Why Replace More? Settle For Short

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Abstract: *Operative dentistry generally aims at restoring all decayed teeth to maintain the complete dentition. This aim to preserve dental arch of atleast 28 teeth might not be possible in developing countries due to dental or financial reasons.*

The 1982 WHO oral health goal for developing countries was set as the retention of twenty functional, aesthetic natural teeth without resorting to a prosthesis which is in line with the findings of the SDA research

Thus the concept of short dental arch could be highlighted as an acceptable oral health status even in developing countries where extraction is the primary treatment for decayed teeth and pain relief. SDA is a simplified treatment approach which still meets the requirements of what would be considered for a satisfactory oral function.

Keywords: *Short dental arch, removable partial denture, TMJ, Implants.*

I. INTRODUCTION

Generally, operative dentistry aims to restore all decayed teeth to maintain occlusion of complete dental arches (CDA). This aim to preserve dental arches of at least 28 teeth might not be attainable for dental or financial reasons. In this respect, a World Health Organization workshop described the goal for oral health as "the retention throughout life of a functional, aesthetic, natural dentition of not less than 20 natural teeth and not requiring recourse to a prosthesis"[1]. Especially in developing countries, extraction is the most common treatment for decayed teeth and pain relief. This may lead to interrupted dental arches, but shortened dental arches (SDA) may also result after extractions. With the exception of individuals with developmental disorders, most of the patients are provided with a complete dentition consisting of 28 teeth. This occlusal system is not stable during life as changes occur due to physiological as well as pathological processes such as tooth wear, loss of alveolar bone, caries, periodontal disease, traumatic injuries or severe conditions such as periodontitis, labial and mesial tooth migration, impaired occlusal stability and temporomandibular disorders. The need to replace every lost tooth in order to maintain the health of the masticatory system was an opinion based more on belief than scientific evidence. The best solution might therefore be a treatment with limited goals which still meets the requirements of what could be considered for a satisfactory oral function.

Molar replacement may not be necessary in terms of dietary demands, but it may be indicated for arch stability and esthetic and psychological reasons. The number of teeth included in the final restoration should be decided for each patient on an individual basis after considering all esthetic, phonetic, functional, emotional, and economic factors.

Shortened Dental Arch

The SDA is defined as a specific type of dentition with an intact anterior region and a reduction in the occluding pairs of posterior teeth, starting posteriorly.The term 'shortened dental arches' (SDA) was first used in 1981 by the Dutch prosthodontist Arnd Kayser for a dentition with loss of posterior teeth. His studies concluded that there is sufficient adaptive capacity in subjects with SDA when at least four occlusal units are left (one unit corresponds to a pair of occluding premolars; a pair of occluding molars corresponds to two units). Kayser emphasized that it was needless to restore all the teeth which are lost for successful and satisfactory functioning of oral function. The molars do not have any exclusive function; all separate functions performed by molars are also provided by the anterior teeth and premolars (Table 1). Kayser developed a system considering occlusal units as premolar equivalents in which a molar corresponds to two occlusal units and a premolar to a single occlusal unit (Figure 1). The shortened dental arch (SDA) concept is related to the World Health Organization's goal for oral health, which is, 'the retention throughout life of a functional, aesthetic, natural dentition of not less than 20 teeth and not requiring prosthesis'.

Controversy regarding side effects of non-replaced molars such as:

1) Higher rates of temporomandibular disorders
2) Tooth migration, supra eruption and increased wear
3) Insufficient chewing efficiency and performance
4) Compromised aesthetics

Also has to be answered when SDA is considered. The World Health Organization has acknowledged that the SDA concept provides a realistic approach when caries levels are high and resources are limited.

According to Davenport et al, the classical criteria for application of the SDA concept are as follows:

1) Dental problems (caries, periodontal disease) confined mainly to posterior teeth;

2) Good prognosis for approximately 10 pairs of anterior and premolar teeth which are in a favorable occlusal relationship;
3) Limited possibilities for extensive restorative care eg. financial restrictions, ill health or disability;
4) Absence of para-function or mandibular dysfunction;
5) When the affordability of prosthesis is low.

Table 1

	Anterior	Premolar	Molars
Biting	+	-	-
Chewing	-	+	+
Speech	+	-	-
Esthetics	+	+	+/-
TMJ(mandibular stability)	+	+	+
Dental arch(occlusal stability)	+	+	+
Preservation of alveolar process	+	+	+

+ = major involvement; ± = minor involvement (depending in age, adaptation) ;
– = no involvement

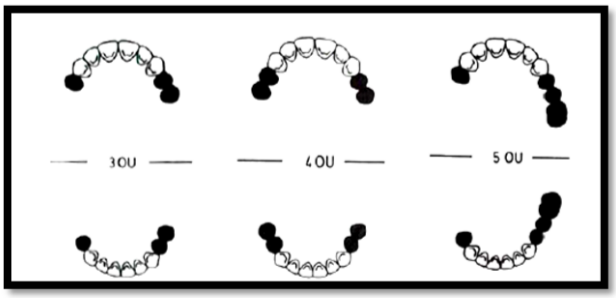

Fig 1: Schematic representation of SDA with 3, 4 and 5 ou (Occlusal Units).

Removable Partial Denture

Removable prostheses may be a less expensive option than implant- supported crowns for increasing arch length, although they may not provide patients with the same chewing ability or level of satisfaction. Removable partial dentures can be detrimental to the supporting teeth when plaque retained on the prosthesis also accumulates on the teeth, increasing the risk of decay and bone loss. Compression of the prosthesis against the residual ridge during chewing may cause bone loss that can change the fit of the prosthesis on the residual ridge and increase stress at the clasp-tooth interface. The bulk of the prosthesis and its attachment to adjacent teeth prevent it from being the most natural method for restoring lost tooth structure. A 1999 study by Kuboki et al found that some patients do not use their removable prosthesis and are more comfortable with an SDA.[3]

A randomized clinical trial revealed no statistically significant difference in frequency of tooth loss after 3 years of follow-up among shortened dental arch subjects with and without RDP.

In another study, subjects with a shortened dental arch only perceived benefits of RDP from a OHRQoL perspective if anterior teeth replacements are included. This study shows that shortened dental arches can last for 27 years[13] and over. On dentition level, the number of treatments provided is comparable with complete dentitions. Herewith, this study contributes to the body of evidence that the SDA concept is a cost-effective approach. Moreover, replacement of absent posterior teeth by free-end RDP in shortened dental arches is not recommendable since RDP seems to be associated with a less favorable clinical course [2]

Nassani et al concluded that prognosis of is not predictable and its contribution to oral functions in patients with SDAs is considered to be dubious [4]

Implant

An SDA may preclude the need to place implants in soft posterior bone sites adjacent to sinus and neurovascular anatomy or to perform bone grafting for site development, allowing dentists to avoid the cost of additional implants and crowns. Conversely, an SDA offers less chewing surface area and may increase force due to function or para-function on the remaining teeth and temporomandibular joints (TMJs).

Patients with limited ability to tolerate extensive dental procedures and those who are comfortable with an existing SDA may not want to increase their arch length. Financial limitations may also dictate the extent of restorative dentistry. Patients may perceive that decreased proprioception prevents the restoration from feeling as natural as original teeth. Implant-supported restorations provide superior function and patient satisfaction compared to the less expensive removable prosthesis [3].

Abu and Marnewick in their case report on Implant-supported crowns for a shortened dental arch have reported that clinical outcomes of using implant supported crowns till the second premolar area were highly satisfactory for the well-oriented patient. An arch extending to the second premolars was adequate for normal

functional demands, oral hygiene, oral comfort, and possibly reduced costs on a dentition subjected to modern diet.[6]

TMJ Problems

The absence of molars is a clinical concern, since it could place more force on the remaining dentition and TMJs during tooth contact. The potency of this increased force may be an individual response, depending on the duration and intensity of tooth contact from oral habits and noctural or diurnal bruxing. Severe bruxers may display significant tooth wear, fracture, mobility, or migration which may not be seen in non-bruxers. If teeth have little contact, no deleterious effect from excessive force would be expected.

Radiographic remodeling of the condyle has been described as a functional adaptation to mechanical stress. Kopp and Rockler reported an association between radiographs indicating reduced joint space and subcortical sclerosis and a loss of molar support. Hansson et al found a correlation between radiographic structural bone change and same-side loss of molar support; they attributed these changes to increased biomechanical loading of the TMJ. Cadaver studies showed a correlation between missing teeth and the amount of bony remodeling and articular disc alteration while also showing that the risk of osteoarthritic changes is increased in patients who have lost several teeth or are edentulous. [3] Hattori et al recorded the pressures generated from clenching on two bite splints of different designs, one full-arch and one SDA. The authors used finite element analysis with these clinical data to determine the resulting forces at the TMJ. During maximum voluntary clenching, SDAs produced smaller TMJ loads compared to a complete dentition design. The SDA never caused over- loading in the TMJ, as the clenching strength was limited by the neuromuscular regulatory system via the periodontal receptors [5].

TMJ pain and restricted mouth opening were reported in low percentages in subjects with SDA. Sarita et al on 2003, reported the subjects has a greater prevalence of joint sound but there is no difference in pain, mandibular mobility, maximum mouth opening or clicking/crepitus of the joint for SDA and control group [12].

Chewing efficiency and performance in SDA[14]

The literature indicates that masticatory ability closely correlates with the number of teeth and impaired where there are fewer than 20 uniformly distributed teeth in the mouth. Overall literatures concluded that if the premolar regions are intact and there is atleast 1 pair of occluding molars, SDA does not impair the masticatory ability. In contrast they also concluded that there is severely impaired masticatory ability when the patient has a reduced number of occluding premolars and/ or asymmetric arches especially with hard foods

Dentist attitudes towards the SDA concept

A survey in the Netherlands for dentist attitude to SDA concept, with 64% response rate found that, all but one of the respondents viewed the SDA concept as having a useful place in clinical practice [7]. When <10% of patients were treated , outcome of SDA management was generally satisfactory.

In UK [8] the results of a survey among consultants in restorative dentistry indicated that, 95% of the participants were of the opinion that SDA had a place in contemporary clinical practice and the great majority (88%) reported having prescribed SDA therapy during the last 5 years. Among the respondents, 63% had used it 'on occasion' and 25% 'frequently'. Around four-fifths (82%) of the participants indicated that SDA therapy was satisfactory in terms of oral function, comfort and well-being. However, 37% of the participants had experienced a need to prosthetically extend SDAs after first applying the SDA concept.

In Sweden [9] the response rate was 54%. Among the respondents, 62% were men and 38% were women. Fifty-six percent were private practitioners (PPs) and 44% were employed by the public dental health service (PDHS). The results showed small differences in attitudes between various groups of practitioners but large individual variations. In general, Swedish general practitioners had a positive attitude toward the SDA concept with respect to oral function and oral comfort, and have an affirmative opinion towards the concept.

Survey in Tanzania [10] revealed that, most of the responding dentists were of the opinion that SDA provided satisfactory or acceptable chewing function (71%), dental appearance (79%), and oral comfort (48%). Most dentists (89%) indicated that the SDA concept had a useful place in clinical practice. However, only 3% of dentists indicated regular use and 68% had never applied the SDA concept; furthermore, 89% of the dentists responded that they usually inserted free-end acrylic partial dentures in subjects with SDA. Questionnaire study done among 51 specialist Prosthodontists in Kerala and Karnataka suggested an overall positive opinion toward the SDA concept [15].

These surveys of dentist attitudes in several countries indicated that a great majority of the responding dentists accepted the SDA concept but that it was not so widely practiced. Especially in Tanzania, there was a striking discrepancy between the theoretical and clinical/practical acceptance of the SDA concept.

Criteria for Application of SDA [11]

When considering the SDA concept as a treatment approach to simplify a cumbersome treatment plan, the clinician should assess whether subjects meet the following criteria:

1) Major problems (caries, periodontal disease, severe tipping and drifting as a result of interrupted dental arches) confined mainly to the molar region.
2) Good prognosis of the anterior and the premolar regions.

3) Limited possibilities for restorative care.
4) Patients are motivated for maintaining remaining dentition

Advantages of SDA Concept [11]

1) The remaining teeth are easily accessible for oral hygiene and restorative procedures.
2) The shortened dental arch concept is a simplification of restorative treatment
3) It enhances prognosis for the remaining teeth (due to quality care).
4) It reduces the amount of restorative work and the associated costs, thus allowing more people to benefit from the available resources.

Disadvantages of SDA Concept [11]

1) Psychological difficulty of having lesser number of teeth.
2) Greater prevalence of joint sounds with subjects having only unilateral posterior support and those with no posterior support.
3) The combinations of increased occlusal loading and existing periodontal disease represent a risk factor for further loss of teeth in subjects with existing pathology in anterior dentition also.

Contraindications to SDA[11]

1) Marked dento-alveolar mal relationship - severe Angle Class II and Class III relationship.
2) Parafunction - intensive bruxism
3) Pre-existing TMD
4) Advanced pathological tooth wear
5) Advanced periodontal disease - marked reduction in alveolar bone support
6) Patient under the age of 40 years

II. CONCLUSION

- The concept may be considered a significant development to have influenced prosthodontic thinking in the last few decades.
- The literature, predominantly from the European Union, indicates that the SDA concept is both in line with current occlusion theories and in accord with the problem solving approach to modern dentistry
- Therefore the concept deserves serious consideration in treatment planning for partially edentulous patients.
- The SDA concept is relevant for developing countries as it offers a functional approach at a reduced cost without compromising patient's oral health care.

III. REFERENCES

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