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Prosthetic rehabilitation of a severely resorbed ridge using a maxillary complete denture opposing a mandibular implant-supported overdenture: a case report

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Abstract

A 64-year-old patient was referred to the prosthodontics clinic with a history of two failed mandibular dentures and significant functional impairment. The patient had been completely edentulous since the age of 40 due to advanced chronic periodontal disease. She experienced progressive loss of retention and stability of the mandibular prostheses, resulting in discomfort, pain, and difficulty with speech and mastication. The intraoral examination revealed severe alveolar bone resorption of both arches, shallow palatal vault, and reduced maxillary and mandibular arch height and width. The existing dentures, partially lined with soft lining material, exhibited poor retention and stability. The maxillary denture lacked posterior seal, and the mandibular denture, despite adequate extension, was considered intolerable. A treatment plan consisting of a combination of maxillary conventional complete denture and mandibular implant-supported overdenture was executed. This approach was found to be a clinically effective, cost-efficient, and predictable solution in addressing the patient's concern for improved oral function.

Keywords: *complete edentulism, implant-supported prosthesis, mandibular overdenture, ridge resorption*

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Introduction

Conventional complete dentures have been the standard treatment for edentulism for decades. However, prolonged use of conventional complete dentures can lead to reduced denture retention and stability due to progressive alveolar bone resorption. This condition compromises the intimate fit of the denture base with the residual alveolar ridge, resulting in reduced masticatory efficiency and increased patient discomfort. Furthermore, the underlying oral mucosa will be exposed to undue stress, resulting in mucosal irritation and ulceration, which will further diminish the patient's quality of life. (Soboleva and Rogovska, 2022).

The implant-supported overdenture has proven to be an effective treatment option for edentulous patients, particularly for those with severely resorbed mandibular ridges, in which the conventional dentures' retention and stability are compromised. Studies have shown that implant-supported

overdentures provide superior outcomes compared with conventional dentures in terms of masticatory function, patient satisfaction, and preservation of residual ridge (Kutkut *et al.,* 2018). The implants serve as an attachment to the prosthesis, which significantly reduces the prosthesis's mobility, thus improving the masticatory efficiency, patient comfort and satisfaction. Additionally, implants have been shown to preserve residual alveolar bone by decreasing the rate of bone resorption, an advantage not offered by conventional dentures (Kutkut *et al.,* 2018).

The provision of a combination of maxillary conventional denture and mandibular implant-supported overdenture for edentulous patients provides a cost-effective and minimally invasive solution. This treatment strategy was recommended by the McGill Consensus in 2002 and the York Consensus in 2009. It advocated the use of a two-implant retained mandibular overdenture, opposing a complete maxillary denture as the standard of care. This recommendation is based on substantial evidence indicating improvements in denture retention and stability, as well as significantly better patient satisfaction and quality of life compared to conventional dentures (ELsyad *et al.*, 2013; Thomason *et al.*, 2012). Patients using a fixed implant-supported prosthesis in the mandible, while retaining a maxillary complete denture, experience considerable improvements in oral function and quality of life (Carlsson, 2014).

Moreover, the McGill Consensus emphasises the cost-effectiveness of this treatment approach. Overdentures supported by implants are not only easier to clean but also provide a more satisfactory solution for patients who struggle with the retention and stability of conventional dentures (Kortam & Abdeen, 2021). The consensus suggested that while the patient preference should be considered, the clinical benefits of implant-supported overdentures make them a compelling choice for many edentulous individuals (Thomason *et al.,* 2012). Thus, the treatment objectives, by providing a conventional maxillary denture and a mandibular implant-supported overdenture, are to offer a cost-effective, minimally invasive treatment that enhances denture retention, stability, oral function, and overall patient quality of life.

Case report

A 64-year-old Caucasian lady was referred to the prosthodontics clinic with a history of failed two pairs of complete dentures. She reported significant difficulty in speaking and chewing due to the looseness of the mandibular denture. Her primary concern was finding a predictable and reasonable treatment option to restore the oral function and improve her quality of life.

The patient had been fully edentulous since the age of 40, following the loss of her teeth due to advanced chronic periodontal disease. Since then, she has had three sets of complete dentures. However, the two most recent sets of dentures, particularly the mandibular dentures, were deemed intolerable due to poor retention and stability. Over time, the looseness of the mandibular denture had worsened, causing discomfort and pain during speech and mastication.

The patient's medical and social history revealed that she had no medical illness and had quit smoking 15 years ago after being a habitual smoker. The extraoral examination revealed no abnormalities or significant findings, while the intraoral examination demonstrated severe residual ridge resorption in the maxillary and mandibular arches without prominent muscle attachments. The maxillary arch exhibited a shallow palatal vault and reduced arch height and width (Figure 1).

The current maxillary complete denture exhibited poor retention and stability caused by the insufficient posterior extension, which led to the absence of a proper posterior seal. The fitting surface of this denture was partially lined with soft lining material (Figure 1). Despite having adequate extension, the mandibular complete denture demonstrated poor retention and stability.

Similar to the maxillary denture, the fitting surface was also lined with a soft lining material.

A thorough discussion with the patient concluded that a maxillary conventional complete denture combined with a mandibular implant-supported overdenture would be the most appropriate solution to fulfil the patient's functional and aesthetic requirements. This treatment plan was selected based on its predictability, clinical efficacy, and cost-effectiveness, aligning with the patient's preference for a reliable and reasonably priced solution.

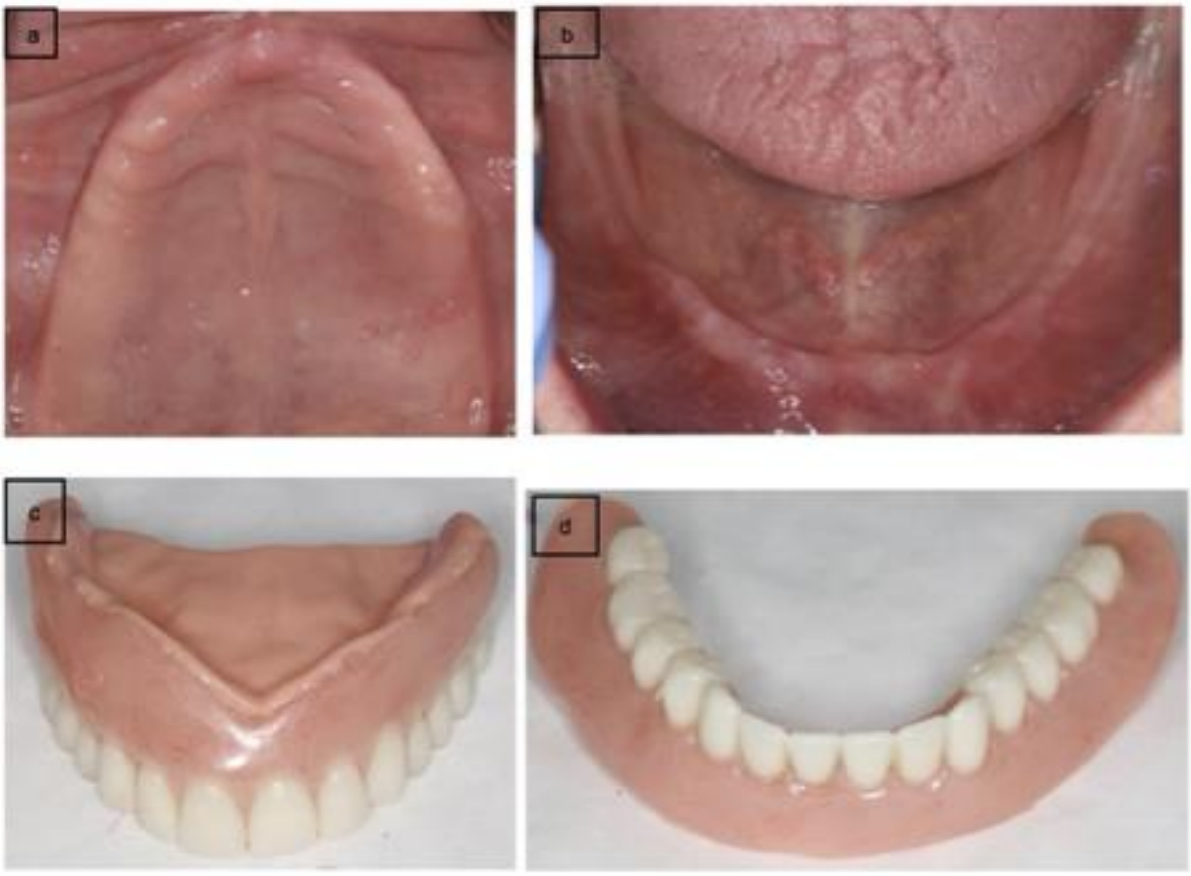

Figure 1. (a) maxillary edentulous ridge, (b) mandibular edentulous ridge (c) current maxillary conventional denture, (d) current mandibular conventional denture.

Treatment procedures

Stage 1 surgery

The case was planned for a delayed loading protocol, where the surgical sites are allowed to heal for a period of typically 3-6 months after implant placement before attaching the definitive restoration. This protocol was chosen to enhance implant stability and promote optimal osseointegration. Moreover, this step also allows the soft tissue around the implant to heal and mature, reducing inflammation and the risk of peri-implant diseases.

A conventional two-stage surgical protocol was carried out for implant placement. Based on the clinical and radiographic evaluations (Figure 2), two 4.0 x 6 mm Astra Tech™ implants (Astra Tech, Dentsply) were selected to be positioned in the interforaminal region. A clear acrylic surgical stent which had been fabricated by copying the existing mandibular denture was used to guide the surgical drills during osteotomy and fixture carrier drill with implant fixture into the accurate position in the bone (Figure 3). Both implants recorded a final placement torque of more than 20 Ncm, as recommended by the manufacturer.

Subsequently, two cover screws were placed in the respective fixtures before the soft tissue flaps were approximated with non-resorbable nylon sutures. Post-operative instructions were given. The sutures were removed after one-week post-surgery and the surgical sites were left to heal for the next three months.

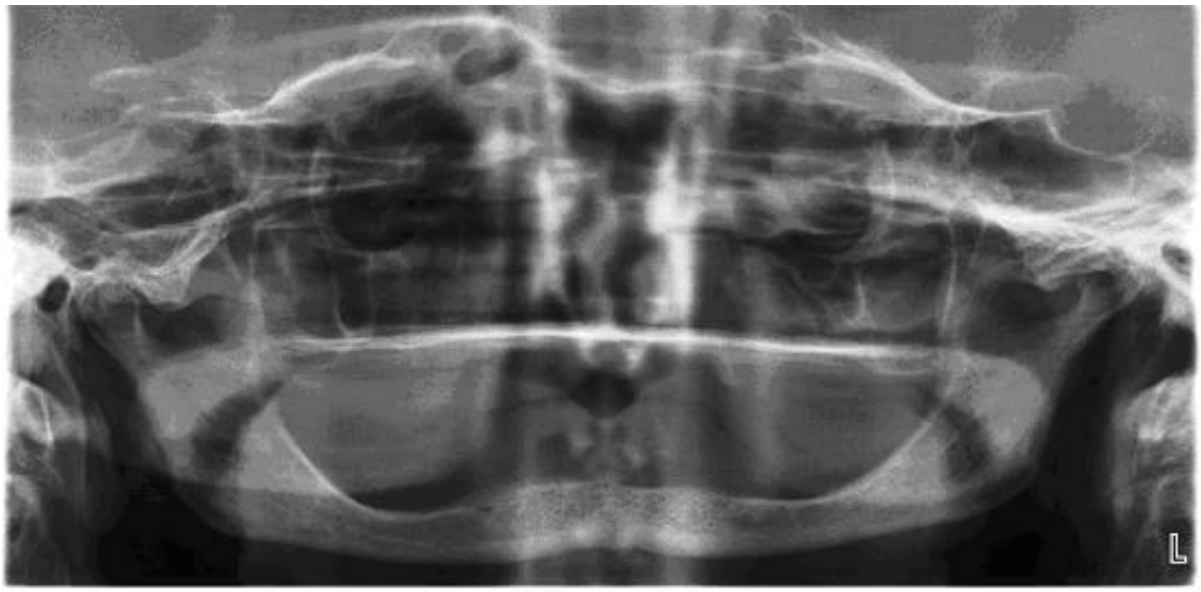

Figure 2. Orthopantomogram (OPG) indicates severely reduced mandibular bone height and enlarged maxillary sinuses.

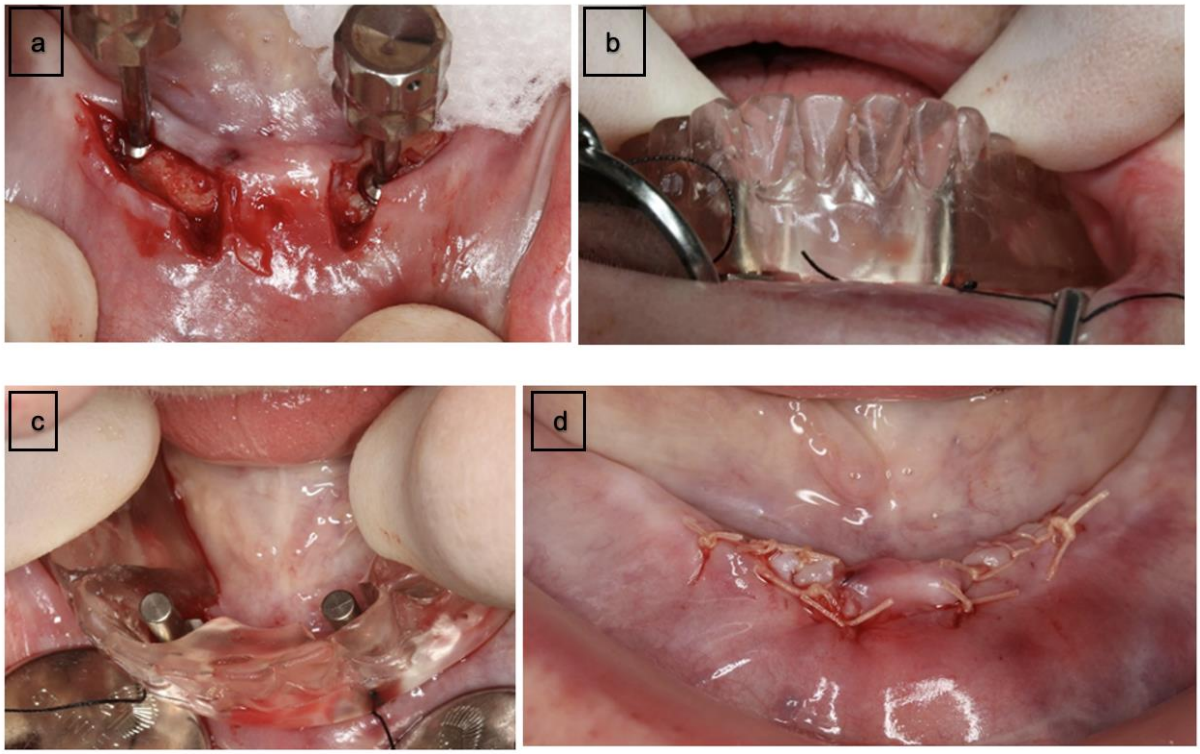

Figure 3. Stage 1 surgery. (a) Two incisions were made for two implants, (b) surgical stent was used to aid during the implant placement, (c) Placement of the guide pin to assess the parallelism of the implants, and (d) Incisions were sutured using non-resorbable nylon suture.

Stage 2 surgery

After the healing period, a second-stage procedure was performed to expose the submerged implant fixtures. This stage aimed to ensure the implants had successfully osseointegrated and prepared the surrounding soft tissues for the final prosthetic phase.

A slit incision was made over the implant sites to expose the cover screws, carefully preserving the surrounding soft tissue. The cover screws were then removed using a manual driver, and the implant fixtures were thoroughly inspected for signs of osseointegration, such as absence of mobility and stability within the bone.

Next, two 4.0 x 4.0 mm healing abutments (DESS® Dental) were selected based on the soft tissue height and contour of the gingival margins (Figure 4). It is hand-tightened to the implant fixture. The healing abutments guided the formation of soft tissue contours, creating an ideal emergence profile for future prosthetic restorations.

The patient was instructed on maintaining oral hygiene around the healing abutments, including the use of soft-bristle toothbrushes and antiseptic mouth rinses, to minimise the risk of peri-implant mucositis during the healing phase.

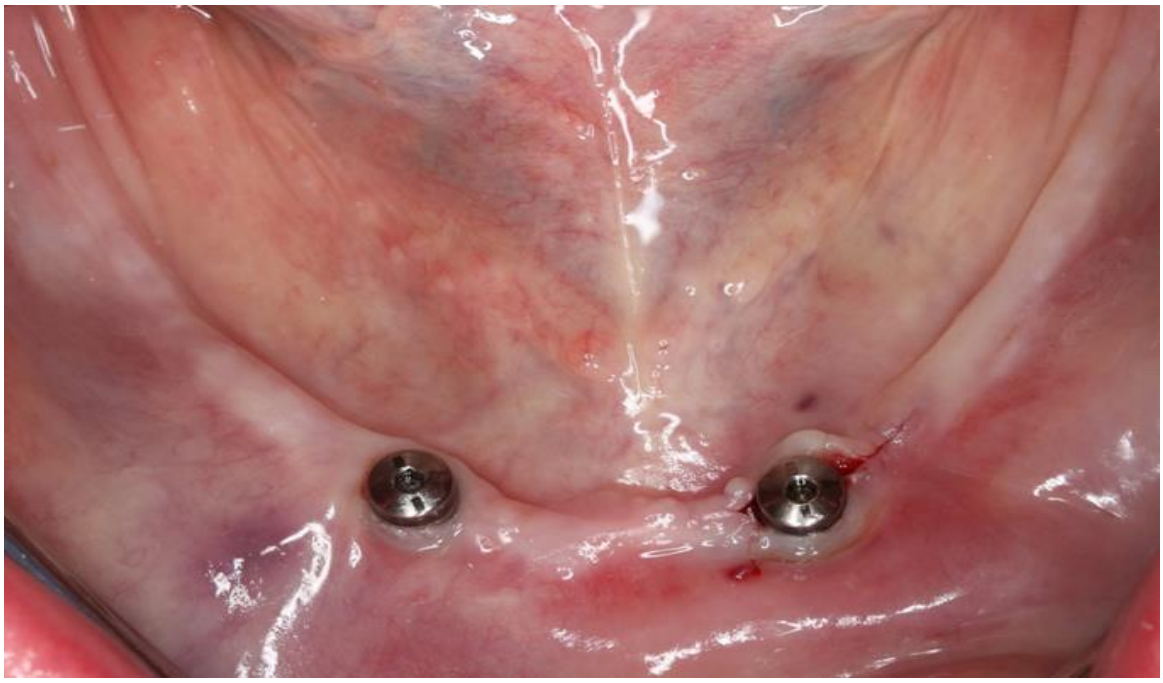

Figure 4. 4.0 x 4.0 mm healing abutments (DESS® Dental) placement.

Restorative phase

Two weeks post-stage two surgery, the healing abutments were removed and replaced with the locator abutments (Zest Dental Solutions, United States), which were torqued to 25 Ncm as per the manufacturer's recommendation (Figure 5). The appropriate height of the locator abutments was determined by measuring the gingival cuff heights. A secondary impression of the maxillary arch was taken using zinc oxide eugenol impression material. For the mandibular arch, an abutment-level impression was made with polyether impression material using a closed-tray technique. These impressions provided accurate details of the implant positions and the surrounding tissues.

The registration of the maxillo-mandibular relationship (MMR) record was made using heat-cured acrylic bases with wax occlusal rims. The locator housings and black processing inserts for the implants were incorporated into the mandibular base. The

wax rims were adjusted to allow appropriate labial support, buccal corridor, occlusal plane, freeway space, midline position, smile line and inter-canine width. The retruded jaw relation was recorded using addition silicone occlusal registration material (VPS Hydro Bite®) and the master casts were then mounted on a semi-adjustable articulator with a facebow transfer.

A wax try-in was performed to verify aesthetics, occlusal plane, phonetics, and functional support. Once satisfactory, the dentures were processed using heat-cured polymethyl methacrylate (PMMA). At the denture insertion stage (Figure 6), the dentures were evaluated for retention, extension, and stability, and any overextended flanges were adjusted. The occlusion was refined for accurate intercuspal and excursive movements. Finally, the mandibular denture's black processing inserts were replaced with blue Locator™ inserts, providing 5 lbs of retention force to ensure optimal functionality and comfort for the patient. The patient was also provided with denture hygiene education, which included instruction on proper denture cleaning technique, the importance of daily care and the need to remove them at night to prevent irritation and infection.

Figure 5. Locator abutments (Zest Dental Solutions, United States) placement.

Review and maintenance phase

The patient was reviewed one week after the insertion of the maxillary denture and mandibular implant-supported overdenture. She reported excellent tolerance to the dentures and expressed satisfaction with the improved retention and stability. The patient was particularly pleased with the ability to wear the dentures comfortably during eating and with the overall aesthetic appearance.

During the appointment, the soft tissues were carefully examined for any signs of trauma or irritation or pressure points. The occlusion was also evaluated to identify and address any potential interferences or uneven contacts. No significant concerns were observed. The oral hygiene practices and denture maintenance were reinforced, emphasising the importance of meticulous cleaning of both the prosthesis and peri-implant structures.

The patient was advised to attend regular follow-up visits every 3 to 6 months for the first year, followed by annual check-ups. These appointments are to monitor the condition of the implants, soft tissues, and prostheses. These routine visits are essential for maintaining the long-term functionality, stability, and comfort of the dentures, as well as promptly addressing any emerging issues. This ongoing care will help ensure optimal oral health and sustained patient satisfaction over time.

Figure 6. The new maxillary conventional denture opposing mandibular implant-supported overdenture. (a) Frontal view, (b) patient appearance with the denture, (c) Right side (d) Left side.

Discussion

Conventional complete dentures are a popular treatment option in managing complete edentulism. It is often associated with several limitations that impact their functionality, comfort, and long-term efficacy. Their retention and stability primarily rely on a combination of physical and physiological factors, including the denture base adaptation, border seal and interaction with the surrounding oral tissue. However, progressive resorption of the alveolar ridge over time compromises the fit and function of the dentures. This can lead to discomfort, diminished masticatory efficiency, and impaired speech. Many patients report dissatisfaction due to instability, decreased confidence during mastication or speech, and an overall reduction in oral functionality (Ortensi *et al.*, 2020).

Implant-supported overdentures provide a superior alternative to conventional complete dentures by addressing some of the limitations associated with them (Doundoulakis *et al.,* 2003). It provides significantly more stability and retention than conventional dentures, which improves chewing efficiency, speech, and patient confidence(Burns, 2004). Moreover, the functional load transmitted through the implants helps to preserve the underlying alveolar bone and reduce the rate of bone resorption typically associated with conventional dentures.

The use of two implants to support an overdenture is a widely accepted approach for managing severely resorbed mandibles, particularly endorsed by the McGill Consensus Statement (2002) and the York Consensus (2009) (Feine *et al.,* 2002; Thomason *et al.,* 2009). This method effectively enhances denture retention and stability, addressing the common challenges associated with conventional dentures in cases of advanced ridge resorption (Thomason *et al.,* 2009). By anchoring an overdenture to two implants, the stability of the prosthesis is significantly improved, minimising movement during function and enhancing patient comfort (Kumar *et al.*,2018)

One of the primary advantages of this approach is the preservation of alveolar bone(Burns, 2004). Unlike conventional dentures, which can accelerate ridge resorption due to uneven pressure distribution, implants provide functional stimulation to the surrounding bone, helping to maintain its structure over time. This benefit is particularly pronounced in the anterior mandible, where bone density is generally higher. Furthermore, the use of only two implants is a cost-effective alternative to an extensive full-arch implant solution, making it accessible to a wider range of patients (Imre *et al.,* 2011). It is also a minimally invasive procedure, reducing the need for complex surgeries such as bone grafting or ridge augmentation. This is especially beneficial for elderly patients or those with systemic health conditions.

From a prosthetic perspective, the use of attachment systems such as locators, ball attachments, or bar systems enhances the retention and function of the overdenture. Locator attachments are highly popular due to their low profile and ease of use, which is why we opt for locator attachments. In addition, the locator system also allows the prosthesis to be easily removed for cleaning, promoting better oral hygiene and long-term implant health (Lee & Lee, 2019).

Implant placement is typically performed in the interforaminal region of the mandible, where bone quality and quantity are generally sufficient, and vital structures, such as the inferior alveolar nerve, can be avoided (Bassi *et al.,* 2013). In cases where bone is severely compromised, as in this case, short or narrow implants may be considered.

Short implants (especially those ≤6 mm in length) are increasingly used in implant dentistry, particularly in cases with limited vertical bone height. These implants eliminate the need for invasive procedures, such as sinus lifts or vertical ridge augmentations, thereby reducing surgical morbidity, treatment time, and cost (Kanazawa *et al.,* 2016). Previous studies have also shown a comparable success rate for short implants to standard implants in many scenarios, particularly when placed in dense bone or using modern implant designs, such as wide-diameter and tapered implants (Froum *et al.*, 2020).

Delay loading protocols are adopted because they are frequently associated with lower failure rates, especially when patient risk factors are present (H.Cai *et al.*). In addition, several studies indicate that delayed loading results in less marginal bone loss around the implant compared to immediate loading (Bahaaeldeen Mohamed *et al.*, Yasmeen O. Hassan *et al.*). Thus, this protocol provides a more predictable outcome and a reliable approach.

Ultimately, the combination of a maxillary complete denture with a mandibular implant-supported overdenture is a viable and cost-effective treatment option for edentulous patients (Thomason *et al.,* 2009). Compared to full-arch implant-supported prostheses, this approach is less invasive and more accessible for patients with medical, anatomical, or financial constraints(Grageda & Rieck, 2013). It effectively enhances oral functionality, including improved chewing efficiency and speech, while significantly increasing patient satisfaction and quality of life. This option offers significant clinical benefits that justify the investment.

Conclusion

The combination of a maxillary complete denture and a mandibular implant-supported overdenture successfully met the treatment objectives by enhancing prosthesis retention, stability, and oral function. The patient reported high satisfaction, particularly in terms of comfort during mastication and improved aesthetics. This minimally invasive and cost-effective approach not only improved quality of life but also contributed to alveolar bone preservation, aligning with the McGill Consensus (2002) recommendations for standard edentulous care.

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