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Maxillary Canine Pier Abutment Management Using Fixed Movable Bridge Design

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Abstract A fixed movable bridge is a type of fixed partial denture that is exclusively indicated where a lone standing abutment is situated between two partially edentulous spaces. The prosthesis design involves fabrication of two separate fixed partial dentures that are joined in one place with a non-rigid connector. Such design provides independent movement of two separate fixed partial dentures which may occur as a result of periodontal tooth movement of mandibular flexure. Most of the reported cases have been successfully designed in either posterior or anterior region. We present a case of a fixed movable bridge whose one component restored a missing anterior tooth and the other component a missing posterior tooth. With maxillary canine as a pier abutment, the challenges in designing included to place the non-rigid connector in a space that had two different angles in the horizontal plane. Another challenge was to provide an adequate thickness of the distal retainer without the retainer encroaching on the overjet and overbite of natural occlusion. This was successfully accomplished by preparing a rest seat that had different width and depth on the distal aspect as compared to the mesial aspect. The patient reported to be extremely satisfied with the design outcome for his complex partial edentulous situation.

Keywords: *pier abutment, fixed movable bridge, anterior guidance, overjet and overbite*

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1. Introduction

The use of a natural tooth to support a restoration has always been in the eyes of critics who support the view that natural teeth are affected by such procedures. Advances in restorative dentistry have seen a plethora of research in the most compatible restorative material that can be used in the oral cavity. Stem cell research has been found effective to regenerate existing cells within the pulp and periodontium. [1] It may or may not be possible to regenerate an entire biological natural tooth in the near future, till then the choice remains to replace missing tooth with fixed or removable prosthesis. Selection of a natural tooth to support a prosthesis is a clinical step that requires a clinician to have a very sensitive and insightful diagnostic ability. [2] A fixed prosthesis can be either a conventional fixed partial denture (FPD) that includes single crown or it can be an implant supported single crown or an FPD. [3] Conventional FPD are ideally indicated in a class III or class IV partial edentulous situation in which natural teeth are present on either side to support and retain the prosthesis. Absence of teeth on either side of a single standing tooth/teeth have been restored traditionally with a removable partial denture. [4] In earlier FPD designs such situations were successfully restored using an FPD with a cantilever extension that replaced additional missing tooth on one side. Cantilever extensions have been limited to very specific clinical situations that need to thoroughly evaluate before indicating such FPD designs. [5] The single standing or a lone standing natural tooth between two partially edentulous spaces is termed as pier abutment. [6] For fixed partial to be successful in such situations means that the FPD design should prolong the longevity of pier abutment. This is because when such tooth is connected to remaining natural teeth on either side with a fixed restoration, the forces on the restoration will act like that of a seesaw and invariably cause damage to the periodontal structures around the tooth. Authors have suggested that instead of using a rigid connector, one must use at least one non-rigid connector at any end. [7,8] This would break the stresses and the FPD will be functionally independent of each other. Such type of FPD are called as a fixed movable bridge (FMB) in prosthodontic terms.

Use of a completely fixed prosthesis without any stress breaking mechanism in such cases is also bound to be loaded by stresses that are related to mandibular flexure. [9] When masticatory muscles contract, they tend to move the two sides of the mandible closer together. This induces stresses on the fixed partial denture if it is present on one side of the mandible. Depending upon the strength of the cement used, the fixed prosthesis may either be decemented or transmit the whole stresses to the periodontium of the pier abutment. Many authors have reported the use of non-rigid connectors in prosthetic management of pier abutments. [2,4,6,9] The majority of these cases have been reported in either mandibular or maxillary posterior regions. There are very few cases reported exclusively in the anterior region while there are scant cases that have a pier abutment that supports anterior and posterior teeth simultaneously. This article in the form of a clinical case report presents one such rare rehabilitation of a Kennedy class III modification 1 partially edentulous situation with an FMB using a semi precision non-rigid connector. The main aim of presenting the case is to discuss the problems in designing that were encountered and the means to overcome such issues.

2. Case Report

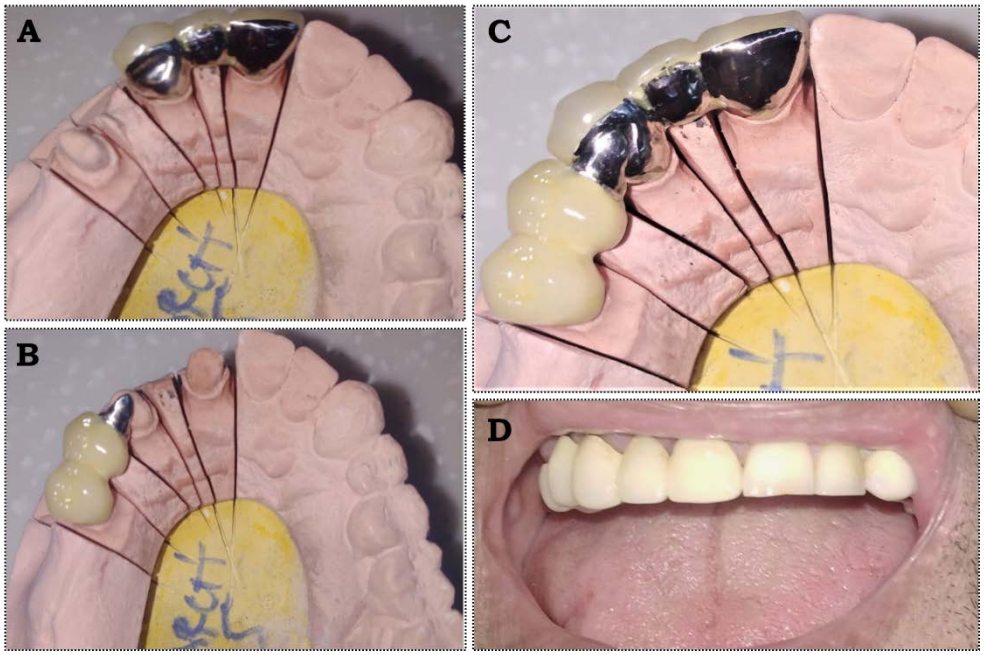

Figure 1. (A) Mesial component of FMB shows a rest seat placed within restoration on left canine (B) Distal component of FMB shows the rest as the form of non-rigid connector between two prosthesis segments (C) Two components of FMB in place (D) Intra oral view of the completed restoration

Figure 2. Occlusal view of completed prosthesis FMB using the pier abutment (canine) with a non-rigid connector in the form of a semi precision attachment

An elderly adult male patient in his early fifties reported to the undergraduate clinic for clinical fixed prosthodontics for his treatment of missing maxillary right central incisor and first premolar. The patients personal, medical, social, drug history was not relevant to the current treatment. The patient reported that he had multiple teeth in both maxillary and mandibular arches extracted due to caries. Patients oral hygiene status indicated that he had a fair oral hygiene maintenance with both gingival and periodontal conditions being satisfactory. In the maxillary arch the patient had an existing fixed partial denture on the left side that extended from left canine to the second molar. Patients extra oral examination revealed normal clinical features in terms of aesthetic evaluation for low and high lip lines, lymph nodes, mandibular movement and temporomandibular joints. Intra oral examination revealed a Kennedy class 2 modification 2 partial edentulous situation for maxillary arch and a Kennedy class 1 modification 1 for mandibular partial edentulous arch. Maxillary arch presented a pier abutment situation in which the maxillary right canine was a pier with maxillary right lateral incisor and first premolar missing. The patient had already a five unit fixed partial denture on the left side that had a left second premolar as a pier abutment with missing first premolar and first molar. The FPD design was that of a rigid connector in the posterior segment. The patient was provided with different treatment options. These included implant supported prosthesis for all partially edentulous situations, fixed partial denture with non-rigid connectors for both maxillary segments (after removal of existing prosthesis), a combination of fixed and removable partial denture. The patient was also recommended to undergo preprosthetic non-surgical preparation that included oral prophylaxis. The patient opted for the treatment of fixed prosthesis without replacement of old prosthesis and without using any removable partial denture. For FMB routine clinical and laboratory procedures were done. The preparation for right canine however included a modification which was in the form of a wide cingulum rest once the preparation for metal ceramic retainer was done. The final FPD was designed to be fabricated of a base metal alloy (Remanium CSe, Dentaurum J.P. Winkelstroeter KG, Ispringen, Germany), on which feldspathic dental porcelain (VMK-95 Metall Keramik; Vita Zahnfabrik, Bad Sackingen, Germany) would be fused. In the laboratory, the FMB was fabricated together in terms of wax patterns. The mesial component included a three unit FPD with rest seat on the occlusal surface and the distal component included a two unit FPD with one side having an occlusal rest (Figure 1 A, B). When placed together on the cast (Figure 1C), the whole assembly would have anterior teeth having contact with metal while the posterior component having occlusal contact with metal supported occlusal ceramic. The anterior component was cemented with zinc phosphate cement while the other component was cemented on the second premolar with the rest seat having a free non-cemented contact to allow stress breaking effect (Figure 1 D). Opposing occlusion was adjusted before final cementation. The shade of the anterior bridge matched the remaining natural teeth while the shade of the posterior previously made fixed fixed prosthesis had too high value that made it look artificial (Figure 2). This was also one of the reasons why the patient was advised to remove the existing fixed partial denture. The patient was given instructions for fixed partial denture maintenance, [10] and was put on a follow up for one year at regular three-month interval. During subsequent follow up visits, the patient was highly satisfied with the outcome of the prosthetic treatment.

3. Discussion

A partial edentulous situation that comprises of a pier abutment in between the two edentulous spaces has been presented in this case report. The significance and the main feature of this report being the fabrication of an FMB that unites the anterior with the posterior arch. A prosthesis irrespective of the design should be planned with caution. The pier abutment acts as a fulcrum in between the two edentulous spaces thereby causing a teetering movement around the middle retainer in an FPD that has rigid connectors on both sides. [11,12] Studies show that the stress distribution in such designs is affected by connectors location and presence. [2,13,14] The replacement of two teeth on either side results in a long span edentulous area. Conventionally and traditionally a fixed partial denture is not indicated in case the span is long. A long span FPD that has been obtained from a single casting will inevitably result in marginal discrepancies which is why all long span FPD should be cut followed by soldering. Zirconia as a substructure is also not indicated since zirconia reinforced ceramics are limited to only short span replacements and zirconia won't allow placement of the non-rigid connector. [16]

The problems or the challenges faced during treating this patient were mostly related to bridge designing and patient related factors. Among FPD designs, the use of a non-rigid connector at the corner of the mouth poses technical challenges. [17,18] These were anticipated during wax up of the diagnostic casts. One of the challenge was how to place the rest and rest seat at an angle. Since the canine is placed at an angle the distal surface of the canine variety in terms of the mesial aspect of the canine. Placing an occlusal rest had to conform to these variations otherwise the retainer would have had less thickness of metal which on the long term would have fractured after repeated loading. To avoid such complications, it was decided that the rest seat within the cingulum of the canine was to be made different when compared to the mesial side. The width and the taper of the rest seat on the distal side were therefore increased relatively than to the mesial side. This allowed the bulk of the rest seat to be on the distal side which enhanced strength of the occlusal rest that was carried by the distal component of the retainer. The patient was informed about the possibility of failure in the future and the measures that were necessary to be taken at the appropriate time. The cementation process was modified, and a relatively weaker cement for definitive cementation was decided accordingly. Another issue that was important during designing was not to encroach upon the existing overjet and overbite. Since the placement of the extra thickness of metal on the rest was mandatory, it would have interfered in the existing overjet and overbite. [19] This was the

main reason for preparing a deep rest seat in the canine to overcome any possibility of encroaching upon the overjet or overbite. Both of these two spaces are naturally present in the anterior teeth and they are protective in nature. [20]

The challenges that were patient related involved inability to motivate the patient to remove existing rigid design of previous FPD. The patient had got the maxillary FPD done few months back. Besides design, another problem in the previous FPD was shade not matching with adjacent teeth. The mismatch between the proposed ceramic shade and the restoration shade can be attributed to multiple factors. Different shade guides used by the clinician and the laboratory technician are one of the common reasons. [21] In this case the patient was told by the previous dentist that the mismatch was because of the above mentioned discrepancy. But the patient had no complaints about the aesthetic mismatch between the two. Variations in perceptions of patients regarding aesthetics and its constituents have also been reported in the literature. [22] Prescribing the use of a cast partial denture for treatment of long span partial edentulous space has been recommended in the literature. [23] This case presented with a Kennedy class II partial edentulous situation in the maxillary arch. Even after closure of anterior partitioning edentulous space, it was mandatory that patient replaces the distal extension base on the same side with a cast partial denture. However, the patient decided not to go for a removable partial denture despite being educated about the ill effect on current treatment.

4. Conclusion

Fixed movable bridge is an excellent treatment option that has been reported scantly in the literature. Long term clinical studies should be directed in this FPD designing to understand their clinical performances and patient satisfaction. The FMB that was designed in this case was not difficult to fabricate or difficult to be placed.

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Conflict of Interest

None.

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