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## EFFECT OF SIMULTANEOUS APPLICATION OF CERVICAL TRACTION AND NEURAL MOBILIZATION FOR SUBJECTS WITH UNILATERAL CERVICAL RADICULOPATHY

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## ABSTRACT

**Background:** Cervical Traction and Neural Mobilization both have been individually advocated for treatment of Cervical radiculopathy due to their various effects. But the combined effect of these techniques applied simultaneously has not been explored in studies. Hence the purpose is to find the effect of simultaneous application of cervical traction and neural mobilization on improvement in neck pain, radicular symptoms and neck disability in subjects with Cervical Radiculopathy.

**Methods:** An experimental study design, 60 subjects with Unilateral Cervical Radiculopathy and ULTT1 positive for median nerve bias, randomized 20 subjects each into three groups- Group A, B and C respectively. Group A received both Cervical Traction and Neural Mobilization. The Group B received only Mechanical Cervical Traction. The Group C received only Neural Mobilization. The duration of intervention was given 3 treatment sessions per week for four weeks. Outcome measures such as Numerical Pain Rating Scale, Global Rating of Change Scale, Neck Disability Index were measured before, at the end of 2nd and 4th week post treatment.

**Results:** Comparison of post intervention means at 2<sup>nd</sup> and 4<sup>th</sup> week of treatment there is a statistically significant ( $p < 0.05$ ) difference in improvement in outcome measures between three groups. Group A subjects shown greater percentage of improvement than Group B and Group C.

**Conclusion:** The present study concludes that simultaneous application of mechanical cervical traction with neural mobilization is more effective in improving pain, functional disability and severity of radicular symptoms than mechanical cervical traction and neural mobilization alone for subjects with Unilateral Cervical Radiculopathy.

**Key words:** Cervical Radiculopathy, Neck Pain, Median Nerve, Cervical Traction, Neural Mobilization, Pain, Neck Disability, Global Rating.

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## INTRODUCTION

Cervical radiculopathy (CR) is, by definition, a disorder of the cervical nerve root (CNR) and most commonly is caused by a cervical disc herniation, spondylotic spur or cervical osteophyte or other space-occupying lesion, resulting in nerve root inflammation, impingement or both which may lead to chronic pain and disability.<sup>1,2,3</sup> The average annual incidence rate of cervical radiculopathy is 83 per 100 000 for the population in its entirety, with an increased prevalence occurring in the fifth decade of life (203 per 100 000).<sup>4,5</sup>

The location and pattern of symptoms in Cervical radiculopathy vary depending on nerve root level affected and primarily presents with sensory symptoms into the upper limb such as pain, numbness, tingling sensation; motor symptoms like muscle weakness; and reflex hypo activity which often result in significant functional limitations and disability.<sup>6,7</sup> Treatment techniques such as Cervical Traction and Neural Mobilization both have been individually advocated for treatment of Cervical radiculopathy due to their various effects.<sup>8</sup>

Neural tissue mobilization techniques (NMTs) theorize to examine the neural tension in nerves and mobilize the nerves that exhibit neural tension by passive or active movements by using Tensioning, Sliding and Single Joint Movement techniques and focused on restoring the ability of the nervous system to tolerate the normal compressive, friction, and tensile forces associated with daily and sport activities.<sup>8,9</sup> With this method, tension was gently applied to the involved nerve root that caused mild pulling but no pain and a low-amplitude repetitive movement was introduced in the direction of perceived neural tension. NMTs are widely used to normalize the CNR's structure and function by reducing nerve adherence, facilitating nerve gliding and decreasing neural mechanosensitivity in patients with cervical radiculopathy.<sup>9,10,11</sup>

Mechanical cervical traction is technique used to decompress the nerve root by separating the cervical segments through long-axis traction. Many studies reveals that Intermittent Cervical Traction for Cervical Radiculopathy found to be effective in reduction of pain and disability.<sup>12,13,14</sup>; however, no standard parameters have been reported. It is speculated that improvements in symptoms are due to distraction of articular surfaces by traction which unloads the components of the spine by stretching muscles, ligaments and functional units.<sup>14-17</sup>

Cervical traction and neural mobilization techniques (NMTs) have been advocated in the management of CR due to their immediate analgesic effect.<sup>12-19</sup> The analgesic effect of these two techniques has been explored and recognized in many RCT studies and in systematic reviews.<sup>12-18</sup>

In a case study, the effect of cervical traction combined with neural mobilization found effective on improving pain and disability in a patient with cervical radiculopathy. However the study has been limited with a single case and lack of standardized outcome measure.<sup>19</sup> Therefore, the present study with research question whether the simultaneous application of Cervical Traction and Neural Mobilization does have effect on improving neck pain, radicular symptoms and neck disability in subjects with unilateral cervical radiculopathy? Hence, the purpose of study with objective is to find the effect of simultaneous application of cervical traction and neural mobilization on improving neck pain, radicular symptoms and neck disability in subjects with Cervical Radiculopathy. It was hypothesised that Simultaneous application of cervical traction and neural mobilization will have a significant difference on improving neck pain, radicular symptoms and neck disability in subjects with unilateral cervical radiculopathy

## METHODOLOGY

A repeated measures experimental study design with three groups. As this study involved human subjects the Ethical Clearance was obtained from the Ethical Committee of KTG College of Physiotherapy and K.T.G. Hospital, Bangalore as per the ethical guidelines for Bio-medical research on human subjects. This study was registered with University No. : 09\_T031\_39077. The study was conducted at KTG Multi Speciality Hospital, Bangalore. Subjects included were both male and female with age group between 45 to 55 years<sup>12</sup>, with history of neck pain associated with radicular pain below the occiput and unilateral side of the neck with a tingling sensation occurring on the lateral aspect of the elbow joint,<sup>3</sup> positive for the test item cluster for Provocative Tests which include the Spurling's test, Shoulder Abduction test, Valsalva Maneuver, Neck Distraction test and Upper limb tension test,<sup>3</sup> positive history from the Six historical questions diagnostic for Cervical Radiculopathy<sup>3</sup> which include the following questions: 1. Which are your most bothersome symptoms: Pain, Numbness / Tingling, Loss of feeling. 2. Where are the symptoms most bothersome: Neck, Shoulder, Scapula, Arm above elbow, Arm below elbow, Hand, Fingers. 3.

Symptom behaviour – Constant, Intermittent, Variable. 4. Entire limb numbness. 5. Are the symptoms keeping you away from sleep? 6. Does the neck movement improve or worsen the arm pain. 7. Complaints of pain radiating to Upper Extremity that was provoked or exacerbated by Cervical Range of Motion,<sup>14</sup> Paraesthesia in dermatomal pattern (For Median Nerve),<sup>20</sup> mild to moderate severity of radicular symptoms measured by Visual Analogue Scale between 5 to 7 cm, subjects having clear or unequivocal relief of the radicular pain with the manual cervical distraction test,<sup>14</sup> and positive for ULTT1, Median Nerve Bias.<sup>21</sup> Subjects excluded were with sensory loss or motor weakness due to cervical radiculopathy, history of trauma, rheumatoid arthritis, malignancy, cervical Instability,<sup>15</sup> cord myelopathy, vertebro-basilar syndrome, undiagnosed pain, who has undergone cervical surgeries, bilateral radiculopathy, neuropathies etc. Total 60 Subject (n=60) who meet the inclusion criteria were recruited by Simple random sampling method using closed envelopes, randomly allocated 20 subjects into each Group A, B, and C. Subjects who meet inclusion criteria were informed about the study and a written informed consent was taken. Total four weeks of intervention with 12 treatment sessions which includes 3 treatment sessions in a week was given.<sup>15</sup>

**Procedure of Intervention for Group A:** In this group subjects were treated simultaneously with mechanical cervical traction and neural mobilization. Calibrated Biomed Traction unit was used in the study. For Intermittent Cervical Traction subjects were instructed about the procedure and was taken in supine on the treatment couch with the body in neutral position. The cervical spine was placed at an angle of approximately 15 degrees of flexion with traction force to be 10% of subject's body weight and was increased approximately 1 kg every visit, depending on centralization or reduction of symptoms and on/off cycle set at 60/30 seconds) and treatment was given for 9 minutes per session.<sup>15,20,22</sup> A bursar switch in the unaffected arm was given so that subject can alert the therapist in case of any discomfort during traction and neural mobilization. After starting the traction machine, neural mobilization procedure was performed. The therapist stood on the affected side besides the subject and depressed the subject's shoulder with one hand while the elbow would be kept in 90 degrees of flexion and forearm in supination and wrist and fingers in extended position using other hand. Then subject's arm was passively taken into

90 to 100 degrees of abduction (as tolerable by the subject). This was followed by either the sliding or the gliding procedure. If sliding of the nerve was to be done then alteration of elbow extension (loading median nerve) with wrist flexion (unloading median nerve) and elbow flexion (unloading median nerve) with wrist extension (loading median nerve) was performed for 6 sets of repetitions. Each set was performed in a slow oscillatory manner during the pull time of the traction (60 seconds) followed by 30 seconds rest.<sup>23</sup> In the 60 seconds each time first 3 sets of sliding followed by 3 sets of gliding were given, followed by 30 seconds rest. As the symptoms improved the patient was progressed to gliding/ tensioning technique.<sup>24</sup>

**Procedure of Intervention for Group B:** In this group subjects were treated with only mechanical cervical traction. The Procedure for giving traction was followed same as given in Group A, but no neural mobilization was given along with it.

**Procedure of Intervention for Group C:** In this group subjects were treated with only neural mobilization (median nerve). The procedure of applying neural mobilization was the same as given in Group A, but no traction was applied.



**Figure 1 Group A:** Receiving Mechanical (Intermittent) Cervical Traction along with Neural Mobilization. (Starting position)



**Figure 2 Group A:** Receiving Mechanical (Intermittent) Cervical Traction along with Neural Mobilization. (Taking to ending position)

**Outcome Measurements:**

Outcome measures were measured before, at the end of 2<sup>nd</sup> and 4<sup>th</sup> week of treatment.

1. Pain was recorded by NPRS (Numerical Pain Rating Scale): Subjects was asked to mark



- anywhere on the scale from 0 to 10 which best describes his/ her pain intensity. The mark was recorded using a measuring scale (in cm) to measure the marked point and the obtained NPRS Score was recorded and used for analysis.
2. The Severity of Radicular Symptoms was recorded by the GROC (Global Rating of Change Scale) which is a self administered scale, being filled in by participants themselves. The patient has to rate his/her overall radiculopathy condition from the time that the treatment began until now by marking on any of the numbers from -7 to 7, where it starts from worse i.e. negative to better.
  3. The Functional Disability was recorded by NDI (Neck Disability Index) which consists of 10 sections which have Questions that give information as to how the neck pain has affected the ability to manage in everyday life. Each section was scored on a 0 to 5 scale with first statement being 0 (i.e. No pain) and last statement being 5 (i.e. worst imaginable pain). Higher score indicates participant has more disability.

The Neck Disability Index and Numeric Pain Rating Scale exhibited fair test-retest reliability, with adequate responsiveness in patient with cervical radiculopathy.<sup>25</sup> The NDI is the most widely used and most strongly validated instrument for assessing self-rated disability in patients with neck pain.<sup>26</sup> Global Rating of Change Scale offers a flexible, quick and simple method of charting self assessed clinical progress in research and clinical settings and has clinical relevance, adequate reproducibility and sensitivity to changes. Test retest reliability was found to be high (ICC 0.9) and face validity (0.90).<sup>27</sup>

### Statistical Methods

Descriptive statistical analysis has been carried out in the present study. Out Come measurements analyzed were presented as mean  $\pm$  SD. Significance is assessed at 5 % level of significance with p value was set at 0.05 less than this is considered as statistically significant difference. Repeated Measures Analysis of Variance was used for within the group analysis and Bonferroni's as post-hoc test was used to find the significance in pair-wise comparison. One-way ANOVA and Tukey HD post-hoc test and Kruskal-Wallis Test have been used to compare the means of variables between the three groups and multiple pair-wise comparisons with calculation of percentage of difference between the means. The Statistical software namely SPSS 16.0, Stata 8.0, MedCalc 9.0.1 and Systat 11.0 were used for the analysis of the

data and Microsoft word and Excel have been used to generate graphs, tables etc.

### RESULTS

Total 60 subjects were studied, in Group A there were 20 subjects with mean age 50.55 years, in Group B there were 20 subjects with mean age 49.70 years and in Group C there were 20 subjects with mean age 49.90 years.

Within the group analysis of outcome measures in Group A, Group B, and Group C shows that there is a statistically significant change in means of NPRS and NDI when means were analyzed from pre intervention to 2<sup>nd</sup> week intervention and to 4 weeks post intervention measurements within the groups. There is a clinical significance effect with large effect size. Analysis of severity of radicular Symptoms between the groups found that Group A shown greater percentage of reduction in severity of radicular Symptoms that Group B and C.

In Group A the severity of radicular Symptoms was recorded by the GROC scale before intervention there were 35% of subjects had a condition of 'Quite a bit worse', 30% of subjects were 'Moderately worse', 20% of subjects were with 'Somewhat worse' and 15% subjects with 'A little bit worse'. In Group A after 2 weeks of intervention 10% of subjects were with condition 'Somewhat worse', 25% of subjects with a 'A little bit worse', 15% of subjects with 'A tiny bit worse', 25% of subjects with a 'A tiny bit better', 25% of subjects with 'A little bit better'. After 4 weeks of intervention 15% of subjects with 'A tiny bit worse', 20% of subjects with 'A tiny bit better', 5% of subjects with 'A little bit better' 15% of subjects with 'somewhat better', 20% of subjects with 'Moderately better', 20% of subjects with Quite a bit better, 5% of subjects with 'A great deal better'.

In Group B the severity of radicular Symptoms was recorded by the GROC scale before intervention there before intervention there were 40% of subjects had a condition of 'moderate worse', 25% of subjects were 'Somewhat worse', 10% of subjects were 'A little bit worse'. In Group B after 2 weeks of intervention 10% of subjects were with condition 'Somewhat worse', 25% of subjects with a 'A little bit worse', 40% of subjects with 'A tiny bit worse', 25% of subjects with a 'A tiny bit better'. After 4 weeks of intervention 10% of subjects with 'A tiny bit worse', 25% of subjects with 'A tiny bit better', 30% of subjects with 'A little bit better', 25% of subjects with 'somewhat better', 10% of subjects with 'Moderately better'.

In Group C the severity of radicular Symptoms before intervention there were 25% of subjects had

a condition of 'Quite a bit worse', 30% of subjects were 'Moderately worse', 25% of subjects were with 'Somewhat worse' and 20% subjects with 'A little bit worse'. In Group C after 2 weeks of intervention 20% of subjects were with condition 'Somewhat worse', 35% of subjects with a 'A little bit worse', 25% of subjects with 'A tiny bit worse', 20% of subjects with a 'A tiny bit better'. After 4 weeks of intervention 15% of subjects with 'A tiny bit worse', 20% of subjects with 'A tiny bit better', 20% of subjects with 'A little bit better', 35% of subjects with 'somewhat better', 10% of subjects with 'Moderately better'.

When the NPRS and NDI means were compared between the groups, before intervention shows that there was no statistically significant difference between the groups at pre-intervention and 2<sup>nd</sup> week post intervention. When the means were compared at 4<sup>th</sup> week post-intervention shown that there was a statistically significant difference between the groups A and B, and Group A and C and there is no statistically significant difference between the Group B and C.

**Table 1:** Basic Characteristics of the subjects studied

Basic Characteristics of the subjects studied		Group A	Group B	Group C	Between the groups Significance <sup>a</sup>
Number of subjects studied (n)		20	20	20	--
Age in years (Mean ± SD)		50.55 ± 3.39 (45-55)	49.70 ± 3.24 (45-55)	49.90 ± 3.12 (45-55)	p = -0.827 (NS)
Gender	Males	7	7	7	p = 0.763 (NS)
	Females	13	13	13	
	Within Group Significance	P = 0.000**	P = 0.000**	P = 0.000**	
Side	Right	10	10	10	p = 0.527 (NS)
	Left	10	10	10	
	Within Group Significance	P = 0.000**	P = 0.000**	P = 0.000**	

**Table 2:** Analysis of NPRS and NDI within the Group A (Repeated measures analysis)

Study Group	Pre intervention (Mean ± SD) min-max	2nd week (Mean ± SD) min-max	4th week (Mean ± SD) min-max
NPRS	6.14 ± 0.62 (5.1- 6.9)	4.25 ± 0.90 (2.4-5.8)	1.76 ± 0.65 (1.1-3.3)
Neck Disability Index in %	49.40 ± 11.70 (28- 70)	34.20 ± 7.56 (18-46)	19.90 ± 3.91 (28-70)

\*\* Statistically Significant difference p < 0.05; NS- Not significant; a. Friedman's ANOVA.

		Percentage of change	F value <sup>a</sup>	Significance <sup>b</sup> (1-tailed) P value	Effect size r	95% Confidence Interval for Difference <sup>b</sup>	
						Lower Bound	Upper Bound
NPRS	Pre to 2nd week	-30.78%	183.31	P = 0.000**	+0.77 (Large)	5.84	6.43
	2nd week to 4th week	-58.58%	234.71	P = 0.000**	+0.84 (Large)	3.83	4.67
	Pre to 4th week	-71.33%	972.71	P = 0.000**	+0.96(Large)	1.45	2.07
Neck Disability Index in %	Pre to 2nd week	-30.76%	104.12	P = 0.000**	+0.61(Large)	43.92	54.87
	2nd week to 4th week	-41.81%	104.13	P = 0.000**	+0.76 (Large)	30.66	37.74
	Pre to 4th week	-59.71%	154.89	P = 0.000**	+0.86(Large)	18.06	21.73

Adjustment for multiple comparisons: Bonferroni.

**Table 3:** Analysis of NPRS and NDI within the Group B (Repeated measures analysis)

Study Group	Pre intervention (Mean ± SD) min-max	2nd week (Mean ± SD) min-max	4th week (Mean ± SD) min-max
<b>NPRS</b>	6.28 ± 0.51 (5.2- 6.9)	4.79 ± 0.93 (2.6-6.2)	2.83 ± 0.87 (1.1-4.3)
<b>Neck Disability Index in %</b>	53.20 ± 12.37 (30- 76)	36.90 ± 9.30 (20-52)	25.00 ± 6.60 (14-38)

\*\* Statistically Significant difference  $p < 0.05$ ; NS- Not significant; a. Friedman's ANOVA.

		Percentage of change	F value <sup>a</sup>	Significance <sup>b</sup> P value	Effect size r	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
<b>NPRS</b>	Pre to 2nd week	-23.72%	109.02	P = 0.000**	+0.70 (Large)	1.07	1.91
	2nd week to 4th week	-40.91%	152.89	P = 0.000**	+0.73 (Large)	1.49	2.42
	Pre to 4th week	-54.93%	536.53	P = 0.000**	+0.92(Large)	3.01	3.88
<b>Neck Disability Index in %</b>	Pre to 2nd week	-30.63%	182.17	P = 0.000**	+0.59(Large)	12.74	19.85
	2nd week to 4th week	-32.24%	158.36	P = 0.000**	+0.59 (Large)	9.11	14.68
	Pre to 4th week	-53.00%	239.22	P = 0.000**	+0.81(Large)	22.83	33.56

Adjustment for multiple comparisons: Bonferroni.

**Table 4:** Analysis of NPRS and NDI within the Group C (Repeated measures analysis)

Study Group	Pre intervention (Mean ± SD) min-max	2nd week (Mean ± SD) min-max	4th week (Mean ± SD) min-max
<b>NPRS</b>	6.15 ± 0.61 (5.1- 6.9)	4.70 ± 0.88 (3.1-5.8)	2.45 ± 1.01 (1.1-4.2)
<b>Neck Disability Index in %</b>	50.80 ± 11.28 (28- 70)	37.60 ± 8.76 (20-54)	23.80 ± 6.61 (14-38)

\*\* Statistically Significant difference  $p < 0.05$ ; NS- Not significant; a. Friedman's ANOVA.

		Percentage of change	F value <sup>a</sup>	Significance <sup>b</sup> P value	Effect size r	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
<b>NPRS</b>	Pre to 2nd week	-23.57%	191.21	P = 0.000**	+0.69 (Large)	5.86	6.43
	2nd week to 4th week	-47.87%	305.84	P = 0.000**	+0.76 (Large)	4.29	5.11
	Pre to 4th week	-60.16%	480.85	P = 0.000**	+0.91(Large)	1.98	2.93
<b>Neck Disability Index in %</b>	Pre to 2nd week	-25.98%	233.79	P = 0.000**	+0.54(Large)	45.51	56.08
	2nd week to 4th week	-32.24%	158.97	P = 0.000**	+0.66 (Large)	33.49	41.70
	Pre to 4th week	-53.14%	255.55	P = 0.000**	+0.82(Large)	20.70	26.89

Adjustment for multiple comparisons: Bonferroni.

**Table 5:** Comparison of NPRS score between the three groups -Group A, B and C

	Percentage of difference	Effect size r	Between two Groups Significance a p value	95% Confidence interval of the difference		Between three Groups <sup>b</sup>
				Lower	Upper	
Pre intervention NPRS Score						
Group A and Group B	2.25%	0.12 Small	P = 0.732 (NS)	-0.587	0.307	0.396 p = 0.820 (NS)
Group B and Group C	-2.09%	0.11 Small	P = 0.764 (NS)	-0.317	0.577	
Group A and Group C	0.16%	+0.00 Small	P = 0.998 (NS)	-0.457	0.437	
2nd week of intervention						
Group A and Group B	-11.94%	+0.28 Small	P = 0.158 (NS)	-1.225	0.155	4.002 p = 0.135 (NS)
Group B and Group C	-1.89%	+0.05 Small	P = 0.953 (NS)	-0.605	0.775	
Group A and Group C	10.05%	+0.025 Small	P = 0.267 (NS)	-1.140	0.240	
4th Post Intervention NPRS Score						
Group A and Group B	46.62%	+0.57 (Large)	P = 0.001 **	-1.719	-0.411	12.935 p = 0.002 **
Group B and Group C	-14.39%	+0.19 (Small)	P = 0.358(NS)	-0.279	1.029	
Group A and Group C	32.85%	+0.37 (Medium)	P = 0.036**	-1.344	-0.036	

\*\* Statistically Significant difference  $p < 0.05$ ; NS- Not significant  
 a. Post Hoc Tests -Tukey HSD      b. Kruskal-Wallis Test

**Table 6:** Comparison of NDI between the Groups A, B and C

	Percentage of difference	Effect size r	<sup>a</sup> Between two Groups Significance p value	95% Confidence interval of the difference		Between three Groups <sup>b</sup>
				Lower	Upper	
Pre intervention NDI						
Group A and Group B	7.40%	0.15 (Small)	P = 0.568(NS)	-12.77	5.17	F = 0.531 p = 0.591 (NS)
Group B and Group C	-62.30%	0.10 (Small)	P = 0.797(NS)	-6.57	11.37	
Group A and Group C	2.79%	+0.06 (Small)	P = 0.925 (NS)	-10.37	7.57	
2nd week of intervention						
Group A and Group B	7.59%	+0.15 (Small)	P = 0.583(NS)	-9.23	3.83	F = 0.877 p = 0.422 (NS)
Group B and Group C	1.87%	+0.03 (Small)	P = 0.964(NS)	-7.23	5.83	
Group A and Group C	9.47%	+0.20 (Small)	P = 0.427(NS)	-9.93	3.13	
4th Post Intervention						
Group A and Group B	22.71%	+0.42 (Medium)	P = 0.021 **	-9.55	-0.65	F = 4.154 p = 0.021 **
Group B and Group C	-4.91%	+0.06 (Small)	P = 0.794 (NS)	-3.25	5.65	
Group A and Group C	17.84%	+0.33 (Medium)	P = 0.097 (NS)	-8.35	0.55	

\*\* Statistically Significant difference  $p < 0.05$ ; NS- Not significant  
 a. Post Hoc Tests -Tukey HSD      b. One way ANOVA



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## DISCUSSION

It is found from the analysis that 4 weeks of interventions consisting simultaneous application of Mechanical Cervical Traction along with Neural Mobilization for the subjects in Group A shown statistically significant greater percentage of improvement in pain, functional disability and severity of the radicular symptoms than Group B who received only Mechanical Cervical Traction and Group C who received only Neural Mobilization.

In Group A subjects the improvements could be because of simultaneous application of Mechanical Cervical Traction along with Neural Mobilization. In this present study maintaining the application of cervical traction for 1 min, slider neural mobilizations was applied during traction to mobilize and restore the normal structure and function of the nerve root that causing radiculopathy. Even though there are no standard parameters have been reported for cervical traction, it is speculated that traction causes distraction of articular surfaces, unloads the components of the spine by stretching muscles, ligaments, reduce adhesions within the dural sleeve, relieve nerve root compression within the central foramina, decreases pressure within intervertebral discs, relieves tonic muscle contraction and improves vascular status within the epidural space and perineural structures.<sup>13-17</sup>

Neural tissue mobilization techniques focus on restoring the ability of the nervous system to tolerate the normal compressive, friction, and tensile forces associated with daily and sport activities.<sup>8,9</sup> The techniques used in this study were tensioning technique, Sliding technique and Single Joint Movement technique which are commonly used Neural Mobilization techniques.<sup>28,29,30</sup> Sliding techniques during traction allows large range neurally non-aggressive movements. The clinical assumption is that these sliding techniques result in a larger longitudinal excursion of the nerve with a minimal increase in strain on impinged or tensed nerve. A gliding/ tensioning technique may reduce intraneural swelling and circulatory compromise via fluctuating effects on intraneural pressure. Nerve gliding is induced by elongation of the nerve bed which elongates the nerve, increases the nerve tension and intraneural pressure reducing the intraneural blood flow in the oedematous neuropathies. Dynamically altering intraneural pressure may result in a 'pumping action' or 'milking effect' with beneficial effects on nerve hydration as it facilitates evacuation of the intra neural oedema when correctly applied and

hence brings about a reduction in symptoms.<sup>31,32,33</sup> The effects of these techniques individually have been explored in many RCTs and systematic reviews. In a single case study by Christos Savva et.al found that cervical traction combined with neural mobilization significantly shown effective in improving pain and disability in a patient with cervical radiculopathy.<sup>19</sup>

In Group B (Traction Group), there were significant improvement in post intervention measurements and this could be because of Mechanical cervical traction received for 12 sessions that might have shown decrease in pain level and perceived disability in patients with cervical radiculopathy. In Group C (Neural Mobilization Group) the improvement could be because of Neural Mobilization Techniques that used to normalize the CNRs (cervical nerve root) structure and function via the possible reduction of nerve adherence, facilitation of nerve gliding and decreased neural mechanosensitivity.<sup>9</sup>

When the NPRS score and NDI means were compared at pre-intervention and 2<sup>nd</sup> week post intervention between the groups there was no statistically significant difference between the groups. When the means of 4<sup>th</sup> week post-intervention were compared between three group there was a statistically significant difference between the groups. There is significant improvement in severity of radicular Symptoms measured by Global Rating of Change Scale between the groups. Group A subjects shown greater percentage of reduction in severity of radicular Symptoms than Group B and C. These improvements were obtained without use of any conventional treatment techniques like exercises and modalities. The improvements obtained in Group A subjects were -71.33% in NPRS and -59.71% in NDI and with greater percentage of reduction in radicular symptoms following 12 sessions of treatment during 4 weeks of duration. Therefore, based on findings it was found that the simultaneous application of mechanical cervical traction along with neural mobilization received by Group A subjects found to be more effective than the Groups B and C subjects. Therefore, the present study rejects null hypothesis.

### Limitations of the Study:

Subjects with wide range group between 45 to 55 years of age were considered for the study, thus results cannot be generalized to individual age. Dosage of treatment parameters of the combined treatment techniques in the study was not standardized according to individual patients. Effectiveness are based on subjective outcome



measures therefore objective outcome measures were not used. The long term effect were not found.

### **Recommendation for future research:**

Further study is needed to find the effectiveness of combined techniques on outcome measures such as cervical spine movements, EMG studies, H reflex, muscle strength, and quality of life. Studies are needed on bilateral cervical radiculopathy and also with combination of other conventional treatment techniques, for other nerves involved in radiculopathy. Further randomized controlled trial is needed to find effect by increasing frequency of session in short term duration of study lesser than 4 weeks of treatment. The long term effect of these techniques needs to be studied by follow-up.

### **CONCLUSION**

The present study concludes that simultaneous application of mechanical cervical traction with neural mobilization is more effective in improving pain, functional disability and severity of radicular symptoms than mechanical cervical traction and neural mobilization alone for subjects with Unilateral Cervical Radiculopathy. The simultaneous application of mechanical cervical traction along with neural mobilization is recommended in the treatment of Unilateral Cervical Radiculopathy.

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