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Innovative Solutions for Challenging Anatomical Traits: Comparing Different Hollow Denture Fabrication Techniques

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ABSTRACT

The core tenets of complete denture treatment are retention, stability, and support with acceptable aesthetics and good speech. For patients with specific anatomical traits such as highly resorbed ridges, long lip length, and increased interridge distance, the principles are often compromised with conventional dentures. Conventional dentures might add to weight, provide inappropriate retention, and thus, in turn, transfer abnormal forces to underlying hard and soft tissues hastening the process of residual ridge resorption. To manage the complication, hollowing the denture seems a fair alternative. Hollow denture provides several advantages like reduced weight, balanced force distribution, improved retention, and slow ridge resorption. This article presents several ways of crafting hollow dentures with the aim of preserving the underlying tissues, enhancing denture performance, and minimizing bone resorption.

Keywords: Hollow denture, Caramel, Glycerin, Thermoplastic, Chocolate

INTRODUCTION

"Being perfectly imperfect goes well with dentures.
Sometimes, the imperfectness in denture is what makes it a better fit for the patients"

A hollow denture is one of the imperfections adapted by dentures to neutralize the shortcomings of conventional dentures in intricate cases involving severely atrophic ridges, increased lip length, maxillofacial defects, etc.[1] Increased interridge distance and decreased denture bearing area in these cases make retention, stability, and support a challenge, that needs the use of intramucosal inserts, suction discs, or springs to improve the prosthesis.[2] While intramucosal inserts have garnered limited acceptance, suction discs or springs are not without their drawbacks, often causing irritation or inefficacy. Making weight reduction of prosthesis more promising approach for improving retention and stability of denture. Hollow denture involves the fabrication of a 3D spacer for reducing weight. This article elaborates on the use of various spacer materials. Polyvinylsiloxane putty, thermocol, glycerin, chocolate, gel wax, and caramel have been explored as innovative choices for spacer. The cases highlight the pros and cons of the techniques and the patient's acceptance and satisfaction with hollow dentures.

CASE SERIES

1. Hollow denture using a two-flask technique

An 86-year-old male patient reported to the Department of Prosthodontics, Crown, and Bridge, complaining about difficulty in chewing. Intraoral examination showed atrophic maxillary and mandibular edentulous ridges having increased interridge distance. Hence, hollow maxillary complete denture and conventional mandibular denture was adopted as a treatment modality.

1. Steps for conventional complete denture fabrication were followed up till the try-in stage.
2. For maxillary denture, owing to denture strength, the distance from the teeth to the denture base was calculated. The rest of the space between the shim of 2 mm thickness and teeth, with 3 mm of the denture base would be occupied by the spacer. The spacer of choice here is polyvinyl siloxane putty.
3. The land area of the cast was indexed at 3 points [one anteriorly and 2 posteriorly] with the help of the scrapper and the try-in denture was sealed to the definitive cast.
4. The try-in denture was duplicated using alginate.
5. A 2 mm thermoplastic sheet template was adapted on the duplicated cast with vacuum heat-pressed machine.
6. For processing, two split denture flasks with interchangeable counters were used.
7. The first flask was used to dewax the try-in denture in the conventional way.
8. After the wax elimination, 2 mm of baseplate wax was adapted onto the dewaxed definitive cast in the base flask.
9. A second Counter flask was used to pour this baseplate adapted wax and processed using heat cure polymerizing resin.
10. After deflasking, the template was placed on the definitive cast using the indices as a guide. An endodontic file with a rubber stop was used to measure the space between the premolar region of the template and the processed denture base. Available space was calculated by subtracting the measured file length from the space between the template and 2mm below the cervical line of teeth. Therefore, the spacer would occupy the area between the line marked 2mm below the cervical line of teeth and the denture base.
11. Polyvinylsiloxane putty was adapted on the processed base to occupy the space that will form a hollow denture. The polymerized putty was shaped to leave 2 to 3 mm of space below the teeth and 1 mm on the buccal and palatal surfaces. The first counter flask was reseated on the base with the putty spacer to verify for complete closure.
12. Heat cure polymerizing resin was packed and cured.
13. After processing, two openings were made on the distal part to remove the putty using thick orthodontic wire. The holes were sealed with self-cure acrylic resin.
14. The denture was finished and polished and the seal was verified by floating technique.

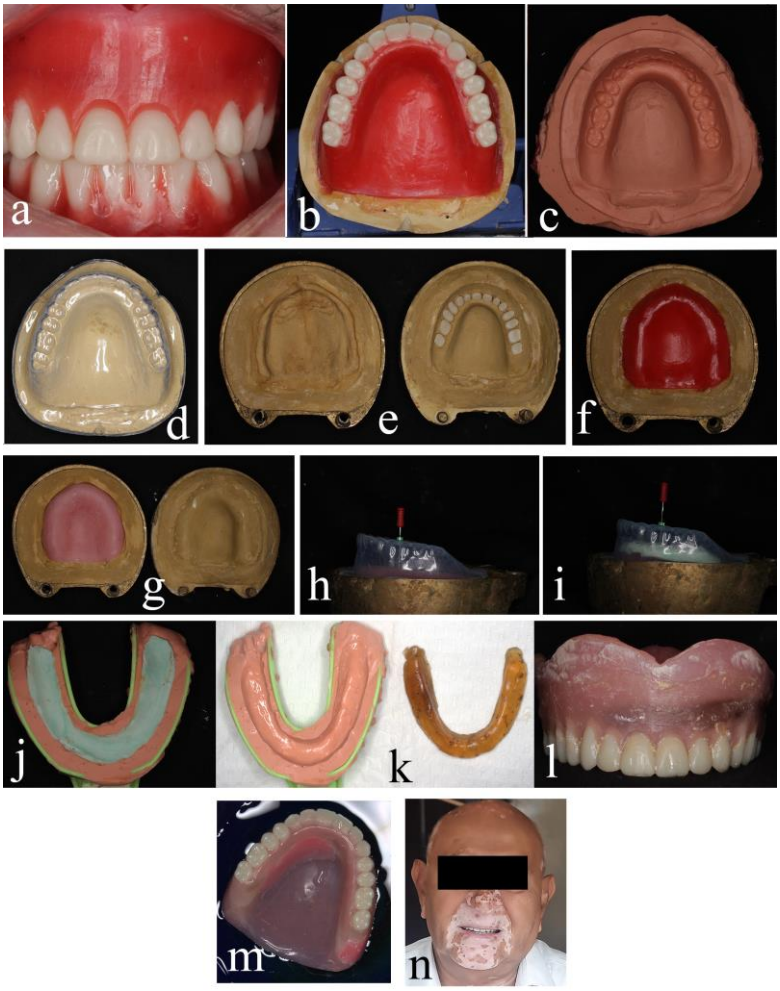

Figure 1: (a) Final trial of the denture (b) Waxed-up maxillary denture (c) Alginate impression of the waxed-up maxillary denture (d) A 2mm thick polyethylene sheet pressed on the duplicate stone cast of waxed maxillary complete denture (e) Dewaxing of flask (f) A 2mm thick modelling wax adapted over the master cast to ensure adequate and uniform resin thickness in the complete denture (g) Processed heat cure denture base. (h) Measuring the distance between the denture base and polyethylene sheet (i) Measuring the distance between the putty spacer and polyethylene sheet. (j) Alginate impression of temporary putty spacer (k) soap spacer (l) Soap seen within the processed maxillary denture (m) Floating denture after retrieval of soap and sealing holes (n) post-operative extraoral view

2. Hollow denture using caramel

A 71-year-old male patient with a history of surgically operated mucormycosis reported to the Department. Intraoral examination revealed Aramany class IV maxillary defect and a completely edentulous mandibular arch. A hollow closed bulb maxillary obturator prosthesis and a conventional mandibular complete denture were planned to improve the retention and stability of dentures.

1. The preliminary impression, final impression, and maxillomandibular jaw relation were recorded in a conventional manner.
2. Due to poor neuromuscular coordination, non-anatomic teeth were given in the denture. A trial of waxed-up dentures was done and flasking followed by dewaxing was done in a conventional way.
3. A 2 mm baseplate wax was then adapted on the teeth in the counter flask and on the maxillary cast to mimic the denture surface with heat cure resin.
4. Silicone putty was placed into the defect and the flask was closed.
5. The two halves were then separated, the putty was removed and the excess was trimmed. The accurate fit of the putty

spacer was verified again by flask closure.
6. An alginate impression of the putty spacer was made.
7. Some amount of sugar was melted to form caramel. This caramel was then poured into the alginate mold and allowed to set.
8. The set caramel was placed into the flask and checked for proper closure.
9. Since the wax was adapted on both the halves, it was again dewaxed.
10. Once confirming the proper closure of the flask, heat-polymerizing acrylic resin was packed, ensuring the alignment of the caramel spacer correctly.
11. Denture was cured using conventional method.
12. After processing, holes were created at the distal end of the teeth on both sides.
13. Denture was immersed in water until the total dissolution of caramel.
14. The cavity is now dried, and the holes were sealed using autopolymerizing resin.
15. The denture is polished, and the seal's integrity is confirmed by immersing the denture in water.

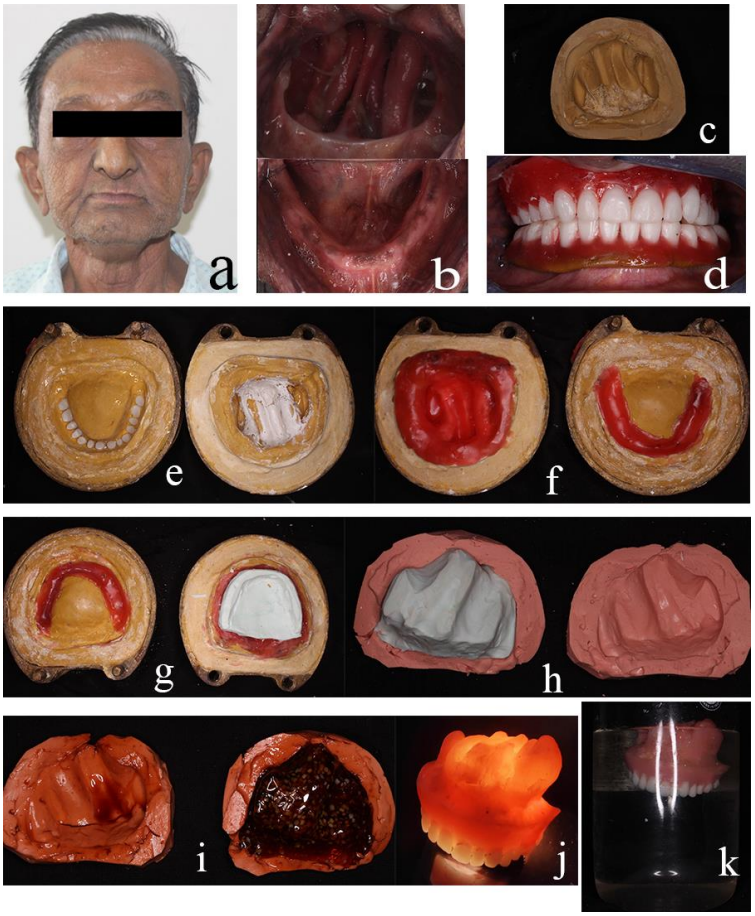

Figure 2: (a) Preoperative extraoral view (b) Preoperative intraoral maxillary and mandibular arch (c) Master cast of the maxilla (d) Final denture trial (e) Dewaxing of flask (f) A 2mm thick modeling wax adapted to ensure uniform resin thickness in the complete denture (g) Making temporary putty spacer by placing putty on the wax sheet adapted on cast and flask closure (h) Alginate impression of putty spacer for making a mold (i) Melt sugar and pour it into the mold (j) Transillumination of denture reflecting hollow cavity (k) Floating denture

3. Hollow denture using glycerin

A 52-year-old male patient came to the department with a chief complaint of inability to chew food and an unaesthetic appearance. Systemic history revealed diabetes mellitus for 5 years and

mucormycosis 1 year ago. An intraoral examination revealed a class IV maxillary defect. A removable maxillary closed bulb obturator prosthesis was planned.

The process of fabrication of a hollow denture is almost similar to the case mentioned above with the difference of using a glycerin spacer instead of caramel.

The steps for fabricating a denture were done according to the conventional method until the stage of dewaxing.

1. A 2 mm baseplate wax was adapted on the intaglio surface of the cast in the base flask and on the teeth in the counter flask assuming heat cure acrylic in its place in the final denture.
2. Putty body silicone was mixed and placed into the defect area in the base flask and into the trough area beneath the teeth in the counter flask and the two halves were closed.
3. After setting, the flask was separated and two separate putty spacers were obtained.
4. Molds were made for these putty spacers with alginate and silicone.
5. Later, a transparent glycerin bar was melted and poured into both molds.
6. After the glycerin was set, it was packed into the flask within the heat cure resin.
7. The denture was processed.
8. A few holes were made in the defect part of the maxillary denture, and the glycerin was removed with the help of an orthodontic wire and by immersion into water.
9. The holes were sealed with autopolymerizing resin.
10. The denture was polished and checked for the integrity of the seal by immersing it in water.
11. Denture was delivered giving adequate denture retention and stability to the patient.

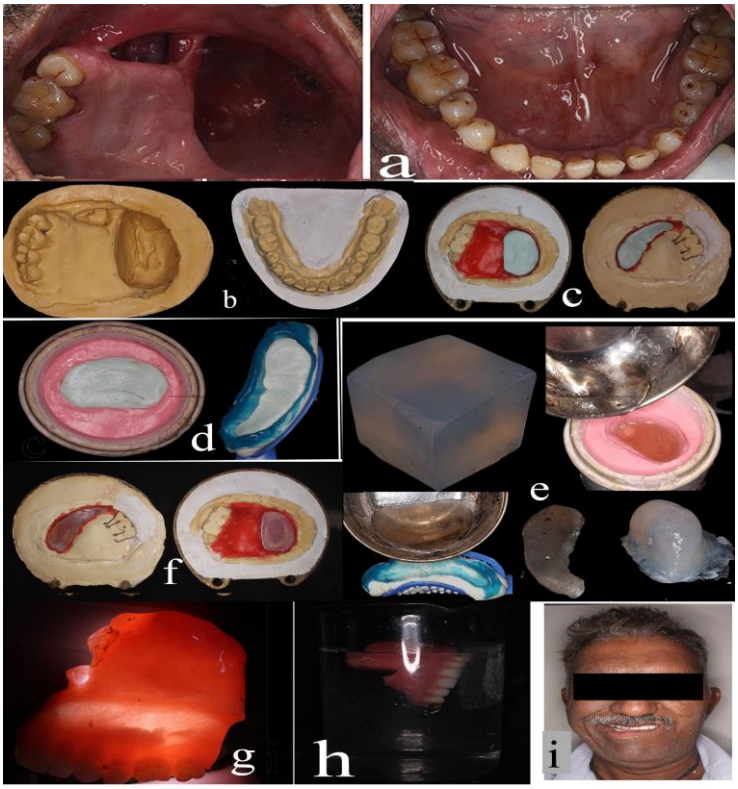

Figure 3: (a) Preoperative intraoral view (b) Master cast of maxilla and mandible (c) Placing putty on 2 mm modeling wax adapted on the cast and teeth for uniform resin thickness after dewaxing. (d) Taking impression of the temporary putty spacer (e) Making glycerin spacer by melting and pouring it into the mold (f) Trial closure checked with spacer (g) Floating denture (h) The light passing through denture indicates hollow cavity (i) Postoperative extraoral view

4. Hollow denture using gel wax

A 61-year-old male patient reported to the department having a chief complaint of inability to chew food. He gave a history of diabetes mellitus and was hit by mucormycosis in the Covid era. Intraoral examination showed an atrophic maxillary ridge and missing teeth 11,21,22,23, 24,25,26,27. A hollow removable maxillary partial denture was planned.

New material was tried for crafting this hollow denture. Gel wax that is used for making candles was used as a spacer to form a hollow cavity. The steps were akin to the previous case.

1. Instead of melting glycerin, gel wax was melted and poured into the mold formed by taking an alginate impression of the putty spacer.
2. The gel sets quickly within 5 minutes and is ready to be packed into the flask for fabricating a hollow denture.
3. It was observed that the hollow cavity was already exposed on the buccal side of the denture.
4. The gel was retrieved through it and the exposed area was then sealed with autopolymerizing acrylic resin and confirmed with a float test.
5. The denture with reduced weight was polished and delivered to the patient.

The advantages of this method were its ease of use and retrieval, simple, and less time-consuming as well as cost-effective.

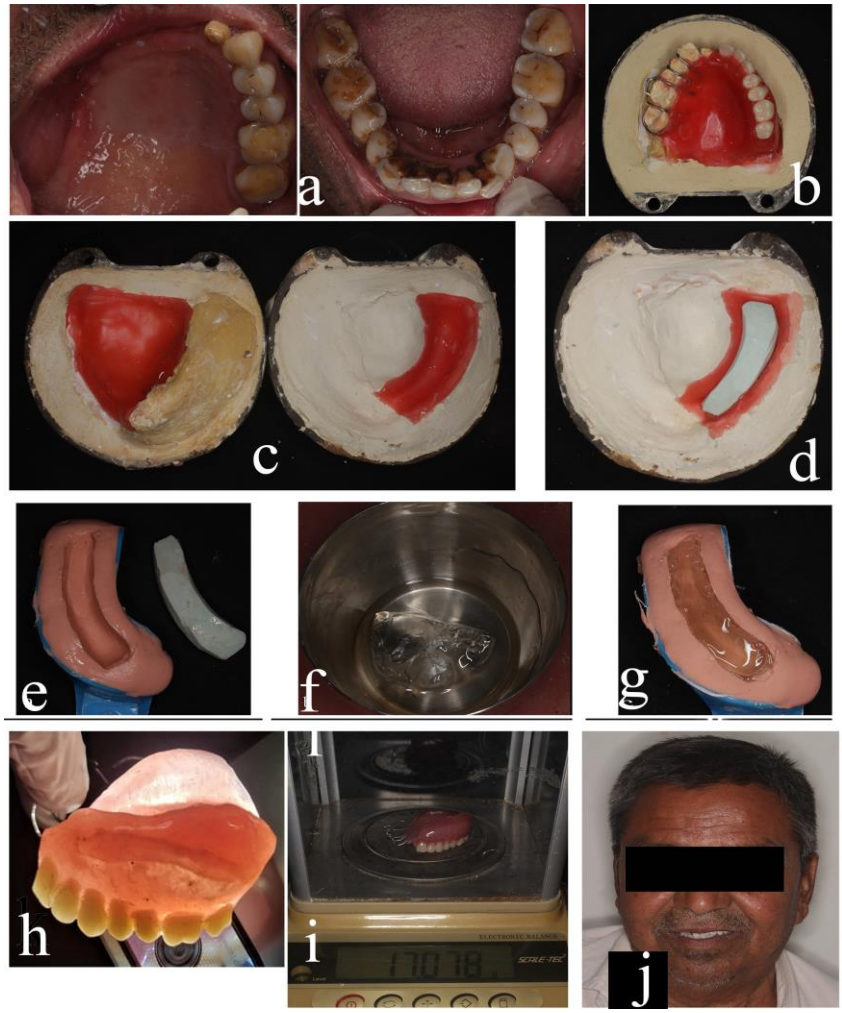

Figure 4: (a) Preoperative intraoral view (b) Flasking of the maxillary denture (c) A 2mm thick modeling wax adapted on cast and teeth (d) Making putty spacer by placing it over wax in the counter flask and close the flask (e) Making mold out of alginate impression. (f) Melting gel wax (g) Let the gel wax set in the mold (h) Transillumination of denture indicating hollowness (i) Light weight of denture (j) Smile of satisfaction.

5. Hollow denture using chocolate

A 48-year-old male patient had a chief complaint of difficulty in mastication. Intraoral examination revealed partially edentulous maxillary and mandibular aches. A hollow removable maxillary denture and a conventional mandibular partial denture were fabricated.

The steps followed in the previous cases are similar except for the spacer material used for making a hollow denture. New material was tried for crafting this hollow denture. Dairymilk chocolate spacer was used for packing within the heat cure resin while processing. The chocolate was removed through holes made into processed dentures

It gives an even thickness of denture, is easy to remove, and is cost-effective. However, it is a little tacky to use.

Figure 5: (a) Dewaxing of maxillary partial denture (b) Modelling wax adapted on cast in the flask and on teeth in counter flask resembling resin thickness (c) Chocolate spacer made (d) After deflasking,, chocolate color seen through denture resin (e) Weight reduction of the denture (f) floating denture (g) Postoperative extraoral view

6. Hollow denture using thermocol

Another patient with a history of surgically operated mucormycosis with class IV maxillary defect reported to the department and a hollow open bulb obturator was planned for the patient.

The processing technique is similar but thermocol was used to reduce the weight of the denture. Also, there was no need for the removal of thermocol from the processed denture. It successfully reduced the weight but resulted into a denture with porosities and looked unaesthetic.

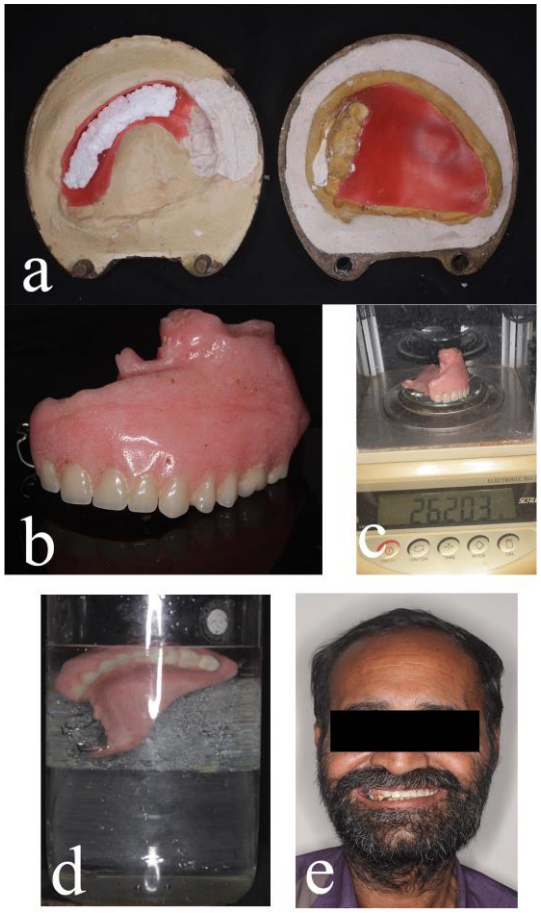

Figure 6: (a) Thermecol cut into shape into the space between the flask and counter flask. (b) Finished open bulb hollow obturator with white grainy appearance of thermocol (c) weight of denture (d) Floating denture (e) post-operative extra oral view

DISCUSSION

Creating space within the denture, leading to reduced weight and the development of a hollow cavity inside, is termed a "hollow denture."

Fattore, Fine, and Edmonds[3] used a double-flask method to reduce denture weight. The disadvantages included the risk of seepage of fluid into the junction. difficult to measure and gauge the thickness and a common area for denture adjustment.

O Sullivan et al.[4] used a transparent pressure-formed matrix of trial denture external contours to facilitate the fabrication of silicon putty cavity form. The authors proposed that heat polymerizing a part of the denture with polymerized resin can minimize leakage at the denture's junction,

Aggerwal et al.[5] inculcated the “Lost salt technique” and the neutral zone concept for hollow dentures. Half of the heat-cured acrylic resin in a semi-soft state was placed over the dewaxed mold, with salt crystals positioned on it. The remaining acrylic resin was added and cured. Salt was then flushed with water through holes made in the denture. It is cost-effective and easy to flush salt but the thickness of denture is not uniform and results in porosities.

Gopinadh Anne et al.[6] weighed hollow dentures made by using cellulose balls, polyacrylic fibers, and bean balls. The authors concluded that bean balls showed a maximum of 31.3% weight reduction. But they were considered “whispy prostheses” as the material was left inside the denture.

The literature shows the use of various other materials for hollowing dentures, including vinyl polysiloxane putty, thermocol, dough of plaster-pumice-sugar syrup, salt crystals, modeling clay, surgical catheter and orthodontic wire, gelatin, and vacuum formed thermoplastic sheet with salt. While some materials like vinyl polysiloxane putty

pose retrieval challenges, others like salt, caramel, and glycerin soap, can be easily removed from the cavity.[7]

The use of the double flask technique was cumbersome and more time-consuming, with increased cost as well. In other cases, single-flask techniques had additional advantages. It does not require an additional flask and an extra step for hollowing is avoided.

The advantages of using caramel are the ease of retrieval which is highly soluble, cost-effective, and easy. Disadvantages include its brittleness so there are chances for it to break under compression molding.

It is easy to recontour glycerin, sustains high curing temperature, and is easy to retrieve. However, it is time-consuming to remove glycerin from the denture cavity. There could be incomplete removal of the glycerin. Authors Anchal Qanungo et al.8 (2016), Barman J et al.9 (2020), Nimonkar Sharayu et al.10 (2020), Kamaldeep Sharma et al.11 (2023) also found similar results and stated the advantages of using glycerine spacer.

Other new materials like gel wax and chocolate were tried for the first time in literature for hollow denture fabrication. It gave equivalent results. However, gel wax being soft, has to be handled gently and was pushed out under compression molding. Chocolate can be used but it is tacky and sticky to use. The issue with thermocol is the denture looks ugly and seems to have porosities in the denture. The exact thickness cannot be measured. It gets displaced under compression molding and thermocol stays withing the denture.

CONCLUSION

Amongst different materials that were used, glycerine was considered to be the best due to the following reasons:

1. It gives a uniform thickness of the denture.
2. There were no porosities.
3. It sustains high curing temperature.
4. Easy to carve and retrieve
5. Esthetic.
6. Simple to use and cost-effective.

Declaration by Authors

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REFERENCES

1. Radke U, Mundhe D. Hollow maxillary complete denture. J Indian Prosthodont Soc. 2011 Dec;11(4):246-9
2. Wyatt CC. The effect of prosthodontic treatment on alveolar bone loss: a review of the literature. J Prosthet Dent. 1998 Sep; 80(3):362-6.
3. Fattore LD, Fine L, Edmonds DC. The hollow denture: an alternative treatment for atrophic maxillae. J Prosthet Dent 1988;59: 514-6.
4. O'Sullivan M, Hansen N, Cronin RJ, et al. The hollow maxillary complete denture: a modified technique. J Prosthet Dent 2004; 91(6):591-4.
5. Aggarwal H, Jurel SK, Singh RD et al. Lost salt technique for severely resorbed alveolar ridges: An innovative approach. Contemp Clin Dent 2012;3:352- 5.
6. Gopinadh Anne et al. Wispy Prosthesis: A Novel Method in Denture Weight Reduction Journal of Clinical and Diagnostic Research 2016;10(4): ZC31-ZC34.
7. Shaikh, Dr & Pattanaik, Dr & Pattanaik, Dr & Sunder, Dr. (2021). Maxillary hollow denture: A literature review. International Journal of Applied Dental Sciences. 7. 517-520.
8. Qanungo A, Aras MA, Chitre V, Mysore A et al. An Innovative and Simple Technique of Hollow Maxillary Complete Denture Fabrication. J Clin Diagn Res. 2016; 10(8):ZD23-ZD25.
9. Barman J, Rahman R, Bhattacherjee S. Fabrication of hollow maxillary complete denture: A simplified technique. Int J Oral Health Dent 2020;6(1):63-5.
10. Sharayu Vinod Nimonkar et al. A method of hollowing the obturator prosthesis and an overview on the pros and cons of the

various materials used for hollowing, Journal of Medicine and Life. Vol: 14 Issue: 3 May-June 2021
11. Sharma, Kamaldeep & Jain, Reeta & Singh, et al (2023). Hollow denture fabrication using putty index: A case report. IP Annals of Prosthodontics and Restorative Dentistry. 9. 44-47.

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