

Distal extension bases: Removable partial dentures

Review Article

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ABSTRACT

Distal Extension Bases-Removable Partial Dentures were considered one of the best treatment options to restore missing posterior teeth in upper and lower jaws. Recently, this kind of treatment has begun to disappear gradually due to the appearance of dental implant world. In this paper I'm going to review some important aspects for the success of such treatment.

KEY WORDS: Altered cast, design, load, impression technique, stability

Distal extension base is defined as that edentulous segment of either upper or lower jaw that lacks posterior abutment. This term substitutes the old one which is free end saddle, and no more used in the literature. It is well known that when a clinician begins to restore this part of the mouth, he will face many problems to satisfy the patient's needs in terms of stability and function. When a removable partial denture (RPD) is considered for restoration of missing posterior in the distal free-end edentulous ridges, the design of the RPD is a problem.^[1] This is due to the quite difference in the displacements between the periodontal support tissues of abutments and the residual ridge mucosa.^[2] When the functional load is induced, a rotary movement usually occurs around the fulcrum of the terminal abutments.^[2,3] This fact not only lowers the denture function and causes the patient's discomfort but also traumatizes the supporting tissues of dentures; thus a good design for a distal-extension RPD should prevent rotary movement to protect the supporting tissues.^[1] A major concern with the use of a distal extension removable partial denture (RPD) is the control of excessive torqueing forces that may act on the abutments.^[4] It must be taken into consideration for the achievement of optimum function is; to try hard to preserve that which remains, rather than to carefully replace that which is missing.^[5]

Successful Removable Partial Dentures

Requirements for successful RPD function include

cross-arch stability of the framework, maximal coverage of the edentulous residual ridge and stress control.^[6]

However, other basic principles for the success of the RPD in general, include: a rigid major connector, multiple positive rest seats, mesial rests, parallel guide planes, the I-bar clasp design and the altered cast impression technique.^[7] Although the design of clasp assemblies minimizes stresses on abutment teeth, the single most important factor in minimizing abutment teeth movement is the fit of the denture base.^[8,9] Also, the patient's oral health must be optimal.^[10-12] In spite of all efforts, the RPD will be subjected to some movement, as the bases of the RPD are supported by movable tissues.^[13] The borders should cover the residual ridges maximally to the junction of the movable and immovable tissues; that is, the tissue surfaces of the RPD should be extended to the physiological limits, in order to minimize the movement of the base.^[14] Frank and Nicholls^[15] reported that indirect retainers aid in force distribution, whereas guide planes and clasp assemblies provide the retention desired of a distal extension RPD. Support for the resistance of the vertical forces is achieved via rigid teeth, mucosa and bone, hence, if a distal extension RPD is to be successful, harmony needs to exist among these three biological systems.^[14] If the support required by any one component is excessive, it can result in mobility of abutment teeth, ulceration of mucosa, accelerated

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resorption of the remaining residual ridge or all of these, thus increasing the possibility of premature failure of the prosthesis.^[16]

It is worth mentioning that distal extension RPDs move excessively during function especially if the design is improper, which may lead to pain, discomfort, instability of the prostheses and tissue damage. This effect can be minimized by special concern on: the design and impression technique.

The Design

It is believed that a careful design of the metal framework will minimize the torque applied to the abutment teeth.^[4] Many designs are intended for torque releasing effects on these teeth. These designs comprise of a mesial occlusal rest linked through a minor connector, a proximal plate and a buccal retentive element in a form of an I-bar (RPI),^[17-19] L-bar (RPL),^[20] or Akers circumferential clasp (RPA).^[21] A modification for (RPI) system is suggested by Shifman and Ben-Ur^[4] who used Akers clasp instead of I-bar on mandibular first premolar, and lingual bracing arm that connects the mesial occlusal rest to the distal proximal plate which obviates the need for a separate minor connector and makes the design more hygienic. However, this design lacks an indirect retainer which is considered crucial for the design in such situation.

Many authors advocate the preference for mesially placed occlusal rests to those placed distally, theorizing that such designs release stresses from the abutment teeth.^[4] During function: the mesial rest directs the forces on the abutment tooth mesially, ensuring good contact with the adjacent tooth, while the distal one on the same tooth would tend to tip the abutment tooth posteriorly and open the contact with the adjacent.^[22]

A 5-year clinical study by Kapur *et al.*^[23] suggested no difference between distal -extension RPD designed in a form of RPI or a distal rest with circumferential clasps (E-type), with respect to the effect on the abutment teeth. However, in this study,^[23] second premolars were splinted to first premolars by full coverage cast gold restorations which may account for their conclusion.^[24]

Impression Technique

Good mucosal support of distal extension RPD has an essential role in sharing the occlusal load, even with rigid retainers on the abutment teeth.^[1] The prosthesis can be stabilized in response to vertical stresses by means of favorable load distribution between supporting bone and abutment teeth.^[25] The residual ridge supporting the extension base has two forms: the anatomic, seen when the tissues at rest, and the

functional, seen when the tissue is under load and partially displaced.^[26] It is desirable to register the residual ridge in its functional state.^[14] The material used to register the ridge in its functional state may not be useful for the registration of the teeth.^[26] To achieve that target, an altered cast technique is created.

Altered cast technique is necessary to ensure that the metal framework and the base will be related in the same relationship as that which exists between the abutment tooth and the supporting mucosa when the base subjected to occlusal loads.^[27] The altered cast impression technique demonstrated the least amount of movement of the base at the time of placement and the most favorable ridge to denture base relationship.^[16,28] The altered cast procedure is commonly used for bilateral distal extension mandibular removable partial dentures (RPDs) to promote optimal adaptation of the extension bases.^[3,29] The original technique was found by Applegate in 1937.^[26]

The rationale of the altered cast impression is: (1) to obtain maximum tissue coverage for support within the physiologic acceptance of limiting border tissues and (2) to confine the spatial relationship of residual ridges to the teeth.^[30] It is essential that the framework is seated completely and finger pressure is applied only to the parts of the framework that come in contact with the teeth – never to the tray itself.^[14] To make an altered -cast impression correctly, the framework should remain exactly in the same position as during the try in step.^[3] Problems often arise because the impression material placed between framework and mucosa may cause the framework to lift away from the mucosa; subsequently, during flasking, the framework will depress again, producing inaccuracies in the prosthesis.^[31] However, the traditional altered cast technique requires an additional appointment for jaw registration. These multiple appointments can be quite troublesome and time-consuming.^[32] In recent years, a number of reports have proposed procedures for registering jaw relation and making the altered-cast impression during the same visit as the framework try-in.^[32,33] The technique by Lay *et al.*,^[32] for making a jaw relation record during the same visit as the framework try-in, has the disadvantage that the index is elastic and does not remain attached to the impression.^[31] However, Santana-Penin and Lozano^[31] suggested a similar procedure that makes use of a rigid jaw relation index in a form of acrylic resin column, eliminating possible errors associated with the fitting of provisional indices during the laboratory phase. Some clinicians advocate making impressions with no pressure applied to the residual ridge,^[29,34] whereas others advocate loading the residual ridge during the impression procedure.^[3,35-37] The altered cast

impression, as described by Leupold and Kratochvil,^[29] displaces residual ridge mucosa.^[38]

Simple and efficient impression procedure for obtaining maximum tissue coverage, for denture base supports, allows selective placement of tissues over primary stress-bearing areas to record the anatomic form of teeth and functional form of the residual ridges with a single impression procedure.^[30] This procedure reduces the treatment time and avoids laboratory errors that may be incorporated during the altered cast technique. Besides, the alveolar sulcus is also captured in its functional form, permitting the placement of a sublingual bar when indicated.^[39, 40] On the other hand, no single impression material can record the anatomic form of teeth and functional form of the residual ridge simultaneously.^[3]

CONCLUSION

The decision of the ongoing procedure to fabricate a distal extension (RPD) needs an optimum and well done technique in terms of design and impression procedure. Many designs are proposed for the sake of that target. In addition, an altered cast technique is modified to reduce the treatment time and the possible laboratory errors and to get a stable and accurate prosthesis. Dental implants are still considered the first treatment option for restoring an edentulous extension base. But, despite enormous progress with the use of implants to restore posterior edentulous region, removable partial dentures are still a viable treatment option for some patients.^[4] Regarding this issue, the most critical factors that govern our decision are cost and time. So as patients and clinicians, we have to make a compromise.

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