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Treatment Options for the Free End Saddle

Abstract: Many treatment options are available for the management of the free end saddle. This paper reviews past and current treatment methods for management of this situation.

Clinical Relevance: To understand the problem posed by the free end saddle and the techniques available to clinicians for its management in general dental practice.

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Figures published by the World Health Organization (WHO) reveal that the proportion of older people aged over 65 is currently growing at a faster rate than any other age group.[1] As practitioners we are therefore far more likely to encounter partially dentate patients, highlighting the importance of being fully aware of methods of restoring the dentition.

A functional dentition has been defined as that which allows an individual to eat, speak, and socialize without active disease, discomfort or embarrassment.[2,3] According to the WHO, a minimum number of 20 teeth are needed to fulfil this requirement[2] and the Adult Dental Health Survey uses the presence of 21 teeth as an indicator of a functional dentition.[4] Though many patients may possess a functional dentition according to the WHO, the number of teeth required to satisfy functional demands varies with each individual and the prosthetic replacement of missing teeth is commonly seen. Missing teeth are most likely to be replaced with a fixed or removable prosthesis in the 55–64 year age group.[4] When considering the replacement of missing teeth, the distal extension saddle, particularly in the lower arch, presents a considerable challenge. This situation is encountered when there are no teeth at the distal end of an edentulous area, as seen in Kennedy Class I and II classifications.[5] This lack of distal abutment teeth creates problems with support and retention should restorative treatment be sought.[6] Though many management options are available, none appears to provide an ideal solution to this scenario. There are concerns regarding decreased oral function with a reduced occlusal table,[6,7] and an increased prevalence of periodontal disease and caries when wearing both fixed and removable prostheses has been reported.[8,9]

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The shortened dental arch

It may be difficult to decide whether or not to replace missing posterior teeth. The shortened dental arch (SDA) concept provides one potential management option for such a scenario. It is a treatment option that has gradually met with acceptance amongst the dental community as having a useful place in clinical practice.[10] It describes a dentition with an intact anterior region and a reduction of occluding pairs of posterior teeth beginning posteriorly[11] (Figure 1). Despite some reports of reduced oral function and comfort in those patients with an SDA, much of the literature comparing complete and shortened dental arches indicates no clinically significant difference in masticatory ability, oral comfort, aesthetics, migration of remaining teeth and periodontal support.[7,12,13] Clinical studies have shown that sufficient adaptive capacity remains in those subjects retaining at least four occlusal units (one unit corresponding to one pair of occluding premolars, two units corresponding to one pair of occluding molars).[11]

Figure 1. Maxillary shortened dental arch.

Furthermore, in a 9-year follow-up study, no significant differences were found in temporomandibular joint disorders between subjects with complete and shortened dental arches.[14]

Not every patient is an ideal candidate for SDA therapy and a recent review by Allen emphasized the importance of appropriate case selection, as failure may potentially compromise future treatment options for the patient.[15]

Despite evidence providing firm support for the SDA concept as a viable clinical option in certain conditions, there still remains a discrepancy between its theoretical acceptance and practical use.[10,12] There is often a perceived need to restore lost posterior teeth, and the SDA may not even be offered as a practical option for the partially dentate. In a survey conducted amongst UK restorative dentistry consultants, 95% of participants felt that the SDA had a place in contemporary clinical practice, although 37% still went on to restore the SDA with either a fixed or removable prosthesis, in spite of acceptance of the theory.[16] When considering management options for the free end saddle the option of no treatment, where appropriate, should be placed toward the top of the list.

Removable prostheses

Restoration of the shortened dental arch is quite often achieved with a removable partial denture (RPD). Shortened maxillary arch extension with an RPD is less problematic than the mandibular arch owing to a greater denture bearing area and lower soft tissue displaceability.[6] In the lower arch, the absence of distal abutment teeth creates problems with support and retention. The mucosa of the edentulous area is more displaceable and offers less support than the abutment tooth. This support differential causes a removable prosthesis to sink out of occlusion under load, eliminating effective occlusion and mastication.[5,6] This has been reported to accelerate bone resorption owing to the denture relying entirely on the residual alveolar ridge for its support.[5,6] Additionally, the absence of distal abutment teeth makes direct retention of the distal end of the saddle impossible. The denture is able to rotate around the abutment tooth and has a tendency to drift, with the potential to cause injury to the abutment tooth and soft tissues, producing discomfort.[5,6]

Figure 2. Photograph showing posterior extension of lower working impression.

Studies suggest approximately 20% of SDA patients wearing an RPD are dissatisfied with them owing to problems with comfort, function and appearance and some have even reported discontinuing their use over longer periods.[17]

Furthermore, there is some data to suggest an increased incidence of caries and periodontal breakdown associated with RPDs,[8,9,18] though work published by Bergman has shown that, whilst RPDs may enhance plaque accumulation, it is possible to produce little or no damage to the remaining teeth and periodontal tissues in those patients with carefully designed prostheses and high levels of oral hygiene.[19,20]

Attention to several key design elements can aid in the construction of satisfactory lower distal extension saddle dentures. These features include:

- Simple rigid design;
- RPI system;
- Balance of forces;
- Precision attachments;
- Overdentures and telescopic crown retained dentures.

Simple rigid design

Accurate fully extended working impressions ensure optimal load distribution. Mandibular free end saddles should be extended posteriorly on to the anterior third of the retromolar pad, and laterally they should be limited by the buccinator muscle (buccally), and the palatoglossal arch, superior constrictor, and mylohyoid muscle (lingually)[21] (Figure 2). A reduced area of occlusal table has been shown to reduce loads generated during mastication and this can be achieved by narrowing, shortening and even omitting artificial posterior teeth.[5]

Figure 3. (a) Pre-operative unilateral free end saddle. **(b, c)** Free end saddle restored with RPD providing indirect retention. (Courtesy of Dr Shuva Saha.)

Other aspects of design may include the use of wrought clasps which do not rigidly hold the tooth, mesial placement of rest seats to allow more even load distribution, and indirect retention. This term refers to those elements of an RPD that counteract the rotational movement seen in an occlusal direction about a fulcrum line along the clasp axis. The portion of the RPD mesial to this fulcrum will sink in towards the tissue, which is resisted by the indirect retainer components, typically made up of one or more rest seats (occlusal rests, cingulum rests) and the supporting minor connectors. They are usually placed as mesially as possible from the distal extension saddle, in order to optimize the leverage against dislodgment[5,22] (Figure 3a–c).

a

b

Figure 4. (a) RPD housing magnetic retention system. **(b)** Magnetic abutment attachment.

RPI system

The RPI system is designed to avoid harmful torque on the distal abutment tooth. It comprises an occlusal rest (R), distal guide plate (P) and a gingivally approaching I bar (I) clasp (Figure 3). These components allow vertical rotation of the distal extension saddle into the underlying mucosa during loading. As the saddle is pressed into the mucosa, the denture rotates about a point close to the mesial rest located on the distal abutment tooth. The distal guide plate and I bar disengage from the tooth and avoid potentially harmful torquing forces to the tooth and supporting structures.[5]

Balance of forces

A modification of the RPI system is available commercially as *Equipoise* (**www.equipoisedental.com**). It consists of a mesial rest seat and guide surface with lingual cusp arm extending into a distal undercut from the rest.[5] It has the opposite effect from the RPI system as the abutment tooth is held in a rigid manner.

Precision attachments

Studies have demonstrated that RPDs retained with precision attachments can positively alter patient attitudes towards wearing RPDs, being preferred in most cases.[23] They are usually made up of two components, one located on the abutment tooth and the other housed in the RPD. When the corresponding parts are coupled, they produce positive retention and stability. There are five main groups of precision attachments (intracoronal, extracoronal, studs, bars and auxiliary) and readers are directed to the recent review of precision attachments by Preiskel for details regarding indications for use and descriptions of these main groups[24] (Figure 4a, b).

Overdentures and telescopic crown retained dentures

Where part of the roots or crown of a fractured molar remain, simple preparation may allow these teeth to serve as overdenture abutments, often without the need for elective root canal therapy.[25]

Overdentures are useful for the maintenance of alveolar bone and proprioception, and are known to enhance denture retention.[5] An oral hygiene programme to include brushing and/or fluoride application would aid in the prevention of caries.[5]

Telescopic crowns have also been shown to aid in the retention of partial dentures and are widely used on the continent.[26] They are made up of a primary coping on the abutment tooth and a secondary coping (crown) located in the RPD, which is an accurate negative duplication of the primary part. The primary and secondary parts interlock, thus aiding retention. Although studies indicate a high rate of patient acceptance, clinical data on the long-term survival of these prostheses is currently rather limited.[26]

As seen in other fields of healthcare, treatment options available are always under review and constantly evolving. The altered cast impression technique is one such example. Whereas it was once believed that taking an impression of the alveolar mucosa under controlled pressure would improve load distribution and thus denture stability and support, a recent randomized clinical trial has suggested that this technique offers no significant advantages over non-specialized careful impression techniques.[27] The periodontal tissue destruction associated with stress breaker designed dentures provides another example of a technique no longer favoured, furthermore highlighting the need for continued evidence-based work.[18,19]

Fixed prostheses

Cantilevered bridgework

Cantilevered bridgework provides a method of extending an SDA by a maximum of one unit bilaterally. Conventional bridgework would be indicated when faced with a heavily restored abutment tooth. This option can often improve the appearance of the abutment but at the cost of heavy tooth destruction, increasing the risk of pulpal complications.[28] Treatment costs are likely to be higher than compared to an RPD, but this option has reasonable longevity with studies indicating a mean survival rate of between 15–20 years.[29]

Whilst resin-retained bridges are unable to improve the aesthetics of an abutment, they have the chief advantage of being minimally invasive, typically relying on bonding to enamel on the abutment tooth.[30] With appropriate case selection and design, resin-retained bridgework has become more predictable, with data indicating a survival rate of 74% after 4 years, the most frequent reported complaint being that of debonding.[30,31]

The advent of fibre-reinforced composites in recent years has permitted the use of fibre-reinforced bridgework. This technique employs fibres to reinforce laboratory composite material, thereby enhancing the physical properties. It offers the advantage of improved aesthetics with the use of tooth-coloured retainers as opposed to cast metal wings, but there is currently limited clinical data as to the longevity of fibre-reinforced composites.[32]

Implant-retained prostheses (crown or bridge)

The development of predictable osseo-integration techniques has led to more sophisticated fixed options when considering the distal extension saddle. Implant-retained prostheses provide greater scope for SDA extension than that offered by cantilevered bridgework. Studies indicate good long-term survival rates[33] and high

a

b

Figure 5. (a, b) Post-operative mandibular SDA extended with implant-retained bridges. (Courtesy of Dr Craig Barclay.)

levels of patient satisfaction, making this an excellent alternative in those patients unable to tolerate RPDs, despite their greater expense.[33,34]

Treatment is lengthy and involves careful planning with regard to implant positioning, placement, design of the fixed prosthesis and maintenance. The finished prosthesis should restore function and aesthetics whilst limiting the occlusal loads distributed to the supporting implants to within physiological tolerances. Great care must be exercised with this option as even the smallest technical and clinical errors can be extremely difficult and costly to correct[33] (Figure 5 a, b).

Summary

When considering whether an SDA should be restored with a removable prosthesis, one must evaluate the harmful effects posed by the prosthesis on the soft tissues and remaining dentition against the potential risks of reduced posterior support.

Whilst removable prostheses may provide an affordable treatment option, in the absence of adequate plaque control, they have been linked to an increased risk of periodontal tissue destruction and caries compared to alternative treatment options. Additionally, many patients may face more difficulty adjusting to a removable prosthesis psychologically than compared to fixed prostheses, which have been associated with greater patient satisfaction. Cantilever bridgework provides a means of extending the shortened dental arch but restoration is limited to one unit on each side, a limitation overcome with implants if anatomy and finances are favourable. There are a number of acceptable treatment options available, and it remains the responsibility of the practitioner to be aware of such options.

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BookReview

Current Concepts on Temporomandibular Disorders. By Daniele Manfredini. Quintessence Publishing Co, New Malden, 2010 (320pp h/b, £148). ISBN 978-1-85097-199-3.

This is a book which has resulted from the contributions of 45 authors with the aim of addressing current concepts on temporomandibular disorders. It is divided into four sections.

The first deals with anatomy of the temporomandibular joint and masticatory muscles, TMD classification and TMD as a chronic pain disorder. The second part deals principally with aetiology of temporomandibular disorders, subdivided into chapters on aetiology of muscle disorders, disc displacements, TMJ osteoarthrosis, bruxism and, finally, there is a section of future perspectives in TMJ pathophysiology. The third section is devoted to diagnosis, including clinical assessment, psychological assessment and imaging of the TMJ. This section then widens its remit to include an instrumental approach to diagnosis and further diversifies to include differential diagnosis of orofacial pain, headache and temporomandibular disorders, the relationship between otologic and TMD symptoms and examines malocclusion and body posture. The final section is on management of temporomandibular disorders but this is not a clinical treatise. This section follows the format of the rest of the book in being a literature review of current thoughts on procedures. The overall feeling of this book therefore is one of a large literature review and not of a clinical manual.

The reader gets the feel of 33 very different chapters written by different authors and to this extent it lacks some editorial continuity. This is demonstrated throughout the book by authors presenting different viewpoints. One example is that three different authors present very different viewpoints on the importance of bruxism and there are similar contradictions in relation to TMJ imaging. There is also a chapter devoted to bruxism and TMD but there is no reference made to tooth surface loss, even though this is illustrated in figures.

There is a strong emphasis throughout the book on psychosocial aspects of temporomandibular disorders, however again this is reflected as a literature view rather than giving the reader specific guidance of what is within and what is outwith the dentist's area of expertise.

The sections on classification of temporomandibular disorders reflect the difficulties that are commonly accepted. The author suggests that classifications for epidemiological and research use have little clinical relevance and that some clinical classifications are 'not simple if even possible'.

If the book is to be revised at a later date, a useful addition would be a Glossary of Terms as several of the terms used will not be familiar to non-American readers. This is especially so in the earlier chapters.

The authors may have made a rod for their own back as 'current concepts' do not remain current for very long and in a book based on a literature review will need to be continually updated.

On a positive note, however, this book does provide a good 'position statement' and will bring the reader up-to-date as things stand at the time of writing and has a strong basis of evidence-based research.

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