



Injection Augmentation

Introduction

Vocal fold injection augmentation is a procedure that was described over a century ago to improve dysphonia and dysphagia from glottis insufficiency (vocal fold paralysis/paresis, vocal fold atrophy, vocal fold scar). This procedure was originally described as a surgery performed under general anesthesia with direct laryngoscopy. Over the past 15-20 years, this procedure has been increasingly performed in the office in an awake, non-sedated patient with flexible laryngoscopic guidance. Advances in endoscopic technology, filler injection material, and training of otolaryngologists have led to this shift from the operating room to the office. Advantages include: avoidance of general anesthesia/operation, vocal feedback, cost and time savings, and the procedure does not impede the recovery of the recurrent laryngeal nerve in cases of vocal fold paralysis/paresis. Main disadvantage is that all the filler materials are temporary, lasting for months to up to 2 years. The patient has to tolerate an awake in office procedure. The ENT physician also has to ensure that all the filler material has resorbed before offering a medialization thyroplasty.

- Sulica L, Rosen CA, Postma GN, Simpson B, Amin M, Courey M, Merati A. Current practice in injection augmentation of the vocal folds: Indications, treatment principles, techniques, and complications. *Laryngoscope*. 2010;120(2): 319-25
- Simpson CB. Treatment of Vocal Fold Paralysis. In: Bailey BJ and Johnston JT, eds. *Head & Neck Surgery: Otolaryngology*, 4th ed. Philadelphia, PA: Lippincott Williams & Wilkins, 2006:857.

Indications and Contraindications

- Indications
 - glottal insufficiency due to unilateral vocal fold paralysis or paresis, vocal fold atrophy, vocal fold scar, sulcus vocalis, or loss of the soft tissue of the vocal folds
- Contraindications
 - unstable cardiopulmonary status, allergy to any injectable materials including local anesthetic, poor exposure of the endolarynx due to a prolapsing arytenoid or severe supraglottic constriction, poorly defined anatomic landmarks of the neck



- Relative Contraindications
 - large posterior glottal gap or large interarytenoid defects that require laryngeal framework surgery, anticoagulation
 - Krishna P, Rosen CA. (2008) Office-based laryngeal procedures. In Eugene N. Meyers (Ed.), *Operative Otolaryngology: Head and Neck Surgery* (pp 291-301). Philadelphia, PA: Elsevier

Treatment Methods

- Patient is seated upright in an examination chair. Ideally, the patient is bent forward at the waist with the neck extended in a “sniffing” position to maximize exposure of the larynx.
- Patient is topically anesthetized by several methods. 1) Transnasally, topical oxymetazoline and Pontocaine 2% or Lidocaine 4% can be applied by spray or cotton-soaked pludget. 2) Transorally, topical cetacaine can be sprayed into the oropharynx and palate. Lidocaine 4% can also be delivered with an orotracheal injector device transorally with fiberoptic guidance and dribbled into the larynx when the patient says “ah”. 3) Nebulization of lidocaine can also be performed using a simple disposable nebulization device from respiratory therapy and an external source of pressurized air (e.g. from an oxygen source). 4) Lidocaine 4% can be delivered with a flexible cannula through the working channel of a flexible laryngoscope.
- An assistant performs a flexible laryngoscopy with the image projected on a video monitor. The scope is inserted transnasally on the side opposite the intended vocal fold to be injected.
- Location of injection is from the mid membranous vocal fold to the posterior vocal fold lateral to the vocal process. Depth of the injection is into the substance of the vocal fold lateral to the thyroarytenoid muscle. Superficial injections into Reinke’s space should be avoided because it will result in a stiff vocal fold and poor voice outcome.
- Injection augmentation can be performed by various techniques: 1) trans-cricothyroid membrane, 2) trans-thyroid cartilage, 3) trans-thyrohyoid membrane, and 4) per-oral. Technical success and voice outcomes are similar regardless of technique when performed by an experienced laryngologist.
 - 1) Trans-cricothyroid membrane - 25 gauge needle bent 45-degrees is inserted through the cricothyroid membrane, 3-7 mm lateral to midline, and is passed



cephalad and laterally. The needle travels submucosally and gentle pressure transmits motion medially to the vocal fold, confirming the location prior to injection. Alternatively, the needle can be inserted into the tracheal lumen, and with direct visualization of the needle, it is directed laterally to the deep aspect of the vocal fold.

- 2) Trans-thyroid cartilage - 24- or 25 gauge needle is inserted through and perpendicular to the thyroid cartilage ala. Advancing the needle midline transmits motion to the vocal fold, confirming the needle's location prior to injection. Beware of plugging of the needle with the cartilage, which may be overcome with additional pressure of the plunger. Be cautious to avoid mucosal violation with excessive medial pressure or possible overinjection of material. This technique is ideal for younger patients without calcification of the thyroid cartilage.
- 3) Trans-thyrohyoid membrane – 25 gauge needle (1.5 inches long) is inserted through the thyrohyoid membrane right above the thyroid notch. The needle is directed into the laryngeal lumen at the petiole of the epiglottis. Under direct visualization, the needle is directed sharply caudal and advanced to the vocal fold for injection. The needle can be left straight, or it can be bent prior to insertion to improve the inferior angle.
- 4) Per oral – the patient is asked to hold his/her tongue with a gauze. A curved needle with a 90 degree angle is inserted through the oral cavity, oropharynx and into the larynx with direct visualization from a transnasal fiberoptic scope. The false vocal fold may be retracted with the shaft of the needle so that the lateral area of the vocal fold is injected. Lengths of the needle may vary from 220 mm to 250 mm
- Total procedure takes about 30 minutes. Patient can be observed in the office afterwards at the discretion of the ENT physician. Patient should remain NPO for 1-2 hours afterwards to prevent aspiration. Patient can drive home afterwards.
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- Mallur PS, Rosen CA. Vocal fold injection: review of indications, techniques, and materials for augmentation. *Clin Exp Otorhinolaryngol.* 2010;3(4):177-82.

Injection Materials

- Various filler injection materials can be used. Materials vary in duration, viscoelastic properties, and biocompatibility. Materials are broadly classified as temporary and long-lasting materials. Temporary materials last weeks to months. Long-lasting materials last from 1 year to “forever”.
- Temporary materials include: bovine gelatin (Gelfoam), collagen-based products (Cymetra, Zyplast), hyaluronic acid (Restylane, Perlane, Juvederm), and carboxymethylcellulose (Prolaryn Gel)
- Long-lasting materials include: autologous fat, calcium hydroxylapatite (Prolaryn), polydimethylsiloxane (PDMS or particulate silicone), and historically, polytef paste (Teflon).
- Teflon is no longer used because it caused granulomas from foreign body inflammatory reactions. It often required surgical excision, with subsequent vocal fold tissue loss and poor voice outcomes
 - Mallur PS, Rosen CA. Vocal fold injection: review of indications, techniques, and materials for augmentation. *Clin Exp Otorhinolaryngol.* 2010;3(4):177-82.

Management of complications

- Inappropriate placement of the vocal fold injection material can occur in several locations: 1) too superficially into Reinke’s space, 2) very lateral into the paraglottic space or 3) inferior into the subglottis. If the filler is too superficial, it can be “milked” out of the vocal fold with the needle used for the injection or an Abraham cannula. If the filler material is permanent in nature (e.g., calcium hydroxylapatite), it should be removed under microlaryngoscopy with general anesthesia in the near future.
- Airway embarrassment, laryngeal spasm, or unexpected vocal fold swelling may occur and the procedure should be aborted



- Bleeding into the airway may occur and limit visibility. This is usually minimal. Gargling can help and the procedure can continued
 - Epistaxis or hematoma on the skin can occur, but this is usually self-limited
 - Risk of infection is low
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- Krishna P, Rosen CA. (2008) Office-based laryngeal procedures. In Eugene N. Meyers (Ed.), *Operative Otolaryngology: Head and Neck Surgery* (pp 291-301). Philadelphia, PA: Elsevier