BIOM International Seminar: The Impact of OMM on Cervical Spine Range of Motion and on Laryngeal Function

Laura Lepczyk, Theresa Sexton, Bo Pang, Peter LaPine, Ph.D., Lawrence Prokop, D.O., Shane Sergent, D.O., Gary L. Willyerd, D.O.
Background / Definitions:

- **Dysphonia**: Change in voice quality
  - A wide range of structural, infectious and/or neurological conditions can lead this.
  - Can be the initial sign of an underlying pathology, as is the case with the qualitative change in vocal function known as hoarseness, which may be a sign of laryngeal cancer.

- **Relative Average Perturbation (RAP)**: Quantitative Measurement of voice on a sustained vowel
  - The lower the number, the better the voice quality

- **Range of Motion (ROM)**: Measurement of movement around a joint or body part
  - Can be a structural cause of dysphonia
Manual treatments have been used in the multidisciplinary approach to reduce a variety of musculoskeletal conditions.

The focus of this research was to evaluate the impact of osteopathic manipulative medicine (OMM) on the quantitative changes in laryngeal efficiency as measured by vocal quality.

There is little data on the treatment of voice changes and their associated pathologies using OMM.

In our study, we use OMM of the upper extremity, neck, and face to determine relationship with measurable changes in ROM and voice quality.
Methods

Inclusion criteria:
- Patients 18 years or older with a swallow dysfunction or audible changes in vocal quality
- Positive history of neck pain, cerebrovascular accident, degenerative disease, traumatic brain injury, spinal cord injury, or musculoskeletal disorder

Exclusion Criteria:
- Clinically deaf,
- Recognized developmental delay
- History of reconstruction of velum or pharyngeal flap.

Controls Criteria:
- 18 years or older
- No active pathology
- Has tissue texture changes in the areas examined
Our research took place in Iquitos and Lima, Peru in conjunction with MSUCOM’s Peru Medical Elective.

Prior to examination and treatment with OMM, ROM of subject’s cervical spine was measured using a CROM cervical ROM device that was calibrated before each use.

The following degrees of cervical motions were recorded;
- Left rotation
- Right rotation
- Left side-bending
- Right side-bending
- Flexion
- Extension
ROM Calibration Device
Methods Continued

- **Relative Average Perturbation Calculations:**
  - RAP is a quantifiable measure of vocal quality.
  - The higher the calculated RAP %, the greater the amount of dysphonia.
  - The Relative Average Perturbation (RAP) was calculated for 2 vowels, /i/ and /a/.
  - Vowel segments of no less than 4 seconds duration were partitioned to eliminate voice onset and voice termination time.
  - Using acoustics software, we collected data on the voice fundamental frequency (F0) and frequency perturbation from the algorithm for RAP.
  - RAP values were captured with public domain acoustics software (PRAAT) using a headset microphone with a mouth:microphone distance of less than 1"
Methods Continued

Next, the patients were examined using standard OMM visual and palpatory diagnostic techniques to identify muscle spasm and decreased mobility in the targeted muscles.

Restrictions were treated using the following OMM techniques:
- Soft tissue stretch
- Myofascial release
- Articulatory techniques
- Muscle energy

Post-OMM, the voice (RAP) and ROM analyses were repeated
51 patients were included in this study
- 15 served as controls
- 36 had active pathology

Our results suggest a relationship between increased ROM and increased quality of voice production

There is greater musculoskeletal movement with less dysphonia observed following OMM

Overall, 50 of the 51 subjects had an overall increase in degrees of ROM across all 6 categories of movement, with the mean increase per individual at 55 degrees
Results Continued:

Figure 1: Mean increase in range of motion tested on 3 planes before and after OMM treatment across all 51 participants. Flexion – 7.5 degrees, Extension – 11.3 degrees, Left Sidebending – 8.2 degrees, Right Sidebending – 6.0 degrees, Left Rotation – 12.2 degrees, Right Rotation – 9.4 degrees.
Figure 3: Mean range of motion tested on 3 planes before and after OMM treatment across all 51 participants. A. Flexion/Extension – Flexion Pre-OMM: 32 degrees, Flexion Post-OMM: 42 degrees; Extension Pre-OMM: 40 degrees, Extension Post-OMM: 53 degrees. B. Rotation – Left Pre-OMM: 35 degrees, Left Post-OMM: 47 degrees; Right Pre-OMM: 40 degrees, Right Post-OMM: 49 degrees. C. Sidebending – Left Pre-OMM: 27 degrees, Left Post-OMM: 36 degrees; Right Pre-OMM: 26 degrees, Right Post-OMM: 32 degrees.
Results Continued

**Figure 2: Mean Relative Average Perturbation (RAP) Percentage before and after OMM treatment.** Decreased RAP is an indicator of vocal improvement.

- RAP for /i/ had a difference of $2.96 \times 10^{-4}$
- RAP for /a/ had a difference of $7.59 \times 10^{-4}$
Conclusion

- A positive relationship exists between cervical spine change in ROM and perturbation measure.

- This relationship suggests a relationship between increased ROM and increased quality of voice production.

- As such, there is greater musculoskeletal movement with less dysphonia observed following OMM.

- Our results shows a quantifiable, positive change in laryngeal function as a result of the use of OMM.
Conclusion Continued

- Implication of our project: Especially important in a developing country, such as Peru, where access to many diagnostic procedures and treatments may be limited due to cost and accessibility.

- Also suggest a new potential application for the use of OMM as a treatment for functional dysphonia, such as Muscle Tension Dysphonia.

- Using OMM to treat patients with neck pain secondary to musculoskeletal problems or voice changes secondary to an underlying pathology, has the ability to reduce pain, restore motor and communicative function, and to improve the overall quality of life in a cost-effective manner.
Future Implications

Future research will investigate the effect of OMM treatment on specific pathologies associated with voice changes.

Our research could extend to other pathologies, including dysphagia and dysarthria.

This is the first of a series of analyses

Measurable & quantifiable outcome for the use of OMM
Acknowledgements

- We wish to thank MSU College of Osteopathic Medicine, MSU Department of Communicative Sciences and Disorders, and MSU Department of Physical Medicine and Rehabilitation for their role in the development of this project.

- We also want to thank Anthony Argusa\(^1\) and Carley Metevier\(^2\) for their contributions to this project.

- We would like to recognize the Universidad César Vallejo for providing clinical space and Dr. Kenny Briceno for his assistance in subject recruitment.
Literature Cited:
