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Hollow Dentures: Treatment Option for Atrophic Ridges. A Clinical Report

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Abstract

Severely atrophic ridges provide decreased retention, support, and stability and pose a clinical challenge to the success of complete denture prostheses. Extreme ridge resorption also increases the interridge distance. Restoration of the vertical dimension and esthetics thus demands increased height of the prosthesis and in turn leads to an increase in prosthesis weight. Reducing the weight of the denture enhances stability and retention and reduces further resorption of the jaw, thereby favoring the prognosis of the denture. This report describes the rehabilitation of an edentulous patient with resorbed maxillary and mandibular ridges and an increased interridge distance using simplified techniques of fabricating hollow dentures.

Prosthodontic rehabilitation attempts to alleviate anatomical and functional deficiencies, rehabilitation of atrophic edentulous ridges being one of them. After dental extractions, the residual alveolar bone undergoes a period of accelerated resorption for about 10 weeks, followed by a slower, but progressive resorption.[1] Residual ridge resorption is a complex biophysical process affected by various anatomic, prosthetic, functional, and metabolic factors.[2,3] Extreme resorption of either ridge (maxilla or mandible) 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.[4] Restoration of lost vertical dimension results in fabrication of a heavy complete denture that may compound the poor denture-bearing ability of the tissues and lead to decreased retention and resistance.

To increase the retention and stability of a heavy prosthesis, methods like use of undercuts, modifications in impression techniques,[5] use of magnets,[6] use of implants,[1] use of intramucosal inserts,[7,8] incorporation of suction disks,[9] and fabrication of lightweight dentures[4,10,11] have been tried. Numerous methods and materials have been used to fabricate a lightweight denture, allowing for restoration of esthetics and function such as mastication, deglutition, and speech. Weight reduction approaches have been achieved using a solid 3D spacer, including dental stone, cellophane-wrapped asbestos,[12] silicone putty,[4,13] modeling clay, and thermocol[14] during laboratory processing to exclude denture base material from the planned hollow cavity of the prosthesis.

Alternately, fabrication of multiple and separate pieces of the prosthesis either individually or around a 3D spacer has also been described.[4,10] In this technique, following the initial polymerization process, the solid spacer is removed, and individual pieces of the prosthesis are then joined using autopolymerizing acrylic resin repair techniques.

This article describes a report of an edentulous patient with resorbed maxillary and mandibular ridges and an increased interridge distance where simplified techniques were used for fabrication of maxillary and mandibular hollow dentures.

Clinical report

A 60-year-old male patient reported to the Department of Prosthodontics, Goa Dental College and Hospital, Bambolim, India, with the chief complaint of difficulty in eating and speaking due to loss of teeth. History revealed that he had lost his teeth due to periodontal involvement and had been edentulous for 6 years.

Clinical procedure

On examination it was found that maxillary and mandibular ridges were atrophic. After a thorough evaluation of the patient's history, medical condition, radiographs, and existing clinical conditions, treatment options were explained to the patient. Treatment options discussed were implant-supported prostheses and conventional complete dentures. Pros and cons of both were explained to the patient. He decided in favor of a conventional complete denture prosthesis due to the cost

Figure 1 A 1 mm thick polyethylene sheet heat pressed on duplicate stone cast of waxed maxillary complete denture.

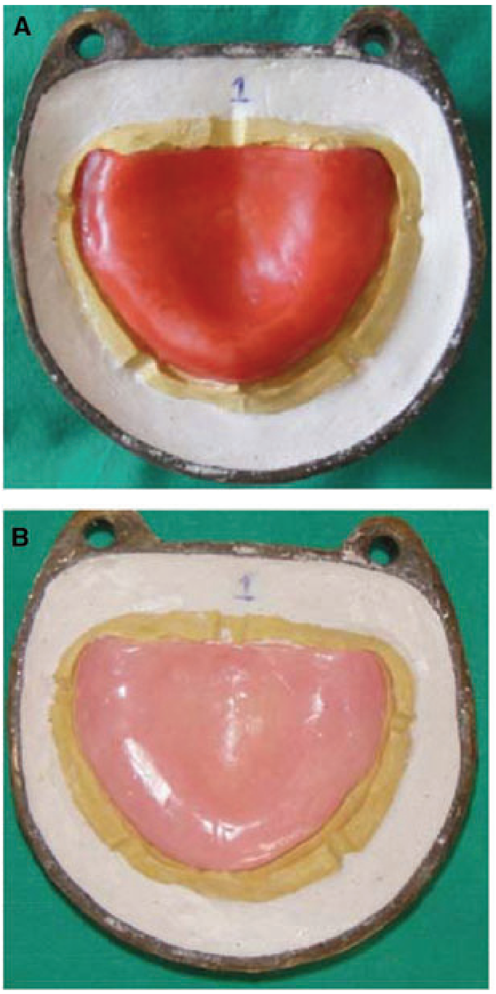

Figure 2 (A) A 2 mm thick baseplate wax was adapted to the definitive cast in base 1; (B) processed with counter 2 to obtain a heat-cure record base.

Figure 3 Template prepared over duplicated trial denture placed over permanent record base using the notches as guide.

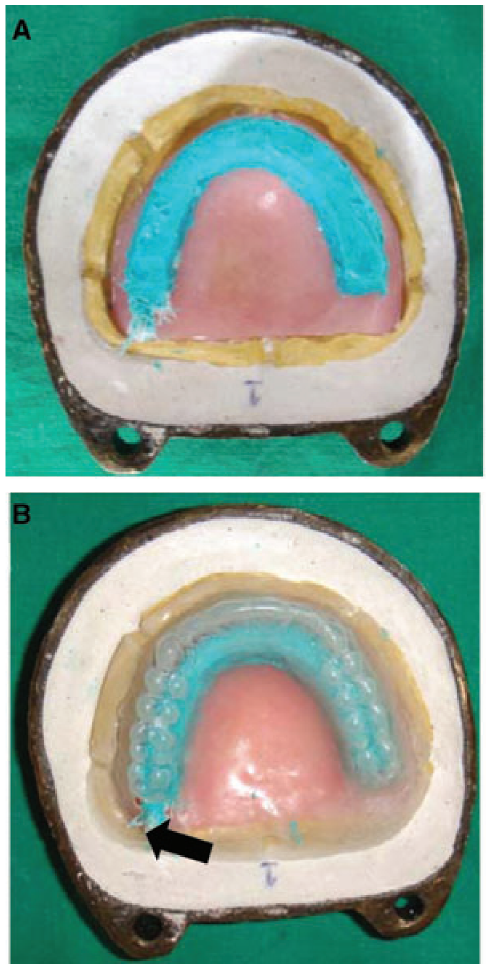

Figure 4 (A) Gauze rolled, coated with light-body silicone impression material, and placed on the record base over the ridge crest; (B) 2 mm space left between light-body silicone-coated gauze and template.

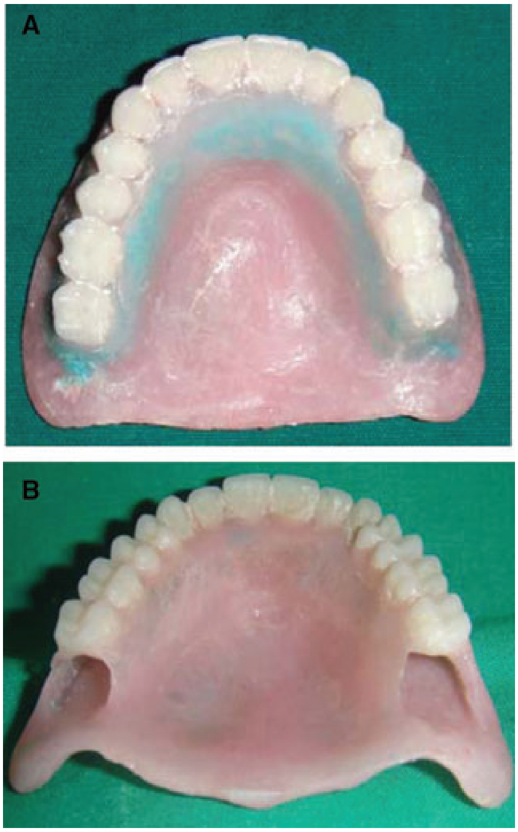

Figure 5 (A) Deflasked maxillary denture; (B) light-body silicone coated gauze was pulled out, and the cavity was cleaned.

involved and the surgical procedures associated with an implant-supported prosthesis.

Standard clinical procedures were carried out until try-in of waxed dentures.[15] During try-in, esthetic and phonetic analysis of the trial denture demanded an increase in the height of the dentures that in turn would increase the weight of the prosthesis. To reduce the weight of the prosthesis, it was decided to rehabilitate the patient with hollow dentures.

Figure 7 A 0.5 mm deep groove made 3 mm below the neck of the teeth.

Laboratory procedure for the maxillary denture

Notches were made at five sites on the land area of the maxillary cast, and the waxed denture was sealed to the definitive cast. An impression of the waxed denture was made with irreversible hydrocolloid (Tropicalgin, Zhermack, Badia Polesine, Italy) and poured in dental stone. A 1 mm thick polyethylene sheet (Scheu-Dental, Iserlohn, Germany) was pressed on the duplicated stone cast (Fig 1) to form a template.

Two split dental flasks with interchangeable counters were selected for processing. The maxillary trial denture was invested in one of the selected flasks (flask 1), and wax elimination was carried out. Baseplate wax (2 mm thick) was adapted over the definitive cast in base 1, conforming to the border extensions (Fig 2A). Its fit with counter 1 was verified, and excess wax removed. The second flask counter (counter 2) was assembled over the base with the waxed-up cast (base 1). This assembly was dewaxed, and heat-cure acrylic resin (Trevalon, Dentsply India Pvt. Ltd., Gurgaon, India) was packed. Trial closure was

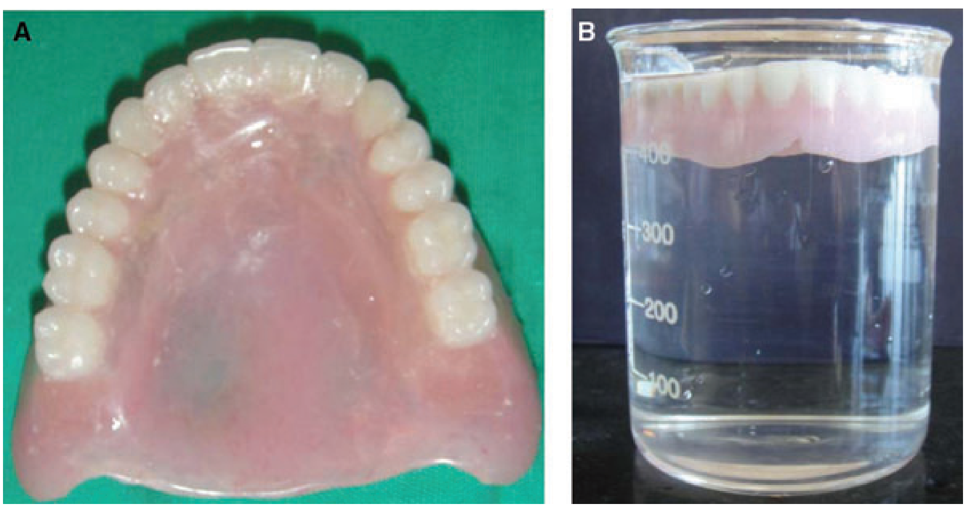

Figure 6 (A) Hollow maxillary complete denture; (B) hollow denture floating in water.

Figure 8 Baseplate wax was adapted over the master cast and ridge lap portion up to the plaster groove in base 1 and counter 1, respectively, to be processed using the two-flask technique.

Figure 9 Processed shells to be joined using heat-cure resin.

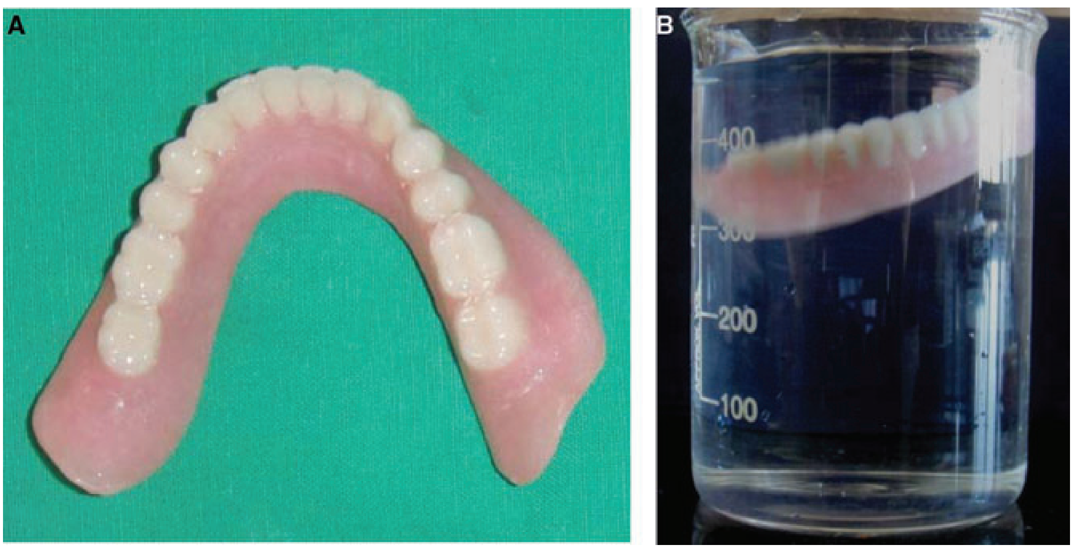

Figure 10 (A) Completed mandibular denture; (B) hollow denture floating in water.

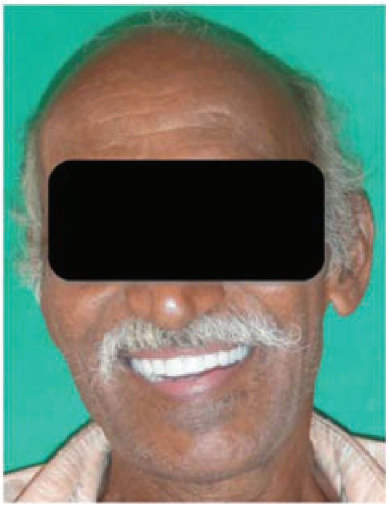

Figure 11 Finished and polished dentures delivered to the patient.

carried out and processed to obtain a permanent record base (Fig 2B).

The template of the duplicated trial denture was placed over the obtained permanent record base using the notches in the land area of the cast as guides (Fig 3). A roll of gauze coated with light-body addition silicone impression material (Aquasil LV, Dentsply Caulk, Milford, DE) was adapted over the ridge crest area of the permanent record base before complete polymerization (Fig 4A). After polymerization, light-body material was shaped with a sharp instrument, leaving 2 mm of space between the light-body material and the template (Fig 4B). A small window was cut in the template distal to the most posterior tooth. One end of the gauze piece incorporated within the light-body material was exposed through this window (Fig 4B). This would help in easy retrieval of the light-body silicone-coated gauze from the cavity after processing of the denture. Petroleum jelly was applied over any light-body silicone that would come in contact with acrylic in the subsequent steps. Counter 1 was reseated on base 1 with the permanent record base and light-body coated gauze roll and verified for complete closure. Heat cure acrylic resin was packed over teeth in counter 1, and base 1 was assembled and processed. The processed denture was recovered in the usual manner (Fig 5A). Using a micromotor handpiece, openings were cut into the denture base distal to the second molar. A sharp instrument was used to release the light-body silicone from the denture base. Light-body silicone-coated gauze was pulled out through the opening, and the cavity was cleaned. Water spray was used to remove traces of light-body silicone completely (Fig 5B). The cavity was air dried, and the openings were sealed using autopolymerizing acrylic resin (Fig 6). The denture was weighed (Fig 6) and immersed in water overnight to assess leakage into the cavity.

Laboratory procedure for the mandibular denture

A 0.5 mm deep groove was made on the waxed trial denture, 3 mm below the neck of the teeth (Fig 7). Two split dental flasks with interchangeable counters were used for processing. The waxed-up trial denture was invested and dewaxed in the conventional manner.

Baseplate wax (2 mm thick) was adapted to the definitive cast in base 1, conforming to the border extensions (Fig 8). Molten wax was filled over the ridge lap surfaces of denture teeth up to the projection in the plaster corresponding to the groove made 3 mm below the neck of the teeth. A wax shim (1 mm thick) was adapted to correspond to the cameo surface of the denture (Fig 8). The second flask counter (counter 2) was used to invest the baseplate wax adapted over the definitive cast in base 1. This assembly was dewaxed, and heat-cure acrylic resin was packed and processed to obtain a permanent record base. The second flask base (base 2) was used to invest the baseplate wax adapted over the teeth in counter 1. Wax was eliminated, heat-cure acrylic resin was packed, and trial closure was carried out and processed.

Both halves of the original flask now contained a processed acrylic resin shell. Any acrylic resin tags that would interfere with complete flask closure were removed using a sharp blade (Fig 9). Heat-cure acrylic resin was mixed and added along the periphery of the shell in counter 1 in small amounts. Base 1 with the permanent record base was placed over and processed. Dentures were recovered from the flask. The seal between the preformed acrylic resin shells was evaluated for any fluid seepage into the denture cavity by weighing it before and after placement in water for a day (Fig 10).

Dentures were then finished, polished, and delivered to the patient (Fig 11). The patient was reviewed after a week, and minor adjustments were made.

Discussion

Reducing the weight of the maxillary prosthesis has been shown to be beneficial when constructing an obturator for the restoration of a large maxillofacial defect.[16-17] Given the extensive volume of the denture base material in prostheses provided to patients with severe residual ridge resorption, reduction in prosthesis weight may be achieved by making the denture base hollow. Hollow dentures not only help in reducing the weight of the denture that acts as a dislodging factor, but also reduce the extra loads on underlying tissues and remaining amount of bone.

The procedure described for the fabrication of a maxillary denture in this article incorporates the use of a clear, vaccum-formed matrix of the trial denture external contours to facilitate the fabrication of a hollow cavity form, ensuring appropriate dimensions of both the denture base acrylic resin for structural integrity and the denture cavity for optimal weight reduction. The thickness of acrylic resin can also be controlled, ensuring an even depth of resin to prevent seepage of fluids and saliva into the cavity and prevent deformation under the pressure of flask closure.

Previously, vinylpolysiloxane (VPS) putty has being used for fabrication of hollow prostheses due to its stability and ability to be carved, and because it does not adhere to acrylic resin on setting.[4] Most importantly, it does not interfere with acrylic resin polymerization during subsequent processing; however, removing set putty from within the cavity, especially in the area between the canines, is difficult[14] due to the curvature of the arch, making the procedure cumbersome and time consuming. In the technique described in this article, VPS has been used for the reasons stated but in a different consistency (light body). A gauze roll coated with light-body material was placed over the permanent record base in the area that needed to be hollowed. Additions could be made as needed, and excess could be removed using a sharp instrument. The separating medium was applied over light body, enabling easy removal of the set material. A vaccum-pressed matrix was used to verify the thickness of the covering acrylic. After polymerization, the cavity was emptied through a small window cut distal to the most posterior tooth on the denture. The gauze roll coated with light-body material was retrieved easily, making this technique simple and time saving.

The mandibular denture was fabricated in two parts, followed by the assembly of two separate shells using heat-cure acrylic resin. The possible disadvantage associated with hollow dentures fabricated as two separate shells fused with autopolymerizing resin is that they are weak, prone to fracture, and undergo discoloration with time. Also, a long-sealed junction creates a site of potential leakage and seepage of fluid into the denture cavity, requiring complex and time-consuming laboratory procedures. Furthermore, this junction is a common site for postinsertion adjustment, thus increasing the risk of leakage.

Considering the strength of the mandibular denture, the distance from the teeth to 3 mm of the denture base was marked to be formed in heat-cure acrylic resin. Two shells were sealed and completely covered with heat-processed acrylic resin to minimize the risk of stains and leakage around the area of the seam and to increase the durability and longevity of the prosthesis.

Finished and polished maxillary and mandibular dentures were duplicated into solid prostheses to determine the difference in weight if they had not been hollowed. For maxillary and mandibular dentures the difference in weight between solid and hollowed counterparts were 6.54 g and 3.87 g, respectively.

Conclusion

Preprosthetic surgeries and implant-retained prostheses 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.

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