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Implant supported overdenture with cross arch teeth arrangement in rehabilitation of severely atrophied mandibular ridge- A case report

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Abstract

The prosthetic management of a patient with resorbed ridges has long been a major obscurity. Conventional complete dentures were the standard treatment protocol for all such patients over a prolonged period of time. However, most patients find it difficult to get accustomed to the mandibular denture in a severely resorbed ridge situation due to insufficient retention, compromised stability and poor support. Additional woes creep in when the resorbed mandibular ridge is broader than the maxillary arch and poses a threat to harmonious occlusion in the prosthesis. Several studies have illustrated that, the virtues of two-implant supported mandibular overdenture are superlative to conventional complete dentures and can be utilized as the first treatment option in such compromised ridges. Implant supported overdentures are feasible, economical and a highly prudent treatment modality over conventional complete dentures. Different designs of the prosthesis, loading protocols and attachment systems have been introduced and are routinely employed to achieve optimum results. This article depicts a distinctive and enthralling case report of a patient rehabilitated with implant supported overdenture for the mandibular arch and conventional complete denture in the maxillary arch with cross arch teeth arrangement.

Keywords: Mandibular resorbed ridge, Implant, Overdenture, Ball and Socket Abutment, Cross-arch teeth arrangement.

Introduction

An overdenture is defined as any dental prosthesis that covers and rests on one or more remaining natural teeth, the roots of natural teeth and/or dental implants. The concept of osseointegration. The concept off osseointegration has fueled advancement in the field of implant supported prosthesis which is imperative in the management of mandibular edentulism where resorption rate varies and is faster than maxilla. Thus the management of severely resorbed mandible poses a major challenge in providing stable, retentive and functionally comfortable prosthesis.[1] Implant-supported overdentures when used as a treatment modality in rehabilitation of severely resorbed ridges have accentuated stability, retention, function and esthetics apart from preserving and decreasing the rate of resorption of the residual alveolar ridge.[2]

The implant-supported overdentures are significant in situations where there are unfavorable ridge relations, inadequate spread of implants antero-posteriorly, malignment of implants. It is also indicated in patients to enhance easy removal of the prosthesis in order to maintain adequate hygiene of the abutment and in certain situations that restrict the use of fixed implant prosthesis. It is also indicated for previous denture wearers to augment stability and support.[3] Implant therapy outcome is determined by meticulous planning and precise execution. The biomechanical factors are more lenient in regard to implant overdenture compared to a fixed implant prosthesis. However, appropriate attachment selection is critical for loading of the prosthesis and achieving patient comfort with harmonious occlusion. Any discrepancy between implant and denture can incorporate undesirable force distribution and accelerate the resorption of residual bone, produce premature abutment wear and can compromise the osseointegration.[4]

Implant supported overdentures are used in conjunction with attachments. The attachments currently available can be broadly divided into two major categories:

- Splinted/bar attachments — Dolder bar and Hader bar are examples of splinted attachments
- Non-splinted/solitary/stud attachments — Ball attachments, magnets and locators exemplify solitary attachments.

There is abundant literature on implant supported overdenture with two implants used as the primary treatment modality in resorbed mandibular ridge. When different attachment systems were compared in terms of hygiene, retention & stability results deduced that the type of attachment system used had no statistical significance to patient acceptance and satisfaction. [1,7]

Cross arch arrangement is the technique, in which the upper and lower posterior teeth are interchanged with each other onto the contralateral sides. By doing so, the posterior teeth are arranged in a more favorable position and thereby the occlusal forces are directed more to the center of the remaining residual alveolar ridge and thus, well tolerated. This technique is employed especially when the mandibular ridge is wider compared to the maxillary ridge resulting in an unconventional jaw relation. It helps to achieve harmonious occlusion in the final prosthesis. The shortcoming of this type of arrangement is the possibility of cheek bite due to the loss of buccal overlap from the upper teeth.[8] This case report discusses the prosthodontic rehabilitation of an edentulous patient using implant supported overdenture in the mandibular arch and conventional complete denture for maxillary arch with cross arch teeth arrangement.

Case report

A female patient, aged 33 years, presented with a chief complaint of missing teeth in her upper and lower jaws [Fig 1A]. She lost all her teeth due to dental caries and periodontal problems over a period of three years and was completely edentulous for one year now. The patient had no history of any major systemic illnesses. Intraoral examination revealed convex shaped maxillary ridge and severely resorbed mandibular edentulous arch with knife edged ridge according to Cawood's Classification.[9] Overlying mucosa was healthy and no abnormality was detected. Temporomandibular joint examination revealed no abnormal findings. Routine blood examination revealed no significant findings. Treatment options for rehabilitation included conventional complete dentures for both the arches, full mouth rehabilitation using implant retained fixed prosthesis and/or implant supported overdentures. The patient was informed about the treatment options available and implant supported overdenture for mandibular arch and conventional complete denture for maxillary arch was decided as treatment option.

Treatment Procedure

Conventional procedures were adhered to in the fabrication of maxillary and mandibular complete dentures. Cross arch teeth arrangement was incorporated. Centric and eccentric interferences were eliminated and patient was informed and reinstated regarding oral hygiene maintenance. The patient was recalled at regular intervals for review. Meanwhile, an OPG with a radiographic stent was carried out for implant treatment planning. Treatment planning for implant size and placement site were evaluated with the help of radiograph. Based on the radiographic assessment, positions A and E were selected for implant placement on the mandibular ridge.[10]

Surgical Phase

During the surgical appointment, local anesthesia was administered, a mid-crestal incision was performed from left molar to right molar region and a full-thickness flap was reflected [Fig 1B]. Ramping on the top of the ridge to create a broad base that would assist in better osseointegration was performed to minimize the crestal bone loss. Osteotomies were performed in sequential manner and two [ADIN] implants 3.0 mm × 10 mm were placed at sites A and E respectively. The implants were torqued to 35N and cover screws were placed [Fig 2]. The osteotomy sites were secured using resorbable sutures after placement of bone graft and platelet-rich fibrin. The patient was placed on Amoxicillin 500 mg and Mefenamic acid 500 mg for one week [BID] and Chlorhexidine digluconate mouthwash 0.12% for four weeks. The patient was instructed discontinue wearing the lower denture and follow strict oral hygiene measures. The patient was recalled for review regularly and healing was assessed for the next six months. There was no prudent complication like periimplantitis, mucosal abnormalities or crestal bone resorption during the healing period. Osseointegration of the implants placed were verified through radiograph after six months and the prosthetic phase of the treatment was initiated.

Prosthetic Phase

At this stage, the cover screws were exposed. Healing collars were placed one month to obtain a good gingival zenith and contour. After one month, the healing caps were removed and Ball and socket over-denture abutments of 2 mm diameter were screwed into the implants [Fig 3A] incorporating narrow platform between the fixture shoulder and abutment to aid in enhanced esthetic result. The keyway components of the attachments, which consists of rubber O-rings contained in titanium retaining rings, were placed onto the implant abutments [Fig 3B]. Housing were made in the tissue

surface of the mandibular denture over the implant abutments but weren't extended onto the cameo surface. Pressure indicating paste was used for this purpose.

Low-viscosity vinyl polysiloxane elastomeric impression material was injected to fill the space in the denture base created for the keyway attachment. The denture was placed in the mouth immediately and the patient was asked to close her mouth in centric position under light occlusal contact and maintain till the material was set. The impression material from one of the attachment sites in the denture base was removed and a vent was created using bur to extend the hole completely through the cameo surface of the denture, to allow excess acrylic resin to escape. The other attachment site with set elastomeric impression material oriented the denture to the abutment attachment. The pick-up space was half filled with self-cure acrylic resin and the mandibular denture was placed over the abutments. The complete seating of the denture was verified and the patient was asked to maintain light occlusal pressure in the centric relation position while the resin polymerized. The same was performed to the other abutment site also. The excess resin material was trimmed and the denture around the vent area was polished [Fig 3C].

Fit of the dentures and occlusion were evaluated in centric relation position**.** Final finishing and polishing were done and inserted [Fig 3D]. Instructions were given to the patient regarding maintenance of the dentures. A regular follow-up and evaluation of the patient and the prosthesis was undertaken. The patient was recalled after a week, one month and three months to evaluate the overall prognosis and the maintenance of the prosthesis.

Discussion

Residual alveolar ridge with severe resorption poses a serious challenge in achieving retention using conventional complete dentures. The rate of resorption of mandibular ridge is more rapid compared to the maxillary ridge. The anterior mandible resorbs four times faster than anterior maxilla. The factors owing to this differential rate off resorption are the difference in quality of bone, difference in square area of maxilla and the presence of mucoperiosteum as shock absorber. The patient presented with severe resorption of the mandibular ridge due to prolonged edentulism which propels the rate of resorption and thus rehabilitating the patient using conventional dentures wouldn't warrant adequate retention and chewing ability. So, implant supported overdentures were planned as a treatment option. The implant-supported overdenture takes anchorage from the abutment which allows a normal function of tongue and perioral musculature without destabilizing the denture during mandibular movements especially in resorbed ridge scenario.

The implant-supported overdenture could be designed in two ways [10]. One, implants are connected by a rigid inter connecting bar. Second, implants are solitary and are not connected. The major advantage of solitary implants is that, prefabricated stock retentive abutments can be used and when repair is required due to fracture of the abutment and it doesn't require the entire denture to be remade. An interconnecting bar splinting the implant may be deemed necessary in cases of implant malalignment or tilted implant placement.

The two most commonly employed systems for attachment are bar & clip and ball attachment. The bar & clip consists of a rigid bar interconnecting the implants. This system amplifies the retention and reduces the load distribution on the implants. It is commonly used to aid in correcting misaligned implants. The bulk of the attachment limits its application though, as it requires more vertical and buccolingual spaces. However, the ball and socket attachment system is considered to be the

simplest as these attachments have considerable stress-breaking effect, provide adequate amount of retention and stability, are available in various vertical heights, and can be used with non-parallel implants. [10-12] It has been suggested that although a divergence of 10° is well tolerated, excessive wear results from wide divergences between two unsplinted implants, which deprives the retention of the overdenture.[13]

In this case, two implants were placed in positions A and E of mandibular ridge according to Misch Classification [10] and the implants were not splinted together using a rigid interconnecting bar. Direct pick-up procedure was used to connect the ball abutment attachment system to the overdenture instead of the indirect technique. Direct clinical placement of the attachment significantly reduces chair time and alleviates any additional laboratory procedures or component parts involved in the indirect procedure. It involves abutment attachment to the overdenture using auto-polymerizing acrylic resin.

Several studies in the literature have explicated a rapid reduction in the bone resorption rate with overdenture application compared to conventional dentures. The oral health related quality of life assessment [OHRQLA] indicated a consistent trend in patient satisfaction and acceptance than with conventional dentures.[14] Several Randomized Controlled Trials (RCTs) pertaining to implant retained overdentures have provided data concluding an increase in patient satisfaction chewing ability, bite force and a positive impact on the quality of life.[15] Albeit abundant data being available for conventional loading with mandibular overdentures, there is paucity in literature on immediate loading of mandibular overdentures. [16] Due to this insufficient data, it is difficult to conclude that immediate loading leads to better patient satisfaction.[17]

The occlusal scheme incorporated in the implant supported overdenture doesn't hold substantial significance. The most important factor is appropriate tooth morphology to minimize the biomechanical risk factors in the implant-supported overdenture. [18,19] In this case, owing to the constricted maxilla and the broad mandible, a cross arch teeth arrangement was incorporated for better function and mastication. In this type of arrangement, there is a change of the arch as well as the side of the teeth; thus, the name cross arch arrangement. The teeth were arranged following the principles of teeth arrangement taking into account the biomechanical factors. Occlusion developed using cross arch arrangement was enabled to function efficiently with the least trauma to supporting tissues. The passive fit of the overdenture, shallow cuspal inclination and elimination of interferences in both centric and eccentric contact were ensured to accommodate occlusal stabilization and reduce the lateral forces on the implants. The scanty literature available on cross arch arrangement in implant overdenture prosthesis precludes several from incorporating it if required.

For a successful outcome of the overdenture therapy, the patient was emphasized about prosthesis maintenance. Post insertion instructions to maintain oral and denture hygiene were reinforced to the patient and reviewed regularly. In this case, meticulous treatment planning, appropriate site selection for implant placement, adhering to proper biomechanical principles, high initial stability in conjunction with harmonious occlusion with the maxillary denture ensured successful outcome of the treatment procedure. This case report, highlights the importance implant supported overdentures as a feasible and predictable treatment modality in rehabilitating patients with compromised ridges despite unconventional occlusal scheme incorporated. Patient was elated and

satisfied at the end of receiving the prosthesis and adhered to the maintenance protocol.

Conclusion

Osseointegrated implants can be exploited to provide good retention and support for complete dentures. They have produced tangible results in edentulous patients with severe alveolar resorption and unable to adapt to conventional complete dentures. Therefore, implant-supported overdentures are a predictable treatment option for completely edentulous arches. They galvanize the benefits of improved aesthetics, phonetics, bone preservation and comfort resulting in an enhanced quality of life for the patient. Arrangement of artificial posterior teeth in cross-arch relation to compensate for abnormal jaw relations providing stable and retentive implant supported overdenture with improved function has been demonstrated through this case report making a significant contribution to the scarce literature available on this matter. The tussle among several authors with regard to the design of the overdenture, selection of the attachment system and the loading protocols has opened new avenues of research and development in this field. However, long term success can be achieved by abiding to comprehensive design principles, optimum number and location of implants, favorable stress distribution over the implant and the supporting tissues, compliance with biomechanical factors during teeth arrangement and strict adherence to appropriate maintenance protocol by the patient.

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Legend Figures

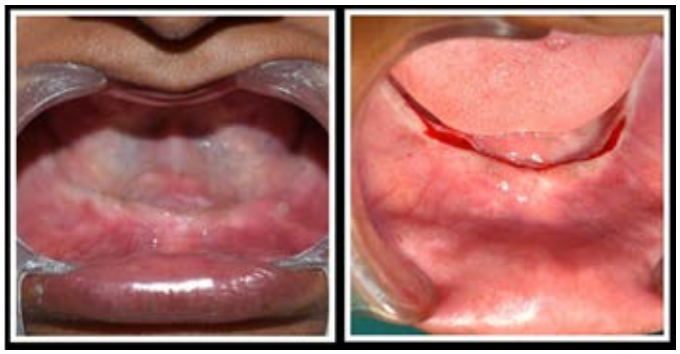

Fig 1: A. Pre-operative Photograph. B. Mid-crestal incision.

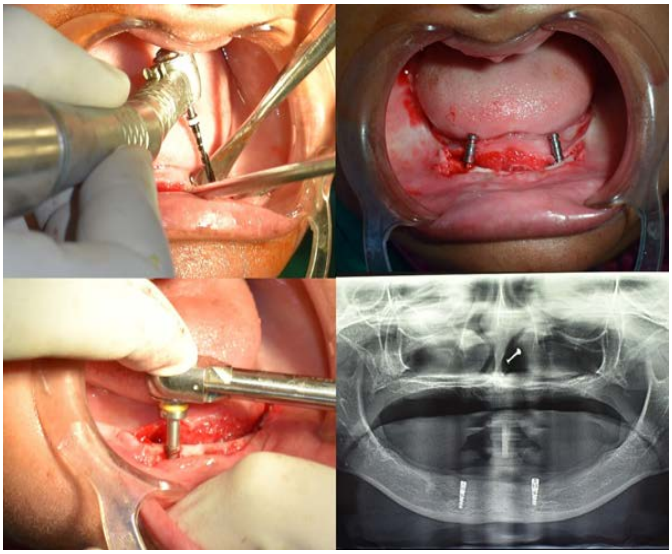

Fig 2: Implant Placement procedure.

Fig.3: A. Ball-abutments attached to the implant. B. Housing component placed over the ball-abutment. C. Housing component incorporated in tissue surface of the mandibular denture. D. Post-operative Photograph with cross arch teeth arrangement in the denture