Prosthetic rehabilitation of resorbed mandible with two implant-supported overdentures using ball attachments

ABSTRACT
The aim of this study was to describe a technique of fabrication of two implant-supported mandibular overdentures. There are several treatment modalities for completely edentulous patients including conventional complete dentures (CDs), implant-supported overdentures (IODs), and implant-supported fixed prosthesis. Patients with a severely resorbed mandible often experience problems with their conventional CDs. Treatment concepts involving IODs have proven to be as satisfactory as implant-supported fixed prosthesis with added advantage of ease in hygiene maintenance and less cost. This clinical report summarizes a simplified and accurate method of fabricating two implant-supported mandibular overdentures. In this case, two implants were placed in the intercanine region of mandibular ridge and conventional CD was installed. Three months later, this CD was converted into implant-supported mandibular overdenture. Conventional CDs have shown less satisfaction rates by patients over a period of time in terms of function. Moreover, there are researches showing increased rate of resorption with these dentures. Thus, IODs are used routinely to provide a better quality of life to edentulous patients.

Keywords: Ball attachments, dental prosthesis, implant-supported overdenture, resorbed mandible

INTRODUCTION
Dental implants have a significant effect on the current prosthodontic therapy for edentulous patients. Particularly, a mandibular removable implant-supported overdenture (IOD) supported by two or more implants is a treatment option for elderly edentulous patients who are dissatisfied with conventional complete dentures (CDs). van Steenberghe et al. in 1987 were among the first authors to propose the placement of only two implants in the edentulous mandible.[1] This option provides great patient satisfaction, chewing ability, and comfort. This article presents a design and fabrication technique of the implant-retained overdenture that uses two freestanding mandibular implants in the interforaminal region.

CASE REPORT
An edentulous 53-year-old male patient presented to the Department of Prosthodontics, with a complaint of all missing teeth in the lower arch. The patient did not have any medical conditions and was not taking any medications that were associated with compromised healing. An extensive clinical and radiological examination was done. Clinical examination included an evaluation of size and shape of the edentulous ridge, palpation for undercut areas, and an assessment of condition of the mucosa [Figure 1]. Mandibular ridge exhibited a moderate degree of alveolar ridge resorption in the posterior region. Overlying mucosa was healthy and normal. Temporomandibular joint examination was found to be normal. Orthopantomograph was advised to evaluate bone availability and architecture. The inter-ridge distance was assessed. Routine blood examination revealed no abnormal
findings. A treatment plan was prepared after a standard protocol. It included fabrication of a conventional CD for the maxillary arch and two free-standing IODs for the mandibular arch. Positions B and D were selected for implant placement.

The patient was given a detailed explanation of the treatment protocol and duration of treatment, and then, informed consent was obtained from the patient. Maxillary and mandibular CDs were fabricated in a conventional manner. Bilaterally balanced occlusal scheme was done. Semi-anatomic tooth form was selected. Deflecting contacts in both centric and eccentric positions were removed. The patient was given instructions regarding maintenance of denture. The mandibular denture was duplicated and holes were made in bilateral canine positions. These holes were packed with gutta-percha points, and the patient was advised for DentaScan for evaluating the height and width of the planned implant site. This radiographic template was prepared in (DPI self-cured acrylic resin, Clear) and was later on used as surgical template after removing the gutta-percha points. Adin (Touareg™) implants of 10 mm length and 3.5 mm diameter were selected. It was decided to use ball and socket type of attachment system.

Surgical procedure
Implant surgery was carried out in a two-stage surgical protocol. Surgery was performed under local anesthesia. The progressive osteotomy sites were prepared in the B and D regions with the help of surgical template. Parallelism was checked by guide pins. The selected implants were placed at the prepared sites.

Surgical cover screws were placed. The flaps were approximated with primary closure using 3–0 silk sutures. The patient was told to avoid wearing the lower denture for 2 weeks following surgery. Antibiotics were prescribed for 7 days. The patient was advised to use disinfectant mouthrinse (chlorhexidine) 3–5 times daily. Instructions were given regarding oral hygiene maintenance. The patient was advised to follow semisolid diet for 1 week. The sutures were removed in 10 days. Postoperative orthopantomograph was taken. The intaglio surface of the denture was relieved in the bilateral canine region. Soft-tissue-conditioning material (GC Reline Soft™) was applied to the intaglio surface of the denture according to the manufacturer’s directions, and the excess liner material was removed. The denture was finished, polished,
and installed into the patient’s mouth. Thus, the patient could wear the denture during the osseointegration period without loading the underlying implants. Regular follow-up visits were done, and the denture was relined as needed. Three months later, the patient was planned for the second-stage surgery. At this stage, the implants were exposed, the surgical cover screws were removed and healing abutments were placed [Figure 3], and the gingival tissues were allowed to heal for 15 days.

**Loading of implants**
The comfort and fit of the dentures was checked before installation of attachments. Ball and socket overdenture abutment of 3 mm diameter was selected according to the soft-tissue thickness. The soft-tissue thickness was checked by Williams probe. Indirect technique of placing ball abutment was selected to avoid long chairside time. For this purpose, an impression of mandibular ridge along with healing abutment was taken with addition silicone light body. A customized tray is fabricated using self-cured acrylic resin. Holes were made in the indentation of healing abutments for placement of impression copings. Healing abutments were then removed and impression copings were placed, and the fitting of tray was verified in the mouth. Tray adhesive was applied and impression was made using addition silicone (Aquasil, Dentsply putty and light body) with direct technique. Laboratory analogs were attached to the impression copings. Implants were secured with healing abutments. A cast was prepared using dental stone, and ball abutment was attached to laboratory analogs. The attachments were placed and O rings were blocked out on the abutments. Acrylic resin from the intaglio surface of the denture was removed to allow the passive fit of the denture against the abutment. A round bur was used to vent the pickup space toward the surface of the denture. The vent was situated lingual to the denture teeth. The pickup space was half filled with self-cure acrylic resin (DPI RR cold cure), and the mandibular denture was placed over the abutments. The complete seating of the denture was verified, and the denture was kept in position while the resin polymerized. The excess resin was trimmed and polished in the venting area. The ball abutments were placed in the implants with a torque of 15 Ncm [Figures 4, 5], and complete seating was ensured with radiographs. Fit and occlusion of the dentures was checked in centric relation position [Figure 6]. Dentures were also checked for any deflecting contacts. Home care instructions were given to the patient [Figure 7]. Training of the patient to place and remove the prosthesis properly was done. The patient was recalled after 24 h. The regular follow-up was advised every 3 months. The patient was instructed to remove their prosthesis at night. A soft single-tufted brush was indicated to keep attachments free from plaque and food debris.

**DISCUSSION**
The IOD remains in place during mandibular movements, which allows the tongue and perioral musculature function properly. Various treatment concepts involving different
numbers and types of implants, as well as different retention mechanisms, have been proposed. Bars, magnets, ball attachments, and rigid and nonrigid telesopic copings have been used to retain overdentures.[13] In this report, ball attachment was applied because of several advantages. Two dental implants with ball attachments are usually sufficient in facilitating proper IOD functionally.[8] The ball attachment is less sensitive technique, less costly, and makes peri-implant hygiene easier for older patients. In addition, it can be prosthetic rehabilitation of resorbed mandible with two IODs used with an existing conventional denture. The ball attachments provide greater stability and more even distribution of load. The resilient O-ring attachment was chosen as it appears to transfer stress in a more favorable manner, being a shock absorber, pressure, and torque reduced. As the prefabricated stock abutments are identical, they can be easily replaced in case of abutment failure and do not require denture remaking. This advantage cannot be achieved in castable bar as it needs to be remade in case of failure.[9] Malposed implants, however, can be a problem as stock abutments may not compensate for the alignment. In that cases, interconnecting bar can overcome this issue. The number of implants under a mandibular overdenture is debatable. van Steenberghe et al. were among the first authors to propose the placement of only two implants in the edentulous mandible. Their 98% success rate, with up to 52 months of observation, was encouraging.[10] A single implant is also quoted in literature in the symphysis region. However, a much detailed study is still required. In this article, two implants were chosen as they provide desirable denture stability without much increasing the cost factor. Another issue related with installation of the abutments in denture. There are two methods in literature: one method dictates that it can be indirect method that is in laboratory and the other one is to be done directly in patients’ mouth. In this article, indirect approach was used as it provides better accuracy of the denture and less chairside time.[11] Stoker et al. (2011) presented further data for the 8-year results of an Randomised Clinical Trial (RCT), on over 100 patients, regarding the aftercare and cost analysis with three types of mandibular implant-retained ODs. Patients with two implants showed less marginal bone loss than those with four implants, suggesting that two implants seem to be preferable for mandibular implant-supported OD. Marco Cune et al. 2010 found no marked difference in patient satisfaction between patients with ball-socket and bar-clip-retained two-implant mandibular overdentures at initial evaluation and after 10 years of function. Clinical and radiographic conditions were seen after 10 years of function, with slightly shallower probing depths around implants that were provided with ball-socket attachments. Proper maintenance is very crucial for success of any prosthesis. Regular follow-up is very necessary.[12] The adequate number of implants and the emergence of abutments are important. Parallelism should be achieved for axial dissipation of forces. Treatment planning should be prosthesis driven. Arie R. Hoeksema et al. 2016 performed a study on clinical performance of mandibular two-implant overdentures in different age groups and found them to be equally successful in younger and older patients.

CONCLUSION

Restoration of the edentulous mandible is a challenge. A proper treatment planning is necessary regarding number of implants, design of the overdenture, and selection of the appropriate attachment system. Clinicians should plan a case according to patients’ need. Patients who had received implant overdenture are more satisfied with the comfort of their lower dentures and have experienced less difficulty in their daily life compared to patients with conventional mandibular dentures. Therefore, implant-supported mandibular overdentures for the treatment of edentulous patients as a means to improving their quality of life should be considered.

Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

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