Surgical Ergonomics

Clark A. Rosen MD
Lewis Francis Morrison, MD Endowed Chair in Laryngology
Co-Director, UCSF Voice and Swallowing Center
Chief, Division of Laryngology
Professor, Department of Otolaryngology – Head & Neck Surgery

UCSF Voice and Swallowing Center
University of California, San Francisco
Clark.Rosen@UCSF.edu

Disclosure

Clark A Rosen MD

- Olympus America Inc - Consultant
- Instrumentarium - Royalties
- Freundenberg Medical - Consultant
- Reflux Gourmet LLC - Shareholder
NIOSH recommendations

- Workstation design: Avoidance of
  - static loads
  - fixed work postures
  - extended periods of leaning to the front or side
  - holding limb in a bent or extended position
    - Recommend use of articulated arm supports
  - head tilt (flexion) greater than 15°

[Image of a diagram showing a neutral posture at a workstation]
Work-related musculoskeletal symptoms in surgeons

- **Dentists**
  - Most common cause of ill-health retirement
- **Endoscopic, laparoscopic surgeons**
- **Otolaryngologists**
  - U.K.: 72% of surveyed otolaryngologists had back pain or neck pain
  - Pediatric otolaryngologists: 68% had pain or discomfort attributed to surgical practice
  - 73% of ENT surgeons at non-ID ENT program reported back pain


Vaibush et al. Lscope 2019
Otolaryngology Surgery is an Occupational Risk

- Microlaryngoscopy is inherently “risky”
  - NIOSH
  - Static, fixed work postures
  - Limb extended

Bernard BP, National Institute for Occupational Safety and Health, publication no 97-141; 1997

Ergonomics of Microsurgery of Larynx

Overview

- MSL Ergonomic Issues
- Research of MSL ergonomics
  - 3D motion analysis
  - Survey of AAOHNS
  - Randomized trial
- Improved Ergonomics for MSL
Methods
MSS associated with Microlaryngoscopy

- Survey of AAO-HNS members
  - In person (national meeting)
    - Attendees of laryngology-related lectures
  - E-mail
- 38 items
- 4 sections
  - Demographics
  - Experience with MLS
  - Operating room set-up (equipment and surgeon)
  - Musculoskeletal symptoms: experience of, treatment for, effect on practice

Results

- 83% of respondents reported ever experiencing MSS during a MLS case (n=398)
- 21% reported taking breaks during MLS because of symptoms
- 53% reported ever having symptoms 48 hours after MLS
- Location: neck>upper back>shoulder, lower back
Significant impact

- Reported in 8 individuals:
  - Decreased number of MLS cases due to MSS (n=8)
  - Stop performing MLS due to MSS (n=4)
  - Filed for disability due to musculoskeletal injuries related to MLS (n=5)
  - Retired prematurely due to musculoskeletal injuries related to MLS (n=3)

Comparison of Microsuspension Laryngoscopy (MSL) Positions: A Randomized, Prospective Study

- Is there a difference in...
  - Risk of musculoskeletal symptoms
    - Pain
  - Muscle activity and fatigue
  - “Favorable” versus “unfavorable” surgical position for microlaryngoscopy
Methods
Randomized, Prospective Study of MSL surgical positions

- 18 otolaryngology trainees (PGY2-7)
- MSL simulator
- Simulated MSL surgical task, 15 min
  - Randomly counterbalanced
  - Rest period, 15 min
- Surface EMG recordings
- Questionnaires

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Favorable</th>
<th>Unfavorable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope Angle (°)</td>
<td>39.7 (0.5)</td>
<td>59.9 (1.5)</td>
</tr>
<tr>
<td>Neck Angle (°)</td>
<td>11.7 (2.2)</td>
<td>29.7 (4.7)</td>
</tr>
<tr>
<td>Arm Rests</td>
<td>Yes</td>
<td>No</td>
</tr>
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</table>
Conclusion

- Electromyographic evidence of decreased muscle activation and fatigue; less self-reported pain with more “favorable” MLS ergonomic position

- Quantifiable evidence that improved surgeon ergonomics positively impacts muscle activation and pain associated with MSL

How to accomplish an ergonomically favorable position

Laryngoscope ~40°
Neck 0-10°flexion
Arm support
Foot support

- Once laryngoscope in…
- Move pt to come to you
Factors

- Fixed
  - Microscope focal length?
  - Patient anatomy
  - Static posture

- Variable
  - Laryngoscope angle
    - Trendelburg
  - Bed height
  - Chair height
  - Eyepieces (articulated)
  - Microbreaks

Ergonomics for MSL- Steps

- “Optimal” position
  - Goal
- Factors to consider
  - Equipment
  - Body position
- Step by Step position creation
- Self-evaluation
MSL Ergo Equipment

- Table
  - Angle
    - Trendelenburg
  - Height control
- Chair
- Microscope

MSL Ergo Microscope

- Modern microscope
  - Not the 1950 PE tube microscope
- Stable
- Adjustable
  - Height
  - Angle
- Focal Length
  - Fixed versus Variable
- Eyepieces need to be articulated
  - Major determinant of H&N position
MSL Chair

- Adjustable height
- Back support
- Arm support
  - No impact of wrist ROM
  - Mid-forearm support

MSL Ergo Factors

- Laryngoscope angle
  - Determined by H&N position to obtain optimal visualization of the larynx
  - Once Laryngoscopy suspended, then adjust table to place lscope at ~ 40 degree angle and place proximal aspect of scope as low as possible (umbilicus)
  - Laryngoscope must be attached to bed
  - Use Trendelenburg to reduce angle of laryngoscope
  - Lower height of bed to bring proximal aspect of laryngoscope into your “lap”
MSL Body Position

- Adjust chair as close to table as possible
  - Decrease arm extension
  - Allows for a neutral back position
  - Decrease shoulder and neck tension
- Knees under the bed (head)
- Support Feet and Legs
  - Feet flat on ground or base of chair
- Back Straight
How to accomplish an ergonomically favorable position for MSL

Step by Step Approach

- Laryngoscope ~ 40 degrees
- Neck 0-10 degree flexion
- Arm support

- Once laryngoscope in…
- Move patient to you
  - Trendelenburg*
  - Bed height
  - Chair height

*Requires your suspension device to be attached to the bed and not a mayo stand

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Conclusion

- Problem
  - Lack of recognition
  - Static position
  - Musculo-skeleton Injury

- Solution
  - Recognition
  - 2 minutes devoted to surgeon health

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