

Osteopathic Manipulative Treatment for Self-Reported Fatigue, Stress, and Depression in First-Year Osteopathic Medical Students

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Context: During medical education, many students experience psychological distress, including symptoms such as fatigue, stress, and depression.

Objective: To evaluate the effect of osteopathic manipulative treatment (OMT) on self-perceived fatigue, stress, and depression in first-year osteopathic medical students.

Methods: This randomized controlled pilot study with repeated measures was conducted at the Lake Erie College of Osteopathic Medicine-Bradenton in Florida during the fall 2012 semester. First-year osteopathic medical students voluntarily enrolled in the study and were randomly assigned to directed OMT (D-OMT), nondirected OMT (ND-OMT), or control groups. The D-OMT and ND-OMT groups received treatment by osteopathic physicians weekly for 4 weeks. The control group received no treatment. All groups completed the Epworth Sleepiness Scale (ESS), the Self-Perceived Stress Scale (SPSS), and the Primary Care Evaluation of Mental Disorders Patient Health Questionnaire 9 (PHQ-9) depression scale before treatment (pretest), after 2 treatments (midtest), and after 4 treatments (posttest).

Results: All participants self-reported as white and single, with both sexes equally represented, and had an mean age of 24 years. Analysis of ESS scores revealed a statistically significant decrease in the D-OMT group from pretest and posttest scores and a statistically significant increase in the ND-OMT group from pretest to midtest but not from pretest to posttest scores. No statistically significant differences were noted in the control group scores on this measure. No statistically significant differences were seen in the SPSS or PHQ-9 scores from pretest to midtest or pretest to posttest in any of the 3 groups.

Conclusion: The D-OMT regimen used in the current study produced a statistically significant decrease in self-perceived fatigue in first-year osteopathic medical students. Osteopathic manipulative treatment represents a potential modality to reduce self-perceived distress in medical students. Further research is warranted.

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Psychological distress is an established problem in medical education. Previous studies¹⁻³ have investigated the prevalence of psychological distress in medical students and have identified several major manifestations: fatigue, stress, depression, burnout, and low quality of life. One multi-institutional study¹ identified that 82% of 2246 medical students surveyed displayed at least 1 form of distress, with 52% demonstrating 3 or more manifestations of distress. A systematic review² demonstrated a higher prevalence of distress symptoms in medical students compared with the general population. In addition, an investigation⁴ of depressive symptoms in medical trainees highlighted a higher rate of depression and suicidal ideation among medical students compared with residents.

Many aspects of a medical student's life are adversely affected by psychological distress, including mental and physical well-being. Psychological distress can contribute to illnesses, such as tension headaches and irritable bowel syndrome, and can increase all-cause morbidity and mortality.⁵ In addition, a dose-response relationship has been observed between the number of manifestations of distress present in a student and suicidal ideation.¹ Psychological distress also prevents students from achieving their maximal academic potential; medical students experiencing distress have demonstrated lower test scores.⁵⁻⁸

Patients with prolonged symptoms of psychological distress present with increased tone and altered biomechanics in the parts of the body in which these symptoms manifest.⁸ The psychobehavioral model of osteopathic manipulative treatment (OMT) seeks to influence mental and emotional conditions, particularly stress and anxiety, by targeting associated anatomical locations.⁹ Accordingly, we propose that OMT could be used as a treatment modality for patients with psychological distress.

In the present study, we assessed the effect of directed OMT (D-OMT) and nondirected OMT (ND-

OMT) on the psychological distress of first-year osteopathic medical students. We hypothesized that 1 month of D-OMT would reduce the prevalence of psychological distress in the students. No reductions in distress symptoms were anticipated in either the ND-OMT or control groups.

Methods

This randomized controlled pilot study was approved by the Lake Erie College of Osteopathic Medicine (LECOM) Institutional Review Board (IRB #20-001). The study coordinator obtained informed consent according to protocol. Participants were provided with both written and verbal explanations of study procedures. They were given a study number at enrollment by a trained research coordinator who was not involved with data collection. Study numbers were assigned using simple randomization, with each number corresponding to 1 of 3 groups: D-OMT, ND-OMT, or control (*Figure 1*). A database containing only study numbers was then given to a second research coordinator, who was involved only in data collection. Participants were not told their group assignment.

Setting

The study occurred during September and October 2012 in the OMT laboratory at LECOM-Bradenton. The laboratory windows and doors were closed during treatment sessions, and outside noise was minimized. The OMT was performed by licensed osteopathic physicians at LECOM. Physicians participated in a 3-hour training session before the study began to ensure uniformity of technique. A total of 7 physicians were trained. Five physicians were present at each session, providing D-OMT and ND-OMT protocols to 4 participants per session. A research assistant was present during treatment sessions to monitor technique consistency through direct observation and to manage treatment duration with a stopwatch.

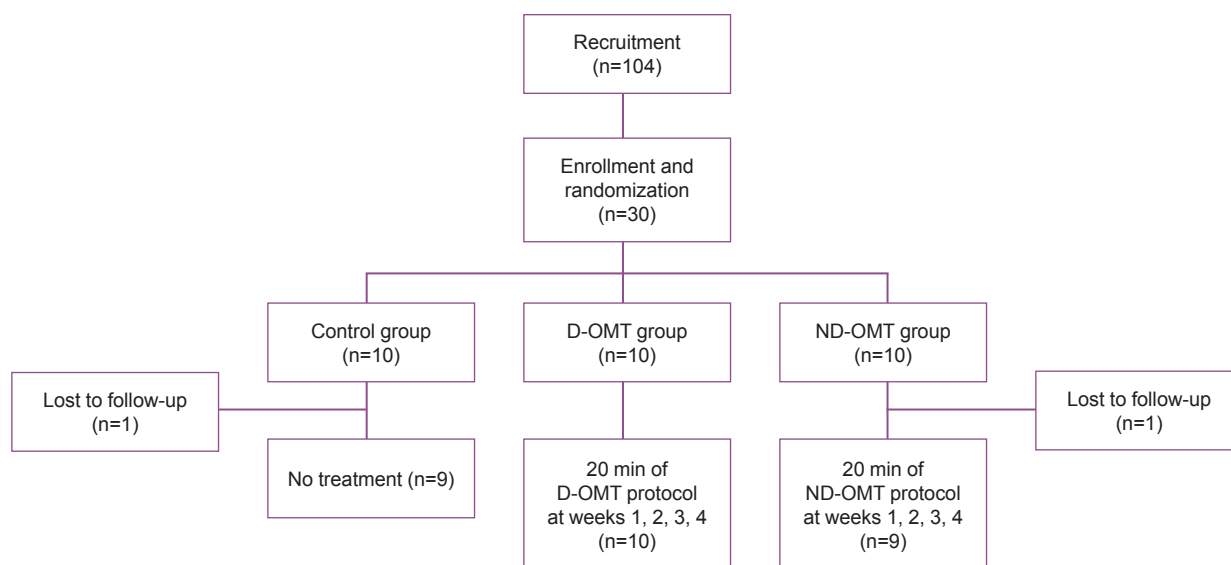


Figure 1. Study flow diagram. *Abbreviations:* D-OMT, directed osteopathic manipulative treatment (OMT); ND-OMT, nondirected OMT.

Participants

First-year osteopathic medical students at LECOM-Bradenton were recruited by a general interest survey. One hundred four students volunteered to participate and were subsequently screened for exclusion criteria. Students were excluded if they had a history of psychiatric disorder or other contraindicated health concerns (eg, pregnancy, open wounds, neoplasm, bone fracture, fasciitis). Students with previous exposure to OMT were also excluded from the study.

General Protocol

Participants in the D-OMT and ND-OMT groups received 20 minutes of OMT weekly for 4 weeks. After treatment, participants rested supine for 10 minutes to allow for normalization of the autonomic nervous system before completing the treatment session. The control group received no treatment. All groups completed surveys regarding self-perceived fatigue, stress, and depression. Each survey was made available electronically for 24 hours on designated dates.

D-OMT Protocol

Soft tissue release in the core, where distress can manifest as cervical musculoskeletal dysfunction as well as hypersympathetonia, was the focus of D-OMT.⁹ To address these anticipated dysfunctions, osteopathic physicians provided 20 minutes of OMT, which consisted of 4 minutes of rib raising, 3 minutes of anterior cervical fascia release, 7 minutes of sternocleidomastoid inhibition, 3 minutes of levator scapulae inhibition, and 3 minutes of occipitoatlantal release. Techniques were performed bilaterally.

Rib raising was performed with the physician's finger pads at the rib angles. Sustained pressure was applied to release muscle tension; this technique was repeated down the thorax.¹⁰ To perform anterior cervical fascia release, the physician placed his thumb pads in the participant's supraclavicular fossa and pressed the thumbs inferiorly until tension was released, then moved laterally and repeated the technique.¹¹ Sternocleidomastoid inhibition was performed with the physician applying inhibitory pressure with his thumb at the insertion point of the mas-

toid process until a soft tissue release was felt. The physician then grasped the belly of the muscle between his thumbs and forefingers, again applying inhibitory pressure until release occurred. This process was repeated down the sternocleidomastoid until the insertion point near the jugular notch, at which point the physician applied inhibitory pressure with his thumb.¹² To perform levator scapulae inhibition, the physician placed his thumbs on the participant's upper medial border of both scapulae at the insertion points. Inhibitory pressure was applied until soft tissue tension released. The physician repeated this technique along the scapula and up to the mid-cervical spine attachment points.¹³ Occipitoatlantal release was performed with the physician cradling the participant's head in both hands. Finger pads were positioned at the insertion of the extensor cervical muscles at the occiput. Anteriorly directed inhibitory pressure was applied until soft tissue tension released. The physician's fingers moved laterally, and the process was repeated.¹³

ND-OMT Protocol

To control for bias related to the benefits of experiencing hands-on contact by a physician, ND-OMT was performed. Techniques focused on the extremities and pelvis, with little effect on the core. Physicians performed 4 minutes each of facilitated positional release of the lower extremities, unwinding of the lower extremities, facilitated positional release of the upper extremities, unwinding of the upper extremities, and integrated neuromusculoskeletal release. Techniques were performed bilaterally.

To perform facilitated positional release on the lower extremity, the physician grasped the participant's foot with his thumb on the dorsum and fingers on the plantar surface. The physician externally rotated and abducted the hip while bringing the knee into 90° flexion. The knee was allowed to drop laterally, and the foot was inverted and internally rotated. The physician then drew the foot inferiorly to straighten and place tension on the knee. This position was held until a release was felt. In the same position, the physician then grasped the calca-

neus and forefoot, flexing and adducting the hip and bending the knee to 90°. The foot was externally rotated and drawn inferiorly, straightening and placing tension on the knee.¹⁴ To unwind the lower extremity, the physician grasped the ankles, applying combinations of distraction, traction, compression, twisting, and bending to provide release of the lower extremity.¹⁵

Facilitated positional release on the upper extremity was performed with the participant supine while the physician grasped the olecranon with his thumb and index finger, with the participant's elbow bent to 90°. Using his other hand, the physician grasped the dorsum of the wrist and then rotated the forearm into pronation, compressed it, and then extended it. This position was held until the elbow fully extended and a release was felt.¹¹ To unwind the upper extremity, the physician grasped the participant's wrists. Combinations of distraction, traction, compression, twisting, and bending were used to provide release of the upper extremity.¹⁶

To perform integrated neuromusculoskeletal release of the pelvis, the physician cupped the proximal and distal anterior superior iliac spine with his palms, compressing medially and rotating anteriorly and posteriorly. When the physician met resistance, the position was held until release occurred. The physician then placed his caudad hand behind the sacrum, covering the sacroiliac joint with his index and ring fingers. The physician placed his cephalad hand on the distal anterior superior iliac spine, with his forearm on the proximal anterior superior iliac spine. The physician engaged the barriers using distraction, compression, and twisting until release was noted.^{15,16}

Outcome Measures

Scores on the Epworth Sleepiness Scale (ESS), Primary Care Evaluation of Mental Disorders Patient Health Questionnaire 9 (PHQ-9) depression scale, and Self-Perceived Stress Scale (SPSS) were used as outcome measures. These scores were obtained at weeks 0, 2, and 4 of the study to provide pretest, midtest, and posttest

values, respectively. Basic demographic information was obtained during initial patient consent.

The ESS consisted of 8 questions scored from 0 to 3, with scores summated. Questions recorded the participant's likelihood of falling asleep during activities such as sitting and reading, sitting inactive in public, and as a passenger in a car. A total ESS score of 10 or greater indicated fatigue.¹⁷

The PHQ-9 comprised 9 questions scored from 0 to 3, with scores summated. Questions assessed, for example, how often the participant felt bothered by feeling little interest or pleasure in activities, poor appetite or overeating, and trouble concentrating. Total scores were interpreted with 0 to 4 indicating minimal depression, 5 to 9 indicating mild depression, 10 to 14 indicating moderate depression, 15 to 19 indicating moderately severe depression, and 20 to 27 indicating severe depression.¹⁸

The SPSS comprised 14 questions scored from 0 to 4. The survey asked participants, for example, how often they had felt upset because of an unexpected event, how often they had felt nervous and stressed, and how successful they had felt in dealing with life hassles. Scores were obtained by reversing the score of the 7 positive items and summing all items.¹⁹ A total SPSS score of 25 or greater was used to indicate high stress, making an SPSS score for the present study one-half SD point higher than the normal SPSS score in an age-matched US population.²⁰

Statistical Analysis

Descriptive analysis (mean, median, 25th percentile, and 75th percentile) for all participant groups was performed using SigmaStat 3.0 (Informer Technologies, Inc). The Wilcoxon signed-rank test was performed in Excel 2010 (Microsoft Corp) with QI Macros 2014 (KnowWare International Inc) for all participant groups, comparing the pretest data with both the midtest and posttest data in each category of fatigue, stress, and depression. The Bonferroni correction was used to account for multiple comparisons. The Fisher exact test was used to compare

the number of men and women in each group in Excel 2010 with QI Macros 2014. Hypothesis testing was conducted using an α value of .025.

Results

Sample Demographics

Thirty students were selected using a random number generator (www.stattek.com). The decision to include 30 participants was based on logistical restraints, including OMT laboratory space and physician availability. Of the 30 participants, 2 were lost to follow-up, owing to protocol noncompliance (failure to attend a treatment session or complete a survey). Their data were excluded from analysis. All participants self-reported as white and single, with an age range of 21 to 29 years (median, 24 years). Of the 28 participants, 13 (46%) were women, and 15 (54%) were men.

The randomization of students into study groups yielded comparable demographics. The D-OMT group was 70% male, with a mean age of 24.2 years. The ND-OMT group was 44% male, with a mean age of 24.0 years. The control group was 44% male, with a mean age of 23.8 years. The analysis found no statistically significant difference in scale scores between the number of men and woman in each group: D-OMT compared with each of the other 2 groups ($P=.370$) and ND-OMT compared with the control group ($P\geq.99$).

Prevalence of Psychological Distress

At baseline, 8 participants (28.6%) reported fatigue, 11 (39.3%) reported *mild or moderate* depression, and 11 (39.3%) were classified as stressed. Compared with the study sample, the D-OMT group had a higher prevalence of fatigue and stress and a lower prevalence of depression. The ND-OMT group had a lower prevalence of fatigue, but they had a similar prevalence of stress and depression when compared with the D-OMT group. The control and OMT groups had a comparable prevalence of distress symptoms.

Of 28 students surveyed, 8 students (29%) reported no fatigue, stress, or depression at baseline. Twenty students (71%) had at least 1 symptom of psychological distress. Of the 9 students who had 1 symptom, 5 reported fatigue, 3 reported stress, and 1 reported depression. Ten students reported 2 manifestations of distress, most frequently presenting with symptoms of both stress and depression. One student reported manifestations of fatigue, stress, and depression.

Effects of OMT on Fatigue

The D-OMT group showed a decline in median ESS scores from pretest to midtest to posttest. A significant difference was not noted between pretest and midtest ESS scores ($P=.047$), but a statistically significant decrease in ESS scores for pretest and posttest was seen ($P=.019$). This decrease in scores was also noted in the 25th and 75th percentiles, decreasing from 5 and 12, respectively, to 2 and 9 from pretest to posttest.

There was no identifiable difference in ESS scores in the ND-OMT group when comparing pretest scores with midtest scores ($P>.99$) and with posttest scores ($P=.678$). The control group demonstrated an increase in ESS scores, but in the 25th and 75th percentiles, this increase was not statistically significant. A statistically significant increase was noted between pretest and midtest ESS scores ($P=.013$) but not between pretest and posttest scores ($P=.051$) (Table and Figure 2).

Effects of OMT on Depression

A decline in median PHQ-9 scores was observed in the D-OMT group from pretest to midtest, as well as pretest to posttest. No statistically significant difference was noted when comparing pretest scores with both midtest ($P=.126$) and posttest scores ($P=.047$).

The ND-OMT group showed a decline in median PHQ-9 score from pretest to posttest. However, no statistically significant difference in pretest to midtest ($P=.859$) or pretest to posttest ($P=.260$) PHQ-9 scores in the ND-OMT group was observed. The control group

had an increase in median scores from pretest to midtest, with the median score from midtest to posttest unchanged and no statistically significant difference in pretest to midtest ($P=.193$) or pretest to posttest ($P=.343$) PHQ-9 scores (Table and Figure 3).

Effects of OMT on Stress

No effect on SPSS scores for the D-OMT group was identified; the median score decreased from pretest to midtest and increased from midtest to posttest. No statistically significant differences were noted from pretest to midtest ($P=.919$) or pretest to posttest ($P=.139$). Both the ND-OMT and control groups had an increase in median SPSS score from pretest to midtest and a decline from midtest to posttest. Median posttest scores for each group were similar to the corresponding pretest scores. No statistically significant differences were found in SPSS scores in the ND-OMT group from pretest to midtest ($P=.953$) or pretest to posttest ($P=.906$). No statistically significant differences were seen in SPSS scores in the control group from pretest to midtest ($P=.477$) or pretest to posttest ($P=.086$) (Table and Figure 4).

Discussion

The negative effect of psychological distress on medical students remains a concerning aspect of medical education. Distress symptoms may prevent students from optimizing their academic performance.⁵⁻⁷ Despite the availability of school wellness programs and mental health services, medical students often experience barriers to these resources or underuse them.²¹ The medical school community must strive to improve student resources, as well as explore alternative treatment offerings, including OMT.

The current study highlights a high prevalence of psychological distress among osteopathic medical students, with 71% of participants reporting at least 1 symptom of distress at baseline. This finding is particularly striking when considering that students were en-

Table.
Descriptive Analysis of Outcome Scores in Students Assessed for Psychological Distress (N=28)^a

Group	Pretest		Midtest		Posttest	
	Mean (SD)	Median (25%, 75%)	Mean (SD)	Median (25%, 75%)	Mean (SD)	Median (25%, 75%)
Epworth Sleepiness Scale^a						
D-OMT (n=10)	8.7 (4.4)	8 (5, 12)	6.3 (3.4) ^b	7 (3, 8)	5.9 (4.0) ^b	5 (2, 9)
ND-OMT (n=9)	6.2 (2.9)	7 (3.75, 8)	6.8 (3.5)	6 (4.75, 9)	6.3 (2.7)	7 (5.5, 7.25)
Control (n=9)	7.4 (3.1)	8 (4.75, 10)	8.6 (3.7)	8 (5.5, 11)	8.7 (3.5)	8 (6, 10.75)
Self-Perceived Stress Scale^c						
D-OMT (n=10)	25.3 (7.8)	24.5 (19, 31)	23.5 (5.8)	22.0 (19, 28)	24.9 (5.6)	23.5 (22, 28)
ND-OMT (n=9)	21.8 (8.1)	18.0 (16.75, 29.25)	22.0 (6.5)	20.0 (17.5, 27.5)	21.6 (7.0)	19.0 (16.75, 27.75)
Control (n=9)	22.0 (6.7)	22.0 (17, 25.75)	24.3 (8.3)	27.0 (18.25, 29.25)	22.1 (8.8)	22.0 (19.25, 25)
PHQ-9^d						
D-OMT (n=10)	4.4 (3.3)	4.5 (2, 5)	3.0 (2.6) ^b	3.0 (1, 4)	3.4 (2.9) ^b	3.0 (2, 5)
ND-OMT (n=9)	4.7 (2.9)	4.0 (2, 7.25)	4.4 (3.4)	4.0 (1.75, 7)	6.3 (2.7)	7.0 (5.5, 7.25)
Control (n=9)	3.8 (3.2)	3.0 (2, 4.5)	4.8 (3.9)	4.0 (1.75, 7.5)	4.3 (3.0)	4.0 (3.75, 5.5)

^a The Epworth Sleepiness Scale consisted of 8 questions scored from 0 to 3; a score of 10 or greater indicated fatigue.

^b Statistically significant difference from pretest.

^c The Self-Perceived Stress Scale contained 14 questions scored from 0 to 4; a score of 25 or greater indicated high stress.

^d The Primary Care Evaluation of Mental Disorders Patient Health Questionnaire 9 (PHQ-9) depression scale contained 9 questions scored from 0 to 3. Total scores were interpreted as follows: 0-4, minimal depression; 5-9, mild depression; 10-14, moderate depression; 15-19, moderately severe depression; and 20-27, severe depression.¹⁸

Abbreviations: D-OMT, directed osteopathic manipulative treatment (OMT); ND-OMT, nondirected OMT.

rolled in their first semester of medical education. Previous studies indicate that psychological distress peaks during the transition between the second and third year.⁶ Accordingly, early identification and treatment of medical students with symptoms of psychological distress is paramount, because distress may increase in prevalence and severity as students progress through their first year of education.

The current study also demonstrates the potential use of OMT as a means of reducing fatigue symptoms in medical students. Notably, the D-OMT group had a sta-

tistically significant decrease in symptoms. The control group had a statistically significant increase in fatigue symptoms from pretest to midtest but not from pretest to posttest. The ND-OMT group maintained a similar level of fatigue throughout the study. The effect of ND-OMT may have been related to therapeutic manipulation of the autonomic nervous system via the sacrum, pelvis, and extremities, or may have been a perceived relaxation related to physician touch. It is also possible that simply resting supine weekly contributed to the observed effects in the ND-OMT group.

No statistically significant effects of OMT on stress or depression were noted. The anticipation of an examination may have affected stress more than the other distress symptoms, thus affecting study findings. Also, it is unknown whether reducing 1 symptom could have influenced self-perception of the other symptoms (eg, being less fatigued causing a participant to report lower levels of depression or stress).

Osteopathic manipulative treatment represents an unexplored method to reduce symptoms of psychological distress. These findings suggest that OMT could be used as a treatment modality within the osteopathic medical student population. One possibility would be for students to regularly perform OMT on each other to help reduce symptoms of distress. Using OMT to reduce distress could be extended to postgraduate and practicing physicians—groups perhaps at high risk for psychological distress. Patients undergoing mental health care may find benefit of OMT as an adjunct treatment.

Limitations

Data analysis was limited because of the small sample size. The conclusions of this study, therefore, may not be representative of the true effects of OMT on distress symptoms. Additionally, between-group analysis was not performed. It is possible that the decrease in fatigue symptoms in the D-OMT group would not be statistically significant when compared with the ND-OMT and control groups. It is also possible that the statistically insignificant increases and decreases in symptoms noted would be statistically significant if compared with the changes in symptom scores found in each group.

This study was limited to first-year osteopathic medical students enrolled in a problem-based learning curriculum. As such, it does not represent the general medical student population. Furthermore, student participation in this study was voluntary. The students' decision to enroll may have been influenced by their awareness of preexisting psychological symptoms, which may have influenced data regarding distress prevalence.

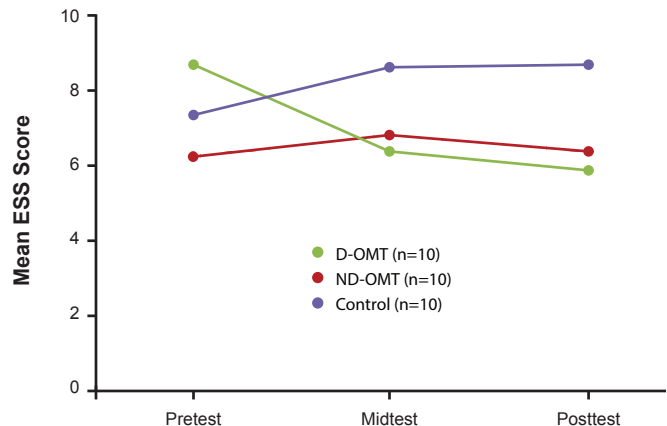


Figure 2.

Mean Epworth Sleepiness Scale (ESS) score for each study group. The ESS consisted of 8 questions scored from 0 to 3, with scores summated. A score of 10 or greater indicated fatigue. *Abbreviations:* D-OMT, directed osteopathic manipulative treatment (OMT); ND-OMT, nondirected OMT.

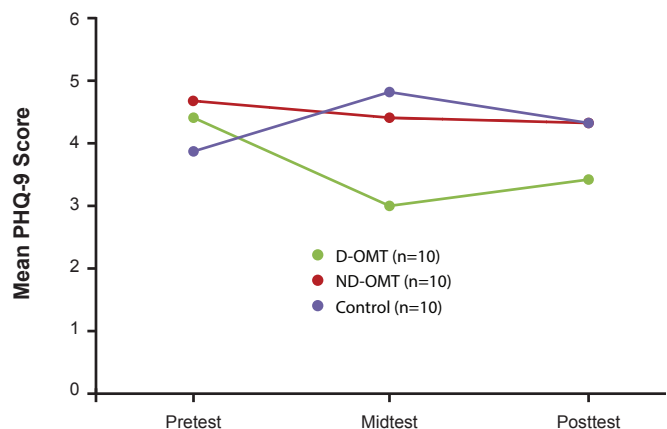


Figure 3.

Mean Primary Care Evaluation of Mental Disorders Patient Health Questionnaire 9 (PHQ-9) depression scale score for each study group. The PHQ-9 comprised 9 questions scored from 0 to 3, with scores summated. Scores were interpreted as follows: 0-4, minimal depression; 5-9, mild depression; 10-14, moderate depression; 15-19, moderately severe depression; and 20-27, severe depression. *Abbreviations:* D-OMT, directed osteopathic manipulative treatment (OMT); ND-OMT, nondirected OMT.

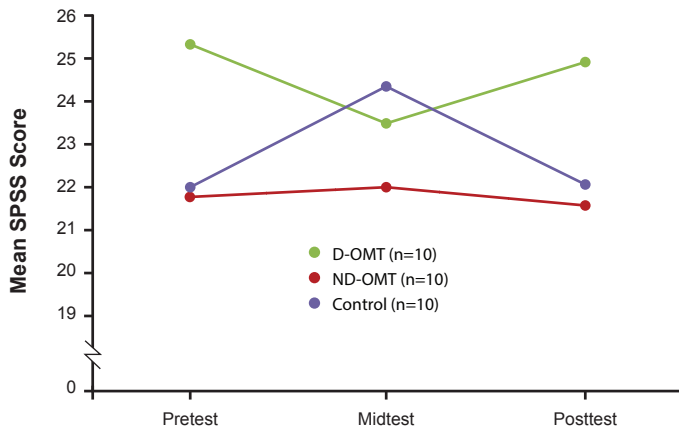


Figure 4. Mean Self-Perceived Stress Scale (SPSS) score for each study group. The SPSS comprised 14 questions scored from 0 to 4. A score of 25 or greater indicated high stress. *Abbreviations:* D-OMT, directed osteopathic manipulative treatment (OMT); ND-OMT, nondirected OMT.

Examinations were scheduled during the study period, with an examination scheduled 1 day before the midtest and an examination scheduled 1 day after the posttest. Self-perceived distress symptoms may have been affected by the completion of or anticipation of examinations. Participants were enrolled in an introductory OMT course during the study. During this time, their education was largely focused on OMT principles and foundation. However, exposure to basic techniques may have introduced a bias in participant survey responses.

Future studies with larger sample sizes and longer study durations are required to further investigate the effects of OMT on psychological distress in medical students. Such studies may provide clarification as to why a perceived benefit of OMT on fatigue was observed but no demonstrable changes in stress or depression were found. Increasing study duration may also allow for analysis of distress symptoms with and without impending school examinations as a potentially confounding factor. To further delineate the effects of

resting, physician touch, and therapeutic touch seen in the ND-OMT group, future studies should include a comparable resting period in the control protocol.

Previous research demonstrates that distress symptoms vary during medical education, and it is unclear whether the efficacy of OMT is dependent on baseline distress levels.⁶ The current study used a uniform treatment protocol; however, an individualized treatment protocol may provide greater efficacy in relieving distress symptoms. It is also important to evaluate whether OMT performed by student peers would have the same efficacy as OMT performed by licensed osteopathic physicians, because student-on-student treatment may be a more practical treatment option for many students.

Conclusion

The current randomized controlled pilot study demonstrated that it is feasible to assess the effect of OMT on fatigue, stress, and depression symptoms in first-year osteopathic medical students. Although limited, this study demonstrated a statistically significant decrease in fatigue symptoms in first-year osteopathic medical students who received D-OMT. No statistically significant effects were seen in students receiving ND-OMT or in those receiving no treatment. In addition, no statistically significant effects of D-OMT on self-perceived stress or depression were observed. Further studies are warranted to explore OMT as a treatment modality for medical students with self-perceived distress.

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Author Contributions

Student Doctors Wiegand and Bianchi and Dr Best provided substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; Student Doctors Wiegand and Bianchi drafted the article or revised it critically for important intellectual content; and all authors gave final approval of the version of the article to be published.

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