

Literature Review Article

Relining of removable dentures: a literature review

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Abstract

Introduction: The alveolar bone resorption that occurs after tooth loss leads to maladaptation of prostheses over the mucosa, causing discomfort to the patient. However, these maladaptations can be solved by prosthesis relining. **Objective:** The aim of this study was to discuss based on the literature, the relining of complete and partial removable dentures. **Literature review:** Dentistry makes use of relining materials that can be either rigid or resilient, having a temporary or permanent characteristic. However, to obtain a satisfactory result, the knowledge of their indications, contraindications, advantages, disadvantages is required, in addition to the characteristics and types of materials. Patients should be aware of the importance of constant monitoring, or even the need to reline their dentures, as it is not possible to determine the biological tolerance of each individual. **Conclusion:** The installation and preservation phases become essential to minimize bone resorption, and also to achieve rehabilitative treatment success.

Introduction

The alveolar bone resorption occurring after tooth loss has been classified as a chronic, progressive, and cumulative disease of bone repairing that can lead to maladaptations of the prostheses. It appears to be continuous over the life of totally-edentulous or partially-edentulous patients [30]. In rehabilitative cases with complete and partial removable dentures, this resorption compromises the adaptation of the prostheses, many times also damaging the speech and mastication. Therefore, prosthesis relining is indispensable to recover the biomechanical properties and occlusion and to provide comfort to patient [19].

According to Silva *et al.* [29], when properly indicated and used, relining materials promote interesting final outcomes in relation to patient's comfort. Notwithstanding, the clinical effectiveness depends on the knowledge of its features, indications and properties, having a definitive or temporary characteristic [5]. Prosthesis relining can be achieved through direct or indirect techniques; rigid or resilient materials especially made for this purpose [30, 33, 34].

Current studies have indicated an alternative method for the polishing of dentures [7], indicators of the measurement of bone resorption [20] and reduction of alveolar bone resorption [11]. Although the prosthesis clinical success over time has been high, the continuous monitoring of the patient should be considered [3, 22, 33]. Thus, the installation and monitoring are indispensable steps for the success of the rehabilitative treatment. Questions of the installation and monitoring of the prostheses have been raised because the latter are important to minimize bone resorption and consequently leading to rehabilitative treatment success. Therefore, it seems appropriate the conduction of a literature review to discuss the guidelines of complete and complete denture relining.

Literature review

Bone resorption

Bone resorption is the main cause of removable prosthesis maladaptations; however this latter may also occur due to failures in impression or acrylization during the prosthesis construction. Many factors may alter the balance between the process of bone formation and resorption. According to Baat *et al.* [10], the main factors related to the

resorption intensity have been the edentulous period and the mechanical action on the mucosa. Aquino *et al.* [1] have also cited the time of prosthesis use, age, route of force transmission towards the alveolar bone, site of the edentulous area, antagonist arch, adaptation of the niche support and saddle extension, finding the mean maladaptation of the saddle base of removable partial dentures (RPD) of 0.27 mm at the period from 1 to 5 years of use. Among the systemic factors, the literature has reported the advanced age, low calcium ingestion, diabetes, osteoporosis, corticosteroids use and estrogen deficiency [10, 11, 24].

Alveolar bone resorption (ABR) involves the chronic, progressive, and cumulative bone resorption process, so that the bone tissue undergoes an intermittent metabolic activity over life, resulting in the gain or loss of bone mass [27]. Kliemann and Oliveira [19] emphasized the importance of RPD relining because even if the patient is undergoing resorption stability, due to a systemic disease the physiologic tolerance balance may be altered and functional forces become damaging.

Barbosa *et al.* [3] studied the clinical procedures for the installation of complete dentures, highlighting the evaluation of the prosthesis edges and occlusal adjustment. The authors concluded that the continuous monitoring of the patient by the professional should be considered. The CD installation is an important procedure to aid in rehabilitative treatment predictability because it is not possible to determine the biological tolerance of each individual. The proper installation provides greater comfort and consequently a greater prosthesis acceptance. Some techniques have been employed to improve prosthesis stability. Barbosa *et al.* [4] considered that one of the limitations occurring due to resorption is the shallow labial vestibule, which may compromise the prosthesis stability at the impression act. Among the techniques of vestibule deepening, vestibuloplasty with secondary epithelialization is the one providing the most adequate outcome in addition to an advantageous procedure.

Oliveira *et al.* [24], by discussing on the osteoporosis manifestations, emphasized the importance of panoramic radiographs in the evaluation of the alteration rates of oral cavity, making possible to achieve a proper referral of the patients in addition to the access of bone quality. Telles [33] highlighted that patients rehabilitated through mucous-supported dentures should be annually monitored so that the levels of bone resorption and possible maladaptation of the base with the mucosa can be verified.

By relating bone resorption with the use of dentures, Kranjčić *et al.* [20] proposed as bone resorption indicators the measurement between the thickness of the RPD base and the space of interocclusal resting, before and after the relining of prostheses. The interocclusal resting space has been defined as the distance (in mm) between the maxillary and mandibular central incisors when the patient's mandible is at physiologic resting position. The results showed statistically significant differences between the measurements performed in the study.

Relining technique

Tamaki [32] defined the relining as the readjustment of the denture base by the addition of a new material amount, which is indicated: in cases of maladapted CD not responding to retention and stability tests at the delivery moment; or in cases after use they lost these properties. Notwithstanding, during the technique description through employing a surgical guide for alveolotomy, the author affirmed that relining is not necessary. Telles [33] indicated immediate CD relining at 3 to 6 months after its installation; in maladapted prosthesis due to residual edge resorption; for correcting maladaptation problems of new prosthesis base; and in prosthesis that will be used as templates for planning and installation of osseointegrated implants.

By considering removable partial dentures (RPD), Kliemann and Oliveira [19] has classified the relining regarding to procedure type (mediate and immediate); support type (tooth-supported and tooth-mucosa-supported); prosthesis treatment type (relining and rebasing). They considered the mediate better than immediate relining in relation to technique, durability, materials used, greater reproduction of details, adequate flow, and low porosity and it is commonly indicated in cases of free-end PRD.

Relining materials

Rigid materials

Acrylic resins appear in Dentistry at middle 1930s to replace vulcanized rubber that although showing satisfactory physical and mechanical properties did not present good esthetic [26, 28, 29, 33]. Acrylic resins have been indicated for immediate and mediate relining, also for rebasing

of maladapted prostheses not responding to the retention and stability tests at the delivery moment, and in case of property lost after sometime of use [9, 32].

Silva [30] recommended as alternative for CD maladaptation the acrylic resin relining. The author assumption is based in a clinical case in which a considerable improve of patient's mastication and speech was seen. The author considered this a simple technique, at one stage, with excellent outcomes for the patient, also highlighting that relining would be contraindicated in cases of prostheses with great tooth wear or malpositioned teeth; premature contacts or interferences; patients exhibiting an inflamed or hyperplastic support mucosa; loss of vertical dimension greater than 3 mm or lack of interocclusal space.

The composition of acrylic resins for relining is an important factor to be analyzed. Urban *et al.* [34] evaluated the percentage of residual monomer within different brands and concluded that some of the most used resins exhibited high percentage of residual monomers that can compromise the mechanical properties and cause allergic reactions. By evaluating the cytotoxicity of three acrylic resins, Ebrahimi *et al.* [12] found that all tested resins exhibited a certain cytotoxicity degree and indicated to emerge the prostheses in water for 24 hours previous to their delivery.

The materials employed as prosthesis bases should show proper mechanical properties. Azevedo *et al.* [2] observed the hardness of three acrylic resins. The authors concluded that hardness increased during the dry storage period and after this, water immersion resulted in softening of the specimens generating significant hardness reduction. Acrylic resin hardness may cause discomfort, accordingly Eduardo [13] researched the tension behavior on support structures of CD finding that the specimens constructed in acrylic resin and resilient material (silicon) promoted a more comprehensive tension distribution and they were the base type more recommended for CD.

The shear bond strength of four rigid resins for relining was evaluated by Neppelenbroek *et al.* [23]. The bond strength values of rigid relining resins were similar. Acrylic resin samples were polished conventionally at the laboratory or polished by using in-office polishing kits. It was found that this latter was an alternative and effective procedure when the laboratorial polishing was not applicable [7].

According to Silva *et al.* [28], many researches have been developed aiming to improve the acrylic resin characteristics, highlighting microwave

polymerization. Its use has been described as an excellent method because these resins can be an important alternative for the faster and lower cost production of prostheses. Because of the good properties presented, Costa Junior *et al.* [8] concluded that microwave polymerization technique provides a decrease of the polymerization time, reducing the laboratorial working time. The pores within thermo-activated resin may hinder the esthetic and lead to fracture possibility and distortion of the prosthesis bases. By analyzing the acrylic resin polymerization with microwave oven on water immersion, Rossato *et al.* [26] found that there was no alteration on the resin porosity, with or without water immersion.

Currently, the acrylic resin is the most accepted material for relining because it is considered as adequate for readapting on oral cavity, without damaging the tissues. According to the manufacturers, these resins are definitive immediate reliners and did not require posterior replacement due to material degradation. It can be inferred that their properties are similar to those of the material used in the prosthesis base [9].

Resilient materials

Resilient materials can be used to stabilize the prosthesis and condition the mucosa. In cases of maladapted prostheses, these materials reduce inflammations and lesions and have been indicated for implanted-supported prostheses [13]. According to Carvalho [6], chemically-activated resilient resins can be used as either temporary or permanent material, with advantage of enabling the best adaptation of patients to prostheses. Tissue conditioners are other option of temporary materials used in prosthesis relining after surgeries or to recover an irritated or inflamed tissue.

Many indications for the use of resilient materials have been cited, e.g., retentive areas, resorbed alveolar edges, alveolar crest areas, areas of compression relief, recently operated patients, patients presenting tooth development alterations or xerostomia, as reported by Carvalho [6], Eduardo [13] and Silva *et al.* [29]. Bulad *et al.* [5] listed some limitations regarding the use of resilient materials: problems when the rigid base thickness is minimum; instability in water; porosity; discoloration caused by some cleaning methods; failure in the adhesion between the resilient and acrylic base; difficulty in finishing and polishing.

For soft tissue surgeries, Eduardo *et al.* [14] indicated the immediate relining through tissue

conditioners. The authors affirmed to obtain a provisional prosthesis that was kept stable during all period of tissue recovering with satisfactory post-operative period, excellent clinical appearance and faster and painless recovering period.

By evaluating the influence of chemical disinfection and storage, permanent deformation and porosity of three resilient reliners, Goiato *et al.* [16] found that all resilient reliners underwent deformation, even when submitted to chemical disinfection. By assessing the microorganism presence on soft reliner surface, with or without glaze application, Goyatá *et al.* [18] concluded that glazed reliners showed smaller microorganism presence. Landa *et al.* [21] evaluated the influence of glaze application on the superficial roughness of three reliners. The authors observed that Soft Comfort Denso was the resilient reliner that presented the smallest alteration on the superficial roughness with and without glaze application.

The lack of retention and stability and prosthesis fracture has been the major causes of searching for treatment at dental offices [17]. Both the repair and posterior relining promote stability and retention, giving more safeness and comfort, returning the function, speech and esthetics. Eduardo [13] emphasized that resilient materials have limited durability, fact also confirmed by Elsemann *et al.* [15].

Oliveira *et al.* [25] verified the effect of sealant application and storage time on the permanent deformation of a tissue conditioner (Coe Comfort-GC). The authors demonstrated that the studied conditioner showed longevity of at maximum one week, and after that it requires replacement, without advantages for sealant application. Silva *et al.* [29] affirmed that the use of resilient bases promoted interesting final outcomes regarding patient's comfort, but these materials can deteriorate within a short time period. The authors emphasized that clinical effectiveness depends on the knowledge of this characteristics, indications and properties. Patients submitted to this treatment should be aware of the need of constant monitoring or reliner replacement due to the material limitations.

Discussion

Many authors are unanimous in affirming that because of tooth and periodontal ligament loss, and consequently of the local stimulus acting on alveolar bone, such periodontitis and traumas, bone resorption is initiated [1, 4, 19]. This seems to be

continuous over edentulous or partially-edentulous patients' life and may cause the maladaptation of prostheses during speech and mastication [20, 30].

The prosthesis can be relined by laboratorial or in-office procedures. Direct (immediate) relining does not require that the patient stays without the prosthesis. It is a simple technique that extends the usage time [23, 30]. On the other hand, indirect (mediate) relining consists in a laboratorial clinical procedure, generally employing the prosthesis itself as customized tray. Mediate is better than immediate relining due to its technique, durability, material employed, greater detail reproduction, proper flow and low porosity [19, 33]. Notwithstanding, the period that the patient is without the prosthesis and the laboratorial steps that may induce error have been cited as disadvantages [13, 19, 33]. It is commonly indicated for free-end RPD, according to Kliemann and Oliveira [19], and complete dentures according Telles [33].

The relining materials should exhibited adequate properties, such as easy technique, high durability, good dimensional stability and detail reproduction, proper flow, and low porosity [19]. Rigid compared with resilient resins have shown superior qualities, as greater color stability, lower porosities, lower heat releasing, and greater durability [30].

Self-curing acrylic resins have been the most accepted for relining because of the lower polymerization temperature, which is adequate for oral cavity without damaging the tissues [30, 34]. Also they show good resistance and acceptance by patients [13, 25], resistance to abrasion, are impermeable to oral fluids [8] and have certain dimensional stability and esthetic feature [26]. The application of resilient/soft materials for prosthesis relining has been researched aiming at the comfort and masticatory effectiveness. Soft liners, so-called resilient reliners, are a group of elastic materials that can be used either temporary or definitive, decreasing the impact of the masticatory force on the underlying mucosa [13, 15, 29].

Resin liners presenting polymethylmethacrylate causes an important irritation on oral mucosa [34]. Additionally to the replacement of this component, the introduction of other monomers improved these materials, fact proved by Azevedo *et al.* [2] and Silva [30]. Acrylic resins are commercially available in two flasks containing the polymer and monomer. The polymerization process, in which the monomers are converted into polymer is not complete, always resulting in residual monomer [15, 16]. Ebrahimi *et al.* [12] evaluated the cytotoxicity of three acrylic

resins and found that all tested resins induced a certain cytotoxicity degree.

Resilient reliners do not exhibit a satisfactory longevity. Its use should be associated with a strict monitoring because of the resilient characteristic of the material may be lost over time [15, 29]. Additionally, frequent displacements between resilient reliners and the prosthesis base also decrease its useful lifetime [15, 29, 30]. In an attempt to extend the softness and resilience and avoid porosity of tissue conditioners, Eduardo [13] and Eduardo *et al.* [14] indicated the immediate post-surgical relining and affirmed that the reliners can stay for 5 to 6 months, decreasing the costs and avoiding successive material changes.

According to Bulad *et al.* [5] and Silva *et al.* [29], resilient materials have some limitations regarding to its use, such as the instability in water, porosity, discoloration and difficulty of polishing. Some authors have recommended using as temporary material [14, 18]. In the study of Landa *et al.* [21] glaze application influenced on superficial roughness of reliners. Goyatá *et al.* [18] reported that it also decreased the accumulation of oral microorganisms.

Thus, regardless of the material choice, to perform an adequate relining, it is necessary that both oral cavity and the mucosa are at a good health state. Otherwise, the use of tissue conditioners or temporary materials is the most indicated [19]. Patients should be aware that their prostheses will not last forever. Periodically, the degree of bone resorption, prosthesis adaptation, masticatory efficiency, and hygiene conditions should be assessed.

The literature has established that, except from immediate complete dentures requiring relining at a shorter time period [33], the mean period for periodical relining procedures is six years for a complete denture [22] and three years for removable partial prostheses [19]. Although many prostheses are successfully for years, the continuous monitoring of the patient ought to be considered, because it is not possible to determine the biological tolerance of each individual [3, 9, 33]. Therefore, both the installation and monitoring of removable prostheses are indispensable steps for rehabilitative treatment success.

Conclusion

Based on this literature review, it can be concluded that removable prosthesis relining should

be performed from 1 to 4 months after tooth extractions, preferably through immediate relining technique and with self-curing acrylic resin. In-use removable prostheses should be relined from 1 to 5 years, preferably through mediate relining technique and with self-curing acrylic resin. It is worth emphasizing that to reach complete and partial prosthesis relining success, it is necessary the knowledge of the indications, contraindications, advantages, disadvantages, characteristics and types of relining materials.

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