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Treatment of Pier Abutment using Non-Rigid Connectors: Case Series

KEYWORDS: pier abutment, connector, Non-rigid connector, fixed partial denture

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ABSTRACT In fixed partial denture the brunt of the occlusal forces is transmitted to the abutment teeth through pontic, connector and retainer, which is maximum on the terminal abutment due to the direction of the occlusal forces. Real problem arises when we encounter pier abutment. When occlusal load is applied to the retainer of the abutment tooth at one end of fixed partial denture, the pier abutment may act as the fulcrum. Thus, tensile forces may then be generated between retainer and abutment at the other end of the restoration. This will eventually result in debonding of the less retentive terminal retainer resulting in marginal leakage and caries. These failures can be prevented by using the broken stress mechanism provided by a non rigid connector. This clinical case series describes the use of non-rigid connectors to rehabilitate pier abutment cases.

INTRODUCTION:

Connectors are the part of a fixed partial denture (FPD) that unites the retainers and pontics[1]. Connectors may be rigid (solder joints or cast connector) or non-rigid (precision attachment or stress breaker). Rigid connectors between retainers and pontics are the preferred way of fabricating most FPD. They are not indicated in all situations like an edentulous space on either side of pier abutment[2]. Teeth in different segments of the arch move in different directions. These movements of measurable magnitude and in divergent directions can create stresses in a long span prosthesis that will transfer to retainers and their respective abutments teeth[2]. These forces are transmitted to the terminal retainers as a result of the middle abutment acting as a fulcrum, causing failure of weaker retainer[3].

The selection of right type of connector during treatment planning is an essential step for success and failure of the prosthesis[4].This clinical series describes incorporation of non-rigid connector to rehabilitate pier abutment in two different situations.

CASE REPORT 1:

A 35 yr old male patient reported to Department of Prosthodontics, Govt. Dental College and Hospital, Mumbai with the chief complaint of poor aesthetics due to missing and discoloured anterior teeth. Past medical history was insignificant and past dental history revealed that patient had undergone endodontic treatment for 12 and 21. Intraoral examination revealed missing 11, 22 and 24 due to trauma 2 years back and discoloured 12 and 21. In this case 12 and 25 were the terminal abutments and 21 and 23 were the pier abutments(fig-1).

Figure 1: preoperative intraoral view

On radiographic evaluation 12 and 21 were endodontically treated and the abutment teeth had adequate bone support.

After discussing all the treatment options with the patient it was decided to rehabilitate this case by making a five unit conventional fixed partial denture for missing 11 and 22. A non-rigid connector was placed on distal aspect of 23 for the missing 24. A non-rigid connector was used between 23 and 24 as the amount of faciolingual movement and the direction of the movement varies considerably from the anterior to the posterior segment of the arch[2]. A written consent was taken by the patient prior to the commencement of the treatment.

Clinical procedure:

The following clinical procedure was carried out for the oral rehabilitation of this patient.

- Tooth preparation was done for porcelain fused to metal complete veneer preparation with 12, 21 and 23. More preparation was done on the distal aspect of 23 to accommodate the female component of the non-rigid connector(fig-2).
- Partial veneer preparation was done with 25(fig-2).

Figure 2: Tooth preparation done with 12,21,23,25

- Gingival retraction was carried out and final impression was made by double mix double step technique using addition silicone(fig-3).

Figure 3: Final impression

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- Face bow and interocclusal records were made(fig-4).

Figure 4: Interocclusal record and face bow transfer

- Provisional restoration was fabricated using tooth coloured autopolymerising acrylic resin and cemented by temporary non-eugenol cement.
- Impression was poured with Type IV Gypsum product.
- Master cast was mounted on the semiadjustable articulator using interocclusal record.
- Wax pattern was fabricated for 11,12,21,22,23 and 25 and provision was made for the female part of prefabricated plastic dovetail on distal aspect of 23.
- Surveying was done to determine the position and parallelism of plastic dovetail(fig-5).

Figure 5: Prefabricated plastic dovetail incorporated in wax pattern

- Female component of the plastic dovetail was placed within the correct contour of the pier abutment.
- Male plastic pattern was seated in the female component and the wax pattern was fabricated for 24.
- Investment and casting of the wax pattern was carried out.
- Metal try-in of individual unit was done to verify the proper seating (fig-6).

Figure 6: Metal try in of male and female pattern

- Ceramic layering was done for all units except 25.Bisque trial was done to verify the aesthetics.
- During cementation, anterior 5 unit segment with female component was cemented first followed by cementation of posterior two unit segment with male component using glass ionomer cement (fig-7).

Figure 7: Post-cementation intraoral view

- Post insertion instruction was given to the patient to maintain good oral hygiene with the use of dental floss and interdental brush.

After a week patient was evaluated for oral hygiene status.

CASE REPORT 2:

A 40 yr. old female patient reported to Department of Prosthodontics, Govt. Dental College and Hospital, Mumbai with the chief complaint of poor aesthetics and difficulty in chewing due to missing 24 and 26. Past medical history was insignificant and past dental history revealed that patient had undergone extraction of the badly carious 24and 26 two years back.

Intraoral examination revealed missing 24 and 26 with 23 and 27 acting as terminal abutments and 25 acting as a pier abutment (fig-8).

Figure 8: Preoperative intraoral view

The abutments were of adequate clinical height and good periodontal support. Radiographic examination revealed adequate bone support with the abutments.

After discussing all the treatment options and their pros and cons with the patient it was decided to rehabilitate this case by making a five unit fixed partial denture using non-rigid connector on the distal aspect of 25. A written consent was taken by the patient prior to the commencement of the treatment.

Clinical procedure:

Tooth preparation was done for 23 and 25 to receive porcelain fused to metal retainers and 27 was prepared for complete metal retainer (fig-9).

Figure 9 : Tooth preparation done for 23,25 and 27

Impression was made with polyvinylsiloxane. Prefabricated plastic pattern for non-rigid connector was incorporated during wax pattern fabrication on the distal aspect of pier abutment using a surveyor (fig-10).

Figure 10: Final impression

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Investment and casting of the wax pattern was carried out.Metal try-in of both the segments was done to verify the proper seating. Ceramic layering was carried out (fig-11). Bisque trial was done to verify the aesthetics and occlusion.

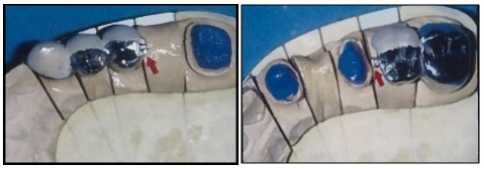

Figure 11: Anterior segment with keyway Mortise and posterior segment with key Tenon

During cementation anterior three unit segment with keyway was cemented first followed by cementation of posterior two unit segment with key using glass ionomer cement(fig-12).

Figure 12: Post cementation

Post insertion instruction was given to the patient to maintain good oral hygiene with the use of dental floss and interdental brush.

DISCUSSION:

Rigid connectors between pontic and retainer are the preferred way of fabricating fixed partial dentures as it provides desirable strength and stability to the prosthesis and minimizes the stress associated with the restoration[2]. But, the real problem arises when we encounter a pier abutment. Natural tooth located between terminal abutments that serve to support a fixed or removable dental prosthesis is known as pier abutment[1].

In such cases, the fixed partial denture with rigid connector, either must function as a unit or the restoration will fail in one of three ways.

1. The least retentive attachment will be debonded with its abutment tooth and destructive caries will follow.
2. Some metallic portion of the bridge will fracture.
3. Porcelain might fracture due to continuous flexing of the metal structure which supports them[5].

These failures occur due to the variation in the movement of individual tooth because of their arch position and the fulcrum created by the pier abutment which may cause failure of the weakest terminal abutments and intrusion of pier abutment[4].Thus, rigid connectors are not indicated for these situations.

Since there are limits to increasing a retainer's capacity to withstand displacing forces, some means must be used to neutralize the effect of those forces. Non-rigid connectors are suggested as a solution to these difficulties[4].

As the Non-rigid connector is a broken stress mechanical union of the retainer and pontic, it prevents the transfer of stress from the segment being loaded to the rest of the fixed partial denture[2].These non-rigid connectors are made by either incorporating a prefabricated insert in the wax pattern or through custom milling of the anterior segment of the casting. The second segment is later customized to the milled retainer. There is a difference in opinion on placement of the non-rigid connector. Markley[5] suggested placement at one of the terminal abutments and not at the pier abutment. Adams[6] suggested placing the connector at the distal side of pier, and if desired, adding one more at the distal side of the anterior retainer, while Gill[7] suggested placing it at one side or both sides of the pier. Carl E.Misch[8] recommended that in conventional fixed prostheses, the "male" portion of a nonrigid attachment usually is located on the mesial aspect of the posterior pontic, whereas the "female" portion is in the distal aspect of the natural pier abutment tooth. This prevents mesial drift from unseating the attachment. SelcukOruc in his stress analysis study concluded that the area of maximum stress concentration at the pier abutment was decreased by the use of a nonrigid connector at the distal region of the pier abutment[9].

The success of FPD depends on size, shape and type of connector[10].This clinical case series discusses the use of Tenon Mortise non-rigid connector for two patients, with Mortise female component placed within the contours on the distal surface of canine and another on the distal surface of the second premolar which were acting as the pier abutment with their respective Tenon male counterparts on the adjacent pontics.

Advantages of the non-rigid connectors are they transmit shear stresses to supporting bone rather than concentring them in connectors. Sutherland[11], stated that non-rigid connectors minimizes mesio-distal torquing of abutments and allow them to move independently. Disadvantages of non-rigid connectors are need of excessive reduction of the pier abutment, increased laboratory time and increased cost.

CONCLUSION:

The selection of right type of connector during treatment planning of pier abutment is an essential step in the success and failure of the prosthesis[11]. Dislodging forces in rigid type of FPD with pier abutment have higher debonding rate than short span prosthesis, resulting in marginal leakage and caries [12]. Fixed partial dentures with non-rigid connectors decreasethe stress on the abutments thereby increasing the longevity of the prosthesis in pier abutment cases.

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