Pre and Post experimental study

Effect of Physical therapy and Visceral Osteopathic Manipulation in Lower Back Pain: A Comparative Study

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How to cite this article: Sharath Hullumani V, Abin Abraham Mammen, Jakka Rahul. Effect of Physical therapy and Visceral Osteopathic Manipulation in Lower Back Pain: A Comparative Study. Indian Journal of Physiotherapy and Occupational Therapy 2023;17(2).

Abstract

Background: Lower back pain the most prevalent conditions that leads to a visit to a pain specialist. Individuals with lower back pain or traumatic back / spine injury compliant triage compliance will first discuss patient presentations and patient attributes.

Methods/Deign: An comparative study was conducted in Cuttack from September 2020 to January 2022.The total sample size was 30 and we used convenient sampling in which 10 in each group were recruited. Then the patient was screened according to inclusion and exclusion criteria with which informed consent was given if the patient agrees to give the consent. Then the patient was selected by convenient sampling based on eligibility criteria. Procedure of study was explained to all the patients and written consent was taken from them. Patients with low back pain were allocated for the study. Amongst this, group1 was given conventional physical therapy, Group 2 was given osteopathy techniques and group 3 was given combined both physical therapy and osteopathy techniques for 6 days a week for 6 weeks.

Results: Significant difference($p<0.001$) were seen in group 3 in both outcome measures from 2nd week.

Conclusion: The combination of both conventional physical therapy and osteopathy manipulative techniques will help in better way in patients with lower back pain.

Key words: Low back pain, Physiotherapy, Physical therapy, Manipulation, Osteopathy, Alternative medicine.

Introduction

One of the most frequent ailments that prompts a visit to a pain specialist is lower back pain. Patients who have experienced low back pain or a severe back or spine injury will first talk about their patient presentations and patient features. According to clinical standards, there are three different types of low back pain: pain without a possible nerve root involvement, pain that may involve a nerve root, and pain brought on by trauma or other secondary causes.[1]

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Physiotherapy for low back pain:

Physical therapists assess patients with musculoskeletal conditions before administering a range of treatments, including manipulation, stretching, strengthening, and aerobic conditioning. Other methods used by physical therapists include ultrasound, transcutaneous electrical nerve stimulation, and applying ice and heat (TENS). Despite the fact that exercise therapy for LBP can be provided in a variety of formats and settings, PT is frequently recommended to patients with LBP.[2]

Physical therapists can use a variety of evidence-based clinical recommendations for the treatment of LBP. According to the American Pain Society/ American College of Physicians clinical practise recommendation, exercise treatment has a moderate effect on LBP.[3]

Significant evidence for trunk coordination, strengthening, and endurance exercises has been identified in the Low Back Pain Clinical Practice Guidelines of the American Physical Therapy Association as well as in a number of European guidelines. Systematic reviews and meta-analyses support the recommendations in these guidelines..[4-12]

Osteopathy for lower back pain:

Osteopathy is a type of manual treatment that aims to rehabilitate the musculoskeletal system through a series of interventions. The American Osteopathic Association recommends osteopathic manipulation treatment for people with low back discomfort (AOA). Licciardone found that osteopathic manipulation treatment considerably reduces low back pain in their meta-analysis. Franke et al. (2014) concluded in a recent meta-analysis that osteopathic manipulation treatment is useful for chronic low back pain and functional impairment. In contrast, the authors of two recently published systematic reviews determined that osteopathic manipulation treatment has no greater benefit in relieving low back pain than other procedures and/ or a placebo.[13-16]

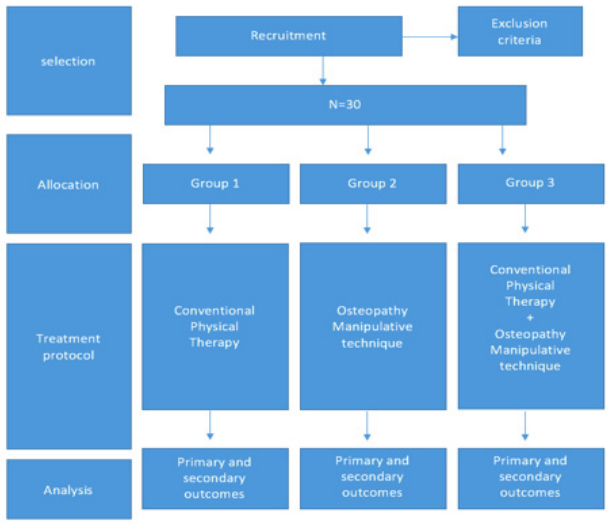
Material and Methods

An comparative study was conducted in Cuttack from September 2020 to January 202 Institutional ethics committee approve the study to conduct. The total sample size is 30 and we used convent sampling in which 10 in each group is recruited. Then the patient was screened according to inclusion and exclusion criteria with which informed consent was given if the patient agrees to give the consent. Then the patient was selected by convenient sampling based on eligibility criteria. Procedure of study was explained to all the patients and written consent was taken from them. Patients with low back pain were allocated for the study.

The *inclusion criteria* were Individuals with age 18-50 years and both male and females, No previous osteopathic treatment, history of low back pain since 6 months were included in this study, patient whose VAS is more than 5.

The *exclusion criteria* were pregnancy, menstruation, recent trauma, spinal tumours, sign of nerve involvement, weakness, bladder and bowel symptoms, unexplained thoracic pain, any neurological condition.

Study design:



Group 1treatment protocol[17]

Week 1, Week 3, Week 5	• 30 repetitions of abdominal bracing with an 8 second hold • 20 repetitions of heel slides with a 4 second hold • 20 repetitions of leg lifts with a 4 second hold • Bracing with bridging, 30 reps with an 8-second hold, then switching to one leg • 20 repetitions of a standing row workout with a 6-second hold are bracing. • 10 minutes of bracing while walking with 8-second holds and 10-second rests
Week 2, Week 4, Week 6	• Quadruped alternative arm and leg lifts with bracing, 30 repetitions with 8 s hold on each side • Side support with knees flexed, 30 repetitions with 8 s hold on each side • Side support with knees extended, 30 repetitions with 8 s hold on each side • Quadruped arm lifts with bracing, 30 repetitions with 8 s hold on each side • Quadruped leg lifts with bracing, 30 repetitions with 8 s hold on • 30 repetitions with an 8-second hold on each side of the side support with extended knees

Intensity: 45 minutes for 6 days a week for 6 weeks, pre and post same outcome measure were used

Group 2 treatment protocol[18]

Week 1, Week 3, Week 5	• Cardia manipulation for 1 minute • Pylorus manipulation for 1 minute • Oddi sphincter manipulation for 1 minute • Duodeno-jejunal valve manipulation for 1 minute • MET for lumbar vertebra, • Cranio Sacral harmonisation for 15 minutes
Week 2, Week 4, Week 6	• 1 minute of manipulation of the ileocecal valve, • 1 minute of manipulation of the sigmoid colon, and 1 minute of manipulation of the entire liver • Cranio Sacral harmonisation for 15 minutes • Global hemodynamic manipulation (10 repetitions with pressure during inspiration and another 10 during expiration) • Functional method for the lumbar vertebrae

Intensity: 45 minutes for 6 days a week for 6 week, pre and post same outcome measure were used

Group 3: combined both group 1 and group 2 exercises and it lasts for 1 hour for 6 days a week for 6 weeks, pre and post same outcome measure were used.

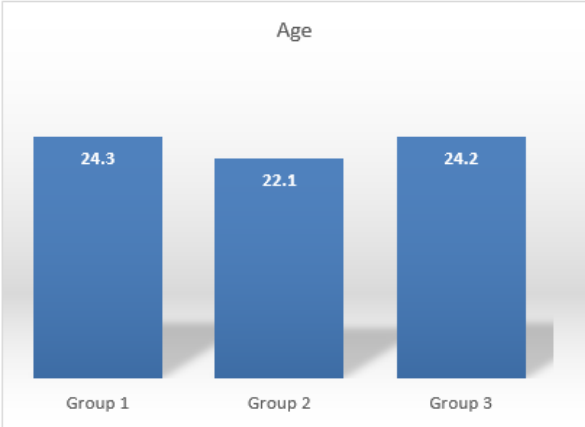
Outcome measures: VAS and Oswestry low back pain disability questionnaire, Outcomes were collected every week on the last day for six weeks.

Results

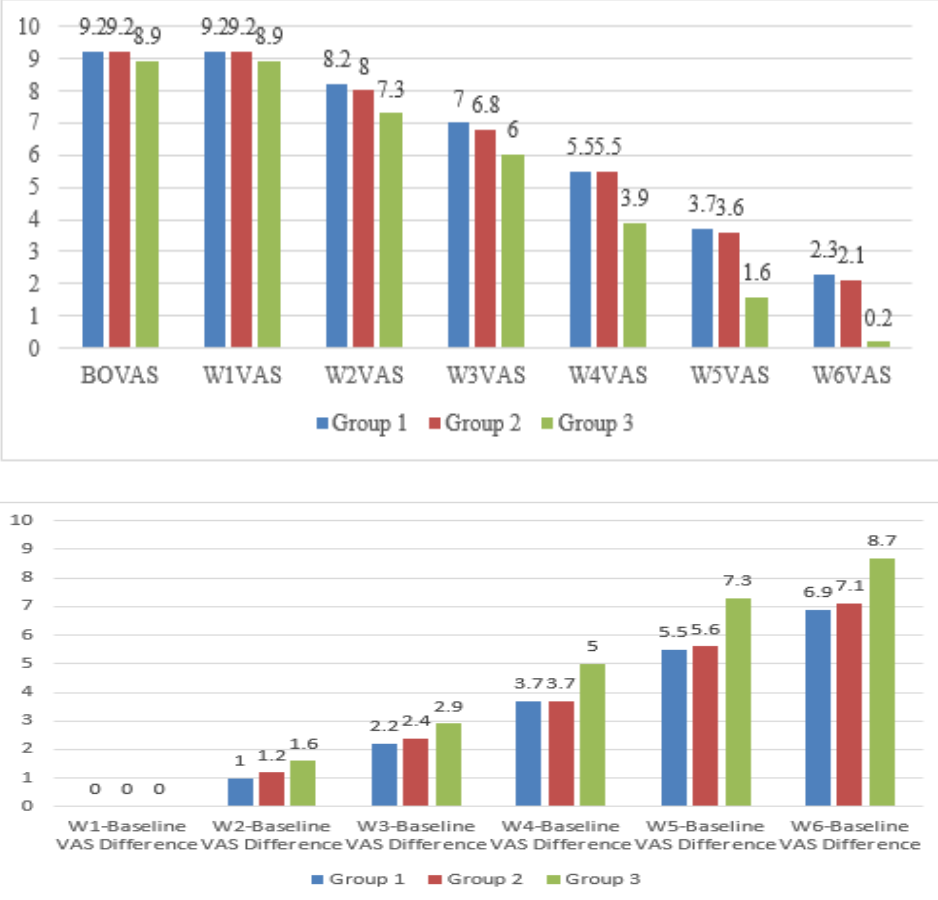
- A total of 30 participants within the age group of 18-35 both male and female were recruited for the study. All of the participants were having problem in there lower back.
- The demographic data (Age, Gender,) were analyzed using descriptive statistics.
- The Posthoc Tukey test was used comparing groups
- One way anova and posthoctukey test used for comparison of the three groups by using SPSS Software 20.0

Table 1: showing age wise distribution in all groups

	Group 1 (n=10)	Group 2 (n=10)	Group 3 (n=10)	ONE WAY ANOVA		POSTHOC TUKEY TEST		
				F value (*=welch test)	P-VALUE	Group 1 vs Group 2 difference (p value)	Group 1 vs Group 3 difference (p value)	Group 2 vs Group 3 difference (p value)
Age	24.3±5.25	22.1±2.64	24.2±2.25	1.911*	0.179	2.2 (0.379)	0.1 (0.998)	-2.1 (0.412)



Graph 1: showing age wise distribution in all groups



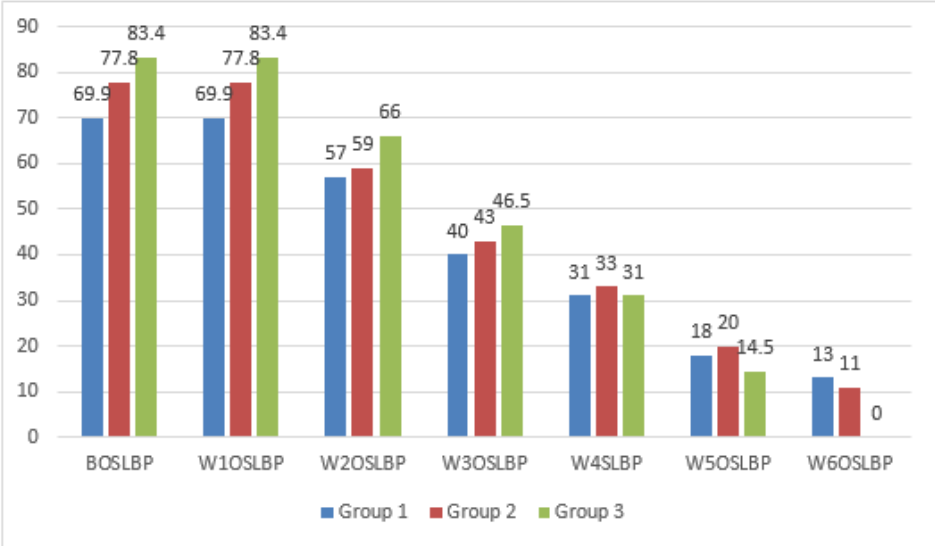
Graph 2: showing difference of VAS in all groups

Table 2: Showing VAS difference in all groups

	Group 1 (n=10)	Group 2 (n=10)	Group 3 (n=10)	ONE WAY ANOVA		POSTHOC TUKEY TEST		
				F value (*=welch test)	P VALUE	Group 1 vs Group 2 difference (p value)	Group 1 vs Group 3 difference (p value)	Group 2 vs Group 3 difference (p value)
BOVAS	9.2±0.63	9.2±0.79	8.9±0.99	0.448	0.644	0 (1)	0.3 (0.694)	0.3 (0.694)
W1VAS	9.2±0.63	9.2±0.79	8.9±0.99	0.448	0.644	0 (1)	0.3 (0.694)	0.3 (0.694)
W2VAS	8.2±0.79	8±0.82	7.3±0.95	3.061	0.063	0.2 (0.861)	0.9 (0.065)	0.7 (0.178)
W3VAS	7±0.82	6.8±0.79	6±1.05	3.5	0.045	0.2 (0.872)	1 (0.048)	0.8 (0.132)
W4VAS	5.5±0.53	5.5±0.53	3.9±1.29	11.578	<0.001	0 (1)	1.6 (0.001)	1.6 (0.001)
W5VAS	3.7±0.95	3.6±0.84	1.6±1.27	13.111	<0.001	0.1 (0.975)	2.1 (<0.001)	2 (0.001)
W6VAS	2.3±0.95	2.1±0.74	0.2±0.63	21.849	<0.001	0.2 (0.837)	2.1 (<0.001)	1.9 (<0.001)
W1-Baseline VAS Difference	0±0	0±0	0±0					
W2-Baseline VAS Difference	1±0.82	1.2±1.03	1.6±0.52	1.4	0.264	-0.2 (0.849)	-0.6 (0.245)	-0.4 (0.525)
W3-Baseline VAS Difference	2.2±0.92	2.4±0.84	2.9±0.57	2.077	0.145	-0.2 (0.84)	-0.7 (0.137)	-0.5 (0.348)
W4-Baseline VAS Difference	3.7±0.68	3.7±1.06	5±1.05	6.285	0.006	0 (1)	-1.3 (0.013)	-1.3 (0.013)
W5-Baseline VAS Difference	5.5±0.97	5.6±1.35	7.3±1.16	7.468	0.003	-0.1 (0.98)	-1.8 (0.005)	-1.7 (0.008)
W6-Baseline VAS Difference	6.9±0.99	7.1±1.37	8.7±1.16	6.934	0.004	-0.2 (0.925)	-1.8 (0.006)	-1.6 (0.015)

Table 3: Showing VAS difference in all groups

	Group 1 (n=10)	Group 2 (n=10)	Group 3 (n=10)	ONE WAY ANOVA		POSTHOC TUKEY TEST		
				F value (*=welch test)	P VALUE	Group 1 vs Group 2 difference (p value)	Group 1 vs Group 3 difference (p value)	Group 2 vs Group 3 difference (p value)
BOSLBP	69.9±9.71	77.8±12.46	83.4±8.13	4.372	0.023	-7.9 (0.215)	-13.5 (0.018)	-5.6 (0.452)
W1OSLBP	69.9±9.71	77.8±12.46	83.4±8.13	4.372	0.023	-7.9 (0.215)	-13.5 (0.018)	-5.6 (0.452)
W2OSLBP	57±11.6	59±14.49	66±10.75	1.457	0.251	-2 (0.931)	-9 (0.253)	-7 (0.427)
W3OSLBP	40±0	43±6.75	46.5±7.47	3.132	0.06	-3 (0.49)	-6.5 (0.048)	-3.5 (0.383)
W4SLBP	31±7.38	33±7.15	31±7.38	0.25	0.781	-2 (0.815)	0 (1)	2 (0.815)
W5OSLBP	18±4.22	20±8.16	14.5±8.96	1.411	0.261	-2 (0.819)	3.5 (0.549)	5.5 (0.239)
W6OSLBP	13±4.83	11±5.68	0±0	26.46	<0.001	2 (0.559)	13 (<0.001)	11 (<0.001)



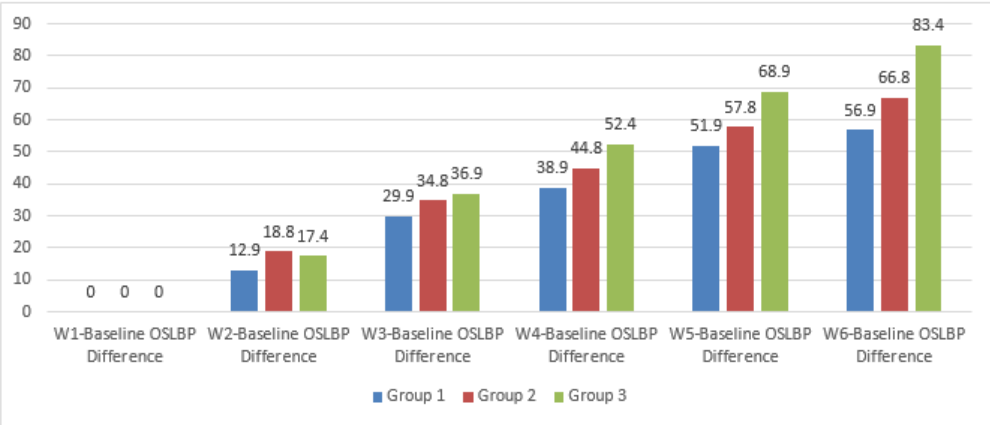
When the BOSLBP values of the three groups are compared, Group 3 has the highest value (83.4), while Group 1 has the lowest value (69.9). With a test value of 4.372 and a p value of 0.023, this difference is statistically significant. With a p value of 0.215, posthoc Tukey tests comparing Group 1 and Group 2 groups show a mean difference of -7.9 and are NOT statistically significant. The mean difference between Group 1 and Group 3 groups is -13.5, and the difference is statistically significant with a p value of 0.018. With a p value of 0.452, the comparison of Group 2 and Group 3 groups reveals a mean difference of -5.6 that is NOT statistically significant.

When W1OSLBP is compared amongst the three groups, Group 3 has the highest value (83.4), while Group 1 has the lowest value (69.9). Posthoc Tukey tests comparing Group 1 and Group 2 groups indicate a mean difference of -7.9 and are NOT statistically significant with a p value of 0.215. This difference is statistically Significant with a test value of 4.372 and p value of 0.023. The mean difference between Group 1 and Group 3 groups is -13.5, and the difference is statistically significant with a p value of 0.018. With a p value of 0.452, the comparison of Group 2 and Group 3 groups reveals a mean difference of -5.6 that is NOT statistically significant.

When the three groups are compared using W6OSLBP, Group 1 has the greatest value, 13, and Group 3 has the lowest value, 0. With a test value of 26.46 and a p value of 0.001, this difference is statistically significant. With a p value of 0.559, posthoc Tukey tests comparing Group 1 and Group 2 groups show a mean difference of 2 but are NOT statistically significant. With a p value of 0.001, the comparison between Group 1 and Group 3 groups reveals a mean difference of 13 and is statistically significant. A mean difference of 11 is seen between Groups 2 and 3, which is statistically significant with a p value of 0.001.

	Group 1 (n=10)	**Group 2 (n=10)**	**Group 3 (n=10)**	**ONE WAY ANOVA**		**POSTHOC TUKEY TEST**		
				F value (*=welch test)	**P VALUE**	**Group 1 vs Group 2 difference (p value)**	**Group 1 vs Group 3 difference (p value)**	**Group 2 vs Group 3 difference (p value)**
W1-Baseline OSLBP Difference	0±0	0±0	0±0					

	Group 1 (n=10)	Group 2 (n=10)	Group 3 (n=10)	ONE WAY ANOVA		POSTHOC TUKEY TEST		
				F value (*=welch test)	P VALUE	Group 1 vs Group 2 difference (p value)	Group 1 vs Group 3 difference (p value)	Group 2 vs Group 3 difference (p value)
W2-Baseline OSLBP Difference	12.9±4.28	18.8±11.6	17.4±4.74	1.625	0.216	-5.9 (0.214)	-4.5 (0.399)	1.4 (0.912)
W3-Baseline OSLBP Difference	29.9±9.71	34.8±10.41	36.9±7.37	1.506	0.24	-4.9 (0.473)	-7 (0.227)	-2.1 (0.868)
W4-Baseline OSLBP Difference	38.9±14.05	44.8±10.83	52.4±8.51	3.549	0.043	-5.9 (0.486)	-13.5 (0.034)	-7.6 (0.309)
W5-Baseline OSLBP Difference	51.9±10.61	57.8±10.74	68.9±6.85	8.133	0.002	-5.9 (0.366)	-17 (0.001)	-11.1 (0.039)
W6-Baseline OSLBP Difference	56.9±13.55	66.8±9.68	83.4±8.13	15.66	<0.001	-9.9 (0.115)	-26.5 (<0.001)	-16.6 (0.005)



W2-Baseline OSLBP comparison When comparing the three groups, it can be seen that Group 2 has the biggest difference, 18.8, and Group 1 has the lowest difference, 12.9. With a test value of 1.625 and a p value of 0.216, this difference is statistically insignificant. With a p value of 0.214, posthoc Tukey tests comparing Group 1 and Group 2 groups show a mean difference of -5.9 but are NOT statistically significant. With a p value of 0.399, the comparison between Group 1 and Group 3 groups reveals a mean difference of -4.5 and is NOT statistically significant. With a p value of 0.912, the comparison between Group 2 and Group 3 groups reveals a mean difference of 1.4 and is NOT statistically significant.

W6-Baseline OSLBP Comparison When comparing the three groups, it can be seen that Group 3 has the highest score (83.4), while Group 1 has the lowest value (56.9). With a test value of 15.663 and a p value of 0.001, this difference is statistically significant. With a p value of 0.115, posthoc Tukey tests comparing Group 1 and Group 2 groups show a mean difference of -9.9 and are NOT statistically significant. With a p value of 0.001, the comparison between Group 1 and Group 3 groups reveals a mean difference of -26.5 and is statistically significant. A mean difference of -16.6 is seen between Group 2 and Group 3 groups, which is statistically significant with a p value of 0.005.

Discussion

The study's goal, as previously mentioned, is to evaluate the effectiveness of traditional physical therapy and osteopathic approaches in treating patients with low back pain and to look into the neurophysiological mechanisms underlying visceral manipulation. Very little information we got will doing literature review on osteopathy and physiotherapy in lower back pain

It is hypothesised that the visceral techniques used in ostepathy treatments will affect the relevant segment somato-viscerally in addition to peripheral, spinal, and central nociceptor stimulation, or neurophysiological consequences. According to studies, visceral procedures can make healthy individuals more sensitive to pain. There have been no studies on the use of visceral operations on people with lower back pain, other from the study protocol that called for its use to 30 patients. Our study, which demonstrated that during the sixth week of therapy, the visceral methods applied had an impact on all quality-of-life measures as well as a reduction in pain, revealed the benefits of visceral applications on function and quality of life.

In order to assess the impact of six weeks of traditional physical therapy and osteopathy procedures on persons with idiopathic low back pain, a pre- and post-test experimental inquiry was carried out. This paper provides a detailed summary of that investigation. It will also enable us to investigate potential neurophysiologic and biomechanical contributors to the therapeutic advantages of visceral osteopathy.

We discovered that the severity of pain decreased after therapy when we examined the pain data from our study. We think that our treatment, which is supported by the visceral technique method, inhibits pain by reducing muscle spasms and sympathetic system activation. The investigations have not extensively delved into the mechanism of pain reduction with manual treatment approaches at the spinal and supraspinal levels. It was stated that osteopathic manual therapy was a breakthrough in manual treatment methods when paired with a range of other treatments. Due to biomechanical strain on the corticospinal system, patients with idiopathic low back pain experience somatic function and pain that is controlled by the 1a reflex route in different segments.

The study found that the stimulation of internal organs caused the muscles between the thoracic vertebrae and the lumbosacral joint to contract. As a result, the extra stimulation brought on by visceral applications in our study may have improved while also reducing spasticity in the pertinent segment and regulating peripheral and central pathways through the visceral somatic reflex arc.

In our study, we found that the vOMT group had a higher effect on energy, physical limitations, and the overall score of physical limitations from quality-of-life ratings than the PRE TEST group, in addition to boosting POST TEST results. We believe that the techniques we used for each patient during visceral treatments improved blood flow, facilitated body fluid discharge, and improved the person's feeling of well-being.

After doing our study, we found that treating patients with lower back pain with visceral osteopathy and traditional physical therapy reduced pain, enhanced function, and enhanced quality of life. These therapeutic methods' great effects on quality of life have demonstrated the potential benefits of visceral applications. The objective of the study is to improve and disseminate these findings by using them on a larger population over a longer period of time.

Ethical clearance given by Sri Sri UNIVERSITY Ethical commitee dated 06-06-2021 with reference number FHW/MOS/2020-22/004

Conflict of interest: None

Funding: None

References

1. YR K, Hullumani V S, Rahul J, S N. Survey on low back pain adherence and importance of physical therapy. International Journal of Physical Education, Sports and Health. 2021;8(2):173-178
2. Nguyen C, Boutron I, Zegarra-Parodi R, Baron G, Alami S, Sanchez K et al. Effect of Osteopathic Manipulative Treatment vs Sham Treatment on Activity Limitations in Patients With Nonspecific Subacute and Chronic Low Back Pain. JAMA Internal Medicine. 2021;181(5):620.

3. Tamer S, Öz M, Ülger Ö. The effect of visceral osteopathic manual therapy applications on pain, quality of life and function in patients with chronic nonspecific low back pain. Journal of Back and Musculoskeletal Rehabilitation. 2017;30(3):419-425.
4. Patel, V. B., Wasserman, R., & Imani, F. (2015). Interventional Therapies for Chronic Low Back Pain: A Focused Review (Efficacy and Outcomes). *Anesthesiology and pain medicine*, *5*(4), e29716.
5. Anar S. Ö. (2016). The effectiveness of home-based exercise programs for low back pain patients. *Journal of physical therapy science*, *28*(10), 2727–2730.
6. Basler, H. D., Bertalanffy, H., Quint, S., Wilke, A., & Wolf, U. (2007). TTM-based counselling in physiotherapy does not contribute to an increase of adherence to activity recommendations in older adults with chronic low back pain--a randomised controlled trial. *European journal of pain (London, England)*, *11*(1), 31–37.
7. Cypress B. K. (1983). Characteristics of physician visits for back symptoms: a national perspective. *American journal of public health*, *73*(4), 389–395.
8. Licciardone, J. C., & Herron, K. M. (2001). Characteristics, satisfaction, and perceptions of patients receiving ambulatory healthcare from osteopathic physicians: a comparative national survey. *The Journal of the American Osteopathic Association*, *101*(7), 374–385.
9. Licciardone J. C. (2003). Awareness and use of osteopathic physicians in the United States: results of the Second Osteopathic Survey of Health Care in America (OSTEOSURV-II). *The Journal of the American Osteopathic Association*, *103*(6), 281–289.
10. Howell J. D. (1999). The paradox of osteopathy. *The New England journal of medicine*, *341*(19), 1465–1468.
11. Edwards, J., Hayden, J., Asbridge, M., & Magee, K. (2018). The prevalence of low back pain in the emergency department: a descriptive study set in the Charles V. Keating Emergency and Trauma Centre, Halifax, Nova Scotia, Canada. *BMC musculoskeletal disorders*, *19*(1), 306.
12. Schneider, M. J., Brach, J., Irrgang, J. J., Abbott, K. V., Wisniewski, S. R., &Delitto, A. (2010). Mechanical vs manual manipulation for low back pain: an observational cohort study. *Journal of manipulative and physiological therapeutics*, *33*(3), 193–200.
13. Licciardone, J. C., &Aryal, S. (2014). Clinical response and relapse in patients with chronic low back pain following osteopathic manual treatment: results from the OSTEOPATHIC Trial. *Manual therapy*, *19*(6), 541–548.
14. Ernst, E., & Canter, P. H. (2006). A systematic review of systematic reviews of spinal manipulation. *Journal of the Royal Society of Medicine*, *99*(4), 192–196.
15. Panagopoulos, J., Hancock, M. J., Ferreira, P., Hush, J., &Petocz, P. (2015). Does the addition of visceral manipulation alter outcomes for patients with low back pain? A randomized placebo controlled trial. *European journal of pain (London, England)*, *19*(7), 899–907.
16. Herzog W. (2010). The biomechanics of spinal manipulation. *Journal of bodywork and movement therapies*, *14*(3), 280–286.
17. Saper R, Sherman K, Delitto A, Herman P, Stevans J, Paris R Et al. Yoga vs. physical therapy vs. education for chronic low back pain in predominantly minority populations: study protocol for a randomized controlled trial. Trials. 2014;15(1).
18. Villalta Santos L, Lisboa Córdoba L, Benite Palma Lopes J, Santos Oliveira C, André CollangeGrecco L, Bovi Nunes Andrade A et al. Active Visceral Manipulation Associated With Conventional Physiotherapy in People With Chronic Low Back Pain and Visceral Dysfunction: A Preliminary, Randomized, Controlled, Double-Blind Clinical Trial. Journal of Chiropractic Medicine. 2019;18(2):79-89.
19. Beliveau, P., Wong, J. J., Sutton, D. A., Simon, N. B., Bussières, A. E., Mior, S. A., & French, S. D. (2017). The chiropractic profession: a scoping review of utilization rates, reasons for seeking care, patient profiles, and care provided. *Chiropractic & manual therapies*, *25*, 35.
20. Cerritelli F, Chiacchiaretta P, Gambi F, et al.. Effect of manual approaches with osteopathic modality on brain correlates of interoception: an fMRI study. *Sci Rep*. 2020;10(1):3214.
21. Licciardone JC, Minotti DE, Gatchel RJ, Kearns CM, Singh KP. Osteopathic manual treatment and ultrasound therapy for chronic low back pain: a randomized controlled trial. *Ann Fam Med*. 2013;11(2):122-129.
22. Ostelo RW, Deyo RA, Stratford P, et al. Interpreting change scores for pain and functional status in low back pain: towards international consensus regarding minimal important change. *Spine (Phila Pa 1976)*. 2008;33(1):90-94.
23. Yvanes-Thomas M, Calmels P, Béthoux F, et al.. Validity of the French-language version of the Quebec back pain disability scale in low back pain patients in France. *Joint Bone Spine*. 2002;69(4):397-405.
24. Boutron I, Altman DG, Moher D, Schulz KF, Ravaud P; CONSORT NPT Group. CONSORT statement for randomized trials of nonpharmacologic treatments: a 2017 update and a CONSORT extension for nonpharmacologic trial abstracts. *Ann Intern Med*. 2017;167(1):40-47.
25. Noll DR, Degenhardt BF, Fossum C, Hensel K. Clinical and research protocol for osteopathic manipulative treatment of elderly patients with pneumonia. *J Am Osteopath Assoc*. 2008;108(9):508-516.