IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 21, Issue 4 Ser.5 (April. 2022), PP 01-12
www.iosrjournals.org

Management of velopharyngeal defect by a hollow speech bulb prosthesis-a clinical report

Dr.Sumayya.A.Nazar
Junior resident
Department of prosthodontics,
Government dental college,Trivandrum

Dr.Vivek.V.Nair
Professor, Department of prosthodontics,
Government dental college,Trivandrum

Dr.Harshakumar.K
Professor and HOD, Department of prosthodontics,
Government dental college,Trivandrum

Dr.R.Ravichandran
Professor, Department of prosthodontics,
Government dental college,Trivandrum

Abstract
The velopharynx is a dynamic anatomic structure which is essential for normal breathing, eating, and speaking. Impairment of velopharyngeal function can be caused by insufficiency or incompetency. Velopharyngeal (VP) insufficiency is an anatomic defect of the soft palate which renders the palatopharyngeal sphincter incomplete. This case report outlines the correction of velopharyngeal (VP) insufficiency with hypernasality of speech with the aid of speech bulb prosthesis. The prosthesis is a combination of cast partial denture with extension into the defect area with retentive component embedded in heat cure acrylic resin material to aid in retention. This improved the hypernasality, speech, comfort, retention, and overall patient acceptance.

Keywords
Velopharyngeal (VP) insufficiency, speech bulb prosthesis, hollow prosthesis, Cobalt-Chromium metal framework

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Date of Submission: 02-04-2022 Date of Acceptance: 15-04-2022

I. Introduction

Velopharyngeal (VP) insufficiency is an anatomic defect of the soft palate leading to an incomplete closure of palatopharyngeal sphincter. The speech utterance and other oral activities such as swallowing, blowing, sucking, and whistling are regulated by the palatopharyngeal or velopharyngeal (VP) valving mechanism.VP insufficiencies may be classified on the basis of physiology and/or structural integrity as velopharyngeal incompetence, velopharyngeal insufficiency (VPI), and velopharyngeal inadequacy .They are frequently used to denote an improperly functioning velopharynx. Obturation of a velopharyngeal dysfunction attempts to re-establish velopharyngeal closure, control nasal emission during speech, and assist in preventing nasal regurgitation of food and fluids during swallowing. A partial soft palate defect may result from the surgical resection of the posterior border from the medial or lateral posterior portion of the soft palate. With such defects, the velopharyngeal apparatus is compromised, and prosthetic obturation is the treatment of choice. Microvascular flaps may be used to reconstruct these areas. But in many cases,complete obturation of the defect becomes unsuccessful and such a patient is usually referred to the prosthodontist for fabrication of an obturator prosthesis. A pharyngeal obturator is a removable maxillary pr osthesis which has a posterior extension to separate oropharynx and nasopharynx. Prosthetic management of VP insufficiency is done by means of speech-aid prostheses (SAPs), whereas VP incompetence is treated with palatal lift prostheses (PLPs). It provides a stable structure against which the muscle of the pharynx can move to form the palatopharyngeal closure.The functional component of the SAP is a nasopharyngeal section

("speech bulb")that is shaped to conform to the activity of the VP during speech and swallowing, whereas PLP reduces hypernasality by approximating the incompetent soft palate to the posterior pharyngeal wall.

This case report presents the stages of prosthodontic rehabilitation of a patient with a surgical soft palate defect by a velopharyngeal obturator with speech bulb prosthesis along with the correction of hypernasality of speech associated with VP insufficiency.

II. Case History

27 year old male patient reported to the Department of Prosthodontics , Government Dental College, Trivandrum with a chief complaint of nasal regurgitation of fluids.

On examination he had a posterior hard palate and soft palatal defect (Fig. 1). Hypernasality of speech was present with deep caries in 16 region On eliciting the history, the patient had undergone a surgical excision 1 year back for squamous cell carcinoma in the palatal region. A speech aid prosthesis with speech bulb was planned for the patient since he exhibited symptoms of velopharangeal dysfunction.

Extraction of 16,followed by replacement with removable prosthesis along with speech prosthesis was done. The entire procedure was explained to the patient and his consent was obtained

Procedure

The palatal defect (Fig. 1) was blocked with gauze piece-coated with petrolatum jelly. The primary impression of the maxillary arch was made using irreversible hydrocolloid impression material (Fig. 2). An impression was poured using dental stone and the original cast was obtained. Custom tray extending till the defect was fabricated on the primary cast with autopolymerizing acrylic resin blocking the area of teeth with wax. After occlusal rest preparation, a secondary impression of the maxillary arch was made with a custom tray using putty ,light body polysiloxane material (Fig. 3). This impression was poured with a type IV gypsum product. The designing of the prosthesis was done on the primary cast after completing surveying ,this design consists of metal extension posteriorly from posterior palatal full coverage for speech bulb. After metal finishing and polishing, metal framework (co-chr)try-in was carried out in the patient's mouth for confirming proper fit and retention (Fig. 4) . A functional impression of the defect for proper velopharyngeal closure was made by keeping impression material over metal extension mesh (Fig. 5a & 5b) and the gross defect area was recorded with a high fusing impression compound followed by functional border molding of the defect with low fusing green stick compound while patient swallows, speaks, makes a circular head movement and breathes appropriately. Final functional contouring of defect was done by placing a layer of light body material (Fig. 6). This functional impression was attached to master cast with altered cast technique and pouring of defect portion was done with the type III gypsum product(Fig. 7). After the final setting of material, the cast was placed in hot water for removal of the impression for the final altered cast (Fig. 8).For Hollowing the prosthesis, adapt two layers of modeling wax (Modeling Wax No 2) on the labial, palatal, and acrylic binding surfaces of the teeth on the both sides of the same flask, to mimic the final uniform thickness of the acrylic resin. Mix and adapt silicone putty into the space available and close the flask. Maintain the clamp pressure until the putty polymerizes. Open the flask, remove the putty, and trim the excess wherever required. Verify the accurate fit of the putty spacer(Fig. 9). Reassemble the flask to verify accurate flask closure with the putty spacer.Get an index of putty spacer and melted soap(Pears soap) is poured into the mould of the index. After the soap spacer set in the index, remove the soap spacer(Fig. 10) and verify its fit in the flask. Mix heat-polymerizing acrylic resin (DPI Heat Cure, Denture Base Material; Dental Products of India), pack the flask, and carry out a trial closure ensuring orientation of the putty spacer(Fig. 11). Replace the putty spacer with the soap spacer and close the flask(Fig. 12). Polymerize the denture and recover the processed denture in the usual manner . Make two small openings, on the labial aspect of denture and keep the denture in water overnight. Air-dry the cavity, and seal the openings using autopolymerizing resin. Polish the denture in the usual manner. Verify the integrity of the seal after polishing. Thus a speech prosthesis on a Co-Cr metal framework was fabricated(Fig. 13) . The superior surface should be convex and well polished, to facilitate deflection of nasal secretions into the oropharynx. The tongue side of the prosthesis should be slightly concave (Fig 14 &15).Hence a hollow speech bulb prosthesis is fabricated (Fig. 16).

III. Discussion

The role of the soft palate is to maintain the functional separation between the oral and nasal cavities. To fulfill this role, the soft palate undergoes synchronized movements as per the physiological demands of speech, respiration, and deglutition. To produce phonation for vowels and most of the consonants, the velopharyngeal wall needs to be closed completely. In contrast, the VP valve needs to be completely open for the production of nasal sounds (m, n, ng). The defects in the soft palate (congenital or acquired) lead to the continuity between oropharynx and nasopharynx. The primary objectives of prosthodontic therapy are the restoration of mastication, deglutition, and to make speech functionally acceptable. The definitive prosthesis

generally used for VP defect patients is an obturator. An obturator should be a single piece. It can either be closed or open type. Some of the disadvantages of an open type obturator include an unpleasant odor due to the accumulation of nasal secretions and difficulty in polishing the internal surfaces of the obturator [6]. Hence, a closed lightweight hollow bulb obturator is preferred as it is easier to maintain [7]. Hollow bulb obturators reduce the weight of the prostheses from 6.55% to 33.06% depending on the size of the defect when compared to solid obturators [6].Soap solution which is used for creating hollowness can easily be removed. The decreased weight also results in increased retention, better patient acceptability, and comfort. Properly obturated defects reduce the nasalance or hypernasality of voice and hence, speech becomes more clear. Metal framework is used for the fabrication of obturator as conventional treatment of speech bulb prosthesis, fabricated with either self-curing resin or heat-curing resin, has been associated with drawbacks such as inadequate marginal adaptation, soft palate discomfort, and ulcerations [5].The metal framework extended from the prosthesis posteriorly and laterally rendered enough palatal support, improved function, swallowing, and reduced the hypernasality of speech. This was reaffirmed by asking the patient to say "s" sounds after the insertion of prosthesis.

IV. Conclusion

A definitive prosthesis in the form of a Co-Cr cast partial denture with a hollow bulb in the defect area can be a suitable treatment option for patients with palatopharyngeal defects; in order to restore their speech, swallowing, and masticatory abilities.

Fig-1 PRELIMINARY IMPRESSION OF THE DEFECT IN ALGINATE

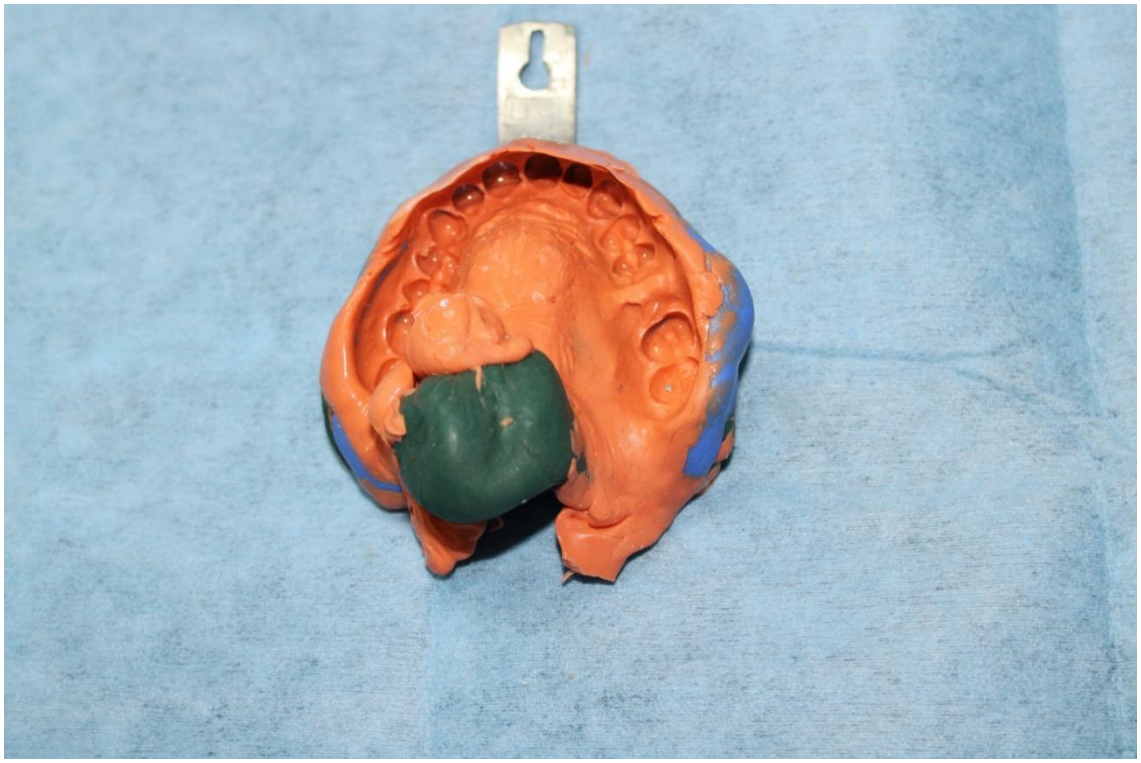

FIG-2 FINAL IMPRESSION IN PUTTY,LIGHT BODY,WITH THE DEFECT IN COMBINATION OF GREEN STICK IMPRESSION COMPOUND(7:3)

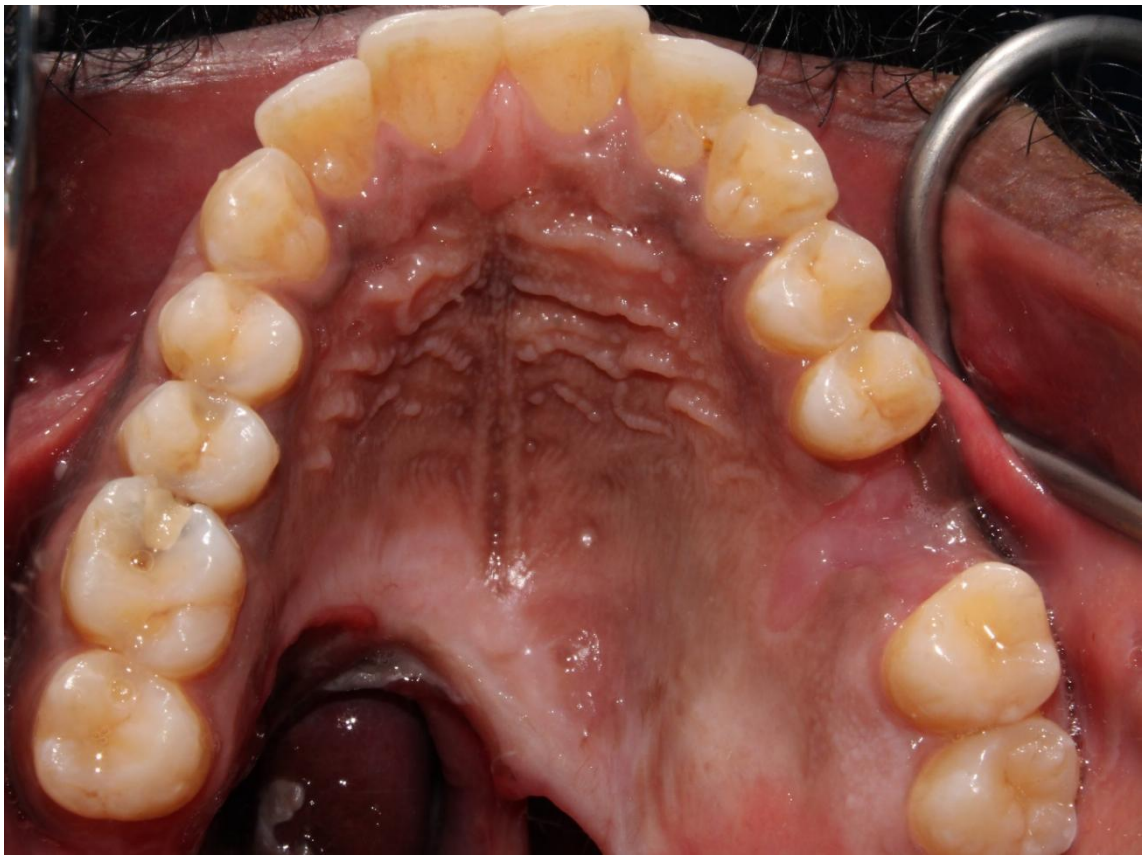

FIG-3 DEFECT AREA

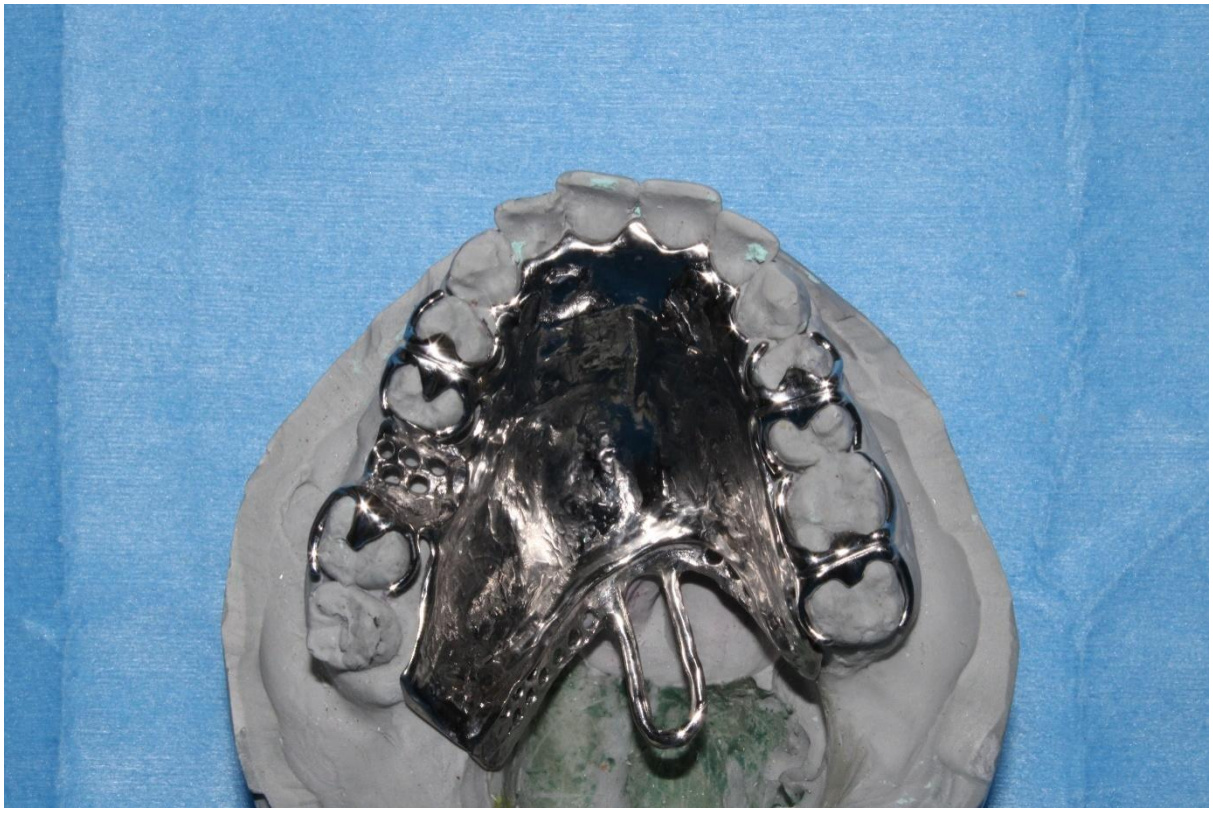

FIG-4 FIT OF PROSTHESIS IN THE CAST

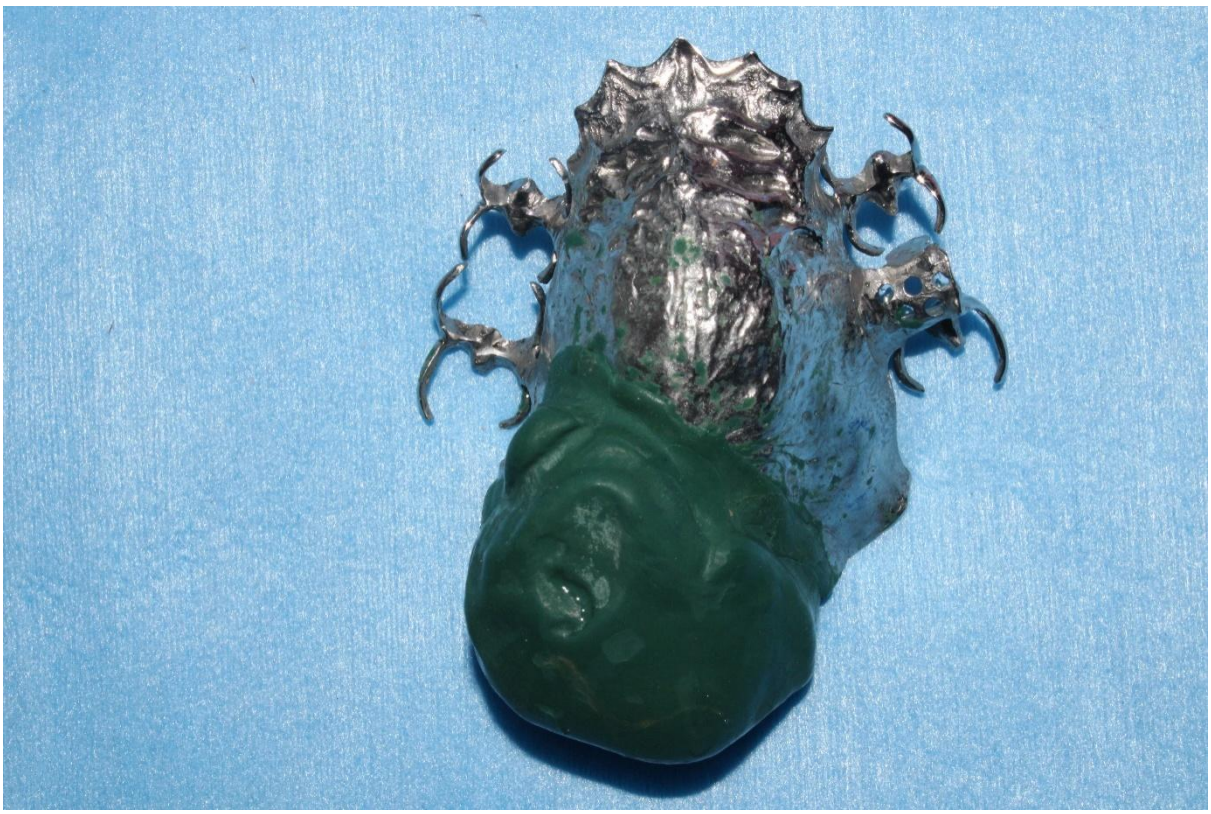

FIG-5 MOULDING OF FUNCTIONAL IMPRESSION ON THE CAST (FRAMEWORK(SUPERIOR SURFACE)

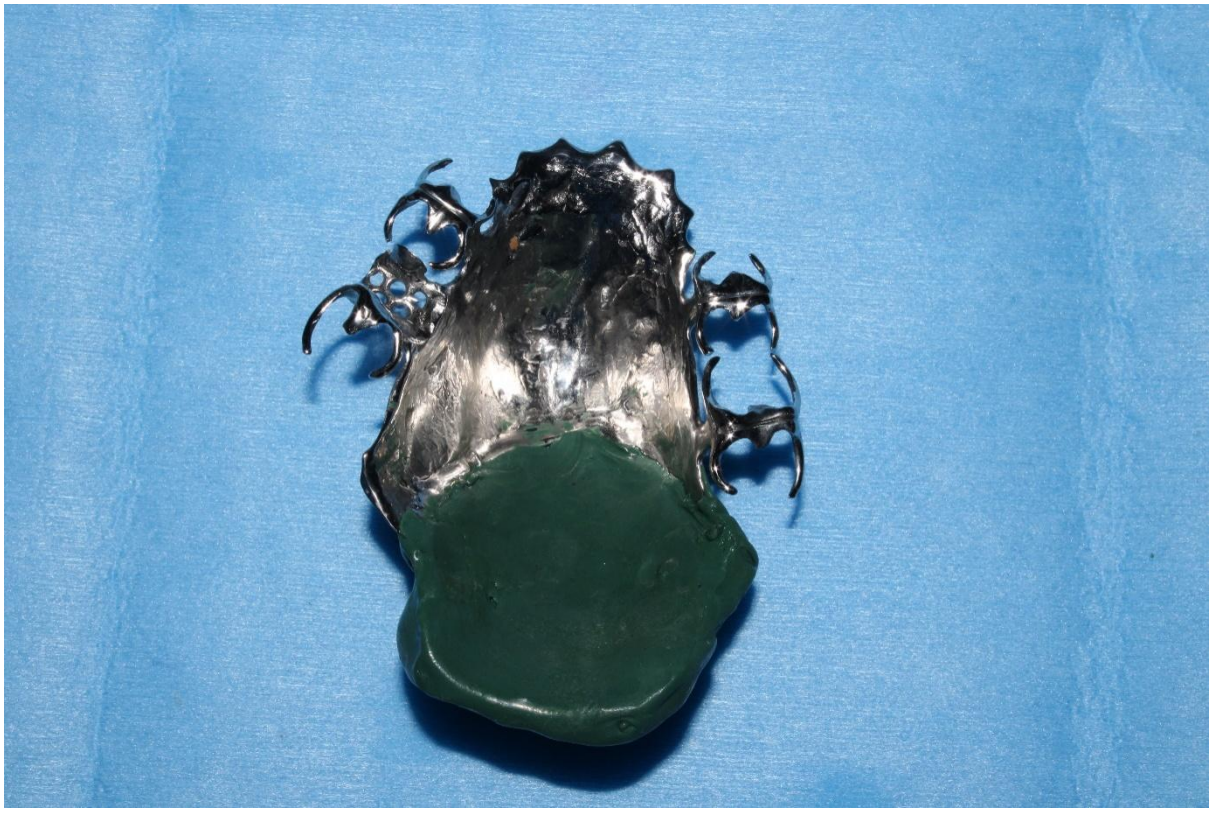

FIG-5 FUNCTIONAL IMPRESSION TOWARDS TONGUE SIDE

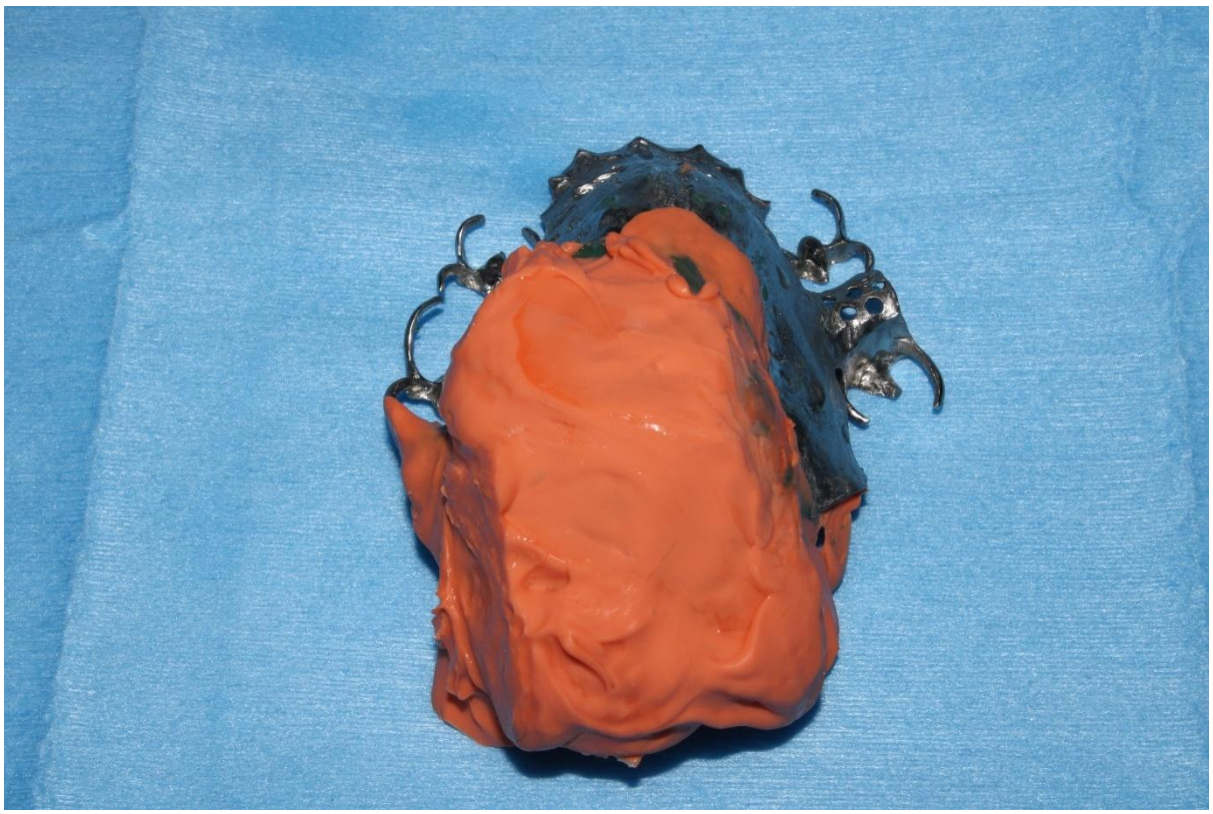

FIG-6 FINAL LINING OF THE IMPRESSION WITH LIGHT BOY MATERIAL

FIG-7 BEADING AND BOXING FOR THE ALTERED CAST

FIG-8 ALTERED CAST

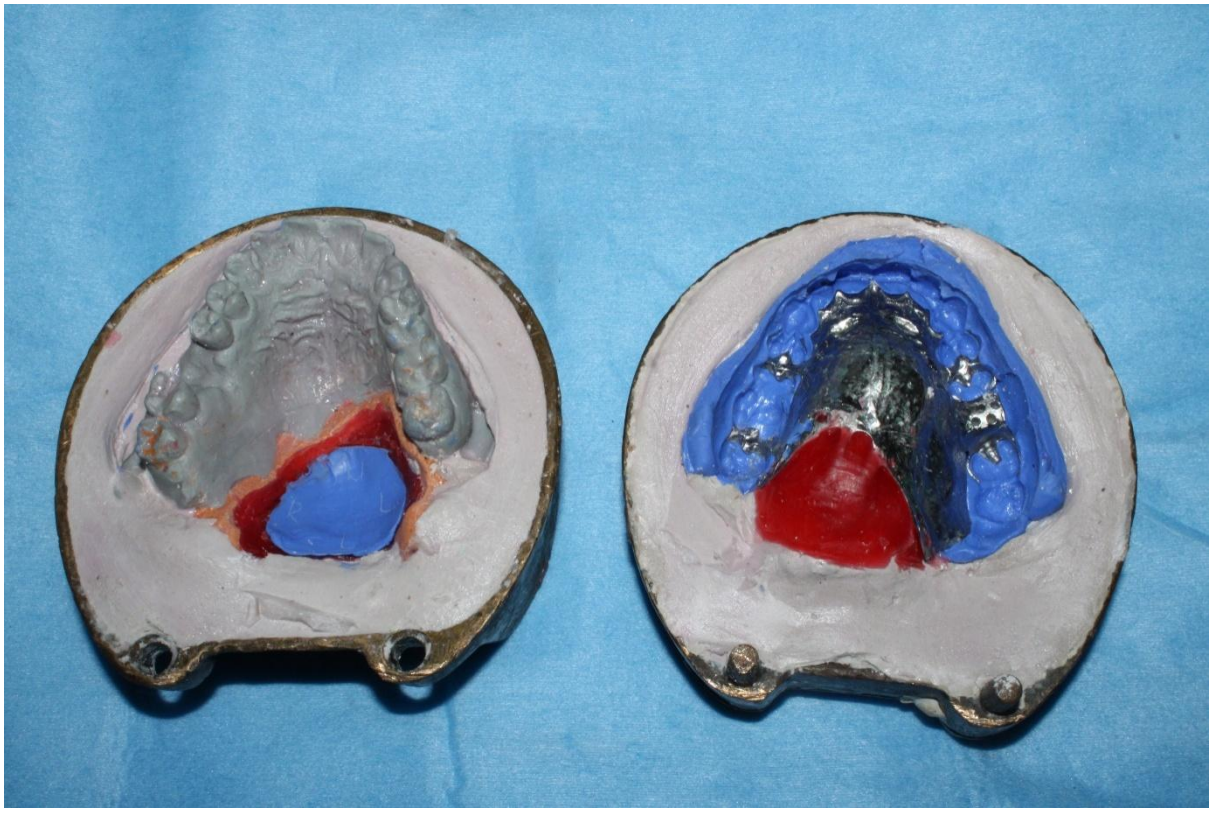

FIG-9 PUTTY SPACER IS CREATED

FIG-10 SOAP SPACER IDENTICAL TO PUTTY SPACER IS FABRICATED

FIG-11 TRIAL PACKING WITH THE PUTTY SPACER

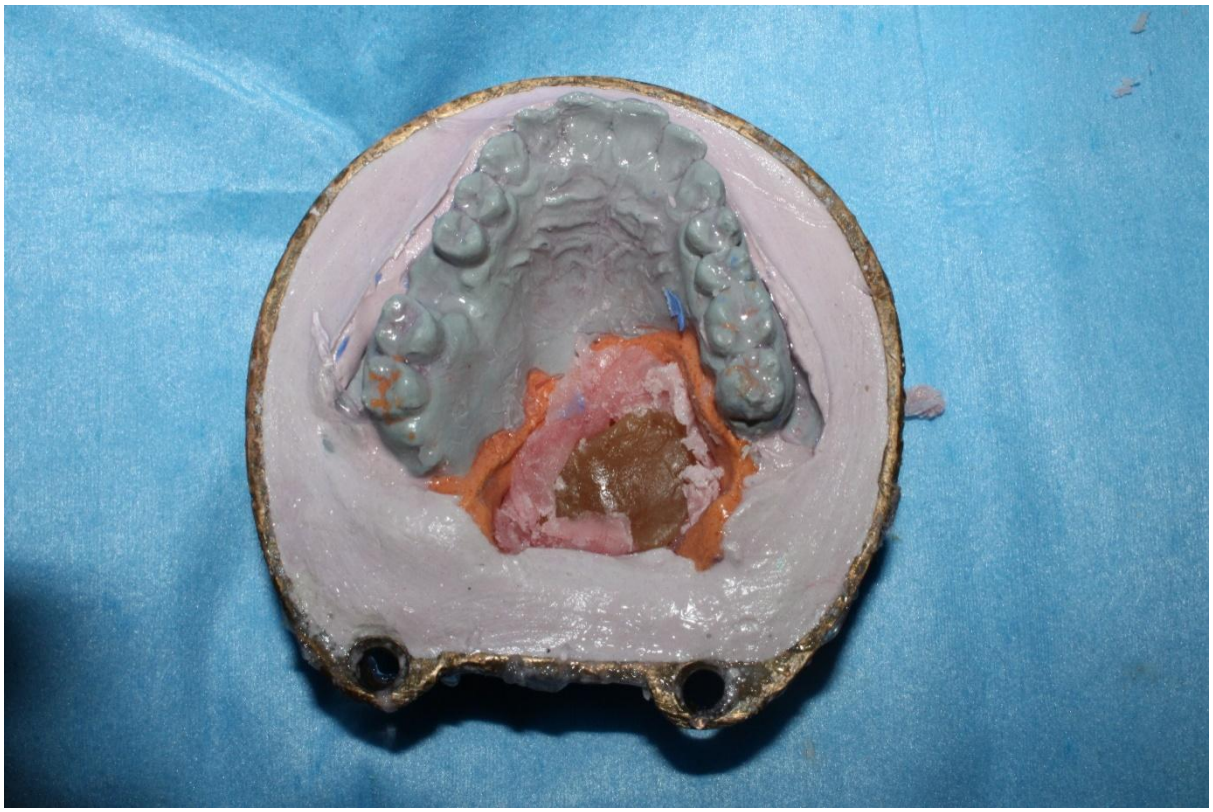

FIG-12 FINAL PACKING WITH SOAP SPACER

FIG-13 PROSTHESIS IN SITU

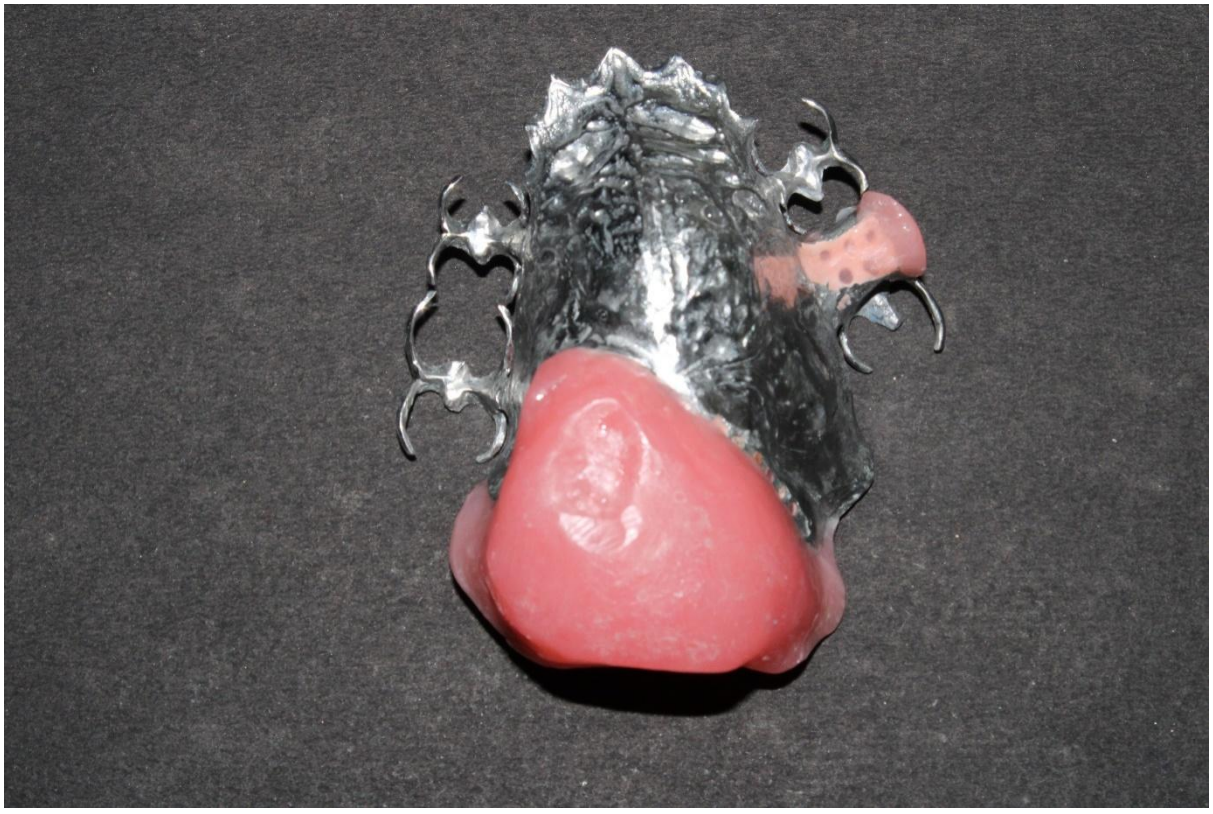

FIG-14 ITALANGIO SURFACE OF THE PROSTHESIS

FIG-15 ORAL SURFACE OF THE PROSTHESIS

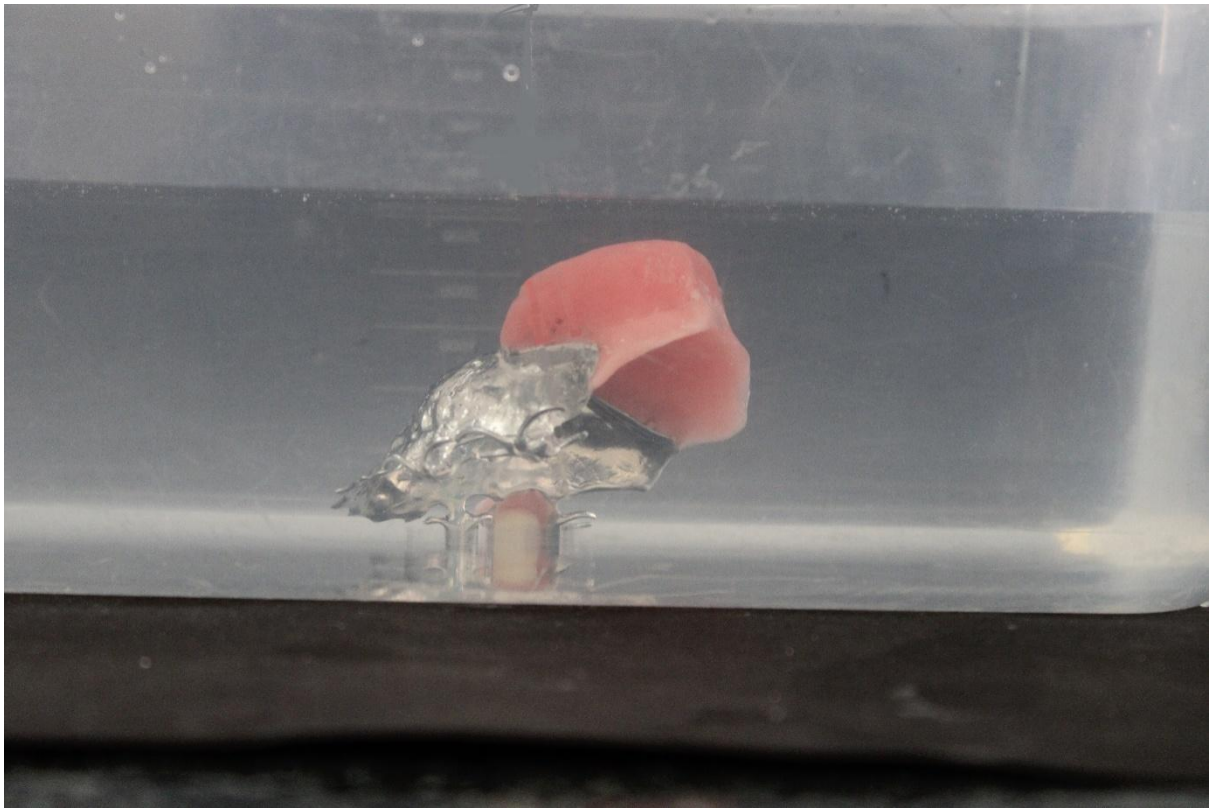

FIG-16 FLOATING HOLLOW DENTURE

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Dr.Sumayya.a.nazar, et. al. "Management of velopharyngeal defect by a hollow speech bulb prosthesis-a clinical report." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 21(04), 2022, pp.01-12.