Ensuring the Survival of Pier Abutment: A Case report

ABSTRACT

Comprehensive treatment planning is an important aspect before actively undertaking the actual treatment procedures, even in similar looking clinical situations. The biomechanics of most commonly used fixed-fixed bridges falls deficient to justify load transmission in complex cases like pier abutments supporting a long span fixed prosthesis. In such situations, non-rigid connectors offer a relatively favourable loading thus ensuring the long term health of the abutment teeth.

KEYWORDS: fixed prosthesis, pier abutment, non-rigid connector, semi precision attachment

INTRODUCTION

In the present phase of dentistry, where implant supported fixed prosthesis takes up the lead over the conventional fixed prosthesis, one commonly comes across a situation where patient’s systemic health, alveolar bone parameters and financial constraints pose a challenge in selection of such prosthesis. In such cases, fixed partial prosthesis serve as a viable treatment option. Here, the real concern arises when one comes across an edentulous space present on both the sides of a tooth, creating a lone-free standing pier abutment.

In pier abutment cases, a rigid connector may not be an ideal choice for fixed partial prosthesis due to differences in arch positions of abutments, disparity in the retention capacity of the retainers and the direction of the physiological tooth movement of various tooth. According to Shillingburg, 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 can create unfavorable stress on the abutment teeth in the long span prosthesis. Some means must be used to neutralize the effects of these forces. Thus, the use of nonrigid connector has been recommended to reduce this hazard.

The non-rigid connectors could be made by an incorporation of pre-fabricated inserts, by the use of a custom-milling machine or by the use of the prefabricated plastic patterns like precision and semi precision attachments. The custom-milling machine has three functions; First, as a surveyor to determine the path of insertion, Second, to align attachments or other assemblies to an extremely high level of accuracy and, final in milling, a process of (giving desired shape) wax or metal in-line, angled or parallel shaping to given contours.

The various indications for the use of non-rigid connector in fixed prosthodontics are: (a) 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, (b) the existence of the malaligned abutment, where parallel preparation might result in devitalization, (c) long span fixed prosthesis that can get distorted due to the shrinkage and pull of porcelain on thin sections of framework and thus, affect the fitting of the prosthesis on the teeth, (d) when the prognosis of an abutment is uncertain; in such cases if the abutment fails only a portion of FPD needs to be remade.

The various contraindications for non-rigid connector usage are: (a) where the abutment presents significant mobility or if the span between the two abutments is longer than one tooth, because the stresses transferred...
to the abutment tooth under soldered retainer would be destructive, (b) and if the posterior retainer and pontic are opposed by a removable partial denture or an edentulous ridge while the two anterior retainers are opposed by natural dentition.

There are certain advantages of non-rigid connectors as they transmit shear stresses to supporting bone rather than concentrating them in connectors. It minimizes mesiodistal torquing of abutments and allow them to move independently.

CASE REPORT

A 32-year-old female patient (Fig. 1) reported to the Department of Prosthodontics with a chief complaint of missing teeth in the upper left region with difficulty in eating.

Patient’s past medical history was insignificant and her past dental history revealed that, she had undergone extraction of badly carious teeth in her upper left region. Intra oral examination showed there was no periodontal problem and the rest of her teeth were sound. Her current dental status revealed missing 24, 26 and diastema with respect to 21, 22 and 11, 12, (Figs. 2,3) which was of aesthetic concern to the patient and she wanted to get her both the problems solved.

The treatment options for the presented case were removable cast partial denture, implant supported fixed prosthesis, conventional fixed partial prosthesis, fixed partial prosthesis with non-rigid connector.

After intraoral examination and evaluation of periapical radiograph of abutment teeth, all the treatment options were discussed with the patient, It was decided to rehabilitate the case with 6 unit fixed prosthesis using non-rigid connector on the distal aspect of the pier abutment, i.e. 25. And a proposed diastema closure with respect to 21 and 22 with extended porcelain contour on 22 and abutment was finalized and the space in between 11 and 12 were planned to be closed with direct composite resin build up. Its risks and benefits were explained to the patient and a written, informed consent was obtained.

Clinical procedure

The following clinical step-by-step procedure was carried out for her oral rehabilitation.

1. Diagnostic impressions were made with irreversible hydrocolloid impression material (align-gum, prime dental products) and poured in dental stone (ultrarock, kalabhai). Putty matrix was made after waxing up the cast for the fabrication of provisional restoration.

2. Teeth preparation was done on teeth 22, 23, 25, 26 for porcelain fused to metal restoration following the principles of tooth preparation with equigingival margins to enhance the esthetics.

3. The gingival retraction was done with an impregnated retraction cord (Super cord, Sure-end, Sure endo corporation, Korea) and final impression was made using addition silicone impression material with a two-step putty wash technique using addition silicone (Ad-sil, acura soft putty, prime dental products, Pvt, Ltd.).

4. An interocclusal record was made with zinc oxide eugenol paste using modeling wax as a carrier.

5. Provisional restoration was fabricated with a tooth coloured autopolymerising acrylic resins using putty matrix and cemented with non-eugenol temporary cement (RelyX Temp, 3M).

6. The impression was poured in type IV dental stone (ultra rock, kalabhai). Master cast was retrieved and die cutting was done.

7. The master cast was mounted on an articulator using interocclusal records.
8. The metal tray in the framework was designed and custom milled (by using software EXOCAD) in chrome-cobalt alloy (Figs. 4, 5).

9. Metal try in was done to verify proper seating followed by porcelain veneering of the metal superstructure (Fig. 6).

10. The final prosthesis was cemented with glass ionomer cement (GC Gold, by GC Corporation, Tokyo, Japan) after occlusal adjustments in centric and eccentric movement of the mandible (Fig. 7).

11. The left-side diastema closure between 21 and 22 was done by the extended porcelain contour of the prosthesis and the right side between 11 and 12 diastema closure was done with direct composite resin build ups (Figs. 8, 9).

12. Patient was highly satisfied with the results of the treatment and same were the clinicians owing to secured long-term steps of the pier abutment with non-rigid connector design.

**DISCUSSION**

Considering the long-term health of the pier abutment, the prosthetic replacement of a partially edentulous ridge is considered a challenging task. The size, shape
and type of connector play an important role in the success of fixed prosthesis 2.

According to Shillingburg, 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. However, most ideal location as discussed by Shillingburg is the matrix of non-rigid connector should be placed distal to pier retainer & matrix should be placed in mesial of distal pontic 3.

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 movements 3. In time, this could produce a pathologic mobility in the canine or failure of the canine retainer. Photo-elastic stress analysis indicated that the prosthesis bends rather than rocks. This will create tension between terminal retainer and respective abutment. The intrusion of the abutments under the loading could lead to failure between retainer and respective abutments 2. The length of edentulous span also affects the success of fixed partial prosthesis as the flexion of a long span fixed partial prosthesis varies with the cube of the length of the edentulous span, which can lead to material failure of the prosthesis or an unfavorable response of the periodontal tissues of abutment teeth 7.

The present case report describes a simple technique to break the stress around the pier abutment by using custom-milled non-rigid connector for a 6 unit fixed prosthesis. The lateral incisor 22 abutment was planned to have the overextended contour within the esthetics and periodontal health of 21–22 interproximal papilla, 11 and 12 space was closed by direct composite resin. The results obtained were highly esthetic.

CONCLUSION

Biomechanical factors such as magnitude, direction and frequency of occlusal forces during function, leverage action 3, flexion of fixed prosthesis and abnormal stress concentration 1 around connector and in the cervical dentine area near the edentulous ridge may lead to the failure of single long span fixed partial prosthesis 6. Therefore, the use of non-rigid connector was planned for the present case considering the long-term prognosis of pier abutment teeth by breaking away the undue stresses at pier abutment.

REFERENCES