A Hollow Denture - A Simplified and Economical approach for Atrophic Maxilla

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Abstract: Retention,stability and support are the basic principles on which the success of a complete denture relies. The skill lies in applying these principles efficiently in critical situations. Resorption of bone occurs as the age advances. Although the resorption process is generally a more serious clinical problem in the mandibular arch,significant loss of alveolar bone in the maxillae can prove equally problematic. The severely resorbed maxillary and mandibular edentulous arches that are narrow and constricted with increased inter-arch space provide decreased support,retention and stability. The consequent weight of the processed complete denture only compromises them further. Such an atrophic maxillary arch that requires wearing a heavy maxillary denture may consistently lose its peripheral seal. The severely resorbed jaw can have various treatment options. The advantage of a hollow denture is the reduction of excessive weight of acrylic resin,which normally replaces lost alveolar ridge in the inter-ridge space of the denture wearer.

Keywords: Retention, Stability, Support, Resorption, Atropic Maxillary Arch, Resorbed jaw, Inter-ridge space.

Introduction: A major problem in dentistry is the prosthetic rehabilitation of deficient edentulous ridges.(1) "No step in denture construction should be stopped short of perfection yet many dentures are worn, which have imperfections built into them, provided they have peripheral seal sufficient to hold them in place"(3). Residual Ridge Resorption is predictable phenomenon following the loss of dentition occurring in edentulous individuals. However, the rate of resorption varies depending on the anatomic, metabolic or mechanical factors(4). Following severe resorption of ridge there is substantial increase inter-ridge space. This leads to fabrication of complete dentures that are more in weight. Heavy dentures, regardless of whether maxillary or mandibular causes poor denture bearing ability. Further, extreme and constant pressure results to bone resorption as well as decrease in retention(5) and stability of denture. Also, these dentures are causes discomfort and inconvenience to the patients(6).

Reducing the weight of a maxillary prosthesis has been shown to be beneficial when constructing an obturator for the restoration of a large Maxillofacial defect[6,7]. Given the high volume of the denture base material in prostheses provided to patients with large Maxillofacial defects or extreme residual ridge resorption, reduction in prosthesis weight may be achieved by making the denture base hollow(9). To decreased the leverage forces, reduction in the weight of the prosthesis was recommended and was also found to be beneficial(3). Different approaches like using a solid 3-dimensional spacer, including dental stone[10–14], cellophane wrapped asbestos [15], silicone putty[16, 17], or modelling clay have been used during laboratory processing to exclude denture base material from the planned hollow cavity of the prosthesis. Fattore et al.[11] and Holt[16] have used different techniques for fabricating a hollow prosthesis.

Case Report: A 60 year old male patient reported to the Department of Prosthetic Dentistry of Vidarbha Youth Welfare Society's Dental College and Hospital, Amravati for prosthetic rehabilitation

of maxillary and mandibular edentulous ridges. Patient's medical history was not significant. Past dental history revealed that patient was a denture wearer since 3 to 4 years and the maxillary denture were loose. Intra oral examination revealed severely resorbed maxillary edentulous ridges with increased inter-ridge distance. Labial, buccal mucosa, hard palate, soft palate and floor of the mouth were normal. Hence, hollow maxillary complete denture and conventional mandibular denture was planned for this patient.

Technique:

1) Upper and Lower Primary impressions were made by means of Impression Compound(Fig1)

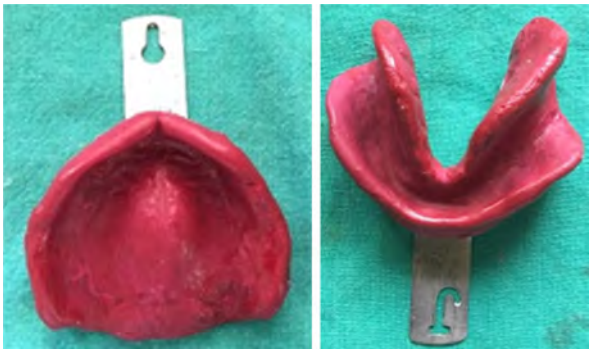

Fig. 1

2) The Impressions were poured with dental plaster (Fig. 2) and primary maxillary and mandibular casts were retained. Special trays were fabricated on these casts with auto-polymerizing acrylic resin. Border moulding were done with green stick compound and Final impression was made with Zinc Oxide Eugenol Paste. (Fig 3)

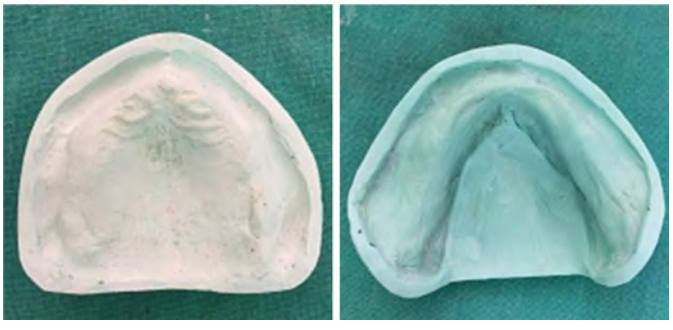

Fig. 2

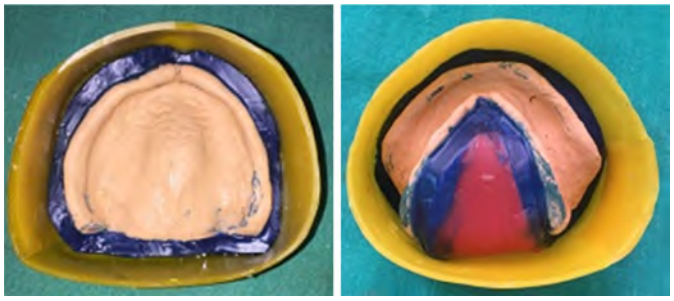

Fig. 3

3) The impressions were beaded and boxed and then poured with Type 3 dental stone and master casts were retrieved.

4) Record bases were fabricated with auto-polymerizing resin. Facebow recording(Fig.4), vertical and centric jaw relation were made.

Fig. 4

5) This was transferred to articulator and mounting of maxillary and mandibular cast was done. (Fig.5)

Fig. 5

6) Teeth arrangement was done. Try in was verified (Fig.6) for retention, aesthetics and maxillary-

mandibular relationship.

Fig. 6

7) The trial denture was then processed in the standard manner up to the wax elimination stage in base 1 counter 1 flask.
8) Adapt 2 layers of baseplate wax (Anutex; Kemdent, Wiltshire, UK) (Fig.7) to the definitive cast in the drag, conforming to the border extensions. Use a second flask to invest the baseplate wax and again complete the wax elimination process. Pack the cope and second drag with heat polymerized acrylic resin (Lucitone 199; Dentsply, York, Pa) and process.

Fig. 7

9) Separate the cope, with the polymerized acrylic resin still attached, from the drag. Place the clear matrix on the definitive cast using the indices in the land area as seating guides. Use an endodontic file with a rubber stop to measure the space between the matrix and the processed resin.(Fig.8)

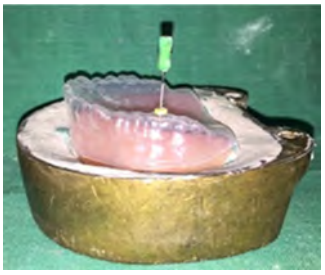

Fig. 8

Mix and adapt vinyl polysiloxane putty (Reprosil; Dentsply Caulk, Milford, Del) to the bur roughened acrylic resin and shape to the approximate contours of the matrix. Shape the polymerized putty with a bur (H251E; Brasseler USA, Savannah, Ga) to leave 2-3 mm of space between the putty and matrix. Provide an additional 1-mm space over the tooth portion of the denture (Fig.9). Fix the putty to the acrylic resin using cyanoacrylate (Superglue; Pacer Technology, Rancho Cucamonga, Calif).

Fig. 9

11) A glycerin soap (Pears, Hindustan Unilever Ltd., Mumbai, India) replica of the putty spacer was hand carved using a Lacron carver (Hu-Friedy, Chicago, IL) for use during the final closure and acrylization. The exact replication was ensured by measuring with a Vernier's calliper.
12) After this,a trial closure was carried out using the temporary putty spacer. The flasks were opened and temporary putty spacer retrieved. The mould space was visually assessed for adequate resin thickness all around the hollow cavity. The hollow space left by the temporary putty spacer was now filled with the soap spacer and final closure of the flasks was achieved. The denture was acrylized in conventional manner.
13) After finishing the denture two openings were cut with a bur into the denture base distal to the most posterior tooth (Fig.10). The denture was then immersed in a bowl of water to allow dissolution of soap. Also, a cleaning brush was pushed in and out through the openings to aid in mechanical removal of the soap. Water spray was used to flush traces of soap completely. The

hollow cavity was air dried and the openings were sealed using auto-polymerizing acrylic resin

Fig. 10

14) The denture was immersed in water overnight and weighed before and after immersion to assess leakage into the cavity. A water test was performed to evaluate the hollow space as evident by the floating denture (Fig11).

Fig. 11

15) Upper and Lower dentures were then finished, polished, and delivered to the patient. The patient was reviewed after a week, and minor adjustments were made.

Discussion: The goal of Prosthodontics treatment is to palliate the anatomical and functional deficiencies resulting from tooth loss. Tooth loss leads to residual ridge resorption which is a complex phenomenon driven by various anatomic, prosthetic, functional and metabolic factors[18,19]. Extreme resorption of either ridge will lead to a reduced denture-bearing area, which in turn will affect retention, stability and support for the complete denture. Excessive ridge resorption also results in a large restorative space between the residual ridges[20].Prosthetic rehabilitation in such scenarios often results in increased height and weight of the prosthesis, overloading the residual ridges and further compromising the retention and stability of the prosthesis. Literature reports various techniques for the fabrication of a hollow complete denture [21-25]. Few authors suggest processing the denture in parts around a 3-D spacer, which are then fused at the denture borders, following spacer removal. [23,24] Nevertheless, additional laboratory steps were needed, and post-insertion adjustments could result in a perforation, leading to fluid seepage into the hollow cavity[23,24]. Other techniques involved incorporation of the spacer within the denture base to form the hollow cavity during processing [21,22,26-39]. However, this necessitated designing large openings in the Cameo surface to facilitate spacer removal. Several spacer materials have been used, such as, gauze coated with addition silicone impression material[23], ice[26], asbestos[27], silicone putty[22,28-32], dough of dental plaster and pumice[31], dough of dental plaster-pumice and sugar syrup[32], modelling clay[33], thermocol[34] and salt[35]. Aggarwal *et al.*[35] proposed the lost salt technique to overcome the following shortcomings encountered in the aforementioned techniques: (a) Extra laboratory steps for the fabrication of a special lid and (b) tedious retrieval of high viscosity materials such as putty and thermocol.

The problem encountered while using salt is its inability to sustain pressures produced during flask closure resulting in a failure to achieve a hollow cavity inside the prosthesis. Hence, no substantial difference in weight of the prosthesis can be achieved. The technique described here uses a soap spacer specifically hand carved out of a glycerin soap bar due to its easy retrievability that can be attributed to a high content of glycerine and other humectants in it, rendering it highly water soluble compared to other soaps. Other advantages of using a glycerine soap spacer are that it can sustain curing temperatures (boiling point of glycerine 290ºC) and doesn't interfere with the polymerization of heat cure acrylic resin or leave any residues inside the hollow cavity. Also because the soap spacer is

eventually removed leaving behind a clean hollow cavity, any concern regarding its biocompatibility in the oral cavity is dismissed[36].

Conclusion: This technique overcomes the disadvantages of the older techniques. The glycerine soap spacer has the advantages of easy retrievability, ease of carving and it doesn't adhere to acrylic resin. Hence, it's a simple, economical, time-saving and a predictable technique[36]. Also the clear matrix of the trial denture helps to facilitate shaping of silicone putty spacer to ensure an even thickness of acrylic to resist deformation and prevent seepage of saliva into the cavity[37]. Pre-prosthetic surgeries and implant-retained prosthesis may not be possible in all cases due to systemic diseases or cost. In such cases, a lightweight complete denture is a logical alternative to counteract the lateral forces better and decrease leverage by reducing extra loads on underlying tissues[36].

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