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A Comparative Study Of Effectiveness Of Chin Tuck Versus Neck Isometrics Among Cervical Radiculopathy Patients

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ABSTRACT: The purpose of this study was to evaluate the "effectiveness of chin tuck versus neck isometrics to alleviate pain, and disability and to improve cervical range of motion among Cervical Radiculopathy patients." For this experimental study, a total of 40 patients (20 in each group) with cervical radiculopathy were recruited from Max physiotherapy department between duration December 2023-March 2024.The experimental method was used to assign participants to the chin tuck exercise group and neck isometrics group. Patients in both groups received 12 supervised treatment sessions (3 times per week for four weeks). Numeric Pain Rating Scale (NPRS), and inclinometer Neck Disability Index (NDI) were used to assess pain, cervical range of motion, and quality of life at baseline and after 4 weeks. Pre and post-treatment comparison of cervical ranges of motion score in experimental has shown that post-treatment mean and standard deviation improved with $p < 0.05$, depicting that neck isometrics effectively enhance cervical ranges in patients with cervical radiculopathy. In contrast, pre and post-treatment comparison of cervical ranges of motion score in group B has shown that post-treatment mean and standard deviation improved with $p < 0.05$, showing that Chin Tuck treatment effectively improves cervical ranges in patients with cervical radiculopathy. In conclusion, both interventions are effective in the treatment of cervical radiculopathy.

KEYWORD: Cervical Radiculopathy, neck isometrics, Chin tuck, NPRS, and Neck Disability Index.

1. INTRODUCTION

Cervical radiculopathy, a condition characterized by nerve root compression in the neck, is a rising global concern. (2) It leads to persistent pain, weakness, and sensory changes, lasting beyond the typical healing period of 3–6 months. (3) Neck pain, affecting over 30% of individuals annually, ranks as the fourth-leading cause of disability. (4) Remarkably, 20%– 70% of people will experience neck pain disrupting their daily lives at some point. (5) Recent data from the European Journal of Pain reveal that cervical radiculopathy results in disability for approximately 352.0 cases per 100,000 individuals worldwide over the past 3 decades. (6) Notably, the incidence of cervical radiculopathy stands at 83.2 cases per 100,000 people, with the highest occurrence between ages 40 and 50. (7) This translates to a yearly incidence of 107.4 cases per 100,000 men and 63.6 cases per 100,000 women. (8)

Herniated cervical discs, mainly affecting the C6 or C7 nerve roots in 80% of cases, lead to cervical radiculopathy. (9)

Symptoms encompass neck discomfort, radiating arm or shoulder pain, numbness, tingling, upper-limb weakness, and altered reflexes. (10) Diagnosis relies on clinical assessment, MRI, and a manual spurling test. (8-9) When substantial nerve root compression causes radiculopathy, it is expected to result in muscular weakness in the specific muscle innervated by that affected nerve root. (11) Studies have confirmed increased muscle fatigue and reduced neck muscle function in patients with cervical radiculopathy. (12) These statistics underscore the growing prevalence and impact of cervical radiculopathy, emphasizing the need for effective management and prevention strategies. Therapeutic exercises, including muscle strengthening, stretching, and stabilization, are vital for mitigating these effects and promoting recovery in chronic neck and nerve pain. (13)

Cervical Radiculopathy (CR) is a disorder of the spinal nerve roots that is largely caused by a space-occupying lesion, disc herniation compression, and bony spur typically osteophytes in degenerating cervical spine which can lead to nerve root inflammation, impingement, or both (1).

Many studies have been done on the treatment of cervical radiculopathy. However, most of them are inconclusive in terms of defining appropriate treatment options that would be efficacious for the treatment of this pathology (9).

The purpose of this study was to assess the neck isometrics technique as an effective treatment to improve neck mobility, and reduce pain intensity and disability for cervical radiculopathy through appropriate randomized controlled trials, taking the factors and outcome measures under consideration that are not addressed properly in previous literature.

Chin tuck is a form of manual therapy that involves the application of a low-load, long-duration stretch to the myofascial complex, intended to restore optimal length, decrease pain, and improve function.

Neck isometrics is based on neurodynamics. The benefit of such a technique includes the facilitation of nerve gliding, reduction of nerve adherence, dispersion of noxious fluids, and increase in neurovascularity and axoplasmic flow.

Neurodynamic assessment techniques are incorporated into treatment involving passive movement of the nerve relative to its environment.

Neck isometrics is an innovative management tool that involves conservative decompression of nerves, various neural mobilizing techniques, and patient education techniques.

Neck isometrics is a method of Chin tuck of disorders of neural tissue. The rationale for using neck isometrics in the treatment of musculoskeletal conditions is based on in vivo and in vitro studies which point to a high efficacy of neck isometrics procedures. Essentially the entire nervous system is a continuous structure and it moves and slides in the body as we move and the movement is related to critical physiological processes such as blood flow to neurons. This movement is quite dramatic and it is not hard to imagine that fluid such as blood in the nerve bed, a constricting scar, inflammation around the nerve, or a nerve having to contend with arthritic changes.

Cervical radiculopathy is a condition caused by the compression of the nerve root in the cervical spine that commonly manifests as neck pain and it may also radiate from the neck into the distribution of the affected nerve root. It is the result of compressive or inflammatory pathology from a space-occupying lesion such as a disc herniation, spondylitic spur, or cervical osteophyte. Many studies have shown the effectiveness of Chin tuck and neck isometrics in cervical radiculopathy patients. However, no study has been conducted to compare the immediate effectiveness of these two approaches in the treatment of Cervical Radiculopathy. So, this study has been designed mainly to compare the immediate effect of Chin tuck and neck isometrics in patients with Cervical Radiculopathy. This study will aim to examine the chin tuck versus neck isometrics in individuals with Cervical Radiculopathy.

2. METHODOLOGY

The study design is an experimental study. The subject of the study is 40 Cervical Radiculopathy Patients as sample size. The study was conducted in Physiotherapy OPD, Selected Hospital. The subject is divided into Group A: 20 Patients, In this group neck isometrics techniques were given. Group B: 20 Patients, In group B Chin tuck was given.

Intervention: All the subjects were given hot packs for 10 minutes before the treatment in both groups.

Subjects fulfilling the sample selection criteria were given treatment for 12 sessions (3 times per week for 4 weeks). Pre-assessment was done at baseline, the second assessment was done after 2 weeks and the final post-assessment was done at the end of the 12th session in the 4th week in both groups.

Outcome measures

The main outcome was to measure the effectiveness of the neck isometrics technique on pain intensity measured on NPRS, range of motion measured on inclinometer, and the effects of treatment on quality of life measured through the Neck Disability Index (NDI).

The numeric pain rating scale (NPRS) is an 11-point scale ranging from 0 to 10, and a higher

score indicates greater intensity of pain. 0 stands for no pain and 10 for the worst possible pain. In subjects with neck pain, NPRS has ICC = 0.77 (17). The inclinometer is a device used for measuring angles and the cervical range of motion Inclinometer has ICC = 0.95 (18).

NDI is a self-reported questionnaire used for measuring functional status in subjects with neck pain, the questionnaire contains a total of 10 sections and for each section, the total possible score is 5: if the first statement is marked the section score = 0 if the last statement is marked it = 5. If all ten sections are completed the score is calculated by the following formula: Score: /50 Transform to percentage score x 100 = %points.

The lesser score represents a lesser disability or better functional status, and NDI has fair test-retest reliability (19). The inclusion criteria are 28 to 55 years, both genders, Subjects who feel neck pain radiating unilaterally on the upper limb for 15 days or more than with Cervical Spurling test positive, Cervical Compression test positive & Cervical Distraction test positive. And no physical impairment unrelated to the spine that would prevent the subjects from safely participating in any aspect of the study.

3. RESULTS

Baseline measurements

Patient age, gender, baseline pain, ROM, and quality of life were noted at the time of recruitment. A total of 88 subjects were included in this study, 5 patients (2 from group A and 3 from group B) were lost to follow-up, mostly due to the ongoing pandemic situation, and missing data were managed through intention to treat analysis with the technique of last observation carried forward. The mean age of the subject in group A was 41.09± 6.05 in and group B was 42.22 ± 5.72. Shapiro-Wilk test of normality has shown that p values were greater than 0.05 for cervical range of motion variables and less than 0.05 for neck disability index (NDI) and numeric pain rating scale (NPRS), showing that data was normally distributed for cervical range of motion (ROM) and not normally distributed for NDI and NPRS. Pretreatment comparison of variables (NPRS, NDI, and cervical ROM) between both groups showed that there was no statistically significant difference between both groups at the baseline as presented in Tables

Table 1: Baseline measurement of pain (NPRS) and disability (NDI).

Variable	**At Baseline**

	Group A	Group B	Z score	p-value
	Mean rank	Mean rank		
NPR	44.99	44.21	-0.24	0.98
NDI	42.94	46.26	-0.71	0.64

Table 2: Baseline measurement of cervical range of motion (ROM).

Variable	**At baseline**			
	Group A	**Group B**	**Mean Change (95% CI)**	**p-value**
	Mean	**Mean**		
Cervical flexion	39.09	38.64	0.65(-3.90,4.99)	0.90
Cervical extension	39.06	42.04	2.97(-8.26,2.21)	0.25
Cervical right side flexion	29.91	30.91	1.00(-4.97, 2.97)	0.71
Cervical left side flexion	29.98	30.46	0.47(-4.26, 3.20)	0.79
Cervical right rotation	36.42	38.48	1.93(-6.26, 2.29)	0.46
Cervical left rotation	40.09	40.90	0.91(-4.98, 3.44)	0.79

A comparison of variables within group A has shown that there was a statistically significant difference between pre-, mid-, and post-treatment NPRS scores. $X^2 = 82.24$, $p<0.001$. Post hoc analysis with Wilcoxon signed-rank was conducted with Bonferroni correction applied, resulting in a significant level set at $p < 0.017$. The Median (interquartile range (IQR)) for pretreatment the in experimental group NPRS score was 6(5 to 6), mid-treatment was 4 (3 to 5) and post-treatment was 3 (2 to 4). There was a significant difference between pretreatment and mid-treatment ($Z = -5.76$, $p<0.001$), mid-treatment and post-treatment ($Z = -5.46$, $p<0.001$), and pretreatment and post-treatment ($Z = -5.74$, $p<0.001$), showing that NPRS score was

significantly improved after 2 weeks and further improved after 4 weeks of treatment in the experimental group as shown in Table 3.

Table 3: Comparison of pain (NPRS), disability (NDI), and cervical mobility (ROM) within the experimental group.

Variable	Baseline	2nd week follow up	At the end of the 4th week	X^2 / F	p-Value
NPRS Median (IQR)	6(5 to 6)	4 (3 to 5)	3 (2 to 4)	X^2 = 82.23	< 0.001*
NDI Median (IQR)	38(30 to 46)	24 (20 to 28)	14 (8.6 to 20)	X^2 = 71.41	< 0.001*
Cervical flexion Mean	39.09	44.74	48.21	F = 78.92	0.01**
Cervical extension Mean ± S.D	39.06	45.74	49.65	F = 66.78	< 0.001
Cervical right side flexion Mean	29.91± 8.46	34.28	37.92	F = 153.9	< 0.001
Cervical left side flexion Mean	29.98	35.27	39.42	F = 132.76	< 0.001

Variable	Baseline	2nd week follow up	At the end of the 4th week	X^2 / F	p-Value
Cervical right rotation[CRR] Mean	36.44	43.01	46.97	F = 75.62	< 0.001
Cervical left rotation[CLR] Mean	40.08	45.47	49.05	F = 108.93	< 0.001

* Friedman test

** Repeated measure ANOVA (for all cervical ranges)

There was a statistically significant difference between pre-, mid-, and post-treatment NDI scores.

X^2 = 71.402, p<0.001. Post hoc analysis with Wilcoxon signed-rank was conducted with Bonferroni correction applied, resulting in a significant level set at p < 0.017. The Median (IQR) for pretreatment Neck Disability Score (NDI) in the experimental group was 38(30 to 46), mid-treatment was 24 (20 to 28) and post-treatment was 14 (8.6 to 20). There was a significant difference between pretreatment and mid-treatment (Z = -5.41, p<0.001), mid-treatment and post-treatment (Z = -5.78, p<0.001), and pretreatment and post-treatment (Z = -5.68, p<0.001), showing that disability was significantly reduced after 2 weeks and further reduce after 4 weeks of treatment in the experimental group.

Pre and post-treatment comparison of cervical ranges of motion score in experimental has shown that post-treatment mean and standard deviation improved with p < 0.05, showing that neck isometrics is effective in improving cervical ranges in patients with cervical radiculopathy as shown in Table 3.

A comparison of variables within group B has shown that there was a statistically significant difference between pre-, mid-, and post-treatment NPRS scores. X^2 = 71.02, p = 0.00. Post hoc analysis with Wilcoxon signed-rank was conducted with Bonferroni correction applied, resulting in a significant level set at p < 0.017. The median (IQR) for pretreatment in the control group NPRS score was 6(5 to 6), mid-treatment was 5 (3.25 to 6) and post-treatment was 4 (2.25 to 5). There was a significant difference between pretreatment and mid-treatment (Z = - 5.48, p = 0.00), mid-treatment and post-treatment (Z = -4.74, p<0.001), and pretreatment and post-treatment (Z = -5.49, p<0.001), showing that

NPRS score was significantly improved after 2 weeks and further improved after 4 weeks of treatment in the control group.

There was a statistically significant difference between pre-, mid, and post-treatment NDI scores, $X^2 = 72.21$, $p<0.001$. Post hoc analysis with Wilcoxon signed-rank was conducted with Bonferroni correction applied, resulting in a significant level set at $p < 0.017$. The Median (IQR) for pretreatment Neck Disability Score (NDI) in the control group was 40(30 to 49), mid-treatment was 30 (22 to 38) and post-treatment was 22 (16 to 30). There was a significant difference between pretreatment and mid-treatment ($Z = -5.23$, $p<0.001$), mid-treatment and post-treatment ($Z = -5.26$, $p<0.001$), and pretreatment and post-treatment ($Z = -5.61$, $p<0.001$), showing that disability was significantly reduced after 2 weeks and further reduce after 4 weeks of treatment in the control group. Pre and post-treatment comparison of cervical ranges of motion score in group B has shown that post-treatment mean and standard deviation improved with $p < 0.05$, showing that conventional treatment is effective in improving cervical ranges in patients with cervical radiculopathy as shown in Table 4.

Table 4: Comparison of pain (NPRS), disability (NDI), and cervical mobility (ROM) within the control group.

Variable	Baseline	2nd week follow up	At the end of the 4th week	X^2 / F	p-Value
NPRS	6(5 to 6)	5 (3.25 to 6)	4 (2.25 to 5)	X^2 = 71.02	< 0.001*
NDI	40 (30 to 49)	30 (22 to 38)	22 (16 to 30)	X^2 = 72.21	< 0.001*
Cervical flexion	38.63	44.06 ±8.74	47.74	F = 54.28	< 0.001**
Cervical extension	42.02	48.08	50.26	F = 32.27	< 0.001
Cervical right side flexion	30.91± 10.21	33.78	36.42	F = 25.78	< 0.001
Cervical left side flexion	30.43	34.08	36.43	F = 33.70	< 0.001
Cervical right rotation	38.47	42.71	45.63	F = 54.97	< 0.001

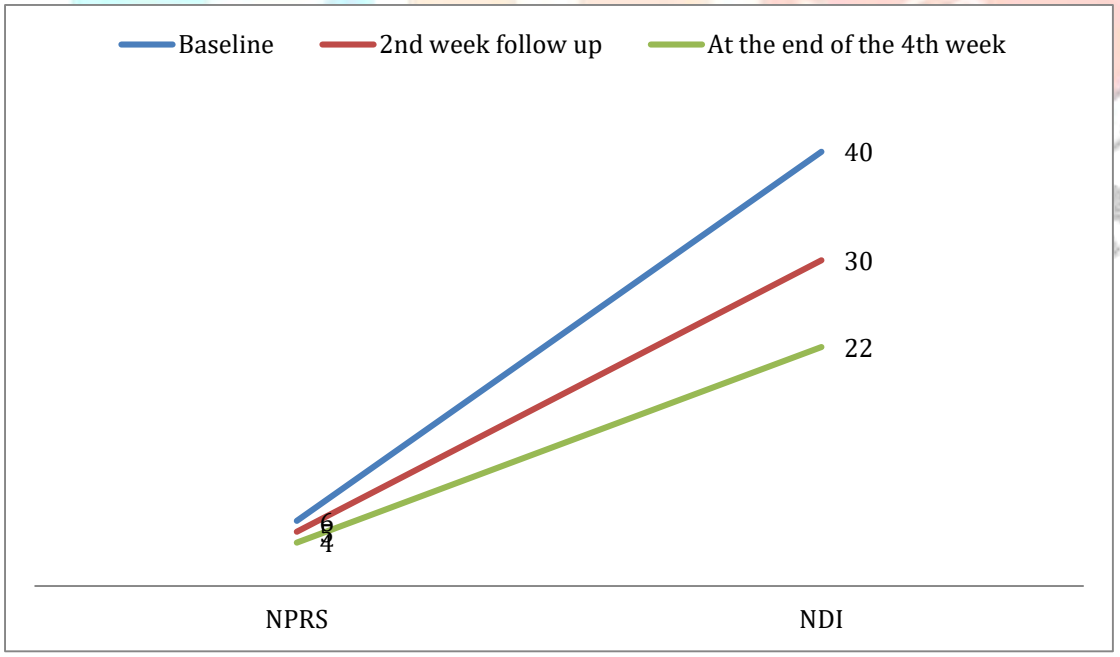
Variable	Baseline	2nd week follow up	At the end of the 4th week	X^2 / F	p-Value
Cervical left rotation	40.91	43.95	45.99	F = 33.65	< 0.001

*Friedman test

** Repeated measure ANOVA

A comparison of the mean and standard deviation of NPRS between group A and group B has shown that there was no significant difference in NPRS score at baseline, as value p>.05, but there was significant difference after 2nd and further improvement after 4th week, as value p < .05, showing that neck isometrics is more effective in reducing pain.

Table 4: Comparison of pain (NPRS), disability (NDI), and cervical mobility (ROM) within the control group.

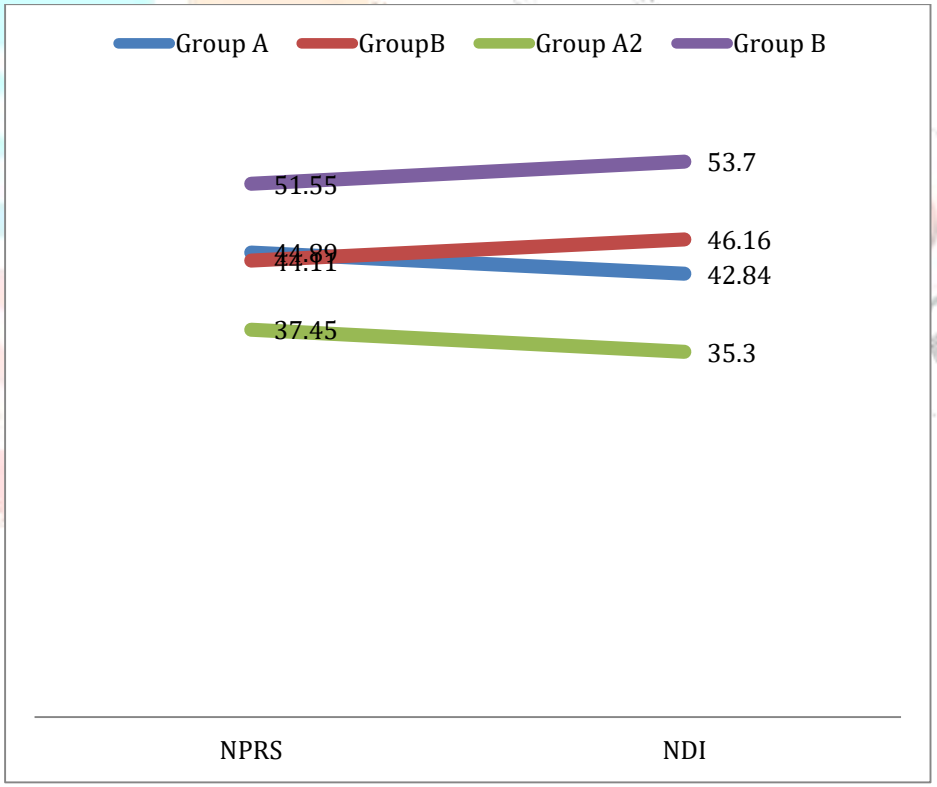


A comparison of NDI between Group A and Group B has shown that there was no significant difference in NDI score at baseline and even after 2 weeks of treatment, as value p>.05, but there was a significant difference after 4 weeks in the Group A as the mean rank was 35.40 with p<0.05 as shown in Table 5.

Table 5: Comparison of NPRS and NDI between the experimental and control group.

Variable	At Baseline				At the end of 4th week			
	Group A	Group B	Z score	p-value	Group A	Group B	Z score	p-value
	Mean rank	Mean rank			Mean rank	Mean rank		
NPRS	44.99	44.21	-0.24	0.98	37.45	51.65	-2.73	0.008
NDI	42.94	46.26	-0.71	0.64	35.40	53.70	-3.48	0.001

Table 5: Comparison of NPRS and NDI between the experimental and control group

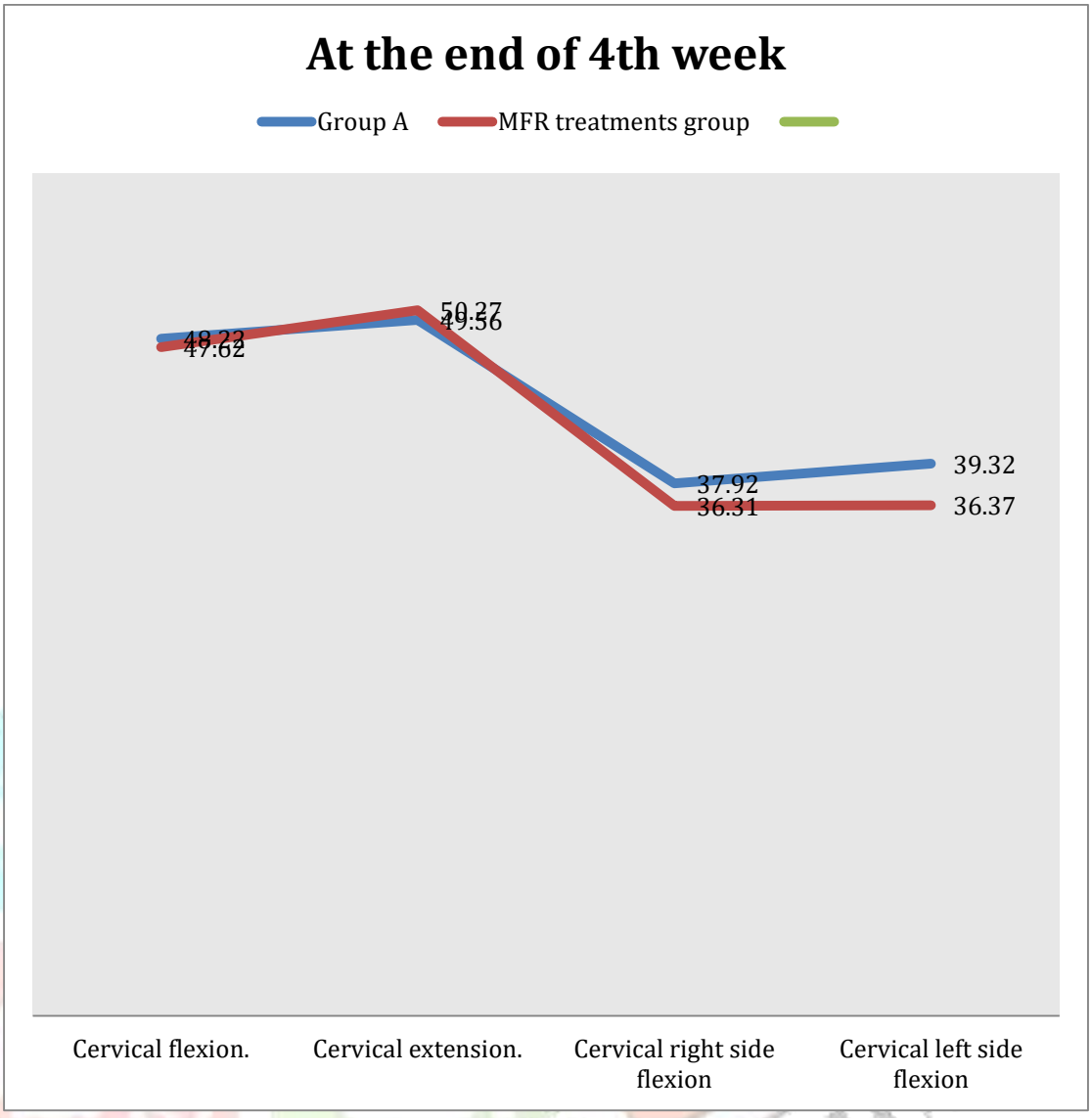


Comparison of the mean and standard deviation of cervical range of motion between group A and group B has shown, that there was no significant difference in cervical ranges at baseline, after 2nd and 4th weeks of treatment, as p-value >.05, so experimental and control groups showed equal improvement as shown in Table 6.

Table 6: Comparison of cervical range of motion between experimental and control groups.

Variables	At baseline				At the end of 4th week			
	Group A	Group B	Mean Change (95% CI)	p-value	Group A	Group B	Mean Change (95%CI)	p-value
	Mean	Mean.			Mean	Mean		
Cervical flexion	39.07	38.63	0.65(-	0.90	48.22	47.72	0.69 (-	0.73
Cervical extension	39.05	42.03	2.97(-	0.25	49.66	50.27	0.70(-	0.76
Cervical right side flexion	29.92	30.92	1.00(-	0.71	37.92	36.41	1.71(-	0.47
Cervical left side flexion	29.97	30.45	0.47(-	0.79	39.42	36.47	2.93(-	0.93
Cervical right rotation	36.42	38.42	1.93(-	0.46	46.97	45.63	1.44(-	0.63
Cervical left rotation	40.07	40.91	0.91(-	0.79	49.05	45.97	3.28(-	0.21

Table 6: Comparison of cervical range of motion between experimental and control group



This study suggests that both treatments are effective in cervical radiculopathy. Pre and post-treatment comparison of cervical ranges of motion score in experimental has shown that post-treatment mean and standard deviation improved with $p < 0.05$, showing that neck isometrics is effective in improving cervical ranges in patients with cervical radiculopathy.

Pre and post-treatment comparison of cervical ranges of motion score in group B has shown that post-treatment mean and standard deviation improved with $p < 0.05$, showing that Chin Tuck treatment is effective in improving cervical ranges in patients with cervical radiculopathy

Such an immediately greater effect of the Neck Isometrics exercise over the Chin Tuck exercise may have resulted from the fact that Chin tuck exercises emphasize a selective activation of the deep or local neck flexor muscles of the cervical spinal segment and it may be insufficient to connect the lumbopelvic link, which provides a stable basis for upright cervical spinal posture and stability (Caneiro et al, 2010; Kobesova and Kolar, 2014; Frank et al, 2013). On the other hand, NECK ISOMETRICS exercises which

emphasize a proper stabilization of the entire cervical-thoracic-lumbopelvic segmental chain may provide a punctum fixum or a stable foundation for the deep neck flexor muscles and psoas major in the lumbar spine (Borghuis et al, 2008; Frank et al, 2013; Liebenson, 2007).

Subjects with cervical radiculopathy show deconditioning of cervical muscles due to inactivity. Exercises are shown to be beneficial in improving the well-being of a person and reducing disability. These have also been shown to improve sleep, emotional and physical functioning, and cognitive functioning, and reduce depression or anxiety (22). In the present study neck isometrics was used along with strengthening exercises of cervical muscles. This showed results consistent with Liang et al, as it showed improvement in the range of motion of the cervical spine and a reduction in pain (10). In the present study, comparison of the NDI score between group A and group B has shown that there was a significant improvement ($p<0.05$) in the NDI score in group A with neuro-mobilization

. and post-treatment comparison of cervical ranges of motion score in experimental has shown that post-treatment mean and standard deviation improved with $p < 0.05$, showing that neck isometrics is effective in improving cervical ranges in patients with cervical radiculopathy. Pre and post-treatment comparison of cervical ranges of motion score in group B has shown that post-treatment mean and standard deviation improved with $p < 0.05$, showing that Chin Tuck treatment is effective in improving cervical ranges in patients with cervical radiculopathy.

while the comparison of NPRS between group A and group B has also shown there was a significant difference after 2nd and further improved after 4th week, as value $p < .05$, showing that neck isometrics is more effective in reducing pain and improving functional status in cervical radiculopathy. Many other studies also support these results as exercise intervention containing isometric exercise of deep neck flexor muscles showed alleviation in levels of pain and disability, measured on the outcome scale of numeric pain rating scale NPRS and neck disability index NDI respectively (24–27). In the present study, both groups were given hot fermentation along with an exercise regime. This treatment program when combined with heating modalities, shows decreased pain in patients with cervical radiculopathy as shown in a randomized controlled trial by Diab et al. (28).

4. **CONCLUSION:** This study suggests that both treatments are effective in cervical radiculopathy. Pre

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