The Myomucosal Vertical Z-Plasty in Secondary Cleft Lip Surgery
A Novel Technique for Correction of the Whistle Deformity

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As surgical techniques have evolved for repair of the cleft lip, the incidence of secondary deformities and the need for revision surgery have decreased. However, a number of factors may contribute to an unacceptable cosmetic or functional result. The whistle deformity (originally referred to as a whistling deformity) is a common complication of unilateral and bilateral cleft lip repair whereby the free margins of the upper and lower lips do not meet when the lips are in repose. The conspicuous cosmetic defect can expose teeth or alveolar mucosa, and functional compromise can affect speech and oral competence.

The causes of the whistle deformity include scar contracture along a vertically oriented cleft lip repair suture line, deficiency of one or more tissue layers at the vermilion border, diastasis or dehiscence of the orbicularis oris, a short prolabium, or a combination of these factors.

As in primary cleft lip surgery, the goal of correcting the whistle deformity is to restore orofacial function and appearance.

Many techniques to repair the whistle deformity have been described, and the best approach often depends on patient-specific characteristics, such as the extent and type of tissue deficiency and any additional associated secondary deformities. We present a novel approach to correcting the whistle deformity with an intraoral myomucosal vertical Z-plasty, a valuable technique that can be added to the tools at the surgeon's disposal.

Methods

Under Institutional Review Board for Human Research approval from the Medical University of South Carolina, a retrospective review was performed of 3 patients who presented with a secondary cleft lip whistle deformity. All patients provided oral informed consent. Preoperative evaluation revealed a whistle deformity with exposure of teeth and alveolar mucosa (Figure 1).

The procedure is performed with the patient under general anesthesia with orotracheal intubation and the endotracheal tube taped to the midline lower lip. With the upper lip retracted superiorly, the vertical limb of the Z-plasty is planned from the peak of the whistle deformity extending toward the nasal spine. As classically described for Z-plasty design, increasing the angles of the Z-plasty limbs increases the final vertical length. Therefore, the length of the vertical central limb can be tailored to the specific dimensions of the whistle deformity. The 2 parallel limbs of the Z-plasty are planned for the desired increase in length of the vertical dimension because a greater angle between limbs of the Z-plasty will increase the vertical length of the reconstructed transposition (Figure 2).

The vertical incision is made through the mucosa and submucosa. Great care must be taken to continually assess the depth of dissection because there may be a dehiscence of muscle in this region. The orbicularis oris is identified and its circumoral continuity assessed; if intact, it is also incised, el-
Elevated, and incorporated into the Z-plasty as an intact myo-mucosal transposition flap. If the orbicularis oris is deficient in the midline, then the parallel limbs of the Z-plasty are incised through the submucosa as far laterally as necessary to access the orbicularis oris. Through the intraoral incisions, the muscle is elevated and reapproximated in the midline with the transposition flaps to reconstruct circumoral continuity. It is critical to include muscle in the reconstruction, particularly across the most inferior region of tissue deficit, to add bulk and strength to the flaps and ensure a lasting result.

Results

Three patients were identified, 2 with a history of bilateral cleft lip repair and 1 with a history of unilateral cleft lip repair. In all 3 patients, the described technique was performed and the whistle deformity was corrected such that the free margins of the lips were in full contact with the lips in neutral resting position. No perioperative or postoperative complications were encountered.
Discussion

The secondary cleft lip whistle deformity has challenged cleft surgeons for more than a century. Since the original description of the Abbe lip-switch in 1898, many corrective techniques have been described, a testament to the complexity of the deformity's etiology and management. Several factors must be considered when evaluating a patient to determine the optimal procedure. The reconstructive options may be limited by the availability of local tissue and its composition, which may include wet mucosa, dry mucosa, vermilion, white roll, or skin. In addition, secondary deformities often occur concurrently, and if an unacceptable cutaneous scar or nasal deformity is also present, the surgeon may elect to address them simultaneously. Some authors have proposed classifications and treatment algorithms based on some of these patient-specific factors.

In our technique, preoperative and postoperative photographs show correction of the whistle deformity. For patient 1, a deficient central lip volume was corrected with the described advancement of oral myomucosal tissue, and the satisfactory cutaneous scar was left untouched; indeed, the fullness postoperatively is a bit excessive, and we hope it will recede slightly over time. For patient 2, the complete absence of dry mucosa in the midline was corrected while maintaining a Cupid's bow. However, the left cutaneous scar became more prominent postoperatively. For patient 3, the deficient central lip is corrected with this Z-plasty, although the scar remains apparent on the dry lip.

When a large tissue deficit is present and local tissue is inadequate for reconstruction, remote tissue can be used and may require a second stage procedure. In cases of such severe deformity, a lip revision is often recommended after any expected orthognathic and rhinoplasty surgery to minimize morbidity and the need for further revision from additional donor sites. Previous studies have reported using tissue from the lower lip in a modified or extended Abbe flap for cases of large tissue deficit, a tight or scarred upper lip, an absent tuberculum, or an absent Cupid's bow. Patel and Hall described using free dermis and fat grafts from the hip, and Lee and Koh reported using cadaveric acellular dermis. In cases of prolabium necrosis, when the tissue defect is limited to skin, a full-thickness skin graft as described by Nadjmi and Jackson can also be used.

Excessive scar contracture commonly contributes to the whistle deformity; therefore, when local tissue is inadequate for reconstruction, techniques that include excision or revision of the scar may be preferred. Assunção et al reported using the excised scar line as a deepithelialized tunnelled pedicled flap. Yin et al described a complete excision of a bilateral cleft lip scar, and the techniques of Mitsukawa and Hosaka and Meijer similarly excise the cutaneous scar while also allowing access to the nasal base to perform limited nasal revision procedures simultaneously.

Several authors have described various methods of using adjacent upper lip mucosa. Such mucosal techniques may include wet mucosa or dry mucosa, depending on the available tissue and appearance of the deformity. The modification of the Kaptansky technique described by Juri et al involves a large bilateral advancement of lateral upper lip tissue, including predominantly dry mucosa to reconstruct the central tubercle. V-Y plasty and modified V-Y plasty techniques have been reported with success. Although V-Y plasty is one of the most common techniques used for a whistle deformity, a criticism of this procedure is the foreshortening of the horizontal lip length, resulting in a fishlike appearance of the upper lip. Z-plasty techniques for the whistle deformity have been reported, although they are generally performed by transposing tissue from the dry mucosa or along the wet-dry junction, or they include only mucosa and submucosa.

The technique that we describe is unique in that it leaves intact the cutaneous scar, vermilion border, and Cupid's bow while still providing access to the orbicularis oris, allowing the surgeon to reconstruct its circumoral continuity and to create strong and bulky transposition flaps. Because this flap design incorporates the muscle, this technique not only provides excellent aesthetic results but also enables improved functional results. In addition, it allows for an adjustable yet predictable amount of tissue transposition by carefully designing the Z-plasty dimensions and angles. However, the Z-plasty design is a powerful tool than can result in excessive fullness at the previous site of deficiency; thus, careful design is imperative. The appropriate candidate for this procedure is the patient with a satisfactory appearance to the vermilion, white roll, and cutaneous scar but a deficit of lip mucosa. A patient who requires revision of the nose or cutaneous lip scar is a poor candidate for this procedure because those deformities cannot be easily addressed. It is preferable that the deficit be of wet mucosa because it is intraoral mucosa that is transposed inferiorly. A potential pitfall of this procedure is that a large transposition could distort the appearance of the outer cutaneous lip if the muscle is not sufficiently elevated from the subcutaneous plane.

Conclusions

The whistle deformity is a well-described complication of unilateral and bilateral cleft lip surgery. Many corrective techniques have been proposed, and several patient-specific factors must be considered, including the extent of the deficit and the availability of local tissue. We describe a novel procedure with a myomucosal vertical Z-plasty transposition, a technique to add to the tools available to the cleft surgeon for addressing this common defect.
Critical revision of the manuscript for important intellectual content: Gudis.
Administrative, technical, or material support: Gudis.
Study supervision: Patel.

Conflict of Interest Disclosures: None reported.

REFERENCES