An In-Depth Look at Office-Based Laryngeal Procedures

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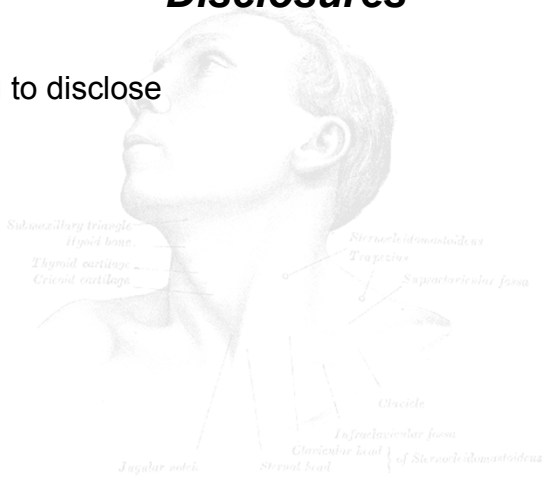
Disclosures

- Nothing to disclose



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Change

1. **Discovery/Innovation**
2. **Promotion**
3. **Recalibration/Acceptance**

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Development of Direct Laryngoscopy

- Green (1803 – 1866)
  - "Father of American Laryngology"
  - Studied in Europe in 1838
  - Published 3 textbooks on diseases of the air passages
  - Instrumented the larynx and trachea without vizualization
    - "…passed a probang made of whalebone and tipped with a tiny sponge soaked in silver nitrate through the larynx and into the trachea to treat almost all maladies of the air passages."
    - The patient had to be accepting and the probang needed to be curved correctly
    - Controversial technique not easily replicated
    - Disregarded by contemporary practitioners
      - "…defense mechanism of the larynx were too great to let such a a thing happen except by accident…"

Charles Snyder, Laryngoscope 1975

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Development of Direct Laryngoscopy

- Green (1803 – 1866)
  - Descriptions of direct instrumentation – 1858
    - After Garcia had demonstrated autoscopy
    - First laryngoscopes brought to the US
    - Blade like instrument to retract the tongue in one hand
    - Curved forceps to remove polyps in the other hand

Charles Snyder, Laryngoscope 1975

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General Technique of Rigid Endoscopy

- Originally intension
  - Esophageal examination
  - Tracheal examination was believed impossible secondary to the "defenses of the larynx"
- Local anesthesia – "in office"
- Patient seated and then reclined after procedure initiated
  - Required 2 assistants
  - Head hanging – extension - extension

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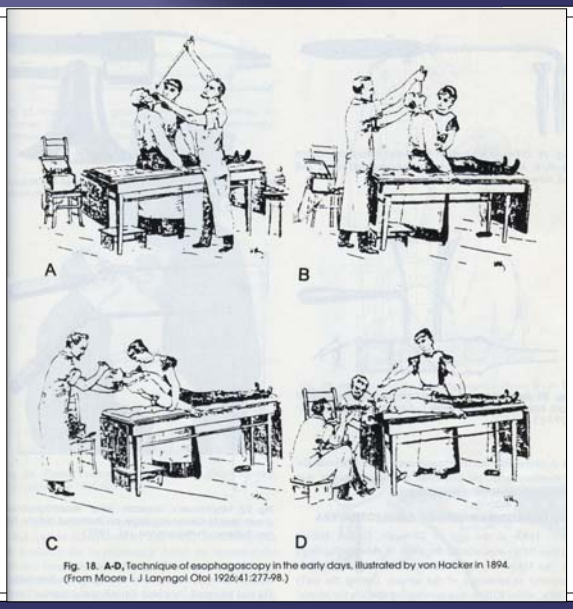

Fig. 18. **A-D,** Technique of esophagoscopy in the early days, illustrated by von Hacker in 1894. (From Moore I. J Laryngol Otol 1926;41:277-98.)

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Development of Direct Laryngoscopy

- Topical anesthesia – 1850
  - Allowed easier passage through the larynx
  - Bronchoscopy became more reproducible and applicable
- Kirstein – 1895
  - "….if the scope intended for the esophagus accidentally slipped into the larynx and trachea an excellent view could be obtained."
  - Reproducible method

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Forms of Direct Laryngoscopes

- Tubes
  - Originally used by Kirstein
  - Modified from esophagoscopes
  - Intended to fulcrum off the maxillary dentition

Extension – Extension

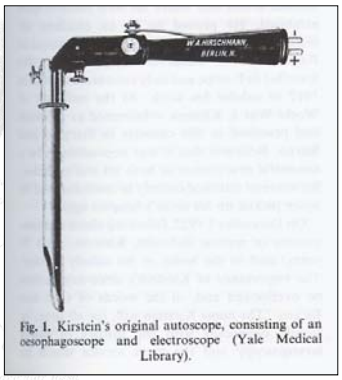

Fig. 1. Kirstein's original autoscope, consisting of an oesophagoscope and electroscope (Yale Medical Library).

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Forms of Direct Laryngoscopes

- Tubes
- Blades
  - Developed by Kirstein to prevent fulcrum
  - Used in the office
  - Contemporary "intubating" laryngoscope

Fig. 2. Kirstein's modified autoscope. blade is shown attached to the handle laryngeal blade shown below (Yale Me

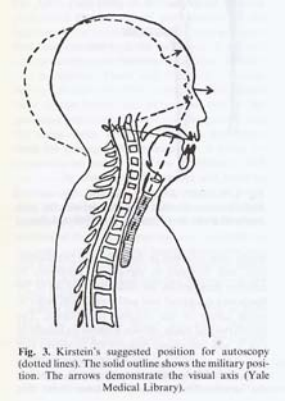

Fig. 3. Kirstein's suggested position for autoscopy (dotted lines). The solid outline shows the military position. The arrows demonstrate the visual axis (Yale Medical Library).

Flexion - Extension

Forms of Direct Laryngoscopes

- Tubes
- Blades
  - Developed by Kirstein to prevent fulcrum
  - Used in the office
  - Contemporary "intubating" laryngoscope
  - Position – surgeon stood in front or behind the patient

Fig. 24. Kirstein's autoscopy around 1895. (From Zeitels S. Laryngoscope 1995;105:1-51.)

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Direct Laryngoscopy – General Anesthesia

- Laryngoscopy
  - Began as an office-based procedure
  - An accidental outcome of esophagoscopy
- General anesthesia – 1900's Ether
  - Brought uncomfortable direct laryngoscopy into the OR
  - Suspension devices
    - Killian – 1912 "blade-like"
    - Lewy – 1950 "suspension for tubed laryngoscopes

To fulcrum or not to fulcrum

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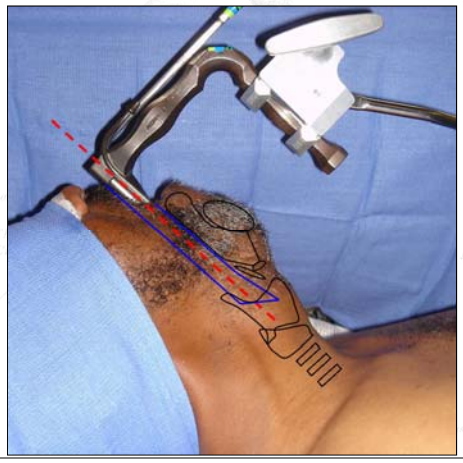
To fulcrum or not to fulcrum…..



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Fulcrum

Suspension

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Contemporary Technical Developments

- Light
  - Proximal light source
    - Original endoscopists used external light directed down the shaft of the instrument
    - Czmerak(1870) first to add artificial light for indirect laryngoscopy
    - Killian and Lynch (1910) "head lamp" external light source for direct endoscopy

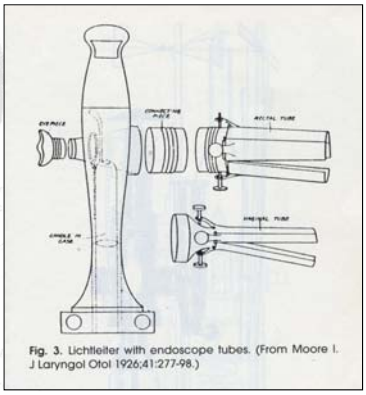

Fig. 3. Lichtleiter with endoscope tubes. (From Moore I. J Laryngol Otol 1926;41:277-98.)

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Contemporary Technical Developments

- Light
  - Proximal light source
  - Distal light source
    - Jackson (1904) "electric bulb"
    - Halogen
    - Xenon gas

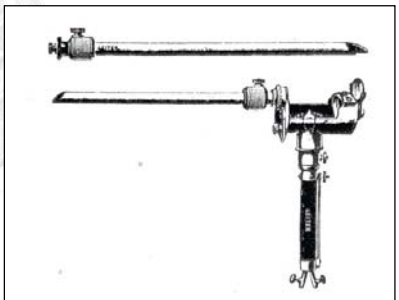

Fig. 13. Mikulicz-Leiter panelectroscope attached to von Hacker tube. (From Weir N. Otolaryngology: an illustrated history. Boston: Butterworth-Heinemann, Ltd., 1990.)

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Contemporary Technical Developments

- Fiberoptic capability
  - Baird (1927)
    - Light and image transmitted through glass fiber
    - "clad fiber" – glass fibers with high refractive index surrounded by fibers with low refractive index
  - Light is easier to transfer than image
    - Multiple fibers in any arrangement
  - Image transmission –
    - Fibers must be arranged in parallel
    - 5 micron fiber size to compare with 35mm photography

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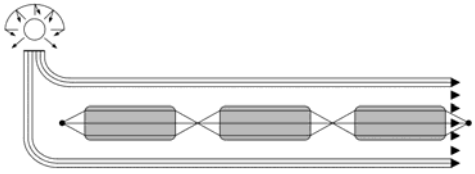
Contemporary Technical Developments

- Rod lens telescope
  - Harold Hopkins (1950)
  - Karl Storz (1960)
    - Fiberoptic light transmission
    - Rod lens for image transmission



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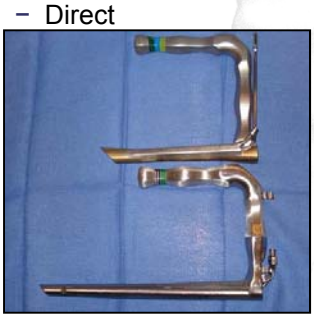
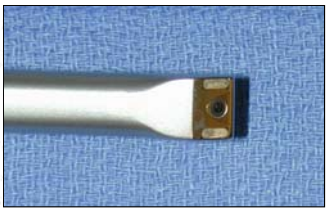
Tube Within a Tube Concept

- Light is carried through a second tube within the tube for visualization
  - Indirect
  - Direct





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Contemporary Technical Developments

- Flexible Fiberoptic Image Transmission **Innovation**
  - Hirose and Sawashima (1968) **Promotion**
    - "Machidascope"
  - Clinical trials (1975) **Recalibration**
    - Easy to perform
    - Well tolerated
    - Equal in diagnostic capabilities to other forms of indirect laryngoscopy

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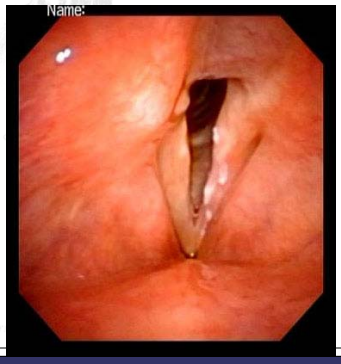
Contemporary Technical Developments

- Miniaturized CCD image transmission (1990's)
  - Light supplied by fiberoptic light transmission
  - Distal chip scope



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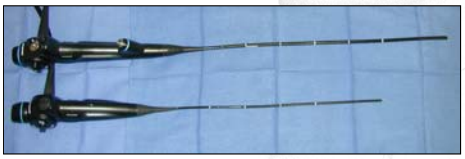
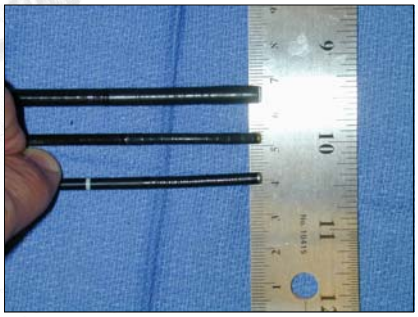
Contemporary Technical Developments

- Distal chip scopes with channels for instrumentation





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Summary

- Laryngoscopy for instrumentation of the larynx started as an in-office procedure as an accidental outgrowth of esophagoscopy
  - We did not have adequate anesthesia
  - With improvements in GA Laryngoscopy was taken to the OR
- We take light sources for granted
  - Tube within a tube concept
- Improvements in fiberoptics and the development of distal chip scopes with working channels small enough to pass through the nose improved patient comfort and visualization

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Summary

- As rigid direct laryngoscopy was an out growth of rigid direct esophagoscopy, Fiberoptic and flexible laryngoscopy was an outgrowth of flexible esophagoscopy
  - Larger tubes fit through the mouth with patient sedation
  - Need proof of concept:
    1. Smaller scopes where as good as larger diameter scopes
    2. Patients can reliably be instrumented without sedation if the scope is passed through the nasal cavity

The Birth of Contemporary Interventional Transnasal Laryngoscopy Innovation

- Began with transnasal esophagoscopy
  - Advantages over transoral route
    - Does not require sedation
    - Patient preference
  - Disadvantages over transoral route
    - Patients are unsedated (they can still talk)
    - Smaller scope diameter - reduced ability to instrument?

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Historical Background Promotion

- Medical College Wisconsin 1996 - GI
  - Comparison unsedated TNE with sedated EGD in 24 patients
    - Sensitivity of unsedated TNE 89%
    - Specificity – 97%
    - Patient safety – without complications
      - Sedation
      - Nasal
    - Patient tolerance – reported as less stressful than sedated EGD ($p < 0.05$)

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Historical Background

- Columbia University 2001 - OHNS
  - Evaluation of dysphagia in 14 patients
    - Patient discomfort 2/10
    - No complications
    - Findings
      - Zenker's
      - Patulous esophagus
      - Stricture

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Transnasal Esophagoscopy versus Conventional Upper Endoscopy

- Patient acceptance/comfort
- Accuracy of findings

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Transnasal Esophagoscopy versus Conventional Upper Endoscopy

- Cleveland Clinic Foundation 2005 (GI)
  - Patients underwent both unsedated and sedated studies
  - Unsedated studies
    - Transnasal
    - Transoral
  - Diagnostic accuracy of endoscopy using the 4-mm video endoscope was similar to that of standard endoscopy
  - Patient tolerance
    - Preprocedure anxiety scores (29 vs. 42.5, P = 0.021)
    - BMI - 31.5 kg/m2 vs. 28 kg/m2, P = 0.029
    - Patients preferred transnasal to transoral

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Transnasal Esophagoscopy versus Conventional Upper Endoscopy

Accuracy of Findings

- Medical College of Wisconsin – 2002 (GI)
  - TNE for management of Barrett's Esophagitis (n = 32)
    - Patients underwent both unsedated TNE and sedated UEGD
    - Similar results with conventional upper endoscopy
      - Histological grade
      - Identification of change

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Transnasal Esophagoscopy versus Conventional Upper Endoscopy

Accuracy of Findings

- Medical University of South Carolina – 2002 (GI)
  - Ultrathin (3.1 mm scope) TNE versus conventional scope (n=181)
    - Patients underwent both unsedated TNE and sedated UEGD
    - Findings
      - Sensitivity for detecting columnar lined esophagus - 94%
      - Sensitivity for all esophageal findings - 87%
      - Patient tolerance
        - » Evaluated by endoscopist - similar for both procedures
        - » 95% of the patients undergoing unsedated BPE were willing to have the procedure repeated under similar circumstances.

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We can do this! Recalibration

- Just because you can do something, it doesn't mean you should - John M. Lore Jr.
- But, what are the:
  - Indications
  - Benefits
  - Costs

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Case 1

- 74 year old author, professor, public speaker
- 6 month history of gradual voice change
  - Rough – cannot focus voice
  - Increased effort
  - Difficult to be heard

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video

CASE 1 – 3RD RECURRENCE

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Case 1 – Further Management

- Continue ablation

- Options?
  - Further MDL with ablation
  - Cidofavir
  - Celebrex
  - TNFE with ablation though fiber laser delivery system
    - KTP
    - PDL
    - Waveguide system

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Room Preparation

- Informed consent
- Patient placed in seated position
- Topical anesthesia applied
  - Nasal cavity for all procedures
  - Larynx and trachea for airway intervention
- Available airway intervention

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Patient Preparation

- Topical anesthesia
  - Sprayed into nasal cavity
    - Anesthetic – Lidocaine 4%
    - Decongestant – Neosynepherine 0.5%
  - Dripped into larynx and trachea for airway interventions only
    - Lidocaine 2 - 4%
  - Other methods
    - Inject into trachea

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Laryngeal/Tracheal Anesthesia

- Patient seated with head up at 90^0
- Anesthetic dripped through working channel

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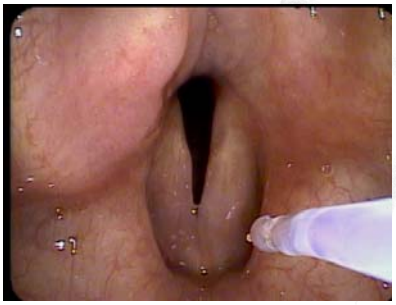
Patient Preparation Videos

Application of topical anesthesia



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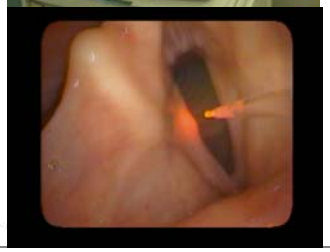
Instrumentation

- Laser fibers
  - CO_2
  - PDL
  - KTP
  - Ho:YAG
  - Thulium



KTP Laser

- Nd:YAG crystal (1064 nm) that is frequency doubled with a KTP crystal to produce a laser beam of 532 nm
- Current KTP lasers are Q-switched with pulse durations of 1 to 100 msec, and the longer pulse durations may help reduce purpura
- Used to treat superficial facial telangiectasias

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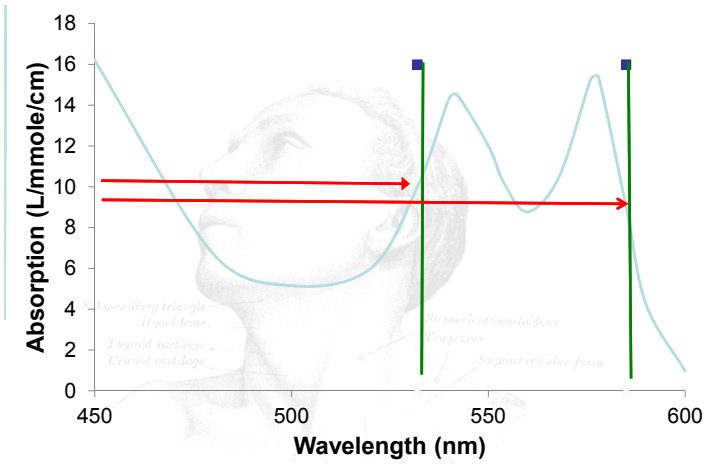

Absorption Curve for Oxyhemoglobin

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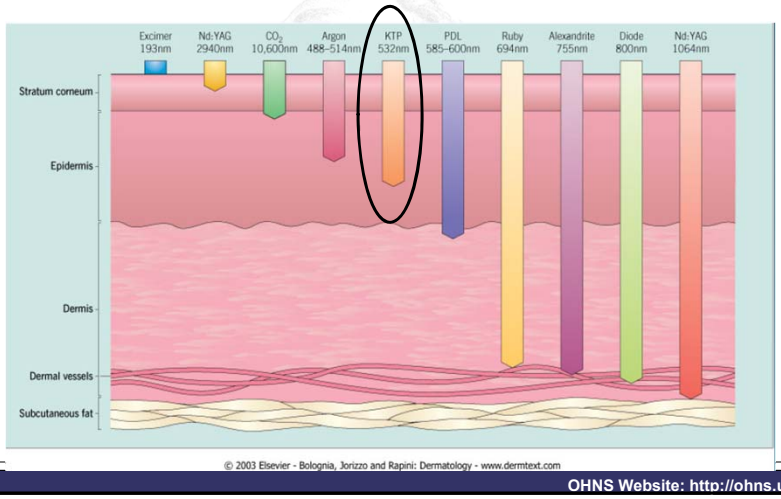
Depth of Penetration



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KTP – Theoretical Tissue Interactions

- 532 nm
- 15ms pulse length 2 pulses per second
- 0.3 J per pulse (0.015s x 20 watts)
- 2 Hz repetition rate
- 3 mm from tissue
- Blood Absorption 226 1/cm
- Tissue Absorption 2.2 1/cm

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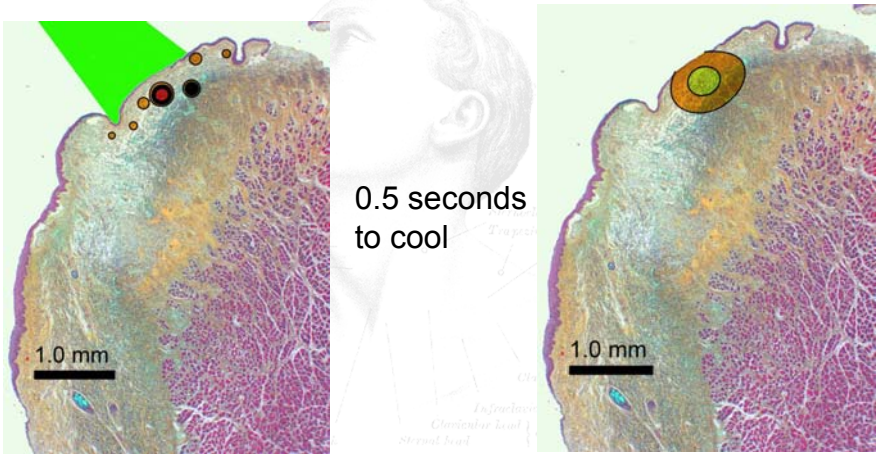
1 Pulse Delivered



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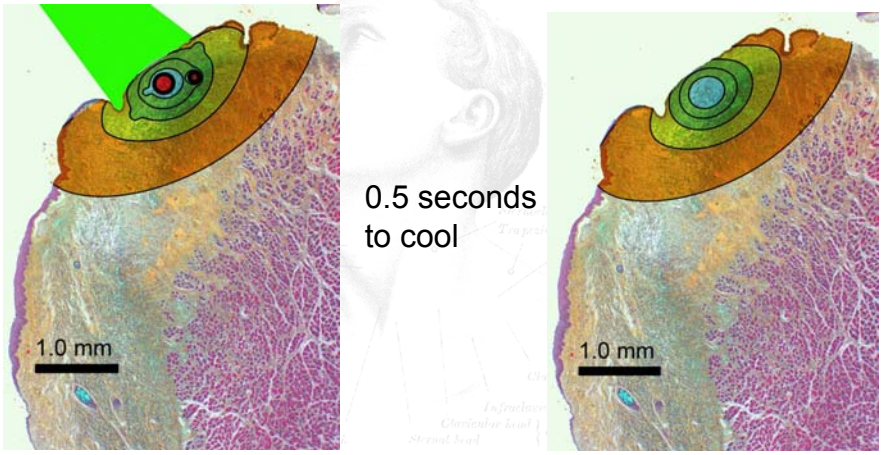
4 Pulses Delivered



Case 1 – TNFE with KTP Ablation

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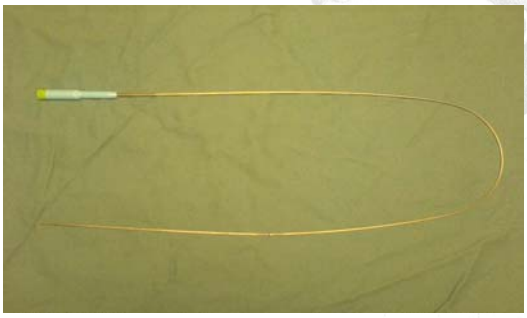
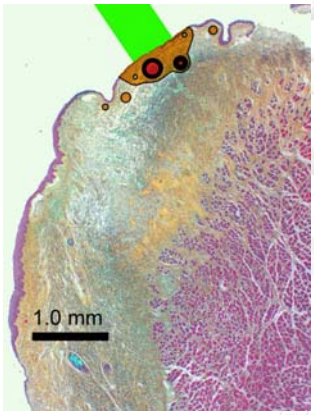
Instrumentation

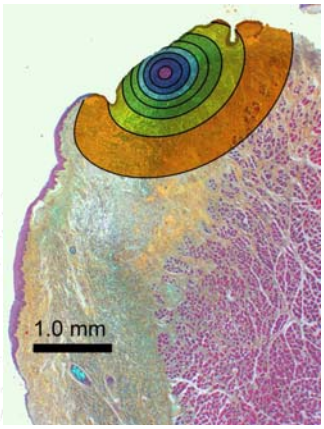
- Sheaths to protect channel



KTP – Contact Mode



After 4 pulses with 0.5seconds between each pulse



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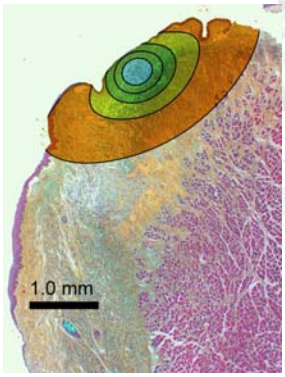
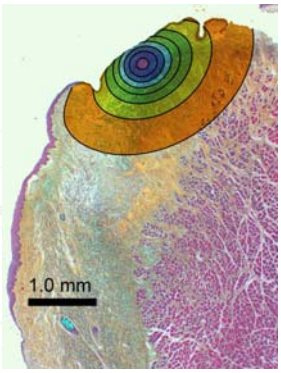
Theoretically Tissue Interaction Pulsed KTP

Non- Contact



Contact



<u>Laser Settings</u>

Power 35 watts

15 mmsec pulse length

2 pulse per sec

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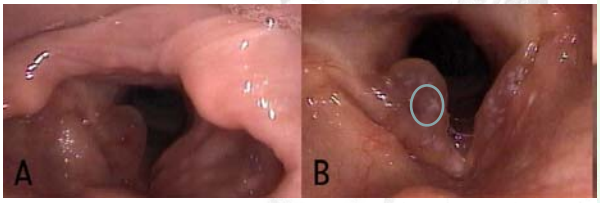
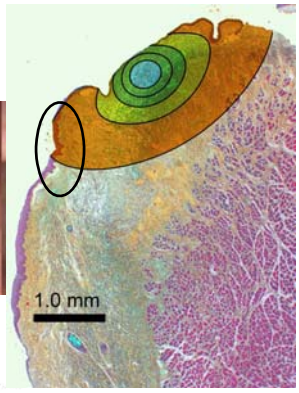
KTP - Clinical Results





Courtesy of Michael Pitman

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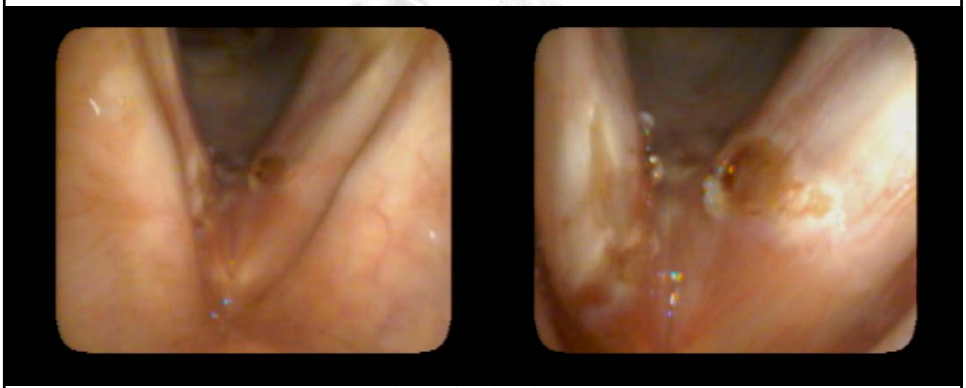
Case 1 – TNFE with KTP Ablation



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Case 3

- 52 year old male
- Remote history of smoking
- 1 year of increasing dysphonia
- No other medical problems
- Video

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Instrumentation

- Cup forceps
  - 1.8 mm
  - Serrated

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Case 3

- Management options
- Imaging CT versus MRI
  - Cartilage involvement - extensive

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Case 4

- 42 year old male
- Father of 2 young children
- 3 year history of loss of ability to sing to children at night
- Speaking voice is rough and cracks if he is not careful
- Notes vocal fatigue
- No events noted at onset
- Vocal history
  - Sang in college Glee Club
  - No history of formal training

Video

Case 4

- Management options
- Patient vocal demands/desires
  - What if patient says……

Video

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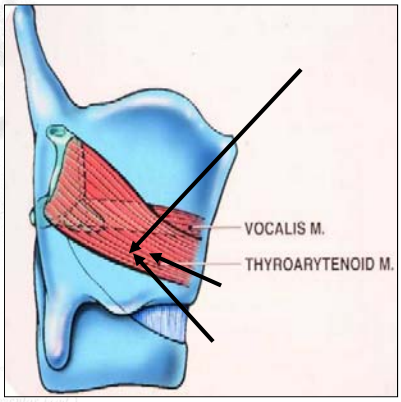
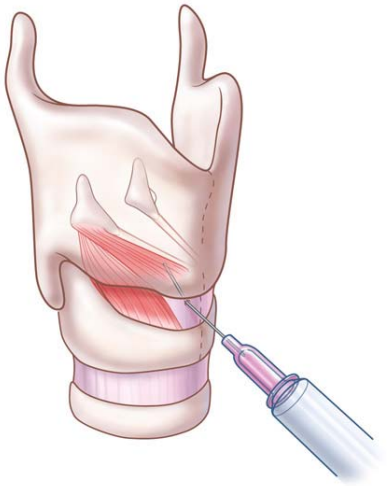
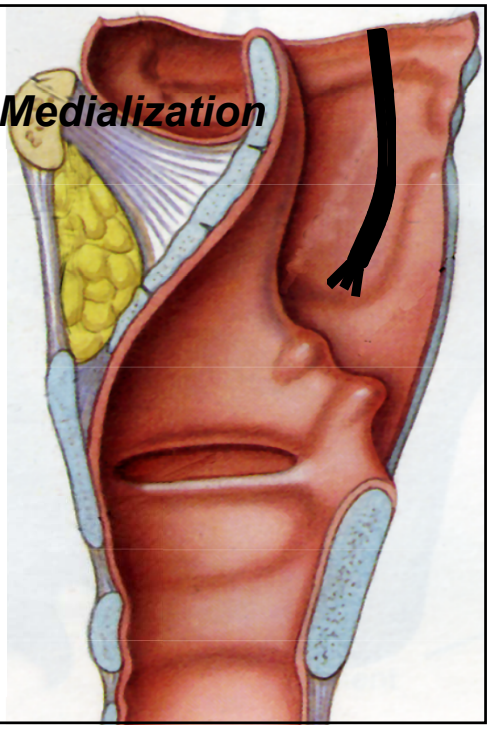
In-office Medialization Routes of Injection

- Cricothyroid Membrane
- Transcartilagenous
- Thryohyoid

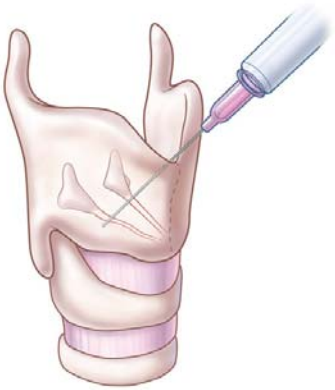


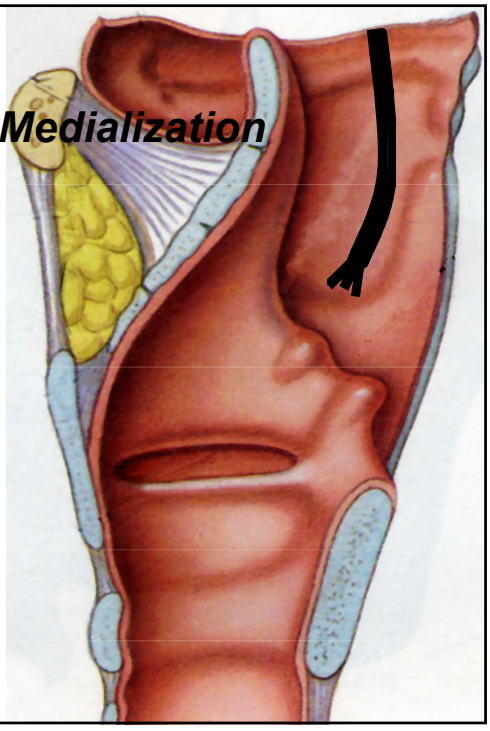
In-office VF Medialization





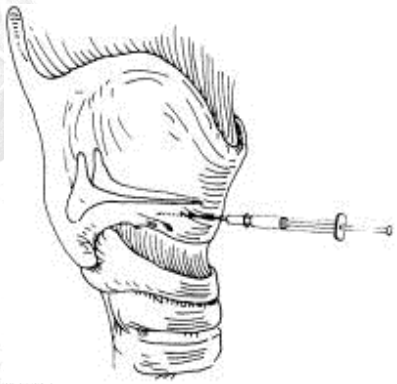
In-office VF Medialization





Trans-Thyroid Cartilage Technique

- Topicalize nasal cavity and larynx
- Needle passed through thyroid cartilage at level of VF
- Movement of needle tip shows location in VF
- Inject under flexible scope visualization



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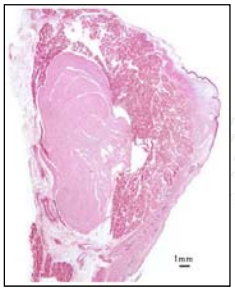
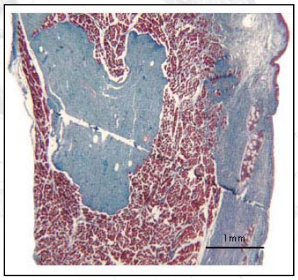
Potential Resting Positions for Injected Substances

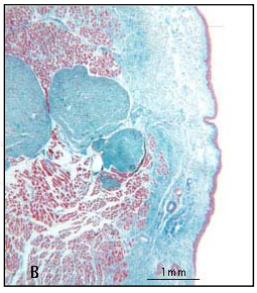
Within TA Muscle



Lateral



Intermediate

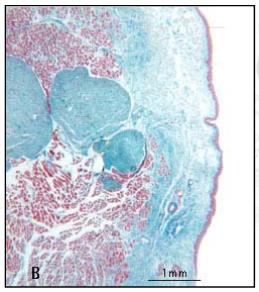


Medial

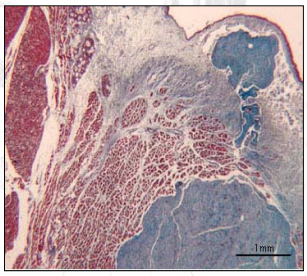
OHNS Website: http://ohns.ucsf.edu

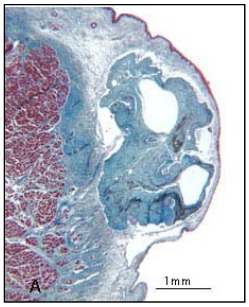
Potential Resting Positions for Injected Substances

Within Vocal Ligament



Just Deep to the Ligament





Reinke's Space

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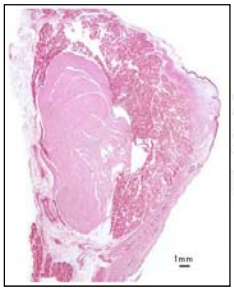
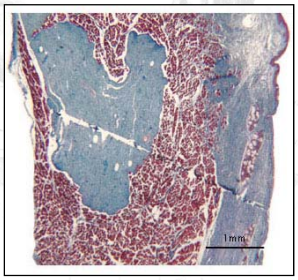
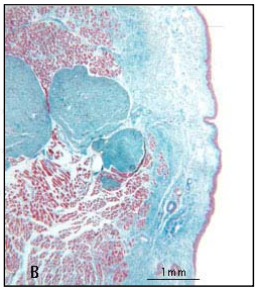
Favorable Resting Positions for Injected Substances



Lateral



Intermediate



Medial

OHNS Website: http://ohns.ucsf.edu

Case 7

- Injection
- Immediately post
- 2 months post

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Thank you

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