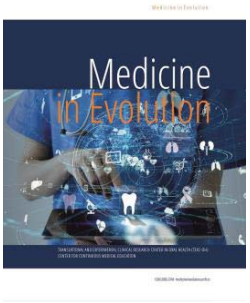
Rehabilitation of an edentulous patient using combined fixed and removable prosthodontic treatment. Case report.



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Abstract

Edentulism, the complete loss of teeth, significantly impacts oral function, aesthetics, and quality of life. Proper rehabilitation of edentulous patients requires a comprehensive approach that addresses both functional and aesthetic concerns. This case report presents the successful rehabilitation of an edentulous patient using a combination of fixed and removable prosthodontic treatment modalities. The treatment plan incorporated dental implants, fixed implant-supported prostheses, and removable overdentures to restore masticatory function, speech clarity, and facial aesthetics. The multidisciplinary approach resulted in significant improvements in the patient's oral health and overall well-being.

Keywords: edentulousness, implants, fixed prosthodontics, cantilever, overdentures

INTRODUCTION

Total edentulism, characterized by the complete loss of teeth, is a prevalent dental condition worldwide, particularly among the elderly population [1]. The primary factors contributing to the development of edentulism are dental caries and periodontal disease, although its etiology is multifaceted, involving chronic systemic illnesses, socio-economic factors, and demographic influences [2]. The absence of teeth impacts speech and nutrition, leading to masticatory dysfunction and promoting an inadequate diet. Furthermore, it affects various psychological and cognitive aspects of life [3]. In these conditions, the treatment of total edentulousness becomes imperatively necessary for the rehabilitation of the functions of the oral-maxillary apparatus, and implicitly for the improvement of the patient's quality of life [4].

In terms of prosthetic rehabilitation for edentulism, the primary therapeutic approach recommended is the use of removable dental prostheses [5]. With technological advancements, additional treatment options have emerged, such as fixed prosthetic dentures through the use of dental implants or the fabrication of overdenture prostheses supported by implants [6].

The aim of this article is to underline the significance of a multidisciplinary approach in managing complex dental rehabilitations, providing valuable insights and broadening the treatment options available for edentulous patients through a customized treatment plan that incorporates both fixed and removable prosthodontic techniques.

CASE REPORT

A multidisciplinary treatment approach was adopted. All surgical procedures were performed by one experienced oral and maxillofacial surgeon. The prosthetic procedures were conducted by two experienced prosthodontists, and manufacturing of the superstructure was done by a single experienced dental laboratory.

A 72-year-old Caucasian female patient presented in a private dental clinic, in Oradea, with the chief problem of discomfort and the impossibility of masticatory function due to the de-cementation of the mandibular prosthesis leading to the destruction of dental abutments.

A comprehensive medical and dental history were obtained and they did not present with any pathological findings. Intraoral examination revealed a poorly adapted, and aesthetically compromised maxillary denture, a partial prosthesis, and a metal-ceramic bridge supported by 11, 21, 25, and 26. The lower jaw with no teeth, just residual root fragments in the anterior region. Figure 1 presents the initial status, an intraoral view, and a radiograph image.

Figure 1. Initial status-clinical view, and radiograph

Based on the clinical and radiographical examinations, it was decided the remove of inappropriate maxillary prostheses and the extraction of all the remaining teeth from the two arches. The prosthetic treatment plan included rehabilitation using an implant-supported maxillary overdenture retained with two bilateral milled bars and implant-supported fixed prostheses for the lower jaw.

After obtaining the patient's consent for this treatment plan, it was scheduled the appointment for the surgical stage.

The surgical treatment was divided into two parts: extractions and implant insertion for the upper jaw and three weeks later, extractions and implant insertion for the lower jaw.

The patient received a prophylaxis antibiotic 1 day before the surgery (clindamycin, 300 mg) to reduce the risk of postoperative infection. Surgery was carried out under local anesthesia.

All the existing teeth in the upper jaw were extracted and a split bone procedure was made at the site of the canine region for both sides. In the same session, four dental implants (SWISS Implant Systems, Switzerland) with a diameter of 3.5 and 10 mm in length were placed according to the bone situation at the region of 13, 23, 11, and 21.

During the healing period, the implants were left in a submucosal position. Two weeks after implant placement, a follow-up visit was scheduled for suture removal and a review of the healing process.

One week later, the surgical intervention for the lower jaw took place, with the extraction of all mandibular teeth (32, 31, 41, 42, 43) and the insertion of four dental implants (SWISS Implant Systems, Switzerland). With a diameter of 3,7 and 10 mm in length, according to the bone situation, all implants were placed axially at regions 44, 34, 42, and 32.

Seven days later, the patient came for suture removal and also to begin the intermarry prosthetic treatment: bimaxillary complete dentures for the period of the implant osteointegration.

In this regard, starting with a preliminary impression, the patient came for several visits ending with the final mobile prostheses, in two weeks. This intermarry prosthetic treatment was necessary to cover aesthetic and functional needs.

Six months after the implant placement, second-stage surgery was performed, and healing abutments were placed. All implants achieved a final torque of 45 Ncm, indicating good implant stability, and the healing caps were then positioned.

Figure 2. Intraoral image with the healing caps

To maintain the mobile prostheses over the healing cups, it was used a direct relining procedure using Elite Soft Relining Zhermack.

Figure 3. Temporary mobile prosthesis over the healing cups

Prosthetic intervention (for the final prosthesis)

For the first session, using standard trays and alginate, an impression was taken to obtain individual trays, both for the maxillary and mandibular arch. The next step was the implanting impression, used for transferring the intra-oral spatial relationship of the implants to the working casts. The implants were exposed by removing the healing abutments. It was chosen the direct open tray technique, uses a custom tray that contains windows exposing the impression on copings. Four impression copings were placed on the maxillary implants after removing the gingival formers. Figure 4 represents the exposure of maxillary implants, the transfer rods in the implants, and the maxillary impression.

Figure 4. Exposure of maxillary implants, the transfer rods in the implants, and the maxillary impression

Customized acrylic resin trays were fabricated on the gypsum casts delivered by the alginate impressions. A pick-up coping impression was made with the addition silicone impression material (Elite Zhermack) in a double mixing technique. After the setting of the impression material, all the screws were loosened, and the impression was carefully removed from the mouth to avoid damage.

The same procedure was applied for the mandibular jaw (Fig. 5). It used the same direct technique also called the pickup impression technique and the impressions were sent to the laboratory to obtain the final casts.

Figure 5. Exposure of mandibular implants, transfer rods in the implants, and mandibular impression

The horizontal and vertical maxillomandibular records were initially obtained with the old relined dentures and found suitable for about the thirds of the face. The soft-pogonion and subnasale were marked with a dot and the distance was measured. This situation of vertical dimension was recorded with a putty condensation silicone material (Zeta Zhermack) covering both dental arches Based on this provisional jaw relation, the casts were mounted on the articulator. A customized maxillary registration tray with wax bite blocks was ordered to the dental lab so that in the next visit, the final horizontal and vertical maxillomandibular records were established safely because the bite block was held in place by screws secured into two implants, and the adjustment was achieved according to the lip support. For the next step, the wax-up try-in was done in the patient's mouth to check for function and aesthetics, and for the proper alignment of the anterior teeth before the maxillary milled bar retainer was designed**.** The occlusion plane was verified, and the shade of the tooth was selected. A bilateral balanced occlusion scheme was followed for teeth arrangement.

Metal frame checking

For the upper jaw were used multi-unit abutments, to support the bar retainer divided into two portions due to the angulation of the posterior implants. For the lower jaw, were

used straight implant abutments. In the same session, it was verified the metal frame for the mandibular implant-supported fixed prostheses and the maxillary separated milled bar. The bilateral bars were screwed over the implant abutments. (fig. 6)

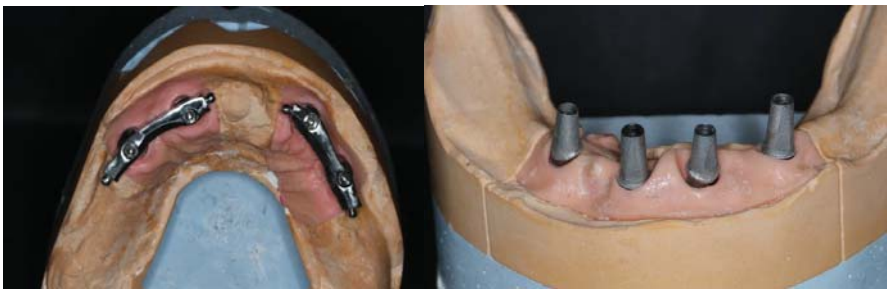

Figure 6. Bar retainer and mandibular abutments on the definitive cast

The Sheffield test was performed on the milled bar, and the fitting was optimum. In this test, the framework is seated onto the implants and one screw is tightened lightly and discrepancies are observed at the other terminal screw. The screw should not resist the tightening process.

For the next visit, the fitting of the framework try-in prosthesis with cobalt chromium reinforcement structure was evaluated in the patient's mouth and the mandibular metal framework was covered with ceramic. (fig. 7)

Figure 7. Wax try-in with the metal frame attached and the ceramic covering the metal framework for the lower prosthesis

The upper occlusion plane was checked on both sides and parallel to the Camper plane. The upper anterior teeth were marked for needed modification according to the smile line.

Delivery Appointment

In this session, upper multi-unit abutments were screwed on the implants with a torque (30 Ncm) applying 1% chlorhexidine gel into the screw channel, and two separated milled bars were screwed on implant abutments. The removable maxillary overdenture was then accurately and rigidly adapted to the bar. Lower standard abutments were also screwed with a torque (30Ncm), and the fixed prostheses were cemented.

Figure 8 presents the final appliances on the casts, the mandibular fixed metal-ceramic prostheses, and the maxillary overdenture, with full coverage of the alveolar process, but without palatal coverage and the internal fitting surface of the overdenture.

Figure 8. Mandibular fixed prostheses and maxillary overdenture

A radiograph CT was made to see the implants, the maxillary metallic bars, and the mandibular fixed metal-ceramic prosthesis. (Fig. 9)

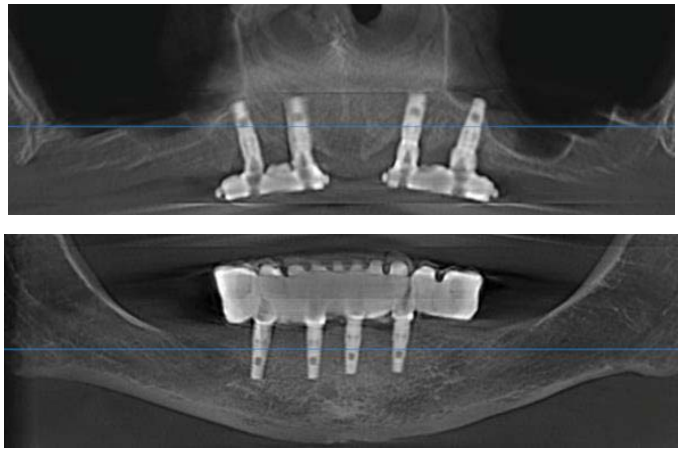

Figure 9. Radiograph image with the appliances

Figure 10 presents the aesthetic smile zone of the patient with the appliance, and the intraoral frontal view of the maxillary and mandibular appliance in occlusion.

Figure 10. Aesthetic smile zone and appliances in occlusion

Postdelivery instructions were given to the patient regarding prosthesis placement, removal, and cleaning. Specifically, the cleaning of the milled bars with super floss and the surfaces of the overdenture with a toothbrush. At the 1-week check-up visit, the prosthesis was evaluated, and the patient had no complaints. No plaque was detected on the bar or

prosthesis. The patient was informed to maintain the hygiene measures and to show up for a recall visit after 3 months.

The patient was delighted with the implant-retained maxillary overdentures and mandibular fixed implant-retained prosthesis.

DISCUSSIONS

Since the introduction of osteo-integrated implants, implant-supported overdentures have emerged as a favorable treatment choice for fully edentulous individuals [8].

Additionally, it decreases bone resorption, ensuring the long-term stability and durability of prosthetic restorations, while also improving masticatory function, thereby enhancing patient satisfaction [7].

In this case, the final superstructure was supported by four implants in both arches. For the upper part, comprised an implant-supported overdenture retained by two bilateral milled bars with an integrated cobalt-chromium reinforcement structure. For the mandible, it included an implant-supported one-piece cross-arch fixed denture with bilateral cantilever segments, featuring cobalt-chromium alloy frameworks covered with ceramics.

The strategy for an overdenture in the upper arch should reduce the surgical efforts. Another treatment alternative would involve fixed implant-retained prostheses. However, achieving this treatment would necessitate the placement of a minimum of six implants in the maxilla, along with an extensive surgical procedure, such as a sinus lift in the area of the first upper molars. Furthermore, a fixed restoration in the maxilla, would not allow sufficient support of the upper lip and sophisticate the hygiene measures for the patient.

The implant-retained milled bar overdenture presents two milled bars. The removable overdenture is then accurately adapted to the bar, limiting rotational and lateral movements.

The rigid anchorage system distributes the stresses due to different forces along with the implant-overdenture complex. The retention is achieved by friction between the bar and counter bar in the overdenture and the fastenings [7].

One of the considerable challenges for screw-retained multi-unit implant prostheses is achieving a passive fit of the prosthesis' superstructure to the implants. This is supposed to be one of the most vital requirements for the maintenance of the osseointegration. Minimizing the misfit and optimizing the passive fit should be a prerequisite for implant survival. This misfit sometimes can be tolerated by the surrounding bone without adverse biomechanical complications [9].

Ideal restorative space for bar-clip overdentures should accommodate the denture base, the acrylic teeth, and the bar-clip attachment system. Therefore, a minimum of 13–14 mm space is required between the implant platform and the incisal plane. 4 mm of this space should be arranged for the bar attachment, with a hygiene space of 1 mm under the bar [10]. Another requirement is adequate inter-implant distance, which should be a minimum of 10–12 mm. If the inter-implant distance is less, a milled bar is indicated with frictional fit components, to increase the retention [10].

The implant impression accuracy also plays a key role and depends on several factors. These include the impression material, impression technique, the implant angulations, and the number of implants [9]. Several impression materials have been used for multi-unit implant impression; the most commonly described were addition silicone and polyether impression materials.

In the lower jaw, rehabilitation was performed using an implant-supported 1-piece cross-arch fixed prostheses with bilateral cantilever segments. The cantilever extension measured approximately 16.5 mm in length from the most distal implant for the left side of the patient, and about 10 mm in length for the right side.

According to one of the most common prosthetic protocols, in totally edentulous patients treated with full-arch implant–supported fixed prostheses, the implants are more often surgically positioned in the inter foraminal region for anatomical and surgical reasons and the prosthetic superstructure designed with cantilever distal extensions [11]. The full-arch fixed prostheses (FFPs) supported by implants have been reported with a high success rate and patient satisfaction [12]. Rehabilitation of a single, completely edentulous arch with implant-supported prostheses should consider the situation of the opposing arch. Least peri-implant strains were observed when forces simulating conventional complete dentures [11]

Regarding the relationship between peri-implant stress and the length of distal extensions in prosthetic rehabilitations using four implants, studies indicate that with the same inclination of distal implant, the peri-implant bone stress increased as the length of the cantilever increased. Also, the influence of the cantilever on stress distribution was greater than the influence of implant inclination. [13]

However, when a vertical load was applied to the axial implant, no matter a solitary implant or the distal implant of All-on-4, it showed that the highest stress was concentrated at the apical region of the implant [13]

In this case, four axial implants were placed in the mandibular jaw, according to the bone situation, all implants were placed axial at region of 44, 42, 32, and 34. The four implants were splinted by wrought cobalt-chromium alloy frameworks covered with ceramics, with bilateral cantilever segments.

CONCLUSIONS

The clinical and laboratory procedures in implant prosthodontics are many and demanding. Each stage may lead to a positional distortion and misfit.

Utilizing multi-unit abutments in bar-retentive overdenture systems offers the benefit of stress absorption and distribution, which in turn leads to low tensile stress values in both the implants and the surrounding bone [14]. The multi-unit abutment is a prosthetic component that facilitates the implant rehabilitation of edentulous patients. The short height design and the wide margin of the element provide ease in seating the framework and restoration. These components also have the advantage of solving the inclination problems with angulated choices [14].

Rehabilitation of the edentulous maxilla using the treatments described is effective in the medium to long term, and the patient expressed high levels of satisfaction with the overdentures. For a completely edentulous mandibular arch, fixed implant-supported prostheses with a cantilever, might be a good option but should always consider the situation of the opposing arch.

In this case, using a one-piece cross-arch fixed implant prosthesis with bilateral cantilever segments was possible, considering that, for the opposing arch, an overdenture was made.

The results demonstrated the importance of a customized treatment plan and how this integrated approach significantly improves the patient's functional and aesthetic outcomes and enhances his overall quality of life.

REFERENCES

1. Lee DJ, Saponaro PC. Management of Edentulous Patients. Dent Clin North Am, 2019, 63(2):249-261.
2. Pengpid S, Peltzer K. The prevalence of edentulism and their related factors in Indonesia, 2014/15. BMC Oral Health, 2018, 18(1):118.
3. Dioguardi M, Di Gioia G, Caloro GA, Capocasale G, Zhurakivska K, Troiano G, Lo Russo L, Lo Muzio L. The Association between Tooth Loss and Alzheimer's Disease: a Systematic Review with Meta-Analysis of Case Control Studies. Dent. J. 2019, 7(2):49.
4. Friel T, Waia S. Removable Partial Dentures for Older Adults. Prim Dent J, 2020, 9(3):34-39.
5. Zhurakivska K, Luciano R, Caponio VCA, Lo Russo L, Muzio LL, Mascitti M, Troiano G. Cost/effectiveness analysis of treatment options for the rehabilitation of the total edentulous mandible. J Oral Rehabil, 2023, 50(5):400-409.
6. Bandiaky ON, Lokossou DL, Soueidan A, Le Bars P, Gueye M, Mbodj EB, Le Guéhennec L. Implant-supported removable partial dentures compared to conventional dentures: A systematic review and meta-analysis of quality of life, patient satisfaction, and biomechanical complications. Clin Exp Dent Res, 2022, 8(1):294-312.
7. Almadani AM, Huettig F. Rehabilitation of a maxillary partial edentulous patient using an implant-supported overdenture retained with two bilateral milled bars. BMJ Case Rep, 2020, 13(8):e235530.
8. Mericske-Stern R. Treatment Outcomes with Implant-Supported Overdentures: Clinical Considerations. J. Prosthet. Dent, 1998, 79(1):66–73.
9. Buzayan MM, Yunus NB. Passive Fit in Screw Retained Multi-unit Implant Prosthesis Understanding and Achieving: A Review of the Literature. J Indian Prosthodont Soc, 2014, 14(1):16-23.
10. Phillips K, Wong KM. Space requirements for implant-retained bar-and-clip overdentures. Compend. Contin. Educ. Dent, 2001, 22(6):516–8, 520, 522.
11. Brånemark PI, Zarb G, Albrektsson T. Tissue Integrated Prosthesis. Osseointegration in Clinical Dentistry. Plast. Reconstr. Surg., 1986, 77(3):496–497.
12. Mohamed LA, Khamis MM, El-Sharkawy AM, Fahmy RA. Evaluation of immediately loaded mandibular four vertical versus tilted posterior implants supporting fixed detachable restorations without versus with posterior cantilevers. Oral Maxillofac Surg, 2022, 26(3):373-381.
13. Wang Q, Zhang ZZ, Bai SZ, Zhang SF. Biomechanical analysis of stress around the tilted implants with different cantilever lengths in all-on-4 concept. BMC Oral Health. 2022 Nov 5;22(1):469. doi: 10.1186/s12903-022-02520-8. PMID: 36335327; PMCID: PMC9636816.
14. Kümbüloğlu Ö, Koyuncu B, Yerlioğlu G, Al-Haj Husain N, Özcan M. Stress Distribution on Various Implant-Retained Bar Overdentures. Materials (Basel). 2022 Apr 30;15(9):3248. doi: 10.3390/ma15093248. PMID: 35591581; PMCID: PMC9101733.