ISSN: 3066-9812
Research Article

Journal of Clinical Epidemiology and Public Health

Effectiveness of Chiropractic Adjustment for Discogenic Cervical Pain: A Randomized Controlled Trial

Rasel Ahmed[1], Faruq Ahmed[2*], Aufika Nusrat[1], Moeidu Bhuian Priti[1], Mohammad Marazul Islam[1], Lila Biswas[3], Md Nuruzzaman[1], Md Abdul Alim[1], & Sabuj Sarker[1]

[1]Department of Physiotherapy, Saic College of Medical Science & Technology (SCMST), Mirpur, Dhaka-1216, Bangladesh
[2]Department of Physiotherapy, Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka-1343, Bangladesh
[3]CRP Nursing College (CRP-NC), Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka-1343, Bangladesh

[*]Corresponding author: Faruq Ahmed, Department of Physiotherapy, Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka-1343, Bangladesh. Email: physiofaruq2020@gmail.com.

Submitted: 16 September 2024 **Accepted:** 23 September 2024 **Published:** 30 September 2024

https://doi.org/10.63620/MKJCEPH.2024.1021

Citation: *Ahmed, F., Ahmed, R., Nusrat, A., Priti, M. B., Islam, M. M., Biswas, L., Nuruzzaman, M., Alim, M. A., & Sarker, S. (2024). Effectiveness of chiropractic adjustment for discogenic cervical pain: A randomized controlled trial. J of Clini Epi & Public Health, 2(3), 01-07.*

Abstract

Background: *Intervertebral disc issues cause of cervical discogenic pain and diverse severe neck pain. Chiropractic adjustment techniques are beneficial, especially in spine-related conditions.*

Objectives: *The trail aimed to assess the effectiveness of chiropractic adjustment to reduce pain and disability status for the patients with cervical discogenic pain.*

Methods: *The randomized clinical trial was conducted from July 2022 to June 2023. A total of 28 individuals with discogenic neck pain were allocated randomly to an experimental and a control group. The trial group provided chiropractic spinal manipulation along with conventional physiotherapy. The control group got just conventional physiotherapy.*

The total duration of the trial regimen was two weeks, four sessions per week, entirely eight sessions. The numeric pain rating scale (NPRS) was used to confine the individual pain level, and the neck disability index (NDI) was used to measure neck function and disability.

Results: *The mean age ± SD of the control and the experimental groups were 42.07 ± 8.43 and 42.29 ± 11.35, respectively. A significant improvement of pain in different positions and disabilities was demonstrated in within-group analysis by paired t-test, whereas no significant improvement was found in between-group analysis by independent sample t-test. Chiropractic intervention has significant ($p = 0.040$) effects on reduction of disability score for the patients with discogenic cervical pain.*

Conclusion: *The study found significant change in pain and disability status after eight sessions of chiropractic manipulation. The findings of the study indicated that manipulative adjustment could be an effective therapeutic approach for subjects with discogenic neck pain.*

Keywords: Chiropractic Adjustment, Discogenic Cervical Pain, Neck Pain, Physical Therapy

Introduction

Neck pain is a major public health concern globally. The cervical intervertebral discs are major causes of neck pain [1]. Cervical discogenic pain is a variety of severe neck discomfort caused by degeneration of the intervertebral discs [2]. Neck pain can develop as a result of acute injury, typically after a car accident, whiplash injury, faulty biomechanics, or it can develop gradually over time, as it does in office workers [3]. The lower cervical

joints are where cartilaginous displacements occur most commonly. Nucleus pulposus development is rare in older age but is possible in young adulthood [4].

Cervical radicular pain is one of the many manifestations of neck and upper extremity pain, and it frequently necessitates interventional procedures [5]. Chronic pain in the head, neck, shoulder, and upper limbs, as well as discomfort that is accompanied by numbness, are all symptoms of cervical discogenic pain (CDP).

Patients' quality of life and physical and mental health are significantly impacted by long-term chronic pain. Clinical research has shown that long-term chronic pain sufferers have impaired sensory, motor, cognitive, memory, and affective processing in their brains [6].

Approximately 10% of adults in the general population experience neck pain at some point in life. It is estimated that between 50 and 70 percent of people will experience neck discomfort and that as many as 60% of patients still experience chronic pain up to five years after their symptoms first appeared. In the United States, neck pain causes major economic effects due to increased visits to healthcare providers, days off from work, and productivity loss [7].

With a lifetime prevalence of 26-71% and an annual frequency of 30-50%, neck pain is the second most prevalent musculoskeletal problem worldwide nowadays, after just low back pain [8].

According to Pakistani data, 62% of goldsmiths in Lahore have neck pain. Also, 51.8% of DPT students are already in Lahore, 78.57% of sewing machine operators are already in Sahiwal, and 72% of computer users are already in Lahore. Indian office workers in Uttar Pradesh and New Delhi top-notch hospitals report a 99.2% and 43.3% prevalence of neck discomfort, respectively. In Saudi Arabia, 11.3% of educators claimed they experienced neck pain [4].

Chiropractic practice involves curing neck pain at regular intervals. Healthcare providers of chiropractic (DCs) frequently use spinal adjustment, mobilization, device-assisted spinal manipulation, education about modifiable lifestyle factors, exercise modalities, heat/ice, massage, soft tissue therapies like trigger point therapy, as well as strengthening and flexibility exercises when treating patients with neck discomfort [9].

Mechanical-postural alterations are the main causes of cervical pain. Chiropractic treatment serves as one of the multiple therapeutic modalities employed by physiotherapists in Brazil [10]. Chiropractic spinal manipulation is a form of medical care that focuses on treating disorders of the neuro-musculoskeletal structure, particularly those that affect the spine [11]. Typically, a spinal adjustment consists of the application of a high-velocity, low-amplitude controlled thrust force to a spinal segment [12].

There is a lack of evidence and investigation to find out the effectiveness of chiropractic adjustments for discogenic cervical pain in physiotherapy treatment. This trial will be helpful for the physiotherapy profession, and future researchers will get a good idea and guidance about this case. So, it will be helpful for delivering treatment to discogenic cervical pain patients. The trial aimed to determine the effectiveness of chiropractic adjustments to reduce pain and disability status for the patients with cervical discogenic pain.

Methods

Design and Ethics

The randomized controlled trial was carried out between the beginning of July 2022 and the end of June 2023. Before participating, patients got complete information about the research aims and protocol and provided signed informed consent. Administrative entities of the Saic ethics committee and the Ethical Review Board (ERB) authorized the project. The registration number is SCMST/PT/ERB-2017-18/1-2023/44.

Population

Community participants who came to seek physiotherapy rehabilitation for their discogenic neck pain were recruited. Data was collected from the outpatient, musculoskeletal unit of the physiotherapy department at Saic Physiotherapy and Rehabilitation Service, Pain-Paralysis Specialized and General Hospital, Unique Pain and Paralysis Center, and Academy of Physiotherapy Pain and Rehabilitation Center.

Patient eligibility criteria were: age between 25 and 60 years, both genders, and being diagnosed with discogenic neck pain by MRI (magnetic resonance imaging). Subjects were excluded if they had any pathological issues in the cervical region, mental illness, a red flag of neck pain, or had a previous neck surgery.

Randomization

Participants were randomly allocated to experimental or control groups through computerized random allocation. Patients who matched and were satisfied with the inclusion criteria were randomly recruited from the outpatient musculoskeletal unit of the physiotherapy department of four rehabilitation centres. After sampling, the researcher randomly allocated individuals to trial and control groups to increase the internal validity of the thesis. Figure 1 depicts the research design and group distribution.

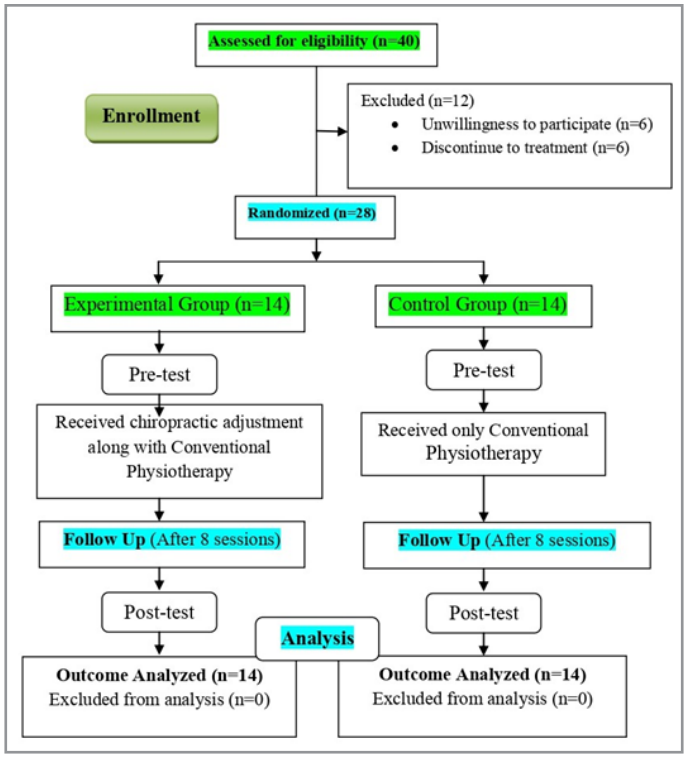

Figure 1: Flowchart of participants and group allocation

Outcome Measurements

A questionnaire was designed taking into account the characteristics and objectives of the current study. There were both closed-ended and open-ended questions on the survey. The questionnaire contains three sections. The first part contained questions on socio-demographic information (a structural questionnaire was used for socio-demographic indication). The numeric pain rating scale (NPRS) was applied in the second part to identify the level of pain. Patients were asked to specify the current intensity of pain using an 11-point scale that range from 0 to 10, whereas 0 indicates no pain and 10 indicates the worst pain ever [13].

The neck function and disability status were assessed using the Neck Disability Index (NDI) scale, which was included in the third section [14]. It is a reliable, valid, and responsive measure of self-reported impairment for neck pain patients [15].

Subscales included symptoms, pain intensity, personal care, lifting, reading, headaches, attention, work, driving, sleeping, and leisure. The capacity to handle daily life was normalized at each point to establish how neck discomfort has impacted it: 30-48% is mild, 50-68% is severe, and 72% or more is total.

Physical Intervention

Patients in the experimental group got chiropractic adjustments along with usual physiotherapy interventions from trained and qualified physiotherapists. In the control group, participants were given only the usual physiotherapy treatment. The total duration of the trial regimen was two weeks, four sessions per week, and the duration of each session of treatment was 40-45 minutes.

The trial group received one thrust movement per segment on every session as chiropractic adjustment along with usual physiotherapy intervention (Mckenzie approach, soft tissue release, ice compression, postural education).

Following a regimen of 4 sessions each week for a duration of 2 weeks, the cumulative number of sessions amounted to 8. Subsequently, the assessor collected data from the patients once more as a post-test. Following the conclusion of the research, the same assessor, who was unaware of the details, repeated the outcome measures. We advised patients not to reveal their training program.

Data Analysis

The statistical analysis was conducted by the statistical program for social science (SPSS) version 22. Paired and independent t-tests were used to evaluate pain and NDI within and between groups. Two-sided 95% confidence intervals were generated. A significant finding was defined as a p-value < 0.05.

Results

In this randomized controlled trial, 28 patients agreed to participate and finally completed the trial. Data were collected through face-to-face interviews with participants using the NPRS and NDI questionnaires for pain and disability measurement. This study has shown that chiropractic adjustment along with conventional treatment relieved pain and decreased impairment in patients with discogenic neck pain.

The initial clinical features of the research participants are displayed in Table 1. Baseline characteristics were similar across groups. All individuals tolerated the intervention well, as it was

safe from implications. The mean age ± SD of the control and experimental groups were 42.07 ± 8.43 and 42.29 ±11.35, respectively. In the control group, the majority of the participants (35.70%) were older than 51 years.

In the experimental group, the majority of the participants (42.9%) were from the age range between 31 and 40 years. The study revealed that the duration of pain of the participant was more than a year for 64.30% and 85.70% in control and experimental group respectively. The study showed that the causes of pain in both the control and the experimental groups were quite similar. The mean ± SD of the pain intensity paired sample test were 4.357±1.823 and 4.714±0.597 for the control and experimental groups.

The mean ± SD of the NDI paired sample test were 13.789±6.216 and 14.357±8.635 for control and experimental groups.

Table 1: Socio-demographic characteristics of the participants

Variable	Control group n (%)	Experimental group n (%)
Mean age ± SD	42.07 ± 8.43	42.29 ± 11.35
Age		
< 31 years	1 (7.10%)	3 (21.40%)
31-40 years	6 (42.90%)	3 (21.40%)
41-50 years	4 (28.60%)	3 (21.40%)
> 51 years	3 (21.40%)	5 (35.70%)
Gender		
Male	7 (50%)	9 (64.30%)
Female	7 (50%)	5 (35.70%)
Marital status		
Married	13 (92.90%)	11 (78.60%)
Unmarried	1 (7.10%)	3 (21.40%)
Living area		
Urban	10 (71.40%)	13 (92.90%)
Semi-urban	1 (7.10%)	0 (0%)
Rural	3 (21.40%)	1 (7.10%)
Duration of pain		
More than a year	9 (64.30%)	12 (85.70%)
Months	3 (21.40%)	2 (14.30%)
Weeks	2 (14.30%)	0 (0%)
Causes of pain		
Long time seating	5 (35.70%)	4 (28.60%)
Long time lying	1 (7.10%)	4 (28.60%)
Long time work	3 (21.40%)	3 (21.40%)
Others	5 (35.70%)	3 (21.40%)
Pain intensity paired sample test		
Mean ± SD	4.357 ± 1.823	4.714 ± 0.597
NDI paired sample test		
Mean ± SD	13.789 ± 6.216	14.357 ± 8.635

In the control group, the NPRS pre-test and post-test mean was 6.79 and 2.43, respectively. There was a mean difference comparing the pre- and post-tests of 4.36. On the period of pre-test, the patient feels mild pain 1 (7.10%), moderate pain 5 (35.70%), and severe pain 8 (57.10%), whereas the standard deviation was 2.12. On the period of post-test, the patient feels mild pain 12 (85.70%) and moderate pain 2 (14.30%), whereas the standard deviation was 1.016. In the experimental group, the NPRS pre-test and post-test mean was 6.07 and 1.36, respectively.

In this case, the researcher observed the mean difference between the pre- and post-test was 4.71. On the period of pre-test, the patient feels mild pain 2 (14.30%), moderate pain 6 (42.90%), and severe pain 6 (42.90%), whereas the standard deviation was 2.165. On the period of post-test, the patient feels mild pain 13 (92.90%) and moderate pain 1 (7.10%), whereas the standard deviation was 1.216 (table 2).

Table 2: Pain intensity according to NPRS of the participants

	Pre-test values		post-test values	
Severity of pain	Control group n (%)	Trial group n (%)	Control group n (%)	Trial group n (%)
Mild pain	1 (7.10%)	2 (14.30%)	12 (85.70%)	13 (92.90%)
Moderate pain	5 (35.70%)	6 (42.90%)	2 (14.30%)	1 (7.10%)
Severe pain	8 (57.10%)	6 (42.90%)	0 (0%)	0 (0%)
Mean ± SD	6.79 ± 2.11	6.07 ± 2.16	2.43 ± 1.01	1.36 ±1.22

An independent sample-t test has been determined to measure the differences of pre-test NPRS between control and experimental groups and also measure the differences of post-test NPRS between control and experimental groups. There are no significant differences found on pre-test and post-test NPRS because the level of significant is (<0.05).

A paired sample t test has been determined to measure the changes in NPRS between pre-test and post-test of NPRS, followed by usual intervention in the control group. In experimental group t-value 7.897, df 13, p = 0.001, and control group t-value 8.942, df 13, p = 0.001 that means the null hypothesis has been accepted and alternative hypothesis has been rejected. Chiropractic intervention has no significant effect on pain for the patients with discogenic cervical pain (table 3).

Table 3: Independent and paired sample t-test Numeric Pain rating Scale between two groups and within group

Test	Variables	t	df	95% CI		Sig value (p)
				Lower	Upper	
Independent sample t-test on pre-test	NPRS between groups	0.882	26	-0.950	2.378	0.386
Independent sample t-test on post-test	NPRS between groups	2.530	26	0.201	1.942	0.018
Paired sample t-test in control group	NPRS within groups	8.942	13	3.304	5.410	0.001
Paired sample t-test in trial group	NPRS within groups	7.897	13	3.425	6.004	0.001

(* p<.05 level of significance)

An independent sample-t test has been determined to measure the differences of pre-test NDI between control and experimental groups and also measure the differences of post-test NDI between control and experimental groups.

The test has found no significant effects on the result according to a statistical test revealing a change between the pre-test of the control and experimental group and between the post-test of the control and experimental group in the NDI score. That means the alternative hypothesis has been accepted and the null hypothesis has been rejected. Chiropractic intervention has significant (p = 0.040) effects on disability remission for the discogenic cervical pain patient treated by chiropractic adjustment.

A paired sample t-test has been determined to measure the changes in the NDI score between the pre-and post-test of NDI, followed by chiropractic adjustment in the experimental group. In experimental group t-value 6.221, p = 0.001 and control group t-value 8.298, p = 0.001, that means the null hypothesis has been accepted and alternative hypothesis accepted. Chiropractic intervention has no significant effects on reduction of disability score for the patients with discogenic cervical pain (table 4).

Table 4: Independent and paired sample t-test Neck Disability Index (NDI) between two groups and within groups

Test	Variables	t	df	95% CI		Sig value (p)
				Lower	Upper	
Independent sample t-test on pre-test	NDI between groups	0.759	26	-5.494	11.922	0.455
Independent sample t-test on post-test	NDI between groups	2.005	26	-.095	7.666	0.040
Paired sample t-test in control group	NDI within groups	8.298	13	10.197	17.375	0.001
Paired sample t-test in trial group	NDI within groups	6.221	13	9.372	19.343	0.001

(* p<.05 level of significance)

Discussion

This study examined how chiropractic adjustments can reduce pain and disability status for the patients with discogenic cervical pain. The result of the study revealed that pain and disability status significantly improved in both groups, while between-group analysis showed no significant changes. Despite this, all of the participants' initial characteristics were the same in the experimental and control groups.

The mean age ± SD of the control and experimental groups were 42.07 ± 8.43 and 42.29 ±11.35, respectively. In the control group, the majority of the participants (35.70%) were older than 51 years. In the experimental group, the majority of the participants (42.9%) were from the age range between 31 and 40 years. In a related study, the researcher found that the mean age ± SD was 40.21 ± 4.91 [16].

In this study, the experimental group had 64.30% male and 35.70% female, where the control group gender had equally. Genebra et al. conducted a study with 100 males and 100 females in their research equally [17]. In this study, the participant's living area in the control group was 71.40% and the experimental group was 92.90%.

In this research, the experimental group mean pre-test overall NPRS was 6.07±2.165 and control group mean pre-test overall pain was 6.77±2.119. An independent sample-t test has been determined to measure the differences of pre-test numeric pain rating scale between the control and experimental groups. There are no significant differences found on the pre-test numeric pain rating scale because the level of significance is (<0.05).

An independent sample-t test has been determined to measure the differences of pre-test NPRS between the control and experimental groups and also measure the differences of post-test NPRS between the control and experimental groups. There are no significant differences found on the pre-test and post-test NPRS because the level of significance is (<0.05). In a paired sample t test, the null hypothesis has been accepted and the alternative hypothesis has been rejected. The chiropractic intervention has no significant effect on pain for the patients with discogenic cervical pain.

Murphy et al. said that given that the Neck Disability Index (NDI) is the most commonly used outcome measure of self-rated disability due to non-specific mechanical neck pain, use in a specific cause of neck pain should be evaluated. The NPRS is a reliable and valid measurement tool for measuring pain intensity in patients with mechanical neck pain [13, 18].

The investigation showed significant improvement in pain relief at subsequent follow-ups of the study [13]. This finding suggests that manipulative adjustment is effective in pain relieving for patients with chronic mechanical neck pain, and the influence can last for 3 months [19].

An independent sample-t test has found no significant effects on the result according to a statistical test revealing a change between the pre-test of the control and experimental groups and between the post-test of the control and experimental groups in the NDI score. Chiropractic intervention has no significant effects on disability remission for the discogenic cervical pain patient treated by chiropractic adjustment. In a paired sample t-test, chiropractic intervention has significant ($p = 0.040$) effects on reduction of disability score for the patients with discogenic cervical pain.

A study conducted by Pennings et al. found that the NDI mean ± SD was 17.321 ± 2.543 in their research. Strong correlations were found between NDI and pain interference, pain intensity, social roles, physical function, sleep disturbance, fatigue, and anxiety. Only one study reported on the test-retest reliability of the NDI in neck and arm pain patients [20, 21].

Several studies provided data on the responsiveness of the NDI in neck and arm pain patients. Two studies reported minimum clinically important differences of 7.5 and 7 NDI points, respectively [22, 23]. One study reported that 20% improvement is a reasonable criterion of clinical success.

The findings of the study indicated that manipulative adjustment with conventional physiotherapy could be an effective therapeutic approach for subjects with discogenic neck pain to reduce pain and disability status. So, further study is needed to improve evidence-based clinical practice as well as knowledge and skill.

Limitations

The limited number of sample sizes and shortened duration of the study - these limitations should be noted. The measurement technique has another drawback. The sample was collected from a few hospitals, which doesn't represent the generality of the findings. It is another limitation of the study.

Conclusion

Chiropractic adjustment is a newly developed treatment approach where the therapist can give manipulation to a specific disc. The findings of the study demonstrated that chiropractic adjustment, along with usual physiotherapy intervention, had a significant effect on pain and disability after eight sessions of treatment for patients with discogenic cervical pain. Considering the assessment, the pain in different positions reduced in both groups compared to the initial assessment.

The significant changes were found within-group comparisons on the NPRS and NDI scale. Further study is needed to improve evidence-based clinical practice as well as knowledge and skill. The study also should be done on more specific treatment or placebo treatment in the control group compared with chiropractic adjustment to find out the effectiveness of chiropractic adjustment for discogenic cervical pain.

Acknowledgments

The authors would like to appreciate the department of physiotherapy of four reputed organizations for their coordination and great collaboration. The authors would also like to thank to all the participants sincerely.

Ethical Consideration

The article paid attention in all ethical concepts.

Author Contribution

All authors contributed equally to preparing the article.

Conflict of Interest

The authors declared no conflict of interest regarding the publication of this paper.

Funding

The authors report there was no funding to declare.

Reference

1. Peng, B., & DePalma, M. J. (2018). Cervical disc degeneration and neck pain. Journal of Pain Research, 11, 28–53.
2. Eloqayli, H. (2019). Cervical discogenic pain treatment with percutaneous jellified ethanol: Preliminary experience. BioMed Research International, 2019, 1–5.
3. Sterling, M., de Zoete, R. M., Coppieters, I., & Farrell, S. F. (2019). Best evidence rehabilitation for chronic pain part 4: Neck pain. Journal of Clinical Medicine, 8(12), 2034.
4. Razzaq, A., Sajjad, A. G., Yasin, S., Tariq, R., & Ashraf, F. (2020). Comparison of Cyriax manipulation with traditional physical therapy for the management of cervical discogenic problems: A randomized control trial. Journal of the Pakistan Medical Association, 70(8), 1329–1333.
5. Manchikanti, L., Cash, K. A., Pampati, V., & Malla, Y. (2014). Two-year follow-up results of fluoroscopic cervical epidural injections in chronic axial or discogenic neck pain: A randomized, double-blind, controlled trial. International Journal of Medical Sciences, 11(4), 309–320.
6. Ma, M., Zhang, H., Liu, R., Liu, H., Yang, X., & Yin, X. (2020). Static and dynamic changes of amplitude of low-frequency fluctuations in cervical discogenic pain. Frontiers in Neuroscience, 14, 733.
7. Young, J. L., Walker, D., Snyder, S., & Daly, K. (2014). Thoracic manipulation versus mobilization in patients with mechanical neck pain: A systematic review. Journal of Manual & Manipulative Therapy, 22(3), 141–153.
8. Humphreys, B. K., & Peterson, C. (2013). Comparison of outcomes in neck pain patients with and without dizziness undergoing chiropractic treatment: A prospective cohort study with 6-month follow-up. Chiropractic & Manual Therapies, 21, 3.
9. Bryans, R., Decina, P., Descarreaux, M., Duranleau, M., Marcoux, H., & Potter, B. (2014). Evidence-based guidelines for the chiropractic treatment of adults with neck pain. Journal of Manipulative and Physiological Therapeutics, 37(1), 42–63.
10. Silva, R. M. V. D., Lima, M. S. D., Costa, F. H., & Silva, A. C. D. (2012). Effects of chiropractic care in patients with cervical pain: A systematic review. Revista Dor, 13(1), 71–74.
11. Gevers-Montoro, C., Provencher, B., Descarreaux, M., Ortega de Mues, A., & Piché, M. (2021). Clinical effectiveness and efficacy of chiropractic spinal manipulation for spine pain. Frontiers in Pain Research, 2, 765921.
12. Henderson, C. N. (2012). The basis for spinal manipulation: Chiropractic perspective of indications and theory. Journal of Electromyography and Kinesiology, 22(5), 632–642.
13. Cleland, J. A., Childs, J. D., & Whitman, J. M. (2008). Psychometric properties of the Neck Disability Index and numeric pain rating scale in patients with mechanical neck pain. Archives of Physical Medicine and Rehabilitation, 89(1), 69–74.
14. Vernon, H., Humphreys, K., & Hagino, C. (2007). Chronic mechanical neck pain in adults treated by manual therapy: A systematic review of change scores in randomized clinical trials. Journal of Manipulative and Physiological Therapeutics, 30(3), 215–227.
15. Agarwal, S., Allison, G. T., Agarwal, A., & Singer, K. P. (2006). Reliability and validity of the Hindi version of the Neck Pain and Disability Scale in cervical radiculopathy patients. Disability and Rehabilitation, 28(23), 1405–1411.
16. Moustafa, I. M., & Diab, A. A. (2014). Multimodal treatment program comparing two different traction approaches for patients with discogenic cervical radiculopathy: A randomized controlled trial. Journal of Chiropractic Medicine, 13(3), 157–167.
17. Genebra, C. V. D. S., Maciel, N. M., Bento, T. P. F., Simeão, S. F. A. P., & De Vitta, A. (2017). Prevalence and factors associated with neck pain: A population-based study. Brazilian Journal of Physical Therapy, 21(4), 274–280.
18. Murphy, F. X., Hall, M. W., D'Amico, L., & Jensen, A. M. (2012). Chiropractic management of frozen shoulder syndrome using a novel technique: A retrospective case series of 50 patients. Journal of Chiropractic Medicine, 11(4), 267–272.
19. Lin, J. H., Shen, T., Chung, R. C., & Chiu, T. T. (2013). The effectiveness of Long's manipulation on patients with chronic mechanical neck pain: A randomized controlled trial. Manual Therapy, 18(4), 308–315.
20. Pennings, J. S., Khan, I., Davidson, C. A., Freitag, R., Bydon, M., & Asher, A. L. (2020). Using PROMIS-29 to predict Neck Disability Index (NDI) scores using a national sample of cervical spine surgery patients. The Spine Journal, 20(8), 1305–1315.
21. Cleland, J. A., Fritz, J. M., Whitman, J. M., & Palmer, J. A. (2006). The reliability and construct validity of the Neck Disability Index and patient-specific functional scale in patients with cervical radiculopathy. Spine, 31(5), 598–602.
22. Cleland, J. A., Fritz, J. M., Whitman, J. M., & Heath, R. (2007). Predictors of short-term outcome in people with a clinical diagnosis of cervical radiculopathy. Physical Therapy, 87(12), 1619–1632.
23. Peolsson, A. (2007). Investigation of clinically important benefit of anterior cervical decompression and fusion. European Spine Journal, 16(4), 507–514.

Copyright: *©2024 Rasel Ahmed, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.*