

# **Effect of Splinting Anterior Telescopic Abutment in Free End Saddle Partial Denture Cases retained by distal implant**

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## Introduction

Rehabilitation of a distal extension partially edentulous arch is considered a challenge although distal extension cases are the most common partially edentulous cases found in the clinic. Esthetically and functionally successful prosthetic rehabilitation needs careful diagnosis and meticulous treatment planning.

The main challenge facing the prosthodontist in treatment of distal extension cases is the distribution of functional stresses between the edentulous ridge and abutment teeth which have different viscoelastic behavior.

Designing suitable direct and indirect retainers are essential in retaining distal extension bases (DEBs). Direct retainers for DEBs are usually in the form of resilient clasps or attachments having stress releasing action.

Recently, great awareness have been raised among population seeking dental prosthetic treatment however, fixed restoration still represent the main demand of patients.

Due to many anatomical, biomechanical and financial obstacles, implant supported partial denture becomes an acceptable treatment modality replacing fixed restoration, however the design on the anterior abutment remains a big dilemma.

Although clasps are the most commonly used direct retainers for long span distal extension cases, the crown of the remaining teeth seldom have good contour for clasping. Crowning of these teeth improves the contour, but displaying a labial clasp arm remains a problem.

Telescopic retainer is an effective type of retainer, possessing retention, support and splinting action between multiple abutment teeth which also

known as a double crown. They provide direct\indirect retention and direct forces along long axis of tooth. They are also more hygienic, provide good esthetics and cross arch stabilization.

The placement of dental implants in an edentulous space not only provides the biologic effect of reducing bone resorption. But in the case of an implant-retained RPD, also provides distinct biomechanical advantage in improving the fulcrum line position as well as providing superior retention and enhancement of esthetics through elimination of unesthetic clasps in the esthetic zone. Presence of a flange on such a prosthesis also allows for extraoral soft tissue support and replacement of facial esthetics lost from advanced ridge resorption. Also, Placement of an implant posteriorly in distal extension cases provides a definite stop and stability and eliminates the problems often associated with a distal extension removable partial denture.

In general, using telescopic retainer in distal extension cases requires splinting of abutment teeth as recommended by many authors. however, the current study discussed whether splinting is mandatory in case of installing distal implant?

## **Aim of the Work**

The aim of this study was to radiographically evaluate the effect of splinting anterior telescopic abutment in free end saddle partial denture cases supported by distal implant on supporting structures using digital radiograph.

## **Prevalence and impact of partial edentulism**

Despite the success of prophylactic treatment and prevention in recent years, the need for prosthetic treatment due to loss of teeth will continue to increase in relation to the age of the patient. Although the rate of edentulism among the elderly is continually decreasing, 75-year-old patients will still likely to have more than 16 residual teeth on average.<sup>(1)</sup>

There are many drawbacks for extraction of natural teeth including drifting and tilting of adjacent teeth, supra eruption of opposite teeth, altered speech, changes in facial appearance and psychological dissatisfaction. Loss of weight and restricted dietary and social activities are some of the major impacts adversely influencing the quality of life.<sup>(1)</sup>

The first objective in prosthodontic treatment is to maintain existing natural tissues and to stop the progression of disease. De van<sup>(2)</sup> stated "The patient's fundamental need is the preservation of what remains of masticatory apparatus rather than the meticulous restoration of what is missing.

Extension base removable partial denture is defined according to the academy of prosthodontic terms as: (a removable dental prosthesis that is supported and retained by natural teeth at one end of the denture base segment and in

which a portion of the functional load is carried by the residual ridge).<sup>(3)</sup>

Distal extension cases are the most common clinical cases among the partially edentulous conditions. The mandibular distal extension cases are more common than maxillary cases due to the general pattern of tooth loss.<sup>(4)</sup>

Although fixed partial denture may be more favorable from a psycho-logic point of view however, a well-constructed removable partial denture (RPD) can be an excellent treatment alternative.<sup>(5,6)</sup>

The effect of molar support loss on stress and strain in premolar periodontium was studied, results suggested that the periodontium surrounding the most posteriorly located occluding premolars might become sensitive to bilateral loss of molar support especially, when patients exhibited higher maximum bite forces.<sup>(7)</sup>

The main function of a partial denture is the preservation of the remaining structures, essentially preservation of the remaining teeth and residual alveolar ridge. A partial denture must not harm abutment teeth, abuse the subjacent soft tissues, or impair the health of the temporomandibular joints.<sup>(8)</sup>

Well constructed removable partial dentures should not cause any adverse periodontal reactions to remaining natural structures, provided that preprosthetic periodontal health has been achieved and maintained with meticulous oral hygiene. Follow-up studies<sup>(9,10)</sup> revealed that oral hygiene plays an significant role in avoiding adverse effects of wearing RPDs, such as gingivitis, caries and periodontitis on abutment teeth. Frequent hygiene recalls and prosthetic maintenance are very important to achieve a good long-term prognosis.

The main clinical problem facing prosthodontists is designing a biomechanical acceptable bilateral distal extension removable partial dentures. Movement of the distal extension base is generated as a result of multidirectional forces transmitted laterally, vertically and antero-posteriorly inducing multidirectional movement and rotation of the distal extension base around vertically, horizontally and anteroposterior axes. This creates detrimental torque and detrimental forces on the abutment teeth and residual ridge.<sup>(11)</sup>

The control of vertical, horizontal and torsional forces that may act on the abutment teeth and the posterior mandibular residual ridges is difficult. This forces have a detrimental effect on denture stability, retention and support.<sup>(12)</sup>

Esthetics is the primary demand for patients seeking prosthetic treatment, there are three strategies have been reported to design both functional and esthetic removable partial dentures. These strategies include use of the esthetic clasp assemblies, use of precision and semi-precision attachments, and, use of the concept of the rotational path removable partial denture.<sup>(6)</sup>

## **Problems associated with distal extension partial dentures**

Loss of distal abutment is the primary cause of problems associated with distal extension removable partial dentures.<sup>(13)</sup>

### **I- Problems in support**

Support is the resistance to the vertical component of masticatory force, which prevents the partial denture from being displaced toward the soft tissue'.<sup>(14)</sup>

The problem of support in distal extension cases is mainly due to loss of posterior abutment. So, the denture is dependent on the residual ridge for posterior support and on abutment teeth anteriorly.<sup>(15-17)</sup>

The main difficulty facing the prosthodontist in treatment of distal extension removable partial dentures is the distribution of functional stresses between the two different supporting oral structures with different viscoelastic behavior.<sup>(18)</sup>

The difference in displaceability between the mucosa covering the ridge and the periodontal ligament of the teeth was estimated to be twenty to twenty five times so, under functional occlusal load, an axis of rotation is created around the most

distal abutment. This induces torsional stresses on the abutment teeth and possible traumatization of the ridges. <sup>(19-21)</sup>

The movement of distal extension base is produced as a result of multidirectional forces transmitted vertically, laterally and anteroposteriorly. <sup>(11)</sup>

This movement is dependent on contour and quality of the residual alveolar ridge, extent of residual ridge coverage by the denture base, type and accuracy of impression registration, accuracy of fit of the denture base, design of the partial denture framework and total occlusal load applied.

Also, a rate of elastic recovery of teeth after a series of loading cycles is more rapid than that of the mucosa covering the ridge resulting in uncontrollable movements of denture. <sup>(22)</sup>

## **Designing distal extension bases support:**

Several researches<sup>(23,24)</sup> have suggested various concepts of removable partial denture designs for enhancing support in distal extension cases. These included load reduction, distribution of load, partial overdentures, telescopic retainers and implant.

### **1- Load reduction**

Reduction of load could be done by decreasing the number of artificial teeth, reducing the size of the occlusal table and using modified anatomic teeth. Balanced occlusion, maximum coverage within physiological limits of the limiting structures, and adaptation of the base to the tissues, as well as proper selection of abutment teeth and retainers influence load reduction.<sup>(25-27)</sup>

It was advised to place the artificial teeth on the crest of the alveolar ridge or in the neutral zone between the tongue and cheek with maximum coverage of the base as central loading was found to cause the least abutment movement.<sup>(28)</sup>

Design of removable partial denture plays an important role in distribution of force between abutment teeth and residual alveolar ridges. Rigidity of major connectors and

maximum coverage of denture bases are of great importance in decreasing stresses on abutment teeth. <sup>(29)</sup>

## **2- Distribution of load between teeth and ridges**

Distribution of load between residual ridges and teeth is very important for the preservation of the remaining hard and soft oral tissues. It was recommended by many investigators to use this concept as a suitable treatment modality for the extension base. <sup>(19, 30)</sup>

### **A- Anterior placement of occlusal rest:**

Forces transmitted to the mesial aspect of abutment will act to tip the abutment forward maintaining a tight contact with the tooth anterior to it and thus obtaining stabilization and support from the remaining anterior teeth. <sup>(30)</sup>

Placement of occlusal rest mesially in distal extension cases is recommended. This changes the stresses on the saddle from class I lever to class II lever. This decreases the stresses over the abutment and allows more even distribution of the load on the saddle. <sup>(23,30)</sup>

In addition, mesially placed occlusal rest increases the distance between the fulcrum point and the distal extension base, so the arc of rotation at any given point on the distal

extension base is flatter and more perpendicular to the ridge. Also The tendency for tooth rotation will be towards the mesial rather than the distal side; this provides additional support from the anterior natural tooth. <sup>(31)</sup>

### **B- Functional impression technique**

The objective of the functional impression technique is to provide maximum support for the partial denture base to minimize movement of the denture base which would cause leverage on the abutment teeth. <sup>(32)</sup>

Numerous studies <sup>(33,34)</sup> stated the advantages of the altered cast impression technique. The advantages include increased support for the denture base and decreased forces on the abutment tooth. The removable partial dentures made from an altered cast impression technique are believed to improve stress distribution, enhance patient comfort and preserve oral health.

Another study compared removable partial dentures made from anatomical impression with those made from an altered cast impression technique relative to clinical outcomes at insertion and one year later. The altered cast impression technique did not give significant advantages, provided the standards of this study were met. These standards included a

maximum extended impression, ensure complete seating of the framework, and coverage of the retromolar pad and buccal shelf by the denture base.<sup>(35)</sup>

### **C- Improving the supporting quality of the residual ridge**

The typical residual ridge to support a denture base would consist of cortical bone covering relatively dense cancellous bone with a rounded crest and high vertical slopes and covered by firm, dense connective tissue. The objective of conditioning abused and irritated tissue, removal of hyperplastic tissue and removal of bony spicules is to provide optimum support against vertical and horizontal stresses placed on the ridge by denture bases.<sup>(15)</sup>

## **3- Wide load distribution**

### **A- Wide distribution of load over the ridge:**

The length of saddle plays a significant role in broad distribution of load. The maximum extension of the denture base would equally distribute forces between the abutment and the alveolar ridge which is very important for preservation of the remaining hard and soft oral tissues. Dentures without maximum denture base extension or short saddles induced a greater concentration of tensions on the residual ridge.<sup>(36)</sup>