INDONESIAN JOURNAL OF PROSTHODONTICS

CASE REPORT

Semirigid fixed bridge management with nonvital abutment and narrowed space

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Keywords: Fixed partial denture, Non-rigid connector, Non-vital abutment, Pier abutment

ABSTRACT

The prevalence of partial edentulism in adults underscores the increasing demand for tooth replacement options. Fixed partial dentures (FPDs) are widely accepted for this purpose. FPD success hinges on factors such as abutment condition, retainer, connector type, pontic design, and edentulous span. A five-unit fixed bridge with a pier abutment requires a non-rigid connector to enhance prosthetic longevity. Moreover, narrowed spaces require more attention. Analysis and diagnostic wax-up are needed for treatment planning. This case presenting the management of a five-unit semirigid fixed bridge with a non-vital pier abutment and narrow space using diagnostic wax-ups. A 62-year-old woman presented with a missing right mandibular first premolar and first molar, with the right mandibular canine and second molar serving as terminal abutments, and a non-vital second premolar serving as a pier abutment. The space between the canine and non-vital second premolar is narrower than normal. Analysis and diagnostic wax-up were done to ensure the space is enough and to avoid excessive reduction, mainly the canine, as it is a vital tooth. The non-vital pier abutment, which has been endodontically treated before, was strengthened with a fiber post. Continued with tooth preparation and fabrication of a five-unit porcelain fused to metal semi-rigid fixed bridge. The design of FPD plays an important role in the success of FPDs. The edentulous span and non-vital pier abutments require more attention; also, non-rigid connectors act as stress breakers to maintain the longevity of all components of FPDs. (IJP 2025;6(2):86-91)

Introduction

The loss of teeth in an individual can disrupt both functional and aesthetic aspects. The long-term loss of teeth without replacement has significant consequences. Adjacent and opposing teeth may migrate, resulting in the edentulous space becoming smaller or larger than before. This can impact prosthesis fabrication, as there may not be enough space to replace the missing teeth adequately.[1]

There are several ways to replace missing teeth. Fixed partial dentures, in the form of bridges, are one way to manage the missing teeth. This type of prosthesis is often chosen by patients for its comfort and simplicity compared to implant-supported prostheses, which require a surgical process. The success of bridge prostheses is influenced by several factors, including the condition of the abutment teeth, connectors, pontics, and the edentulous space.[2]

Most of bridge prostheses are typically constructed using rigid connectors. However there are several cases when non-rigid connectors are often recommended. In some cases of tooth loss, there are situations involving pier abutments. According to The Glossary of Prosthodontic Terms, a pier abutment, also known as an intermediate abutment, is a natural tooth or implant abutment located between terminal abutments, which serves to support fixed or removable prostheses.[3,4] For example, the second premolar becomes a pier abutment when the first premolar and first molar are missing, while the canine and second molar remain. In such cases, the success of the prosthesis and stress distribution depends on both the pier and terminal abutments.[4]

In the case with the presence of pier abutment, the use of rigid connectors may cause the bridge prosthesis to detach from the abutments, and the pier abutment acting as a fulcrum. Additionally, the stress distribution with non-rigid connectors can prolong the lifespan of the bridge prosthesis.[4] Apart from connectors, the condition of the abutment teeth also requires attention and consideration. Abutment teeth that have lost structure or are non-vital require special attention to be included in the fixed prosthesis.

This case report illustrates the management of a five-unit semirigid fixed bridge with a non-vital pier abutment and narrow edentulous space, emphasizing the utilization of diagnostic wax-up and the significance of non-rigid connectors in the presence of pier abutment.

Case Report

A 62-year-old female patient presented at Department of Prosthodontics, dental hospital, Faculty of Dentistry, Universitas Indonesia, with complaints of missing teeth in lower right jaw, causing discomfort and noticeable gaps during chewing. The patient sought

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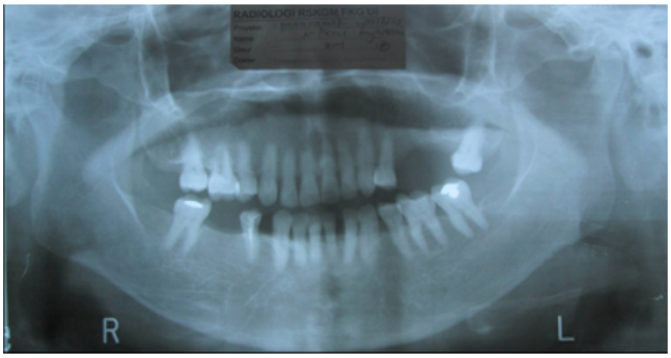
DOI 10.46934/ijp.v6i2.298

Figure 1. **Pre-op intraoral photograph**



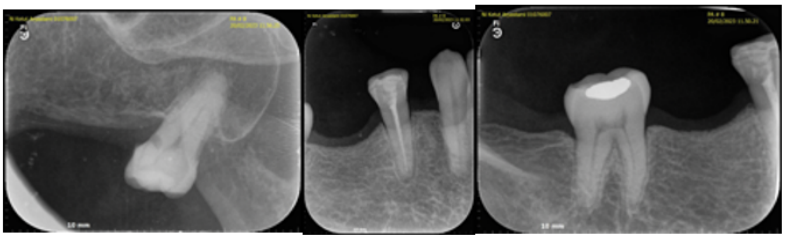


Figure 2. **A. Panoramic x-ray, B. Dental x-ray**

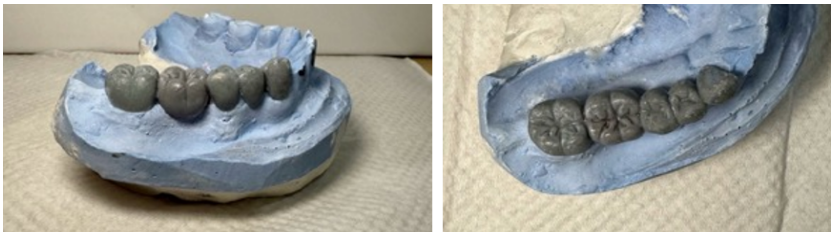


Figure 3. **Diagnostic wax up**

Figure 4. **Temporary restoration**

treatment to improve both function and appearance through denture fabrication. Upon examination, the patient was not undergoing any medical treatment, had never worn dentures before, also revealed moderate oral hygiene with calculus and stains. There was a stable bite with cuspid-protected articulation on both sides, and the patient reported no bad habits. Several teeth were missing, including 25, 26, 27, 44, and 46, with composite filling on 28, amalgam filling on 37 and 47, and endodontic treatment on 45 with composite restoration. Tori mandibular was present both on the right and left sides. Radiographic assessments were performed to complete the examination. After careful examination, the treatment plan for the patient included a partial denture to rehabilitate the upper jaw, and semirigid fixed bridge with porcelain fused to metal retainer crown on tooth 43, partially veneered with occlusal metal on tooth 47, and dowel crown with pre-fabricated fiber post on tooth 45. The selection of nonrigid connector over rigid ones was justified, particularly due to the presence of a pier abutment, causing the need to minimize stress concentration.

The step-by-step clinical procedure for rehabilitating the lower jaw includes the following: a) fabrication of diagnostic wax-ups b) Dowel crown on tooth 45: preparation of the crown, removal of gutta-percha, preparation and cementation of fiber post. This is followed by preparation of tooth 43 and 47, impression with rubber base materials, and fabrication of temporary restorations. c) Fabrication of the metal coping with non-rigid connectors in the laboratory, followed by trying them in the patient's mouth, as well as color match for facing porcelain. d) Returning to the laboratory for fabrication of facing porcelain and insertion of the restoration.

The non-vital tooth 45, which had undergone endodontic treatment exhibited no complaints. As planned, a dowel crown with pre-fabricated fiber post and partial compostite core was placed. As a study by Sorensen and Martinoff found that 94% of endodontically treated posterior teeth that received coronal coverage were successful.[5] Pre-fabricated fiber posts were preferred for their similarity to dentin in elastic moduli, aiding in stress distribution. The preparation of root canal could be minimize compared to cast posts, since extensive of root canal preparation can increase the risk of tooth fracture. Non-vital teeth with tapered customs post fail more frequently when used as abutments.[6,7] Dowel crown with pre-fabricated fiber post was done on this tooth,

During abutment teeth preparation, parallelism was carefully checked, especially for teeth 43 and 45, given their involvement in a three-unit fixed bridge. The treatment plan also considered the narrow edentulous area resulting from tooth loss that has been left

DOI 10.46934/ijp.v6i2.298

Figure 5. **Working cast**

Figure 6. **Metal coping with nonrigid connector**

Figure 7. **Try in of metal coping**

empty for quiet a long time. This condition can affect the adjacent teeth's migration to mesial or distal, and extrusion. Narrow space may interfere the aesthetic and functional aspects, and fabrication could be more complicated. To address this issue, several alternatives were considered, including diagnostic wax-up procedures, orthodontic treatment, increasing the proximal contour of tooth, and creating a smaller pontic size.[8,9] After discussion with the patient and several considerations, she did not want to undergo on orthodontic treatment. For alternatives, diagnostic wax-up was chosen and during the fabrication of diagnostic wax-ups, the narrow space could not accommodate an ideal size of pontic. The pontic was created smaller in order to fit the space, aesthetic aspect was sacrified but still acceptable. To accommodate the space, the planning was to reduce the mesial side of tooth 45 more than 43, as it is a vital tooth.

Following the diagnostic wax up, silicone index made from putty (rubber base) were created for guidance and temporary restorations. The subsequent clinical procedure involved the preparation of abutment teeth. Amalgam restoration on tooth 47 were replaced with composite restoration. After evaluating the preparations, working casts were made using rubber base material and the double impression technique. Provisional restorations were fabricated using tooth-colored bis-acryl materials and cemented with non eugenol temporary cement. The working casts were mounted on the articulator using interocclusal record and sent to the laboratory. In this step, the laboratory work consisted of fabricating metal copings with nonrigid connectors.

The replacement of amalgam with composite on tooth 47 aimed to prevent galvanic reactions that occur when dissimilar alloys or metals are placed in direct contact within the oral cavity.[10] To achieve adequate preparation of supporting teeth, Goodacare et al suggest a reduction of 0.5 – 1 mm for metal and 2 mm reduction for porcelain fused to metal. Due to the minimal occlusal space of tooth 47 caused by the extruded antagonist tooth, intentional endodontic treatment was avoided. After careful consideration, partial veneering with occlusal metal was performed for this tooth.[11,12]

At the next appointment, the metal coping with nonrigid connector was tried on the patient. The anterior segment with the key was inserted first, followed by the posterior segment with the keyway on the mesial side of the pontic. Individual unit try-ins were also performed to verify proper seating, retentiveness, and margin fitness. During this step, evaluation of space

Figure 8. **Insertion and cementation**

Figure 9. **Try in of denture frame**

Figure 10. **Post-op intraoral photgraph**

for porcelain was also conducted, except for the occlusal space for tooth 47, as it is planned to be occlusal metal. Tooth color was determined using shade guide to achieve a natural color. Provisional restorations were re-cemented and the metal coping was sent back to the laboratory for porcelain facing fabrication. Facing porcelain fabrication was completed in the laboratory.

The next visit aimed to cement the restorations using temporary non-eugenol cement. However, before cementation, the final restorations were checked for the retentivess, margin fitness, color match, as well as occlusion and articulation to ensure proper distribution. Once it was confirmed that the restorations were in good condition, cementation proceeded with anterior segment being cemented first, followed by the posterior segment. Any excess cement was removed, and the patient received instruction to maintaining proper oral hygiene.

After approximately 7 days, an evaluation of the restoration was conducted. The patient reported no complaints, felt comfortable, and could chew on the right side comfortably. The restorations were check objectively for any trapped food, and the gingival margin was inspected. After removing the restorations, the edentulous area was examined for any signs of redness. Once everything was ensured, permanent cementation was carried out using luting lass ionomer cement, following the same procedure as before.

At this stage, an impression of the upper jaw was also made taken to fabricate the metal frame denture. The major connector for the denture was a palatal strap, with akers clasps on tooth 24 and 28, and double akers clasps on tooth 16 and 15. At the next appointment, the denture frame was tried on the patient to evaluate the retentiveness and adaptiveness, and a bite registration was performed using a bite rim. The cast then mounted on the articulator according to the bite registration. Similarly to the lower jaw, the edentulous space was narrowed to accommodate only tooth 26 and 27. Evaluation of the denture wax was conducted, followed by gum cuff formation, packing and polishing of the denture. During insertion, occlusion and articulation was checked, and patient received instructions on maintaining proper oral hygiene and cleaning the denture thoroughly.

While fabrication of fixed partial denture using rigid connectors is generally preferred due to the rigidity of the connection between pontic and retainers, providing desirable strength and stability to the prosthesis while minimizing the stresses associated with the

DOI 10.46934/ijp.v6i1.298

restoration, there are cases where nonrigid connectors are indicated. Nonrigid connectors are particularly indicated in cases of pier abutments, promoting a fulcrum-like condition, or in the presence of malaligned abutments where achieving parallelism requires extensive preparation. They are also recommended for long-span fixed partial dentures in the mandibular arch consisting of both anterior and posterior segments.[2] The advantages of using nonrigid connectors include their ability to act as stress breakers and transmit masticatory stress along the axis of abutment tooth, transferring it to the supporting bone rather than concentrating it in the connectors. However, the use of nonrigid connectors also increases laboratory work time and expense.[13,14]

Since there's a pier abutment in this case, a nonrigid connector could break the stress posterior to the pier abutment, allowing so the posterior and anterior units to move independently. Conversly, flexion in the mesiodistal direction caused by splinting of rigid connector can result in the failure of fixed prosthesis due to excessive loading on the surface of the abutment tooth.[15]

There are several types of nonrigid connectors, such as dove-tail or key-keyway or Tenon Mortise, loop connectors, split pontic, and cross-pin and wing. Key-keyway connectors are identified as the most common type. There is some conflicting opinion regarding the placement of nonrigid connectors. Markley suggested placing the connector on one of the terminal abutments rather than on the pier abutment, while Adams and Gill suggested the opposite, which is to place it on the pier abutment. According to Shihlingburg, the ideal placement for this connector is on the middle abutments or the distal aspect of the pier abutment to reduce stress concentration. Additionally, placing the connector on either of the terminal abutments could result in the pontic acting as a lever and the middle abutment functioning as a fulcrum. This statement is supported by a finite element study by Oruc et al.[5,16,17] A study showed that nearly 98% of the posterior teeth, when subjected to occlusal forces, tilted mesially. Placing the keyway on the distal side of the pier abutment securely seats the key into the keyway with any mesial movement.[18,19] In this case, the nonrigid connector was placed within the pontic of first molar and distal side of pier abutment, avoided overcontouring, which is a common problem associated with the use of extracoronal attachment.

In accordance with the diagnostic wax up,the pontic on tooth 44 is smaller, it sacrificing some esthetic aspects but still deemed acceptable. In this case, both pontics both 44 and 46 are designed as modified ridge lap pontics. The modified ridge lap pontic combines aesthetic features with ease of cleaning. The facial side of this pontic overlaps the ridge on the facial side to achieve the appearance of the tooth emerging from the gingiva, while the lingual side remains clear of the ridge for hygiene purposes.[20]

Conclusion

The design of fixed-partial-denture is crucial for their long-term success. While fabrication of fixed partial denture is generally preferred, certain factors such as the presence of pier abutments may necessitate alternatives approaches. The incorporation of nonrigid connectors as stress breakers is particularly significant for the longevity of dentures. Additionally, attention must be paid to factors such as the edentulous span and the condition of non-vital abutments to ensure the durability of the prosthesis. In cases where a narrow edentulous span is present, treatment complexity may increase, potentially leading to compromises in aesthetic aspects, as observed in this study. Thorough examination is essential for determining the viability of nonvital abutments, and the use of pre-fabricated fiber posts can be beneficial in enhancing the condition of such abutment.

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DOI 10.46934/ijp.v6i1.298