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CASE REPORT

Post maxillectomy definitive rehabilitation in post-covid mucormycosis patients using conventional and 3D printed obturator: A twin case report

Manu Rathee, Santhanam Divakar*, Prachi Jain, Sandeep Singh, Sujata Chahal

Department of Prosthodontics, Post Graduate Institute of Dental Sciences, Rohtak, Haryana, India

Maxillectomy is the surgical removal or resection of the maxilla or upper jaw bone. Maxillectomy may be total or partial. It is performed during surgical treatment of cancer and infections (bacterial. fungal) of the oral cavity, nasal cavity and maxillary sinuses. Patient affected from post-Covid mucormycosis require local debridement or surgical resection resulting in maxillectomy. After surgery, patient has difficulty in mastication, speech, and swallowing because of communication between oral and nasal cavity. This may also give rise to psychological challenges and social exclusion. The prosthodontic rehabilitation of such patient using obturator provide a separation between oral and nasal cavity and improve the quality of life of the patient. There are various techniques and materials used for fabrication of definitive obturator. This article discusses the prosthodontic rehabilitation after maxillectomy in post-covid mucormycosis patients using obturator by conventional and 3D printed techniques.

Keywords: 3D printing, conventional technique, mucormycosis, obturator, rehabilitation.

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Introduction

Mucormycosis is an invasive fungal infection commonly reported during second wave of Covid-19 especially in patients who underwent oxygen therapy and corticosteroid medication [1,2]. The rhinocerebral form of mucormycosis is the most common form affecting the oral, nasal, orbital and paranasal sinus regions. Surgical resection in these patients results in complete or partial maxillectomy due to which the patient has drastic dimensional changes in the extraoral and intraoral region including collapsed facial form and profile, inadequate soft tissue support, reduced lower facial height, oro-antral communication, and unesthetic senile appearance. It also affects mastication, speech, swallowing, facial expression and mandibular movements [1,3].

A prosthodontist plays a key role in rehabilitation of these patients that not only aids in regaining the regular life style, appearance and confidence but also improves the psychological well-being and quality of life of these patients. Removable obturator plays a bridging role after surgical resection until patient is completely recovered for implant surgery. There are various techniques available for fabrication of obturator such as conventional curing, CAD/CAM and additive manufacturing (3D printing) [4,5]. This article discusses rehabilitation of maxillectomy patient with obturator prosthesis fabricated using two different techniques i.e. conventional and 3D printed techniques.

* Correspondence to: S Divakar
E-mail: divakarsanthanam17@gmail.com

Case 1

Case history and examination

A 52-year-old female reported with difficulty in swallowing food and speech due to palatal defect for past 3 months. Patient was Covid-19 positive six months back and underwent inhalational oxygen therapy for 2 weeks along with IV corticosteroids (methylprednisolone 40 mg every 12 hours for 5 days) and antiviral medications (Remdesivir for 7 days). Four months back, patient had pain and palatal ulceration with mild extraoral facial and orbital swelling. Patient was diabetic, hypertensive and under medication for both. After clinical and laboratory examination, she was diagnosed with Post-Covid Rhinocerebral Mucormycosis. The patient underwent inferior maxillectomy (removal of hard palate, teeth and lower part of maxilla) 3 months back and was on antifungal medications (IV Liposomal Amphotericin B daily for 14 days). On extraoral examination, patient had peri-orbital swelling and apraxia of left eyelids, mid-face collapse, inadequate upper lip support, retrognathic profile and senile appearance due to complete loss of teeth and maxillary ridge (Figure 1A-B). On intraoral examination, patient had completely edentulous maxillary arch with complete loss of alveolar region and with completely dentulous mandibular arch (Figure 1C-D). The defect extended from premaxillary region to maxillary tuberosity and had 6*7 cms depth into the nasal cavity and 5*6 cms width in the oral cavity. There was visibility of nasal septum, inferior conchae and some exposed bone. There was also through and through communication between oral and nasal cavities and restricted mouth opening.

FIg. 1. A. Pre-rehabilitative frontal view B. Pre-rehabilitative smile view C. Intraoral maxillary defect D. Intraoral mandibular view

Treatment plan

The defect was healed completely, thus, on consultation with oral surgeon, definitive prosthesis was planned. Considering the size of the defect and bulk of the prosthesis, a two-piece definitive hollow obturator prosthesis was planned. A written informed consent was obtained.

1st part: Fabrication of conventional hollow obturator

The primary impression was made using irreversible hydrocolloid material (Algitex DPI, India) after blocking the palatal defect area using gauze piece tied by dental floss (Figure 2A). Custom tray was fabricated and secondary impression was made using putty and light body addition silicone elastomeric impression material (Avuegum Light body and putty; Dental Avenue) (Figure 2B). The impression was poured and the master cast was obtained (Figure 2C).

Modelling wax of 2 mm thickness was adapted all around the defect area to provide equal thickness around hollow bulb. The putty addition silicone material was mixed and placed into the two-defect area for silicone putty index (Figure 2D). The remaining wax up was performed above the putty index and conventional dewaxing was carried out followed by retrieval of silicone putty index. A replica of glycerine soap (Pears Natural Glycerine Soap bar, India) was carved out with similar dimensions as that of the putty index (Figure 2E). Heat cure acrylic (DPI heat cure; Dental Product of India) resin was mixed in dough stage and a single layer was placed into the defect area, putty index was placed above it in the exact position and the first trial closure was performed (Figure 2F). The flask was reopened, putty index was replaced by glycerine soap into the hollow cavity and the second layer of heat cure resin was packed (Figure 2G). Then, final closure was done and conventional curing was carried out.

The prosthesis was retrieved, two vent holes were made at anterior and posterior aspects of hollow bulb and the soap was removed using a three-way syringe and stainless-steel orthodontic wire (Figure 2H). The vent holes were blocked using self-cure resin and finishing and polishing of the obturator was done. The prosthesis was evaluated for hollowing effect by placing in water (Figure 2I-J).

Alveolar ridge fabrication

The resected alveolar ridge was waxed up on the cameo surface of the obturator followed by conventional dewaxing and curing was performed. Thus, a single plate hollow obturator with alveolar ridge was obtained (Figure 3A-B).

2nd part: Fabrication of denture part of obturator

The 1st part of the prosthesis with ridge anatomy was kept in position and picked up using irreversible hydrocolloid impression material (Figure 3C). The impression was poured using type III gypsum product after removing 1st plate from the impression and master cast was retrieved (Figure 3D). Over the cast, temporary denture was made of self-cure resin, occlusal rim was fabricated and maxillomandibular jaw relation was recorded (Figure 3E). The

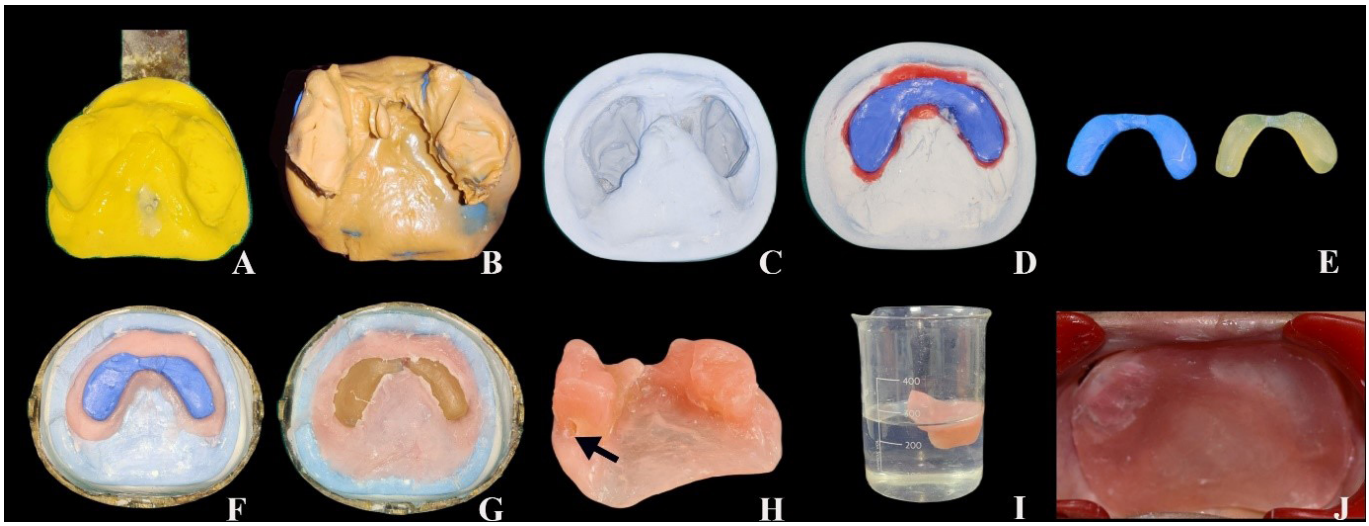


FIg. 2. A. Primary impression B. Secondary impression C. Master cast D. Wax-up and silicone putty index E. Replica of glycerine soap F. Trial closure with putty index G. Putty index replaced by glycerine soap H. Holes (black arrow) made at intaglio surface to remove soap and filled with self-cure resin I. Determining the hollowing effect I. Final 3D printed interim obturator in situ

semi anatomic teeth (Acryrock crosslinked, Ruthinium) was used for teeth arrangement in Angle's class I relationship (Figure 3F). The denture part was fabricated from heat polymerising acrylic resin (DPI heat cure; Dental Product of India) using conventional polymerisation technique followed by trimming, finishing, and polishing (Figure 3G).

Retentive assembly of 1st and 2nd part

A pair of magnets of 12*5 mm (cobalt-samarium, Ambica Corporation, New Delhi, India) were used as the retentive material between the hollow obturator and denture part of the prosthesis. A circular trough was made in the 1st part and 2nd part and a pair of magnets was secured using self-cure resin (Figure 3H).

Insertion and postoperative instructions

The hollow obturator and the denture part were inserted into the patient mouth and evaluated for retention, stability, speech and esthetics. Since the 1st piece prosthesis was less retentive, a soft permanent reliner (MOLLOSIL chairside soft relining) was placed in the undercuts to obtain retention (Figure 4A-D). Post-rehabilitative instructions were given and recalled for periodic follow-up to get the relining material changed once in six months to avoid denture stomatitis.

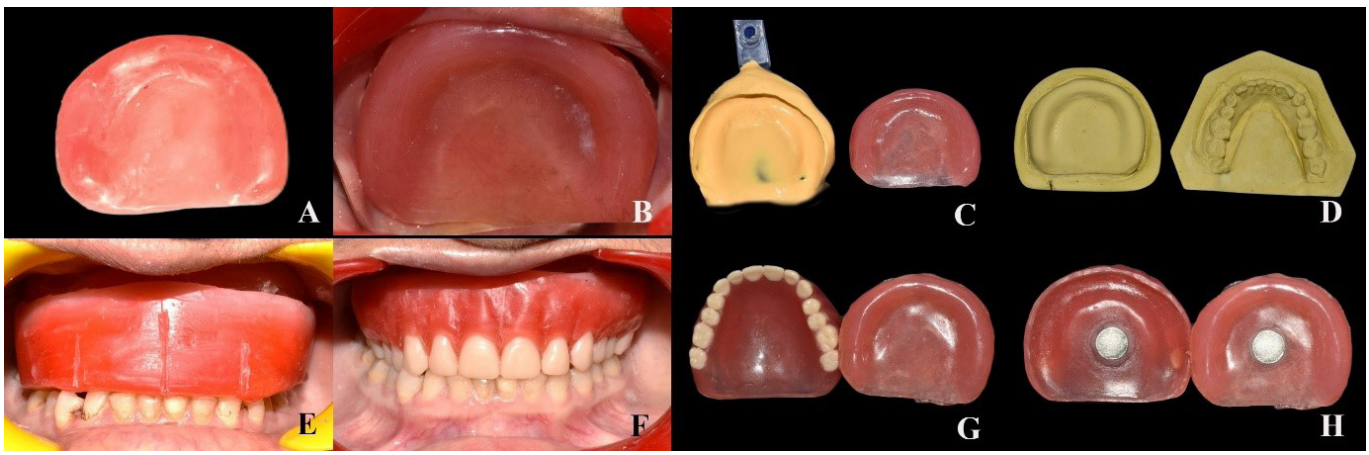
Case 2

Case history and examination

A 46-year-old male reported with nasal regurgitation of ingested food and liquid. Patient was Covid 19 positive two months back and underwent inhalational oxygen therapy and steroids same as case 1. One month back, patient had pain, palatal ulceration with mild extraoral facial and infra-orbital swelling. Patient was diabetic (de novo) and not under medication. He was diagnosed with Post-Covid Rhinocerebral Mucormycosis, underwent infrastructure maxillectomy 20 days back and was on antifungal medications. The extraoral and intraoral features for case 2 were almost similar to case 1 (Figure 5A-B). The defect extended from premaxillary region to maxillary tuberosity with 4*5 cm height into the nasal cavity and 5*6 cm width (Figure 5C-D).

Flg. 4. A. Soft permanent reliner (Mollosil) B. Final two-piece prosthesis relined and attached with each other using magnets C. Final two-piece prosthesis in situ D. Post-rehabilitative view

Flg. 5. A. Pre-rehabilitative frontal view B. Pre-rehabilitative lateral view C. Intraoral maxillary defect D. Intraoral mandibular view



Flg. 3. A. Anatomic alveolar ridge fabrication B. Final Antral part of obturator with alveolar ridge in situ C. Pick-up impression D. Final cast E. Jaw relation F. Try in G. Final prosthesis H. Final prosthesis with magnet attached between oral and antral part

Treatment plan

Since the defect was not healed completely, an interim 3D printed hollow obturator was planned followed by rehabilitation using two-part definitive obturator prosthesis after 3 months.

1st part: Fabrication of 3D printed hollow interim obturator

The impressions were made same as case 1 (Figure 6A-D). After master cast was retrieved, the SMART desktop scanner (open technologies FARO Europe) was used to scan the master cast (Figure 6E). Digital files were exported in the EXOCAD software (Exocad GmbH, Dermstadt, Germany), and the cameo surface of interim obturator was designed (Figure 6F). The hollow bulb into the defect area was designed with appropriate thickness of border (3mm) using "Hollow" function in the software and the two vent holes were designed using "Generate holes" option in software to prevent hydraulic pressure during 3D printing. The hollow bulb obturator design was exported in a standard tessellation language (STL) file format. By using light-polymerising acrylic resin and 3D printer Solido SD300 (Solidmodel, Acton, USA), the interim hollow bulb obturator was fabricated and evaluated for hollowing effect by placing in water (Figure 6G-I).

The final prosthesis was inserted in the patient mouth (Figure 6J) and was recalled after 3 months for definitive rehabilitation.

Definitive prosthesis

After 3 months, the defect area was evaluated for healing and consulted with oral surgeon for definitive prosthesis. The hollow bulb obturator was relined using soft reliner similar to case 1 for retention and stability. The fabrication of anatomic alveolar ridge, denture part (2nd part), and retentive aids between two parts were followed similar to case 1 (Figure 7A-H) (Figure 8A-D).

Discussion

Various rehabilitation options are available for maxillectomy patients such as removable and fixed implant supported prosthesis. Zygomatic and pterygoid implants are the treatment of choice which provides improved function and aesthetic appearance. However, there are some limitations such as cost, complex procedure, increased time and dif-

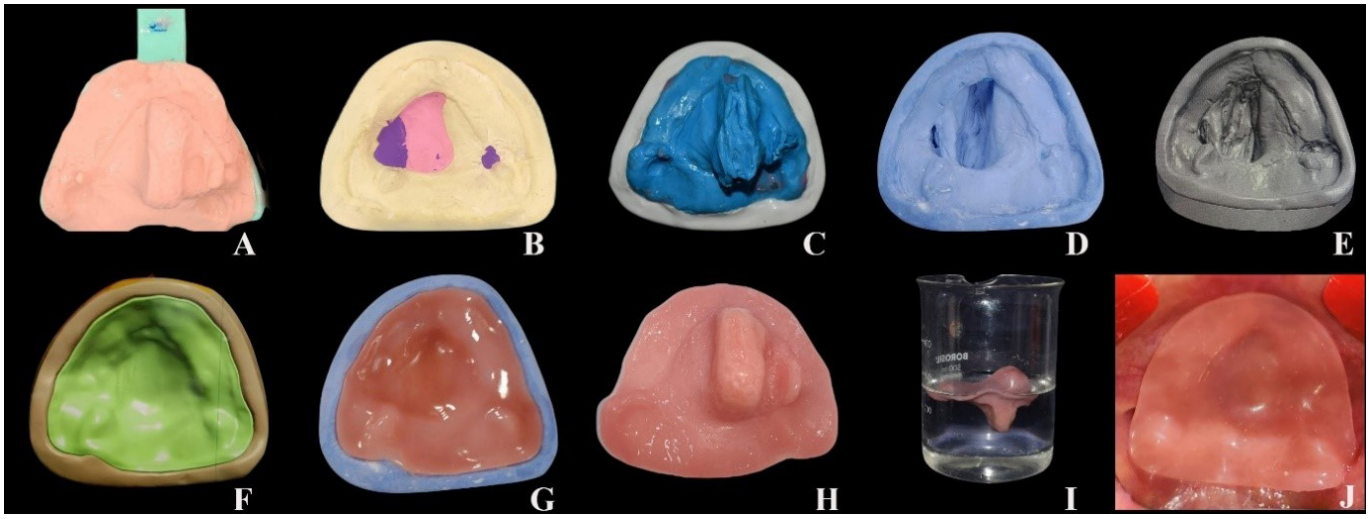


Fig. 6. A. Primary impression B. Primary cast with blocked undercuts C. Secondary impression D. Master cast E. Laboratory scanned master cast using SMART scanner F. EXOCAD designing of obturator G. 3D printed obturator (cameo surface) H. 3D printed obturator (intaglio surface) I. Determining the hollowing effect J. Final 3D printed interim obturator in situ

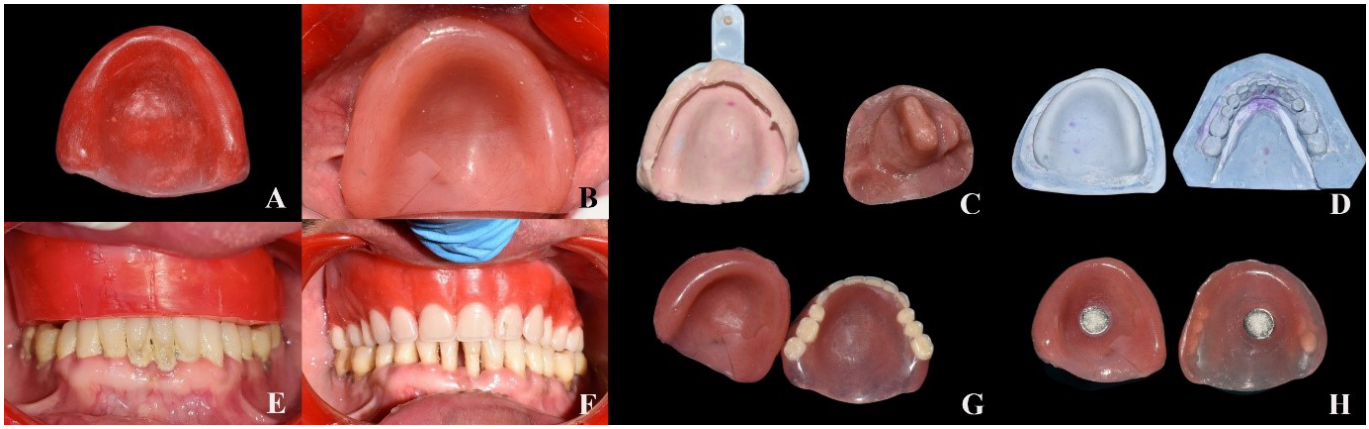


Fig. 7. A. Anatomic alveolar ridge fabrication B. Final Antral part of obturator with alveolar ridge in situ C. Pick-up impression D. Final cast E. Jaw relation F. Try in G. Final prosthesis H. Final prosthesis with magnet attached between oral and antral part

FIg. 8. A. Soft permanent reliner (Mollosil) B. Final two-piece prosthesis relined and attached with each other using magnets C. Final two-piece prosthesis in situ D. Post-rehabilitative view

ficulties in maintenance of the prosthesis. Also, since most of these patients are old and debilitated, a second surgery immediately after surgical resection must be avoided [6].

The removable obturator plays an alternative treatment option which provides adequate obturation of the defect area and easy maintenance of the prosthesis. Based on placement of obturator, it is of three types, immediate (before 48 hrs), interim (after 48 hrs-3 months) and definitive obturator (after 3 months) [7]. The definitive obturator can be a single piece or a two-piece prosthesis. The major hurdles for single piece removable prosthesis are size, extent and configuration of the defect area, condition of the remaining soft and hard tissues, remaining undercuts, and retention and stability of the prosthesis. Since most of these patients have restricted mouth opening and muscular movement, a large single piece obturator results in problems such as non-retentive, increased weight, difficulties in removal and insertion of the prosthesis [8].

In order to overcome these limitations, closed hollow bulb two-piece obturator prosthesis i.e., hollow antral piece (1st part) with anatomical residual alveolar ridge and denture piece was fabricated through innovative use of glycerine soap and silicone putty index for hollow denture fabrication. This will prevent nasal regurgitation of food particles [9].

In the first case, a closed hollow bulb was fabricated using conventional compression molding technique. The conventional technique had the disadvantage of uneven thickness around hollow bulb, porosities, is time consuming and is not suitable for complex designs. Hence, in the second case, we used additive manufacturing (3D printing) for fabrication of hollow bulb that has the advantage such as accuracy, detail reproduction, reduced wastage of material, produce complex structure easily compared to CAD/CAM and require no skilled operators [10, 11].

For retention, the soft permanent reliner was used as a retentive material in the antral part (1st piece) which has the advantages of improved fit and masticatory efficiency, easy placement in the undercuts areas and is atraumatic to the defective mucosa [12]. The magnets were used as a retentive aid between the 1st and 2nd piece that has the advantage of ease of insertion and removal, automatic reseating, strong attractive forces and easy replacement if needed in future [13].

Eventhough the recurrences rate of the mucormycosis is high, the elimination of the cause of the immunocompromised condition, systemic high doses of antifungal medications, surgical removal of nonviable tissues, and prosthetic rehabilitation with oral hygiene counselling will improve the self-esteem of the patient and avoid recurrences [14].

Conclusion

Rehabilitation of complex maxillary defects is a challenging task for prosthodontist due to less favorable undercuts and increased weight of the prosthesis. In our cases, since both the patient had collapsed mid-face and restricted mouth opening, a two-piece prosthesis retained by silicone reliner and magnets was fabricated that significantly improved the self-confidence and the quality of life of the patient.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Conflict of interest

None to declare.

References

1. Rathee M, Alam M, Ahlawat A, S D, Chahal S. Management of Mucormycosis Resultant Hemimaxillectomy Defect from Interim Hollow Obturator to Definitive Two-Piece Magnet Retained Prosthesis - A Case Report. RGUHS J Dent Sci. 2022;14(1):56-59.
2. Ahmadikia K, Hashemi SJ, Khodavaisy S, et al. The double-edged sword of systemic corticosteroid therapy in viral pneumonia: A case report and comparative review of influenza-associated mucormycosis versus COVID-19 associated mucormycosis. Myc. 2021;64(8):798-808.
3. Mahajan K, Das M, Kumar GA. Post-surgical immediate prosthetic reconstruction in patients with rhinocerebral mucormycosis. J Fam Med Prim Care. 2022;11(1):379-385.
4. Rathee M, Singh S, Malik S, S D, Alam M. Reconstruction and Rehabilitation of Maxillary Defects Secondary to Mucormycosis. Saudi J Oral Dent Res. 2022;7(1):1-7.
5. Alfaraj A, Su FY, Lin WS. CAD-CAM Hollow Obturator Prosthesis: A Technical Report. J Prosthodont. 2022 Mar 28.
6. Puryer J, Forbes-Haley C. An Implant-Retained Obturator – A Case Study. Dent Update. 2017 May;44(5):415-8, 421-2.
7. Meenakshi A, Shah D. The obturator prostheses for maxillectomy. SRM J Res Dent Sci 2012;3:193-7.
8. Sridevi JR, Kalavathy N, Jayanthi N, Manjula N. Techniques for fabricating hollow obturator: Two case reports. SRM J Res Dent Sci 2014;5:143-6.
9. Qanungo A, Aras MA, Chitre V, Mysore A, Da Costa GC. An Innovative and Simple Technique of Hollow Maxillary Complete Denture Fabrication. J Clin Diagn Res. 2016;10(8):ZD23-ZD25.
10. Pandey A, Tiwari L. 3D-Printing- The New Frontier in Prosthodontics – A Review. J Adv Med Dent Scie Res 2019;7(11):69-73.
11. Tarika M, A Kohli. 3D Printing in Dentistry – An Overview. Acta Sci Dent Sci. 2019;3(6): 35-41.
12. Yanamoto S, Soutome S, Murata M, Kawakita A, Yamaguchi E, Yoshida K, et.al. Efficacy of silicone soft reliner on the obturator prosthesis

after maxillectomy for oral malignant tumors: A single-arm prospective interventional study. Clin Exp Dent Res. 2020 Dec;6(6):612-7.

13. Rathee M, S D, Malik S, Wakure P, Chahal, S. Rehabilitation and Esthetic Enhancement of Edentulous Patient with Hollow Cheeks Using Innovative Detachable Cheek Plumper: Case Report. Eur J of Dent Oral Heal. 2021; 2(6):9-13.
14. Manjunath NM, Pinto PM. Management of Recurrent Rhinomaxillary Mucormycosis and Nasal Myiasis in an Uncontrolled Diabetic Patient: A Systematic Approach. Int J Appl Basic Med Res. 2018;8(2):122-125.