup>37</sup> Conversely, the term pathological toothwear describes an accelerated process, beyond what would be expected for a particular age, which can compromise tooth structure or pulpal tissues and cause aesthetic or masticatory problems (Fig. 1).<sup>37</sup> Patients may present with a wide range of complaints including sensitivity, sharp teeth, pulpitis, aesthetic concerns and functional problems which may prompt treatment.

Ideally, underlying aetiological factors should be controlled before commencing restorative treatment. However, this may not be possible in some circumstances where protection of remaining tooth structure is a priority. Preventative advice should be tailored to the individual following investigation of their medical history, diet and potential parafunctional habits. The patient's ability and motivation to maintain restorative treatment should be considered. In addition, clinical photographs and study models may be a useful aid to assess progression and plan treatment.



**Fig. 1** a) An older patient with tooth surface loss affecting the maxillary and mandibular anterior dentitions as a result of long-term acid reflux and tooth grinding. b) The same patient following selective crown lengthening and provision of full-coverage porcelain crowns.

The use of adhesive techniques to restore toothwear can provide a functional and aesthetic outcome and offers a less invasive, reversible and repairable result compared with conventional indirect restorations (Fig. 2). It may help postpone more invasive or complex treatment and may also be well tolerated by those adults who are unable to cope with lengthy procedures.

Use of the Dahl concept can be an effective strategy in the management of anterior toothwear with no inter-occlusal space. Traditionally, this involved the use of an anterior bite platform to create a posterior open bite which subsequently resulted in the relative extrusion of the posterior teeth and intrusion of the anterior teeth.<sup>38</sup> More recent literature indicates that predictable outcomes can be achieved by restoring the anterior teeth with direct composite at increased occlusal vertical dimension (OVD) as full arch contacts will be re-established over time. This technique does however require a degree of maintenance due to wear, marginal discolouration and fracture of the composite restorations.<sup>39,40</sup>

Management of generalised toothwear can be more complex and the increase in OVD should be carefully planned on study models mounted in centric relation. Diagnostic wax-ups can be used to evaluate and demonstrate proposed changes to the occlusal scheme. In some circumstances the use of a removable prosthesis (such as an overdenture or removable partial denture) may be a viable option to increase the OVD. In more severe cases alternative methods such as crown-lengthening may need to be considered (Fig. 3).



**Fig. 2** a) An older patient with tooth surface loss affecting the lower anterior sextant and worn upper and lower dentures. b) The same patient following direct composite build-ups of the lower anterior teeth and provision of new dentures at an increased vertical dimension.



**Fig. 3** a) A 71-year-old patient with tooth wear, acquired tooth loss, over-eruption and dento-alveolar compensation. The patient was keen to retain as many natural teeth as possible and avoid an overdenture. b) Extractions were undertaken on teeth with a hopeless prognosis, followed by surgical crown lengthening of the remaining upper anterior teeth, provision of milled crowns, precision attachments and upper and lower partial dentures.

### PERIODONTAL CONSIDERATIONS

Older patients have an increased prevalence of periodontal pocketing and loss of attachment through the accumulation of periodontal disease experience and exposure to risk factors throughout their life.<sup>20</sup> Therefore, as tooth retention continues to improve, there will be an increased demand for clinicians to diagnose and manage periodontal disease in the older patient cohort.

Local and systemic risk factors for periodontal disease are well discussed in the

literature. Systemic risk factors include genetics, smoking, diabetes, osteoporosis and stress.<sup>41</sup> Local risk factors include anatomical and iatrogenic factors, for example partial dentures and restoration overhangs. Furthermore, some authors suggest that a number of age-related changes may play a role in periodontal disease in the older patient cohort. These changes include an altered host response to plaque,<sup>42</sup> an impaired neutrophil function,<sup>43,44</sup> and qualitative changes in microbial composition.<sup>45</sup>

Management of periodontal disease will adopt the same principles as for the younger patient. Effective plaque control is crucial and tailored oral hygiene advice should be provided. For patients with poor manual dexterity, the use of electric toothbrushes, modification of toothbrush handles or supervision by carers may be helpful.<sup>44</sup> Prevention of root caries is also important where exposed root surfaces are present and desensitising toothpastes or varnishes may be useful for those with dentine sensitivity.<sup>29,46</sup>

Modifiable local and systemic risk factors should be addressed, for example through smoking cessation, correspondence with GPs regarding uncontrolled systemic conditions and re-contouring overhanging restorations. The provision of non-surgical periodontal therapy with regular reviews, maintenance and reinforcement of oral hygiene advice will form the mainstay of treatment. Suitability for surgical periodontal therapy should be assessed on an individual basis taking into account patient motivation, oral hygiene levels, smoking status and general health.<sup>47</sup>

### ENDODONTIC CONSIDERATIONS

With increased tooth retention and improved attitudes towards maintaining natural teeth, clinicians are more likely to be faced with the decision whether to extract a tooth or provide root canal treatment for the older patient. Careful consideration of individual patient factors, the remaining dentition and anticipated age-related endodontic challenges is important.

Medical conditions may preference one procedure over the other. For example, endodontic treatment may be preferable to avoid an extraction in patients at risk of osteoradionecrosis or bisphosphonate-associated osteonecrosis of the jaw (BRONJ). The patient's ability to comply with endodontic treatment should also be taken into account as some patients with arthritis may be unable to lie comfortably in the dental chair for prolonged periods. Patient motivation and ability to maintain the tooth or any subsequent restorative treatment should also be assessed.

The implications of removing a tooth from the arch should be carefully considered as

preservation of strategic teeth may significantly benefit the overall treatment outcome. Key examples from a functional perspective include the preservation of a last standing molar to aid retention of a removable partial denture, the maintenance of an important occlusal contact and the use of a root as an overdenture abutment.<sup>48</sup> Preservation of an intact anterior segment may be advantageous to maintain aesthetics and avoid the need for prosthetic replacement.<sup>48</sup> Conversely, extraction of the tooth may be the preferable option where teeth have a poor prognosis, are unrestorable, non-functional or have insufficient periodontal support.<sup>49</sup>

A number of age-related changes can impair the diagnosis of pulpal pathology and impede access, shaping and disinfection of the root canal system. Sensibility testing may be more challenging or inconclusive due to an increased pulpal response time or production of false-negative results.<sup>50</sup> Access may be impaired by unfavourable tooth positioning and diminution in the size of the pulp chamber with age. Challenges to effective shaping and disinfection include sclerosis of the pulpal spaces from secondary and tertiary dentine formation, the presence of root or coronal calcifications which can impede instrumentation of canals, and the presence of a more fibrous pulpal tissue (Fig. 4).<sup>51</sup>

Pre-operative clinical and radiographic examination will help clinicians anticipate potential difficulties in endodontic treatment. Orientation, alignment and anticipated depth to the pulp chamber can be gauged from a pre-operative radiograph. Regular inspection of the access cavity to check for visual signs will help the clinician locate the pulp chamber and avoid over-preparation. Ultrasonic instrumentation may be useful to remove calcifications such as pulp stones and copious irrigation, lubrication and use of fine files are important to negotiate sclerosed root canal systems.<sup>48</sup>

### PROSTHETIC CONSIDERATIONS

As current trends demonstrate people are retaining their own teeth for longer, it is likely that prosthetic management of the partially dentate or edentulous arches will be postponed until later in life. This may result in a number of challenges in terms of the provision of prosthetic treatment for patients with age related oral changes, and maintenance for those who have a number of oral health risk factors.

#### Shortened dental arch concept

The appropriateness of replacing missing teeth should be considered as it has been suggested that older patients do not need



Fig. 4 a) Periapical radiograph of 16 in a 73-year-old patient with heavily restored dentition following tooth surface loss. The patient presented with signs and symptoms of symptomatic periapical periodontitis. Note the sclerosed canals. b) Periapical radiograph 12 months following completion of endodontic therapy. The patient's symptoms had resolved.



Fig. 5 a) A patient with missing 22 and treated periodontal disease showing gingival recession. b) The same patient following provision of a resin-retained bridge to replace 22 and maintain a shortened dental arch. Note the extra detail on the pontic to match the surface staining and root discoloration (technical work courtesy of Mr K Deakin).

a complete natural dentition for it to be functionally and aesthetically acceptable. The shortened dental arch concept has been widely accepted and involves preferentially maintaining anterior and premolar teeth



**Fig. 6** a) A patient with missing 22 and treated periodontal disease showing gingival recession. b) The same patient following provision of a resin-retained bridge to replace 22 and maintain a shortened dental arch. Note the extra detail on the pontic to match the surface staining and root discolouration (technical work courtesy of Mr K Deakin).

to provide ten pairs of occluding teeth.<sup>52</sup> Indeed, one of the oral health goals historically described by the WHO and FDI was to maintain at least 20 functioning teeth for life, not requiring prosthesis.<sup>53</sup>

### Removable partial dentures and fixed prosthodontics

Provision of removable partial dentures can be a useful method to replace missing teeth and transition patients into complete dentures however their potential to cause detrimental effects on the teeth and supporting tissues (in terms of caries and periodontal health) have been demonstrated.<sup>54,55</sup> Therefore, partial dentures must be hygienically designed to avoid root surfaces and with at least 3 mm clearance between the connectors and gingival margins.<sup>55</sup> This is especially important for older patients with increased oral risk factors such as poor manual dexterity or xerostomia.

Alternatively, it may be suitable to replace missing teeth with fixed prosthodontics such as resin retained bridges or conventional bridgework (Fig. 5). A randomised controlled trial comparing the restoration of shortened dental arches with resin retained bridges *versus* removable partial dentures found a significantly lower incidence of caries in those restored with resin retained bridges.<sup>56</sup>

### Complete dentures

A number of age-related oral changes and anatomical factors may impair the provision of satisfactory complete dentures. For example, flat atrophic ridges may result in poor support and high fraenal attachments, short sulcus depths and xerostomia may compromise denture retention. Early identification of these features and discussion with the patient regarding their potential impact will help manage patient expectations.

An alternative approach to conventional dentures is the copy or replica denture technique. This has the advantage of being able to reproduce acceptable features from a previously successful prosthesis while allowing less favourable features to be modified. Copy denture technique typically involves fewer stages and less clinical time than conventional dentures, however careful preoperative planning is important to avoid errors from the previous prosthesis from being transferred across. Anecdotal evidence suggests that copying features (such as polished surfaces) in this way may help older patients adapt more easily to a new set of dentures, however there is limited evidence in the literature to suggest that patients will adapt any more successfully to copy dentures than with correctly constructed conventional dentures.<sup>57</sup>

Preservation of tooth roots for use as overdenture abutments is another useful option which has been shown to improve denture support, preserve alveolar bone, maintain proprioception and have psychological benefits.<sup>58,59</sup> Ideally, abutments should be stable in terms of caries and periodontal health, have good endodontic prognosis and favourable positions within the arch.<sup>60</sup> Patients should also be able and motivated to achieve satisfactory levels of oral hygiene in order to maintain the roots.

Dental implants are a predictable treatment modality and pose an alternative solution for replacing missing teeth. There is a substantial amount of evidence in the literature to suggest that patients have greater satisfaction and quality of life improvement with an implant retained lower overdenture compared to conventional dentures (Fig. 6).<sup>61,62</sup> As a result, the McGill and York Consensus statements suggest that a two-implant supported mandibular overdenture should now be considered as the first choice standard of care in the rehabilitation of edentulous patients.<sup>63,64</sup> At present, treatment costs and resources remain a barrier to care however this approach may become more commonplace in the future as the number of edentulous adults continues to decline. Guidelines on selecting appropriate patients to receive treatment with dental implants have also recently been updated.<sup>65</sup>

General risk factors for failure of dental implants include poor general health, smoking, implant site and quality of bone.<sup>66</sup> Some authors also suggest that chronological age may influence the success of implants,<sup>67</sup> possibly due to age-related deterioration in healing, bone quality and systemic health, however there are limited studies on success rates in older adult populations. Dental implants should therefore be considered on a patient-by-patient basis as risk factors, personal expectations and financial prospects will vary widely.

### CONCLUSION

As both the life expectancy and quality of life improves for the ageing population there is also a growing need for more complex dental care. It is important to provide an individualised approach towards care which focuses on the individual concerns and oral health needs. All treatment options should be considered along with the patient's expectations and an appreciation of any important medical or social factors that may influence treatment.

An improvement in oral health over the years has meant that becoming edentulous is more likely to be postponed until much later in life or even avoided. The focus on treatment is moving away from the provision of complete dentures and towards the restoration and maintenance of partially dentate arches which may have been compromised from a lifetime's accumulation of oral disease. Advanced restorative care including the provision of implant-retained prostheses is becoming more commonplace within the older population.

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