Oral rehabilitation with removable partial dentures in advanced tooth loss situations

ABSTRACT

There is a global trend for people to retain more teeth later in life. For this reason, it is common to see patients seeking treatment to replace the loss of a considerable number of teeth. Removable partial dentures are frequently prescribed for these patients. This paper summarizes the effects of tooth loss on quality of life and provides a clinical guide to the management of patients with advanced tooth loss with removable partial dentures.

Key words: Dentures; Quality of life; Tooth loss

Introduction

In the past, total edentulism was believed to be a natural consequence of the process of ageing. With rapid improvements in oral health, there is a global trend for people to retain more teeth later in life. In spite of this, tooth loss is still a problem in elderly people, and in individuals compromised by certain medical conditions. The 2001 Hong Kong Oral Health Survey revealed that tooth loss is still very prevalent, especially among elderly people. More than half of the 65- to 74-year-old non-institutionalized population had retained less than 20 teeth. Of these, 34% were wearing partial dentures and 37% were assessed as needing partial dentures. For these patients, fixed prostheses with or without implant support may not be feasible for various reasons, e.g. lack of suitable abutments, general health problems, and financial constraints. Removable partial dentures (RPDs) can be useful in such a situation. A recent Finnish study found that offering good-quality removable dentures can alleviate the problems caused by having a high number of missing teeth. Nevertheless, many of these cases can be rather complex and difficult to rehabilitate.

Tooth loss and quality of life

It is common knowledge that tooth loss brings with it problems of esthetics, function, and socialization. To the dentists, the main aim of providing dentures may be to restore the physical functions that have been impaired by tooth loss. However, to the patients, it is much more than that. They focus more on the social meanings of the mouth. A study of the emotional effects of tooth loss among partially dentate populations in the UK and Hong Kong found that 49% of the study population had difficulty accepting tooth loss, and 35% of them felt unprepared for the effects that tooth loss had upon them. A similar
study conducted on community-dwelling elderly people in Hong Kong also found that people with considerable tooth loss experienced significant disability because of the restrictions it imposed on their daily living activities, food choices, and enjoyment of food in particular.

A paradigm shift in outcome measures within medical and dental fields, from a disease-centered biomedical approach to a patient-centered biopsychosocial approach, has occurred. Quality of life (QoL) has emerged as an important parameter for evaluating quality and outcome of health care. Enhancement of QoL has become one of the main goals in clinical medicine and dentistry. Oral health, being an integral part of general health, contributes to QoL.

In a survey of older people in the UK, it was found that people perceived oral health as being important to their life quality in a variety of different ways. Most frequently its impact on function (eating) and symptoms (comfort) were considered most important.

It is well documented that tooth loss compromises oral health–related QoL (OHRQoL) regardless of age and general health status. People with a reduced number of remaining teeth or a decreased number of occluding pairs of teeth were found to have a deterioration in OHRQoL. In a study assessing the association between the oral state and general health in relation to QoL, it was found that the devastating effects on life quality of tooth loss without replacement were comparable to those caused by major medical diseases such as cancer or renal diseases. It was also noticed that tooth loss in the maxilla had a stronger impact on the reduction of OHRQoL than that in the mandible, probably due to poor communication and reduced masticatory function limiting social participation. Oral rehabilitation by means of removable or fixed prostheses significantly improves the OHRQoL in partially dentate and edentate people. On the other hand, people with considerable tooth loss but without recourse to removable dental prostheses were found to have a reduced OHRQoL.

Rehabilitation of extensive tooth loss

Patient preparation

People with extensive tooth loss are likely to have further tooth loss. Provision of prostheses to replace missing teeth without taking the underlying cause of tooth loss into consideration is undesirable. Likewise, provision of prostheses in people with uncontrolled diseases can be detrimental to oral health and can compromise the benefit of tooth replacement, if no attempts are made to control disease progress in the first instance. Since dental caries and periodontal disease (or their sequelae) are the two major diseases leading to tooth loss, risk assessment becomes highly critical so that risk factors can be identified, controlled, modified, or reduced. Reduced saliva flow, frequent sugar intake, inadequate oral hygiene, and the presence of partial dentures are some of the more common risk factors. Periodontal disease is a multifactorial disease and a number of local, systemic, and environmental factors act as important modifiers of the development and progress of the disease. Some of the prominent and confirmed risk factors include race, age, gender, socioeconomic status, diabetes mellitus, smoking, genetics, host response factors, oral hygiene level, occlusion, presence of caries lesions, and presence and quality of restorations.

Studies have been carried out to identify predictors of tooth loss. In a 10-year longitudinal study of adults in the US, the percentage of teeth with restorations, mean probing pocket depth score, age, tobacco use, alcohol consumption, number of teeth present, and male gender were reported to be significant predictors. In two other European studies, social class and level of education were also found to be significant predictors of tooth loss. In mainland Chinese, age, high number of teeth with caries lesions, presence of teeth with attachment loss of ≥7 mm, presence of mobile teeth, and a low percentage of sites with subgingival calculus deposits have been proposed as significant predictors. Given the results of these studies, it is apparent that tooth loss is the result of complex interactions among a number of predictors, and no single factor is a dominant predictor. Furthermore, the set of tooth loss predictors may vary by population and by gender.

About one in five people felt unprepared for the effects of tooth loss, and more than half said that better communication would have helped, according to a study of Hong Kong elderly people. By the same token, patients have to be psychologically prepared to receive RPD treatment, first-time denture wearers in particular. They should be well informed about the treatment procedures,
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duration, outcome, and plausible complications. Treatment expectations must also be carefully discussed.

It has to be emphasized that there are situations where the number of remaining teeth is inadequate or their poor distribution around the edentulous arch makes provision of RPDs a poor choice. A failed denture does not enhance QoL and may even be the cause of patients’ psychological difficulties during their remaining denture wearing years.

Construction of removable partial dentures

Replacement of missing teeth can restore the patient’s appearance, speech and masticatory function as well as improve QoL as described earlier. Compared with other treatment options, RPDs have the advantage of being relatively simple, reversible, less costly, and allow further tooth loss to be more easily managed. They can also replace multiple missing teeth and supporting tissues. On the other hand, because the remaining dentition is often impaired in people with advanced tooth loss, there are special problems that must be considered in the construction of RPDs.

Support

Support of an RPD can be derived entirely from natural teeth (tooth-borne), entirely from underlying soft tissue (tissue-borne), or both. In advanced tooth loss circumstances, there are quite often inadequate numbers of suitable abutments, or the distribution of the remaining teeth restricts the RPD to being a tissue-borne one. Total tissue support can only be achieved in the absence of any occlusal/cingulum rests, and no other components of the dentures contact the teeth above the survey line. To maximize support, the extension of the denture base for a tissue-borne RPD has to be optimal with the posterior boundary of the maxillary denture lying at the vibrating line, while that for the mandibular denture lies at the retromolar pad, and the buccal extension of the mandibular denture rests on the buccal shelf. A mobile tooth or a tooth with uncertain prognosis is not suitable for use as a support. The denture base should, however, be extended to cover its palatal/lingual surface as contemplation of its future loss.

Inadequate support results in overloading of the mucosa and underlying bone, which can lead to pain and inflammation of the mucosa and more rapid resorption of the alveolar ridge (Figure 1). In some patients, a displaceable ‘flabby’ ridge may be induced. The RPD becomes ill-fitting and rocks during function which leads to further trauma of the supporting tissues. Alternatively, support can be derived from a decoronized tooth modified into an overdenture abutment. It would therefore seem prudent during treatment planning to take into consideration poor support of the future prosthesis when the decision about tooth extraction is made (Figure 2).

To achieve close adaptation to the mucosal tissues, tissue-borne RPDs are generally acrylic resin-based. Acrylic resin is vulnerable to fracture if it is in thin section. Hence, these dentures are rather bulky and uncomfortable.
Coverage of the gingival margin can be inevitable due to strength limitations. Plaque accumulation, as well as adhesion of pathogenic microorganisms, and subsequent colonization of the denture base and abutment surfaces in contact with it can jeopardize gingival and mucosal health.\textsuperscript{23,24}

Retention

In advanced tooth loss situations, the remaining teeth can be so compromised that finding suitable abutments for clasp ing is a problem. They may be mobile or heavily restored due to previous diseases. Suitable undercuts for clasp ing may be absent or modified due either to poor contour of the teeth, such as exposed roots, or to unwanted tooth movement after extraction of the neighboring teeth. These problems may be solved in part by re-contouring, using composite build-ups or construction of surveyed crowns. A surveyed crown (Figure 3) is a cast restoration that has incorporated the ideal contours of a denture abutment.\textsuperscript{25} For heavily restored teeth, it can also protect the remaining tooth structure and correct for overeruption or tilting. Unfortunately, the use of surveyed crowns is often not possible due to the compromised condition of the remaining teeth.

Clasping anterior teeth for retention may be inevitable. Stainless steel or gold clasps are often used in these situations. These clasps have several advantages over cobalt-chromium clasps. They are smaller in diameter and engage at a deeper undercut and in a less exposed region, which is more esthetically pleasing and better accepted by patients. They are more flexible, therefore less leverage is exerted on the abutments. They are less abrasive which makes them more suitable for use in exposed root areas. However, although these clasps are laboratory-drawn by the dental technicians to adapt as closely as possible to the abutment teeth, many a time the fit is less than ideal. The flexible nature of stainless steel and gold also means that less retentive force can be obtained. Dentures can be rather easily displaced from the undercuts, although total dislodgement is uncommon.

Stability

Stability is the ability of an RPD to be firm, steady, or constant, and resist displacement by functional horizontal or rotational stresses.\textsuperscript{26} As described above, retention of RPDs in advanced tooth loss situations is generally less than ideal. Stability becomes highly critical. In an RPD, good stability relies primarily on a well-fitting denture base, which means a good impression has to be obtained in the first instance. Guiding planes restrict the paths of insertion and removal into a single one that can improve and assist the retention and stability of a denture. They work in pairs, and are more effective when the edentulous saddle between the pair of guiding planes is short, and the proximal surface of the abutment teeth prepared as guiding planes is long. Unfortunately, effective pairs of guiding planes are often absent in advanced tooth loss cases.

Occlusion has a significant role in RPD stability. After considerable tooth loss the remaining teeth might have drifted, shifted, or overerupted, making the establishment of appropriate occlusal planes difficult. If the occlusal planes of the residual dentition are unaltered, there will be occlusal interferences at protrusive and excursive positions. Planned occlusal adjustments are therefore required.
Moreover, the setting of artificial teeth has to take into account the equilibrium of the forces exerted from various directions during function as well as the position with respect to the alveolar ridge. For instance, the occlusal plane of the mandibular denture has to be set where the border of the tongue can rest on the lingual cusps. This is of critical importance with long distal extension bases, where opportunities for direct and indirect retention are limited and retention and stability are serious problems. Similarly, over-extension of the denture borders is undesirable because it can cause unseating of the RPDs during normal soft tissue functioning.

**Vertical dimension and occlusion**

Loss of the occlusal vertical dimension (OVD) is often encountered in people with advanced tooth loss (Figure 4a). As a consequence, occlusion becomes unstable and there is limited interocclusal distance available for restoration. In these cases, re-establishment of the OVD at the centric relation is often necessary (Figure 4b). There are a number of ways to assess OVD clinically. The more popular clinical methods include measuring the distance between two arbitrary facial points, assessing esthetic appearance, and using phonetics. It has to be emphasized that no one method is absolutely reliable, thus several methods are normally used for this purpose. Measurement of the distance between two arbitrary facial points depends on accurate determination of the physiological ‘rest position’ of the mandible. However, this position is not a stable one but is affected by factors such as head and body posture, as well as the presence of teeth. Although judgment of esthetics is subjective, it is often clinically reliable. When using the phonetic method to determine OVD, a number of sounds have to be tested, typically /ch/, /m/, and /s/ sounds. Sentences or passages have been developed to test the closest speaking space. Nevertheless, it seems more natural and convenient to chat with the patients in a casual and relaxed manner. Questions such as “What do you like to do in your spare time?” and “What is your favorite food/TV program/music?” are useful means of initiating conversations.

After determining the appropriate OVD, a trial denture can be constructed with reference to this dimension. A period of several weeks is allowed for patient adaptation or to allow further modifications. Using mounted study models, the dental technician can do a diagnostic wax-up of the occlusion at this dimension, and occlusal adjustments can then be planned. This planned occlusal adjustment aims to establish even occlusion across the arches at centric and eccentric jaw positions at the appropriate OVD, with reference to the ideal occlusal planes. It can be as straightforward as simple tooth grinding or as complex as using cast restorations such as palatal shelves, onlays, and crowns. The trial denture is then used as a guide for the restoration of the remaining dentition to the new OVD.

**Esthetics**

Esthetics can be the most important reason motivating patients to seek treatment for replacement of their missing teeth. It has also been found to contribute significantly to their general satisfaction with prostheses. However, patients and dentists can judge esthetics very differently. There is no reliable, objective scale available to quantify...
esthetics in RPDs. Therefore, it is very important to have an understanding of the patient's personality, attitude, previous denture experience and expectations, etc. Assessment of the patient's general well-being is also warranted as people in a depressed state may have a negative self-assessment of their dental appearance.

An esthetic denture is one that does not look like a denture in the patient's mouth. In other words, it harmonizes with the patient's remaining dentition. To achieve this, the shade and shape as well as the characteristics of the remaining teeth have to be assessed and well-matched. However, it is commonly observed in advanced tooth loss situations that the remaining dentition is badly damaged or is malaligned. Re-contouring by simple tooth grinding or by using extensive restorations, such as cast restorations, might be warranted. Furthermore, attention should also be paid to the shade and contour of the denture flanges so that they mimic the oral mucosa. Good lip and cheek support are important, particularly when the patients are being viewed at a distance. These can be achieved by careful positioning of the artificial teeth using an appropriate thickness for the denture flanges. Soft tissue support can be clinically verified by unobstructed performance of oral functions such as smiling and deglutition.

Maintenance and follow-up visits

Regular recall programs are crucial for successful dental treatment. These programs have to be customized to suit the patient's individual needs. Likewise, the frequency of recall varies depending on the patient's condition. Some patients may benefit from quarterly reviews whilst for others annual recall is sufficient.

The process of adaptation to RPDs is complex. It has been explained by a psychosomatic phenomenon where full incorporation of prosthetic reconstructions to the stomatognathic system may be independent of the clinical and laboratory management. In a retrospective investigation of factors affecting adaptation to removable prostheses, it was shown that men adapt to removable dentures more readily than women. It has also been observed that the number of follow-up visits for denture adjustment was similar in new and experienced denture wearers. More adjustment visits were provided to patients whose muco-osseous tissues were atrophic and to those who suffered from systemic diseases.

Despite the fact that RPD itself does not cause dento-gingival disease, there is a 'biological cost' of prosthetic intervention. Gingivitis and gingival recession are prevalent at sites in close proximity to the dentures, as revealed by a clinical study of Hong Kong patients who had received RPDs 5 years previously. Caries, especially root caries, are frequently detected at surfaces in contact with RPDs. There is evidence showing a significant association with and potentially a large contribution made by the wearing of RPD to having new or untreated root caries lesions. Hence, it may be prudent to take active precautionary measures such as the application of fluoride varnish on sites in contact with the dentures during recall appointments.

Conclusions

Removable partial dentures are commonly provided to patients with advanced tooth loss. The patients have to be physically and psychologically prepared to receive this treatment. The construction of RPDs for these patients poses special problems caused by the rather impaired remaining dentition and the lack of suitable abutments. Successful oral rehabilitation relies on careful treatment planning, and good knowledge of and skill with prosthetic dentistry.

References


