Management of the Soft Palate Defect

Defects of the soft palate may present as perplexing problems to the clinician. One of the difficulties is a lack of universal terminology. Without accepted terminology it is impossible to adopt a method of communication that allows universal understanding of specific clinical findings. Poor communication hampers discussions among the surgical and rehabilitative teams.

The term "**velum**" is often used interchangeably with the preferred "**soft palate**". Such an interchange of terms is incorrect as the term "velum" refers to a covering or veil while the soft palate is actually a complex neuromuscular aponeurosis. Although the muscular activity of the soft palate provides function, it is also evident that a complex feedback system of afferent and efferent neural connections is required to control physiologic movement. Likewise, tissue bulk, in the form of connective tissue and epithelium, is required to provide contact with the pharyngeal walls during function.

Abnormalities of the soft palate can occur in different ways. The resultant deficiencies are usually grouped into **congenital**, **acquired** or **developmental** defects depending upon the etiology. In the congenital cleft palate the embryological development of the hard and /or soft palate is interrupted. Surgical resection of neoplastic disease can alter the continuity the soft palate resulting in an acquired defect. Diminished capacity of the soft palate to respond to functional demands may be the result of muscular or neurologic diseases.

Beyond etiology, defects are also classified according to the anatomy and physiology of the structures. These classifications identify the degree and type of palatopharyngeal closure. The resultant diagnosis often determines the course of treatment. When some or all of the anatomical structure of the soft palate is absent, the term **palatopharyngeal insufficiency** applies. When the soft palate is of adequate dimensions but lacks movement because of disease or trauma affecting the muscular and/or neurologic capacity the term **palatopharyngeal incompetence** applies. The term **palatopharyngeal**

inadequacy includes incompetence and/or insufficiency but may also suggest a reduction or absence of pharyngeal wall activity.

Absence or loss of some or all of the soft palate results in insufficient structure or altered function of the remaining structure to provide closure with the pharynx (Fig. 1). In this situation an obturator prosthesis is designed to close the opening between the residual hard and/or soft palate and the pharynx. A **pharyngeal obturator prostheses,** which may also be called a **speech aid 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 affect palatopharyneal closure. A **meatus obturator** is designed to close the posterior nasal choanae through a vertical extension from the distal aspect of the maxillary prosthesis. This obturator design may be indicated when the entire soft palate has been lost (Fig. 2). Such a design will reduce leverage factors on the prosthesis but will not permit function of the pharyngeal muscles against it. The meatus oburator is often thought to be mechanical while the fixed pharyngeal obturator is thought to be more physiologic. The hinged pharyngeal oburator is not often referred to in recent times because of the mechanics involved in its fabrication.

The soft palate normally serves to establish a separation between the oral and nasal cavities. The soft palate moves in response to physiologic demands of speech, deglutition and respiration. The movement of the soft palate is a coordinated activity that results in varying degrees of closure between the soft palate and the pharyngeal walls during breathing, speaking and swallowing. At some times there may be complete closure while at other times there may be varying degrees of opening. When it occurs, palatopharyngeal inadequacy results in physical and psychosocial concerns for the patient. The objectives of prosthetic intervention are to prevent food and fluid regurgitation and to improve speech intelligibility. The prosthesis will include both a pharyngeal and a palatal section. Pharyngeal extensions add bulk, weight and leverage thus generating stress to the supporting structures of the mouth through the palatal section of the prosthesis.

The greater the defect, the larger the obturator portion of the prosthesis will be. Although larger prostheses create more weight, thereby negatively impacting prosthesis retention, there are times when a smaller defect may be more problematic. Unilateral soft palate defects are more difficult to obturate because the function of the residual soft palate does not provide closure on the nondefect side and it can be difficult to extend the obturator around or over the residual tissue (Fig 3). The configuration of the residual soft palate may complicate the prosthetic situation if the residual soft palate drapes towards the base of the tongue. In classic prosthodontic literature, House [1]provides three classifications of soft palates. In his description of complete denture therapy, the most favorable orientation of the soft palate occurs when this structure extends horizontally from the hard palate and the least favorable condition exists when the soft palate is nearly perpendicular to the plane of the hard palate. It is easier to lift and/or obturate incompetent soft palates that are more horizontal.

Design of the prosthesis must apply the basic principles of support, retention and stability so as to minimize the stress generated to the structures of the mouth. Remaining natural teeth, residual ridges, endosseous implants, hard palate and residual soft palate will all contribute to the support, retention and stability of the prosthesis from either a positive or negative standpoint. All of these entities need to be considered in detail before prosthetic intervention is undertaken. The location of the fulcrum line, retentive undercuts and potential for indirect retention will be important factors in determining the prognosis.

In general, the prosthesis will have a fulcrum line near the defect area. If natural teeth or implants are present to provide retention and support for the prosthesis, the fulcrum line will pass between the most posterior occlusal rests on each side of the arch. Retentive clasps placed into undercuts adjacent to the defect will resist the downward displacement of the prosthesis due to the effects of gravity. Occlusal rests on the opposite side of the fulcrum line from the defect will act as indirect retainers. Long guide planes on the natural teeth will also assist in prevention of rotational dislodgment of the prosthesis.

When natural teeth or implants are not present, retention of the prosthesis is problematic. Large, parallel sided residual ridges may be sufficient to retain the prosthesis particularly if the superior aspect of the residual soft palate can be engaged. A square arch form may provide improved retention and indirect retention to the prosthesis. Regardless of the anatomic situation, every effort should be made to develop a border seal as with a conventional complete denture. In most situations, a denture adhesive may be of benefit towards use of the prosthesis because the obturator portion will tend to dislodge a prosthesis that does not have positive retention opportunities.

Palatopharyngeal incompetence may be related to degenerative disease, cerebrovascular accidents or trauma. When palatopharyngeal incompetence is encountered, rehabilitative efforts are designed to elevate the soft palate. A **palatal lift prosthesis** is used to raise the soft palate to the level of the hard palate (Fig. 4). This elevation places the junction of the middle and posterior thirds of the soft palate in close proximity to the posterior pharyngeal wall creating a muscular seal that prevents nasal regurgitation of fluid and food during deglutition. The prosthesis also prevents the escape of air into the nose when speaking. Because this prosthesis provides a mechanical rather than a functional closure of the palatopharyneal valve, the ideal closure that prevents the passage of air and/or food and liquids will also result in an inability to breath through the nose. Reduction of the prosthesis to allow nasal breathing may be needed. It must be remembered that a palatal lift prosthesis only addresses palatopharyngeal closure. The physiologic acts of speaking and swallowing are dependent upon the coordinated function of many other oral and pharyngeal muscle groups which may also be affected in palatopharyngeal incompetence. The prosthesis may stimulate a return of muscular function in some patients but, depending upon the etiology, others may experience little or no improvement.

Type of prosthesis

The defect etiology usually determines the type of prosthesis that is needed. Before treatment is initiated the natural course of existing disease or the stage of rehabilitation

should be considered. In many instances it will be unwise to proceed immediately to a definitive prosthesis. An interim prosthesis is indicated if the long term disease prognosis is guarded or if the natural progression of disease or rehabilitation will demand frequent modifications of the prosthesis.

In many situations it may be possible to use “diagnostic” interim prostheses to determine the ability to tolerate a definitive prosthesis. Sometimes the diagnostic prosthesis may take the place of definitive care; this is particularly true when frequent modifications of the prosthesis are needed.

Technical Considerations For The Pharyngeal Obturator/Speech Aid Prosthesis

The pharyngeal obturator prosthesis does not displace the soft palate but replaces missing portions of the soft palate (Fig. 5). Therefore, a pharyngeal obturator prosthesis has less active displacement force upon it than does a palatal lift prosthesis. Despite the lack of active displacement forces, this prosthesis continues to generate stress to the palatal portion of the prosthesis due to the forces of gravity. For this reason the principles of retention and stability outlined for the palatal lift prosthesis should still be applied.

The obturator section of this prosthesis is formed after the oral portion of the prosthesis is made. In some patients it may be more convenient to develop the obturator portion once the framework of the oral section is completed but before full completion of the oral portion. A retentive loop is extended posteriorly from the palatal portion of the prosthesis to facilitate placement and retention of impression material in the pharynx.

Modeling compound is added to the retentive loop until it contacts the posterior and lateral pharyngeal walls. Border molding is achieved by adding and removing modeling compound in the posterior and lateral pharyngeal areas. After the warmed modeling

compound addition is inserted the patient is instructed to flex the neck fully to achieve contact of the chin to the chest. This movement will establish contact of the posterior aspect of the obturator with the soft tissue covering the dorsal tubercle of the atlas. Lateral aspects of the obturator are formed by rotation and flexion of the neck to achieve chin contact with the right and left shoulder respectively. Once contact is present around the lateral and posterior borders of the modeling compound obturator, there should be absence of air and liquid flow from the oral to the nasal cavities (Fig. 6). After slight (0.5-1.0 mm) reduction of the compound, mouth temperature wax is adapted to the modeling compound. The material remains in place for 7-10 minutes and the previous neck flexion and rotary flexion movements are repeated (Fig. 7). Difficulties in nasal breathing may necessitate reduction of the lateral aspects of the obturator until breathing is unstrained. Such a reduction of the prosthesis may result in a return of some degree of hypernasality.

The inferior portion of the obturator is maintained parallel with the horizontal hard palate if possible (Fig. 8). This level will prevent the tongue from dislodging the prosthesis during deglutition. After completion of the impression, standard dental laboratory procedures are used to transform this portion of the prosthesis into acrylic resin.

Technical considerations with the Meatus Obturator

The meatus obturator should be considered when the posterior extension of a fixed obturator prosthesis is likely to result in prosthesis displacement. [2] The meatus obturator projects vertically at the posterior aspect of the prosthesis to obturate the posterior nasal choanae (Fig. 9). Because the vertical extension is closer to the palatal portion of the prosthesis there is less torque placed on the palatal portion thus decreasing the tendency for dislodgement. This prosthesis is most applicable to the fully edentulous patient who has undergone a total soft palate resection. [3] Since the posterior and lateral pharyngeal walls cannot function against a meatus obturatur, speech will tend to be hyponasal. With ideal obturation there will be absence of nasal breathing.

As with the other prosthetic designs the oral portion of this prosthesis is fabricated to full extension in an effort to maximize retention, support and stability. The vertical portion of the prosthesis is made in modeling compound. The prosthesis is inserted with a rotational path, first seating the vertical extension to the posterior choanae and then seating the oral portion of the prosthesis. Once the vertical extension is formed in modeling compound, mouth temperature wax is used to refine adaptation to the posterior choanae.

Once the meatus extension is processed onto the denture it is necessary to provide for nasal breathing (Fig. 10). One hole should be placed through each side of the prosthesis so that breathing is possible through each nares. Use the smallest opening possible at the best angle to prevent nasal regurgitation.

Technical Considerations for The Palatal Lift Prosthesis

The soft palate extension of the palatal lift prosthesis is designed to elevate an immobile soft palate to the approximate level of the palatal plane (Fig. 11). [4 5 6] The posterior target of the elevation is the dorsal tubercle of the first cervical vertebrae (atlas). The ease of elevation is dependent upon the elasticity, fibrosis and muscular activity of the soft palate.

When elevated, the soft palate will tend to displace the palatal lift and this displacement must be resisted by the retentive components of the prosthesis (Fig. 12).[7] The retentive clasps must be rigid and placed as close as possible to the obturator portion of the prosthesis. Occlusal (cingulum, incisal) rests will resist displacement of the prosthesis towards the tissue but it is the retentive aspect of occlusal rests (indirect retainers) that are most critical in this prosthesis. The further away from the fulcrum line the more effective the occlusal rests will be as indirect retainers. Parallel guide planes may also resist rotational displacement of a palatal lift prosthesis if there is sufficient clinical crown length.

When natural teeth are absent, retention of the prosthesis is severely compromised. In the absence of favorable anatomy, it may be impossible to use a palatal lift prosthesis unless dental implants can be placed as denture adhesive is usually not sufficient to counteract the displacement forces of the soft palate. When reduced denture retention is anticipated it may be prudent to first fabricate a conventional prosthesis and then gradually add to the posterior aspect of the prosthesis while attempting to minimize the amount of elevation.

The lift section of a palatal lift prosthesis is formed after the oral portion of the prosthesis is completed. A retentive loop is extended posteriorly from the palatal portion of the prosthesis to facilitate placement and retention of impression material to raise the soft palate.

Modeling compound is added to the retentive loop until the soft palate contacts the posterior and lateral pharyngeal walls. Initially, it will be necessary to manually hold this material in place until hardened as the soft palate will displace it easily. Once the basic extension has been established, border molding is achieved by adding and removing modeling compound in the posterior and lateral pharyngeal areas. After the warmed modeling compound addition is inserted the patient is instructed to flex the neck fully to achieve contact of the chin to the chest. This movement will establish contact of the middle third of the soft palate with the soft tissue covering the dorsal tubercle of the atlas. Lateral aspects of the lift are formed by rotation and flexion of the neck to achieve chin contact with the right and left shoulder respectively. A dull appearance of the modeling compound ensures tissue contact. Once contact of the soft palate with the pharyngeal walls is present, nasal breathing will not be possible. After slight (0.5-1.0 mm) reduction of the compound, mouth temperature wax is adapted to the modeling compound. The material remains in place for 7-10 minutes and the previous neck flexion and rotary flexion movements are repeated. Once the lift has been added to the palatal portion of the prosthesis, difficulties in nasal breathing may necessitate reduction of the lateral aspects of the lift until breathing is unstrained. Such a reduction of the prosthesis may result in a return of some degree of hypernasality.

Flaccid soft palates can be elevated easily with little counter force that would tend to dislodge the prosthesis. Taut soft palates that resist elevation compromise potential success of this type of prosthesis. Increased force used to elevate a taut soft palate may generate soreness or ulceration or result in dislodgement of the prosthesis. In these situations, it will be necessary to compromise on the level of elevation and focus on lateral extension of the prosthesis to attempt adequate closure at a lower level in the oropharynx.

Evaluation of Effectiveness of Treatment

When treatment is complete the patient will have palatopharyngeal closure during speech and deglutition while unimpeded nasal breathing will still be possible. Effectiveness of treatment with a palatal lift or a pharyngeal obturator prosthesis may be evaluated through subjective or objective methods.

Speech evaluation will determine the presence of nasality. Following treatment patients may experience hypernasal speech if the oropharyngeal contact is ineffective. If oropharyngeal contact is excessive the patient may experience hyponasal speech. Trained observers of nasality are often able to describe the quality of pharyngeal closure through speech alone. [89] The less experienced or skilled observer may benefit from the input of a speech pathologist or therapist in assessing the patient.

Patient reports of food or fluid regurgitation may indicate inadequate pharyngeal closure. Evidence of excessive closure would be an inability to achieve nasal breathing. Effective

closure of the oropharynx may require modifications to the palatal lift or the pharyngeal obturator to achieve the balance between inadequate and excessive closure.

Objective methods for evaluation of oropharyngeal closure involve direct visualization, indirect visualization, and measurement of air pressure differentials. Direct visualization may be performed through the use of a nasal endoscope. This fiber optic scope is used to determine the presence or absence of oropharyngeal closure. [1011] Indirect methods of visualization involve the use of radio-opaque fluids and cineradiography to assess fluid regurgitation. [12131415] Air pressure in the oral and nasal cavities can be assessed to determine the presence of closure.[1617]

Objective methods of assessment require the use of testing armamentarium that may interfere with test results. In addition the proper use of testing equipment demands time to establish skills while the improper use of equipment could prove dangerous to the patient. [11] Conversely, subjective testing may not be of sufficient sensitivity to discern the borderline air or fluid emissions. Neither approach is perfect. Experience of the clinician may be the most appropriate method to determine the most favorable test for the patient in question.

Summary

As with all phases of prosthodontics, there can be considerable difference in soft palate defects from one patient to another. The goal of this chapter was to outline the basic types of soft palate defect and to offer basic suggestions in their management with obturator or lift prostheses. There are many techniques that would lend themselves to development of acceptable obturator prostheses. It is important that the clinician become

familiar with a technique with which he/she is comfortable and can master. Application of that technique to the variations in soft palate defects should not be that difficult. It must always be remembered, and the patient must be so counseled in advance of treatment, that the prosthodontist cannot restore the intricate neuromuscular structure that is the soft palate. The clinician can only try to provide an alternative means for oropharyngeal function. How successful that alternative is will be dependent on the patient's ability to accept the defect and to adapt to an alternative environment.

Legends

Figure 1. Residual soft palate defect following surgical management of cleft hard and soft palate.
Figure 2. Surgical loss of soft palate in edentulous patient.
Figure 3. Partial surgical removal of soft palate leaves remaining right segment which only functions minimally and does not aid in palatopharyngeal closure.

Figure 4. (A) Nonfunctioning soft palate without defect. (B) Nonfunctioning soft palate radiographically. (C) Palatal lift prosthesis in place which elevates soft palate so that it makes contact with pharyngeal wall.
Figure 5. Soft palate obturator will separate oral from nasal pharynx but not lift scarred soft palate in repaired clefts.
Figure 6. Once framework for oral portion of the prosthesis is completed, impression of obturator portion of the prosthesis is made with impression materials attached to a retentive loop cast to the framework. Modeling plastic is border molded to conform to the motions of the patient.
Figure 7. Completed obturator impression made in mouth temperature wax.
Figure 8. Tongue surface of the obturator portion of the prosthesis should not encroach on tongue space any more than necessary for reasonable strength of materials.
Figure 9. Meatus obturator extends vertically into the defect as opposed to being horizontally suspended between the oral and nasal pharynx.
Figure 10. (A) Openings placed through meatus obturator to allow for nasal breathing. (B) Meatus obturator in place.
Figure 11. Palatal lift prosthesis elevates soft palate to provide palatopharyngeal closure.
Figure 12. Not relationship of direct and indirect retainers to the fulcrum line. The further forward the indirect retention, the better the resistance to dislodgement.

Objective	Design Feature	Result
Support	Occlusal rests	• Rests on natural teeth limit movement towards tissue
	Major connector	• Contact of major connector with tissue decreases movement
	Hard and soft tissue	• Contact between denture base and underlying tissue
Retention	Retentive clasps	• Undercuts on primary retainers engaged by clasps
	Skin graft	• Junction of skin graft and host tissue creates retentive interface
	Residual ridges	• Residual ridges and hard palate provide retention in edentulous patients
	Indirect retention	• Occlusal rests on opposite side of fulcrum line interfere with rotation of the prosthesis away from tissue
	Endosseous implants	• Direct retention of prosthesis •
Stability	Minor connectors	• Minor connectors prevent lateral motion of prosthesis
	Denture flanges	• Contact of flanges with residual ridges diminishes motion

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