The Prosthodontic rehabilitation In Velopharyngeal Disorders

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**ABSTRACT**

Velopharyngeal disorders are due to incomplete closure of palatopharyngeal sphincter. This kind of inability will lead to hypernasality and decreased intelligibility of speech. In case of congenital defect surgical reconstruction is preferred but residual soft palate defect may require prosthetic treatment. Whereas in case of acquired soft palate defect reconstructive surgery is contraindicated and such kind of defect may require prosthetic rehabilitation to restore the normal anatomy along with basic vital functions of speech, mastication and deglutition.

**Keywords:** Cleft palate, palatopharyngeal incompetence, hypernasality, videofluorography, videoendoscopy, palatal lift appliance

**INTRODUCTION**

Cancers of mouth, larynx, tongue, oropharynx and nasopharynx comprise approximately 5% of all cancers.\(^1\) Patients who have been operated for such lesions will be having difficulty in normal functioning of masticatory and deglutition system. In such cases speech will be affected at maximum leading to psychological and social problems for the patients. Velopharyngeal disturbances can be the result of the congenital defect such as cleft palate. Such patients can be given a normal lifestyle by the teamwork of the surgeon, speech pathologist, and a prosthodontist. Velopharyngeal closure is sphincteric in nature.\(^2\) While treating the palatopharyngeal diseases the prosthodontist has the responsibility to provide a normal closure mechanism for Velopharyngeal sphincter to establish normal speech and prevent nasal regurgitation of food. Any speech aid prosthesis will tend to obstruct any opening or cleft in palate and frequently carry an extension into the pharynx assigned to improve or supplement the Velopharyngeal valving. In maxillofacial prosthesis, the dentist must have a thorough understanding of the normal anatomy, Velopharyngeal sphincter mechanism, speech and diagnostic aids for Velopharyngeal incompetence. This article will focus on all these guidelines for the prosthodontist.

**Speech:** Speech is a learned process that makes use of anatomic structures designed primarily for respiration and deglutition. Kantner and west divided speech into six components including respiration, phonation, resonation, articulation, neurogenic integration and audition.\(^3\) Resonation and articulation are most readily affected by maxillofacial prosthetic rehabilitation. No single organ in human body is solely responsible for speech. Speech is formulated by synchronized functioning of static structure (teeth, alveolar bone and palate) and dynamic structures (tongue, soft palate and lips). Oral cavity, nasal cavity and pharynx act as resonating chambers for speech. Patients with Velopharyngeal disorders exhibit hypernasality because they are unable to control and divert sufficient airflow into the oral cavity without surgical and / or prosthetic intervention.

**Physiology and normal Velopharyngeal sphincter:** Soft palate, posterior pharyngeal wall and lateral pharyngeal wall are three main components of the Velopharyngeal sphincter. At rest, the soft palate drapes downward so that the oral pharynx and nasopharynx are open and coupled to allow for normal breathing through the nasal passages. When functioning, the soft palate arches upwards and backwards to contact posterior pharyngeal wall at or above the level of palatine plane. At this moment, the lateral pharyngeal wall moves medially and posteriorly whereas the posterior pharyngeal wall moves anteriorly to facilitate Velopharyngeal closure.(fig:1) Velopharyngeal deficiencies: It may be due to palatopharyngeal insufficiency or incompetence.\(^5\) Palatal insufficiency is due to inadequate length of the soft palate.(fig:2) It may be seen in cases of developmental aberrations or acquired soft palate defects. Velopharyngeal incompetence is functional inability of soft palate to affect a complete seal with posterior and lateral pharyngeal wall. Velopharyngeal incompetence may be due to cleft palate, traumatic injuries to neuromuscular system and / or the peripheral

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efferent cranial nerves, Cerebrovascular accidents, brain stem tumors and neuromuscular diseases such as multiple sclerosis and cerebral palsy. Figure 1: Normal velopharyngeal closure pattern

Figure 2: Inadequate length of soft palate leading to hypernasality

Figure 3: Prosthesis should be at the level of alatine bone and first cervical vertebra

Figure 4: (A) Convex superior surface of the prosthesis (B) Concave inferior surface.

Indications for prosthetic appliance in unoperated patients: Most of the congenital defects are treated surgically but there are situations which require prothetic rehabilitation are listed below:
1. A wide cleft with a deficient soft palate: This type of defects cannot be treated surgically using local flaps. Patients with such defects have to be rehabilitated with prothetic appliances.  
2. A wide cleft of the hard palate: In such defect surgical repair may lead to low vaulted palate and has to be rehabilitated with prosthesis.  
3. Neuromuscular deficient of the soft palate and pharynx: In presence of neurogenic deficiency of critical muscle, the pharyngeal flaps would not be able to improve speech so a prothetic appliance would be needed.  
4. Delayed surgery: When surgery is delayed due to medical or age reasons, the defect can be temporarily closed with prosthesis.  
5. Expansion prosthesis to improve spatial relations: Expansion prosthesis may be used to correct spatial relations of maxillary segments prior to surgery.  
6. Combined prosthesis and orthodontic appliance: It may be used in conjugation with orthodontic procedure.

Indications for prosthetic appliance in operated patients:
1. Incompetent palatopharyngeal mechanism: If the patient is near functional closure prosthesis may serve as physical therapy modality.  
2. Surgical failures: Prosthesis may be given in case of graft failure, scarred or contracted palate and multiple perforations in palate.

Contraindications for prosthetic appliance:
1. Feasibility of surgical repairs: Where surgical repair can re-establish anatomical and functional defect it should be preferred.  
2. Mental retardation: A mentally retarded person will not be able to take good care of the appliance.  
3. Uncooperative patient and parents: Prosthesis cannot be given in such cases.  
4. Lack of trained prostodontist: Only a good prostodontist who is aware of anatomy and physiology of involved regions and basic rules of reconstruction of prosthesis can rehabilitate patient otherwise surgical reconstruction should be advised.

Patient selection and diagnosis:
1. Interview of individual and family: An interview is conducted to assess awareness of the patient and his family for the speech problems and nasal regurgitation of food. While interviewing, the dentist come to know whether there is presence or absence of hypernasalaty and type and severity of resonance disorder.  
2. Oral examination: Oral examination enables speech pathologist and prostodontist to
evaluate the anatomical structure. This also provides an opportunity to evaluate the patient’s level of cooperation and response of the gag reflex. But this can’t provide information regarding palatopharyngeal function or speech. It has been shown that middle third of soft palate is responsible for Velopharyngeal closure. The lower third of soft palate drapes inferiorly and anteriorly blocking the visual examination of closure site.

3. **Instrumental assessment:**
   - A. Acoustical assessment of palatopharyngeal competence: Nasometer devise samples nasal and oral energy and gives nasalance values.
   - B. Aeromechanical assessment of palatopharyngeal competence: Aeromechanical assessment of palatopharyngeal competence is accomplished instrumentally by monitoring oral or nasal air pressures and transnasal airflow during the /P/ and /S/ consonants in a patient’s vocal repetition of special test words. A computerized system for assessing aeromechanical competence of the palatopharyngeal valve is the PERCI-PC (palatal efficiency rating computed instantaneously, version 2.0, microtronics corp) supported by an IBM-PC-AT.
   - C. Audio tape recording: Patient’s voice is recorded on audio tape at each visit to facilitate perceptional assessment of the resonance characteristics over time.
   - D. Videofluorographic assessment: Multiple fluoroscopy including lateral and frontal projection can aid in diagnosis of Velopharyngeal incompetence.
   - E. Flexible fiber optic videonasendoscopy: It provides excellent visualization of palatopharyngeal movement without exposure to radiation.

**Treatment planning: First patient visit:**
- Speech is assessed to confirm or deny the existence of palatopharyngeal incompetency.
- With the confirmation of palatopharyngeal incompetency, a videofluoroscopic assessment is conducted. A tracing of the palatal port structures is made from this segment.
- A palatal lift is constructed on the tracing of the palatal port at rest. To allow adaptation to the prosthesis, the full posterior extension of the lift component is left a few millimeters short at this visit.
- At this appointment patient may be asked to drink water to confirm presence or absence of the nasal regurgitation.
- The patient is referred to the speech therapist for the speech therapy two to three times a day for 6-8 weeks.

**Second visit:**
- The progress report from the speech therapist is reviewed.
- Speech is assessed to confirm any change in palatopharyngeal function. If the patient has developed adequate soft palate function by stimulation, modifications will not be required at this stage for the prosthesis.
- But if the palatopharyngeal incompetency persists, additional modifications of the lift are required.
- Videonasendoscopy is used to identify the size and shape of the residual opening in palatal port with the prosthesis in place. Additional material will be added to the prosthesis to achieve adequate closure.
- Speech therapy will be continued.

**Third visit:**
- The progress report from the speech pathologist is reviewed.
- If additional modification of the prosthesis is indicated, use of nasoendoscopy will again be required. Future visits will determine the success of the treatment. If the disease is improving by the prosthesis, the prosthesis size will be reduced over the time.
- If the treatment becomes unsuccessful, permanent palatal lift prosthesis will be required or a palatal surgery would be treatment of the choice.

**Guidelines for the construction of the prosthesis:**
- Based on the fluoroscopic and nasoendoscopic evaluation following guidelines has to kept in mind while fabricating the prosthesis.
- There should be a 5mm gap between the bulb and posterior pharyngeal wall at rest to facilitate normal breathing pattern
- Angle of the bulb relative to the palatal plane should be approximately 20°.
- Mckerns and Bzoch showed that in men the pharyngeal closure occurs above the palatal plane whereas in women it occurs at or near the palatal plane.
- As the advances the pharyngeal closure occurs at a higher level compared to palatal plane.
- The palatal bulb can be approximated to the pharyngeal tissue overlying the anterior tubercle of the first cervical vertebra.
- The oral surface of the bulb should be concave so that it will not affect the normal tongue movements.
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- Its superior-inferior height should be around 10-12mm to maintain the nasal resonance.
- A obturator with a hinge attachment can be given to the patient.\textsuperscript{11}
- Though this kind of non-invasive treatment may be given to the patient easily, retention may be a factor of concern. Retention can be increased by properly designed cast partial denture, tooth or implant supported overdenture.\textsuperscript{12,13,14}

\textbf{CONCLUSION}

The prosthodontist can restore the Velopharyngeal defect to improve the vital functions of speech, mastication and deglutition. The success of the prosthesis depends upon the patient selection and the design of prosthesis. The properly designed prosthesis will lift the soft palate improving the speech without creating any discomfort to the patient. Prosthesis should be designed so that it will maintain the normal airway. Whenever speech aid prosthesis is given to the patient regular speech evaluation is necessary by the speech therapist to estimate the success of the treatment.

\textbf{REFERENCES}