Regenerative Approach to Velopharyngeal Incompetence with Fat Grafting

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KEYWORDS

• Velopharyngeal incompetence • Hypernasality • Nasal air escape • Nasoendoscopy • Fat grafting • Regenerative medicine • Submucous cleft

KEY POINTS

- Mild to moderate velopharyngeal incompetence (VPI) constitutes a dilemma for surgeons. Standard techniques such as velopharyngoplasties are invasive and carry the risk of airway obstruction. Autologous fat injection offers the advantage of considerably less morbidity.
- Fat grafting to the nasopharynx should be performed under direct vision with the assistance of a rigid endoscope connected to a video system to visualize the correct injection sites.
- The level of placement is important. Fat should be introduced into the muscular layer to avoid the risk of caudal displacement, along the natural cleavage plane in the prevertebral space.
- It is mandatory to use blunt cannulas only, never sharp needles, to prevent the risk of injecting into the vessels or injury to the internal carotid artery.
- Fat grafting to the velopharyngeal port can successfully treat cases of moderate VPI while preserving the pharyngeal anatomy.

Videonasoendoscopy pre-operative and post-operative of fat injection in a patient affected by velopharyngeal insufficiency accompanies this article at http://www.plasticsurgery.theclinics.com/

INTRODUCTION

The muscular activity of the velum and the pharyngeal walls regulates speech resonance and contributes to speech articulation. During phonation, the levator veli palatini muscle elevates the velum in an upward and backward direction while the palatopharyngeus and the pharyngeal constrictor muscles approximate the pharyngeal walls toward the midline. By this mechanism, the lateral and posterior walls of the pharynx are pulled in and the aperture between the nose and oropharynx gradually closes.

If for differing anatomy, either congenital or acquired, closure of the velopharyngeal (VP) port does not take place, the air escapes from the oropharynx into the nose, impairing normal speech articulation and resonance. This condition is termed velopharyngeal incompetence (VPI) and the ensuing resonance alteration is known as hypernasality. VPI may also affect suction and deglutition, with possible nasal regurgitation of fluids and foods.

Beginning from the second half of the nineteenth century, numerous surgical techniques have been proposed over the years to treat VPI by reducing

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the passage between the oropharynx and nasopharynx.[1] Such methods include: soft palate re-repair, when musculature has not been reapproximated during primary closure or when scar tissue is present along the midline impairing palatal elevation[2]; double-opposing Z-plasty, to recreate the levator muscle sling and elongate the velum simultaneously[3]; pushback procedures, designed to lengthen the soft palate, preserving its dynamics, by moving the entire palatal fibromucosa backward with reduction of the space between the velum and the posterior pharyngeal wall[4]; velopharyngoplasties; and advancement of the posterior pharyngeal wall.

Velopharyngoplasties encompass the superiorly based and the less used inferiorly based pharyngeal flap,[5–8] or the transposition of the posterior pharyngeal pillars, containing the palatopharyngeus muscle.[9] These plasties are effective in diminishing the passage between the nasal cavity and the oropharynx for management of severe VPI, but may have a relevant morbidity either in the immediate postoperative period, such as severe pain and risk of bleeding, or over the long term, such as snoring and obstructive sleep apnea (OSA). However, they are considered an overtreatment in the presence of moderate VPI.

Advancement of the posterior pharyngeal wall is a well-known method in use since the beginning of the twentieth century.[10] A large variety of implants[11–17] or autologous tissue[18,19] have been placed over the years into the retropharyngeal space, with the aim of pushing the posterior wall of the pharynx forward to meet the velum and reduce the size of the nasopharyngeal port. To be efficacious, the implant should be located high in the pharynx at the point of the velar contact. Over time, however, extrusion or dislocation of the implant in a lower position along the posterior pharyngeal wall has often been reported, making the rationale of this technique questionable.

Recently, autologous fat transplantation to the velopharynx has been proved to be successful in the treatment of VPI.[20–25]

PATIENT SELECTION AND TREATMENT GOALS

The aims of this article are to highlight patient selection criteria for fat grafting and illustrate the technical details for making the procedure effective in reducing the VP gap.

Patient selection constitutes a critical step. Fat grafting, in fact, can successfully correct only mild to moderate gaps of VP closure.

Preoperative assessment is based on a thorough evaluation performed by the surgeon together with a specially trained phoniatrician and a speech therapist.

Treatment protocol includes:

- Perceptual evaluation, with spontaneous speech and repetition of sentences and phonemes, designed to assess resonance, audible air escape and turbulence, articulation defects, and potential dysphonia
- Acoustic measurements, such as nasometry
- Aerodynamic evaluation to quantify the nasal air leakage
- Videofluoroscopic study of the VP port in multiple projections
- Videonasopharyngoscopy

In the authors' clinical practice, perceptual evaluation and videonasopharyngoscopy are considered the standard for patient selection, while aerodynamic measurements are performed in selected cases and for research purposes. Perceptual assessment includes video recording of several speech samples using a professional microphone. The videos are blindly evaluated by independent listeners with specific expertise in VP function. The information gained from such studies provides us with quantifiable data and assists us to critically and blindly evaluate our results. It is of critical importance to distinguish between VP incompetence and VP dysfunction that can be treated conservatively by speech therapy without the need of additional surgery.

Videonasopharyngoscopy is performed by introducing a flexible scope through the middle meatus. This instrumental assessment is of paramount importance for the objective evaluation of the size and location of the VP closure gap. Furthermore, hyponasality (resonance alteration due to nasal airway obstruction) is associated in some cases with VPI and can partially mask an existing hypernasality. The direct visualization of the nasal fossae and the nasopharynx may explain the etiology of hyponasality resulting from obstructive anatomic conditions. This distinction is of particular importance because the type of resonance determines the appropriate treatment. Videonasopharyngoscopy has been recognized as superior to videofluoroscopy in identifying small closure gaps and confirming the size of opening, important for surgical planning.[26] It is well tolerated, also by children, provided a flexible endoscope, with diameter inferior to 3 mm, is used. The new technology of microchip videoendoscopes allows high-definition videos to be obtained even with endoscopes of very small diameter.

In relation to the aforementioned considerations and depending on the nasopharyngeal gap