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CASE REPORT

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Indigenously Fabricated Non-rigid Connector for a Pier Abutment

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ABSTRACT:

Rigid connectors between pontics and retainers are the preferred way of fabricating most fixed partial dentures. A fixed partial denture with the pontic rigidly fixed to the retainers provides desirable strength and stability to the prosthesis while minimizing the stresses associated with the restoration. A completely rigid restoration is not indicated for all situations requiring a fixed prosthesis. In order to overcome the potential risk of this clinical situation the use of non-rigid connectors has been advised1.

Key words: Pier abutment, Differential movement, Non rigid connector

INTRODUCTION

An edentulous space can occur on both sides of a tooth, creating a lone, freestanding pier abutment Physiologic tooth movement, arch position of the abutments, and a disparity in the retentive capacity of the retainers can make a rigid five-unit fixed partial denture a less than ideal plan of treatment.

Studies in periodontometry have shown that the faciolingual movement ranges from 56 to 108 µ and intrusion is 28µ. Teeth in different segments of the arch move in different directions. Because of the curvature of the arch, the faciolingual movement of an anterior tooth occurs at a considerable angle to the faciolingual movement of a molar .These movements of measurable magnitude and in divergent directions can create stresses in a long-span prosthesis that will be transferred to the abutments. Because of the distance through which movement occurs, the independent direction and magnitude of movements of the abutment teeth, and the tendency of the prosthesis to flex, stress can be concentrated around the abutment teeth as well as between retainers and abutment preparations. It has been theorized that forces are transmitted to the terminal retainers as a result of the middle abutment acting as a fulcrum, causing failure of the weaker retainer.

However, photo elastic stress analysis and displacement measurement indicate that the prosthesis bends rather than rocks. Standlee and Caputo suggest that tension between the terminal retainers and their respective abutments, rather than a pier fulcrum, is the mechanism of failure. Intrusion of the abutments under the loading could lead to failure between any retainer and its respective abutment. The loosened casting will leak around the margin, and caries is likely to become extensive before discovery.

The retention on a smaller anterior tooth is usually less than that of a posterior tooth because of its generally smaller dimensions. Since there are limits to increasing a retainer's capacity to withstand

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displacing forces, some means must be used to neutralize the effects of those forces. The use of a nonrigid connector has been recommended to reduce this hazard.

In spite of an apparently close fit, the movement in a nonrigid connector is enough to prevent the transfer of stress from the segment being loaded to the rest of the fixed partial denture (Fig 7-23). The nonrigid connector is a broken-stress mechanical union of retainer and pontic, instead of the usual rigid connector .The most commonly used nonrigid design consists of a T-shaped key that is attached to the pontic, and a dovetail keyway placed within a retainer. Use of the nonrigid connector is restricted to a short-span fixed partial denture replacing one tooth. The magnification of force created by a long span is too destructive to the abutment tooth under the soldered retainer. Prostheses with nonrigid connectors should not be used if prospective abutment teeth exhibit significant mobility. There must be equal distribution of occlusal forces on all parts of the fixed partial denture. A nonrigid fixed partial denture transfers shear stress to supporting bone rather than concentrating it in the connectors. It appears to minimize mesiodistal torqueing of the abutments while permitting them to move independently. A rigid fixed partial denture distributes the load more evenly than a nonrigid design, making it preferable for teeth with decreased periodontal attachment.

If the posterior abutment and pontic are either unopposed or opposed by a removable partial denture and if the three anterior units are opposed by natural teeth, the key and the posterior units that are subjected to little or no occlusal forces may supraerupt.The location of the stress-breaking device in the five-unit pier-abutment restoration is important. It usually is placed on the middle abutment, since placement of it on either of the terminal abutments could result in the pontic acting as a lever arm. The keyway of the connector should be placed within the normal distal contours of the pier abutment, and the key should be placed on the mesial side of the distal pontic. 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. Nearly 98% of posterior teeth tilt mesially when subjected to occlusal forces. If the keyway of the connector is placed on the distal side of the pier abutment, mesial movement seats the key into the keyway more solidly. Placement of the keyway on the mesial side, however, causes the key to be unseated during its mesial movement's .In time; this could produce a pathologic mobility in the canine or failure of the canine retainer.[1, 2, 3, 4]

Case report:

A female patient aged about 35 years reported to the department of prosthodontics, Kamineni Institute of Dental Sciences, with chief complaint of missing upper left posterior teeth and difficulty in mastication. Intraoral examination showed missing upper left 1st premolar & upper left 1st molar missing (Fig. 1).Clinical and radiographic examinations showed sufficient bone support around remaining teeth.

Treatment plan

Routine oral prophylactic procedures were carried out. Considering patient's age, clinical and radiological examination, a 5 unit, Porcelain fused to metal FPD with a rigid connector distal to upper right canine & a non-rigid connector distal to upper maxillary 2nd premolar was planned.

Clinical procedure

Tooth preparation was done according to biomechanical principles (Fig. 1). After gingival retraction, an impression was made with vinyl polysiloxane impression material by double mix 2 step technique. When the material had fully set, impression was removed and inspected to ensure that all desired landmarks had been captured. Impression was, then poured in type IV dental stone and the cast was obtained and removable dies were prepared. Provisional restorations were made with auto polymerizing acrylic resin. Orientation relation

record was taken and was transferred to the articulator followed by the centric relation record.

Laboratory procedure

The 5 unit fixed partial denture prosthesis was planned so that all units would receive full porcelain fused to metal restorations. The wax pattern of anterior 3 unit fixed partial denture was prepared first with inlay wax. In this case, we planned for an indigenously prepared semi rigid attachment. The key way pattern was obtained by slicing a square orthodontic bracket. The keyway was prepared by applying wax separating medium on to the bracket and flowing the inlay wax into it n later separating .With the help of a surveyor, the pattern was seated in a box prepared within distal contour of wax pattern of middle retainer by holding the mandrel extending from the top portion of the plastic key. While seating the pattern, the mandrel was aligned parallel with the path of insertion of distal abutment[5, 6,] It was also verified with the surveyor that the surface of keyway was also parallel with the mesial surface of the prepared distal most abutment. First, anterior 3 unit fixed partial denture with keyway was invested and casted in nickel - chrome alloy. The casted anterior 3 unit fixed partial denture was kept on the working model. The key made of wax was seated in the casted keyway and was attached to the wax pattern of the posterior 2 unit fixed partial denture (Fig. 4). Try-in of the casted anterior 3 unit fixed partial denture and wax pattern of the posterior 2 unit fixed partial denture; with key seated in casted keyway was done in the patient's mouth and necessary corrections were made. Shade selection for porcelain was done in natural daylight using Vita pan Classic shade guide. Posterior 2 unit fixed partial denture was then invested & casted in nickel - chrome alloy followed by porcelain application & finishing of the final prosthesis (Fig. 5). Anterior 3 unit fixed partial denture was cemented followed immediately by posterior 2 unit fixed partial denture using glass ionomer luting cement. Cement was not applied in the keyway to allow movement of components of the bridge relative to each other.

Conclusion:

A common clinical situation, either in the maxillary or mandibular arch, is of a missing first premolar and first molar, resulting in FPD design in which the canine and the second molar are the terminal abutments and the second premolar serves as a pier abutment. It has been postulated that the tendency of the terminal abutments to intrude during function results in a teetering movement, where the pier acts as a fulcrum. This movement will eventually result in deboning of the less retentive terminal retainer, namely the canine, and inevitably the failure of the pros-thesis. In order to overcome this potential risk, the use of non-rigid connectors has been advised[7, 8, and 9].

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Fig 1. Intra oral presentation with 24, 26 missing and 25 acting as pier abutment

Fig 2. Square orthodontic bracket sliced longitudinally to act as the keyway and attached to distal wall of 25

Fig 3. 2 unit distal part of the 5 unit bridge with key attached to the mesial aspect of pontic replacing 26

Fig 4. The 5 unit wax pattern together

Fig 5. The casted 3 units with keyway

Fig 6. The casted 2 units with the key

Fig 7. The completed 3 unit cemented first

Fig 8. Post cementation occlusal view

Fig 9. Post cementation - in occlusion