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The lone standing abutment: A case report

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Abstract

Pier abutment is characterized by a lone standing abutment with edentulous regions on either side of it. The goal of this case report is to discuss the use of key and keyway, a type of non-rigid connector to rehabilitate a patient with a pier abutment situation. Following radiographic evaluation of the abutment teeth, tooth preparation was done and the key and key way were fabricated in the prosthesis in such a way that the keyway was placed on the mesial side and the key on the distal side of the retainer or pontic. Rehabilitating a patient with a key and key way type of non-rigid connector is an ideal and recommended option when a patient presents with a pier abutment situation.

Keywords: Pier abutment, non-rigid connector, key and key way

1. Introduction

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

Factors that influence the longevity of a fixed partial denture and its abutment include occlusion, span length, bone loss, and quality of periodontium [1].

Biomechanical factors such as overload, leverage, torque, and flexing induce abnormal stress concentration in a fixed partial denture [1].

In certain partially edentulous situations, the pattern of missing teeth may entail the use of fixed partial denture (FPD) utilizing pier abutment [2].

Pier abutment, also named intermediate abutment and is defined by the Glossary of Prosthodontic Terms as a natural tooth located between terminal abutments that serve to support a fixed or removable dental prosthesis.

Teeth in different segments of the arch move in different directions. Because of the curvature of the arch, the faciolingual movement of anterior tooth occurs at a considerable angle to the faciolingual movement of molar tooth. These movements can create stresses on the abutments in long-span prosthesis. A non-rigid connector, a stress breaking mechanical union of retainer and pontic, is usually recommended in such situation.

Connectors, the portion of a fixed dental prosthesis that unites the retainer(s) and pontic are considered as heartthrob of abutments, since under occlusal load maximum stresses are concentrated on them [3].

When an occlusal load is applied to the retainer on the abutment tooth at 1 end of a fixed partial denture with a pier abutment, the pier abutment may act as a fulcrum. 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 [4].

1.1. The indications for the use of non-rigid connector in fixed prosthodontics are [5]

1. The existence of Pier abutment, which promote a fulcrum-like situation that can cause the weakest of the terminal abutments to fail and may cause the intrusion of the pier abutment.
2. The existence of the malaligned abutment, where parallel preparation might result in devitalisation. Such situation can be solved by the use of intracoronal attachments as connectors.
3. The presence of mobile teeth, which need to be splinted together with fixed prosthesis. Long span, fixed partial dentures which can distort due to shrinkage and pull of porcelain on thin sections of framework and thus, affect the fitting of the prosthesis on the teeth.

1.2. The four types of non-rigid connectors are

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

This clinical report describes the prosthodontic management of an edentulous span on both sides of a pier abutment, with fixed partial denture having a non-rigid connector.

2. Outline of the case

2.1. Patient

A 76 year old male patient reported to the Department of Prosthodontics of M.S. Ramaiah Dental College and Hospital, Bangalore, Karnataka with a chief complaint of missing teeth associated with difficulty in mastication as well as aesthetic problem.

His Past Medical History revealed no relevant details and his Past Dental History revealed dental extraction of the missing teeth due to dental caries.

2.2. Clinical examination

On Intraoral examination, the patient presented with a pier abutment situation where in the two terminal abutments were the Right central incisor and the Left 2nd premolar and the lone standing abutment or the pier abutment being the Left canine.

2.3. Radiographic examination

Radiographic evaluation of the abutment teeth were done to confirm good bone support and to eliminate any kind of periapical pathology in relation to the abutment teeth.

2.4. Diagnosis and treatment planning

After discussing all the pros and cons a final treatment outcome was decided and the same was explained to the patient which was to rehabilitate the patient with a fixed dental prosthesis replacing all the missing teeth in the maxillary arch. Because of the lone standing abutment and the presence of edentulous spaces on either side of the lone standing abutment a fixed dental prosthesis with stress breakers also called as non-rigid connector was planned.

The entire treatment, cost and time required to finish the procedure was explained to the patient and a informed consent was taken before starting to rehabilitate the patient with a Fixed dental prosthesis.

3. Clinical procedure

3.1. The following steps were carried out during the treatment procedure:

1. Tooth preparation in relation to Right canine, Right central incisor, Left canine and Left 1st premolar was completed for a porcelain fused to metal crown restoration.



Fig 1: Tooth preparation

2. Gingival retraction of the prepared tooth was done using gingival retraction cord and a hemostatic agent followed by making a Final impression using elastomeric impression material with a two stage putty wash technique.



Fig 2: Final impression

3. Temporary provisional crowns were made using auto-polymerizing tooth coloured acrylic resin and cemented with a eugenol free temporary cement.
4. A die stone master cast was obtained.



Fig 3: Master cast

5. The patient was recalled for a tentative jaw relation to obtain interocclusal records for fabrication of the restorations.



Fig 4: Jaw relation

6. The patient was recalled for a metal try in of the two segment prosthesis with the anterior segment having the female component or the key way on the distal aspect of the Left central incisor retainer and the posterior segment having the male component or the key on the Left lateral incisor.



Fig 5-6: Metal trial

7. After ensuring the correct fit of the anterior and posterior segments, a bite with the metal restoration in place was taken using a bite registration material followed by shade selection under day light.
8. The patient was recalled for a bisque trial of the final prosthesis to ensure proper shade selection and the patients approval was obtained regarding the same before cementing the final prosthesis.



Fig 7-8: Bisque trial

9. The approved fixed dental prosthesis was then glazed and the patient was recalled for the final cementation of the two segment prosthesis with Glass Ionomer Type 1 luting cement



Fig 9-10: Final prosthesis



Fig 11: Occlusion

10. The patient was given post cementation instructions and was instructed to maintain good oral hygiene, use of dental floss and interdental brush and was asked to report back after 1 week for a follow up visit.

4. Discussion

According to Schilling burg *et al* every restoration must be able to withstand the constant functional and parafunctional forces to which it is subjected. ^[1] This is of particular significance when designing and fabricating a FPD, since the forces that would normally be absorbed by the missing tooth were transmitted, through the pontic connector and retainers, to the abutment teeth. These forces if exceeded beyond the physiologic limits of hard tissues can cause initial bone loss and failure of the prosthesis. ^[2]

Pier abutment, also named intermediate abutment, is defined by the Glossary of Prosthodontic Terms as a natural tooth located between terminal abutments that serve to support a fixed or removable dental prosthesis. This pier abutment acts as a fulcrum because of its strategic position when it is subjected to occlusal forces acting on the ends of the prostheses that will tend to lift the other end like a class I lever causing stress on the terminal abutments and ultimately failure of the fixed dental prosthesis and trauma to the periodontium. ^[3]

Connectors are the part of a fixed partial denture (FPD) that unites the retainers and pontics. ^[4] Connectors may be rigid (solder joints or cast connector) or non-rigid (precision attachment or stress breaker).

Rigid connectors between retainers and pontics are the preferred way of fabricating most FPD. The selection of right type of connector during treatment planning is an essential step for success and failure of the prosthesis. ^[5]

In an FPD requiring the restoration of two missing teeth and where an intermediate pier abutment is present with a single casting (rigid connectors) is not an ideal treatment.

Markley (1951) suggested that non rigid connector should be placed at one of the terminal retainers. ^[6]

Gill (1952) recommended placing non rigid connector at one side or both sides of pier abutment.

Schillingburg *et al* (1973) suggested that matrix of nonrigid connector should be placed distal to the pier retainer & matrix should be in distal pontic. ^[7]

According to a study conducted by Selcuk Oruc & Arzu Atay, the stress distribution & values of an FPD and pier abutment are affected by the presence & location of a non rigid connector.

The nonrigid connector is a broken-stress mechanical union of retainer and pontic, instead of the usual rigid connector. Botelho and Dyson reported that rigid FPDs with pier abutment are linked with higher debonding rates than short span prosthesis. ^[8]

Therefore, accurate planning of the design philosophy was critical for the reflexive fit of non-rigid connectors, which prevented the leverage effect to a large extent and imparted it to the long-term success of the long-span FPD with pier abutments.

5. Conclusion

The potential hazard of debonding of the prosthesis and eventually the failure of the fixed dental prosthesis can be taken care of if the right type of connector is selected during the fabrication of the prosthesis. Hence, proper treatment planning can increase the life span of the prosthesis.

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