

REVIEW

Failures in the rehabilitation treatment with removable partial dentures

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Abstract

Background. Despite being functional and having aesthetic benefits, the acceptance of patients regarding the use of removable partial dentures (RPDs) has been low. In part, this is due to the deleterious effects that causes discomfort to the patient. Success depends not only on the care expended by the patient, including daily care and oral hygiene, but also on common goals set by their professional and clinical staff, aiming beyond aesthetics, to incorporate issues of functionality and the well-being of patients. **Methods and results.** For rehabilitation treatment with RPDs to reach the desired level of success without damaging the support structure, all the steps (diagnose, cavity preparation, adaptation of the metal structures, functional of distal extension and posterior follow-up) in the rehabilitative treatment should be carefully developed. A literature review was carried out, searching through MEDLINE (PubMed) articles published between 1965 and December 2012 including clinical trials and reviews about the use of RPDs. **Conclusions.** This study describes factors that lead to failures and complications in oral rehabilitation through the use of RPDs and suggests possible solutions.

Key Words: failure, removable partial denture, periodontal disease

Introduction

The truth about edentulism is that it has not disappeared and shows no sign of decreasing, because as the global population ages oral health surveys indicate that the proportion of partially edentulous elderly is increasing. Even developed countries like the US reveal alarming rates and, during the course of the next decade there will be 10 million new cases of RPDs in the US alone [1–3].

Despite advances in implant-supported prostheses, removable prostheses are still widely used in clinical practice. This type of prosthesis represents a conservative type of treatment and provides a quick and cost-effective solution for most people and, despite having functional and aesthetic benefits, the acceptance of patients regarding the use of RPDs is relatively low, i.e. ~ 30–50% of patients never or only occasionally use their RPDs. In part, this is due to the deleterious effects caused by bad planning and preparation of rehabilitation treatment, which can cause discomfort to patients [4–6].

Future success depends not only on the care taken by the patient, including daily oral hygiene care, but also on common goals set by professional and clinical staff, aiming beyond aesthetics to incorporate issues such as functionality and the well-being of patients. These steps involve adequate diagnosis and proper planning, the preparation of abutment teeth and the construction of the prosthesis according to bio-mechanical principles. In general, it is necessary to ensure that the strategies and expectations that should be equally met by both patient and professional are totally clear.

It was deemed appropriate to conduct a literature review in order to discuss factors that lead to failures in oral rehabilitation through the use of RPDs and to suggest possible solutions.

Our search strategy involved an electronic search through MEDLINE (PubMed) of articles published between 1965 and December 2012. The following keywords were used: failure; removable partial denture; periodontal disease. The references of the selected articles were reviewed for possible inclusion

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an, after revision, 50 articles were included in this study and two Dental Prosthesis books revised. Included in this review were clinical trials and reviews about the use of RPDs. Studies that evaluate implant supported prosthesis, finite element or dental material performance were excluded.

Literature review

RPDs have been developed to rehabilitate distal extension or large extension of the edentulous ridge and in most cases there is a significant loss of residual ridges. Other indications in the relevant literature include temporary prostheses; assistance in the containment of teeth with mobility and the restraint of maxillary fractures. The only contra-indication would be in cases where oral or general health would be compromised to the point of jeopardizing the dental treatment [7,8].

For most procedures performed in dentistry there is no doubt that achieving a successful treatment depends on the efforts of the professional, their technical staff and also of the patient. However, in the case of RPDs, the failures and complications that occur mainly depend on the dentist. The technical team and the patient may neglect their duties, but it is up to the dentist to analyse, predict and primarily correct errors during the manufacture of the prosthesis, as well as being able and willing to perform all phases of treatment.

Among the steps that can lead to complications or failure through carelessness or lack of professional experience are the following: absence of diagnosis and planning, absence of cavity preparation; failure to adapt the metal structures of RPDs; absence of functional casting of the distal extension; absence of care and instructions during the placement of RPDs; and absence of posterior follow-up [3,9–11].

Many dentists carry out some of these stages of treatment without taking some preliminary steps and/or transfer responsibilities to their technical staff. This ends up creating problems in the form of a chain reaction until the result is dissatisfaction with or intolerance to the prosthesis on the part of the patient and deleterious long-term effects on biological oral components [12,13].

Absence of diagnosis and planning

There is a high failure rate in cases of rehabilitation with RPDs because of the lack of planning [13,14]. This fact has led many authors to controversial conclusions about the use of RPDs; in other words, some have concluded that the treatment with RPDs is deleterious to periodontal tissues and induces the formation of carious lesions [5,15,16]. Others have noted that these changes were minimal or almost non-existent. When they are present, the studies showed

that these potential changes are not caused by the use of the RPD itself but by poor planning and construction of the RPD and also by poor hygiene practices adopted by patients [17–21].

Many dentists do not analyse outline study models or they transfer that responsibility to their technical staff, who in general do not have sufficient scientific knowledge to determine plans that concern retentive areas, bones interference or mucous tissue and, thus, have the ability to determine the best design and axis of insertion-removal for each RPD patient [9,10,22,23]. Absence of planning can lead to changes affecting the protection and support of the periodontium, leading to the formation of areas of inflammation and ulceration, periodontal pockets, increased mobility and in more severe cases tooth loss or fracture, particularly of the abutment teeth, because the stiffness of the metal transfers stress to the periodontium and mucous tissue.

Among the tests performed in study models before the design of the metal frame, we would highlight the planning and preparation of guide plans on the interproximal face of abutment teeth aiming to achieve parallelism during insertion and removal of the prosthesis. After the identification of possible retentive areas and the analysis of aesthetic issues, the design is outlined in detail on a plaster model, determining the location of occlusal support as well as the preparation of niches, which are essential for the transmission of force along the long axis of the abutment teeth [18,24]. Furthermore, in the case of denture teeth-supported, the occlusal supports should be placed near the prosthetic space and, in the case of large prostheses, occlusal restraints should be placed distally from the edentulous space to prevent the formation of axial movement. Clasps should be located below the prosthetic equator of the abutment teeth and opposition clasps should always be designed to neutralize the forces generated on the abutment teeth during the insertion and removal of the prosthesis. In addition to being rigid, the larger upper connections must have contact with the soft tissues and in the lower region this should provide relief to the soft tissues. Seals and connectors may suffer deformities and/or fractures and the prosthesis bases may suffer from defects in the short-, medium- and long-term, affecting the performance of the stomatognathic system [3,11,25]. Therefore, the entire planning phase is crucial for the health of abutment and non-abutment teeth, the alveolar ridge and the longevity of RPDs.

Other aspects should also be considered to ensure the adequate transmission of force to the abutment teeth and the residual alveolar ridge, such as reducing the number of posterior artificial teeth, the extension of the saddle to the end of the alveolar ridge. The smaller connectors should be designed so as to avoid contact with the free gingival margin, indirect retainers should be designed to minimize movement

of the prosthesis around the fulcrum line and the guide plans should promote the settlement of the prosthesis along a single axis of insertion-removal [5,8,12,26].

Absence of cavity preparation

To receive RPDs, the abutment teeth must be adequately prepared. The goal is to stabilize the prosthesis and to preserve the periodontal support tissue to prevent the onset of mobility, loss of vitality and tooth fracture, because in this way there is a reduction of resulting lateral forces and cervical dislocation of the prosthesis. This step involves parallel guide plans, re-shaping of the buccal and lingual faces and the preparation of niches to receive the occlusal support [27–29]. The absence of this step will cause failure in determining the axis of insertion-removal and, consequently, increased torque, leading to increased dental mobility [8,24,29,30].

In the study by Jorge et al. [24] the importance of performing all these steps in the ASA prior to the preparation of the actual teeth themselves was stressed. According to these authors this detail is essential for the smooth integration of the RPD with the stomatognathic system of the patient, because only in this way is it possible to use the prosthesis associated with the conservation of biological structures in the long-term [24].

Absence of adaptation of the metal structures of RPDs

When testing the metal framing components of RPDs, the following have to be verified: the trajectory of insertion; adaptation, biomechanical qualities and occlusion; as well as aesthetics and phonetics. What has been observed on the plaster model should be confirmed in the patient's mouth. The insertion and removal of the RPD should not require great effort and should always match the pre-determined model in design.

Deficiency in the settlement of the structure on the abutment teeth can be caused by distortion of the mold, showing that the metal structure should be re-made after obtaining a new master model. Excess metal may also interfere with this settlement, indicating the need for local adjustments. To verify interference points, disclosing solutions such as liquid carbon applied to the site can help mark the area to be adjusted. Using special tips, re-contouring can be repeatedly conducted so that the interference is removed and a satisfactory structure is obtained [21].

Absence of functional casting of the distal extension

Dental-mucous-supported dentures or distal extension are considered more problematic from the

standpoint of re-absorption of the alveolar ridge. This is due to the great difference between the resilience of the abutment teeth (0.1 mm) and the mucosa (1.3 mm) [31,32].

Treatment of patients with re-absorbed alveolar ridges in total prosthesis is a big challenge for dentists. Therefore, an essential factor is to preserve teeth and to support and stabilize RPDs. Correct planning and molding is required for the preservation of both the alveolar ridge and the abutment teeth and also to reduce leverage from the force of mastication. Re-absorption is higher or lower depending on the extension of the edentulous space, the antagonist arch, the location and amplitude of the applied force and the cross-section of the alveolar ridge. Re-absorption is inevitable due to masticatory forces; however, with appropriate molding forces are better distributed along the whole ridge and re-absorption is diminished [33,34].

There are three types of functional casting: altered cast impression procedure, transfer casting and direct casting. The three techniques have the same goal: to improve the adaptation of the base and to minimize ridge re-absorption [35,36].

Absence of care and instruction during the fitting of RPDs and absence of posterior follow-up

According to Pavarina et al. [40] the reasons most cited by dentists regarding the need for further consultations after the fitting of RPDs are: 71%, the need to check dental hygiene control and adaptation of the prosthesis; 65%, cleaning of the dentures; 62%, assessment of periodontal health; and 58%, detection of caries. This shows that professionals already have knowledge and experience about the future need for scheduling a return visit for these patients, but they usually do not, and this is one of the biggest factors leading to failures related to the use of RPDs. For most dentists, their interest in the patient is limited to the period of the fitting of the prosthesis. This was confirmed by a questionnaire developed in Ireland where the results showed that only 40% of professionals call their patients for a review and the other 60% only arrange a visit for those who report faults or complaints. It was also noted that only 10% of professionals refer patients for periodontal treatment or perform oral hygiene instruction [6,38,39].

Unfortunately, the objectives of fitting prostheses are currently focused on aesthetics and rehabilitation, forgetting that the key to a successful treatment includes educating the patient about the care and use of the prosthesis and the importance of maintaining oral hygiene [7,25,38].

Klages et al. [42] analysed the need for patients to be heard in relation to their complaints and their perceptions regarding issues relating to aesthetics,

pain and tissue damage. Analysing a patient's personality can be a valuable tool to be considered when installing the prosthesis and also to anticipate future complaints. Whenever pain is present after using RPDs patients fail to use them, which denotes, in a certain way, failure on the part of the professional.

Repeat visits to the dentist are required to complete the adaptation phase, especially in cases where there were failures of planning and preparation. Furthermore, patients who have systemic problems in the oral mucosa, such as xerostomic patients, require at least three sessions of after care. Another example of patients who require a greater number of return visits is those who suffer from atrophy of the alveolar ridge [41,42].

Correct planning of the design of the structure of the prosthesis, according to biomechanical principles as well as protecting the oral structures already discussed, would allow for proper hygiene and less plaque accumulation and would consequently reduce the incidence of carious lesions and periodontal diseases [24,43,44]. It is noteworthy that it is not the use of the prosthesis itself that promotes the onset of these changes, but rather that they occur when RPDs are not made according to biomechanical principles, and also when patients fail to return to explain their complaints and difficulties with the new RPDs to their dentist [45–47].

The patient's return is also important for motivation and evaluation as well as checking the standard of oral hygiene. Several studies have shown signs of poor hygiene in patients using RPDs. As mentioned previously, these patients have a pre-disposition to plaque accumulation around the metal frame and retention clasps. Consequently they are more likely to develop caries and periodontal lesions, because poor hygiene is the main vector of these lesions [48–52].

Vermeulen et al. [51] conducted a longitudinal study lasting 10 years with 748 patients using RPDs to assess the need for repair, replacement and also lack of use. They found that there was a predictable level of success regarding prosthetic treatment provided that the patient regularly visited their dentist over an adequate period of time depending on the individual needs of that patient.

Ribeiro et al. [52] demonstrated that the method adopted to carry out instruction in oral hygiene does not greatly affect the effectiveness of patient motivation regarding oral hygiene and RPD hygiene. The demonstration of hygiene simply by using illustrations can change patients' habits. Constant professional supervision is crucial in order to guarantee continuity in relation to the motivation and education of patients rehabilitated with RPDs.

Conclusion

For rehabilitation treatment with RPDs to reach the desired level of success without damaging the support

structure, all the steps in the rehabilitative treatment should be carefully developed. Even though a technical team is involved in the process, it is the dentist who is ultimately the professional that is responsible for predicting and correcting faults due to their scientific knowledge. Moreover, it is important to stress that rehabilitative treatment with RPDs is an ongoing process that does not end at the moment of fitting.

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