

Review of Injectable Materials for Glottic Insufficiency

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Indications

- Unilateral TVC paresis/paralysis
- Loss of TVC tissue/bulk
 - Presbyphonia
 - Sulcus vocalis
 - Postop scarring (e.g., after partial cordectomy)

Ideal Qualities of Injection Material

- Nonreactive
- Biocompatible
- Nonresorbable
- Easy to use
- Biomechanically similar to native TVC

Goals of Injection Augmentation

Short-term

- Restoration of VC function while awaiting possible return of function
- Approximation of voice quality/results that can be obtained with longer-lasting injection material or medialization thyroplasty

Long-term

- Permanent or semi-permanent correction of glottic insufficiency
 - Ideally suited for pts with minimal voice sx, mild glottic insufficiency (<2 mm glottic gap)

Short-term Injection Materials

- **Gelfoam**
 - Absorbable gelatin
- **Carboxymethylcellulose**
 - Cellulose derivative
 - *Radiesse Voice Gel*
- **Collagen**
 - Connective tissue protein found in ECM
 - *Cymetra*
 - *Cosmoplast*
 - *Cosmoderm*
 - *Zyplast*
- **Hyaluronic acid gels**
 - Glycosaminoglycan found in human ECM
 - *Hylaform*
 - *Restylane*

Gelfoam

- First reported for TVC augmentation by Schramm et. al. 1978
- Length of effect: 8-10 weeks
- Characteristics
 - Mix with saline to make Gelfoam paste
 - 30-year experience
 - Minimal tissue reaction
 - Relatively low cost

Radiesse Voice Gel

- The only temporary substance with FDA approval for use in VC injection augmentation
- Length of effect: 2-3 months
- Characteristics
 - Low allergy risk
 - Not detected by skin or serologic allergy testing
 - Inert
 - Good voice quality and VC vibration
 - Ready-to-use form

Zyplast

- Bovine-derived cross-linked collagen
- Length of effect: 4-6 months
- Characteristics
 - 20-year use experience
 - Ready-to-use form
 - Overinjection needed in anticipation of later resorption
 - Potential allergic response
 - Skin testing recommended, leading to 2-4 week delay in treatment

Cymetra

- Micronized acellular dermis from cadaveric tissue, rehydrated with lidocaine
- Length of effect: 4-6 months
 - Milstein et. al. 2005 reported 8 pts with continued voice improvement @ 1 yr post-injection
- Characteristics
 - Acellular matrix of collagen and elastin integrates into injected tissue site
 - Low immunogenicity (no allergy testing)
 - Overcorrection required (compensate for resorption)
 - Several studies demonstrate safety and efficacy

Cosmoderm/Cosmoplast

- Human-derived collagen dermal filler
- Length of effects: unknown
- Characteristics
 - FDA approval for rhytids/scars, but no published studies on use in larynx
 - Low immunogenicity (no allergy testing)

Hyaluronic Acid Gels

- Cross-linked chains of hyaluronic acid --> viscous, water-insoluble form
- Length of effects: 4-6 months
 - Some studies report 9 months or longer
 - Comparable to collagen
- Characteristics
 - Promotes ingrowth of new connective tissue
 - May require less overcorrection than collagen
 - Viscoelastic properties similar to native TVC
 - However, cross-linkage = poor replacement for LP
 - Safety/efficacy established in European studies

Long-term Injection Materials

- Autologous fat
 - Harvest & prep time, morbidity
 - Variable length of effect
- Teflon
 - Permanent, irreversible
 - Tendency to migrate
 - Potential for granuloma formation
- Calcium hydroxylapatite (Radiesse)

Radiesse

- Synthetic calcium hydroxylapatite microspheres in aqueous-based carboxymethylcellulose gel carrier
- Length of effect: 1 year +
- Characteristics
 - Biocompatible
 - Similar mineral composition as human bone
 - Requires more precise injection
 - Slower resorption time
 - Needs to be lateral, within thyroarytenoid muscle

Voice Results with Radiesse

Rosen et. al. 2007

- **Multi-center, prospective clinical trial**
 - Each patient served as own control
- **68 patients injected with Radiesse (50% in office)**
 - Unilateral TVC paralysis: 57%
 - Glottic insufficiency: 42%
- **6 months post-injection**
 - Patient satisfaction
 - Significant voice improvement: 56%
 - Moderate voice improvement: 38%
 - Significant improvement in voice outcome measures
 - Vocal effort
 - Voice severity
 - Strobe rating of glottic closure
 - Maximal phonation time (MPT)