The San Venero Roselli Pharyngoplasty: An Electromyographic Study of the Palatopharyngeus Muscle

IGNACIO TRIGOS, M.D.
ANTONIO YSUNZA, M.D.
DAISY VARGAS, M.D.
MARIA DEL CARMEN VAZQUEZ, M.D.

Electromyography of the palatopharyngeus and salpingopharyngeus muscles was performed in three groups: normal subjects, subjects with cleft palate before surgical treatment, and subjects with repaired palatal clefts incorporating the San Venero Roselli pharyngoplasty.

Results suggested that the salpingopharyngeus muscle is inconsistently present in man. The palatopharyngeus is primarily concerned with swallowing and is not active during velopharyngeal closure. Its activity is not affected by the San Venero Roselli procedure. The surgical approximation of this muscle may be advantageous because of its antagonistic action to the levator veli palatini.

KEY WORDS: *palatopharyngeus, salpingopharyngeus, San Venero Roselli pharyngoplasty, velopharyngeal closure.*

Velopharyngeal insufficiency occurs in a sizable percentage of patients with repaired palatal clefts. Ysunza and Trigos (1986) reported a failure rate of 20% after palatal closure with a push-back displacement. San Venero Roselli (1934) described a type of sphincter pharyngoplasty that sutured the posterior faucial pillars high on the pharyngeal midline. Trigos and Ysunza (1988) found that this procedure was helpful in preventing palatal shortening when combined with a push-back palatoplasty. Not considered to date is the change in muscle dynamics after this procedure. This paper compares the palatopharyngeus and salpingopharyngeus electromyographic patterns in three subject groups: normal subjects, subjects with cleft palate before surgical treatment, and subjects with repaired clefts incorporating the San Venero Roselli pharyngoplasty. Special attention was focused in interpreting the electromyographic findings relative to how San Venero Roselli's procedure influenced velopharyngeal function.

The authors are affiliated with Hospital Manuel Gea Gonzalez, Mexico City, Mexico. Dr. Trigos is chairman of the Department of Plastic Surgery; Dr. Ysunza is Coordinator of the Department of Phoniatrics, Dr. Vargas is Resident in Plastic Surgery, and Dr. Vasquez is a Clinical Research Fellow of the Department of Phoniatrics.

METHOD

Operative Technique

While the subject is under general anesthesia, a lidocaine and adrenaline solution (1:200,000) is infiltrated on the palate and posterior tonsillar pillars. A palatoplasty (Wardill, 1937) and an intravelar veloplasty (Krienz, 1970) are performed. The palatoplasty incision at the uvula is continued posteriorly along the upper two-thirds of the anterior border of the posterior tonsillar pillar. As the dissection is deepened, the palatopharyngeal muscle fibers are identified. The transversely oriented fibers of the superior constrictor muscle are located and preserved because of their importance to velopharyngeal closure, especially in the velopharyngeal closure pattern with marked lateral pharyngeal wall movement (Croft and Shprintzen, 1981). Three layers are identified as follows: pharyngeal mucosa, muscle, and oral mucosa. Each of these layers is sutured to approximate the posterior pillar in the midline (Fig. 1).

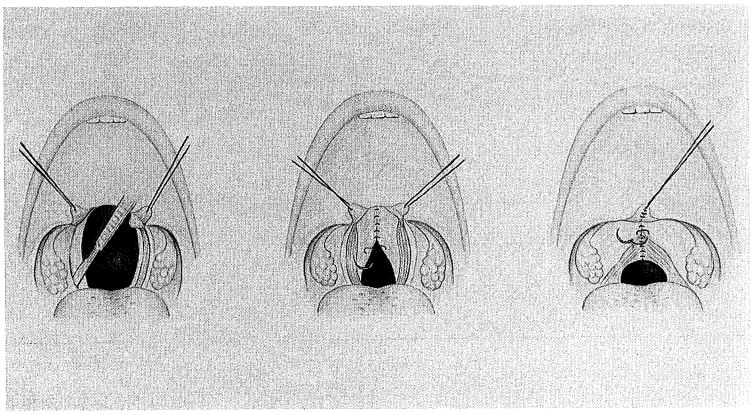

FIGURE 1 San Venero Roselli pharyngoplasty. The posterior pillars, including the palatopharyngeus, are approximated toward the midline, creating a sphincter pharyngoplasty.

Subjects

The subjects were divided into three groups:

Group 1: Ten subjects without cleft with normal language, speech, and voice.

Group 2: Ten subjects with unrepaired palatal clefts as an isolated malformation (i.e., no associated malformations). All were over 4 years of age.

Group 3: Ten subjects with repaired palatal clefts, all operated with the combination San Venero Roselli push-back procedure. All subjects in Group 3 were seen at least 6 months postoperatively at the time of the study. Nasal resonance was normal in all, and velopharyngeal closure was confirmed by nasoendoscopy and videofluoroscopy.

Electromyography

Following local anesthesia of the pharynx, a coaxial needle was inserted orally under direct vision into the bulk of the palatopharyngeus muscle (Fig. 2). Potentials were recorded by a Nicolec Compact Four multisensory system. The recording was displayed on a cathode ray tube (CRT) oscilloscope at a sensitivity of 97.65 μv per cm^2. Analysis time was 100 ms. All recordings were stored on a computer for further analysis.

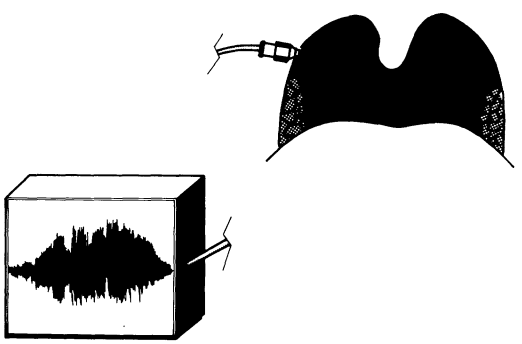

FIGURE 2 Electromyographic recording technique. A coaxial needle is inserted on the bulk of the palatopharyngeus. Potentials are recorded by a Nicolet Compact Four multisensory system. The recording is displayed on a CRT oscilloscope. All recordings are stored on a computer for further analysis.

The protocol included (1) insertion activity recording, (2) spontaneous activity recording for 300 ms, and (3) motor activity during (a) forced inspiration with mouth opened, (b) phonation of /a/, (c) swallowing, and (d) phonation of /ka/, /ko/. Each activity was recorded for at least 100 ms. The same procedure was repeated for the salpingopharyngeus muscle.

Results

Salpingopharyngeus muscle activity was detected only inconsistently in each group of subjects. In Group 1, salpingopharyngeus muscle activity could be found only in four of 10 subjects; in Group 2, it was recorded in three subjects; finally, in Group 3, the muscle activity was documented only in two subjects. In contrast, the palatopharyngeus muscle activity was easily recorded in all three groups of subjects.

Palatopharyngeus and salpingopharyngeus muscle activity during oral inspiration and phonation of /a/ was negligible in all three groups.

During swallowing, both muscles showed great activity reaching a complete interference pattern, i.e., the condition in which the motor potentials cover the CRT screen completely during maximum muscular effort (Fig. 3). There were no notable differences in either amplitude or frequency of the motor potentials among the three groups. During phonation of /ka/, /ko/, for which velopharyngeal closure is attained, no activity was found for either muscle.

Discussion

In our opinion, the San Venero Roselli pharyngoplasty offers many advantages. It is

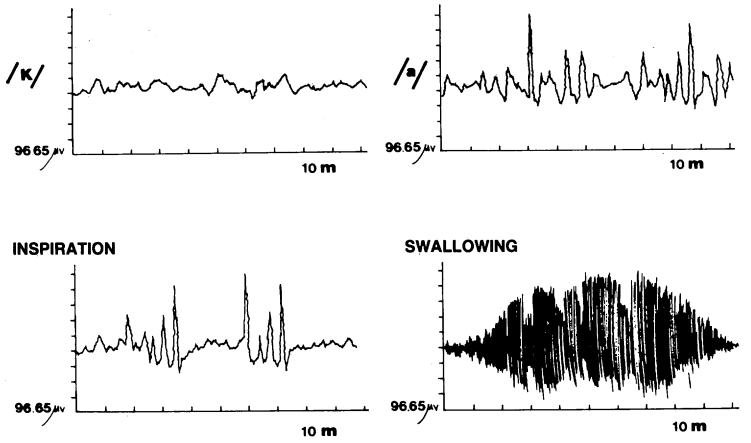

FIGURE 3 Electromyographic recordings of the palatopharyngeus during /ka/, /ko/, /a/, forced oral inspiration, and swallowing. Note the complete interference pattern recorded during swallowing. During phonation of /a/ and oral inspiration muscle activity is negligible. During phonation of /ka/, /ko/, for which velopharyngeal closure is attained, no activity was found for this muscle. These patterns of activity were found in all three subject groups. None of the subjects showed a departure from the patterns illustrated.

FIGURE 3

helpful in preventing palatal shortening when performed together with a push-back palatoplasty (Trigos and Ysunza, 1988). Furthermore, in our experience, patients with persistent velopharyngeal insufficiency following a San Venero Roselli procedure can be treated later with a pharyngeal flap.

Orticochea (1970) described an operation to correct velopharyngeal insufficiency. Roberts and Brown (1983) have advocated this procedure to treat all degrees of nasal escape; in their series, however postoperative nasal escape occurred in three of 10 patients. Ortichochea (1983), reviewing a large number of patients collected over a 20-year period, found a correlation between movement of the velopharyngeal sphincter and improvement of velopharyngeal closure. When movement of the velopharyngeal sphincter reappeared after the pharyngoplasty, usually within 3 months to 1 year postoperatively, velopharyngeal closure was improved.

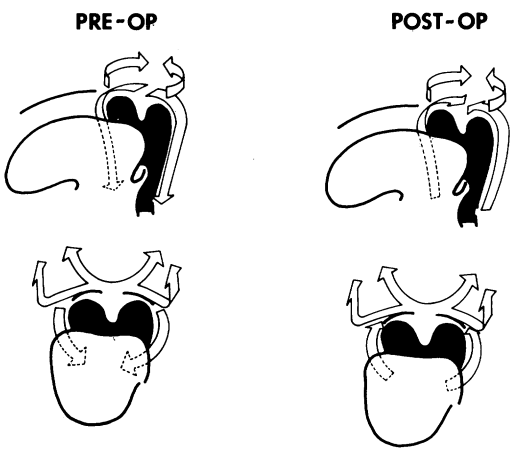

FIGURE 4 ***Top and bottom left,*** **the function of the palatopharyngeus, superior pharyngeal constrictor, and tensor and levator palatini muscles. The arrows indicate that the palatopharyngeus may be considered a levator antagonist. It is a swallowing muscle. After San Venero Roselli pharyngoplasty (right), the change in direction (arrows) indicates that the posterior pillar approximation, including the palatopharyngeus, may defeat its depressor action and allow the levators to function better.**

Fritzell (1969) stated that the salpingopharyngeus muscle is present only inconsistently in man. Our findings support this statement, since salpingopharyngeus muscle activity could be recorded only in nine of 30 subjects. Furthermore, after the operation (Group 3), access to the muscle is very difficult. Fritzell also reported electromyographic studies of the palatopharyngeus. He found that this muscle is not active during velopharyngeal closure but is activated in normal subjects and those with cleft palate on open sounds such as vowels and on swallowing. The findings in this study demonstrated these same patterns of activity during velopharyngeal closure in all three groups of subjects. Thus, according to Fritzell, the palatopharyngeus can be considered to be a palatal depressor and principal antagonist of the levator veli palatini.

The salpingopharyngeus action is not as clear; its role as levator antagonist remains obscure. Nonetheless, Fritzell found this to be an inconsistent muscle and considered its action irrelevant to velopharyngeal closure. Our findings confirm these statements. Furthermore, a San Venero Roselli pharyngoplasty did not modify salpingopharyngeus activity when it was present.

We believe that the San Venero Roselli pharyngoplasty is useful because it prevents palatal contraction after a push-back operation. It also reduces the size of the nasopharyngeal passage. Finally, based upon our findings in this study, it may be assumed that the surgical approximation of the posterior tonsillar pillars, including the palatopharyngeus muscle, may defeat their palatal depressor action and allow the palatal levators to function better (Fig. 4).

References

Croft C, Shprintzen RJ. (1981). Patterns of velopharyngeal valving in normal and cleft palate subjects: a multiview videofluoroscopic and nasoendoscopic study. Laryngoscope 91:265–271.

Fritzell B. (1969). The velopharyngeal muscles in speech. Acta Otolaryngol (Suppl.) 250:1–81.

Krienz OB. (1970). Fundamental anatomic findings for an intravelar veloplasty. Cleft Palate J 7:27–32.

Orticochea M. (1970). Results of the dynamic muscle sphincter operation in cleft palates. Br J Plastic Surg 23:108–112.

Orticochea M. (1983). A review of 236 cleft palate patients treated with dynamic muscle sphincter pharyngoplasty. Plastic Reconstr Surg 71:180–185.

Roberts MF, Brown B. (1983). Evaluation of a modified sphincter pharyngoplasty in the treatment of speech problems due to palatal insufficiency. Ann Plastic Surg 10:209–217.

San Venero Roselli G. (1934). Divisione palatina, sua cura chirurgica. In: San Venero Roselli G, ed. La'divisione congenita del labio e del palato. Rome: Casa Editrice Luigi Pozzi, 262–268.

Trigos I, Ysunza A. (1988). A comparison of palatoplasty with and without primary pharyngoplasty. Cleft Palate J 25:163–166.

Wardill WE. (1937). Palate repair technique. Br J Surg 16:127–135.

Ysunza A, Trigos I. (1986). Nasopharyngoscopy and videofluoroscopy for the diagnosis of velopharyngeal insufficiency. Cirugia Plastica Ibero Latino Americana 1:7–17.