ABSTRACT

**Objectives:** To report the first two human cases of vocal fold reconstruction using a novel vascularized flap.

**Methods:** Case details, indications, techniques, complications and outcomes are retrospectively reviewed.

**Results:** Both patients underwent successful surgical vocal fold reconstruction without complications and had lasting voice improvement.

**Conclusions:** The proposed technique describes the successful translation of a novel and widely applicable surgical method of reconstructing the vocal fold previously tested in a canine model.

INTRODUCTION

Beginning with Brunings’ novel work in 1911 with paraffin wax injection and Payr’s version of the original thyroplasty using a pedicled vascularized thyroid cartilage flap for vocal fold paralysis, numerous original and successful techniques have built the armamentarium of options for displacing and augmenting vocal folds when the vocal folds meet. Voice results and surgical options retain meaningful limitations, however. When techniques utilize sometimes costly exogenous materials such as Silastic™ or Gore-Tex™, extrusion can be seen and they have no place in the lamina propria due to obvious viscoelastic mismatch. Temporary injected materials such as Radiesse™, while able to be applied in a less invasive manner in an office-based setting, are subject to rejection as a foreign body, allergic reaction by the patient, and migration from their injection site. To overcome rejection, implantation of autologous free fat and fascia grafts, whether injected, endoscopically placed or delivered through a minithyrotomy approach, have been implemented with similar concerns related to long-term viability. Durability of effect with autologous substances is thought to arise from a lack of blood supply to support the implanted free graft. Experimental and clinical work has sought to solve this problem by pursuing vascularized pedicled tissue transfer for vocal fold and laryngeal reconstruction. Yet, to date applications of these techniques are limited. The Composite Thyroid Ala Perichondrium Flap (CTAP) incorporates fat from the pre-epiglottic space pedicled on vascularized perichondrium from the thyroid ala19. Experimental work in a canine model showed that placement of the CTAP (“see-lap”) into the lamina propria of normal canine vocal folds yielded no surgical complications, no disruption of native viscoelastic properties of the glottis relative to control values, no histologic differences of key anatomic components of the lamina propria relative to the control vocal fold and no growth of bone or cartilage from the implanted tissue at one month after implantation. Given these favorable findings, clinical application of the CTAP in two human cases was pursued and is presented here.

METHODS AND MATERIALS

After Institutional Review Board approval, the charts of the two individuals undergoing CTAP placement for correction of glottic defects were accessed and patient demographics, history, and pre and post-operative voice data were collected.

RESULTS

**Case 1**

A 52-year-old woman presented for management of long-standing dysphonia following unilateral left vocal fold Teflon™ injection 15 years prior for idiopathic left vocal fold paralysis. Formal voice measures were not obtained at that time. Stroboscopy exam revealed an immobile left vocal fold with convexity and total loss of mucosal wave with inflammatory change of the overlying epithelium. Movement and pliability of the right vocal fold was normal. She underwent open removal of the Teflon™ under general anesthesia through a thyroplasty type I window and subsequent elevation and delivery of a laterally based CTAP into the defect to prevent vocal fold lateralization (empty paraglottic space syndrome). She was discharged the next day. Post operative evaluation revealed no wound complications, airway restriction symptoms or dysphagia. She was then seen four, 10 and 22 months postoperatively. Clinically, the patient noted improved use of her voice during everyday voice use and greater ease projecting over background noise. There was a substantial increase in pitch range from 82-200 Hz to 81-1175 Hz, and a change from incomplete glottic closure to complete glottic closure.

**Case 2**

A 70-year-old man presented with dysphonia following an open partial cordectomy for a right sided T2N0M0 squamous cell carcinoma in 2004. His chief complaint was vocal difficulty with increased effort and reduction of the need to repeat himself. He reported a reduction of the Vocal Handicap Index from 26 to 14.

**DISCUSSION**

• These two cases represent the first application of the CTAP flap for vocal fold reconstruction
• Experimental work in a canine model supported clinical translation into human use
• Successful voice improvements were noted after CTAP delivery
• CTAP delivery was achieved under both general anesthesia and sedation
• CTAP delivery was successful both when the flap was either laterally or inferiorly based
• No swelling, airway or wound complications were observed
• Voice function was noted to improve over time
• Voice improvement was durable over time
• No resection of the flap was noted
• No physical migration of the flap was noted
• CTAP was successfully placed deep and superficially within the vocal fold
• CTAP can be used for bilaterally vocal fold restoration
• Superficial placement represents the first vascularized flap to be used for lamina propria restoration
• A theoretical advantages include improvement over time due to remodeling of the flap from the “bioreactor” effect of aerodynamic shear stress from phonation on the flap
• Another theoretical advantage is a paracrine softening effect on vocal fold scar from the adipocytes of the flap

CONCLUSIONS

• These first two reported cases of CTAP use represent the translation of a new surgical technique for correction of glottic insufficiency.
• There were no operative complications or morbidity. CTAP was used successfully for correction of both a paraglottic space and a superficial vocal fold defect with improvement of voice.
• These early successes suggest that further use of CTAP may be promising. Conceptual advantages, not demonstrated here, include uni- or bilateral CTAP flap use, and the potential for favorable tissue effects against scar given recent evidence of scar modulation by adipose in dermal environments.

REFERENCES