Case Report

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Non-Rigid Connectors in Fixed Prosthodontics: A Case Report

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Abstract

The occlusal forces applied to a fixed partial denture (FPD) are transmitted to the supporting structures through the pontic, connectors, and retainers. The excessive flexing of the long-span FPD, which varies with the cube of the length of span, can lead to material failure of prosthesis or to an unfavorable response. Biomechanical factors such as overload, leverage, torque and flexing, induce abnormal stress concentration in an FPD. Stress concentration is found in the connectors of the prosthesis and in the cervical dentin area near the edentulous ridge. This factor plays an important role in the potential for failure in long-span FPD. The conventional use of a nonrigid connector (NRC) aids in compensating for the difference in the resistance and retention form between the abutments. The design and passive fit of NRC is critical to the success of a long-span FPD. This paper a case report of Pier abutment treated with FPD having Tenon-Mortise Connector.

Keywords: Non-rigid connectors; Tenon-Mortise connectors.

Introduction

The occlusal forces applied to a fixed partial denture (FPD) are transmitted to the supporting structures through the pontic, connectors, and retainers.[1]

Biomechanical factors such as overload, leverage, torque, and flexing induce abnormal stress concentration in an FPD. Stress concentration is found in the *connectors* of the prosthesis and in the *cervical dentin area* near the edentulous ridge. This factor plays an important role in the potential for failure in long-span FPD. Thus, the choice of connectors for a particular clinical situation is very important.

The Concept of Non-Rigid Connector[2-7]

In some patients, the pattern of missing teeth may require the use of an FPD with a pier abutment. Restoration of 2 missing teeth and an intermediate pier abutment with a rigid FPD is not an ideal treatment.1-3 When an occlusal load is applied to the retainer on the abutment tooth at 1 end of an FPD with a pier abutment, the pier abutment may act as a fulcrum (Fig 1).

Thus, 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 forces during fulcrum action, and resultant tensile force at the retainer to-abutment interface may result in potential loss of retention for these restorations. It has been reported that rigid FPDs with pier abutments are associated with higher debonding rates than short-span prostheses. Thus, these restorations may result in marginal leakage and caries. Nonrigid connectors are suggested as a solution to these difficulties.

Stress analysis of effects of nonrigid connectors on fixed partial dentures with pier abutments was studied by Oruc et al. they developed 3-dimensional cross-section FEM model (SAP 2000) simulating a 5-unit metal ceramic FPD with a pier abutment with rigid or nonrigid designs (connector location at the

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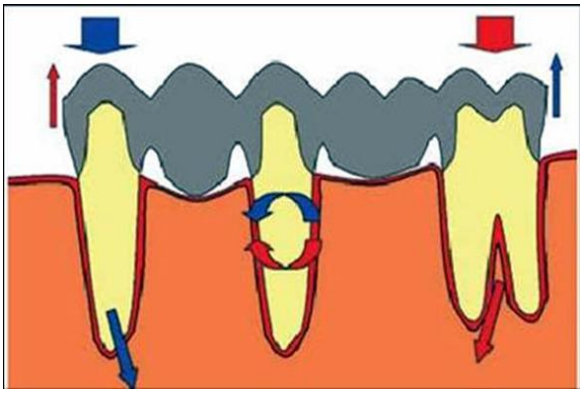
Fig 1: Schematic representation of pier abutment acting as a fulcrum. Blue line: anterior loading situations, Red line: posterior loading situations



mesial region of the second molar, at the distal region of the second premolar, at the mesial region of the second premolar, and at the distal region of the canine). The analysis of the von Mises stress values revealed that maximum stress concentrations were located at the load areas for all models. Also, for all models, the highest stress values were located at connectors and cervical regions of abutment teeth, especially at the pier abutment. They 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 second premolar.

Clinical guidelines for NRC Fabrication

The NRC could be made by an incorporation of prefabricated inserts, by use of a custom-milling machine or by use of the prefabricated

Figure 3: Teeth preparations & gingival retraction

Figure 2: Pre-treatment view

plastic patterns.[2] The NRC should be prepared within the contours of the retainers and the male (Tenon) is attached to the pontic. The limiting factors are the abutments having a large pulp size, and abutments with reduced clinical crown height.

The four types of NRCs[2,3] are the

1. Dovetail (key-keyway) or (Tenon-Mortise) connectors.
2. Loop connectors.
3. Split connectors.
4. Cross pin and wing connectors.

Align the path of the keyway to that of distal abutment. Deep wax box is carved into distal of wax pattern for the incorporation of keyway, which in turn requires intracoronal preparation of adequate depth and parallel path of insertion.

Figure 4: Die Cast

Fig 5 &6 : Prefabricated NRC pattern embedded in wax pattern with surveyor rod

Some nonadjustable intracoronal attachments

1. *Rod and tube attachment*: It could be used in FPDs with a minor alignment problem of the abutment.
2. *Cylindrical slide attachment*: Same as above.
3. *Stern tube-lock*: Patrix and matrix elements are plastic burnout patterns, which are incorporated into the wax patterns and cast.
4. *Preat-contur*: Slide attachment tapering from the occlusal surface to the cervical margin.
5. *Conicast*: Same as the Preat-contur.
6. *Dovetail slide attachment by Prof. Beyeler* : could be used in posterior FPD with minor alignment problem of the abutments and as a connector.
7. *Laboratory-made*: It appears simple but requires precision.

Adjustable intracoronal attachments

1. *Ancra*: Activation could be done by the expansion of the slot with a suitable instrument.
2. *McCollum*: The active side of the Patrix must face buccally to allow activation without interference from the lingual or palatal bracing support.

If a NRC is placed on the mesial side of the

Fig 7a: Mesial segment with keyway (Mortise) on its distal aspect. The second and first molars with key (Tenon) on its mesial aspect was fabricated

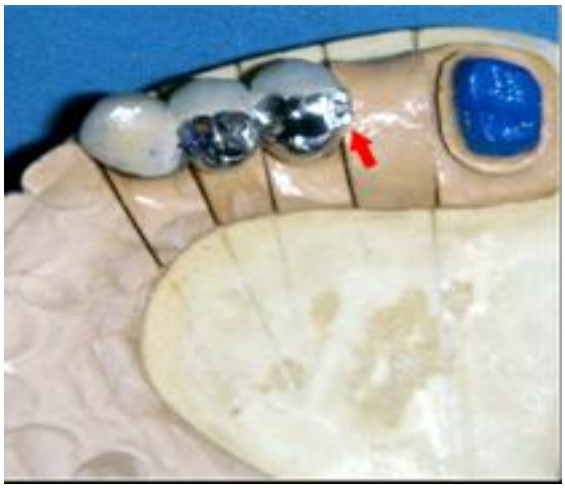


Fig 7b: Distal segment key (Tenon) on its mesial aspect

Fig 7c: Both segments together

middle abutment, mesially directed movement will *unseat the key*.[8]

If a NRC is placed on the distal side of the retainer of the middle abutment, movement in the mesial direction will *seat the key into the keyway*.

Case report

A 35-year-old lady came to our Department, with the chief complaints of replacement of some missing teeth in the upper left posterior region.

Period of edentulism was approximately 3 months. Oral examination revealed missing maxillary left first premolar and molar. {Figure 2).

Radiologic examination revealed the abutments without any periapical pathology.

Preparation of canine, second premolar and molar was done for metal-ceramic FPD with buccal ceramic facing and a NRC between the second premolar and first molar. The buccal margin was deep chamfer and all the other margins were chamfer finish line. The distal of the second premolar was prepared to accommodate a NRC. (Figure 3)

Single step putty-wash impression was made for the preparation of the working model. It was poured in high strength die stone. (Figure 4)

The provisionals prepared were cemented with temporary luting cement.

Figure 8: Post-treatment view

Fixed partial denture with NRC was prepared. Prefabricated pattern (Bego, Germany) was used with surveyor for proper alignment.

The anterior segment of canine, first and second premolars with the keyway (Mortise) on its distal aspect was fabricated. (Fig 5, 6, 7a-c)

After finishing of the FPD, application of ceramic was done on the buccal surface. First the cementation of anterior segment was done and then the cementation of the posterior segment was done. Figure 8 shows Post-treatment view with definitive FPD cemented in place.

Conclusion

Because the pier abutment used in rigid FPDs can act as a fulcrum, the restoration of a terminal abutment may become loose. When fabricating a 5-unit FPD from the maxillary canine to second molar with a pier abutment, the use of a nonrigid connector at the distal of the second premolar may reduce potentially excessive stress concentration on the pier abutment.

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