Use of non-rigid connector in management of pier abutment: A case report

Sunit Kumar Jurel[1], Vinit Shah[2], Pooran Chand[3], Raghuwar Dayal Singh[4], Balendra Pratap Singh[5]

[1,5]Associate Professor, [2]Junior Resident, [3]Professor & Head, [4]Professor Junior Grade, Department of Prosthodontics, Faculty of Dental Sciences, King George's Medical University, Lucknow

Corresponding Author:
Raghuwar Dayal Singh
[4]Professor Junior Grade, Department of Prosthodontics, Faculty of Dental Sciences, King George's Medical University, Lucknow
E-mail: raghuwards@rediffmail.com

Abstract

A five unit fixed dental prosthesis with a pier abutment poses a unique challenge of a fulcrum and torquing forces at the intermediate abutment. The use of a rigid connector can lead to localization of forces on the pier abutment. Therefore, the use of a non-rigid connector as a stress breaker has been advocated to alleviate the situation. The following case report describes the factors associated with a pier abutment situation and its successful management using a non-rigid connector.

Keywords: *Non-rigid connector, Pier abutment, Fixed Dental Prosthesis, Intermediate abutment, Stress breaker*

Introduction

Replacement of missing teeth by a fixed dental prosthesis (FDP) involves careful consideration of the biomechanical principles in designing the prosthesis. A challenging scenario is a 5 unit FDP for restoration of two missing teeth with a pier abutment. A pier abutment with a natural tooth located between terminal abutment is also known as an intermediate abutment.[1] The situation poses a challenge because if it is restored by a conventional rigid connector, detrimental stress accumulation occurs at the connectors and cervical regions of abutment teeth, especially the pier abutment.[2,3] Such a challenge can be managed by a FDP with a non-rigid connector. It provides a stress breaking mechanical union of retainer and pontic, thus transferring the stress to the supporting bone rather than concentrating it on the connectors.

There are four types of non-rigid connectors[4,5]:

- Dovetail (key-keyway or Tenon-Mortise) type connectors.
- Cross-pin and wing type connectors.
- Split type connectors.
- Loop type connectors.

A non-rigid fixed dental prosthesis appears to minimize mesiodistal torqueing of the abutments while permitting them to move independently.[6]

Case report

A 40 years old female presented to the Department of Prosthodontics with a complaint of multiple missing teeth. On examination, the patient presented with missing mandibular left first premolar and first molar (Fig. 1). The missing teeth were extracted about 2 months back and now the patient wanted a fixed replacement for them. The patient was evaluated thoroughly and a comprehensive treatment plan drawn. The possible treatment options with their pros and cons were discussed with the patient and finally it was decided to rehabilitate the patient by a fixed dental prosthesis with a non-rigid connector using the mandibular left canine and second molar as retainers and the second pre molar as a pier abutment. The treatment option was explained to the patient and a written consent obtained for the same.

The tooth preparation for canine, second premolar and second molar was accomplished for porcelain fused to metal fixed dental prosthesis with equigingival margins and a shoulder finish line (Fig. 2). The gingival retraction was carried out with gingival retraction cord (Ultrapak; Ultradent, USA) and final impressions were made using elastomeric impression material (Aquasil; Dentsply Limited, Addlestone, UK) using two step putty-wash technique. The impressions were poured in type IV dental stone (Ultrarock; Kalabhai Karson Private limited, Mumbai, India). Interocclusal records were made using a bite registration paste (Ramitec; 3 M ESPE, AG Dental Products, Germany). Provisional restorations were fabricated (Protemp 4; 3M ESPE, USA) for the prepared teeth.

In the laboratory, master casts were retrieved and die prepared. The wax pattern was fabricated on the canine, first premolar and second premolar and a recess was cut on the distal aspect of the pier abutment to fit the prefabricated plastic dovetail for the female part of the non-rigid connector. Surveying was done to determine the parallelism and optimum position of the plastic dovetails within the contour of the pier abutment. The male pattern was removed from the female pattern and care taken to keep the inside of the female pattern free of wax. After casting, the segment was tried to verify proper seating. The male pattern was now seated into the female pattern and wax pattern was fabricated for the mandibular left first and second molars. Casting of the pattern with male component was done and finished. Metal try-in of the individual units was done to verify proper seating (Fig. 3). On achieving satisfactory fit, ceramic (Ceramco-3, Dentsply, USA) was added to the units (Fig. 4).

At the time of cementation of the prosthesis, the anterior segment with the keyway was cemented first followed by posterior segment with the key using glass ionomer cement (Fig. 5). The patient was instructed in maintenance of proper oral hygiene and the use of floss and interdental brush was encouraged. The patient was motivated for the importance of regular recall visits.

Fig. 1: Intraoral pre-operative view

Fig. 2: Finished preparations

Fig. 3: Metal coping try-in

Fig. 4: Final prosthesis showing the non-rigid connector

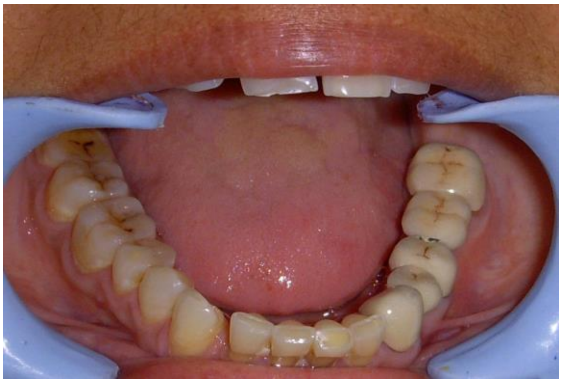

Fig. 5 a & b: Fixed Dental Prosthesis with non-rigid connector cemented

Discussion

Rigid connectors are the norm in fixed dental prosthesis because of their ease of fabrication. However, a pier abutment scenario poses a difficult situation where the middle (pier) abutment acts as a fulcrum. Because of the dislodging forces, a rigid connector in a pier abutment FDP leads to higher rates of debonding and therefore the situation demands a non-rigid connector to act as a stress-breaker. However non-rigid connectors are to be prescribed with caution and are contraindicated in situations where the abutments presents with significant mobility, an edentulous span wider than one tooth on either side of the pier abutment or where the FDP with non-rigid connector is opposed by a combination of natural teeth/fixed prosthesis and edentulous ridge/removable prosthesis.

The right choice of connector selection in planning a FDP is the key to success. While non-rigid connectors can predictably improve the treatment outcome of a pier abutment FDP, the shortcomings of a non-rigid connector are the increased laboratory time and costs, increased reduction of tooth structure on the pier abutment and chances of key being dislodged from keyway in the presence of occlusal instability. Also there is difference in opinion on the site of placement of the non-rigid connector. While Markley advocated placement of the non-rigid connector at one of the terminal retainer so as to shield the relatively weak premolar to take detrimental loads as a pier abutment, Gill recommended placement of non-rigid connector on one or both sides of the pier abutment.[7,8] Adams advocated placement of non-rigid connector at the distal side of the pier abutment and adding another on the distal side of the anterior retainer if the situation demands.[9] Shillingburg et al. suggested the placement of non-rigid connector on the middle abutment as placing it on the terminal abutment may result in the pontic acting as a lever arm and thus worsening forces.[10] Further, since the long axes of the posterior teeth generally have a slight mesial tilt, placing the keyway on the distal aspect of the pier abutment would mean that any force and resulting mesial movement leads to seating of key into the keyway instead of dislodging it. This theory has also been supported by the finite element analysis study conducted by Oruc S et al.[2]

Conclusion

Failing to plan is planning to fail. Thus, it is imperative to foresee and understand demands arising in a pier abutment scenario. The selection of right type of connector is an important step and the skillful use of a non-rigid connector can go a long way to allay the situation and is desirable for clinical success.

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