

ORIGINAL ARTICLE

Managing Prosthetic Mismatch: Complete Denture Occlusion Against FP1 and FP2 Implant-Supported Restorations

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HOW TO CITE THIS ARTICLE:

Priyanka Johar, Tarun Kalra, Manjit Kumar, et al. Managing Prosthetic Mismatch: Complete Denture Occlusion Against FP1 and FP2 Implant-Supported Restorations. Ind J Dent Educ. 2025; 18(3): 141-150.

ABSTRACT

The rehabilitation of a completely edentulous arch opposing a dentate or implant-supported dentition presents significant biomechanical and prosthetic challenges. The rehabilitation of edentulous and partially edentulous patients requires a strategic approach to restore both function and esthetics. In cases where the maxillary arch is fully edentulous and the mandibular arch retains natural posterior teeth, a combination of a maxillary complete denture and a mandibular implant-supported prosthesis provides a balanced occlusal scheme. The presence of natural posterior teeth in the mandible influences occlusal load distribution, requiring careful prosthetic planning. This article presents a prosthodontic rehabilitation case involving a maxillary complete denture opposing a mandibular FP1 and FP2 implant-supported fixed prosthesis with five remaining natural posterior teeth. In cases of a single denture opposing an implant-supported fixed prosthesis, special attention must be given to occlusal harmony, implant-protected occlusion principles, and balanced denture stability to avoid rapid ridge resorption and prosthetic complications. This case emphasizes the importance of precise prosthetic planning, occlusal scheme customization, and regular follow-up to ensure long-term success and patient satisfaction. The report highlights the interplay between fixed and removable prosthodontics in a partially edentulous patient, providing a functional and aesthetic solution tailored to the patient's needs.

KEYWORDS

• Splinting • Implant protected occlusion • Complete Denture

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➤ **Received:** 23-07-2025 ➤ **Accepted:** 05-09-2025



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INTRODUCTION

Implant therapy has become the treatment modality of choice for the replacement of missing teeth in both partially and completely edentulous patients. Dental implants differ significantly from natural teeth in their biological integration and biomechanical behaviour. One of the critical determinants of implant success is the establishment of an appropriate occlusal scheme.

The concept of Implant-Protected Occlusion (IPO), introduced by Misch and Bidez in 1994, is specifically designed to optimize force distribution during functional loading. By ensuring maximal intercuspation during clenching and reducing occlusal stress on the implant components, IPO plays a pivotal role in preserving peri-implant structures and enhancing prosthetic longevity.

Occlusal overload is a major etiological factor for both biological complications such as peri-implantitis and mechanical failures, including screw loosening, component fracture, and implant failure. Unlike natural teeth, dental implants are osseointegrated and lack a periodontal ligament, thereby eliminating the physiological shock-absorbing mechanism. As a result, the crestal bone functions as a fulcrum under excessive occlusal forces, predisposing the implant system to both biological and mechanical deterioration.

Rangert *et al.* emphasized that the long-term clinical success and survival of implants are closely associated with biomechanically sound occlusal principles. Therefore, adherence to the tenets of implant-protected occlusion is essential throughout all phases of implant therapy including implant selection, surgical placement, and prosthetic rehabilitation to ensure optimal treatment outcomes.¹

With the advancement and high success rates of contemporary implantology, edentulous patients now have the opportunity to significantly enhance their quality of life through implant-supported rehabilitation. Treatment options include removable implant-retained overdentures and fixed implant-supported full-arch prostheses.

Extensive literature supports the clinical superiority of fixed full-arch implant restorations over removable alternatives. These fixed solutions offer enhanced masticatory efficiency and force, improved

patient satisfaction, reduced maintenance requirements, better preservation of alveolar bone, and higher overall prosthetic success rates.²

Implant-supported metal-acrylic resin fixed complete dentures offer an effective solution to the instability and discomfort commonly associated with conventional mandibular removable complete dentures (RCDs). These prostheses are fabricated by arranging acrylic resin denture teeth on a metal framework and processing them with denture-base acrylic resin. The use of acrylic resin teeth is advocated due to their ability to function as shock absorbers, compensating for the absence of periodontal ligaments. This design has demonstrated high clinical success and patient satisfaction.³

FP1 Prostheses closely mimic the natural tooth anatomy, emerging directly from the gingiva without the need for any artificial soft tissue replacement. They are best suited for patients with minimal alveolar ridge resorption, allowing for a natural and esthetic emergence profile.

The interocclusal space, defined as the vertical distance between the edentulous ridge and the opposing dentition, is a critical factor in planning and designing implant supported prostheses. For FP1 restorations which aim to mimic natural teeth without the use of artificial gingival components a minimum of 7–10 mm of interocclusal space is typically necessary. This space allows for proper accommodation of the implant, abutment, and restorative materials while supporting a natural emergence profile and functional occlusion. Successful FP1 prostheses depend on minimal alveolar ridge resorption and accurate implant placement to achieve optimal aesthetics and biomechanical stability.⁴

CASE REPORT

An 81-year-old male patient reported to the Department of Prosthodontics, Crown and Bridge, with the chief complaint of missing teeth in the upper jaw and expressed a desire for their replacement. Patient presented Partially Edentulous mandibular ridge with missing teeth wrt 35, 36 and root stumps wrt 31, 32, 33, 34, 41, 42, 43 (*Figure 1* and *Figure 2*). The proposed treatment plan included a conventional complete denture for

the maxillary arch and an implant-supported prosthesis for the mandibular arch. An orthopantomogram (OPG) was performed to evaluate the quality and quantity of the alveolar bone for the replacement of root stumps and missing teeth with an implant-supported prosthesis (Figure 3). A preliminary impression of the maxillary arch was made using impression compound (Figure 4), while the mandibular impression was recorded with irreversible hydrocolloid. Primary casts were poured accordingly. For the maxillary arch, a custom tray was fabricated to perform the secondary impression using the selective pressure technique. Sectional border moulding was carried out with green stick compound, followed by the final impression using zinc oxide eugenol (Figure 5). Maxillomandibular relationship was recorded using Niswonger's technique (Figure 6). Teeth arrangement was performed on a non-adjustable articulator using acrylic anatomic teeth (Figure 7). After a satisfactory try-in appointment, the denture was processed through conventional acrylization and denture insertion was done (Figure 8).



Figure 1: Complete Edentulous Maxillary Arch



Figure 2: Partially Edentulous Mandibular Arch

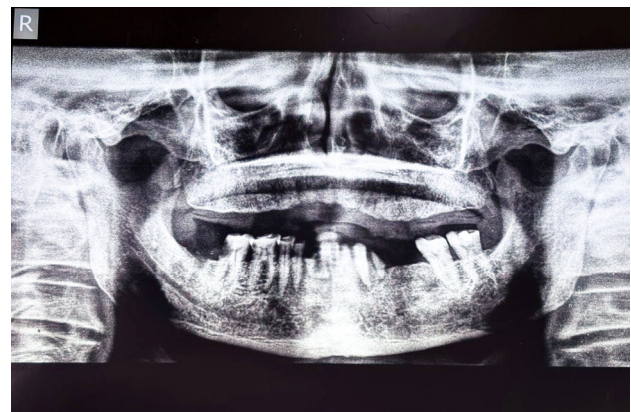


Figure 3: Orthopantomogram



Figure 4: Primary Impression



Figure 5: Secondary Impression



Figure 6: Jaw Relation

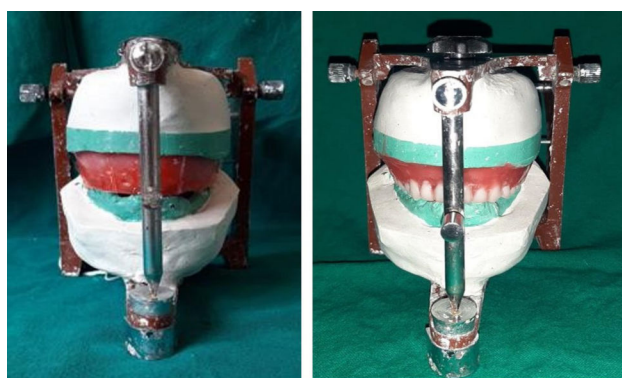


Figure 7: Teeth Arrangement



Figure 8: Denture Insertion

Root stumps were extracted from the regions 31, 32, 33, 34, 41, 42, and 43 (Figure 9). Implants were subsequently placed in regions 36, 34, 33, and 43, achieving primary stability at the time of placement (Figure 10 and Figure 11) with interrupted suture placed (Figure 12) and RVG's were taken (Figure 13 and Figure 14). Following a healing period of four months, during which osseointegration was achieved, second-stage surgery was performed to uncover the implants and proceed with prosthetic rehabilitation (Figure 15). A digital impression was taken using scan bodies one week after the placement of healing abutments, allowing time for the formation of an appropriate emergence profile around the implants (Figure 16).

A verification jig was subsequently provided by the laboratory for trial to confirm the accuracy of implant positions (Figure 17). However, as the jig did not seat properly, splinting of the impression copings was done again after achieving satisfactory emergence profile from 34 to 36 region and final impression was made (Figure 18 and Figure 19). A metal framework trial was done (Figure 20) and FP1 prosthesis were delivered wrt 34,35 and 36

(Figure 21). Splinting was done using dental floss as a scaffold, over which GC Pattern Resin was applied using the brush and bead technique was done. This method provided rigidity to the splint, enhancing the accuracy of both the jig and the final impression. An open tray implant impression technique was then employed to ensure precise transfer of implant positions. To minimize polymerization shrinkage and internal stresses, the Pattern Resin splint was sectioned 17 minutes after initial polymerization and then rejoined with additional resin. This protocol helped achieve an accurate final impression, validated by a precise fit during the subsequent jig trial (Figure 22).

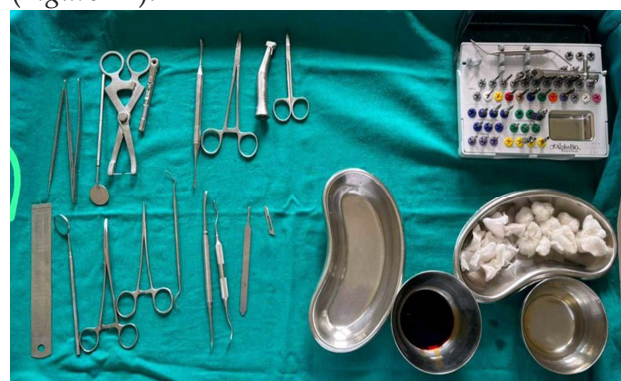


Figure 9: Armamentarium for Implants



Figure 10: Implant Placement Wrt 36,34,33,43



Figure 11: Implant Placement Wrt 36,34,33,43

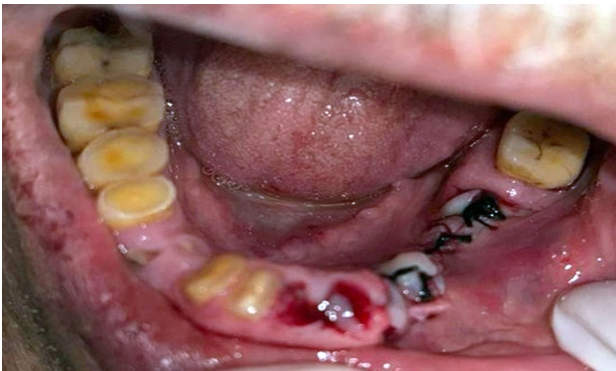


Figure 12: Inerrupted Suture

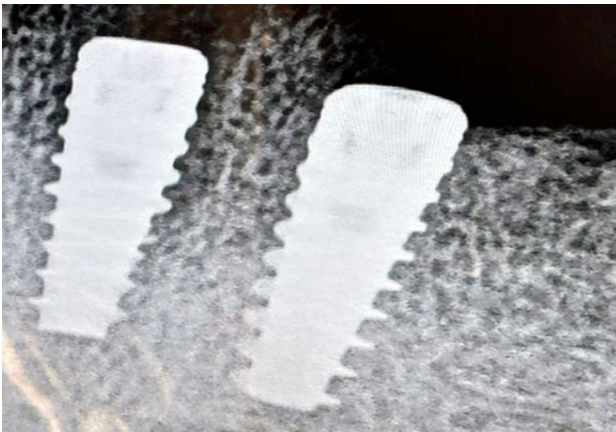


Figure 13: Implant Placement Wrt 43,44

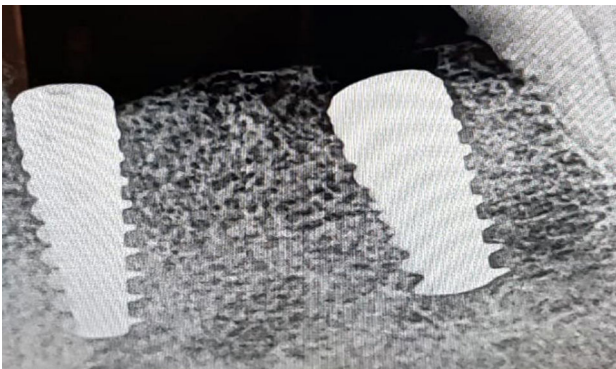


Figure 14: Implant Placement Wrt 46, 44



Figure 15: Second Stage Surgery

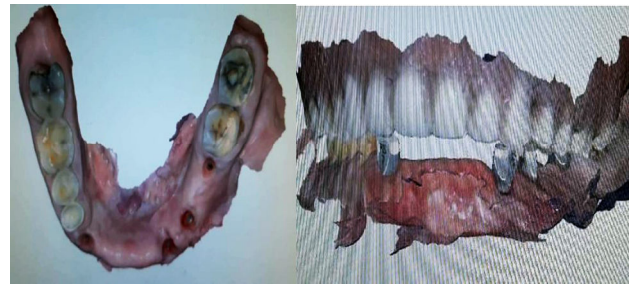


Figure 16: Implant Level Digital Impression Made

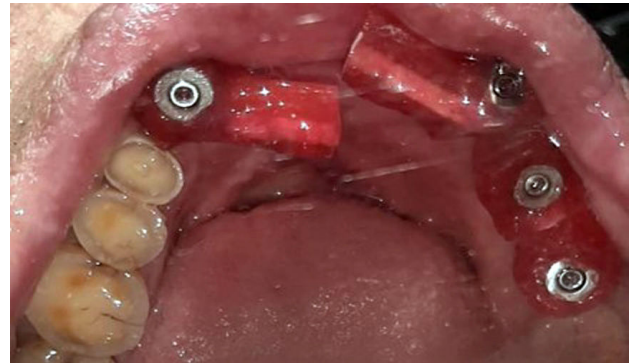


Figure 17: Jig Trial

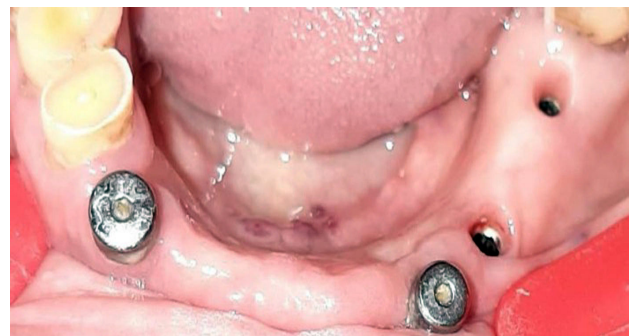


Figure 18: Emergence Profile

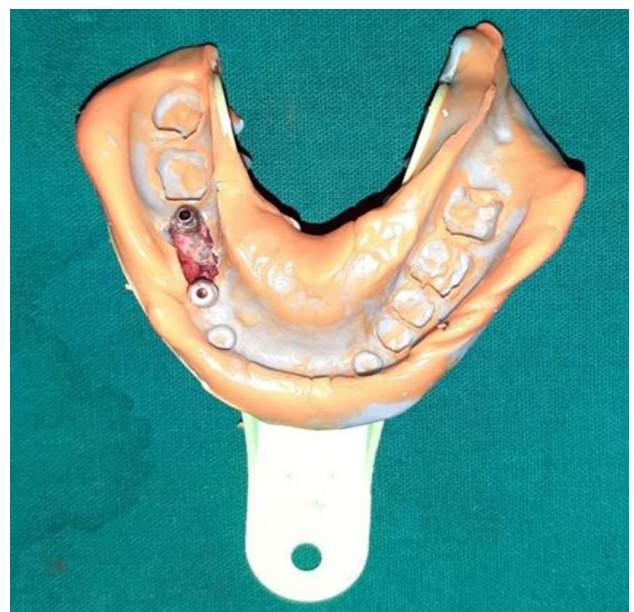


Figure 19: Open Tray Implant Impression



Figure 20: Metal Trial



Figure 21: Screw Retained Implant Prosthesis (Fp1)

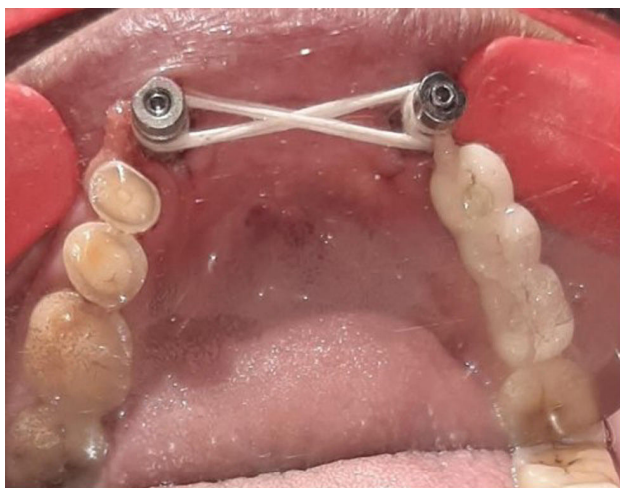


Figure 22: Splinting of implant impression copings for passive fit of prosthesis with pattern resin

Following verification of the passive fit of the laboratory-fabricated verification jig using the one-screw test and multiple radiographic evaluation (RVG's), a metal framework trial was conducted for the long-span implant-supported bridge extending from region 34 to 36 and 33 to 43 (Figure 23). Upon confirming the fit and accuracy, the final FP1 prosthesis was

delivered to the patient ensuring functional and aesthetic rehabilitation (Figure 24). Post-insertion instructions were then provided to the patient to ensure proper maintenance and longevity of the prosthesis (Figure 25, Figure 26 and Figure 27).



Figure 23: Open Tray Implant Impression



Figure 24: Screw Retained Implant Fixed Prosthesis (FP 2)



Figure 25: Post-operative Photographs

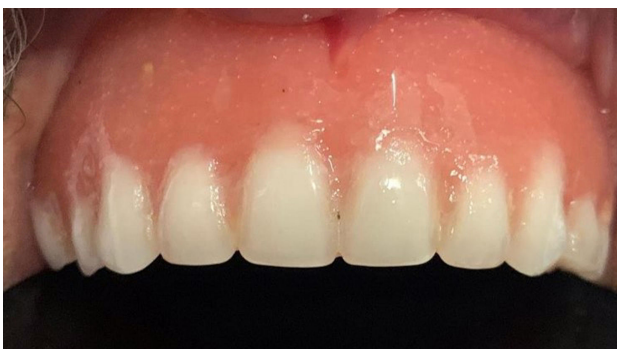
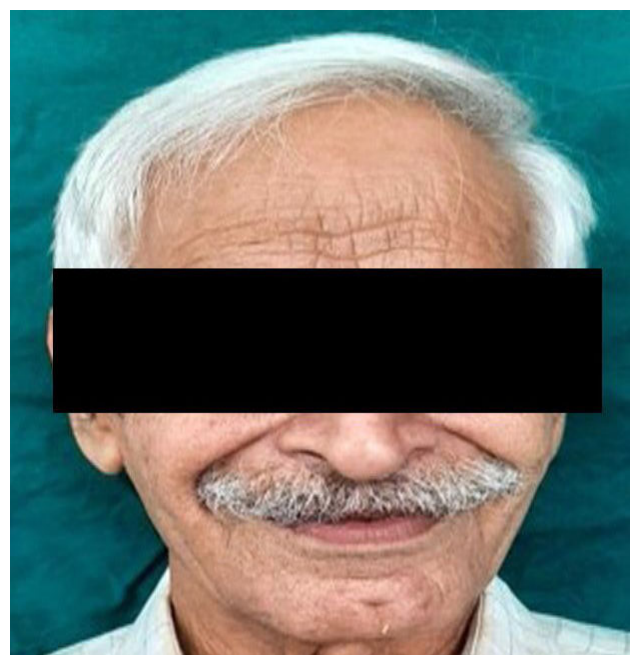


Figure 26: Pre Operative Photograph

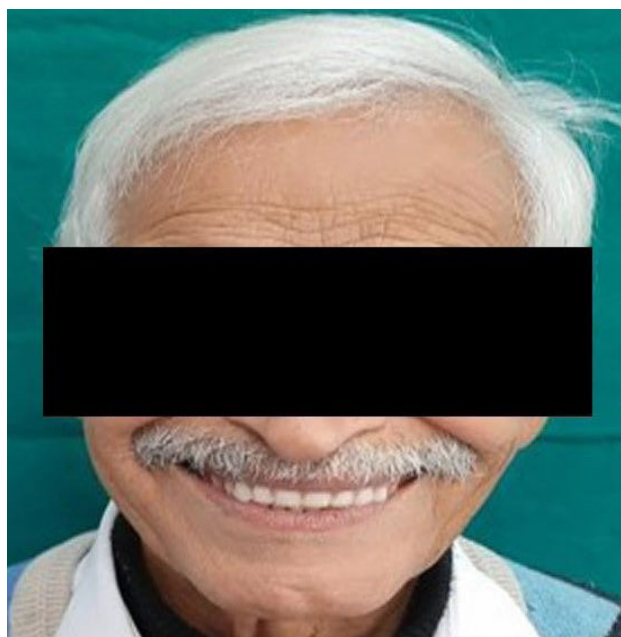


Figure 27: Post-operative Photograph

Table 1: Prosthodontic Classification

Prosthodontic Classification	
Type	Definition
FP-1	Fixed prosthesis; replaces only the crown; looks like a natural tooth.
FP-2	Fixed prosthesis; replaces the crown and a portion of the root; crown contour appears normal in the occlusal half but is elongated or hypercontoured in the gingival half.
FP-3	Fixed prosthesis; replaces missing crowns and gingival colour and portion of the edentulous site; prosthesis most often uses denture teeth and acrylic gingiva but may be porcelain to metal.
RP-4	Removable prosthesis; overdenture supported completely by implant.
RP-5	Removable prosthesis; overdenture supported by soft tissue and implant.

Five Prosthetic Treatment options in implant dentistry

advantages and Disadvantages of Fixed Restorations

Advantages:

1. Provides psychological comfort by closely resembling natural teeth.
2. Minimizes food entrapment compared to removable prostheses.
3. Requires less maintenance, as there are no attachments that need frequent

adjustment or replacement.

4. Offers long-term durability, often lasting the lifetime of the implants.
5. Involves a comparable overall cost to that of fully implant-supported overdentures.

Disadvantages:

1. Managing complications can be more complex and challenging.
2. The prosthesis cannot be removed at night, which may increase the risk of nocturnal parafunctional habits.
3. Absence of a labial flange in maxillary restorations may compromise facial esthetics due to inadequate lip support.
4. Oral hygiene can be more difficult to maintain around fixed components.

An FP-2 prosthesis restores the crown and part of the root, resembling teeth with bone loss and gingival recession. Due to more apically placed bone, implants are positioned deeper than in FP-1, resulting in longer-looking teeth with overextended gingival thirds. While the incisal edge is correctly placed, the cervical area often appears more apical and lingual. Patients should be informed that the teeth may look longer, though this is usually not noticeable unless the lip line reveals the cervical region during smiling or speech.⁷

Biomechanical overload can lead to a range of complications, including early implant failure, early crestal bone loss, intermediate to late implant failure, screw loosening, debonding of cemented restorations, component fractures, porcelain fractures, prosthesis fractures, and peri-implant disease. To address these issues and reduce harmful occlusal forces while establishing a consistent occlusal approach, Dr. Carl E. Misch introduced the concept of Implant-Protected Occlusion originally described as medially positioned lingualized occlusion. This occlusal philosophy incorporates specific design principles aimed at minimizing excessive loading on the bone-implant interface and associated prosthetic components, thereby ensuring that the functional forces remain within physiological limits. Following are the factors influencing implant protected occlusion (table 2)¹

Table 2: Implant Protected Occlusion

Implant Protected Occlusion
No premature occlusal contacts or interferences (timing of occlusal contacts)
Influence of surface area
Mutually protected articulation
Implant body angle to occlusal load
Cusp angle of crown (cuspal inclination)
Cantilever or offset distance
Crown height
Occlusal contact position
Implant crown contour
Protect the weakest component
Occlusal materials

The fabrication of a single complete denture is often underemphasized and demands a deeper understanding of achieving bilateral balance. Theilmann simplified Hanau's Quint into five key elements: condylar guidance (CG), incisal guidance (IG), compensating curve (CC), cusp height (CH), and occlusal plane (OP), expressed as:

$$CG \times IG = CC \times CH \times OP$$

Balance is achieved when these elements are in harmony; altering one requires adjusting at least one other. In full denture cases, the dentist can control IG, CC, CH, and OP to achieve balance. However, in single denture cases—opposing natural teeth, partial dentition, or an existing denture control is limited, complicating balance. In cases with an existing denture, modifying both arches simultaneously may improve control and overall stability.⁸

The primary objective in fabricating a single complete denture (SCD) is to achieve bilateral balanced occlusion, ensuring even stress and force distribution to enhance prosthesis stability. For optimal results, the occlusal plane of the opposing natural dentition must be harmonious to support balanced occlusion and bilateral stability.⁹

Once a fixed restoration is placed, the arch functions similarly to natural teeth opposing a complete denture. Fixed restorations can correct pre-existing occlusal disharmonies, and their occlusion with denture teeth is

harmonized on an articulator during the development of casting patterns.¹⁰

Joining direct transfer copings with acrylic resin is a widely adopted technique to prevent rotation and ensure a rigid relationship between implants during analog fastening. Splinting enhances the stability of the impression assembly and helps achieve greater accuracy in transferring implant positions. Although impression outcomes can be influenced by variables such as materials and techniques, DISTORTION often arises from coping manipulation during transfer. Comparable accuracy may be achieved using rigid or low-flexibility impression materials, which avoid the polymerization shrinkage associated with acrylic resin. Vigolo *et al.* demonstrated improved master cast accuracy using square impression copings splinted with autopolymerizing acrylic resin or modified through airborne-particle abrasion and adhesive application. Cabral and Guedes also reported superior outcomes when acrylic resin splints were sectioned and rejoined before impression making.¹¹

CONCLUSION

In this case, a maxillary complete denture was provided as the opposing arch to both FP-1 and FP-2 implant-supported prostheses in the mandible. Occlusal harmony in this case was achieved by establishing balanced occlusion in the maxillary denture and maintaining a narrower occlusal table in relation to both the FP-1 and FP-2 prostheses. Splinting played a crucial role during the open tray final impression procedure in ensuring an accurate transfer of implant positions, thereby contributing to the passive fit of the prosthetic metal framework.

DISCUSSION

The open tray impression technique is a widely utilized method in implant dentistry. It involves attaching impression copings to the implant fixtures intraorally. After the impression material sets, the copings are unscrewed and removed along with the impression, eliminating the need for repositioning and minimizing distortion during removal. This technique is also referred to as the pick-up impression method and is particularly effective in managing angulated implants.

The approach can be performed using splinted or non-splinted techniques. Splinting involves rigidly connecting impression copings to prevent individual movement during impression making, enhancing accuracy by reducing rotational discrepancies during analog placement. Common splinting materials include light-curing composite resin, impression plaster, thermoforming sheets, acrylic resin, and auto-polymerizing resin, often supported with dental floss. More recently, titanium bars have been introduced for intraoral welding of abutments or analogs, providing an advanced method of splinting for improved stability and precision.⁵

Although the open tray technique combined with the splinting of transfer copings using acrylic resin is widely regarded as the most accurate impression method, a detectable gap between the implant head and the prosthetic framework is still often observed. This highlights the critical importance of precise splinting and necessitates the routine use of an intraoral soldering index to enhance fit and passivity.⁶

In 1989, Misch outlined five prosthetic treatment options in implant dentistry (Table 1). The first three are classified as FP-1, FP-2 and FP-3 and are fixed prostheses, which may replace a single tooth, multiple teeth, or an entire arch. These restorations can be either cement-retained or screw-retained and are designed to represent the final prosthesis during treatment planning and communication among the implant team. The classification is based on the extent of hard and soft tissue replacement required. A defining characteristic of all fixed prosthetic options is that they are non-removable by the patient.

The remaining two options designated RP-4 and RP-5 are removable prostheses. These are distinguished not by their appearance, but by the degree of implant support they rely on.

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