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Use of nonrigid connector in managing stresses to the pier abutment

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Abstract:

The use of a nonrigid connector (NRC) in a fixed partial denture having pier abutment increases the life of the prosthesis. Rigid connectors though most commonly used, result in early failure of the prosthesis such as debonding as well as put adverse effects on the abutments when used in the case of pier abutment. When prosthesis comes in function, the pier abutment acts as fulcrum, and high-stress concentration may occur at pier abutment ensuing in excessive displacement at terminal abutments. This case report presents rehabilitation of missing first premolar and first molar using NRC at the second premolar (pier abutment).

Key words: Fulcrum, nonrigid connector, pier abutment, stresses

Fixed partial denture (FPD) treatment has always been accepted as the first modality for replacement of one or two teeth. The success of FPD depends on the selection of abutment teeth, retainer, connector, pontic design, and longevity of edentulous span.[1]

Connectors are that portion of the FPDs that unite the retainers and the pontics. They are of two types, rigid connectors and nonrigid connectors (NRCs). Rigid connector could be made by casting, soldering, and welding. The cast connectors are to be properly shaped in wax patterns. The soldered connectors are made by fusion of intermediate metal alloy to the previously made castings. The connector that permits limited movement between the otherwise, independent members of the FPDs is the NRC.[2] A pier abutment or intermediate abutment is a natural tooth located between terminal abutments that serve to support a fixed or removable dental prosthesis.[3]

Planning a FPD that has rigid connectors for a pier abutment results in debonding of the anterior abutment[4] or teetering movement,[5] wherein the middle retainer acts as a fulcrum. This problem can be easily avoided with the use of a NRC.

The following case report illustrates the rehabilitation with a 5-unit fixed dental prosthesis using NRC on the distal part of the pier abutment.

Case Report

A 35-year-old female patient [Figure 1] reported to the Department of Prosthodontics, College of Dental Sciences, Davangere, with missing teeth #14 and #16, and she had difficulty in chewing. On examination, it was found that the patient had canine-guided occlusion bilaterally.

Radiologically and clinically, the abutment teeth were having favorable criteria.

After discussing all the treatment options, it was decided to rehabilitate the case with 5-unit FDP using NRCs on the distal aspect of pier abutment. A precision attachment named Preci-Vertix (Ceka Preci line system) [Figure 2] was selected in this case. It had frictional retention and plastic pattern male/patrix and female/matrix, with built-in paralleling mandrels.

- Fixation: Male/patrix cast as part of pontic pattern; female/matrix cast as part of crown pattern

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- Space requirements: Height - 2 mm, preparation depth - 2 mm, and width - 2.6 mm.

Procedure

- Tooth preparations were completed and impressions were made with polyvinyl siloxane impression material
- Wax pattern was fabricated [Figure 3], and recess for the female was cut accordingly to fit the plastic dovetail on the distal aspect of pier abutment
- Surveying was done to determine the position/parallelism of plastic dovetail [Figure 4]
- Plastic dovetail female was placed within the correct contour of the abutment tooth. Male pattern was removed from the female pattern, keeping the inside of female pattern free of wax. Any extension of the female pattern above the occlusal of the abutment was left remaining
- After investing and casting, excess height of the female pattern was reduced, and metal try-in of the part with the matrix/female was done [Figure 5]
- Male/patrix pattern was seated in the casted female. Adjacent pontic and abutment were waxed up, and the mandrel was cut off from the male pattern [Figure 6]. Casting of the male pattern was contemplated
- Now matrix and patrix were assembled [Figure 7]
- Ceramization was done on #13, #14, and buccal facing was done on #15, #16, and #17. The prosthesis was cemented with glass ionomer cement [Figure 8].

Discussion

Connectors are the part of a FPD that unite the retainers and pontics.[3] Connectors may be rigid (solder joints or cast connector) or nonrigid. Although rigid connectors are most commonly fabricated, in some situations like using pier abutment, NRCs are indicated.[6] If rigid connector is given in a prosthesis with pier abutment, the pier abutment may act as a fulcrum. Tensile forces may then be generated between the retainer and abutment at the other end of the restoration. Anterior or posterior abutments may experience extrusive force, and the resultant tensile force at the retainer to abutment interface may lead to potential loss of retention for these restorations, thus resulting in marginal leakage, caries of abutment, and FDP

Figure 1: Preoperative lateral view

Figure 2: Preoperative occlusal view

Figure 3: Wax pattern fabrication

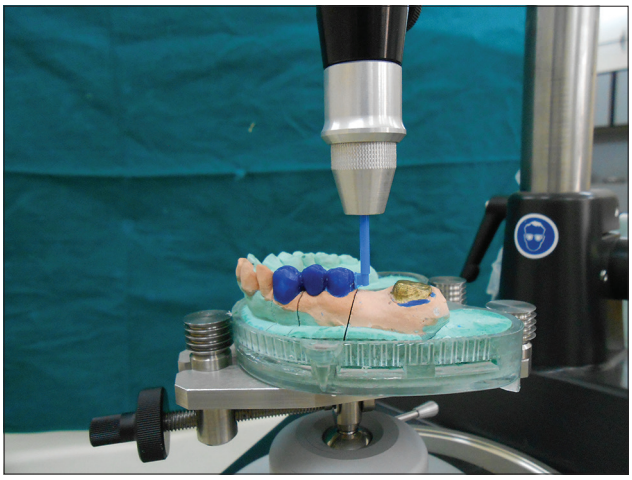

Figure 4: Placing the attachment with the surveyor

Figure 5: Casting of mesial portion of prosthesis with the key part of the attachment and wax pattern fabrication of the distal part

Figure 7: Final prosthesis

failure.[7] The use of a NRC has been recommended to reduce this hazard. The NRC act as stress breaker between retainer and pontic instead of usual rigid connector. The movement in a NRC is enough to prevent the transfer of stress from segment being loaded to the rest of the FPD.[8]

In addition, stress concentration is originated in the connectors of the prosthesis and in the vicinity of the cervical dentin near the edentulous ridge. When a NRC is integrated at the distal region of the pier abutment, the area of stress concentration in pier abutment is reduced. NRC transmits shear stresses to supporting bone rather than concentrating them in connectors. It minimizes mesiodistal torquing of abutments and allows them to move independently.[9]

Location of the nonrigid connector

The stress distribution and values of an FPD and pier abutment are affected by the presence and location of a NRC. The area of minimum stress concentration occurs in pier abutments when a NRC is located at the distal region of the pier abutment for a 5-unit FPD.[10] The NRC if placed on the terminal abutment could result in pontic acting as a lever arm. Placement of the NRC on one or both side of pier abutment has also been documented.[11] In a conflicting opinion, Markley[12] has suggested that NRC should be placed at one of the terminal retainers instead of at premolar as it would be subjected to a relatively weak premolar to extreme loads.

Figure 6: (a) Mesial portion of prosthesis with the key part of attachment. (b) Distal part of prosthesis with the keyway

Figure 8: Postoperative lateral view

The long axes of the posterior teeth usually lean slightly in a mesial direction, and vertically applied occlusal forces produce further movement in this direction. The "male/key" portion of a nonrigid attachment usually is located on the mesial aspect of the posterior pontic, whereas the "female/keyway" portion is in the distal aspect of the natural pier abutment tooth. This prevents mesial drift from unseating the attachment and moreover seats the key into the keyway more solidly.[13]

It is interesting to note that an implant does not undergo mesial drifting, and the NRC location is more flexible. For a natural pier abutment between two implants, a stress breaker is not indicated.[14]

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Conflicts of interest

There are no conflicts of interest.

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