

Three-dimensional vocal fold structural change due to implant insertion in medialization laryngoplasty

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Introduction:

Previous investigations suggest that soft thyroplasty implants lead to superior acoustics compared to stiff implants in the treatment of glottic insufficiency. The goal of this study was to quantify the three-dimensional structural change of the vocal folds due to implant insertion in medialization laryngoplasty, and its potential effect on voice production.

Methods:

Medialization laryngoplasty were performed in excised human larynges using soft (silicone) and stiff (Silastic) implants. MRI images of the larynges were obtained and used to reconstruct the three-dimensional laryngeal geometry with and without implant insertion.

Results:

Implant insertion deformed the vocal folds into a thin layer wrapped around the implant. The medial-lateral dimension

of the vocal folds was significantly reduced from about 4 mm to 1 mm, and the vocal folds were stretched in the coronal plane by about 70%. Insertion of stiff implants also led to noticeable soft tissue tears and gaps between the implant and the vocal folds. In contrast, soft implants were better able to mold into the vocal folds with less tears or gaps.

Conclusions:

With implant insertion, the implant assumed the role of the body layer in the coupled vocal fold-implant system, whereas the original TA muscle and cover layer became the new cover layer. Use of implants with stiffness comparable to that of the vocal folds is recommended because the degree of medialization can be adjusted without much negative effects on phonation frequency, phonation threshold pressure, or vibration amplitude.