Case Report

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Prosthodontic Rehabilitation using Maxillary Fixed Dental Prosthesis with Tenon and Mortise Stress Breaker and Mandibular Complete Denture with Metal Reinforced Base: A Case Report

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KEYWORDS

Metal denture base, Non-rigid connector, Pier abutment, Single complete denture, Stress breaker

ABSTRACT

The goal of restorative dentistry is to preserve teeth's natural structure and function while averting further issues with oral health. The most common treatment approach for rehabilitating one or two teeth is the insertion of a fixed dental prosthesis. This method offers a workable alternative for replacing lost teeth, and its longevity guarantees a long-term solution to prevent further oral health problems. To summarize, individuals with one or two missing teeth can have their smiles restored with a fixed dental prosthesis, which is a dependable, efficient, and effective method. To solve the prevalent problem of repeated prosthesis fractures, a single complete denture with a metal-reinforced base was utilised. This procedure offers a more durable and long-lasting solution for replacing lost natural teeth compared to traditional methods. This case study describes the thorough clinical treatment and fabrication of a pier abutment and metal denture base.

INTRODUCTION

Planning a Fixed Dental Prosthesis (FDP) can provide difficulties when there is a single, freestanding pier abutment with edentulous space on both sides of the tooth. The anterior abutment, which uses the middle retainer as a fulcrum, may debond if stiff connectors are used for the pier abutment. Rigid connectors are also less than optimal for pier abutments because of physiologic tooth movement, the position of the abutments about their arch, and the retentive capacity of the retainers. To prevent additional oral health issues, it is imperative to consider these considerations when evaluating treatment choices for FDP [1]. A fixed dental prosthesis success depends on several variables, including the edentulous span, retainer, connector, pontic design, and abutment teeth. For the FDP to last a long time and function well, the correct kind of connector must be chosen. One form of complete denture that can be used to replace missing teeth in the mandible or maxilla is the single complete denture (SCD) [2]. These dentures are intended to be used in opposition to fixed partial dentures or natural teeth. However, issues including denture instability, decreased retention, and breakage from bending pressures can result from high masticatory forces from the opposite arch when a person has a fixed dental prosthesis or natural dentition in addition, this may result in excessive ridge resorption, which could exacerbate the rehabilitation process by making the ridge hyperplastic or flabby. Metal denture bases are a dependable substitute for denture bases that fail due to strong masticatory or functional stresses. The objective of our case report is to evaluate the effectiveness and benefits of using metal denture bases in improving durability and patient comfort

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compared to acrylic resin dentures [3]. Research has demonstrated that these dentures offer a more natural feel when chewing food and are more pleasant for patients.

CASE REPORT

A 55-year-old female patient reported to the Department of Prosthodontics with a chief complaint of inability to chew food due to missing teeth from the last 3 months.

Figure 1 1a) Extraoral View; 1b) and 1c) Intraoral View of Maxillary and Mandibular Arch

During the extraoral examination, the patient's face exhibited bilateral symmetry (Figure 1a). Sunken cheeks and other facial abnormalities compromising esthetics, such as vertical dimension loss and reduced lower lip support, were noted. On intraoral examination, the patient exhibited a completely edentulous mandibular arch and an absence of the maxillary right first premolar and molar. Despite the missing teeth, there was adequate bone support that could potentially accommodate prosthetic pontics. The main concerns identified during the examination include addressing the challenges posed by complete mandibular edentulism and the need to restore the missing maxillary teeth to restore function and aesthetics. Evaluating the suitability of the remaining bone for supporting abutments is crucial for planning the prosthetic treatment effectively. (Figure 1b & 1c). For the maxillary arch, the patient was presented with several treatment options: implants for edentulous spaces or a fixed partial denture with a non-rigid connector. The patient refused the implant option due to financial constraints. When using a fixed dental prosthesis with a pier abutment, careful consideration is needed to prevent excessive stress on the abutments and prosthesis, which can lead to problems like overloading and prosthesis failure. A non-rigid connector or semi-precision attachment was chosen to mitigate these risks by allowing slight movement between components, distributing forces more evenly, and ensuring the long-term stability of the prosthesis and supporting structures. The patient was offered several options for the mandibular arch: conventional complete denture, complete denture with a metal-reinforced base, implant-retained prosthesis, and implant-supported fixed prosthesis. Due to financial constraints, implants were ruled out. A metal denture base was chosen to provide strength and support, especially since the opposing arch has natural teeth and a fixed dental prosthesis. This decision ensures stability and functionality while considering the patient's existing dental structures.

CLINICAL PROCEDURE

After obtaining informed consent from the patient, a primary impression was taken and poured with a type III dental stone (Kalabhai Karson Pvt Ltd, Kalrock, India) (Figure 2a). Utilizing a temporary bite registration for occlusal reference, the maxillary right canine, second premolar, and second molar were prepared for PFM crowns with a shoulder finish line and subgingival margins. Subgingival finish lines are strategically placed to preserve gingival health, improve aesthetic integration with natural teeth, and maintain the biological width. This approach minimizes plaque accumulation, enhances the longevity of the crowns by reducing bacterial infiltration, and contributes to the overall health of the surrounding periodontal tissues. The gingival retraction was carried a gingival retraction cord (Size #000) (Figure 2b) (Sure-Endo, Sure Cord – Knitted Gingival Retraction Cord, India). The final impression was made using elastomeric impression material (Neopure, A-silicone Impression Material, Orikam Healthcare Pvt. Ltd., India) a two-stage putty wash technique (Figure 2c) poured in Type IV dental stone (Kalabhai Karson Pvt Ltd, Kalrock, India). Direct method Provisional restorations were made from a tooth-coloured acrylic resin and cemented with temporary cement (Prevest, Oratemp C&B Temporary Crown and Bridge Material, India) (Figure 2e & 2f).

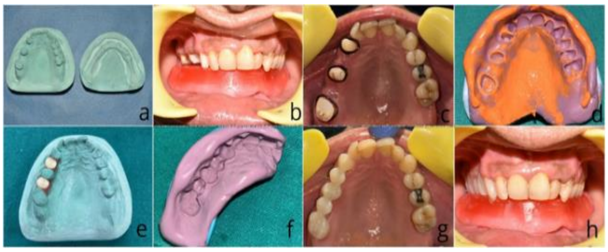

Figure 2 2a) Primary casts; 2b) Tooth preparation is done with reference of occlusion bite registration; 2c) After tooth preparation with gingival retraction; 2d) Putty with light body impression; 2e) Temporary teeth arrangement done; 2f) Sectional impression for temporization and 2g, 2h) Temporary crown placed

Wax patterns were fabricated for 13, 14, 15,16 and 17 (Figure 3a, 3b & 3c). Placing the female portion of the metal fit in the posterior pontic instead of the usual distal position on the pier abutment enhances both the aesthetics and functional performance of the restoration. This placement improves the natural appearance by concealing the junction between the pontic and abutment, distributes chewing forces more evenly to reduce stress on the abutment and enhances the overall stability and durability of the restoration. These factors collectively promote patient comfort and satisfaction (Figure 3d & 3e). In a clinical setting, both the anterior and posterior segments were tested to ascertain the marginal fit of the restoration. Subsequently, a temporary crown was given. The laboratory procedure was concluded by assembling the anterior segment with the female portion (keyway mortise) and the posterior segment with the male portion (key tenon) on the working cast.

Figure 3 3a, 3b, 3c) Wax Pattern of Male and Female Component of Pier Abutment; 3d, 3e) Metal Try-in of Pier Abutment and 3f) Temporary Crown

The final prosthesis was thoroughly examined for retention, stability, and precise fit (Figure 4a). The prosthesis was then cemented using Type I Glass ionomer cement (GIC), starting with the anterior segment and followed by the posterior segment (Figure 4b & 4c). Post-treatment instructions were provided to the patient, including the need for periodic follow-up and oral hygiene maintenance.

Figure 4 4a) Final Prosthesis of Pier Abutment; 4b) Male Component; and 4c) Male with Female Component of Pier Abutment Prosthesis

The primary impression of the mandible arch was made using a impression compound, mandibular border moulding and the final impression was made using green stick compound (DPI, India) and light body consistency additional silicone (Neopure A-silicone Impression Material Orikam Healthcare India Pvt. Ltd) (Figure 5a). The master cast was poured, and the mandibular master cast was duplicated using silicone putty (manufactured by Orikam Healthcare India Pvt. Ltd) (Figure 5b). It was then poured into a silicone putty mould using high-quality phosphate-bonded investment material (Bego, Wirowest, Germany) (Figure 5c).

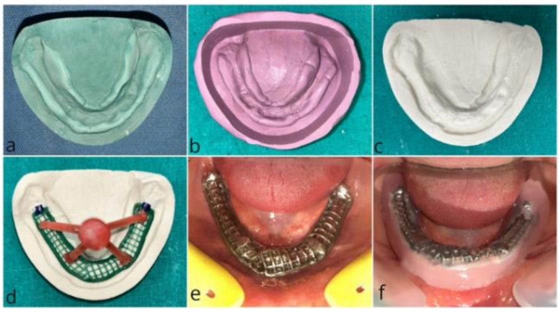

Figure 5 5a) Master Cast of Mandibular Arch; 5b) Master Cast Duplication Impression; 5c) Impression Poured with Investment Material; 5d) Wax Pattern of Metal Denture; 5e) Reinforced Metal Frame Try-in and 5f) Metal Denture Base

On the refractory cast, the meshwork wax pattern was carefully and precisely adapted over the crest of the mandibular arch (Figure 5d). Following the burnout and casting procedure, the metal framework was fabricated using high-quality cobalt-chromium alloy via a centrifugal casting machine (Bego, Germany) and meticulously adjusted to ensure proper adaptation (Figure 5e). Following this, the wax-up process proceeded similarly to a denture base. Conventional dewaxing was performed, and then heat-cure acrylic resin (DPI heat cure; Dental Product of India) was mixed into the dough stage and placed into the dewaxed area. Subsequently, conventional curing was carried out to finalize the denture's fabrication. After retrieval, the denture underwent necessary adjustment to ensure proper adaptation, followed by finishing and polishing to achieve a smooth and aesthetically pleasing surface. The maxillary arch impression was made using irreversible hydrocolloid material and cast poured with type III dental stone.

Following verification of the metal-reinforced base fit, an occlusal rim was fabricated, and the jaw relationship was established (Figure 6a & 6b). After registering the jaw relationship, the casts were mounted into a mean value articulator. Subsequently, teeth arrangement was meticulously carried out (Figure 6c), followed by a verification try-in process to ensure proper fit, occlusion, and aesthetics of the prosthesis (Figure 6d). In a conventional method, polymethyl methacrylate resin was used to process the denture prosthesis. Finishing and polishing of dentures was done. Follow-up assessments include clinical checks for stability and patient feedback on comfort, speech, and chewing. Objective measurements like occlusal contact and bite force distribution may also be used. Post-insertion instructions focused on denture maintenance and oral hygiene to ensure long-term satisfaction and oral health. Regular dental check-ups are recommended to maintain optimal denture performance and patient comfort. (Figure 6e & 6f).

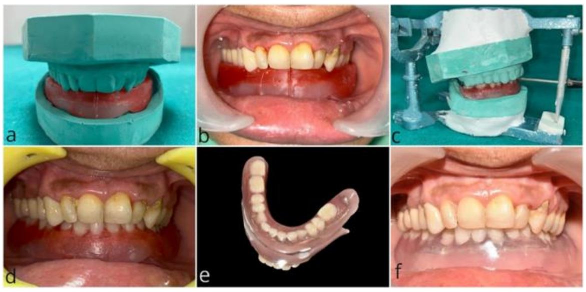

Figure 6 6a) Occlusal Rim; 6b) Jaw Relationship Registration; 6c) Teeth Arrangement; 6d) Try-in; 6e) Mandibular Complete Denture with Metal Reinforced Base and 6f) Intraoral Post-Rehabilitation View

Follow-up appointments were scheduled at regular intervals to ensure that the patient was comfortable and happy with the treatment (Figure 7a & 7b).

Figure 7 7a) Pre-Operative Extra Oral View and 7b) Post-Operative Extraoral View

DISCUSSION

According to definitions, a pier abutment, also known as an intermediate abutment, is a natural tooth or implant abutment situated between terminal abutments and used to support a fixed or removable dental prosthesis [4].

It is essential to consider potential issues such as the middle retainer acting as a fulcrum and causing debonding of the anterior abutment when using rigid connectors in fixed dental prostheses involving pier abutments. Due to their susceptibility to changes in arch position and physiological tooth movement, rigid connectors are not recommended for use with pier abutments [5]. Therefore, when planning a fixed dental prosthesis, careful evaluation of the pier abutment's potential to cause prosthesis failure is necessary, with non-rigid connectors often preferred in such cases. Additionally, misaligned abutments during parallel preparation may lead to devitalization and reduce the retention capacity of fixed dental prostheses (FDPs). Non-rigid connectors are beneficial as they accommodate minor movements, minimize stress on abutments, and enhance prosthesis stability and longevity [6]. In practice, selecting a non-rigid connector for a fixed dental prosthesis with a pier abutment aims to manage mobility and instability issues, especially when the matrix (male part) and patrix (female part) are improperly positioned, potentially leading to improper load distribution and stress concentration on the pier abutment. To mitigate these challenges, precise positioning of the matrix and patrix, the use of stress breakers to absorb forces, consideration of endodontic treatment for abutment reinforcement, and regular monitoring and maintenance are essential to. ensure the prosthesis's integrity [7]. Conventional denture base materials like polymethyl methacrylate (PMMA) often exhibit poor mechanical properties under heavy occlusal loads and are prone to fracture due to flexural fatigue from repetitive stress. To address these issues, metal-reinforced denture bases are commonly used to strengthen the denture and enhance dimensional stability, fracture resistance, retention, and precision [8]. When selecting dental prostheses such as facings, tube teeth, metal pontics, or metal-reinforced denture teeth, and utilizing a "floating denture base" for tooth-tissue supported spaces, it is advisable to avoid using them in areas solely supported by tooth tissue or expected to undergo bone resorption [9]. Metal foundations offer advantages such as stiffness, heat conductivity, shape stability, abrasion resistance, and easy cleaning due to low porosity [10]. However, challenges include difficulties in relining, modifying the metal surface, and achieving a natural appearance compared to real teeth [11]. It is crucial to distinguish between a metal-reinforced base for complete dentures and an all-metal connector in removable partial dentures, as the former enhances strength but may limit space for denture teeth, affecting their profile. These considerations should address limitations, anticipate outcomes for durability and function, and manage maintenance needs such as relining and surface adjustments to ensure the long-term fit and appearance of the prosthesis.

CONCLUSION

In this case, we identified that strain on terminal retainers was due to the pier abutment acting as a fulcrum. Selecting the right connector type in fixed dental prostheses is crucial to prevent prosthesis failure from debonding. Using a non-rigid connector allows for movement, redistributing pressures away from the pier abutment and reducing failure risks. We evaluated patient comfort and found that metal bases, replacing acrylic resin in full dentures, improved fit, strength, and comfort directly from patient feedback and clinical assessments. Our case report highlights that improper strain management from pier abutments can lead to prosthesis failure, emphasizing the importance of material choices for better patient outcomes.

DECLARATION OF INTEREST

The authors declare that there are no conflicts of interest.

REFERENCES

1. Shillinburg HT, Sather DA, Wilson EL, Cain JR, Mitchell DL, Blanco LJ, et al. Fundamental of fixed Prosthodontics. Chicago: Quintessence; 2012; 4:91-92.
2. Rathee M, Singh S, Malik, Sanju M, Alam M, Chahal S. Fracture resistance by reinforcement of complete denture with metal base a case report. Asia Pacific Dental Journal 2022; 9(1):16-18.
3. Kanojia EM, Bhoyar A, Dubey SR, Sathe S, Khubchandani SR, Shinde R. Shielding the Pier Abutment Using a Nonrigid Connector. Cureus 2024;16(1).
4. Mattoo K, Brar A, Goswami R. Elucidating the Problem of Pier Abutment through the Use of a Fixed Movable Prosthesis. A Clinical Case Report. Int J Dent Sci and Res. 2014; 2(6):154-157.
5. Venkataraman K, Krishna R. The lone standing abutment: A case report. Int J Applied Dent Sci 2016; 2(1):20-23
6. Nisal S, Banik M, Gade J, Atulkar M. Management of Pier Abutment Using Non-Rigid Connector: A Case Report. Int J Oral Health and Medical Res. 2016; 2(5):128-131.
7. Rathee M, Chahal S, Ahlawat A, Alam M, Divakar S, Singh S. Maxillary complete denture buttressed with metal denture base and amalgam stops opposing deranged occlusal plane: a case report. Eur J Dent Oral Health 2022;3(2):5-8.
8. Han-Kuang Tan. A preparation guide for modifying the mandibular teeth before making a maxillary single complete denture. J Prosthet Dent 1997; 77:321-322.
9. Barco MT. Scoll A. Synnoll. Precision metal occlusal surfaces for removable partial dentures. Int J Prosthodont 1989; 2:365-367.
10. Rathee M, Bhoria M, Priyanka B. Oral rehabilitation with metal base complete denture for a patient with oral lichen planus. IJRID 2014; 4(4):117-121.
11. Rathee M, Dixit P, Alam M, Jain P, Singh ST. Prosthetic Management of Pier Abutment Through Digitally Fabricated Non-Rigid Connector: A Case Report HTAJOCD 2023; July-Aug (6):35-36.

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