"Case Report"

Redesign of Removable Partial Denture to Address Gingival Recession

Sekar Hasna Kairunnisa¹, Fahmi Yunisa ²

¹ Student, School of Dentistry, Universitas Muhammadiyah Yogyakarta, 55183, Indonesia
² Lecturer, School of Dentistry, Universitas Muhammadiyah Yogyakarta, 55183, Indonesia
* Corresponding author, e-mail: sekarhasna@gmail.com

Abstract

Tooth loss due to orofacial trauma could alter mastication, speech, and aesthetics of the patient which affect the patient's quality of life. After the acute phase of trauma has ended, further treatment is to restore the function and aesthetics by using prostheses. Some treatment options are available, one of them is removable partial denture (RPD). Materials of RPD vary from cast metal, acrylic resin with metal clasp, and flexible thermoplastic resin. Cast metal and acrylic resin RPDs include a rest component to transfer the occlusal load toward the axis of abutment tooth, in order to provide support. Meanwhile, flexible partial denture has no rest components, which makes this prothesis lack of support. This condition may in turn affects the periodontal tissue. This article aims to restore the ideal design of RPD by using rest components to maintain periodontal health. A 23-year-old patient complains that her previous denture does not feel comfortable. She wore flexible removable denture for the past 5 years after she got an accident that makes her lost 3 of her teeth. From the objective examination, she lost 23, 24, and 25 teeth. Gingival recession was seen in tooth 26, bone resorption was seen in mesial tooth 26, negative palpation, inter occlusion was fine. The diagnosis of the patient is Edentulous Class III Kennedy. The treatment is redesigning the RPD into acrylic resin with clasp. The result is that this new prothesis functions well in patient. In conclusion, ideal design of RPD results more benefits for periodontal tissue.

Keywords: removable partial denture; design; occlusal rest; support; gingival recession

INTRODUCTION

According to the 2010 statistics from Balitbang Kemenkes RI, the utilization rate of dental health services for tooth extraction among individuals over the age of 12 in Indonesia was 79.6%, while the utilization rate for prosthesis was only 4.5%. Tooth loss due to trauma leads to individual’s quality of life as a consequence of altered mastication, speech, and aesthetic. Those who did not wear denture immediately, often complaining discomfort and pain in surrounding edentulous area. Therefore, the advised plan following the completion of the acute trauma healing period is to undergo rehabilitative treatment aimed at restoring both the functional and aesthetic aspects of the teeth through the use of dental prostheses. Several dental prosthesis options are available, which are removable partial denture, fixed denture, or implant.

A removable partial denture (RPD) is one type of prosthesis that may be indicated in a case of several loss of teeth. This type of prosthesis offers the benefit of being easily inserted and/or removed by the patient. Furthermore, it is more cost-effective and conservative compared to the other types of prosthesis.

There are three types of material and design of RPD, which are metal frame (cobalt chrome), acrylic (polymethyl methacrylate), and thermoplastic/flexible denture. Metal frame is considered as a gold standard design of RPDs since it has superior mechanical properties compared to other RPDs materials. On the other hand, due to its metal components, it is not aesthetically pleasant. Therefore, the alternative option is a flexible denture.

Recently, flexible denture has gained popularity among the other RPD materials as it offers double advantages of aesthetic and flexibility. Flexible denture, unlike metal-clasp RPD, features a thin finger-like extension that emerges into undercuts. This would function as a clasp
by covering a major portion of the abutment teeth, as well as the vestibular and buccal gingiva. Consequently, long-term periodontal health of abutment teeth might be affected. As Japan Prosthodontic Society (JPS) has shown that thermoplastic resin RPD is linked to increased risk of periodontal disease in abutment teeth. Oremosu and Soroye (2022), found in their study about Denture Characteristic, Oral Hygiene Practice, and Periodontal Changes ff Partial Denture Wearers And Non-Denture Wearers In A Teaching Hospital reported that gingival recession was found to be 13% in RPD wearers. Other studies reported that 72.5% denture wearers had gingival recession. Therefore, this article aims to redesign the RPD based on RPD design principle in-order-to maintain periodontal health.

CASE REPORT
A 23-year-old patient came to Universitas Muhammadiyah Yogyakarta Dental Hospital with complaints of discomfort in wearing her removable partial denture. She stated that the RPD lacks of metal clasps. The patient has been wearing removable partial denture for 5 years as a result of tooth loss following traffic accident. Recently, the denture has become ill-fitting and she has been experiencing discomfort for over a month. This condition is aggravated when she eats chewy and solid food. Moreover, she occasionally experienced the sensation of her gums being compressed when wearing denture. No systemic condition is present, neither allergic to foods and/or medicine.

Objective examinations showed edentulous areas in 23, 24, and 25. Gingival recession was seen in tooth 26. Ridge condition was normal and negative on palpation. Interocclusal relation was good. OHI score was 1.3 (good).

CASE MANAGEMENT
A treatment plan for this case is to redesign the RPD into an ideal design of RPD. Redesigning the RPD was made according to the ideal principles of RPD design, which allows supports, stability, and adequate retention. In general, the components of this RPD includes acrylic base plate with clasps.

Alginate impressions were made using perforated tray no. 2 and diagnostic casts were prepared to evaluate abutment teeth and design making. A Centric relation record was also made. According to edentulous classification, loss of three teeth of the same region in a row classified as edentulous class III Kennedy, hence, the suitable RPD design is bilateral RPD with the support of teeth and oral mucosa. Therefore, the new design would be clasp-retained RPD. Teeth 13, 16, 22, and 27 were used as support. Retainer used in RPD was direct retainer using C clasp with occlusal rest on tooth 27, cingulum rest on tooth 22, modified circumferential clasp with cingulum rest on tooth 12, and C clasp with occlusal rest on tooth 16. The connector used was acrylic base plate on palatal.
Preparation of abutment teeth were done on the second appointment. Occlusal rests were created by small round bur on mesioocclusal tooth 16 & 17 with 0.8 mm depth. The casts were mounted on a surveyor and were analyzed for existence of any undercuts.

After the new denture was completely finished the patient returned for insertion. During the insertion, the operator assessed the path of insertion, retention, stability, occlusion, and patient’s comfort.

The patient came for a follow-up appointment one week later. The operator assesses the patients’ insertion, removal, and cleansing of the RPD. The outcomes are favourable, retentive, and stable. Nevertheless, the patient experienced discomfort while eating in anterior region. As a result, occlusal adjustment was performed until the patient comfortable.

DISCUSSION
Flexible denture has gained popularity as it offers better aesthetic and comfortability. The lack of a metal clasp gives this denture seamless appearance with the oral mucosa, making it the preferred choice for patients. Flexible denture employs resin clasps made of thermoplastic denture base resin. Therefore, the retention obtained by creating a seal around the entire border of the denture by its bases. Since the flexible bases doesn’t provide rest component, this may also contribute in a more somatic tissue displacement. Consequently, the occlusal forces would directly transmitted to gingiva, potentially traumatizing the marginal gingiva.
Since the flexible denture doesn’t provide rest components, this Additionally, the flexible bases may also contribute in more somatic tissue displacement. This subsequently leads to gingival recession. Regarding to the study about “Short-term effect of thermoplastic resin removable partial dentures on periodontal health: A randomized cross-over trial” the statement from Japan Prosthodontic Society (JPS), thermoplastic resin RPD is associated with increased risk of periodontal disease in abutment teeth. Denture that should be a rehabilitative treatment, could cause the other oral problem if not planned ideally. Planning and designing RPD should be balanced between the risks and benefits to the patient.

Biomechanical principles of RPD’s design proposed by McCracken focuses on the forces distribution toward supporting tissues by providing retention and stability of RPD. Alveolar bone provides the support for RPD, by way of periodontal ligament and the residual ridge bone through its gingival tissue overlying. Potentially destructive forces should be minimized, thus the physiologic tolerances of the supporting tissues are not exceeded, in order to inhibit pathological changes in that area. Dula, et al., (2015), suggests the ideal design of RPD should aim be minimal stress towards abutment teeth and alveolar ridges.

Direct retainers, referred to clasps, are essential elements of RPD as they apply forces on the abutment teeth when the denture lifts in the opposite direction of its insertion path, thereby, the clasps ensure retention to the denture. The RPD clasps do not completely encircle the abutment tooth, hence they must be engage more than half of the circumference to allow denture stay in position under chewing loads. Furthermore, rigid supports provide vertical reinforcement to prevent RPD settling and consequent compression of the surrounding soft tissue. Meanwhile, flexible RPD covers large portion of abutment teeth along with the vestibular dan buccal gingiva to provide satisfactory retention. Rests made from flexible polymers would not effectively transmit vertical forces to abutment teeth, unless the thickness is adequate.

Patient’s chief complaint about loss fitting denture was in accordance with the study of Manzon, et al (2019), which stated that flexible denture wearers reported increased loss retention. Decreased retention of flexible denture could be related to the characteristic of the material, which is water uptake. Water uptake may break the chemical bond with detrimental effects on the mechanical property of the material. Consequently, this could change the retention area. Acrylic denture material is also subjected to water uptake, however, the metal clasp could ensure the stability over time. In addition, the clasp’s retentive force also depends on the amount of undercut, arm length and thickness, cross sectional area, elastic modulus of the clasp material, and friction coefficient.

Regular brushing and denture cleansing are crucial to maintain the patient's periodontal health. The existing approaches to denture hygiene care involve either mechanical or chemical methods. Mechanical techniques involve the utilization of a manual brush and/or a cleaning bath that employs ultrasonic or sonic vibrations. A soft-bristled toothbrush is recommended for manual brushing to avoid scratching and biofilm accumulation. Avoid using silica-containing toothpaste as it is abrasive and can cause scratches on acrylic dentures. Specifically designed denture toothpaste without those particles is recommended. Ultrasonic cleaning baths tend to operate at a frequency range of 20-60 kHz, where the vibrational energy induces cavitation. The process of cavitation involves the formation of bubbles that collide and collapse with the surface debris, effectively dislodging it from the denture surface. The debris removal capability of this product is remarkable and highly compatible with nearly all denture materials. The sonic
cleaning baths in an approximate frequency of 6.5 kHz. Due to its lower vibrational energy, it tends to be less effective than an ultrasonic cleaning bath. Chemical techniques are designed to eliminate microorganisms and are classified depending on their specific modes of action. These include bleach-based, effervescent-type, mineral acid-based, enzyme-based, oral rinses, and flexible denture cleansers. Acrylic dentures should not be cleaned with bleach-based cleansers since they may discolor and impair their physical properties after prolonged exposure to high temperatures and concentrations. Furthermore, it is suggested to remove the denture throughout the night to ensure that the supporting tissues obtain sufficient rest.

CONCLUSION
Within the limitations of the case management, it may be concluded that redesigning flexible removable partial denture with metal-clasp acrylic removable partial denture could effectively restore teeth functionality and enhance aesthetic, while also maintaining the periodontal tissue health.

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