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Case Report

Dentistry Section

Redefining Smiles by Malo Bridge: A Case Report on Digitally Fabricated Fixed Prosthetic Solution for Anterior Mandible

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ABSTRACT

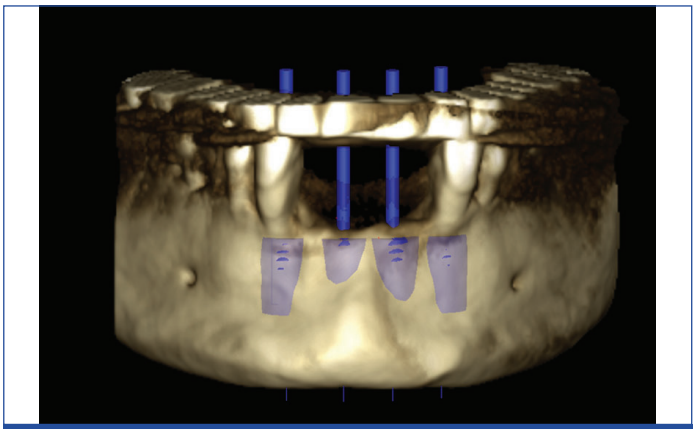
The rehabilitation of edentulous spaces with implant-supported fixed prostheses has evolved significantly, with digital workflows enhancing precision and predictability. This case report details the prosthetic rehabilitation of a 50-year-old male patient presenting with missing teeth in the anterior mandibular region. The patient reported difficulty with mastication and aesthetic concerns due to a long-standing edentulous space. Clinical and radiographic evaluation revealed moderate to severe alveolar ridge resorption and a high crown height space, posing a challenge for conventional prosthetic options. To address the functional and aesthetic demands of the case, a digitally planned implant-supported Malo bridge was selected as the optimal restorative solution. The prosthetic workflow incorporated customised abutments, a screw-retained substructure, and cement-retained individual crowns, all designed using Computer-Aided Design (CAD)-Computer-Aided Manufacturing (CAM) technology and fabricated via Direct Metal Laser Sintering (DMLS) Three-Dimensional (3D) printing. This case highlights the advantages of integrating advanced digital techniques for the fabrication of complex implant-supported prostheses, offering a predictable and durable solution for high crown height space restorations.

Keywords: High crown height space, Implants, Malo concept, Partially edentulous mandible, Screw retained framework

CASE REPORT

The primary complaint of a male patient in his 50s who came to the prosthodontics department was missing teeth in the lower front tooth region. No significant medical history was revealed by him. On asking about past dental history, the patient revealed the extraction of lower front teeth 5 years back due to severe mobility and a removable partial denture was fabricated for the same. Intraoral examination revealed missing teeth in relation to (irt) 32,31,41, and 42. Grade 2 mobility was present irt 33, 43 and generalised attrition was also noted. Siebert's Class 3 bone was observed in the anterior region. The patient was not satisfied with the Removable Partial Denture (RPD) and wanted a fixed prosthesis. An OPG was advised, which showed missing 31,32,41, and 42 and bone loss irt 43 and 33 [Table/Fig-1]. The patient was told about the options available for replacing missing teeth, namely a fixed partial denture (FPD) and an implant-supported prosthesis. He opted for implant-supported FPD. Following the identification of enough bone for implant placement by a Cone-Beam Computed Tomography (CBCT) scan [Table/Fig-2].

[Table/Fig-1]: Pre-operative Orthopantomogram (OPG) showing missing teeth with lower incisors and bone loss with canines



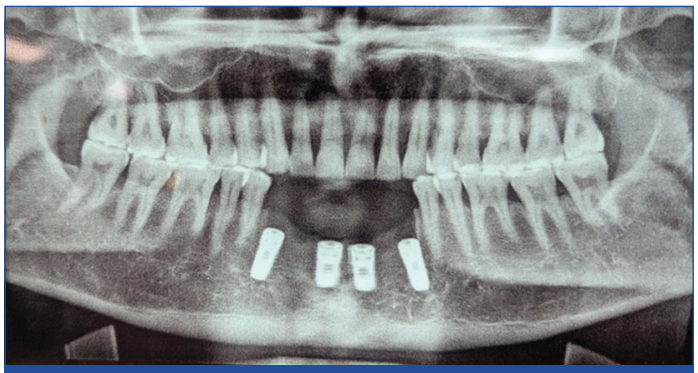
[Table/Fig-2]: CBCT planning of the patient for implant with 31 and 41 (4X10mm), 33 and 43 (4.5×10 mm), with immediate extraction irt 33 and 43.

The patient was considered a good candidate for an implant-supported prosthesis. Due to resorption of bone, both vertically and horizontally, the Malo bridge was considered a prosthetic design.

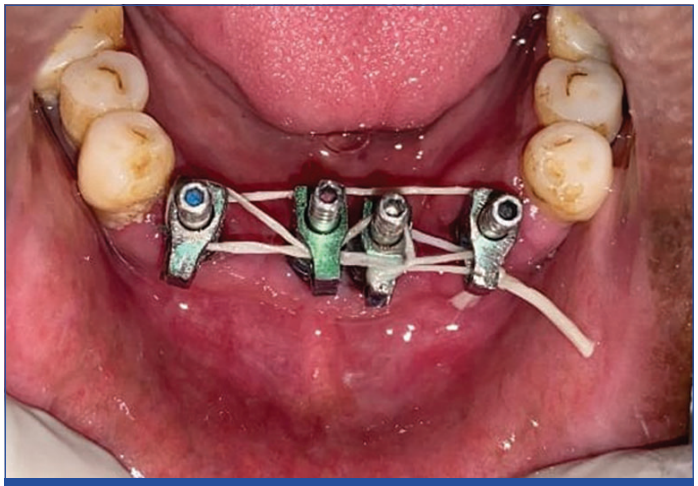
After radiographic evaluation sizes of implants were selected. Under all aseptic conditions, Osstem implant was placed irt 31 (4×10 mm) and 41 (4×10 mm) regions and immediate implant placement was performed after extraction irt 33 (4.5×10) and 43 (4.5×10) [Table/Fig-3]. Primary stability was obtained with 30 N torque. The cover screw was placed and left for osseointegration for four months. After four months, the flap was reflected and the second stage surgery was done to place the gingival former.

Prosthetic phase: The Malo bridge concept [1] was chosen by designing a customised abutment with a screw-retained substructure framework and a cement-retained individual single-unit crown since the implant location was not ideal because of the damaged bone architecture. After the second-stage surgery, the patient was recalled after 15 days for an open tray impression. A

custom tray was fabricated and implants were splinted together [Table/Fig-4]. Impression was made using putty and light body and a stone cast was poured [Table/Fig-5].



[Table/Fig-3]: Implant irt 31 and 41 (4×10 mm), 33 and 43 (4.5×10 mm).

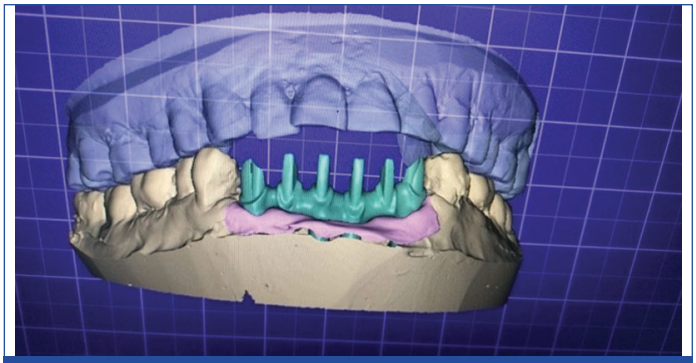


[Table/Fig-4]: Splinted open tray impression coping with floss seen with mandibular anteriors.

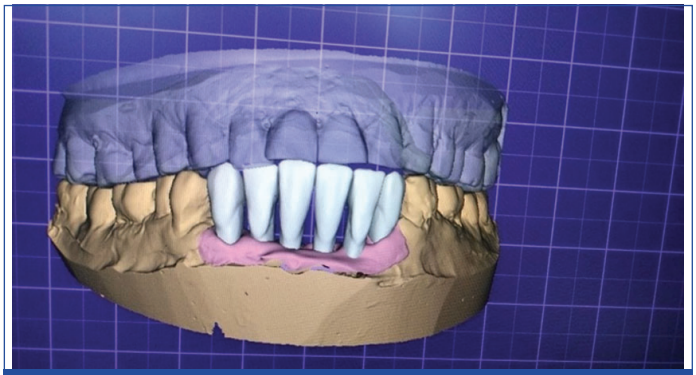
[Table/Fig-5]: Impression of mandible showing splinted open tray coping in the anterior region.

The digital planning was used to customise the abutment with the Malo bridge pattern, and a lab scanner was used to scan the cast with the scan body. The Malo bridge's customised abutment and substructure were created using Exocad software and manufactured using DMLS 3D printing technology [Table/Fig-6]. Sheffield test and radiographs were used to verify the screw-retained substructure for passive fit. Bite registration and shade selection were done. Individual crowns were fabricated from CAD-CAM and then milled [Table/Fig-7].

Screw retained substructure was screwed with a torque of 30 N and the individual crown was cemented [Table/Fig-8]. Aesthetics and



[Table/Fig-6]: Metal screw retained substructure designed in EXOCAD software irt mandibular anteriors.



[Table/Fig-7]: Individual crown designed in EXOCAD irt mandibular anteriors.

[Table/Fig-8]: Final prosthesis cemented with mandibular anteriors with Malo bridge.

phonetics were evaluated. A water flosser was suggested to maintain oral hygiene. The patient was followed up at 15 days, three months, and six months post-insertion, demonstrating excellent adaptation to the prosthesis with satisfactory phonetics and mastication. He reported no discomfort and expressed high satisfaction with both function and aesthetics throughout the follow-up period.

DISSCUSSION

For edentulous region rehabilitation, implant-supported fixed prostheses are becoming more and more popular [2].

Fixed rehabilitation of edentulous cases can be accomplished using cemented metal-ceramic prostheses, traditional screw-retained metal-ceramic prostheses, screw-retained implant hybrid prostheses, and cemented hybrids. For atrophic jaws, metal-ceramic fixed prostheses for implant repair are rarely advised. Due to repeated firing cycles, the porcelain layer's enormous size, excessive weight, and thermal expansion during application may impede precision fit [3].

Another option is a hybrid prosthesis, which is more susceptible to breakage and debonding of the acrylic. The ideal option, which more fully solves those limits, is to use individual ceramic-layered crowns cemented on a 3D-printed metal substructure [4]. Because the vertical bone loss was very severe, the Malo bridge design was selected. The most frequent cause of significant crown height space was mechanical issues with implant-supported rehabilitations, like porcelain fractures or loosening screws [5].

The lower jaw could close into positions that would direct forces horizontally on the posterior teeth, if the front teeth are absent [6].

So, for proper anterior guidance establishment, rehabilitation of anterior teeth is crucial, which was established by phonetics, aesthetics and proper overjet and overbite with maxillary teeth.

The case report on a fully digitally designed and fabricated Malo bridge to restore the anterior mandibular region with high crown height space is presented here, utilising modern digital workflows and 3D printing technologies. This method offers high precision, aesthetics, and durability while taking into consideration the biomechanical difficulties of treating high crown height restorations. This case reflects an example of overcoming limitations, optimising patient outcomes, and the integration of modern techniques and materials in contemporary prosthodontics.

The restoration of the anterior mandible with a fixed prosthesis is a major challenge, especially in cases of high crown height space. These factors encompass controlling the biomechanical stresses acting on the prosthesis, providing pleasing aesthetics and having long-lasting longevity [7]. Functioning from a unifying perspective and employed first in the reconstruction of full arches as intended but as relief, the Malo bridge provides a flexible option that can be used for partial edentulous restorations in more difficult clinical situations, as shown in this case [8].

The high crown height space due to advanced bone resorption leads to increased lever arms and cantilever forces, which can result in mechanical drawbacks [9]. From this perspective, a prosthetic design is required that provides stability and durability while reducing the forces exerted on the implants and prosthetic elements.

The Malo bridge helps ease these concerns with its rigid framework that ensures even distribution of loads and reduces mechanical complications. In this case, the utilisation of digital workflows proved critical for precision and predictability in their outcomes. With a digital approach, detailed evaluation of the available bone, soft-tissue profiles, and occlusal dynamics was performed to carry out a prosthesis that satisfied functional and aesthetic needs.

Three-dimensional printing and CAD-CAM designing and milling improved the accuracy of malo bridge production, which allowed for a better fit and fewer chairside adjustments [10]. Its use also facilitated seamless communication amongst clinician, dental technician and patient, whilst optimising the overall treatment process. The loads over the remaining dentition, as well as the opposing arch, were fully considered from a biomechanical standpoint in terms of the angulations and axial position of each implant to prevent micromobility and preserve healthy peri-implant structures. The splinted configuration of the Malo bridge led to further stability by minimising micromovements and stress at the implant-abutment interface, especially critical in cases characterised by high vertical dimensions.

However, in spite of these advantages, the method is laborious and expensive since changing the points of contact of the various crowns makes the technical stage extremely difficult [11].

In this clinical situation, we could attribute patient satisfaction to the flawless mix of function, aesthetics, and comfort. The Malo bridge also restored the patient's ability for phonetics and aesthetics properly, but also improved their self-confidence by providing an aesthetic smile.

One significant drawback of this particular case is that there was no long-term follow-up beyond six months. Extended monitoring is required to evaluate the long-term effectiveness, peri-implant tissue stability, and prosthetic longevity of the digitally generated Malo bridge in high crown height space instances, even if short-term findings showed positive functional and aesthetic outcomes.

Integration of contemporary digital technology, evidence-based prosthetic practices and multidisciplinary care is required to meet complex restorative demands, as shown in this case. The application of digital scanning could have improved the outcome. More research and longer follow-up studies about malobridge are needed to confirm the effectiveness and sustainability of such interventions in similar cases.

CONCLUSION(S)

Cobalt chrome CAD-CAM milled frameworks with Porcelain-Fused-to-Metal (PFM) overlay crowns were utilised for both soft and hard-tissue ridge deficiencies. Cobalt chrome as a titanium substitute was employed, which was both economical and accurately fitted because of computer-aided milling. CAD-CAM, a boon for creative approaches, has significant success outcomes in the next era of digital prosthesis in implantology due to its manufacturing using 3D printing technology.

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