J Indian Prosthodont Soc (July-Sept 2013) 13(3):352–357
DOI 10.1007/s13191-012-0161-6

CLINICAL REPORT

Prosthodontic Rehabilitation of Velopharyngeal Disorders—A Case Series

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Received: 24 September 2011 / Accepted: 16 July 2012 / Published online: 29 July 2012

Abstract Acquired palatal defects results from cancer resection, whereas cleft palate is the main cause of congenital defects. Both these condition leads to impaired speech intelligibility, seepage of nasal secretions into the oral cavity and vice versa while difficulty in swallowing and hyper nasality is also eminent. In this case report three different technique for treating velopharyngeal disorders have been described.

Keywords Hyper nasality · Meatus obturator · Velopharyngeal insufficiency

Introduction

The velopharynx is a three dimensional muscular valve located between the nasal and oral cavities, consisting of the lateral and posterior pharyngeal walls and the soft palate, and controls the passage of air. Any problem of this valve either due to lack of tissue (velopharyngeal insufficiency) or even lack of proper movement (velopharyngeal incompetence) will result in velopharyngeal dysfunction [1]. Such patient will exhibit impaired speech intelligibility, seepage of nasal secretions into the oral cavity and vice versa [2]. Problems in deglutition and resonance, articulation disturbance, difficulty in swallowing and hyper nasality are also eminent [3]. The velopharyngeal dysfunction may be treated through surgery, prosthesis, speech therapy, or a combination of them all, depending on the case.

Pharyngeal obturators used to separate the nasopharynx and oropharynx during speech and deglutition are a prosthetic solution for velopharyngeal insufficiency. The prosthesis consists of a partial or complete denture base and a pharyngeal extension that will physically modify the pharyngeal airway and provide a seal between the oropharynx and the nasopharynx during function [4, 5]. Velopharyngeal incompetence is treated with palatal lift prosthesis by displacing the soft palate to the level of normal palatal closure of the nasopharyngeal port [6]. Meatus obturator is indicated when entire soft palate has been lost in edentulous patients.

In this article three different technique for treating velopharyngeal disorders have been described.

Case Report 1

A 45-year-old female patient reported to the department of prosthodontics with difficulty in speech and intake of food and water. On examination a midline cleft palate (2–3 cm) involving both hard and soft palate which was present from birth was found. Her medical history was non contributory (Fig. 1).

Diagnosis and Treatment Plan

Veau's Class II cleft palate defect with completely edentulous maxillary and mandibular arches [7]. The patient refused to undergo surgical reconstruction. Therefore,

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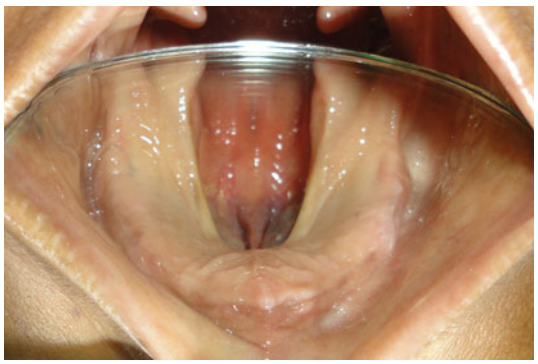

Fig. 1 Preoperative intraoral view

Fig. 3 Extraoral view of the prosthesis

meatus obturator prosthesis was contemplated, considering retention, stability, support and longevity of the prosthesis.

Procedure

A conventional complete denture was fabricated following the basic principles. The patient was asked to wear it for 3 weeks to get accustomed. Impression of the pharyngeal extension area was made by shaping the soft impression compound (Y-Dents Impression Compound; MDM Corporation, New Delhi, India) incrementally over the posterior part of the intaglio surface of the maxillary denture. Patient was asked to swallow and perform head movements such as flexion, extension, right and left head twists [8]. All the tissue contacting surfaces on the impression was scrapped 1–2 mm and mouth temperature wax (MP Sai Enterprise, Mumbai, India) was added and final impression was made [9].

A satisfactory impression consisted of impression of vomer bone, middle and inferior turbinates, and eustachian tube opening. The latter is trimmed for exchange of air through the eustachian tube. The impression was thinned from areas devoid of pharyngeal contact to reduce the weight of the prosthesis (Fig. 2). After flasking and dewaxing, auto polymerizing acrylic resin (DPI Cold cure, Mumbai, India) was packed to form the pharyngeal extension. A vent of 3 mm diameter was created anteroposteriorly in the pharyngeal extension and is gradually enlarged until the hyper nasality disappeared. This venting establishes breathing through the nose [8–10] (Fig. 3). After delivery of the prosthesis, the patient had to undergo a speech therapy program. There are several methods of speech evaluation such as acoustic spectrogram, pressure flow technique and acoustic and aerodynamic techniques [11–13]. Speech can also be assessed by subjecting the patient to the Bloomer Mini Test of Speech Articulation [14]. A marked improvement in her speech intelligibility and esthetics was noted. There was no gagging tendency and no irritation of the mucous membrane (Fig. 4).

Fig. 2 Impression of the pharyngeal extension

Case Report 2

A 26-year-old male patient was referred to department of Prosthodontics from Otolaryngology department with an acquired soft palatal defect (Fig. 5). On examination a portion of soft palate and pharynx were missing in the

Fig. 4 Postoperative intraoral view in occlusion

Fig. 5 Preoperative intraoral view

Fig. 6 Try in of metal framework

anatomical midline. It extended from posterior one-third of the soft palate to middle one-third of the pharyngeal wall measuring 7 cm in length and 3 cm in width. Difficulty in speech and communication along with hyper nasality was detected. Speech evaluation was performed by speech pathologists that assessed resonance, the occurrence of inappropriate nasal air emission, and articulation. The patient refused to undergo a surgical reconstruction. A pharyngeal obturator with clasp retention was planned since the patient had full dentition.

Procedure

A preliminary impression was made with irreversible hydrocolloid (Tropicalgin, Zhermack, Italy) in a stock tray, which was intended to record the defect as much as possible. The diagnostic cast was surveyed for framework designing and a autopolymerizing acrylic resin special tray was fabricated. The final impression was made with poly(vinyl siloxane) elastomeric impression material (Reprosil, Dentsply, USA) with the special tray for framework fabrication. Mouth preparation steps for placement of embrasure clasp between tooth number #15, 16 and between #25, 26 and rest seat preparation in #14 & 24 which will act as indirect retainer was intended. The master cast was fabricated with die stone (Kalstone; Kalabhai Karson Pvt Ltd, Mumbai, India). Surveying of the Master cast was done and wax pattern was fabricated. The pharyngeal extension was positioned horizontally at the level of palatal plane. After casting with cobalt chromium alloy and finishing, the framework was tried in patient mouth (Fig. 6). After accurate seating of the framework in the mouth the impression for the pharyngeal extension was intended to extend posteriorly, to the level of Passavant's pad [15].

Impression compound (Y-Dents Impression Compound; MDM Corporation, New Delhi, India) was applied in increments on the pharyngeal extension of the framework. The patient was instructed to flex his neck to achieve

Fig. 7 Impression of the pharyngeal extension

contact of the chin to the chest to establish contact of the posterior aspect of the obturator with the soft tissue covering the anterior tubercle of atlas. Rotation and flexion of the neck to achieve contact of chin with the right and left shoulder was performed to record the lateral aspects of the obturator [6, 16]. The patient was asked to swallow warm water to elicit pharyngeal muscle activity. Reduction of 1–1.5 mm of impression compound on the peripheral surfaces of the obturator was undertaken. A layer of mouth temperature wax (MP Sai Enterprise, Mumbai, India) was adapted to the compound. The material was returned to mouth and kept in place for 30 min. Neck movement described above are repeated as are additional swallowing and speech (Fig. 7).

The adequacy of the extension of the prosthesis was confirmed by monitoring.

(a) Patient's ability to suck from a glass of water, and water not coming from his nose.
(b) Patient's ability to breathe and swallow with ease.
(c) A marked improvement in speech. With the patient able to articulate plosive sounds such as b and p.
(d) And by verifying the prosthesis with the cephaloradiographs [3].

The prosthesis could be overextended if the patient complains of gag reflex or if there is dislodgement of the

Fig. 8 Intraoral view of the finished prosthesis

prosthesis. The prosthesis was then flasked keeping the impression side in a manner that the wax and the impression compound could be removed with ease after dewaxing without making any alteration in the extensions. The prosthesis was processed in heat activated acrylic resin (DPI Heat Cure, Mumbai, India), polished and inserted in the patient's mouth. The prosthesis was monitored closely to ensure it did not cause soreness to the soft tissues (Fig. 8).

Case Report 3

A 17-year-old female patient reported with a chief complaint of nasal regurgitation and hyper nasality of voice. The patient had a congenital cleft of soft palate and a small defect in hard palate. A surgery for the cleft at an early age resulted in a short palate. Patient refused to have further surgical intervention.

The patient was diagnosed as having velopharyngeal insufficiency and incompetency, as the soft palate was insufficient to effect closure after maximum displacement by lift prosthesis. After a successful acrylic resin base provisional palatal lift, a lift with pharyngeal extension was planned with claps retention (Fig. 9).

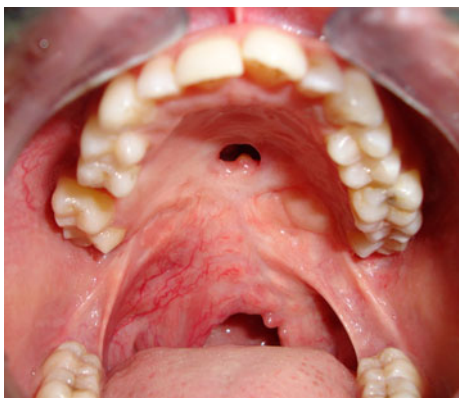

Fig. 9 Preoperative view

Procedure

Preliminary impression was made with an irreversible hydrocolloid (Tropicalgin, Zhermack, Italy) with stock tray, which was intended to record and displace the soft palate superiorly.

On the diagnostic cast, an auto polymerizing resin tray was fabricated with a wire loop extension for the obturator. The wire loop was adjusted such that a space of 1 mm existed between the loop and soft palate at rest.

After surveying the diagnostic cast, mouth preparations were undertaken.

Moulding procedures were done by adding low fusing modelling compound to the wire loop until appropriate displacement of the soft palate was achieved. Then about 1 mm of low fusing compound was scrapped and mouth temperature wax (MP Sai Enterprise, Mumbai, India) was added and inserted in the patient's mouth and left for 5 min. Now impression of the dentate portion was made with poly(vinyl siloxane) (medium body, Reprosil, Dentsply, USA) impression material with the same tray to register the mouth preparations.

Wax pattern of the lift with pharyngeal extension was fabricated on the master cast. The width of the lift should be sufficiently wide and thick to support the lift under heavy pressure without fracturing. After casting and polishing, the framework was tried in the patient's mouth (Fig 10).

The impression of the pharyngeal extension was done with mouth temperature wax (MP Sai Enterprise, Mumbai, India) as in case report 2.

After processing with heat cured acrylic resin the prosthesis was then polished and inserted in the patient's mouth. The palatal lift prosthesis was monitored closely to ensure it did not cause soreness to the soft tissues and have adverse effects on dentition (Fig. 11). The

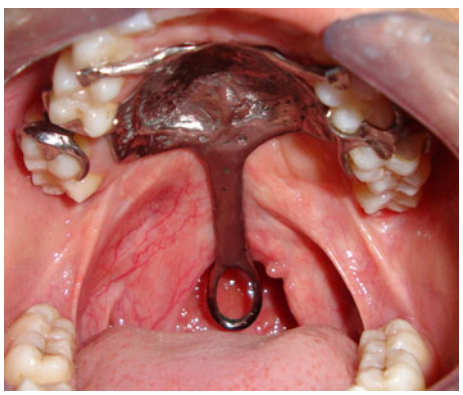

Fig. 10 Tryin of the metal framework

Fig. 11 Postoperative view

palatopharyngeal function was evaluated by inspection of the soft palate and tested by asking the patient to suck water through a straw. A lateral cephalograph was advised for verifying the placement of the palatal prosthesis. A marked increase in the intelligibility of speech was noted.

Discussion

Pharyngeal obturator prosthesis extends beyond the residual soft palate to create separation between the oropharynx and nasopharynx. It provides a fixed structure against which the pharyngeal muscles can function to effect velopharyngeal closure [6, 17, 18]. The level of contact of the prosthesis to the pharyngeal wall may differ in sex. In men, the typical relation of the soft palate to the posterior pharyngeal wall is at a point above the palatal plane. For women, contact is found to occur at or below the palatal plane [19]. Obturators prosthesis made of base metals alloys have the potential of eliciting adverse reactions in patients allergic to cobalt, chromium or nickel. In such situation titanium may be used due to its excellent biologic compatibility and high corrosion resistance [20, 21].

Meatus obturator is formed on the presumption that partial occlusion of the oropharynx from the nasopharynx, will result in marked diminution or complete elimination of the nasality that is objectionable in the speech of cleft palate patients [9, 10]. It is designed to close the posterior nasal conchae through a vertical extension almost 90° upwards from the distal aspect of the maxillary prosthesis to reach the roof of the nasopharynx. They are very efficient, require no muscle trimming and results can be ascertained immediately.Since the vertical extension is closer to the palatal portion of the prosthesis, less torque is placed on the palatal portion thus decreasing the tendency to dislodge [4, 6, 16]. They may be indicated for patients with extensive defects of soft palate and who exhibit a very active gag reflex. They may be the obturator of choice for edentulous patients when retention is a problem [22].

Limitation is that if the two sides of the cleft are very firm and/or the cleft is very narrow, the placement of modeling compound may be obstructed during impression making. More than 2 cm cleft is required and better results have been reported if obturator is directed as high up on the pharyngeal wall as possible. Another limitation was failure to construct a post-dam resulting in an unsatisfactory posterior palatal seal. However, upward extension of the obturator provided a certain degree of retention. Weight of the prosthesis can be reduced by making the meatal extension thin by reducing its anterior-posterior dimension or making the obturator extension hollow. Visible light cure (VLC) denture base materials were introduced with the advent of the Triad system and materials [22–24], but as this is expensive we had fabricated a simpler and more economical prosthesis for the patient.

The palatal lift prosthesis is used to treat velopharyngeal incompetence. The ideal palatal lift is one that assists the pharyngeal musculature to complete normal closure. The primary requirement of a successful palatal lift is retention, since the palatal lift is a posterior extension cantilevered from the removable denture base. An initial test should be done to determine the potential amount of force that will be required to lift the soft palate to create the desired effect. Too much force will likely result in a lift that cannot be kept in place or a irritation and ulceration of the mucosa of soft palate. Nasal endoscopy is the method of choice to evaluate the effect of palatal lift therapy [6].

Gonzalez stated that a palatal lift prosthesis was of value either as a temporary or permanent measure for the correction or improvement of velopharyngeal insufficiencies either as a stimulator of velopharyngeal muscles or a supportive measure used until muscles regain sufficient strength and activity to become effective in achieving velopharyngeal closure [25].

Various techniques may be used to evaluate the use of palatal lift prosthesis on velopharyngeal incompetence. Flexible fiberoptic video nasendoscopy and videofluoroscopy provide visual representation of velopharyngeal movement, however, such methods are invasive. Acoustic assessment samples the oral and nasal energy associated with speech by two unidirectional microphones. This would be of limited value in this patient's treatment, which was concerned more with airflow than with resonance. In addition, the relationship between hypernasality and the degree of velopharyngeal dysfunction is not considered linear when measured by this technique. There are a number of airflow measurement techniques, such as differential pressure, vortex shedding, impeller, ultrasound, and thermal sensors, of which some are very useful [14, 25].

Conclusion

Treatment of patient with soft palatal defects is among the most challenging in dentistry. Defects are highly individual, and require the clinician to call upon all knowledge and experience to fabricate a useable prosthesis. The basic principles and concepts described throughout will help to successfully rehabilitate such patients.

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