Shortened dental arch therapy in old age
This evidence summary aims to locate and summarise evidence to elucidate the value of shortened dental arch therapy in a planned approach to a functional dentition in old age. It does not include detailed descriptions of the studies cited nor does it include information that was not presented in the literature.

The Curious about website encourages dental professionals to raise issues where a review of the available evidence would provide a useful resource for other dental professionals. Where there is a lack of evidence, the topic is considered for research and an award is made available.

These activities are sponsored by the Shirley Glasstone Hughes Fund, a restricted fund within the BDA Trust Fund. The focus of the fund is research into primary care dentistry and aims to generate a body of relevant research for practising dentists.
Key findings

- The dearth of literature covering SDA in old age has prevented a complete answer to the question being generated.
- There are indications that the SDA concept may hold value in treatment plans for patients in the old age group.
- The SDA concept approach can be questionable from the patients’ point of view.

Review question

This evidence summary was prepared in response to the following question: What is the value of shortened dental arch therapy in a planned approach to a functional dentition in old age?

Key terms

**Shortened dental arch:**
A reduced dentition primarily resulting from the loss of molar teeth or the concept of directing treatment and resources to anterior and premolar teeth rather than molar teeth. \(^{(1)}\)

**Functional dentition:**
A functional dentition is necessary for biological and social functions such as chewing, oral comfort, speech, self-esteem and aesthetics. \(^{(1)}\) The concept is based on a person requiring a minimum number of natural teeth, usually cited as 20, to have adequate dental function. \(^{(2,3)}\) Traditionally lost or missing teeth were replaced to avoid negative side effects and maintain function, \(^{(1,11,12)}\) but this approach contrasts with problem solving strategies \(^{(13)}\) and more recent suggestions are that functional demands, the minimum number of teeth required, and therefore what is considered to be a functional dentition, will vary between individuals. \(^{(14)}\) Despite care from dental professionals and oral health maintenance, teeth can be lost or damaged leading to a reduction in the number of occlusal units.

**Old age:**
"Older persons" are defined as those aged 60 years or over. \(^{(4)}\)

The case for action

**Dental health in the old aged**
Treatment planning for those in old age brings implications for service providers as those within this age group have complex and unique requirements. As oral health improves, older adults are retaining more of their teeth and often have some restored but functioning teeth that require maintenance. \(^{(6)}\) This group are at an increased risk of oral disease due to factors such as poor nutritional status, the cumulative effects of dental disease, medical interventions and decreased dexterity and ability to maintain their oral hygiene. \(^{(15-16)}\) This risk is compounded by low levels of dental service utilisation. \(^{(15)}\) Treatment planning is complicated by people having higher expectations of oral health than in previous generations and a predicted rise in both the absolute and relative population of older people indicates that this is a growing concern. \(^{(8,9)}\)

**Functional dentition**
A functional dentition is necessary for biological and social functions such as chewing, oral comfort, speech, self-esteem and aesthetics. \(^{(10)}\) The concept is based on a person requiring a minimum number of natural teeth, usually cited as 20, to have adequate dental function. \(^{(2,3)}\) Traditionally lost or missing teeth were replaced to avoid negative side effects and maintain function, \(^{(11,12,15)}\) but this approach contrasts with problem solving strategies \(^{(13)}\) and more recent suggestions are that functional demands, the minimum number of teeth required, and therefore what is considered to be a functional dentition, will vary between individuals. \(^{(14)}\) Despite care from dental professionals and oral health maintenance, teeth can be lost or damaged leading to a reduction in the number of occlusal units.

Once the posterior teeth have been lost, treatment options include: \(^{(6,15)}\)

- Maintaining the existing condition
- Replacing lost teeth with a removable partial denture
- Replacing lost teeth with a fixed partial denture.

While these options have benefits there are also drawbacks such as dissatisfaction, a possible increased risk of oral disease and financial cost. \(^{(16-21)}\)

**Shortened dental arch therapy**
The shortened dental arch (SDA) concept is a minimal treatment intervention approach based on the notion that satisfactory oral function can be achieved without complete dental arches and that lost teeth do not necessarily require replacement. \(^{(10,22-25)}\) It is aimed at partially edentulous individuals, de-emphasising restorative treatment in the posterior regions of the mouth and aiming to prevent prosthetic overtreatment and provide satisfactory levels of oral function for the patient. \(^{(26,27)}\) It is proposed, following clinical studies, that patients with at least four occlusal units (one unit corresponds to a pair of occluding premolars and two units corresponds to a pair of occluding molars) have sufficient adaptive capacity to maintain oral function. \(^{(22,26)}\) The World Health Organization has acknowledged that the SDA concept provides a realistic approach when caries levels are high and resources are limited. \(^{(29)}\)

While negative consequences such as compromised oral comfort, pain, distress, migration and temporomandibular joint (TMJ) changes \(^{(30-32)}\) have been reported in SDAs, clinical evaluation indicates that it provides satisfactory oral function and stability in certain patients. \(^{(24,25)}\) Various outcomes such as
chewing function, aesthetics, mandibular stability, signs and symptoms of TMJ disorders, occlusal and periodontal stability, migration, occlusal attrition and patients’ satisfaction and quality of life have all been examined and compared with complete dental arches (CDA) with much of the SDA work being carried out in individuals with anterior teeth and between three and five occlusal units. Results demonstrate:

- SDA provides sufficient, but compromised, chewing function and those with a SDA chew for longer with more chewing cycles until ‘swallowing’.
- Appreciation of the appearance of the dentition is compromised to a small extent but not significantly. There is some pain or distress.
- Migration can occur but it is within acceptable levels.
- The absence of molar support is not a risk factor for the development of temporomandibular dysfunction. Though signs and symptoms for TMJ dysfunction are not provoked, the loss of some support may increase the risk of pain and joint sounds.
- SDA provides durable occlusal stability. Minor occlusal changes occur but do not pose any problem to oral function. Occlusal changes can be self-limiting but signs of increased risk to occlusal stability occur in extreme SDAs.
- Occlusal tooth wear in SDAs does not differ significantly from that of CDA but tooth wear increases significantly with decreased posterior support.
- In SDAs there is a potential risk for the loss of further teeth but this may not be significant.
- Alveolar bone height scores tend to decrease in the same degree as in CDA. SDAs with periodontally involved teeth show continuous breakdown.

Oral function in SDA patients is not significantly enhanced by free-end removable partial dentures (RPD) and patients with SDAs who do not wear RPDs are not at a disadvantage to RPD wearers with respect to nutritional status or mastication.

**Attitude towards SDA**

The SDA concept appears to be widely accepted among European dentists with surveys being carried out during the late 1990s in the UK (consultants in restorative dentistry), the Netherlands, and more widely (European Prosthodontic Association). Generally, practitioners agree with the SDA concept but are relatively inexperienced in its application, though many European Prosthodontic Association members have applied the concept. SDA patients have reported an impaired quality of life depending upon whether or not tooth loss extends to the first molar.

**The evidence**

No difference in nutritional status of partially-dentate elders with SDAs and conventional treatments such as RPDs were seen in a randomised controlled trial (RCT) indicating that the value of a SDA with regards to prosthodontics rehabilitation strategies is not detracted from by having a negative impact on nutritional status. This RCT was conducted in the Republic of Ireland and included subjects with a minimum of six remaining natural teeth in one arch. Participants receiving conventional treatment had all teeth replaced using a cobalt-chromium partial denture while those in the SDA group were restored to 10 occluding tooth contacts using resin bonded bridgework.

A further study was located elucidating the value of shortened dental arch therapy in a planned approach to a functional dentition in old age in comparison to a number of different treatment options. The results of the study, carried out in Japan, illustrate that the SDA concept approach can be questionable from the patients’ point of view. The value placed on SDA as a treatment option was the lowest of the options examined and the concept held a negative association with appearance. The SDA approach was looked at more favourably by men than women.

The study used questionnaires to determine how elderly Japanese people (>60 years) subjectively value treatment options for missing molars. Those taking part in the study were given photographs and descriptions of the process and expected outcomes of cantilever fixed dental prosthesis, resin or metal removable partial denture prosthesis, implant-supported fixed prosthesis and an SDA for missing lower bilateral first and second molars. It should be noted that while the SDA concept appears to be widely accepted by European dentists...
there is remaining scepticism in Japan\(^{(28)}\) and therefore due to this difference in acceptance the translatability of the results to the old aged in the UK may not be straightforward.

The dearth of literature covering SDA in old age has prevented a complete answer to the question being generated. Though studies have been carried out on this treatment concept in old aged individuals, data generated is pooled with those from other age groups preventing extraction. However, the available evidence does imply that the SDA concept may hold value in treatment plans for patients in the old age group.\(^{(8,41,48)}\) Treatment plans adopting an SDA approach will be simplified and more attention can be paid to anterior and premolar teeth. Individuals in this group often have an accumulation of dental problems and are at a higher risk of oral disease. Though restoring complete dental arches may be possible, doing so may be beyond the resources available to the patient; they may lack the motivation to pursue a complex treatment plan or there may be limited possibilities for restorative care. Furthermore, restoring a complete dental arch may hold a guarded long-term prognosis and/or may provide questionable long term benefit. The SDA approach may provide an acceptable level of function without the need for extensive treatment or prosthetics and therefore be more cost effective.

### Methods

#### Search strategy

An initial online search was made of Ovid MEDLINE (1946 to Present) using the following search teams: dental arch.mp. or exp *Dental Arch/ and short$.mp. Filters to identify meta-analysis, systematic reviews and clinical studies were employed.

The following databases were also searched using equivalent strategies:

- MEDLINE (PubMed)
- Science Direct
- Cochrane library (DARE, NHS EED, HTA Database, Cochrane reviews)
- International Association for Dental Research
- Centre for Reviews and Dissemination
- TRIP

There was no limit on research methodology or article language. Hand searching of reference lists and grey literature was also carried out. All searches were conducted in July 2013. Studies were included if they examined SDAs in old age and excluded if data for study participants was pooled, preventing extraction of required data, or if age bands for studies covered too wide a range e.g. ≥ 40 years. For the purposes of this summary old age was defined as aged 60 years or over. The study by Kay et al.\(^{(44)}\) was excluded as although some data was presented for those within the >65 years age group this was isolated and did not cover all variables examined in the study.

#### Results

In total, 228 articles were located. Following a primary sift by the author, 70 articles were obtained as full text, two were not obtained as they were published in Japanese.\(^{(45,46)}\) Following examination of the full text articles two were retained as covering the topic. One publication was an RCT\(^{(38)}\) and the other a qualitative study\(^{(47)}\) (Appendix 1). Some weaknesses were noted following assessment of both publications. Though randomisation and blinding were appropriate and data was recorded for all participants (with none lost to follow up) in the RCT there is a risk of bias as it was unclear who assessed the study participants and information regarding the general health status of participants was not presented. There were indications that the study from Ikebe\(^{(47)}\) also held weaknesses for example it was not clear who conducted the interviews or where they were conducted.
References


## Appendix 1

<table>
<thead>
<tr>
<th>First author, date</th>
<th>Study type</th>
<th>Sample and population</th>
<th>Aim</th>
<th>Method</th>
<th>Salient findings</th>
</tr>
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<tbody>
<tr>
<td>McKenna 2012(^{38})</td>
<td>Randomised controlled trial</td>
<td>44 adults aged &gt;65 years in Cork, Republic of Ireland</td>
<td>Investigate the impact of tooth re-placement on the nutritional status of partially dentate elders</td>
<td>Compared nutritional status of those with conventional treatment to those with an SDA.</td>
<td>Conventional and functionally orientated treatment resulted in an improvement in MNA score.</td>
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<tr>
<td>Ikebe 2010(^{47})</td>
<td>Questionnaire and interview</td>
<td>528 adults aged &gt;60 years living in the community (urban Japan)</td>
<td>Determine how elderly Japanese people subjectively value treatment options for missing molars.</td>
<td>Compared subjective importance for treatment options collected.</td>
<td>Participants valued the SDA treatment option the least out of all considered.</td>
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