

Quantifiable effects of osteopathic manipulative techniques on patients with chronic asthma

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In this pilot study, the authors evaluated the immediate effects of osteopathic manipulative procedures compared with sham procedures on 10 subjects who were diagnosed with chronic asthma. The research followed a pretest-posttest crossover design wherein each subject served as her own control. Blinded examiners recorded respiratory excursion, peak expiratory flow rates, and subjective measures of asthma symptoms. Measurements of both upper thoracic and lower thoracic forced respiratory excursion statistically increased after osteopathic manipulative procedures compared with sham procedures. Changes in peak expiratory flow rates and asthma symptoms were not statistically significant.

(Key words: chronic asthma, osteopathic manipulative treatment [OMT], osteopathic medicine)

Since the osteopathic branch of medicine was founded by Andrew Taylor Still, MD, DO, in 1874, anecdotal reports have appeared in the literature attesting to the efficacy of osteopathic manipulative treatment (OMT) in the control of asthma.¹⁻³ Manipulative treatment and alternative modes of medical therapy are currently gaining acceptance in the medical communities of Europe and the United States despite the absence of controlled clinical trials supporting their efficacy.⁴ Several published studies investigating the validity of acupuncture in the treatment of asthma demonstrate conflicting results.⁵

Only one group of authors⁶ has investigated spinal manipulation in the treatment of patients with asthma, but that study was limited to the spinal thrusting technique used by chiro-

practors. They found significant improvements in bronchial reactivity to histamine and subjective measures of asthma severity, but no change in measured values of the forced expiratory volume in 1 second or forced vital capacity.⁶

The cornerstones of osteopathic principles and practice are the interrelationship between the body's structure and function and a belief in the body's natural ability to heal itself. In patients with asthma, therefore, a physician providing OMT aims to affect therapeutic responses via three distinct physiologic mechanisms:

- First, the physician attempts to restore maximal compliance to the thoracic cage to increase the patient's respiratory motion. Patients with asthma who have suffered exacerbations that result in overuse injuries to the respiratory muscles and joints will, theoretically, benefit from releasing those strains.
- The second physiologic mechanism intended to affect therapeutic response in the patient is the normalization of autonomic nervous system function. Branches of the nervus vagus provide parasympathetic innervation to pulmonary structures and the respiratory diaphragm. The sympathetic supply originates in the first four or five thoracic spinal cord segments and the synapse in the vertebral ganglia that lie immediately deep to the costovertebral junctions in the upper thorax. Treatment that restores motion to the occipitotloid and upper thoracic regions will improve responsiveness to adrenergic stimuli.^{7,8}
- Finally, OMT can facilitate lymphatic flow to and from the bronchial tree. Tissues become edematous and metabolic waste products accumulate when lymphatic flow is impeded, adversely affecting cellular function and contributing to disease. Treatment to release strains in the myofascia, the support structure of lymphatic vessels, reduces congestion in the airways of patients with asthma.⁹

With these three proposed therapeutic effects of OMT in mind, the study by Nielsen et al⁶ is in accord with osteopathic principles and practice. The study used a treatment that focused on the thoracic vertebral articulations, finding a statistically significant improvement in "nonspecific hyper-reactivity" that may be explained by the effect of treating the viscerosomatic reflex areas to normalize sympathetic nervous system response. However, this treatment would not be expected by any theoretical mechanism to affect appreciably patients' forced expiratory volume or forced vital capacity.

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ORIGINAL CONTRIBUTION

Figure. Ease-of-breathing visual analog scale (10 cm [4 in]). Values were assigned by measuring the distance to the patient's mark in millimeters.

Directions: Draw a vertical mark across the horizontal line below to indicate how your breathing feels at this moment.

I can easily take in a deep breath. My breathing feels free and unrestricted.	I can't take in a deep breath. My breathing feels constricted, and my chest feels tight.
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The current study was designed to collect objective and subjective measurements before and after intervention using four well-defined OMT techniques. Because of the multifactorial nature of asthma, we opted to sacrifice the benefits that may result from multiple treatment sessions in order to exclude as many confounding factors as possible. By focusing our osteopathic manipulative (OM) intervention on restoring compliance to the thoracic cage, we hoped to determine whether a single session of OM procedures produces a change in thoracic cage compliance that can be measured objectively. We also used a visual analog scale (Figure) to assess patients' subjective reports of asthmatic symptom severity so that we could assess any immediate change in symptoms that might be associated with a single intervention using OM procedures.

Methods

Patient selection

Patients with chronic asthma were recruited by referral over 4 months from the primary care physicians of a community-based teaching clinic in the neighborhood of Sunset Park in Brooklyn, NY. We chose to recruit patients from a population likely to be naïve to OMT because we thought that previously treated subjects may be able to recognize the sham procedures as such.

The clinic's physicians were asked to refer all patients older than 18 years with chronic asthma as diagnosed by history and physical examination. The exclusion criteria were as follows: pregnancy, change in asthma medication during the past 4 weeks, asthma exacerbations during the past 4 weeks, and a concomitant diagnosis of congestive heart failure, renal failure, cirrhosis, or cancer. Such patients were excluded because it was thought that these conditions might produce respiratory complications that could fluctuate and therefore confound our data.

Ten patients were referred in this manner and all were eligible for inclusion in the study. The patients agreed to participate in the study and signed an informed consent agreement. The study was approved by the institutional review board of Lutheran Medical Center in Brooklyn, NY, and was conducted between February 1998 and May 1998. During an intake inter-

view, one of the authors (S.E.B.) determined each subject's asthma severity level according to Nicklas' criteria.¹⁰

Although men were not intentionally excluded from the study, all of the referred patients were women. They ranged in age from 35 to 59 years (mean, 47, SD, 10). None reported any change in medication regimens or baseline symptoms for at least 4 weeks prior to participation in the study. Both smokers and nonsmokers were included. Table 1 summarizes the patients' characteristics. Patients who required changes in asthma medication or had exacerbation of asthma during the study period would have been excluded until 4 weeks after standard medical management had controlled symptoms, but no patients fell into this category. None of the patients had received OMT prior to participation in this study. One subject had received spinal manipulative treatments for low back pain from a chiropractor.

Methodology

The methodology used was a pretest-posttest crossover design in which each patient was treated with OM procedures and sham procedures on different dates scheduled at least 1 week apart. Thus, the subjects served as their own controls.

Each patient underwent two cycles of the pretest-intervention-posttest protocol. In one of these intervention cycles, the procedures consisted of four recognized OMT techniques (balanced ligamentous tension in the occipitotoid and the cervicothoracic junctions, A. T. Still's technique for "upward displacement" of the first rib, direct action release of "lower rib exhalation restriction," and diaphragmatic release). In the other cycle, a set of sham procedures was performed. For each subject, the same clinician administered OM procedures and the sham procedures. In a randomized manner, some patients received the OM procedures during the first cycle and the sham procedures during the second. The rest received the protocol in the reverse order.

Measurements

Within 15 minutes before and after each intervention session, the examiner measured thoracic excursion at two locations, obtained peak expiratory flow (PEF) measurements using a

Table 1
Characteristics of Study Subjects, N = 10

Characteristic	Value
■ Sex <input type="checkbox"/> Female, No.	10
<input type="checkbox"/> Male, No.	0
■ Age, yr, mean (SD)	47 (10)
■ Tobacco-use status <input type="checkbox"/> Smoker, No.	4
<input type="checkbox"/> Nonsmoker, No.	6
■ Asthma severity <input type="checkbox"/> Mild persistent, No.	3
<input type="checkbox"/> Moderate, No.	4
<input type="checkbox"/> Severe, No.	3

handheld peak-flow meter, and collected the patients' subjective assessment of symptoms. The primary investigator (S.E.B.) trained two examiners to execute these measurements in a correct, consistent manner. The examiners who took the measurements were blinded as to whether patients were scheduled to receive OM procedures or sham procedures.

For the thoracic wall measurements, the patients were unclothed. Examiners determined excursion with a standard cloth tape measure held around the circumference of the chest while patients were instructed to take a full inspiration followed by a complete expiration. Both measurement locations were marked with a skin marker during the pretest so that the posttest measurement could be closely duplicated. The upper thoracic measurement was taken at the level of the third intercostal space anteriorly and the fifth thoracic vertebra posteriorly. The lower thoracic measurement was taken at the level of the xiphoid process anteriorly and the tenth thoracic vertebra posteriorly.

During each test, three PEF measurements were taken using a handheld peak-flow meter. The highest measurement of the three readings was recorded. Patients rated their symptoms subjectively using the visual analog scale shown in *Figure*.

Intervention techniques

The intervention took 10 to 15 minutes and consisted of the following four OMT techniques applied in sequential order:

- (1) balanced ligamentous tension in the occipitoatlantal and the cervicothoracic junctions,¹¹
- (2) A. T. Still's technique for "upward displacement" of the first rib,¹²
- (3) direct action release of "lower rib exhalation restriction," and
- (4) diaphragmatic release.¹³

The principal investigator (S.E.B.) performed all these

maneuvers while the subject lay supine, fully clothed, on a treatment table.

The sham procedures took place in the same room, with subjects in the same position on the same treatment table. Gentle manual pressure was applied to the region of the thoracic outlet, the occipitoatlantal and cervicothoracic junctions, and the epigastric region. The upper extremities were circumducted at the shoulder through a partial range of passive motion. No part of the sham procedures consisted of recognized OMT techniques.

Results

No complications were associated with the OM procedures as provided or the sham procedures. Several patients reported feeling relaxed after OM procedures and sham procedures. Two patients reported feeling mildly light headed after OM procedures, transiently, on arising from the treatment table.

Because the data were not normally distributed, the Kruskal-Wallis test was used to assess changes between pretest and posttest results in the four groups created by the crossover design (ie, OM procedures preceding sham procedures, OM procedures after sham procedures, sham procedures preceding OM procedures, and sham procedures after OM procedures). Pretest and posttest values for OM procedures and sham procedures were compared using Wilcoxon signed rank tests. A *P* value of less than .05 indicates statistical significance.

The severity of each subject's asthma was similar before intervention. Data are summarized in *Table 2* as mean and SD. All measurements of thoracic excursion in these subjects showed remarkably little motion with forced respiration. For all measurements of excursion, the range was 0.4 cm to 4.5 cm. The mean was only 1.4 cm. However, the change in upper and lower thoracic excursion in both OM groups (OM procedures preceding sham procedures, OM procedures after sham procedures) demonstrated significant increases in respiratory motion when compared with excursion in the two sham intervention groups (sham procedures preceding OM procedures, sham procedures after OM procedures) (Kruskal-Wallis test: upper, *P* = .002; lower, *P* = .01).

Upper thoracic excursion increased significantly after OM procedures (combined groups), with a mean change of 0.9 cm (0.2 cm SD), whereas it did not increase after sham procedures (combined groups), with a mean change of 0.0 cm (0.2 cm SD) (Wilcoxon signed rank test, *P* = .005). Lower thoracic excursion also increased significantly after OM procedures, with a mean change of 0.8 cm (0.2 cm SD), but not after sham procedures, with a mean change of 0.1 cm (0.4 cm SD) (Wilcoxon signed rank test, *P* = .005).

The mean PEF rate decreased after OM procedures and sham procedures, but more so after OM procedures. The wide variation among these values precludes any statistical significance in this small sample. Subjects' subjective reports of "ease of breathing" improved with OM procedures and sham

Table 2
Measurements Before and After Osteopathic Manipulative Procedures and Sham Procedures

Measurement	OM results, mean (SD)			Sham results, mean (SD)		
	OM first	Sham first	OM only	Sham first	OM first	Sham only
■ Peak expiratory flow rate						
□ Before	322 (65)	264 (82)	293 (76)	241 (97)	331 (23)	286 (82)
□ After	291 (87)	267 (78)	279 (79)	251 (84)	316 (51)	284 (74)
□ Change	-31 (51)	3.0 (9.1)	-14 (39)	10 (20)	-15 (33)	-2.5 (29)
■ Upper thoracic excursion						
□ Before	1.3 (1.0)	1.3 (0.9)	1.3 (0.9)	1.2 (0.9)	1.1 (0.9)	1.2 (0.8)
□ After	2.1 (1.2)*	2.2 (0.9)*	2.2 (1)	1.3 (1.0)*	1.1 (0.9)*	1.2 (0.9)
□ Change	0.8 (0.3)	1.0 (0.2)	0.9 (0.2)†	0.1 (0.2)	0.0 (0.2)	0.1 (0.2)†
■ Lower thoracic excursion						
□ Before	1.2 (1.4)	1.3 (0.9)	1.3 (1.1)	1.3 (0.9)	0.7 (0.6)	1.0 (0.8)
□ After	2.0 (1.4)‡	2.1 (0.9)‡	2.1 (1.1)	1.2 (0.8)‡	1.0 (1.0)‡	1.0 (0.9)
□ Change	0.8 (0.3)	0.8 (0.2)	0.8 (0.2)†	-0.1 (0.3)	0.2 (0.5)	0.0 (0.4)†
■ Subjective rating						
□ Before	7.0 (2.1)	5.0 (2.4)	6.0 (2.4)	4.3 (2.8)	5.9 (2.7)	5.1 (2.7)
□ After	9.0 (1.0)	8.3 (1.9)	8.6 (1.5)	6.5 (3.2)	6.9 (2.7)	6.7 (2.8)
□ Change	2.0 (1.9)	3.3 (1.8)	2.7 (1.9)	2.2 (2.7)	1.1 (2.0)	1.6 (2.3)

**P* = .002, Kruskal-Wallis test.
†*P* = .005, Wilcoxon signed rank test.
‡*P* = .01, Kruskal-Wallis test.

procedures; but, here as well, the difference between the two groups demonstrated no statistical significance.

Comment

The data obtained from this small sample supports our hypothesis that OM procedures, when designed to increase respiratory motion, can achieve that effect in patients with chronic asthma. Thoracic cage excursion with forced respiration increased significantly after a single, brief intervention using OM procedures.

The changes in thoracic excursion measurements were all minute relative to thoracic circumference; the largest increase was only 1.2 cm, less than 2% of an adult's thoracic circumference. However, most of the patients with chronic asthma in this sample had remarkably little chest wall motion associated with respiration; 1.2 cm represents 86% of the mean excursion measured during all tests (1.4 cm SD). Considering the degree of restriction these patients have in their respiratory motions, even a small difference may help to relieve the symptom of "chest tightness" that plagues so many patients with chronic asthma. In our study, subjective evaluation of symptoms improved slightly after OM procedures compared with sham procedures, but the difference was not statistically significant.

An interesting but unexplained result is that PEF rate decreased after OM procedures and sham procedures—although seemingly more so after OM procedures. The numbers were not statistically significant for a sample of this size, however. Perhaps resting in a supine position always has a negative effect on effort-dependent measures. Most of these patients also did not use handheld peak-flow meters regularly to monitor their asthma symptoms. It might be that when patients felt more relaxed and their breathing felt less restricted, they did not try to blow as forcefully into the handheld peak-flow meter. Had they been more experienced with the use of a hand-held meter, the values may have had less variation and, consequently, had more meaning to this study.

It is important to note that because of the strict protocol of the study, OMT was not individualized to treat each patient's pattern of strain and restriction—as would have been the case if used in a treatment setting. For example, all subjects were treated for exhalation restrictions of the lower ribs regardless of whether they had that diagnosis or another, which may have required a completely different OM technique. For further research, a protocol that permits individualization of therapy to address each subject's particular somatic dysfunctions would be more appropriate for ascertaining the benefit of OMT in this clinical application.

We encountered great difficulty with subject recruitment and were able to recruit only 10 subjects during the study period. We believe that the difficulty in recruiting was due in part to subjects' ambivalence about undergoing a form of therapy with which they had no familiarity. For a research design that uses sham procedures as a control, the subjects must be unable to distinguish the proposed treatment method from the sham procedures. Providing some financial incentive in the form of modest compensation for participation in such a study would most likely increase the number of subjects willing to participate.

Our findings support anecdotal reports by osteopathic physicians who have used OMT to treat patients with asthma. But how this apparent improvement in the freedom of respiratory motion might have an impact on actual pulmonary function has yet to be determined and merits further investigation. Future research in this area should use pulmonary function testing to evaluate the effects of OMT.

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Editor's message

"Techniques" versus "treatment" in osteopathic manipulation

In the preceding article, "Quantifiable effects of osteopathic techniques on patients with chronic asthma," Bockenbauer et al used a sequence of osteopathic manipulative techniques on each subject. This study is a nice example of a test of a specified set of manipulative procedures. It is important to note that there are basically two types of studies of osteopathic manipulation: (1) *technique* studies such as this one, and (2) studies of osteopathic manipulative *treatment*.

In a technique study, one or more specific osteopathic manipulative procedures are utilized for each patient. Technique studies are valuable and necessary to determine the specific effects of well-specified but circumscribed manipulations on a target problem.

A study of osteopathic manipulative treatment, however, is designed to make use of the full range of manipulative techniques to treat a targeted problem—depending on the clinician's findings as a result of a thorough physical examination of the patient. Osteopathic manipulative

treatment studies are guided by the patient's condition and response to treatment, which then determine the techniques used.

The study design used by Bockenbauer et al clearly places this article in the category of a technique study rather than a study of osteopathic manipulative treatment.

Accordingly, the authors have used the phrase *osteopathic manipulative procedures* (or *OM procedures*) to indicate the specific sequence of manipulations used in this study. While this usage may seem odd to some readers, the terminology is necessary and useful, clearly differentiating this type of study from a study of the full range of manipulation as used in osteopathic manipulative treatment. The two are different study types designed to test different questions, and the distinction must be clearly made.

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Associate Editor