

A Simplified Palatal Lift Prosthesis for Neurogenic Velopharyngeal Incompetence

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The velopharyngeal mechanism provides the sound and/or airstream between the oral and nasal cavities and influences the voice quality (or basic sound) perceived by the listener. If velopharyngeal closure is compromised, or if the structural integrity or relative size of the oral, pharyngeal, or nasal cavities has been altered, voice quality can be compromised. Velopharyngeal deficiencies may be classified on the basis of physiology and/or structural integrity. Palatal insufficiency and palatal incompetency are often used to define velopharyngeal deficits. Although these terms are often used interchangeably, there are subtle differences. Palatal insufficiency denotes speech and resonance aberrations related to a congenital or acquired anatomical defect. Palatal incompetence refers to patients with essentially normal velopharyngeal structures, but the intact mechanism is unable to achieve velopharyngeal closure. Velopharyngeal incompetence is the dysfunction of an anatomically intact velopharyngeal mechanism occurring in patients with neuromuscular disorders. Surgery is the preferred treatment option for correcting speech in patients with velopharyngeal dysfunction; however, surgery may not be possible or practical in many cases, including advanced cardiovascular or neurologic diseases (cerebral palsy, postcerebrovascular accidents). For patients for whom surgery is not an option, prosthetic treatment combined with speech therapy is the treatment of choice, and palatal lift prostheses (PLP) are often indicated for these patients.¹

The use of a PLP has been described in the dental literature for more than 35 years. Gibbons and Bloomer² introduced the

Abstract

Velopharyngeal incompetence is a contributing factor to speech disorders and implies the presence of hypernasality, inappropriate nasal escape, and decreased air pressure during speech. One prosthetic treatment is a rehabilitative procedure employing a palatal lift prosthesis (PLP), which reduces hypernasality by approximating the incompetent soft palate to the posterior pharyngeal wall and consists of two parts, the anterior denture base and the palatal lifting plate, which are connected with steel wires; however, it seems difficult to reproduce the mobility of the soft palate in speaking, and it is therefore likely that the palatal lifting plate stimulates or oppresses the tissue of the soft palate and hinders rather than assists articulatory function. To avoid these disturbances we devised an adjustable PLP with a flexible conjunction between the denture base and the palatal lifting plate to obtain the optimal vertical lifting angle. The palatal plate was adapted to conform in a passive manner to the soft palate with light-cured resin. The designed PLP simplified the procedure and reduced the number of adjustments and visits.

> concept of mechanically elevating the neurologically impaired soft palate to permit controlled obturation of the nasopharyngeal passageway. The objective of the palatal lift is to improve resonance by displacing the soft palate to the level of normal palate elevation, decreasing the palatopharyngeal port to eliminate hypernasality and nasal emission of air during the production of oral consonant sounds.³ The PLP was fabricated in successive stages to enhance patient adjustment and acceptance of the prosthesis. The design fabrication and fitting of the prosthesis was performed by the prosthodontist and speech pathologist, since the device must be stable, and so as not to cause discomfort or gag reflex. At the same time it must raise the soft palate sufficiently to allow nasal breathing. Elevation of the soft palate should not be performed in one attempt. The adjustment should be carried out at weekly intervals, increasing the amount of elevation by no more than 2 mm in a single attempt. Usually, the placement requires five visits over a 1-month period, with adjustments for comfort and modifications during speech therapy.²

> With the intention of simplifying the procedure, we devised a method in which the PLP was easily adjustable to the appropriate vertical angle and adapted to conform in a passive manner to the soft palate with light-cured resin.

Clinical presentation

A 20-year-old man with velopharyngeal incompetence due to severe brain injury was referred to the Prosthodontics



Figure 1 Palate portion with loops in the shape of an "Ω."

Department, Faculty of Medicine and Dentistry, Santiago de Compostela University, Compostela, Spain for examination. The patient's speech was hypernasal, and oral examination revealed dysarthria induced by incomplete closure of the velopharyngeal orifice. The patient had not previously received speech therapy.

The maxillary teeth were available for a retention PLP. An impression was made in irreversible hydrocolloid (Jeltrate Plus, L.D. Caulk Denstply Intl. Inc., Milford, DE) in a stock metal tray modified with wax. The impression was extended at the pharyngeal end of the soft palate, and a master cast was fabricated in stone. The PLP we applied was composed of two parts: the anterior denture base and the palatal lifting plate. The anterior denture base was fabricated from heat-polymerizing acrylic resin with retentive clasps on the left and right first premolars and first molars.

The palate portion of the device was designed and fabricated on the master cast. A section of 18-gauge stainless steel orthodontic wire (3M Unitek, Monrovia, CA) was adapted to the master cast to form several loops in the shape of an " Ω ," attached to the anterior portion, and adjusted to conform to the appropriate angle (Fig 1). The palatal lifting plate was separated from the anterior denture base and could therefore be adjusted to alter the vertical lifting angle. Further adjustments were made to the wire so the appropriate angle was attained. The lifting angle was determined by evaluating velopharyngeal closure achieved with the palatal lifting plate without inducing a gag reflex. In addition, the " Ω " form allowed us to modify the form in the horizontal plane.

Once the vertical angle that allows velopharyngeal closure was achieved, the palate portion was made. A visible light-polymerized denture base resin core (Triad; Dentsply, York, PA) was placed over the retentive loops to secure the palate portion (Fig 2). A handheld visible light source was positioned (model XL 1500; 3M Dental Products, St Paul, MN). The light was applied for 2 minutes to obtain an initial set (Fig 3). The denture was removed from the mouth, and the light was applied directly to the prosthesis for 8 minutes with a custom polymerization unit (Visible Light Cure 2000 System; Dentsply Trubyte Triad). Air-barrier coating was applied over the VLP resin and was polymerized in the unit for 8 minutes.



Figure 2 A visible light-polymerized denture base resin core placed over the retentive loops.



Figure 3 A handheld visible light source applied directly to the patient's mouth.



Figure 4 The prosthesis placed in the mouth.

The device was positioned in the patient's mouth after checking that it did not interfere with the nasopharyngeal airway or cause respiratory discomfort (Fig 4). A speech pathologist evaluated the patient's speech by using perceptual judgment with a standardized speech passage and a nasoendoscopic examination. A significant reduction in hypernasality was noted, with a 95% closure of the velopharyngeal valve.

Discussion

The literature substantiates the effectiveness of the PLP. In 1967. Lang and Kipfmueller⁴ recommended the use of a PLP for the neurologically compromised patient, provided concomitant speech therapy was offered. Gonzales and Aronson⁵ reported speech improvement and tolerance of the prosthesis for all but three patients in a comprehensive study of 35 neurologically compromised patients treated with PLPs. The best results were obtained for patients where the neurologic disorder was confined to the soft palate. LaVelle and Hardy⁶ studied 44 neurologically compromised patients treated with PLPs for palatal pharyngeal incompetence. Their results showed PLP to be an effective treatment for patients with dysfunctional palates. Wolfaardt et al⁷ reported on a series of 32 patients treated with a PLP. They found that 21 (of 32) of their patients benefitted from its use. In addition, 14 patients were ultimately able to discard the prosthesis due to improved palatal pharyngeal function.

Patient acceptance and compliance remains a significant challenge when using a PLP. Problems such as dysphagia and lack of significant improvement in speech over the short term have often been cited as reasons for this.8,9 Because of discomfort, such as difficulty in swallowing or gag reflex, while wearing a PLP, a PLP requires rigorous clinical adjustment. Occasionally, the procedure has to be repeated a number of times before attaining its final form, especially in patients who have a sensitive gag reflex. The palatal lifting plate is separated from the anterior denture base and thereby is adjustable to alter the vertical lifting angle if necessary; this is accomplished by trial and error, with short reinsertions of the device.¹ It is relatively easy to fit the suitable angle with the design we have proposed. The most difficult and time-consuming phase of the procedure is to carefully adapt the extension wire to conform to the passive soft palate. The placement of light-cured resin directly in the soft palate allows a suitable adjustment and absence of injury to the soft palate as a result of pressure from the supporting palatal section. In addition, light-cured resins offer a number of advantages when compared with conventional procedures using heat-cured polymethyl methacrylate resins: they are easy to construct and repair, they are lightweight and polymerize without residual components (i.e., no free methyl methacrylate),

and they have low bacterial adherence and an unlimited working time. The combination of an easy adjustment of the vertical inclination and the adjustment of the palatal portion directly in the mouth can simplify the procedure and reduce the number of adjustments and visits.

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