J. Dhaka National Med. Coll. Hos. 2015; 21 (01): 61-64

Review Article

The role of the shortened dental arch concept in the management of reduced dentitions

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Abstract :

Current research indicates that a more biological approach to dental care is required to cope with current trends in adult health and to make more efficient use of ever dwindling public financial resources. This paper describes the role of the shortened dental arch concept (SDA) in the management of reduced dentitions, including criteria for its application, possible indications and contraindications, and presents a review of research supporting SDA. In light of recent research, it is suggested that SDA will be of increasing importance as a treatment philosophy for the future elderly.

Introduction :

An increasing number of people are retaining more of their teeth for longer life. The proportion of people in the UK with some natural teeth rose from 70% in 1978 to 79% in 1988 and is likely to reach 90% by the year 2008.The same survey also indicates the continuing prevalence of a high level of dental disease in the adult population.

In addition there is a disparity between professionally assessed need and patient demand for dental treatment, particularly in elderly patients. It is anticipated, therefore, that the dental profession will need to develop new strategic to respond to current trends in adult dental health.

Drummond *et al.* [3]suggest that there is a need to modify current treatment techniques to need the dental needs of the future elderly, as they are currently less likely to seek dental treatment than younger people. Elderly people also have different functional needs to younger people and may not need treatment directed at maintaining complete dentitions. While the traditional approach to dental care has been to maintain complete dentitions, current research suggests that this may not be necessary nor indeed advisable in all patients[4.5].

Limiting treatment goals to provide functional rather than complete dentitions has been suggested as a means of treating middle aged and elderly adults with a history of compromised oral health. 6 views such as these have been influenced by the world health organization`s goal for oral health: `the retention through out life of a functional, asthetic, natural dentition of not less than 20 teeth and not requiring a prosthesis[7].

Strategies in the management of reduced dentitions :

When a patient presents with a reduced dentition, a number of treatment possibilities may be considered. (See Fig. 1)

Replacement of missing teeth may be considered when their loss is causing chewing difficulties or poor asthetics, particularly in patients who are dentally motivated and maintain an adequate standard of oral hygiene: provision of partial dentures to replace missing teethfor poorly motivated patients may accelerate the progression of dental disease.[8]

Tolerance of removable partial dentures(RPD) may also be a problem for some patients,notably in free-end saddle situations,[9] whilst multiple visits for complex restorative treatment may be unacceptable to others, or beyond their financial resources. Limiting treatment goals to provide a functional dentition rather than a complete dentition may be a suitable alternative in such cases.[6]

Strong reservations have been expressed in the past about adopting such a pragmatic approach.[10] failure to replace missing posterior teeth has been implicated by some workers in the aetiology of temporomandibular disorders.[11] Franks suggests that the loss of posterior teeth leads to degenerative changes in the temporomandibular joint(TMJ). However,more recent studies suggest that such changes may be adaptive rather than pathological,[12] and in general do not give rise to functional problems or complaints.

De Kanter,[13] in an epidemiological study of craniomandibular dysfunction(CMD) in a duch population, found that a reduction in the number of teeth does not correlate with CMD except in cases of extreme shortened dental arches (only anterior and canine teeth present).this finding is supported by Witter *et al.*[5]

Removable partial dentures, in particular free end saddle dentures, in the absence of meticulous oral hygiene measures may accelerate progression of caries and destruction of the

periodontal tissus.[8] The contributions of removable partial dentures to oral comfort and oral function in many partially dentate patients may also be questioned. Witter *et al*[14] studied the impact of wearing removable partial dentures on oral function, and found that in the groups of patients studied, chewing and appearance is not significantly improved by these appliances where some natural posterior occlusal support remains.

Shillingburg *et al.*[10] suggest that increased loading of the teeth leads to the destruction of periodontal attachment. However, the knowledge of structure, function and disease processes of the periodontal tissues has increased to the extent that this view is now questioned. Nyman and Ericsson[15] have demonstrated the capacity of the periodontal tissues to tolerate what were previously thought to be excessive loads.

Witter *et al.*[16] found that the response of the periodontal tissues to shortening of dental arches is favourable except in cases of uncontrolled periodontal disease. They also found that there may be some drifting of teeth in shortened dental arches, but that this is generally acceptable to patients. This finding is consistent with the view of Lindhe[17] who states that trauma from the occlusion alone will not result in periodontal tissue break down, but in teeth with progressive periodontal disease, trauma from the occlusion may accelerate progression of the disease process.

Studies such as that by Liedberg *et al*[18] indicate acceptance of missing tooth spaces in significant numbers of patients. This finding is important, especially in relation to the provision of removable partial dentures, as many patients are unlikely to wear such prosthesis unless they perceive there is a need.[19]

Fig. 1- Treatment possibilities for a reduced dentition:

The various treatment possibilities that should be considered when a patient presents with a reduced dentition are:

- Restoration by fixed prosthesis---tooth or implant retained
- Restoration including removable prosthesis ranging from simple removable partial dentures to overdentures
- No prosthetic treatment, but stabling existing occlusion(short end dental arch management)
- Controlled progression to complete dentures.

The shortened dental arch concept :

the shortened dental arch (SDA) concept was conceived and subsequently developed by Kayser and co-worked at the dental school of the university of Nijmegen, the Netherlands.

The concept suggest that the minimum number of occluding pairs of teeth required to provide satisfactory levels of oral function may vary according to age and other factors. This is shown in Table 1 the optimal and suboptimal levels are based on both cross-sectional and longitudinal data.[4.5]

Kayser and Witter[20] suggest that the anterior and premolar teeth are the 'strategic' part of the dental arch and are essential for satisfactory oral function and oral comfort. The SDA concept involves the direction of treatment efforts and resources at the preservation of the anterior and premolar teeth. Complex restoration of the molar teeth should only be undertaken in the absence of 'limiting factors'.[6] Such limiting factors are considered to include a history of poor dental health, particularly in the molar teeth, and financial restrictions. Limiting treatment goals to provide a shortened dental arch (or arches) is suggested when limiting factors are present. This will provide a suboptimal, but acceptable, oral functional level.

Table-1. Oral function requirement in relation to age, expressed as minimum number of occluding pairs of teeth.

Age	*Functional level*	*Occluding pairs*
20-50	I optimal	12
40-80	II suboptimal	10 (SDA)
70-100	III minimal	8 (ESDA)

SDA – Shortened Dental Arch.

ESDA – Extreme Shortened Dental Arch.

The problem oriented approach as described by Kayser at al. May be used in planning[21] care for a broken down dentition. This approach involves making an inventory of the patients dental complaints and planning treatment to resolve these complaints. Teeth should only be replaced if they are considered to be essential for restoration of comfort, function, occlusal stability and cosmetic appearance.

While suggesting that it is preferable to maintain a complete dentition wherever possible, Kayser argues that this is not advisable or feasible in all patients, and that in clinical practice. The SDA approach is a realistic alternative. According to Kayser,[6] SDA may be appropriate for patients meeting particular criteria (see fig.2) but may be contraindicated in patients less than 50 years of age and where there is particular clinical criteria (See Fig.-3).

Possible advantages of SDA include:

- Simplification of holistic restorative management and subsequent maintenance.
- Simplification of oral hygiene maintenance.
- Enhanced prognosis for the remaining teeth when the patient is motivated to maintain his own dentition.

It is suggested[6] that the prognosis of a shortened dental arch depends on:

- Maintenance of excellent oral health.
- The spatial relationship between the maxillary and mandibular arches.
- The age of the patient
- The periodontal condition of the anterior and premolar teeth.
- The adaptive capacity of the TMJ
- Occlusal activity.

Research to support the SDA concept :

There is at present a paucity of longitudinal data available relating to oral function and shortened dental arches Witter and co-workers have monitored a group of patients managed by means of SDA over period of 6

years, and have concluded that in the patients investigated, shortened dental arches provide sufficient oral function and oral comfort. A study by Leak et al., which reports baseline data collected from longitudinal study on the oral health of middle-aged and elderly adults living in Ontario, Canada, concludes that there is no socio-functional benefit to be gained from the replacing missing molar teeth in shortened dental arches unless the patient has fewer than three occluding pairs of posterior teeth.

Fig. – 2: When SDA is appropriate.

SDA may be appropriate for patients meeting the following criteria:

- Progressive caries and periodontal diseases confined mainly to the molar teeth.
- Anterior and premolar teeth of favorable prognosis.
- Financial and other limitations to dental care.

Allen et al. conducted a study on the attitude of the consultants in restorative dentistry in the UK towards the SDA concept, and their experiences with this approach. The main conclusion from this work are that the SDA concept is widely accepted by the consultants, despite certain reservations regarding the established criteria for SDA, and that SDA has a place in contemporary clinical practice.

While recent work favors increasing emphasis on SDA, Ettinger, for example, has suggested that acceptable dental status from a functional view point has yet to be adequately defined. Further research is therefore required to investigate, amongst other priorities, the long-term survival rates of dentitions managed by means of SDA, and also to asses whether current criteria for SDA management need to be extended.

Fig. – 3: When SDA contraindications.

SDA may be contraindicated in patients under 50 years of age and with the following clinical Criteria:

- A dentoaveolar malrelationship such as Angle class III or a severe Angle's Class II relationship, or an anterior open bite.
- A marked reduction in alveolar bone support.
- Evidence of parafunction or abnorlam wear for the age of the patient. Pre-existing TMD.

Conclusion :

Despite limitations in existing knowledge and the need for further research, it is suggested that with an increasing number of patients retaining more of their teeth of longer in life, SDA will be of increasing importance as a treatment strategy in the management of reduced dentitions in middle-aged and elderly adults.

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