International Journal of Science and Healthcare Research
Vol.5; Issue: 1; Jan.-March 2020
Website: ijshr.com
Original Research Article *ISSN: 2455-7587*

Effects of Neural Tissue Mobilization versus Intermittent Cervical Traction in Unilateral Cervical Radiculopathy on Pain, Range of Motion and Quality of Life- A Comparative Study

Aniruddha Pradyuman Barot[1], Yagna Unmesh Shukla[2]

[1]Assistant Professor, SKUM College of Physiotherapy, Ahmedabad - 380054
[2]Senior Lecturer, Government Physiotherapy College, Ahmedabad - 380016

Corresponding Author: Aniruddha Pradyuman Barot

ABSTRACT

Introduction: The experience of pain is multi-dimensional & it is therefore important to provide a holistic approach when assessing and managing pain. As there is paucity in literature comparing effects of neural tissue mobilization versus intermittent cervical traction in unilateral cervical radiculopathy on pain, range of motion& quality of life, there was a need to conduct this study to fill the gap in the available literature.

Materials & Method: After taking informed, written consent patients were divided into 3 groups by simple random sampling method. Group A received neural tissue mobilization plus conventional treatment, Group B received intermittent cervical traction plus conventional treatment and Group C received conventional treatment. All the 3 groups received treatment 6 sessions per week for 2 weeks. Pre and post intervention NPRS, ROM and SF 12 were measured.

Results: Paired t test was applied to analyze pre and post outcome measures within group, while between groups analysis was done by using one way ANOVA test & bonferroni mulitple comparison test. There was statistically significant difference found in NPRS, cervical ROM and MCS of SF 12 at the end of 2 weeks in between group analysis ($p<0.05$). However, no statistically significant difference was found in PCS of SF 12 in between group analysis ($p>0.05$).

Conclusion: Neural tissue mobilization along with conventional therapy is more effective in reducing pain, improving cervical range of motion and mental component of quality of life in unilateral cervical radiculopathy patients than intermittent cervical traction and conventional therapy.

Keywords: Neural tissue mobilization, intermittent cervical traction, unilateral cervical radiculopathy, Quality of life, Range of motion, Pain

Declaration
Ethical approval was obtained from ethical committee & no financial burden was there on patients. Conflicts of interest were not there.

INTRODUCTION

Neck pain is a frequently reported complaint of the musculoskeletal system which has a large impact on health care expenditure; attributed to visits health care providers, sick leave and disability. [1] Twenty six to seventy one percent of the adult population experienced an episode of neck pain at some point in their lifetime. [2]

Cervical radiculopathy (CR) is, by definition, a disorder of the cervical nerve root and most commonly caused by a disc herniation, spondylitic spur, cervical osteophyte or space occupying lesion, resulting in inflammation, impingement or both which may lead to chronic pain and disability. [3] The average incidence rate of cervical radiculopathy is 83 per 1,00,000 for the population in its entirety with an increased prevalence occurring in the fifth

decade of life (203 per 1,00,000). [4,5] The most frequently involved nerve roots are the C5 and C6 nerve roots which are typically caused by C5-C6 or C6-C7 disc herniation or spondylosis. [5]

Neural tissue mobilization techniques theorize to examine the neural tension in nerves and mobilize the nerves that exhibit neural tension by passive/active movements by using tensioning and gliding and focused on restoring the ability of the nervous system to tolerate the normal compressive, friction and tensile forces associated with daily activities. [6,7] Neural tissue management uses specific positions and movements of the neck and arm to reduce nerve mechano-sensitivity, resolve symptoms and restore function. [8]

Cervical traction is a technique used to decompress the nerve root by separating the cervical segments through long axis traction. Many studies reveal that intermittent cervical traction for cervical radiculopathy found to be effective in reduction of pain and disability. [9-11]

According to the international association for the study of pain (IASP), pain is defined as 'an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage'. The experience of pain is multi-dimensional & it is therefore important to provide a holistic approach when assessing and managing pain. As there is paucity in literature comparing effects of neural tissue mobilization versus intermittent cervical traction in unilateral cervical radiculopathy on pain, range of motion & quality of life, there was a need to conduct this study to fill the gap in the available literature.

MATERIALS AND METHOD

- **Study design:** Comparative study
- **Study setting:** Physiotherapy department
- **Sampling technique:** Simple-random sampling (lottery method)
- **Study duration:** 6 months
- **Treatment duration:** 6 sessions per week for 2 weeks
- **Sample size:** 27 [calculated by using the G power software using 80% power and 95% confidence interval; Mean and standard deviation were used from previous similar study]
  - Group A: 09
  - Group B: 09
  - Group C: 09

❖ **Inclusion criteria:**
- ✓ Patient's willingness to participate
- ✓ Both Male and Female Subjects.
- ✓ Age group between 45-55 years.
- ✓ Unilateral radicular pain in upper limb since 3 months.
- ✓ Cervical range of motion less than 45º of extension and lateral flexion and 60º of rotation.
- ✓ Any two of the following tests positive: Spurling's test, Distraction test, Median neurodynamic test 1

❖ **Exclusion criteria**
- ✓ Any orthopedic or neurological conditions of cervical spine and shoulder joint
- ✓ Hypermobility of cervical spine
- ✓ Malignancy
- ✓ Vertebro-basilar insufficiency
- ✓ Patients undergone cervical surgeries
- ✓ Patients with bilateral cervical radiculopathies

❖ Materials used in study:

1. Assessment form
2. Consent form
3. Pen, pencil, paper
4. Numerical pain rating scale sheet
5. SF 12 questionnaire
6. Cervical traction unit
7. Interferential therapy unit with gel, cotton and micro-pore tape
8. Plinth
9. Chair
10. Weighing scale
11. Sand bag
12. Universal goniometer
13. Pillow

Figure-1 Materials used in the study

❖ Outcome measures:

➢ Numerical pain rating scale:
- The NPRS for pain is a uni-dimensional measure of pain intensity in adults. Similar to visual analogue scale (VAS), the NPRS is anchored by describing pain severity extremes. The NPRS can be administered verbally or graphically for self-completion.
- Reliability: High test-retest reliability (r=0.96)
- Validity: construct validity, the NPRS was shown to be highly correlated to the VAS in patients with rheumatic and other chronic pain conditions (pain>6 months) range from 0.86 to 0.95. [12]

➢ Universal goniometer:
- Excellent within session and between session intra-rater and inter-rater reliability, ICC2, 2= 0.79 to 0.92. [13]

➢ SF 12:
- The developers of SF 36 have consequently, suggested that a 12 item sub-set of the items may accurately reproduce the two summary component scores which can be derived from the SF 36 [the physical component score (PCS) and the mental component score (MCS)].
- The scores were put in the free online orthopedic calculator "orthotoolkit" and two summary scores have been generated: Physical component score and mental component score.
- Reliability: The ICC was found 0.61 for PCS and 0.57 for MCS composite scores. [14,15]

❖ **Procedure:**

All the participants of the study were advised to continue their normal routine activities but they should not take any pharmacological agents or other form of treatment other than the designed protocol, during the period of study.

After taking informed written consent patients were divided into 3 groups by simple random sampling method. And treatment was given 3 sessions per week for 2 weeks.

Group A: Interventional group

Patients of these group received neural tissue mobilization plus conventional treatment.

Patient's shoulder is abducted to 90º and laterally rotated then to slide the median nerve, alteration of elbow flexion (unloading the median nerve) with wrist and fingers extension (loading the median nerve) and elbow extension (loading the median nerve) with wrist and fingers flexion (unloading the median nerve) done for 6 sets of repetitions. [16] Each set was performed in a slow, oscillatory manner with 10 seconds rest between the sets.

Frequency: 6 sessions a week for 2 weeks.

Step 1: Starting position of neural tissue mobilization

Step 2: elbow flexion with wrist and finger extension

Step 3: elbow extension with wrist and finger flexion

Figure-2: Application of neural tissue mobilization

Group B: Interventional group

Patients of these group received intermittent cervical traction plus conventional treatment.

Patient was placed in supine position with cervical spine placed at 15º of flexion. The head halter was fitted under patient's occiput and chin. A safety switch was given to the patient and was instructed to press it, if any discomfort felt.

Patients were told that they would feel a gentle pull on their head and neck when the traction was applied, and for that it was important that they should relax as much as possible. [17]

Mode: Intermittent traction

Traction force: 10% of patient's body weight

Hold time: 20 seconds

Rest time: 10 seconds

Duration: 15 minutes

Frequency: 6 sessions a week for 2 weeks.

Figure-3: Application of intermittent cervical traction

Group C: Control group

Patients of these groups received conventional treatment only.

Patients received conventional treatment only, which includes application of interferential therapy, chin nods, isometric neck exercises and scapular strengthening exercises. [18]

They received treatment for 6 sessions a week for 2 weeks

- **Interferential therapy (IFT):**

Patient's position: sitting in a chair with hands supported on pillow.

Types of electrodes: 4 rubber electrodes were used. 2 electrodes were placed on the cervical region and 2 electrodes were placed on affected upper limb.

Frequency: 2 kHz

Base: 20 Hz

Spectrum: 40 Hz

Duration: 15 minutes

Figure-4: Patient receiving Interferential therapy

- Chin nods:

For activation of deep cervical flexors.

Patient's position: sitting

Patient is asked to tuck his/her chin and maintain for 10 seconds.

Repeat for 10 times

Figure-5: Patient performing chin nod exercise

- Isometric neck exercises:
  - For cervical flexion and extension:

Patient's position: sitting.
Patient has to push in forward/backward direction against the physiotherapist's resistance without moving his head (isometric contraction) for 10 seconds then release. Rest interval: 3 seconds. 10 repetitions.

Figure-6: Isometric neck exercises for cervical flexors and extensors

- For cervical lateral flexion:

Patient's position: sitting.
Patient has to push towards right/left side against the physiotherapist's resistance without moving his head (isometric contraction) for 10 seconds then release. Rest interval: 3 seconds. 10 repetitions.

Figure-7: Isometric neck exercises for cervical lateral flexors

- For cervical rotators:

Patient's position: sitting.
Patient has to push towards right side against the physiotherapist's resistance without moving his head (isometric contraction) for 10 seconds then release. Rest interval: 3 seconds. 10 repetitions


Figure-8: Isometric neck exercises for cervical rotators

- Scapular strengthening exercises:
  - For middle trapezius:

Position of the patient: prone with shoulder abducted to 90º and elbow flexed to 90º. Head may be turned to either side for comfort.
Instructions to the patient: ask the patient to lift the elbow towards the ceiling

Figure-9: Middle trapezius strengthening exercise

  - For lower trapezius:

Position of the patient: prone with shoulder abducted to 120º and forearm in mid prone position with thumb pointing towards the ceiling. Head may be turned to either side for comfort.
Instruction to the patient: ask the patient to raise the arm from the table.

Figure-10: Lower trapezius strengthening exercise

  - For serratus anterior:

Position of the patient: standing at the wall with the arms approximately shoulder width apart.
Instructions to the patient: ask the patient to push against the wall, and keep the elbows straight.

Figure-11: Serratus Anterior strengthening exercise

RESULTS

All outcome measures (NPRS, ROM and SF 12) were analyzed at baseline and after 2 weeks of treatment. Confidence interval was

kept at 95% and level of significance was kept at 0.05.

Table 1 shows gender distribution of the patients in all the 3 groups. There was a female predominance in all the 3 groups.

Table 1: Gender distribution among the 3 groups

Gender	Group A	Group B	Group C
Male count %	2 (22%)	4 (44%)	3 (33%)
Female count %	7 (78%)	5 (56%)	6 (67%)
Total	9	9	9

Shapiro-wilk test was applied to check whether the data follows normal distribution or not. No statistically significant difference was found between all the 3 groups (p>0.05). Which suggest that the data follows normal distribution.

Baseline data was calculated by using one way-analysis of variance (ANOVA) test. No statistical significance was found between the 3 groups. (p>0.05). Which suggests all the 3 groups were similar at baseline.

Table 2: Baseline characteristics

Variable/ outcome measures	Total (n=27)	Group A	Group B	Group C	F Value	P value
	Mean ±SD	Mean ± SD	Mean ± SD	Mean ± SD		
Age	49.07±3.67	49.67±3.60	49.33±3.20	48.22±4.41	0.362	0.70
NPRS	06.70±1.03	06.89±1.05	06.67±1.00	06.56±1.13	0.230	0.79
Cervical Extension ROM	34.30±2.90	34.22±2.33	33.78±2.22	34.89±1.76	0.626	0.54
Cervical side flexion ROM	35.11±2.53	34.78±2.72	35.22±2.27	35.33±2.82	0.113	0.89
Cervical Rotation ROM	45.59±3.26	46±3.27	45.67±3.42	45.11±3.40	0.160	0.85
SF 12 PCS	34.51±3.32	34.53±3.17	34.57±3.87	34.43±3.30	0.004	0.99
SF 12 MCS	33.73±4.48	34.95±4.05	34.22±5.44	32.02±3.72	1.04	0.36

Within group analysis for NPRS was done by using paired t test. Analyses showed significant difference between pre and post intervention in all the 3 groups. (p>0.05)

Table 3: Pre and post mean of NPRS within group A, B and C

Groups	Pre treatment		Post treatment		t value	p value
	Mean	SD	Mean	SD		
Group A	6.89	1.05	2.22	0.44	14.0	<0.001*
Group B	6.67	1.00	3.44	0.72	14.5	<0.001*
Group C	6.56	1.13	4.89	1.45	7.07	<0.001*

***p<0.05= statistically significant**

Between groups analysis for NPRS was done by using one way ANOVA test. Statistically significant difference was found between three groups. (p<0.05)

Table 4: Mean difference of NPRS between three groups

Difference in NPRS	Group A	Group B	Group C	F value	p value
Mean	4.67	3.22	1.67	31.25	<0.001*
SD	1.00	0.66	0.70		

***p<0.05= statistically significant**

Within group analysis of cervical range of motion (extension, side flexion affected side and rotation affected side) was done by using paired t test. Which showed statistically significant difference between pre and post intervention. (p<0.05)

Table 5: Pre and post mean of cervical extension ROM within group A, B & C

Groups	Pre treatment		Post treatment		t value	p value
	Mean	SD	Mean	SD		
Group A	34.22	2.33	43.11	2.26	19.54	<0.001*
Group B	33.78	2.24	41.11	1.96	22.00	<0.001*
Group C	34.89	1.76	40.33	2.55	14.40	<0.001*

***p<0.05= statistically significant**

Table 6: Pre and post mean of cervical side flexion ROM within group A, B & C

Groups	Pre treatment		Post treatment		t value	p value
	Mean	SD	Mean	SD		
Group A	34.78	2.72	43.89	1.26	13.48	<0.001*
Group B	35.22	2.27	41.67	2.39	15.64	<0.001*
Group C	35.33	2.82	39.67	2.82	18.38	<0.001*

***p<0.05= statistically significant**

Table 7: Pre and post mean of cervical rotation ROM within group A,B& C

Groups	Pre treatment		Post treatment		t value	p value
	Mean	SD	Mean	SD		
Group A	46.00	3.20	57.56	2.35	17.27	<0.001*
Group B	45.67	3.42	54.11	3.44	8.80	<0.001*
Group C	45.11	3.40	50.67	3.39	13.48	<0.001*

***p<0.05= statistically significant**

Between groups analysis of cervical range of motion was done with one way ANOVA test. Which showed statistically significance difference between three groups ($p<0.05$).

Table 8: Mean difference of cervical ROM between three groups

Difference in ROM		Group A	Group B	Group C	F value	p value
Cervical Extension	Mean± SD	8.89± 1.36	7.00± 0.70	5.44± 1.13	22.07	<0.001*
Cervical side flexion affected side	Mean± SD	9.11± 2.02	6.44± 1.23	4.33± 0.70	25.21	<0.001*
Cervical rotation affected side	Mean± SD	11.56± 2.00	8.44± 2.87	5.56± 1.23	17.57	<0.001*

***p<0.05= statistically significant**

Within group analysis for quality of life, using SF 12 (Short form 12) questionnaire was done by using paired t test. Two components were analyzed separately: physical component and mental component.

Table 9: Pre and post mean of PCS within group A, B & C

Groups	Pre treatment		Post treatment		t value	p value
	Mean	SD	Mean	SD		
Group A	34.53	3.17	53.59	2.19	17.50	<0.001*
Group B	32.28	3.61	51.71	1.81	15.12	<0.001*
Group C	34.43	3.30	50.36	2.27	13.71	<0.001*

***p<0.05= statistically significant**

Between groups analysis of both the components of SF 12 was done by using one-way ANOVA (Analysis of Variance) test. There was statistically significant difference found in mental component of SF 12 questionnaire ($p<0.05$) whereas, no statistically significant difference found in physical component of SF 12 questionnaire.

Table 10: Pre and post mean of MCS within group A, group B and group C

Groups	Pre treatment		Post treatment		t value	p value
	Mean	SD	Mean	SD		
Group A	34.95	4.05	55.81	3.32	11.98	<0.001*
Group B	32.06	4.24	46.77	4.54	7.56	<0.001*
Group C	32.02	3.72	41.17	4.07	6.20	<0.001*

***p<0.05= statistically significant**

Table 11: Mean difference of PCS & MCS between three groups

Difference in SF 12 scores		Group A	Group B	Group C	F value	p value
PCS	Mean± SD	19.05± 3.26	19.43± 3.85	15.93± 3.48	2.64	0.09
MCS	Mean± SD	20.86± 5.22	14.70± 5.83	9.14± 4.42	11.46	<0.001*

***p<0.05= statistically significant**

Multiple comparisons of NPRS was done by using bonferroni multiple comparison test. The p value for group A and group B was <0.05, for group A and C was <0.001 and for group B and group C was <0.001.

Table 12: Multiple comparison test (post-hoc analysis) for NPRS

Outcome measure	Comparison	p value
NPRS	Between group A & B	<0.05*
	Between group A & C	<0.001*
	Between group B & C	<0.001*

***p<0.05= statistically significant**

Multiple comparison for cervical ROM was done by using bonferroni multiple comparison test. In cervical extension ROM the p value was <0.05 between group A and B, <0.001 between group A and C as well as between group B and C. In cervical side flexion affected side and rotation affected side the p value was <0.05 between group A amd B as well as between group B and C and was <0.001 between group A and C.

Table 13:Multiple comparison test (post-hoc analysis) for cervical ROM

Outcome measure	Comparison	p value
Cervical extension	Between group A & B	<0.05
	Between group A & C	<0.001
	Between group B & C	<0.001
Cervical side flexion affected side	Between group A & B	<0.05
	Between group A & C	<0.001
	Between group B & C	<0.05
Cervical rotation affected side	Between group A & B	<0.05
	Between group A & C	<0.001
	Between group B & C	<0.05

***p<0.05= statistically significant**

Multiple comparison for SF 12 was done with bonferroni mulitple comparison test. p value was >0.05 between group A & B, group A & C and group B & C for PCS and p value was 0.04 between group A & B, <0.001 for group B & C and it was >0.05 between group B & C for MCS. Which suggest statistically significant difference in MCS between group A & B as well as between group A & C. Whereas, the difference is not statistically significant between group B & C for MCS as well as between all the three groups for PCS.

Table 14:Multiple comparison test (post-hoc analysis) for SF 12

Outcome measure	Comparison	p value
SF 12 PCS	Between group A & B	1.00
	Between group A & C	0.22
	Between group B & C	0.14
SF 12 MCS	Between group A & B	0.04*
	Between group A & C	<0.001*
	Between group B & C	0.09

***p<0.05= statistically significant**

DISCUSSION

At the end of 2 weeks, patients in all the three groups showed reduction in pain and improvement of cervical range of motion and SF 12 scores on statistical analysis.

The result showed that there was a statistical significant difference of effectiveness of pain and cervical range of motion (cervical extension, side flexion affected side and rotation affected side) between group A, group B and group C. There was also significant difference of MCS between group A & B and group A & C. But there was no statistical significant difference of MCS between group B and group C as well as no significant difference of PCS between all the three groups.

So here, all the three groups were improved after intervention. By comparing NPRS measure group A showed statistically significant improvement in pain, as well as increasing cervical range of motion and improving mental component score than group B and group C. The mean differences of NPRS, CROM and MCS were higher in group A as compared to other two groups.

As per the result of the study, the effects of neural tissue mobilizations can be due to the fact that sliding techniques result in a larger longitudinal excursion of the nerve with a minimal increase in strain on impinged or tensed nerve. Nerve gliding is induced by elongation of the nerve bed which elongates the nerve, increases the nerve tension and intra-neural pressure reducing the intra-neural blood flow in the oedematous neuropathies. Dynamically altering intra-neural 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. [19] 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. [20]

The effect of mechanical intermittent cervical traction on reducing neck and arm pain and neck disability in cervical radiculopathy is well documented in previous studies done by Joghataei et al 2004, Cleland et al 2005. The mechanism by which ICT reduces neck & arm pain is possibly by unloading the components of the spine by stretching muscles, ligaments & functional units, reducing adhesions within the dura sleeve, nerve root decompression within the central foramina. [21]

The effect in group C can be due to introduction of interferential therapy along with conventional exercises. Relief of pain is an important physiological effect obtained by the use of interferential therapy. The increase in local blood circulation due to the local pumping effect of the stimulated muscles or the effect on autonomic nerves and thus the blood vessels help removing the chemicals from the local area. [22]

The present study gives similar results with a study done by Raval et al, 2014 on "effect of simultaneous application of cervical traction and neural mobilization for subjects with unilateral cervical

radiculopathy. They concluded 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. [23]

Kim, Dong-Gyu et al, 2017studied effects of neural tissue mobilization on cervical radiculopathy patients' pain, disability, ROM and deep flexor endurance on 30 patients. The patients were divided into 2 groups: those who received manual cervical traction and those who received neural mobilization with manual cervical traction. NPRS, Neck disability index, ROM and deep flexor endurance were the outcome measures. They concluded that the neural tissue mobilization with manual cervical traction group is more effective than manual cervical traction group. [24]

CONCLUSION

The present study concludes that neural tissue mobilization along with conventional treatment is more effective in reducing pain and improving cervical range of motion and mental component of quality of life in unilateral cervical radiculopathy patients than intermittent cervical traction and conventional treatment.

CLINICAL IMPLICATION

Neural tissue mobilization can be used as the treatment of choice for cervical radiculopathy patients.

FUTURE SCOPE OF THE STUDY

Study can be done with bilateral cervical radiculopathy patients.

Neural tissue mobilization's effectiveness can also be determined for acute cervical radiculopathy patients.

Long term follow up of the patients can be taken to compare sustainability of treatments.

REFERENCES

1. Borghouts JAJ, Koes BW, Bouter LM. Cost of illness in neck pain in the Netherlands in 1996. Pain 1999; 80:629-36.
2. Côté P, Cassidy D, Coroll L. The Saskatchewan health and back pain survey. The prevalence of neck pain and related disability in Saskatchewan adults. Spine 1998; 23(15):1689-98.
3. Virali R. Raval, VinodBabu, Sai Kumar. N, & Amrita Ghosh. (2014). Effect of simultaneous application of cervical traction and neural mobilization for subjects with unilateral cervical radiculopathy. International Journal of Physiotherapy, 1(5), 269-278.
4. Eubacks JD. Cervical radiculopathy: non-operative management of neck pain and radicular symptoms. American family physicians 2010;81(1):33-40.
5. Radhakrishnan K, Litchy WJ, O'Fallon WM, Kurland LT. Epidemiology of cervical radiculopathy. A population based study from Rochester, Minnesota, 1976 through 1990. Brain. 1994;117 (2):325-335.
6. Walsh TT. Upper limb neural tension testing and mobilization. Fact, fiction and a practical approach. Journal of hand therapy. 2005; 18(2):241-258.
7. Nee RJ, Butler D. Management of peripheral neuropathic pain; integrating neurobiology, neurodynamics and clinical evidence. Physical therapy in sport. 2006; 7(3):36-49.
8. Nee R. Vicenzino B, Jull G, Cleland J and Coppieters M, et al. Neural tissue management provides immediate clinically relevant benefits without harmful effects for patients with nerve related neck and arm pain; randomized trial: Journal of physiotherapy. 2012, 58, Australian physiotherapy association 2012.pp 23-31.
9. Clealand AJ, hitman JM, Frit JM, Manual physical therapy, cervical traction and strengthening exercises in patients with cervical radiculopathy: a case series. Journal of orthopedic and sports physical therapy. 2005
10. Joghataei MT, Arab AM, Khaksar H. The effect of cervical traction combined with conventional therapy on grip strength on patients with cervical radiculopathy. Clinical rehabilitation, 2004
11. Moeti P, Marchetti G. Clinical outcome from mechanical intermittent cervical traction for the treatment of cervical radiculopathy: a case series: Journal of orthopedic and sports physical therapy. 2001

12. Ferraz MB et al, Reliability of pain scales in the assessment of literate and illiterate patients with rheumatoid arthritis. J Rheumatol 1990;17: 1022-4.
13. Muhammad Nazim Farooq et al, Pak J med sci. 2016 Mar-Apr; 32 (2): 457-461.
14. TianyaoHuo et al. assessing the reliability of the short form 12 (SF 12) health survey in adults with mental health conditions: a report from the wellness incentive and navigation (WIN) study. Health and quality of life outcomes (2018) 16:34.
15. www.orthotoolkit.com
16. Shacklock M. Clinical neurodynamics: a new system of musculoskeletal treatment. Elsevier Butterworth-Heinemann, 2005.
17. Fater DCW, Kernozek TW: Comparison of cervical vertebral separation in the supine and seated position using home traction units. Physiotherapy Theory pract. 24:430, 2008. , C. Starkey, Therapeutic modalities, 4th edition, F.A. Davis company
18. V. Rajalaxmi et al. To compare effectiveness of interferential therapy with and without neural mobilization along with conventional therapy in cervical radiculopathy patients. International journal of physiotherapy and occupational therapy.Vol. 1, Issue 1, Jun 2015, 65-74.
19. Dilley A, Lynn B, Greening J, DeLeon N. Quantitative in vivo studies of median nerve sliding in response to wrist, elbow, shoulder and neck movements. Clinical Biomechanics. 2003; 18(10):899–907
20. C. Savva et al. The effect of cervical traction combined with neural mobilization on pain and disability in cervical radiculopathy-a case report. Manual therapy 5(18), 443-446, 2013.
21. Sharma et al, effectiveness of TENS versus intermittent cervical traction in patients with cervical radiculopathy. International Journal of Physiotherapy and Research,Int J PhysiotherRes 2014, Vol 2(6):787-92. ISSN 2321-1822 DOI: 10.16965/ijpr.2014.693
22. Jagmohan Singh, Textbook of electrotherapy. 2nd edition, New Delhi, Jaypee brothers medical publishers (P) ltd. 2012, pg. 135-150.
23. V. Raval et al, 2014. Effect of simultaneous application of cervical traction and neural mobilization for subjects with unilateral cervical radiculopathy. Int J Physiother. Vol 1(5), 269-278, December (2014)
24. Kim Dong-Gyu et al. Journal of back and musculoskeletal rehabilitation. DOI 10.3233/BMR-140191. Vol.30, no.5, pp.951-959, 2017.

How to cite this article: Barot AP, Shukla YU. Effects of neural tissue mobilization versus intermittent cervical traction in unilateral cervical radiculopathy on pain, range of motion and quality of life- a comparative study. International Journal of Science & Healthcare Research. 2020; 5(1): 132-142.

******