The assessment of pulmonary function with OMT versus standard respiratory therapy in a healthy population

Mentreddy, A.R., Nicotra, C.M., Padia, H.J., Stewart, D.O., Lorenzo, S., Quinn, T.A., and Hussein, M.O.

Lake Erie College of Osteopathic Medicine- Bradenton

Introduction

Many osteopathic physicians utilize osteopathic manipulative treatments (OMT) in combination with conventional forms of medicine to achieve improved outcomes for patients. Literature shows OMT can improve pulmonary function in both acute[1] and chronic pulmonary conditions.[2,3] The musculoskeletal components of respiration (ribs, sternum, clavicle, thoracic spine, intercostal muscles, ligaments, tendons, and fasciae) induce pressure changes in the thoracic cavity necessary for effective breathing.[4] Therefore, OMT directed toward the structures in this region have enormous potential to alleviate pulmonary disease symptoms.

Currently, most standard pulmonary rehabilitation (SPR) strategies do not make use of OMT. The motivation for this study is to determine the effects of various OMT and SPR techniques and to evaluate if either therapy type, or a combination of the two, improve pulmonary function, as determined by forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and the ratio of FEV1/FVC. Decreased FVC, FEV1, and FEV1/FVC values are associated with multiple pulmonary dysfunctions, including COPD and asthma. By analyzing the effects of various treatments on healthy individuals, it is our plan to use the results of this study to guide further investigation into the use of OMT in the pulmonary patient population.

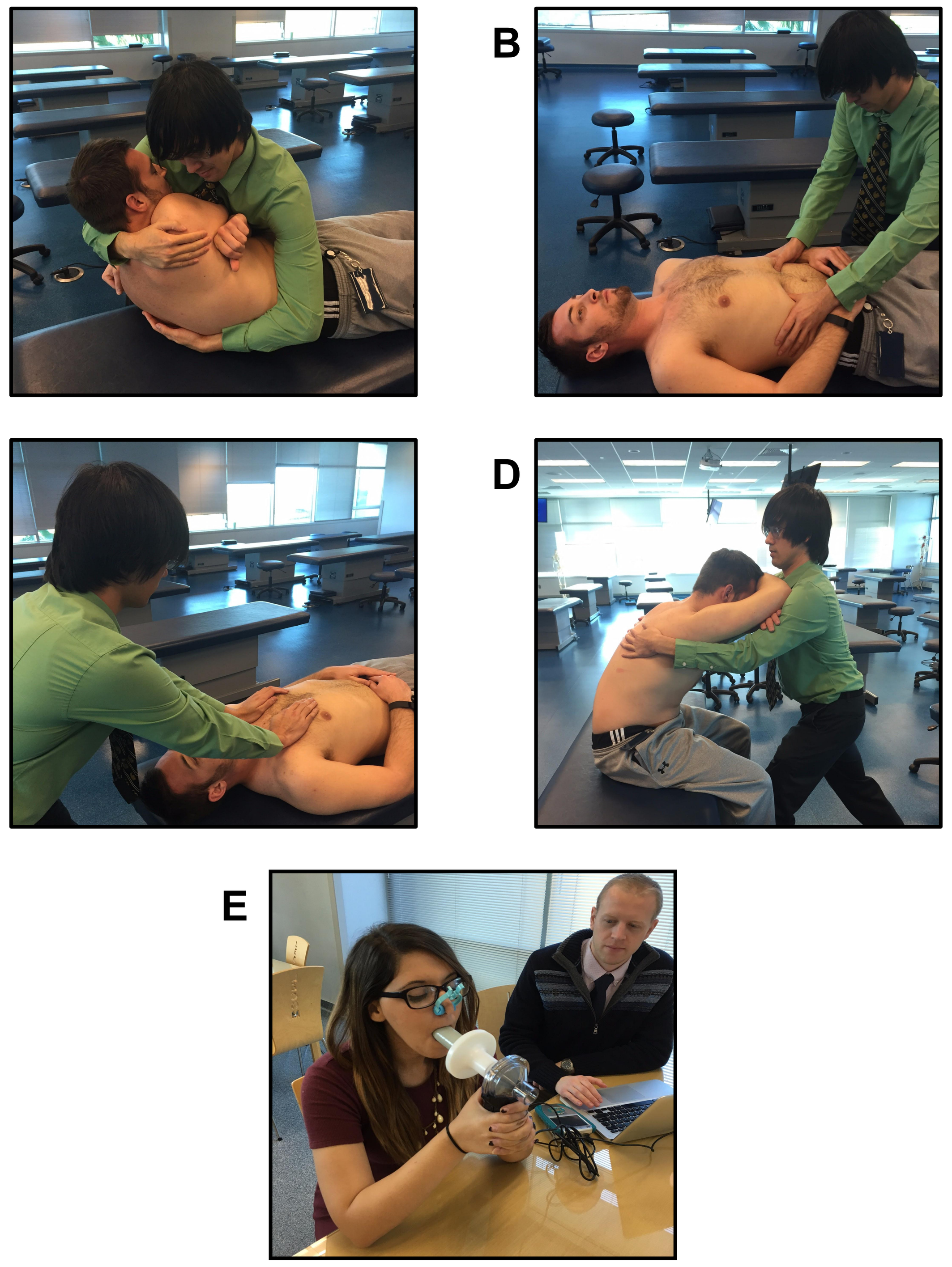


***Figure 1*: OMT and Spirometry** A. Thoracic High Velocity Low Amplitude (HVLA), B. Diaphragmatic Doming, C. Thoracic Lymphatic Pump, D. Rib Raising, E. Spirometer

Methods

1. Ninety healthy participants (age range: 21-38 y/o, median 25 y/o, 60% male) were recruited for this study. Fifty-three participants completed all study procedures (age range: 21-38 y/o, median 24 y/o, 50% male). Subjects were randomly assigned into one of two groups: standard pulmonary rehabilitation (**SPR**), n=25, and osteopathic manipulative treatment (**OMT**), n=28.

2. Study procedures lasted six weeks. Treatment type and sequence are demonstrated in *table 1* below.

Table 1: Study Overview and Timeline

Week	OMT Groups	SPR Groups
1	Thoracic Lymphatic Pump** (n=15)	Pursed Lip Breathing* (n=23)
2	Thoracic High Velocity Low Amplitude (HVLA) (n=16)	Tapotement** (n=15)
3	Rib Raising* (n=9)	Nebulizer with Saline (n=17)
4	Doming of Diaphragm (n=9)	Rest (n=14)
5	Rib Raising then Lymphatic Pump (n=17)	Pursed Lip Breathing then Tapotement (n=22)
6	Rib raising then Pursed Lip Breathing (n=18)	Pursed Lip Breathing then Rib Raising (n=21)

* Treatment showed highest improvement post-treatment weeks 1-4 in respective group (used for weeks 5+6)
** Treatment showed second highest improvement post-treatment weeks 1-4 in respective group (used for week 5)

3. During each week's session, spirometry was utilized to measure **FVC** and **FEV1** and calculate the **FEV1/FVC ratio**, *figure 1E*.
   a. **Pre-treatment**: Three acceptable trials of spirometry
   b. **Treatment**: Given immediately after pre-treatment measurements
   c. **Post-treatment**: Three acceptable spirometry trials
   d. **Subjective evaluation**: Participants subjectively reported their change in breathing on a scale from 1-5

4. Week 5: The two treatments from each group that elicited the greatest improvement in pulmonary function on weeks 1-4 were given as treatments to their respective groups.

5. Week 6: The treatment from each group with the most improvement in pulmonary function were given as treatments to all participants (i.e. both groups received the same two treatments but in the reverse order).

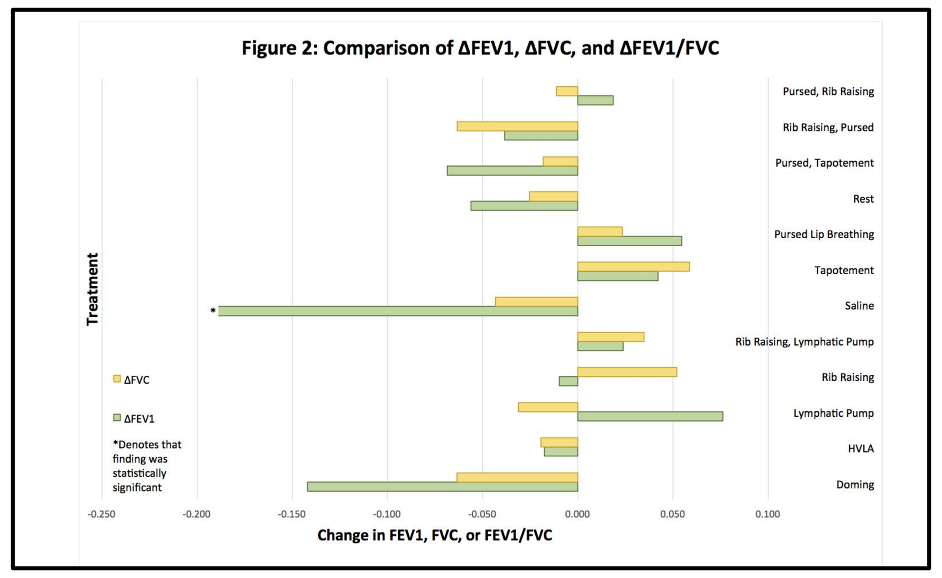
6. After the sixth week, data were analyzed to ensure the following criteria:[5,6]
   - At least two of the three spirometry trials within **150 mL** of each other
   - FEV1 and FVC experimental values at least **80%** of their respective calculated predicted values, based on age, gender, height, and ethnicity[7]
   - FEV1/FVC ratios at least **70%**

7. The finalized data were analyzed using one-way ANOVA and two-tailed paired t-tests.

Results

Spirometry:

Data (mean±SD) from all six weeks indicated that **saline treatment significantly decreased lung function** (FEV1: pre 5.8±1.5L vs. post 5.6±1.5L $p<0.005$; FEV1/FVC: pre 0.87±0.07 vs. post 0.84±0.07 $p<0.05$). All other treatments did not result in any significant changes in lung function. A summary of the changes in each of the OMT, SPR, and combination (OMT + SPR) treatments is shown in *figure 2* below:



Subjective data:

One-way ANOVA indicated statistical significance among some treatments ($p<0.001$).

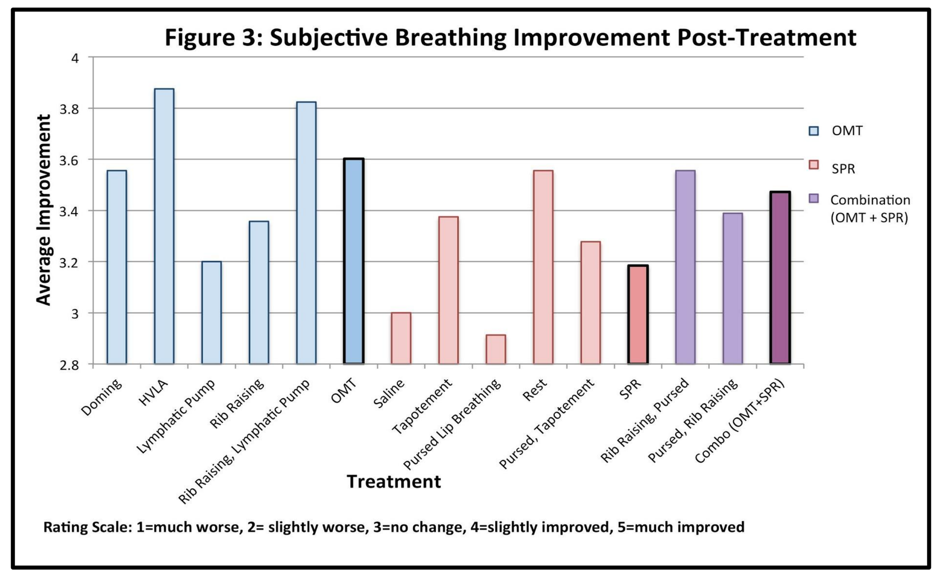
Overall SPR ratings were significantly less than both OMT ($p<0.001$) **and combination (OMT+SPR) treatments** ($p<0.005$).

Pursed lip breathing was rated as having the least improvement (2.9) and was statistically significantly less than all other treatments ($p<0.05$), except for saline via nebulizer.

Saline via nebulizer and thoracic lymphatic pump ratings were significantly less than (in increasing order of significance): rib raising then pursed lip breathing, rib raising, diaphragmatic doming, rib raising then lymphatic pump, and HVLA (all $p<0.05$).

HVLA was rated as having the most improvement (3.9) and was significantly more than (in increasing order of significance): pursed lip breathing, saline, lymphatic pump, pursed then tapotement, rest, tapotement, and pursed then rib raising (all $p<0.05$).

Participants' self-evaluations of their breathing improvement after treatments were averaged for individual treatments and treatment categories (OMT, SPR, combination), *figure 3*:



Conclusions

1. The results of this study (with the exception of saline via nebulizer) support the null hypothesis that there would not be any statistically significant changes in FVC, FEV1, or FEV1/FVC. Because a healthy population was utilized and treatments were only performed once, these results were expected and are consistent with previous studies[8]. Further studies should determine the effects of long-term OMT on healthy populations' pulmonary function.

2. Saline via nebulizer resulted in a significant decrease in FEV1 and FEV1/FVC. The subjective post-treatment improvement, as evaluated by participants, correlates with this objective finding in that saline has the second lowest rating. This is consistent with the use of hypertonic saline as a component of bronchoprovocation testing and sputum induction.

3. Overall, participants in the OMT group felt their breathing improved significantly more than did the participants in the SPR group, indicated by subjective ratings post-treatment. Additionally, there is a trend towards subjective improvement from SPR to combination treatment (OMT+SPR) to OMT.

4. Future applications of this study include evaluating OMT, SPR, and combination treatments in patients with various pulmonary pathologies (pneumonia, asthma, chronic bronchitis, emphysema, etc.) and determining the significance of subjective findings.

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