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Rehabilitation with Implant Supported Overdenture in Edentulous Patients: A Case Report

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Abstract **Case Report**

Implant supported overdentures are becoming the treatment of choice in completely edentulous mandible. They significantly improve the patients' quality of life. The authors, in this review article, provide an update on their clinical use with regard to the number of implants, their position, the type of retention system and attachment.

Keywords: Edentulous, complete denture, overdenture, dental implants, rehabilitation.

INTRODUCTION

Edentulous patients often experience problems with their mandibular complete dentures as they usually show lack of stability and retention together with a decreased chewing ability[1]. This limited retention and stability is mainly due to the fact that they rest on the moving foundation provided by the mandible and its associated musculature along with high bone resorption. However in the maxilla, the ability to cover a broader foundation presents the opportunity to fabricate a more retentive and stable denture [2]. In fact, complete denture wearers are usually able to wear an upper denture without problems, but many struggle to eat with the complete lower denture because it is too mobile [3]. Implant supported prostheses could be an alternative for an edentulous arch including implant supported fixed prosthesis and implant supported removable prosthesis. While implant supported fixed prosthesis offers many advantages like being esthetically pleasing, they are very expensive and not indicated in many conditions [4]. Many patients are satisfied with a stable implant supported overdenture that requires limited clinical time and financial expense [1]. It has already been established that implants survival is very high in the anterior mandible and that the incidence of surgical complications is very low. Furthermore, it has been shown that implants reduce the rate of resorption of the residual ridge in the anterior mandible [3]. The evidence currently available suggests that the restoration of the edentulous mandible with a conventional denture is no longer the most appropriate first prosthodontic choice treatment. In 2009, a further consensus statement (the York Consensus Statement) was released as a support and follow-up to the McGill consensus statement; a two implant-supported mandibular overdenture is the minimum offered to edentulous patients [5].

CASE REPORT

A 65-year-old lady, with history of controlled hypertension, presented to the Department of prosthodontics, Farhat Hached Teaching Hospital, Sousse asking for a comprehensive prosthodontic rehabilitation. She has been edentulous for many years.

Intraoral examination showed a large maxillary edentulous ridge with a broad band of keratinised gingiva and a knife edged mandibular ridge with insufficient bone width and height mainly in bilateral posterior areas (Fig 1).

The decision was in favour of a complete removable denture in the maxilla and a 4-mini implant retained overdenture in the mandible.

Preliminary impressions were made with alginate in both dental arches (Fig 2, Fig 3). Jaw relation record was obtained (Fig 4, Fig 5). After esthetic try-in (Fig 6, Fig 7), dentures were fabricated (Fig 8) and the mandibular prosthesis was duplicated in order to obtain a multi-functional radiographic and surgical guide (Fig 9, Fig 10). Cone beam computed tomography revealed an advanced alveolar bone resorption in the posterior mandible (Fig 11).

Surgery was performed under local anesthesia. The surgical guide was used during the procedure to facilitate implant placement (Fig 12): implant sites' entrances were first marked using a surgical pen directly on the gingiva (Fig 13) followed by implant insertion according to the manufacturer's instructions. 4 mini implants 1.8 * 13mm were finally placed within the interforaminal portion of the mandible corresponding to the position of central incisors and canines (Fig 15). A post-operative panoramic X-ray was taken immediately after the surgery to verify the parallelism of the mini implants (Fig 14).

A polyvinylsiloxane impression of the mandibular complete denture was made to index the position of the ball attachments metal housing (Fig 16, Fig 17). Then, these indexed areas were drilled with a round bur to make room for the abutments (Fig 18). Afterwards, the denture was checked for complete seating. The space between the bottom of the metal housing and the tissue as well as the top of the ball attachments was blocked out with latex in order to prevent soft tissue irritation by the monomer and the excess of the resin in the unwanted areas (Fig 19, Fig 20). The denture was packed and cured in the conventional manner (Fig 21). Care was taken not to damage the metal housings during finishing (Fig 22). Finally, the occlusion was controlled. The patient was satisfied with the final outcome and she was scheduled for regular follow up (Fig 23).

Fig-1: intraoral view

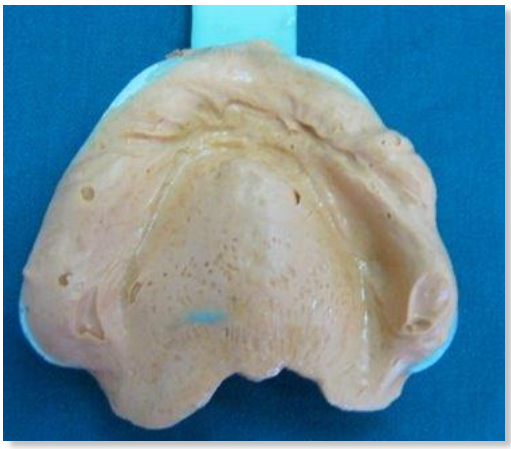

Fig-2: maxillary preliminary impression

Fig-3: mandibular preliminary impression

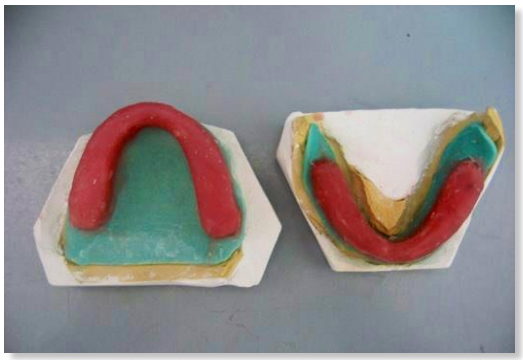

Fig-4: Recording bases with occlusal rims

Fig-5: Acrylic teeth mounted on articulator

Fig-6 and 7: aesthetic try-in

Fig-8: maxillary and mandibular dentures

Fig-9 and 10: radiographic template

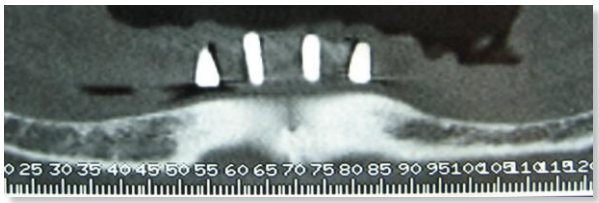

Fig-11: Mandibular CBCT with the radiographic template

Fig-12: surgical guide in place

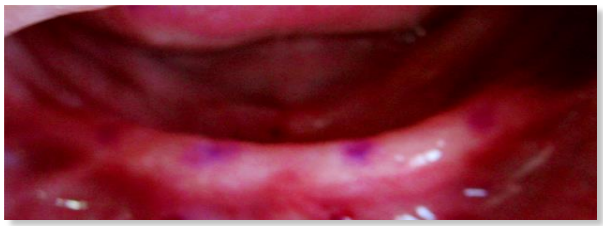

Fig-13: implant sites' entrances marked with the surgical pen

Fig-14: Post-operative panoramic x-ray

Fig-15: intraoral view after mini implants insertion

Fig-16: placement of ball attachment metal housing

Fig-17: indexing of implant position with elastomeric impression material

Fig-18: mandibular denture relieved to make room for the abutments

Fig-19 and 20: latex sheet between ball attachments and their metal housing

Fig-21: mandibular denture packed and cured

Fig-22: Metal housings imbedded in mandibular denture

Fig-23: Final outcome (left: preoperative extraoral view / right: postoperative extraoral view)

DISCUSSION

Edentulism treatment includes conventional complete dentures, implant-retained overdentures and, in some cases, implant supported full arch fixed prostheses. In the past, complete removable dentures have been the most common treatment to restore function. Due to the fact that, edentulism causes continuous ridge resorption, treatment with conventional complete dentures is limited and detrimental changes continue over time [6]. Common problems include lack of stability and retention, soreness in the supporting mucosa owing to reduced denture bearing area and pain with further loss of function [7]. The type of prosthetic constructions and recently the advancement in implant supported prostheses is an important issue for oral health in elderly patients. A recent shift in practice paradigm has been to minimize treatment costs and patient morbidity while providing the most satisfying treatment outcomes according to the state of the art of dental practice [8].

Mandibular two-implant overdentures have been shown to be superior to conventional dentures in randomized and non-randomized clinical trials. Regardless of the type of attachment system used (bar, ball, magnet), patients are significantly more satisfied with two-implant overdentures than with new conventional dentures: they find the implant overdentures significantly more stable, and their ability to chew various foods as much easier. In addition, they are more comfortable and speak more easily with implant overdentures [3].

For successful implant overdenture treatment planning prosthetic space analysis should be taken into account for selection of the prosthetic components of the implant attachment system. At least 13-14 mm interocclusal space is required for bar supported overdenture considering teeth size, denture base thickness, bar thickness for the rigidity, the space from the mucosa to the bar for hygiene and the soft-tissue thickness [9]. Minimum space requirement [10, 11] for ball attachment is 10-12 mm and for locators is 8.5 mm. Inadequate space for prosthetic components can result in an overcontoured prosthesis, excessive occlusal vertical dimension, fractured teeth adjacent to the attachments, attachments separating from the denture, fracture of the prosthesis and overall patient dissatisfaction.

Guidelines to assist with the treatment decision are also limited and controversial in the literature. The attachment selection is affected by the implant number, distribution and alignment, bone quality, arch shape, retention, and denture design [12]. The attachments used for implant overdentures are mainly divided into the bar type and the solitary type and into the resilient type and the rigid type, depending on the movement allowance. Popular overdenture attachments used are: ball attachments with rubber o-rings and/or metal

housings, bar attachments with clips, locators, magnets. Abutment parallelism is paramount for the solitary implants as abutment non parallelism leads to faster wear of the matrix. Therefore with increase in number of implants, splinting should be done as abutment parallelism becomes more difficult [13].

In the mandible it is usually easier to place parallel implants, thus, ball or Locator attachments would be indicated. In the maxilla, implants divergent emergency, worse bone quality and the use of short implants due to sinus proximity, will mandate the use of bar attachments. Bar attachments will be indicated in wide arches. On the other hand, in narrow arches using ball or Locator attachments would be indicated. Depending on bone resorption rate and implants' length: if implant is at least 10 mm long, it can be used as unsplinted, but if it less than 10 mm long , it will be indicated that the implant be splinted with bar attachments. According to Jemt and Lekholm, there were more failures (24%) in implants less than 10 mm long. Depending on implant location: if implants are placed quite far from each other, it will not be indicated to use bar attachments due to increase of bone stress. Finally, it is important to consider cantilevers because their presence is associated with a larger overload of distal implant if overdenture base does not adjust perfectly to the mucosa [14]. A cantilever should not exceed 2.5 times the antero posterior spread of implants according to Carl E. Misch (The antero posterior spread being the distance from the centre of the most anterior implant to a line joining the distal aspect of the most distal implant).

Concerning the optimum number of implants required for implant supported overdenture, treatment typically involve the use of two to four standard diameter implants (>3mm) placed in the anterior mandible. Implants are traditionally placed into the interforaminal portion of the mandible, with distal implants placed 5mm anterior to the mental foramen and mesial implants placed 3.5mm distal to the midline [15-18]. These positions correspond to the first premolar and lateral incisor sites. Implant placement in this region is common, as many edentulous patients exhibit substantial posterior alveolar ridge resorption with limited bone volume to place implants above the inferior alveolar canal. Additionally, the anterior mandible typically has limited critical anatomy such as nerves and blood vessels, and the average bone quality is higher and denser than posterior sites [19-21]. Maxillary implant overdentures typically are supported by four to six standard diameter implants spread more evenly throughout the arch. The implants are traditionally placed in the first molar, first premolar, and canine sites, which have greater bone volume and require less angulation than more anterior locations. If the sinus anatomy and surgical access permit placement in the posterior region, many clinicians advocate placement as posteriorly as possible to maximize the number and distribution of implants [22].

While many authors advocate using standard diameter implants as the first choice for treatment of the edentulous arch, some patients may be excluded from this therapy because of lack of sufficient bone to accommodate an implant with a diameter greater than 3mm [23]. To place implants greater than 3mm in diameter in such patients, additional surgical procedures may be necessary such as onlay bone grafting, osteotomy enlargement, or ridge splitting. Alternatively, a clinician can gain access to more ridge width by using ridge-height reduction procedures, as the mandibular bone becomes wider inferiorly. However, all these procedures may increase the risk of complications, morbidity and/or prolong treatment times [23-25].The placement of narrow dental implants may reduce the need for these more complex surgical procedures.

Having adequate bone around any implant helps to ensure the implant's osseointegration and long-term clinical stability and preserve the crestal bone. On average, more than 1.0-1.5mm of alveolar bone should surround the implant to ensure proper blood supply and minimize alveolar remodeling and crestal bone resorption. For treatment-planning purposes, a 3.4mm standard diameter dental implant requires a minimum of 6.4mm in buccal-lingual width, whereas a 2.4mm narrow diameter implant requires a minimum of 5.4mm in width. Narrow diameter implants are usually less than 3 mm in diameter and are available as a single piece system. They may be indicated in older patients with narrow ridges that cannot accommodate a standard implant without complex surgical procedures allowing minimally invasive surgical procedures in individuals with high bone density and who are satisfied with complete dentures and are looking for a solution to stabilize a loose denture [26]. However, they are not indicated in patients with grinding and clenching, Four mini implants are preferred for implant supported overdenture in either arch [27]. Considering the advantages of mini implants, various randomized controlled trials have been tried on mini implant-supported overdentures for edentulous arches. Results obtained from available evidence state that mini-implants tend to provide good patient satisfaction compared to standard diameter implants when used for implant-supported overdentures [27].

According to Marcello Machado *et al*. in a systematic review and meta-analysis of clinical and radiographic outcomes of mini implants (MI) and narrow diameter implants (NDI) as mandibular overdenture retainers, the average survival rates of MI and NDI were 98% and 98%, respectively, while the average success rates were 93% and 96%, respectively. The average peri-implant bone loss after 12, 24 and 36 months was 0.89, 1.18 and 1.02 mm for MI and 0.18, 0.12 and 0.32 mm for NDI. Both MI and NDI

showed adequate clinical behaviour as overdenture retainers. The NDI showed a better long term predictability to retain mandibular overdentures with most studies adopting conventional loading. {NDI are classified into Category 1: implant diameter <3.0 mm, « mini-implants », Category 2: implant diameter 3-3.25 mm and Category 3: implant diameters 3.3-3.5 mm [28].

CONCLUSION

The evidence currently available suggests that the restoration of the edentulous mandible with a conventional denture is no longer the most appropriate first prosthodontic choice treatment. There is now evidence that a 2-implant overdenture should become the first choice of treatment for the edentulous mandible.

Deciding whether to use a standard or narrow diameter implant for treating edentulous patients can be challenging. Clinicians need to consider a plethora of factors including the patient's age and needs, bone volume and density, prosthetic space, arch morphology. Further future studies are required to compare MI with SDI for implant supported overdentures.

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