Case Report

Maxillofacial rehabilitation of velopharyngeal defects in patients with cleft lip and palate by two different rententive mechanisms

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Abstract
Rehabilitation of velopharyngeal defect is challenging for both surgical and prosthetic field. A prosthodontist can best contribute to the total care of patient with cleft palate by participating in all the phases of treatment from birth to completion of growth. Maxillofacial prosthetics focuses on optimizing the rudimentary functions of speech and swallowing. These functions are disrupted because of congenital, organic, traumatic or surgical abnormalities involving the oral cavity and related anatomical structures. It is a prosthetic challenge to rehabilitate a patient with soft palate defect. Palatopharyngeal dysfunction may take place when palatopharyngeal valve is unable to perform its closure due to lack of tissues or lack of proper movement. The palatopharyngeal prosthesis separates the nasopharynx and oropharynx during speech and deglutition and also provides a base against which surrounding muscles can function to provide adequate seal. This improves speech and prevents regurgitation from the nasal cavity. This clinical report highlights rehabilitation of congenital hard & soft palate defect with a pharyngeal prosthesis that fulfills both the objectives-control of nasal emission during speech and prevention of regurgitation.

Introduction
Velopharyngeal (VP) sphincter, a 3-dimensional muscular valve is formed by the soft palate, lateral and posterior pharyngeal wall. Velopharyngeal mechanism can be impaired by either VP insufficiency or VP incompetency. Velopharyngeal incompetency describes dysfunction of an anatomically intact VP mechanism as in patients with neuromuscular disorders, while palatopharyngeal insufficiency is an acquired or congenital anatomic defect of soft palate. These defects are tremendously inconvenient to the patients because of loss of separation between oropharynx and nasopharynx which substantially interferes with the important function of speech and swallowing. It can be diagnosed with use of perceptual speech evaluation, multiview video fluoroscopy (MVF) and nasoendoscopy (NE).
As described in the above table, VP insufficiency leads to communication problems in combination with swallowing inability which leads to psychological disfigurement along with physical difficulties. The most common approach in management of velopharyngeal dysfunction is surgery in combination with speech therapy. However, when surgical approach is not considered prosthetic management of VP insufficiency is carried out by means of a pharyngeal obturator, whereas VP incompetence is managed by a palatal lift prosthesis. A pharyngeal obturator is a removable maxillary prosthesis which has a posterior extension to separate oropharynx and nasopharynx. This obturator prosthesis restores the defects of the soft palate and allows adequate closure of palatopharyngeal sphincter. When a pharyngeal obturator is placed, adequate separation between the oral and nasal cavities is achieved during production of plosives consonants or while blowing with variable intensity. An effective prosthesis will restore speech, allow proper swallowing, and have an acceptable appearance. However, it should have sufficient retention and stability. In dentulous and partially edentulous patients the retention and stability of the pharyngeal obturator prosthesis is easily achieved by the existing teeth.

Mazaheri and Millard suggest that for optimal restoration of function and speech the following guidelines should be observed:

1. Superior extension should be located in the nasopharynx at the level of normal palatal closure.
2. Inferior extension should be a continuation of the palatal plane and should be concave to provide adequate space for tongue movement.
3. Inferior margin should be placed at the region of maximum pharyngeal activity.
4. Superior surface should be convex and polished to deflect nasal secretions into the oropharynx.

This article presents two case reports for management of velopharyngeal insufficiency using two different designs for obturator.

**Case report I:**
A 45 year old, female patient came to the Prosthodontia department of Government Dental College & Hospital, Ahmedabad with chief complaint of difficulty in swallowing and speaking. Her past medical history revealed that she had undergone surgery for cleft lip immediately after birth which was followed by surgery for cleft palate during early childhood and she also received a conventional prosthesis 2 years back but she was not satisfied with its aesthetics and also encountered difficulty in speech and hypernasality.
On intraoral examination, upper anterior teeth were missing and two oro-nasal communication in premaxilla were evident with a soft palate defect both of which was classified under Group III veau and ruppe classification of cleft lip and cleft palate (Fig. 1).

Based on this clinical findings, it was planned to fabricate a pharyngeal obturator with clasp retention since the patient was dentate. For preliminary impression, perforated stock metal tray was selected and modified to record the defect precisely. The tray was then loaded with heavy body condensation silicone and adapted posteriorly to the defect. Diagnostic cast was made and surveying was done on it and mouth preparation was planned. The next appointment consisted of rest seat preparation on following teeth (16, 17, 26 and 27) and border moulding. Then Dual impression was made by using heavy body and light body addition silicone [AFFINIS (coltene/whaledent)]. (Fig. 2)

The final cast was prepared of type IV dental stone to design the prosthesis. The design consisted of full palatal coverage with a metal strip extending posteriorly into the defect to aid in retention of the prosthesis and anteriorly an open lattice which would aid in replacement of the anterior teeth. The wax pattern was invested and casted. The try-in framework was made up of self-cure acrylic resin and a row of anterior teeth (canine to canine). Necessary adjustments and changes were made during try-in.

The prosthesis (Fig. 3, Fig. 4) was delivered to the patient in next appointment and evaluation of speech was done which showed noticeable improvement. Patient was instructed about the maintenance of the prosthesis and recalled after 1 week she had an mild discomfort in swallowing and moderate gagging which was corrected. After which Patient was also recalled on 2nd week, 1 month and then after 6 months to resolve follow-up complaints. During two years of follow-up period, patient was satisfied with the use of the prosthesis and also expressed her social and psychological satisfaction.

**Case Report II**:

A 25 year old male patient reported to Prosthodontia department of Government Dental College, Ahmedabad with chief complaint of difficulty in speech and swallowing. His past medical history revealed that he had been operated for cleft lip at birth and then during childhood he underwent a surgery for the treatment of cleft palate. The patient was seeking a prosthesis to help in speaking and swallowing. On clinical examination, it was found that the patient had oronasal communication at anterior region of hard palate with soft palate defect which is classified under Group II veau and ruppe classification system of cleft lip and cleft palate and presence of retained deciduous teeth (52, 54) which led to crowding in the upper arch. (Fig. 5)

It was then planned to treat the patient by making hollow bulb conventional prosthesis. Hollow bulb prosthesis was chosen because the defect was large and the weight of the prosthesis needed to be reduced. The preliminary impression was recorded by addition silicone putty [AFFINIS (coltene/whaledent)] and then diagnostic cast was prepared. This cast was used for fabrication of the self-cure acrylic special tray.

During the next appointment, this tray was used for performing border moulding by green stick modelling compound (Dental Products of India, DPI). After recording the borders of the defect, the tray was loaded with light body addition silicone [AFFINIS (coltene/whaledent)] and impression was made and while the tray was still in the mouth, stock metal tray was loaded with the heavy body addition silicone [AFFINIS (coltene/whaledent)] and then diagnostic cast was prepared. This cast was used for fabrication of the self-cure acrylic special tray.
and inserted in the mouth to get a dual impression which consisted of the defect area in functional position and the remaining area in rest position. (Fig. 6)

Final cast was made and the prosthesis was designed with retention clasp on 15, 16, 24 and 25 and a hollow bulb at the area of hard palate defect which could be prepared by lost salt technique functional impression of the soft palate defect area was made using green modeling plastic impression compound ((Dental Products of India, DPI)) with the support of the 1 mm round orthodontic wire which was attached to the posterior part of the upper prosthesis. (Fig. 7)

The prosthesis was given to the patient by making minor adjustments in the clasps. Patient was then asked to have a glass full of water to check whether the defect was sealed completely or not. Adequate VP closure was detected after the patient was examined during drinking water in the upward head position. No nasal reflux was observed.

Further the speech of patient was evaluated hypernasality was reduced after testing the production of oral and nasal consonants and the speech was improved after perceptual speech evaluation. The patient was educated about oral hygiene maintenance of the new prosthesis. The follow ups were done at 1st week, 2nd week, 3rd week, 1 month, and 6 months after insertion of the prostheses. After one year follow-up period, the patient was satisfied with his prostheses. (Fig. 8)

**Discussion**

The restoration of the soft palate presents a challenge completely different from that of the restoration of hard palate. Prosthetic rehabilitation of the patients suffering from the VP deficits with obturator prosthesis varies according to the location and nature of the defect or deficiency.\(^3\)\(^6\)\(^7\) The degree of the defect affects the functions of the obturator. If the defect includes both hard and soft palate then the discomfort in the usage of obturator increases. Most individuals with a history of radiation therapy have poor satisfaction with obturator function due to their dry mouth.

The main objective of the obturation is to provide capability for the control of nasal emission and inappropriate nasal resonance during speech and to prevent leakage of material into the nasal passage during deglutition.\(^4\)\(^9\) For the defects involving soft palate, the movement of the lateral pharyngeal wall is essential for the control of the nasal emission, little or no movement of VP mechanism makes it difficult to achieve normal speech with either surgical reconstruction or prosthetic therapy.\(^1\)\(^3\)\(^10\)\(^12\) The success of soft palate defect prosthesis depends on the functional adaptation of the impression material\(^6\)\(^9\)\(^11\). In the cases discussed in this article, elastomeric impression material were used for making the final impression. Zinc-oxide eugenol impression material can also be used for making final impression as it adheres firmly with the modelling plastic impression material. The only drawbacks of using it is that life threatening complications may arise when a broken part of the impression is aspirated.\(^11\) Elastomeric impression materials, such as polyvinylsiloxane and polyether are now considered appropriate for border moulding procedures.\(^20\)

Retention of pharyngeal obturator can be obtained by direct and indirect retainers for patients with complete maxillary dentition. In first case, both direct and indirect retainers were used for obtaining the retention of the prosthesis while in the second case, only direct retainers were given. The weight of the prosthesis also plays a crucial role in its retention. In the second case a hollow bulb obturator was made to reduce the weight of prosthesis and increase its retention. The use of MVF and/or NE may contribute to the diagnostic confirmation of the assessment of velar mobility,
pattern of velar elevation, size of residual velar gap and lateral pharyngeal wall displacement while the patient is producing standardized sample of connected speech. MVF or NE can substitute for perceptual speech assessment in the diagnosis of VPI. They are complementary tools in assessment of velopharyngeal function. In present cases, the Nasendoscopy was also performed which revealed complete closure of the defect and speech evaluation showed marked improvement.

**Conclusion**
The rehabilitation of the patient by prosthesis should be planned based on the extent and nature of the defect. In this report, two patients with velopharyngeal insufficiency were treated successfully with prostheses having different mechanisms for retention. The prime objective of treatment in patients with oronasal communication is a return to the physiologic functions of mastication, deglutition and speech. All these were fulfilled successfully with the prostheses. There was no regurgitation on swallowing after insertion of the prosthesis and nasal twang during speech improved with a period of time.
Fig. 1  Intraoral view of the patient with congenital bilateral cleft in hard palate and soft palate with missing upper anteriors.

Fig. 2  Border molding and final dual impression of the defect.

Fig. 3  Pharyngeal Obturator Prosthesis cameo surface and intaglio surface

Fig. 4  Intraoral view of the patient’s pharyngeal obturator with smile of satisfaction.

Fig. 5  Intra oral view of the congenital hard and soft palate defects of patient.

Fig. 6  Final secondary Dual Impression of the defects.

Fig. 7  Hollow Obturator with Retention clasps (cameo surface and intaglio surface)

Fig. 8  Patient with hollow bulb pharyngeal obturator restoring both hard and soft palate defects.

References


