Hybrid approach to fabrication of hollow internally weighted mandibular denture: A case report

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Abstract
Preservation of ridge dimensions is critical for denture success. For long the concept of an internally weighted denture, which suggested that gravity and the additional weight to the mandibular complete denture aids in prosthetic retention is widely accepted. However, excessive weight and pressure can accelerate bone resorption. Here, we describe a unique modification of internally weighted metal denture base for the resorbed mandibular ridge with an incorporated additional hollow section over the anterior knife-edge ridge. The weight provided retention and stability while the hollow portion prevented further resorption of the bone.

Key words: Internally weighted, rehabilitation, residual alveolar ridge, resorption

INTRODUCTION
The stability and retention of mandibular denture are difficult due to extreme resorption and reduced denture bearing area. Although weighted denture contributes to retention and stability,[1] decreasing the lower denture weight prevents leverages, resorption and overtaxing of the remaining supporting structures.[2-4] Here we described an innovative technique to fabricate a hybrid prosthesis for resorbed mandibular ridge with the anterior knife edge section.

REVIEW OF LITERATURE
The weighted denture should have the same weight as the missing tissue for optimal clinical outcomes, closest possible adaptation, resistance to lateral deformation, less breakage, and minimal tissue changes. Moreover, a metal base helps prevents bacterial fermentation due to its less porosity and better thermal conduction. Most lower dentures weigh less than half as much as the teeth and supporting tissues lost to promote prosthetic retention.[5] However several studies [Table 1] recommended addition of extra weight and added pressure for residual ridge resorption (RRR).[4-11] We described here a case wherein we adopted a blended approach to achieve the optimal prosthodontics outcome.

CASE REPORT
A male patient, 66 years of age, visited the Department of Prosthodontics, with the chief complaint of difficulty in mastication. On intraoral examination, the patient presented with a mandibular anteriorly high knife-edge ridge and a resorbed posterior section [Figure 1]. No history of any systemic illness and medications was reported. Following radiographic and clinical investigations a modification in the internally weighted denture was planned to relieve the ridge crest of pressure. Further the region above the

Figure 1: Intra oral view of anterior knife-edge ridge with posterior resorbed section
anterior knife edge was planned to be made segmentally hollow to relieve it of the pressure and hence prevent the resorption while increasing the retention of the prosthesis. The ethical clearance committee of the institute approved the study, and a written consent was obtained from the patient after explaining the entire treatment plan.

Primary impressions were made in impression compound (Rolex impression composition, Ashoo Sons, Delhi, India). Border molding was performed with low fusing impression compound (Dental products of India [DPI], The Bombay Burmah Trading Corporation Ltd, Mumbai, India) and final impression was made with zinc oxide eugenol impression paste (DPI, The Bombay Burmah Trading Corporation Ltd, Mumbai, India) and the impression was poured in type III dental stone (Gyprock, Rajkot, Gujarat, India).

The final cast was duplicated. On the duplicated cast two sheets of modeling wax were adopted on the residual alveolar ridge (Rolex, Ashoo Sons, New Delhi, India). One sheet was then cut and removed from the area, which the metal casting would occupy, leaving the anterior part of the ridge so that the thin knife-edge ridge was relieved. This assembly was then duplicated, and a refractory cast was obtained. On the refractory cast, a spacer wax was adopted in the prepared slot for casting and retentive finger-like extensions for acrylic were incorporated. Once the casted metal framework was prepared, it was readapted over the master cast [Figure 2]. Next a permanent record base incorporating the metal framework was fabricated (Trevalon-HI, Dentsply, Germany). The occlusal vertical dimension and the centric relation of the patient were determined with the help of tissue conditioners (GC, Coe-Comfort Professional, GC America Inc.,) neutral zone was recorded [Figure 3]. Teeth arrangement was done in balanced occlusion and try in was done. The mandibular trial denture was duplicated in type three gypsum product and a thermoplastic sheet was adapted over the external surface. This thermoplastic template was later used to verify the extent of the hollow segment.

In order to make the hollow section over the anterior knife edge area, a roll of modeling wax was adapted over the sharp ridge after dewaxing. Autopolymerizing acrylic resin

Table 1: Studies concluding that weight and pressure on the ridge causes RRR

| Author/s          | Year | Conclusion                                                                 |
|-------------------|------|-----------------------------------------------------------------------------|
| Tallgren[5]       | 1972 | Alveolar bone loss was 4 times more in the lower arch. The lower ridge is more likely to respond to the various functional forces transmitted through the dentures. One of the contributing factors with regard to the anterior mandibular resorption is long-term complete denture wearing with impaired retention and stability |
| Yung[6]           | 1975 | A localized high incidence of pressure causes circumscribed complete osteolysis and replacement of bone by fibrous tissue and greatest resorption taking place on the external surface of the knife edge residual ridge |
| Nakashima et al.[4] | 1994 | In a study using experimental dentures to load continuous pressure on the palate of the molar region of rats it was demonstrated that the low pressure (1.5 kPa) did not cause bone resorption, but higher pressure (3.4 and 4.9 kPa) caused RRR. It was concluded that osteoclastic bone resorption was a pressure threshold-regulated phenomenon with a lower threshold for continuous than for intermittent pressure |
| Xie et al.[7]     | 1997 | The rate of resorption in the anterior alveolar ridge is most rapid during the 1st year of denture-wearing |
| Kingsmill[8]      | 1999 | Prolonged pressure occludes the fine periosteal plexus of vessels, stimulating osteoclastic resorption by altering the local oxygen tension and reducing the pH |
| Ohkubo and Hosoi[9] | 1999 | Concluded that weighted dentures did not affect retention or stability. Patients were often dissatisfied due to compression of gingival tissues by the weighted mandibular denture |
| Zmyslowska et al.[10] | 2007 | Continuous pressure is more harmful than intermittent pressure |
| Jagadeesh and Patil[11] | 2013 | In RRR, there is an osteoclastic activity, especially on the external surface of the crest of residual ridges |

RRR: Residual ridge resorption
Hazari and Mishra: Hybrid mandibular denture

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CONCLUSION

For simultaneously aiding retention preventing the important residual ridge from resorption, modified prosthesis presented in this case report was found to be an optimal alternative. In cases such as anterior knife-edge ridges, diabetic patients, were alveolar ridge is more prone to resorption, these dentures may provide good results. These dentures can also be successfully adopted in cases where processing and lateral deformations are anticipated and in patients with neuromuscular disorders since the metal incorporated provides the needed rigidity and strength. This hybrid denture successfully combined the advantages of two concepts eliminating the disadvantages of both.

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DISCUSSION

Several studies have reported that the lower ridge is more likely to respond to the various functional forces transmitted through the dentures.[9] Constant pressure is one of the major cause for RRR.[8] Long-term complete denture wearing with impaired retention and stability further exacerbates anterior mandibular ridge resorption.[8] The functional parameters of force such as frequency, intensity, duration, and direction are transformed into cell activity with stresses which deviate from the normal particularly excessive compressive forces bringing about RRR, which may be because of gravitational reasons. This stress causes an area of complete osteolysis and formation of fibrous tissue on the external surface of the knife edge residual ridge.[6,10,12]

Hence for this case we preferred a modification of the lower denture. The metal insert was given only in the posterior region of the residual ridges, which had provided the necessary retention by the action of gravity and also reduce the weight of the denture. The hollow section given over the anterior knife-edge ridge prevented overloading of the mucosa and bone, thus preventing the bone resorption in the anterior region.

Figure 4: Weighted metal denture base with hollow anterior segment

(DPI-RR Cold Cure, Mumbai, India) in dough consistency was adapted over the wax roll. Once the acrylic resin was cured, the wax roll was then removed by flushing hot water into the tunnel created by autopolymerizing resin [Figure 4]. The thermoplastic template was used to verify the extent of the hollow segment. The hollow segment was within the confines of the template with sufficient space for heat-cure acrylic resin. The two open ends of the tunnel were closed using autopolymerizing acrylic resin. Dentures were processed with high impact heat-polymerized acrylic resin (Trevalon-HI, Dentsply, Germany). The prosthesis was retrieved and polished for the denture insertion.