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NON-RIGID CONNECTOR FOR MANAGING BILATERAL PIER ABUTMENT IN FIXED DENTAL PROSTHESIS-A CASE REPORT

Prosthodontics

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ABSTRACT

In a clinical situation, whether in the maxillary or mandibular arch, is of a missing first premolar and first molar, in right and left upper arch, resulting in fixed partial denture design in which the canine and the second molar of both side act as terminal abutments and second premolar act as a pier abutment. It has been reported that restoration of four missing teeth and two intermediate pier abutments with a pair of rigid FPD is not an ideal treatment option. The concentration of stresses of rigid connector on pier abutments, which acts as fulcrum that leads to more debonding of fixed dental prosthesis affecting the success rate of fixed partial denture. The intrusive tendency of terminal abutments resulting teetering movement, causing debonding of less retentive terminal retainer. The use precision attachment (tenon mortise) for adequate dissipation of forces along the long axis of the tooth causing a stress breaking action. This present case report described a simple method to rehabilitate pier abutment cases using prefabricated semi precision attachment.

KEYWORDS

Pier Abutment, Non-Rigid Connector, Semi Precision Attachments, Tenon-mortise attachment.

INTRODUCTION

In restorative dentistry, replacement of missing teeth is a crucial part. Fixed partial denture treatment is always been accepted as the first modality for replacement of one or two teeth. The success of fixed partial denture depends upon the selection of abutment teeth, retainer, connector, pontic design, and longevity of edentulous span. During the function, the occlusal forces are applied to fixed partial denture prosthesis. These forces are conveyed to the abutments all through the pontic, retainers, and connectors. Biomechanical factors like overload, torque, leverage, and flexing bring about abnormal stress concentration in a fixed partial denture.

Selection of the correct type of connector can determine failure or success of the prosthesis. We are more adapted to the practice of rigid connector in clinical practice since its placement requires just enough proficiency in technique and laboratory skills. The real concern arises when we come across with case of 10-unit fixed dental prosthesis with a pier abutment. [1] A natural tooth situated between terminal abutments which act as a support to fixed or removable dental prosthesis is known as pier or intermediate abutment. [2]

The cause of higher debonding rates is the pier abutment act as a fulcrum during functionality of terminal abutments [3]. As a consequence of this, these restorations may result in marginal leakage and caries. Non-rigid connectors are suggested as a solution to these difficulties.

Connectors that combine the pontic and retainers, may be rigid or non-rigid. The type of rigid connectors are solder joints and cast connectors while non-rigid are precision attachment and stress breaker. Rigid connectors are easy to fabricate but they are contraindicated in some situations, especially where stress breaking mechanism is required the non-rigid connector with pier abutment is preferred.

By means of attachment either precision or semi precision, the principle of broken stress can be achieved (Markley, 1951). The non-rigid connector acts as stress breaker between retainer and pontic. The movement in a non-rigid connector is adequate to avoid the conduction of stresses from segment to the fixed partial denture [4]

Case Report

A 40- year- old female patient was referred to the Department of prosthodontics, with the chief complaint of inability to masticate and unpleasant aesthetics. The intraoral examination revealed missing teeth 14, 16, 24 and 26 (FDI tooth numbering system), with right and left maxillary canine and maxillary second molar acting as terminal abutments and both sides second premolar act as a pier abutment (Fig 1) Intra oral periapical radiograph showed good bone support for all the teeth hence can be used as an abutment. Past medical history was insignificant and past dental history revealed that patient had undergone extraction of extensively damaged right and left maxillary first premolar and first molar two years back, followed by conventional 3-unit FPD each side. But this prosthesis dislodged several times in span of two years providing a lot of discomfort to patient.

The treatment options presented to the patients were: a. Implant in edentulous spaces. b. Fixed partial denture with the rigid connector. c. Fixed partial denture with the non-rigid connector.

The patient did not agree for the implant due to surgical intervention and financial problem. The treatment of the patient with Fixed Partial Denture with rigid connector would have resulted in the adverse effect on abutments as well as the final prosthesis. Therefore, treatment option chosen was to restore with fixed partial denture with the nonrigid connector of Semi precision attachment

After comparing all the treatment options with their pros and cons, it was decided to rehabilitate the case with five-unit FPD using non-rigid connectors with tenon-mortise precision attachment on the distal aspect of a pier abutment.

Fig 1: Intraoral View

Technique: The patient was treated as per following procedure:
1. After removing the old 3-unit FPD each side from patient mouth, the diagnostic impressions were taken with irreversible hydrocolloid material (alginate normal setting type 2) with respect to maxillary and mandibular arches to obtain diagnostic cast (type 2 dental stone). The cast were articulated with the help of interocclusal record. The mockup was done on articulated cast for fabrication
2. The tooth preparation was done for porcelain fused to metal prosthesis on right and left maxillary canine and maxillary second premolar with equi-gingival margins to get desired aesthetics. The tooth preparation of 13, 15, 17, 23, 25 and 27 was done for metal-ceramic fixed partial denture with buccal facing ceramic and non-rigid connector (semi –precision between 15, 16, 25 and 26(fig 2). After gingival retraction, final impression was made with polyvinyl siloxane addition silicone . The cast was poured in high strength die stone after disinfection. By using mock up, temporization and provisional restoration was done using putty index (3M ESPE).

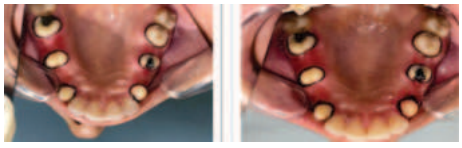

Fig 2 Tooth Preparation

3. Provisional restorations were fabricated with a tooth colour auto polymerizing acrylic resin and cemented with non eugenol temporary cement (NETC cement) (fig 3)

Fig 3 Provisional Restoration Provided

4. Cast was mounted on articulator with face bow transfer (fig 4,5,6)

Fig 4 Facebow Transfer

Fig 5 Facebow Transfer

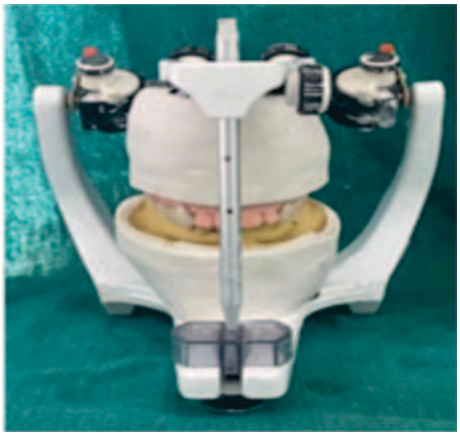

Fig 6 Mounted Cast

5. Fixed partial denture with non-rigid connector was prepared. Wax pattern was fabricated for 13, 14, 15, 23, 24, and 25 first. Wax pattern was fabricated and then the tenon-mortise attachment was placed on the distal aspect of the middle abutment.

Casting was done in two parts. First, the anterior segment consisting of 13, 14, 15, 23, 24 and 25 including the male component of the attachment and later wax pattern for the posterior segment consisting of 16, 17, 26, 27 including the female component was fabricated so that no interference or distortion would be encountered. On the distal surface of the wax pattern of 15 and 25, a plastic castable male semi-precision attachment was waxed up. Surveying was done to determine the position/parallelism of plastic male attachment. Investing and casting were done. (Fig 7)

Fig 7 Ceramized FPD with Tenon Mortise Precision Attachment

6. After casting, metal try-in of the individual units were done to verify proper seating (fig 8,9). Then ceramic facing was added. (Fig 10,11)

Fig 8 Metal Try In Right Side

Fig 9 Metal Try In Left Side

Fig 10 Interocclusal Record Right Side

Fig 11 Interocclusal Record Left Side

7. At the time of cementation, the mesial segment was cemented first followed by cementation of the distal segment. Cementation was done with Type II GIC cement (fig 12,13,14).

Fig 12 Final Prosthesis Cemented

Fig 13 Final Prosthesis Cemented (left)

Fig 14 Final Prosthesis Cemented (right)

8. The patient showed very satisfactory response immediately after cementation. The patient was instructed to maintain proper oral hygiene, and was evaluated after one week to assess the oral hygiene status.

DISCUSSION

The pontics and retainers are combines by the connectors which are the part of a fixed partial denture (FPD) [5], they may be rigid (cast connector or solder joints) or non-rigid (stress breaker or precision attachment). The preferred way of fabricating FPDs are rigid connectors between pontics and retainers, the selection of precise type of connector is crucial steps for success and failure of the prosthesis [6].

The location, shape and type of connector plays a vital role in the success of an FPD (Tylman's, 1989). With high stress concentrations and excessive movements at terminal abutments, a rigid connector with a pier abutment, acts as a lever. To eliminate the fulcrum action of pier abutment are recommended providing break type of connection in fixed partial denture. (Oruc, 2008 and Savion, 2006)

Because of the curvature of the arch, a considerable angle is made between the facio-lingual movement of an anterior tooth and molars. These movements can create stresses that will transfer to retainers and abutments teeth [7]. As a result of the middle abutment, that acts as a fulcrum, the forces are transmitted to the terminal retainers causing failure of weaker retainer [8]. These dislodging forces, have higher debonding rate in rigid type of FPD with pier abutment, than short span prosthesis, causing caries and marginal leakage [9]. To counter this, non-rigid connector has been recommended, that act as stress breaker between retainer and pontic. There is an equilibrium between distribution of stress from segment to the rest of the FPD, and the movement in a non-rigid connector.

The intrusion in abutment under the loading could lead to displacement between abutment and retainers [10]. Savion et al., analysed that the cause for debonding at the canine retainer, is the development of extrusive reactive forces, as the first molar is loaded due to flexural forces, developed within the FPD [11].

Positive aspects of non-rigid connectors are, they transmit shear stresses to supporting bone, it reduces MD torquing of abutments which allow free movement [12].

The negative aspects of non-rigid connectors are: gross tooth reduction of pier abutment, key lift off in the absence of occlusal stability, longer laboratory time [13].

Shillinburg et al, proposed the position of the non-rigid connector should be on middle abutment, in the five unit pier abutment restoration because on either of the terminal abutments placement, could result in the pontic acting as a lever arm. The keyway should be placed within the distal contours of the pier abutment, and the key should be placed on the mesial side of the distal pontic. The long axis of the posteriors tilt in a mesial direction, and occlusal forces produce further movement in this direction. The mesial movements place the key into the keyway more firmly if the keyway is placed on the distal side of the pier abutment. [13].

Seluck Oruc et al., supported and observed that the area of maximum focus of stress occurs in pier abutments and it was reduced by the use of non-rigid connectors at the distal region of the second premolar [14]. As suggested by Markley, that non-rigid connector should be placed at one of the terminal retainers, and highlighted that it should not be placed at the pier abutment because this would subject the relatively weak premolar abutment to extreme loads [15].

Gill recommended placing non rigid connector at one or both sides of the pier abutment [16]. Admas advised placing one non rigid connector at the distal side of pier, and if desired adding one more at the distal of the anterior retainer [17].

The four types of non- rigid connectors are the [18] Dovetail key-keyway or Tenon-Mortise type connectors.

- Cross-pin and wing type connector.
- Split type connector.
- Loop type connector.

Carl E Misch [19]suggested that in conventional FPD, to prevents mesial drift, the 'male' portion of a non-rigid connector located on mesial aspect of the posterior pontic, and, the 'female' portion is in the distal aspect of the natural pier abutment.

CONCLUSION

The use of non-rigid connector applied bilaterally placed between distal of second premolar retainer and mesial of first molar pontic where canine and second molar act as terminal abutments and second premolar act as a pier abutment on each side as discussed in this case report. The success of fixed partial denture depends upon type, shape and size of connectors. For transfer of stresses away from the pier abutment in the fixed partial denture, the precision attachment type of non-rigid connector is employed. The crucial phase in treatment planning of pier abutment is the selection of appropriate connector. By permitting physiological tooth movement the non-rigid connectors distribute the stress to abutments. For success of a long term fixed partial denture, it is significant to design and proper fit of non-rigid connectors.

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