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)