REHABILITATION OF PIER ABUTMENT USING AN INNOVATIVE CUSTOMIZED NON RIGID CONNECTOR

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INTRODUCTION

Pier abutment or an intermediate abutment is defined as a natural tooth located between terminal abutments that serve to support a fixed or removable dental prosthesis.\[1\] It has been proved in many studies that use of rigid connectors for fixed dental prosthesis with a pier abutment results in intruding forces acting on terminal abutments with pier abutment acting as fulcrum.\[2\] These forces will eventually result in debonding of the less retentive terminal retainer. Thus to prevent this potential failure of fixed dental prosthesis with pier abutment, utilization of non rigid connector is highly recommended.

The occlusal forces applied to a fixed dental prosthesis are transmitted to the supporting bone and soft tissues through the pontic, connectors, and retainers. Connector is the portion of a fixed dental prosthesis(FDP) that unites the retainer(s) and pontic and it is subjected to maximum stress concentration under occlusal stresses. Therefore, depending on the clinical condition, the clinician must be very careful in selecting the type of connector for fixed prosthodontic treatment. Although, the rigid connectors are most commonly used, there are certain indications where a non-rigid connector is necessary. For example a case of pier abutment with edentulous spaces on either side that allows physiological tooth movement and relieves stress or when it is impossible to prepare two abutments with a common path for the placement.\[3\] Also when prognosis of an

ABSTRACT

A rigid fixed dental prosthesis supported on a pier abutment can result in breakdown of weaker retainer in the long run because of the tendency of terminal abutments to intrude during function resulting in generation of multidirectional stresses. This will eventually result in debonding of the less retentive terminal retainer. Non-rigid connector placed on the distal aspect of pier abutment appears to reduce potentially surplus stress concentration on the pier abutment. It results in transferring of the harmful stresses to supporting bone & permits abutments to move independently. This case report describes an undemanding method to restore pier abutment case using a customized non rigid connector.

Key-words: Pier abutment, non-rigid connector, Tenon-Mortise
abutment is uncertain; in such cases if the abutment fails only a segment of fixed dental prosthesis needs to be remade.[3] There are few contraindications of using a non rigid connector in a posterior five-unit FPD with a pier abutment like significant mobility of abutments, span between the abutments is longer than one tooth and if the distal retainer and pontic are opposed by a removable partial denture or an edentulous ridge, while the two anterior retainers are opposed by natural dentition, allowing the distal terminal abutment to supra erupt.

This clinical report describes the utilization of a non-rigid connector in a long-span, five-unit fixed dental prosthesis, replacing two missing teeth, with an intermediate pier abutment.

**Case Report:**

A 38 year old female patient reported to the department of Prosthodontics with a chief complaint of difficulty in mastication due to missing teeth in her upper jaw. The intraoral examination showed missing maxillary left first premolar and first molar acting as terminal abutments and second premolar as pier abutment [Figure 1]. Periapical radiograph showed good bone support for all the teeth to be used as abutment. Considering patient’s age, clinical and radiological examination, a two part, 5 - unit Porcelain fused to metal FDP with a non-rigid connector, interposed between pier abutment and distal pontic, was planned. The treatment plan was explained to patient and written consent was obtained.

After making preliminary impressions of maxillary and mandibular partially edentulous arches with irreversible hydrocolloid (Thixotropic, Zhermach, Italy), the impressions were poured with Type III dental stone (Elite Model; Zhermack, Badia Polesine, Rovigo, Italy) and mounted on a mean value articulator for diagnosis purpose. Tooth preparation of 23, 25, and 27 was completed following the biomechanical principles and putty-wash impression (Aquasil, Dentsply, USA) was made for the preparation of the working model [Figure 2]. It was poured in high-strength die stone (Kalabhai Karson Pvt Ltd, India) and die pins were attached using pindex system. Die cutting was done and articulation of the final casts were done on a mean value articulator using interocclusal bite record [Figure 3]. Wax pattern were fabricated for 23, 24, 25. A customized semi precision attachment was made using a small piece of ball pen refill and attached to the distal side of 25 with the help of a dental surveyor (Williams Surveyor, Williams Dental Supply Co., Worcester, MA) [Figure 4 & 5]. The proximal segment with the keyway (Mortise) on the distal aspect of the pier abutment was casted and metal try-in was done [Figure 6]. After metal try-in, wax pattern was fabricated for 26 and 27 with key (tenon) on the mesial aspect of the distal segment made with inlay wax and casting was carried out to obtain distal segment of FDP [Figure 7 & 8]. After finishing, metal try-in was done to verify proper seating and fitting of mesial and distal segment of the FDP. After ceramic build up, FPD was finished and glazed [Figure 9 & 10]. Anterior segment of fixed dental prosthesis was cemented first followed by two unit posterior segment using glass ionomer luting cement( GC, GC Corporation, Tokyo, Japan) [Figure 11]. Occlusion was verified intraorally and oral hygiene instructions were given to the patient [Figure 12]. On subsequent recall appointment, the patient was found to be fully satisfied with the esthetics and function of the FDP.
Discussion:
The size, shape and type of connector play a significant job in the success of a fixed dental prosthesis. It has been proved that high stress values are found at the connectors and cervical regions of abutment teeth, particularly at the pier abutment. When a rigidly designed fixed dental prosthesis with a pier abutment acts as a lever, excessive displacements may be observed at terminal abutments, resulting in damage to the abutment teeth or debonding of the weak retainer. According to Savion et al, the possible cause for debonding is development of extrusive reactive forces at the proximal retainer as the distal abutment is loaded due to flexural forces developed within the FPD. Thus, these type of restorations may result in marginal leakage and caries.\[4\] This factor plays a significant role in the potential for failure in long span FDP.

Non rigid connector transfers shear stresses to supporting bone and soft tissues rather than concentrating them in and around connectors. Thus the mesiodistal torquing of abutments is minimized and their independent movement is facilitated.\[5\] Thus, non rigid connectors can be used to abolish the fulcrum act of a pier abutment. Also segmenting the design of complex fixed partial dentures into shorter components makes them easier to replace/repair independent of each other.

The non rigid connector, function on the basis of broken-stress mechanical union of retainer and pontic, instead of the usual rigid connection. The most frequently used non rigid design consists of a T-shaped key that is attached to the pontic, and a dovetail keyway placed within a retainer.\[6\] The location of the stress breaker in the five unit pier-abutment FDP is of great significance. There is a conflicting belief on where to place the non-rigid connector. Markley advocated placement on one of the terminal abutments and not at the pier abutment whereas Adams suggested placing the connector at the distal side of pier, and if desired, adding one more at the distal side of the anterior retainer.\[7, 8\] Gill was the advocate of placing it at one side or both sides of the pier abutment.\[9\] Carl E. Misch suggested that in conventional fixed prostheses, the "male" portion of a non rigid attachment is usually 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 helps in preventing the mesial drift from unseating of the attachment.\[10\]

Conclusion:
The use of a non rigid connector increases the life of a fixed dental prosthesis as it transfers a lesser amount of stress on the abutments. The broken stress measure provides security against the tremendous leverage forces created by the rigid attachment to two or more teeth thus the selection of suitable design for connector is a significant step in treatment planning of pier abutment. Within the scope and limitation of this clinical report, it can be concluded that a fixed dental prosthesis utilizing a customized non rigid connector is an ideal treatment choice in a clinical situation where a pier abutment is involved. The increased laboratory time and expenditure should be uncared for on considering the enhanced life of the restoration.
References:


1- Pre treatment view

2- Teeth preparation

3- Die preparation

4- Ball pen refill used to fabricate key way on distal side of pier abutment
5- Wax pattern fabricated and key way attached to distal side of pier abutment

6- Metal try in showing mesial segment of FDP in place

7- Wax pattern of distal segment with key on proximal side of 26

8- Completed mesial & distal segments of FDP
9-Finished mesial & distal segments showing key and key way

10-Lateral view after porcelain build up

11- Post cementation view

12-Lateral view showing FDP in occlusion