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ORIGINAL CASE STUDY

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NON-RIGID ATTACHMENT TO BREAK THE STRESS ON PIER ABUTMENT: A CASE REPORT

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ABSTRACT

A most common clinical situation is presented with missing first premolar and first molar, resulting in FPD design in which the canine and the second molar act as terminal abutments and second premolar act as a pier abutment. In such case there is a tendency of terminal abutments to intrude during function results in a teetering movement, where the pier abutment act as a fulcrum. These movements will eventually lead to debonding of less retentive terminal retainer. An appropriate means of causing a stress breaking action is by use of a precision attachment (ten on-mortise) for adequate dissipation of forces along the long axis of the tooth and not in any other direction. The present case report describes incorporation of precision attachment to rehabilitate pier abutment in 5-unit FPD.

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INTRODUCTION

Fixed partial denture has always been the most accepted treatment modality for replacement of one or two missing teeth. The success of FPD depends upon a number of factors but the failure could be attributed to the occlusal forces applied to prosthesis during the function. These forces are transmitted to the abutments all through the pontic, connectors, and retainers leading to abnormal stress concentration in FPD (Mensor, 1973). Stress concentration is maximum at the region of the connector of prosthesis and in abutment near to edentulous ridge (Mensor, 1973). The situation become more challenging when to rehabilitate two edentulous spaces with one Pier abutment in between. Pier abutment also referred as "intermediate abutment", defined as "a natural tooth or implant abutment that is located between terminal abutments that serve to support a fixed or removable dental prosthesis" (The glossary of prosthodontic terms, 2017). However, in such clinical situations the pier abutment acts as fulcrum leading to dislodgment of prosthesis during function. Selection of correct type and right location of connector can determine success or failure of the prosthesis.[3]Connectors that unites the retainers and pontics, may be rigid (solder joints or cast connector) or non-rigid (precision attachment or stress breaker). Rigid connectors are easy to fabricate but their use is not indicated in all situations. Especially in case of pier abutment where a non-rigid connector is advocated acting as a stress breaking mechanical union to circumvent alignment problems in abutment preparations and to separate occlusal stresses (Becerra, 1987). This "Broken-stress" principle can be achieved by means of an attachment either a precision or semiprecision attachment (Markley, 1951). The present case report describes a simple technique to break stress around pier

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abutment by customizing precision attachment within a convention 5-unit FPD.

Case Report

A 35-year-old female patient was reported to the Department of Prosthodontics with a chief complaint of dislodged prosthesis, difficulty in mastication as well as aesthetic problem. Past medical history was insignificant and past dental history revealed that patient had undergone extraction of extensively damaged right maxillary first premolar and first molar two years back, followed by conventional 3-unit FPD (Figure 1). But this prosthesis dislodged several times in span of two years providing a lot of discomfort to patient. Intraoral examination revealed missing right maxillary first premolar and first molar with right maxillary canine and right maxillary second molar acting as terminal abutments and second premolar act as a pier abutment. The radiographic evaluation showed that the abutment teeth had adequate bone support to be used as abutment.

Figure 1. Intra-Oral view of old Prosthesis

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.

Clinical Procedure

After removing the old 3-unit FPD from patient mouth, the tooth preparation was donefor porcelain fused to metal prosthesis on right maxillary canine and maxillary second premolar with equi-gingival margins to get desired aesthetics. Next step was to modify the previously done tooth preparations on right maxillary second molar (Figure 2).

Figure 2. Gingival retraction and Tooth

The gingival retraction was carried out to take final impression using elastomeric impression material (Dentsply Aquasil putty and kit) with two step putty wash technique. An interocclusal record was made using bite registration material (Futar Fast Bite registration material). The provisional restorations were fabricated with a tooth color auto-polymerizing acrylic resin and cemented with non-eugenol temporary cement (Figure 3).The impression was poured in high-strength die stone(Kalabhai Karson Pvt.Ltd.). The Master cast was retrieved and die cutting was done followed with mounting of master cast on an articulator using interocclusal record (Figure 4).

Figure 3. Provisional Restoration Provided preparation of 13,15 and 17

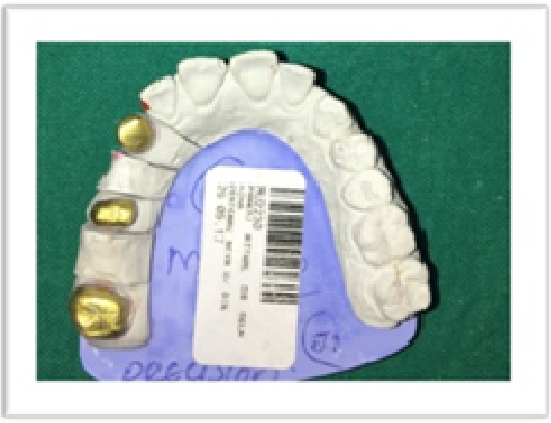

Figure 4. Master cast

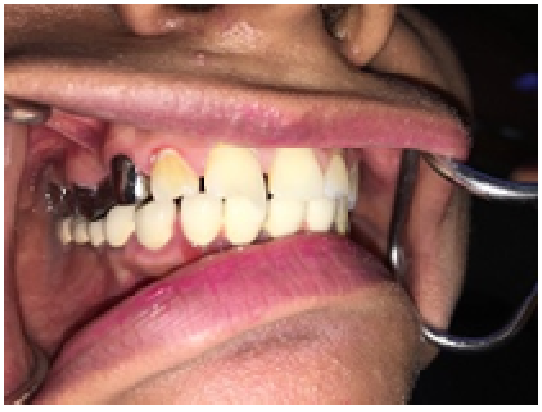

Figure 5. Metal try-in

Wax pattern was fabricated and then thetenon-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 and 15 including the male component of the attachment and laterwax pattern for the posterior segment consisting of 16 and 17 including the female

component was fabricated sothat no interference or distortion would be encountered. The metal try-in was done on patient to check the proper seating of prosthesis (Figure 5). Than ceramic layering was done to obtain a smooth and highly polished surface (Figure 6). Occlusal pre-maturities were corrected prior to final cementation (Figure 7).Anterior segment was cemented followed by posterior segment using type-I glass-ionomer cement (GC Fuji). Excesscement was removed using floss following radiographic evaluation.

Figure 6. Ceramized FPD with tenon- mortise precision attachment

Figure 7. Final Prosthesis cemented

The patient showed very satisfactory response immediately after cementation. The patient was instructed to maintain proper oral hygiene along with use of dental floss and interdental brush regularly. The patient was evaluated after one week to assess the oral hygiene status.

DISCUSSION

The shape, type and location of connector plays an important role in the success of an FPD (Tylman's, 1989). A rigid connector in long span FPD with a pier abutment, acts as a lever with high stress concentrations and excessive displacements may be observed at terminal abutments. Thus, nonrigid connectors are advised to eliminate the fulcrum action of a pier abutment providing an opportunity to break type of connection in fixed partial denture (Oruc, 2008 and Savion, 2006). Savion et al., stated that the possible reason for debonding is development of extrusive reactive forces at the canine retainer as the first molar is loaded due to flexural forces developed within the FPD.[8]Bothelo and Dyson reported that rigid FPDs with pier abutment were linked with higher debonding rates than short span prosthesis (Botelho, 2005)

The most broadly used nonrigid connector is a key and keyway (Tenon-Mortise), a T-shaped key is attached to the pontic and adovetail key way is placed on the retainer. Carl E Misch recommended that in conventional FPD, the 'male' portion of a non-rigid connector usually located on mesial aspect of the posterior pontic; whereas, the 'female' portion is in the distal aspect of the natural pier abutment (Badwaik, 2005). This prevents mesial drift from unseating the attachment. However, an implant does not undergo mesial drifting and the non-rigid connector location is more flexible. For a natural pier abutment two implants, a stress breaker is not indicated (Badwaik, 2005). The four types of non- rigid connectors are Dovetail key-keyway or Tenon-Mortise type, Cross-pin and wing type, Split type and Loop type connector (Adams, 1956). The accurate position of the dovetailor cylindrically shaped mortise is critical; it must parallel the path of withdrawal of a distal retainer (Standlee, 1988). The positioning of the mortise which iscylindrical in shape is very critical and must be parallel to the path of removal of the distal retainer. The location where the non-rigid connector is to be placed is also crucial step of treatment planning. There is a conflicting opinion on where to place the nonrigidconnector as Markleysuggested placement on oneof the terminal abutments and not at the pier abutment whereas, Adams and Shillingberg suggested to place connector at the distalside of pier (Picton, 1962). Advantages of non-rigid connectors are they, transmit shear stresses to supporting bone rather than concentering them in connectors. It minimizes mesio-distal torqueing of abutments and allow them to move independently. Disadvantage of non-rigid connectors are: (1) More tooth reduction of pier abutment, (2) Increased laboratory time and expense. (3) In the absence of occlusal stability some key has been observed to lift off from their keyway (Oruc, 2008).

Conclusion

This case report discusses the use of non-rigid connector situated between distal of second premolar retainer and mesial of first molar pontic where second premolar act as a pier abutment and canine and second molar act as terminal abutments. The use of precision attachments which act as stress breakers play an important role in increasing the longevity, stability and success of long span fixed partial dentures. The selection of proper connector is important step in treatment planning of pier abutment. Non-rigid connectors in form of ten on mortise precision attachment of cylindrical size was chosen for the present case.

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