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Non-Rigid Connector for Management of Pier Abutment: A Case Report

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I. INTRODUCTION

Pier abutment or intermediate abutment is a frequent clinical situation, either in the maxillary or mandibular arch. Missing first premolar and first molar results in a fixed partial denture (FPD) design in which the canine and the second molar act as terminal abutments and second premolar acts as a pier abutment. FPD with rigid connectors is not indicated in this situation. According to GPT-9 a rigid connector is a cast, soldered, or fused union between the retainer(s) and pontic(s) or splinted crowns. (1) When occlusal load is applied to retainer on the abutment tooth at one end of the FPD with rigid connector; the pier abutment acts as fulcrum and generates tensile forces between the retainer and the abutment at the other end of the FPD. This tensile force on the other end acts as an extrusive force and it may gradually result in loss of retention of anterior or posterior terminal abutments. Biomechanical factors such as overload, leverage, torque and flexing induce abnormal stress concentration in an FPD. (2) The excessive flexing of a long span FPD can lead to material failure of prosthesis or to an unfavourable response.(3)

Miles R Markley stated that teeth joined rigidly together either must function as a unit, or the restoration will fail in one of three ways:(4)

a) The least retentive attachment will be torn loose from its abutment tooth, and destructive caries will follow.

b) Some metallic portion of the bridge will fracture.

c) Frail parts of the bridge, such as porcelain facings or thimbles, will fracture due to continual flexing of the metal structure which supports them.

This challenge can be managed by FDP with a non-rigid connector. According to GPT-9 non rigid connector is any connector that permits limited movement between otherwise independent members of a fixed partial denture. (1) It provides a stress breaking mechanical union of retainer and pontic, thus transferring the stress to the supporting bone rather than concentrating it on the connectors. A non-rigid fixed dental prosthesis appears to minimize mesio distal torqueing of the abutments while permitting them to move independently (3).

A non rigid attachment may be indicated for other situations in which a discrepancy in the long axis of the abutment teeth is such that the rigid prosthesis could not be seated without excessive removal of structure on one or more of the abutment teeth.(2)

The non rigid connector can be made by the incorporation of pre fabricated inserts, by the use of a custom milling machine or by the use of incorporation of pre fabricated plastic patterns.(5)

There are four types of non-rigid connectors(6)

- Dovetail (key-keyway or Tenon-Mortise) type connectors.
- Cross-pin and wing type connectors.
- Split type connectors.
- Loop type connectors.

When a fixed partial denture is fabricated with a non-rigid connector, it is necessary to align the path of insertion of the keyway with that of the distal abutment. Key keyway is best suited for relieving stress at mid span on long pontics. The cross pin and wing are the working elements of a two-piece pontic system that allows two segments to be rigidly fixed after the retainers have been cemented on their respective abutment preparations. The design will find use primarily in accommodating abutment teeth with disparate long axis. The path of insertion of each tooth preparation is made to parallel the long axis of that tooth. Split type connector is an attachment that in placed entirely within the pontic. It is particularly useful in tilted abutment cases, where the use of a conventional dovetail would necessitate the preparation of a very drastic box in the distal aspect of the pier abutment

Selecting the type of connector plays a very significant role in the success of the prosthesis. While non-rigid connectors can predictably improve the treatment outcome of a pier abutment FDP, the shortcomings of a non-rigid connector are the increased laboratory time and costs, increased reduction of tooth structure on the pier abutment and chances of key being dislodged from keyway in the presence of occlusal instability. Also there is difference in opinion on the site of placement of the non-rigid connector. Oruc et al on a study on Stress analysis of effects of non rigid

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connectors on fixed partial dentures with pier abutments concluded that the stress distributions and values of an FPD and a pier abutment are affected of a non rigid connector. The area of minimum stress concentration occurs in pier abutments when a non rigid connector is located at the distal region of the pier abutment for a 5-unit FPD (mandibular canine, second premolar, and second molar as abutments) with a pier abutment.

II. CASE REPORT

Figure 1) Pre operative picture showing missing 14 and 16

A 55 years old male patient came to the Department of Prosthodontics with a chief complaint of multiple missing teeth.(Figure 1) On examination, the patient presented with missing maxillary right first premolar and first molar. The missing teeth were extracted about 6 months back and now the patient wanted a fixed prosthodontic rehabilitation. Patient reported history of placement of FPD on 24, 25, 26, 27 three months back. Past medical history was not significant. Radiographic analysis showed adequate support for the abutment teeth. Patient had a history of extraction of 14 and 16 due to dental caries. The possible treatment options with their pros and cons were discussed with the patient and finally it was decided to rehabilitate the patient by a fixed dental prosthesis with a non-rigid connector using the maxillary right canine and second molar as retainers and the second pre molar as a pier abutment. The treatment option was explained to the patient and a written consent obtained for the same.

PROCEDURE:

- The tooth preparation for canine, second premolar and second molar was accomplished for porcelain fused to metal fixed dental prosthesis with equigingival margins and a shoulder finish line. (Figure 2a)
- The gingival retraction was carried out with gingival retraction cord (SilTrax AS Braided Retraction Cord) and final impressions were made using elastomeric impression material (Zhermack Elite Hd+ Soft Putty and DPI Photosil light body impression material) using two step putty-wash technique.
- The impressions were poured in type IV dental stone.
- Interocclusal records were made using a bite registration paste (Zhermack Occlufast Rock Bite Registration Material).
- Provisional restorations were fabricated (DPI Self cure Tooth Moulding Powder) and where luted by non eugenol temporary cement (Oratemp NE)
- In the laboratory, master casts were retrieved and die prepared. (Figure 2B)
- The wax pattern was fabricated on the canine, first premolar and second premolar and a recess was cut on the distal aspect of the pier abutment to fit the prefabricated plastic dovetail for the female part of the non-rigid connector.
- Surveying was done to determine the parallelism and optimum position of the plastic dovetails within the contour of the pier abutment.
- The male pattern was removed from the female pattern and care taken to keep the inside of the female pattern free of wax.

Casting of the patterns was done and finished. (Figure 3)

- Metal try-in of the individual units was done to verify proper seating. (Figure 4A, 4B)
- On achieving satisfactory fit, ceramic was added to the units.
- At the time of cementation of the prosthesis, the anterior segment with the keyway was cemented first followed by posterior segment with the key using glass ionomer cement.
- The patient was instructed in maintenance of proper oral hygiene and the use of floss and interdental brush was encouraged.
- The patient was motivated for the importance of regular recall visits.

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CAST POURED WITH

Figure 2a) Tooth preparation (mirror image) Figure 2b) cast showing the die cutting

Figure 3) Metal framework of the FPD with non rigid connector on the cast

Figure 4a) Anterior segment metal try in figure 4b) posterior segment metal try in
(Intra oral mirror image)

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Figure 5) Final prosthesis with ceramic layering

Figure 6) Anterior segment cementation followed by posterior segment cementation
(Intra oral mirror image)

III. CONCLUSION

The selection of proper connector is a significant step in treatment planning of pier abutment. The size, shape and type of connectors play a pivotal role in future success of a FPD. Non-rigid connectors transfer less stress to abutments also allowing physiologic tooth movement. Thus, the design and passive fit of non-rigid connectors is significant to success of a long span fixed partial denture.

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