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### EFFECTIVENESS OF TENS VERSUS LASER ON PAIN AND DISABILITY IN SUBJECTS WITH CERVICAL RADICULOPATHY

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**Abstract:** **INTRODUCTION:** Cervical Radiculopathy is a condition which results in neck pain radiating to upper limb, numbness, and weakness, which often results in significant functional limitations and disability. **AIM:** Aim of the study is to compare the efficacy of TENS versus LASER on pain and disability in subjects with Cervical Radiculopathy. **OBJECTIVES:** •To study the efficacy of TENS on pain with VAS and disability by NDI in subjects with Cervical Radiculopathy. •To study the efficacy of LASER on pain with VAS and disability by NDI in subjects with Cervical Radiculopathy. •To compare the efficacy of TENS and LASER on pain and neck disability in subjects with Cervical Radiculopathy. **METHODS AND MATERIALS:** 30 subjects were randomly assigned into two Experimental groups i.e. Group 1 and Group II based on the computerized randomization. The subjects in Group I were given LASER, Active neck and shoulder rom exercises, Isometric neck exercises& home advices and those in Group II were given TENS, Active neck and shoulder rom exercises, Isometric neck exercises& home advices. All the participants were assessed with VAS and NDI before and after the treatment. **RESULTS:** According to the obtained values, the pre and post test values of VAS and NDI had a extremely significant effect with p value<0.05 in both groups but there is a high significance results in Group-II, compared to Group-I. **CONCLUSION:** Results suggest that TENS is more effective than LASER in Cervical Radiculopathy subjects.

**Keywords:** Cervical Radiculopathy, Transcutaneous electrical nerve stimulation, Light amplification by the stimulated emission of radiation



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## INTRODUCTION

Cervical Radiculopathy is dysfunction of a cervical nerve root resulting in pain in the neck and arm with associated sensory, motor, and reflex abnormalities. Involvement of the ventral root of the spinal nerve results in motor weakness, and involvement of the dorsal root of the spinal nerve results in sensory deficits. Involvement of either root may result in reflex abnormality because the reflex arc comprises both (pertinent to C5, C6, and C7). In most cases, both the ventral and dorsal roots are affected, resulting in motor and sensory Cervical Radiculopathy<sup>(1)</sup>.

Cervical Radiculopathy is one of the most common health related complaints<sup>(2)</sup>. Cervical Radiculopathy is a pathological condition of the nerve root. That may lead to chronic pain and disability<sup>(3)</sup>. The term Radiculopathy implies consistently reproducible neurological findings, motor loss, sensory abnormalities and reflex changes<sup>(4)</sup>. Evidence exists that inflammatory mediators, including nitric oxide, prostaglandin, interleukin-6 and matrix metalloproteinase are released by herniated intervertebral discs<sup>(5,6,7)</sup>

Cervical Radiculopathy causes symptoms that radiate away from neck, often reported as upper extremity pain and numbness. Although the problem is in neck, the symptoms will be felt wherever the nerve travels that is in shoulder, arm, and hand. The most common levels of root involvement in cervical Radiculopathy are C6 and C7<sup>(5, 8,9)</sup>

Medical management of cervical Radiculopathy includes analgesics, antidepressants, muscle relaxants, opioids, NSAIDS to treat pain , inflammation and muscle spasm.<sup>(5,8,10)</sup>.

Surgical management is optioned when there is intractable pain, progressive neurological deficits and spinal cord compression .surgical management is decompressing the nerve roots and spinal cord and removing the offending osteophytes.<sup>(8)</sup> Most common surgical approach is anterior cervical fusion.<sup>(5,8)</sup>

Traditional treatment of cervical Radiculopathy in physiotherapy include rest, hot packs, Intermittent Cervical Traction(ICT), Inter Ferential Therapy(IFT), Transcutaneous Electrical Nerve Stimulation(TENS), Light amplification by stimulation of emission of radiation(LASER), mobilizations, manipulations, postural corrections, neck exercises and home advices<sup>(11,12,13,14)</sup>.

TENS is a non-invasive analgesic treatment that is used to relieve nociceptive, neuropathic, and musculoskeletal pain<sup>(15)</sup>.

The TENS is selectively to excite A- $\beta$  nerve fibres and produce an analgesic effect by gating signals conveyed by pain A  $\delta$  and C fibres<sup>(16)</sup>.

LASER was demonstrated to modulate inflammatory, proliferative and remodelling phases of healing process <sup>(17,18)</sup>. Additional effects appear to include a direct influence on neural structures that are damaged by compression (or) inflammation. This improves nerve recovery <sup>(19, 20, 21)</sup>.

Studies to find out the effectiveness of TENS versus LASER among subjects with cervical Radiculopathy are sparse. Hence the present study was undertaken with an intention to find out and compare effectiveness of TENS versus LASER a newer technique towards better in treatment of Cervical Radiculopathy subjects.

### **NEED OF THE STUDY**

Cervical Radiculopathy is a condition in which there is a narrowing of spinal canal and neural foramina and it occurs even after medical management.

Several studies have been conducted to examine the recovery of the neck and arm pain in Cervical Radiculopathy subjects. It estimated that 50% of the population will experience neck and arm pain at some point in their life time.

A multitude of physical therapy interventions has been effective in the management of Cervical Radiculopathy include Intermittent cervical traction, Inter ferential therapy, TENS, LASER, Mobilizations, Manipulations. Yet the results of these studies are controversial <sup>(22)</sup>.

As there are many controversial and unclear results, to overcome the problem of re-occurrence and make the treatment feasible, hence there is a clear need to know whether TENS or LASER is effective in subjects with Cervical Radiculopathy in reducing pain and disability.

### **AIM OF THE STUDY**

Aim of the study is to compare the efficacy of TENS versus LASER on pain and disability in subjects with Cervical Radiculopathy.

### **OBJECTIVES OF THE STUDY**

To study the efficacy of TENS on pain with VAS and disability by neck disability index in subjects with Cervical Radiculopathy

To study the efficacy of LASER on pain with VAS and disability by neck disability index in subjects with Cervical Radiculopathy.

To compare the efficacy of TENS and LASER on pain and neck disability in subjects with Cervical Radiculopathy

## **MATERIALS AND METHODOLOGY**

30 subjects were randomly assigned into Group I and Group II based on the computer randomization<sup>(23)</sup>.

**SOURCE OF DATA:** subjects were recruited from Neurology OP and Department of Physiotherapy SVIMS.

**STUDY DESIGN:** Two way Experimental design

**SAMPLE SIZE:** A total of 30 Samples were taken, 15 Samples were divided into each group.

**SAMPLING TYPE:** Simple random sampling.

### **MATERIALS:**

- TENS machine – Techno med
- LASER- Techno med
- High couch
- Chair
- Pillows
- Conductive gel
- Adhesive plaster
- Scissor
- Neck disability index
- Visual analogue scale

**STUDY DURATION:** Six months duration from September 2015-February2016.

### **INCLUSION CRITERIA:**

- Subject between the age group 35-55 Years.
- Subjects of both males & females were included.
- Subjects with neck pain radiating to upper limb.

- Subject with positive compression test.
- Subjects with positive upper limb tension test 1 or 2 or both.
- Subjects with Cervical Radiculopathy more than 4 weeks.
- Subjects with significant changes in radiological findings.

**EXCLUSION CRITERIA:**

- Subject with Radiculopathy by other cause <tumours, infections>.
- Subject with Cervical Myelopathy.
- Subjects with Spondylolysthesis of cervical spine.
- Subjects with progressive motor deficit.
- Subjects with spinal canal stenosis.
- Subjected with any orthopaedic problem in effected upper limb.

**METHODOLOGY:**

The Subjects who fulfilled the inclusion criteria were randomly assigned into two groups. Group-I received LASER, and Group-II received TENS. Informed consent was taken from all the subjects. Prior to the treatment, pre-test values of VAS and NDI were measured.

**TREATMENT PROTOCOL:**

**EXPERIMENTAL GROUP-1:**

- LASER for 12 min.
- Active neck & shoulder ROM exercises.
- Isometric neck exercises.

Diode LASER was given for 12 min by Techno med machine, using the Frequency of 3HZ, Wave length of 808nm(red), power output was 200mW, Diode surface 1cm<sup>2</sup>, Energy density 2J/cm<sup>2</sup> at each point, Power density 12Mw/cm<sup>2</sup>, number of points 6, for each point 2 minutes, site of tender points neck, shoulder, scapula, elbow, dorsum of fore arm, wrist. Daily energy delivered 12J, Total energy delivered 180J, Application mode is probe held stationary in contact with skin<sup>(24)</sup>.

Subjects were made to sit comfortably in the chair with the arm relaxed position by supporting the pillow under the arm and foot are contact with ground, advised the patient to wear goggles and LASER is given as per the points with probe held contact with the skin.

#### **EXPERIMENTALGROUP-2:**

- TENS for 12 min.
- Active neck & shoulder ROM exercises.
- Isometric neck exercises.

TENS was given for 12min by Techno med machine, using the frequency of 5HZ and Intensity of high pulse duration 300 microseconds and placement of electrodes for TENS was: area of greater intensity of pain<sup>(25)</sup>.

Subjects were made to sit comfortably in a chair with the arm relaxed position by supporting the pillow under the arm and foot are contact with ground and TENS is given at area of greater intensity of pain.

#### **HOME PROGRAMME:**

Subjects of both the groups were given Home advices like usage of semi hard cervical collar, Heat (or) Cold application and Ergonomics like Postural corrections, avoid forward bending, Neck flexion activities.

**TREATMENT SESSIONS:** 5 sessions of treatment for a week was given, for a period of 5 weeks, in both groups.

#### **OUTCOME MEASURES:**

1. **PAIN:** Pain was measured by visual analogue scale. Subject was given a 10cms rating marked score, where '0'- no pain & '10'-severe pain and was asked to mark his pain levels<sup>(26)</sup>.

2. **NECK DISABILITY:** Neck disability index is a 10 item questionnaire designed to measure disability in neck. All the items were answered and percentage of disability was calculated<sup>(27)</sup>.

Pre values were recorded at the first day of treatment and Post values were recorded after 5<sup>th</sup> week for all the outcome measures, VAS and NDI.

**STATISTICAL ANALYSIS**

Statistical analysis was done using Graph pad instant 3 version software Excel, SPSS16.0. For this purpose the data was entered into Microsoft excel spread sheet, tabulated and subjected to statistical analysis.

Out of the 30 subjects, 15 were randomized into Group I and 15 into Group II. all the subjects completed the entire study protocol by 5 weeks, as defined. The outcome measures of this study for which statistical analysis was done are VAS and NDI.

Description of study subjects by age and sex in Group I and Group II:

Group I

Gender	Number of Subjects	Mean Age(Years)	SD
Females	7	44.14	6.939
Males	8	43.25	5.175

SD=Standard Deviation

Group II

Gender	Number of Subjects	Mean Age(Years)	SD
Females	7	48.50	7.387
Males	8	43.43	4.995

SD=Standard Deviation

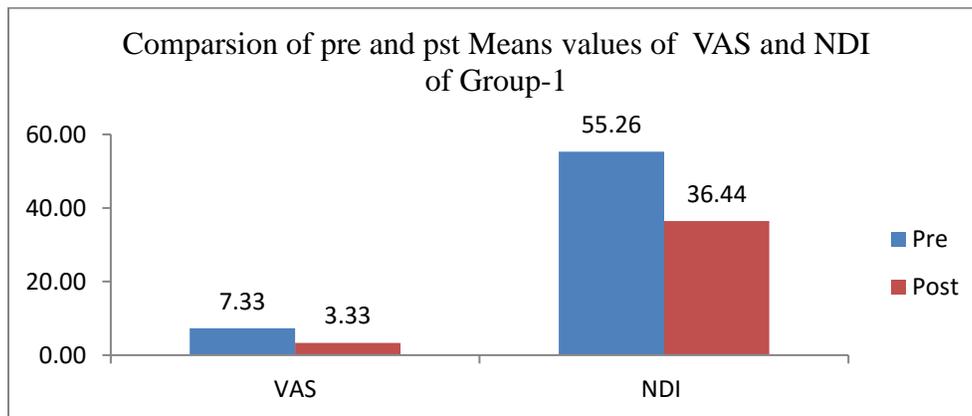
**TABLE-I: ANALYSIS OF PRE AND POST MEAN VALUES OF VAS AND NDI OF GROUP-I**

Group-1		N	Mean	SD	Std. Error	df	t-value	p-value
VAS	Pre	15	7.33	0.724	0.187	14	14.491	0.000
	Post	15	3.33	1.234	0.319			
NDI	Pre	15	55.26	7.752	2.002	14	8.263	0.000
	Post	15	36.44	7.002	1.808			

SD=Standard deviation, df=degrees of freedom

To compare pre-post values for the parameters VAS and NDI in Group-I, t-test for paired sample observations has been utilized. It is observed that the post values have shown some significant impact on the subjects.

The following diagrammatic representation represents the mean scores for the parameters VAS and NDI in pre and post values Group-1.



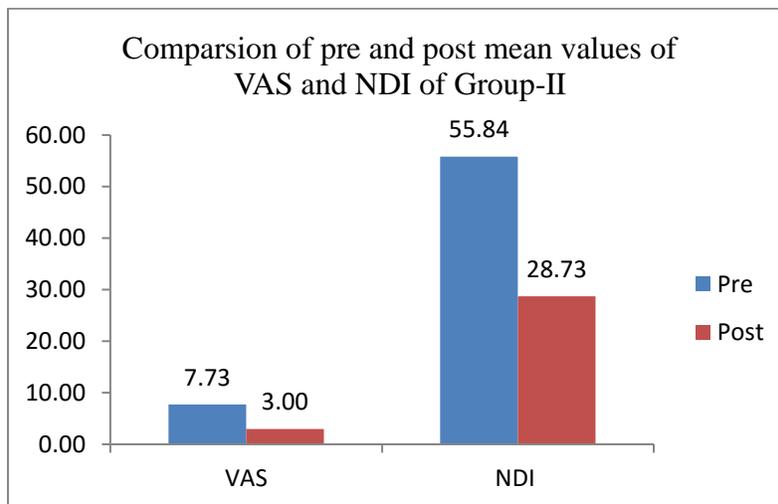
**TABLE-II : ANALYSIS OF PRE AND POST MEAN VALUES OF VAS AND NDI OF GROUP-II**

Group-II		N	Mean	SD	Std. Error	df	t-value	p-value
VAS	Pre	15	7.73	0.884	0.228	14	11.953	0.000
	Post	15	3.00	1.414	0.365			
NDI	Pre	15	55.84	9.135	2.359	14	13.036	0.000
	Post	15	28.73	6.221	1.606			

SD=Standard deviation, df =degrees of freedom.

To compare pre-post values for the parameters VAS and NDI in Group II, t-test for paired sample observations has been utilized. It is observed that the post values have shown some significant impact on the subjects.

The following diagrammatic representation represents the mean scores of parameters VAS and NDI in pre and post values of Group-II.



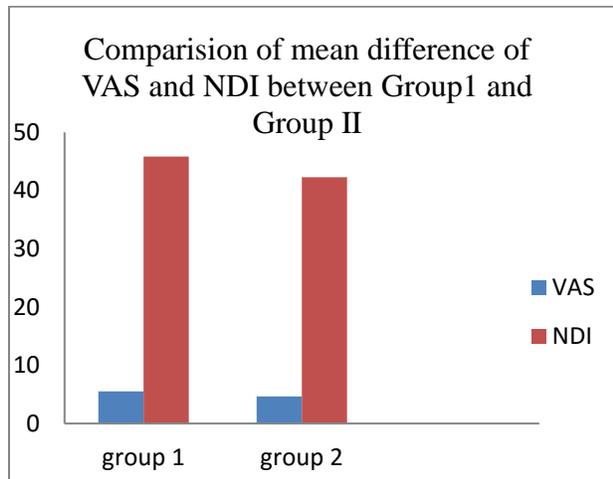
**TABLE-III: ANALYSIS OF COMPARISON OF MEAN DIFFERENCE OF VAS AND NDI BETWEEN GROUP-I AND GROUP-II**

Group		N	Mean	SD	Std. Error	df	t-value	p-value
VAS	1	15	4.00	1.069	0.276	28	1.519	0.140
	2	15	4.73	1.534	0.396			
NDI	1	15	18.83	8.824	2.278	28	2.684	0.012
	2	15	27.11	8.053	2.079			

SD=Standard deviation, df=degrees of freedom

To test the significance between Group I and Group II the unpaired t-test has been used. It is observed that there is a significant impact between Group I and Group II.

From above table we observe that there is a high reduction in Group II when compared to the Group I. The following diagrammatic representation represents the reduction in the respective parameters.



## RESULTS

According to the obtained values, the pre and post test values of VAS and NDI had a extremely significant effect with  $p$  value  $< 0.05$  in both groups but there is a high significance results in Group-II, compared to Group-I.

## DISCUSSION

The purpose of this study was to investigate the effectiveness of TENS versus LASER on pain and disability in subjects with Cervical Radiculopathy.

Based on the statistical analysis, the alternate hypothesis stating that TENS reduces pain and increases functional abilities in subjects with Cervical Radiculopathy can be accepted and null hypothesis is rejected.

Group-I (who were treated with LASER) and Group -II (who were treated with TENS) both showed statistically significant difference between pre and post treatments in values of VAS and NDI. But the subjects in Group-II showed better improvement than Group-I in terms of scores in VAS and NDI.

The Statistical significant results in Group-I can be explained due to the effect of LASER and exercise protocol given.

The biological actions of LASER are multiple. Studies have documented changes in biochemical markers of inflammation, the distribution of inflammatory cells and a reduction in the occurrence of oedema, haemorrhage and necrosis after local Laser irradiation with different sources of Laser beams (wave length of 660&684nm, 780nm&904nm)<sup>(17,18)</sup>.

Additional effects may include a direct influence on neural structures that are damaged by compression<sup>(19,20,21)</sup>. LASER phototherapy improves peripheral nerve recovery<sup>(28)</sup>. LASER may

have direct effect on neural structures. Which could increase the nerve recovery (or) inhibit A $\delta$  & C Fibres transmission<sup>(24)</sup>.

Isometric neck exercises, Active neck & shoulder ROM exercises strengthen the neck without irritation of soft tissues (or) joints of cervical area<sup>(29)</sup>.

The LASER might have contributed to alter the mechanics of surrounding muscle and fascia therefore showed statistical significant results.

The inadequate dosages used might be the main reason for the inconsistency among the LASER efficacy trials and application parameters of LASER (wavelength, intensity, duration) may effect the final improvement in pain or functional limitation. No scientific consensus seemed to exist on the application dosage of LASER. Even experts cannot agree on appropriate parameters for LASER therapy<sup>(30)</sup>.

In Group-II, TENS have the reason behind Statistical significant improvement, when compared to Group-I.

Pain control TENS units typically produce a continuous train of pulsed current at frequencies in the range 1 to 120HZ, some as high as 200HZ. The pulses are normally rectangular in shape, biphasic and the pulse duration is normally 50-200ms. The aim is selectively to excite A- $\beta$  nerve fibres and produce an analgesic effect by gating signals conveyed by pain A $\delta$  & C fibres<sup>(25)</sup>.

In present study we are used High Rate TENS optimally stimulated A- $\beta$  fibres, not because of its higher frequency but small pulse width. The short pulse duration results in preferential recruitment of the largest diameter nerve fibres<sup>(15,16)</sup>

Pain control of TENS is provided by Gate control theory it suggest that large myelinated A $\beta$  fibres provide pathway for TENS. These fast-conducting fibres are highly sensitive to electrical stimulation and quickly conduct the electrical impulse to the spinal cord. Small, slower-conducting non-myelinated C fibres carrying noxious stimuli are unable to pass their message. The mechanism by which nociceptive fibres are prevented from pass on their message to the spinal cord is described as presynaptic inhibition, which may cause reduction of pain<sup>(22)</sup>.

Additional mechanisms by which TENS may inhibit pain is

\*Direct inhibition on an excited abnormal firing nerve.

\*Restoration of an artificial afferent input in Differentiation and central pain.

\*Role played by endogenous opioid peptides<sup>(15)</sup>.

Isometric neck exercises, active neck and shoulder ROM exercises strengthen the neck without irritation of the soft tissue(or) joints of cervical area<sup>(30)</sup>.

Hence Group-II who received TENS showed Statistical significant result.

## CONCLUSION

It is concluded from this study that subjects of Cervical Radiculopathy who underwent TENS showed significant results in alleviating pain and increase in functional activities rather than subjects with Cervical Radiculopathy who underwent LASER.

Hence, it is concluded that TENS is more effective in improving pain and functional activities in subjects Cervical Radiculopathy Alternate hypothesis is accepted and null hypothesis is rejected.

## LIMITATIONS

1. The sample size is relatively small and require much more samples to get a proper generalization about TENS.
2. Long term effects have not been studied.
3. The amplitude of TENS varies subjectively and needs more clear description to avoid bias in the studies.

## RECOMMENDATIONS

1. Studies may further be conducted on specific nerves.
2. Follow up may be studied, to evaluate the recurrence rate.

## REFERENCES

1. Caridi J, Pumberger M, Hughes A. Cervical Radiculopathy: a review. HSS J 2011; 7: 265–72.
2. Ellenberg MR, et al: Cervical Radiculopathy. Archives of Physical Medicine and Rehabilitation 75:342-352, 1994.
3. Rubinstein SM, Pool JJM, van Tulder MW, Riphagen II, de Vet HCW. A systematic review of the diagnostic accuracy of provocative tests of the neck for diagnosing cervical radiculopathy. Eur Spine J 2007; 16: 307–19.
4. Charles R. Clark, The Cervical spine 4<sup>th</sup> edition, The Cervical spine research Society.
5. Noseworthy, Miles J Belgrade and Orlando Charry. Neurological Principles & Practice, Radicular Limb Pain, 2<sup>nd</sup> ed, 2006. Malaysia: Informa health care.223-36.

6. Furusawa N, Baba H, Miyoshi N, et al. Herniation of cervical intervertebral disc: immunohistochemical examination and measurement of nitric oxide production. *Spine*. May 15 2001; 26 (10):1115-16.
7. Kang JD, Stefanovic-Racic M, McIntyre LA, Georgescu HI, Evans CH. Toward a biomechanical understanding of human intervertebral disc degeneration and herniation. Contributions of nitric oxide, interleukins, prostaglandin E2, and matrix metalloproteinase's. *Spine*. May 15 1997; 22 (10): 1065 -73.
8. Wilkins, Rengachary Setti. *Neurosurgery, Cervical Disc and Cervical Spondylosis*, 2<sup>nd</sup> edition. [http://www.Allaboutbackpain.com/html/cervical/spine-cervical radiculopathy](http://www.Allaboutbackpain.com/html/cervical/spine-cervical%20radiculopathy).
9. Samuels, *Manual of Neurologic Therapeutics*, 7<sup>th</sup> ed, Neck and Back pain, Philadelphia, Lippincott Williams & Wilkins.76-86.
10. Cameron M.H; *Physical agents in rehabilitation, from research to practice*, 1<sup>st</sup> ed, W.B Saunder, Philadelphia, 1999.221.
11. Ann Thomson, Alison Skinner, Joan Piersy: *Tidys physiotherapy*, 12<sup>th</sup> ed, Butterworth Heinemann(p)Ltd. Oxford, 1991,113-19.
12. Jayanth Joshi, Prakash Kotwal: *Essentials of Orthopaedics and Applied Physiotherapy*, Elsevier, New Delhi, 1999, 386-95.
13. Natrajan. M et al: "Natrajans text book of Orthopaedics and Traumatology ", 5<sup>th</sup> edition, MNOH, India, 2002,119.1996,Mcgrawhill:USA.3765-74.
14. Johnson M. Transcutaneous electrical nerve stimulation. In: Watson T,ed. *Electrotherapy: Evidence-based Practice*. Edinburgh: Churchill Livingstone, 2008; 253–96.
15. John Low Ann Reed, *Electrotherapy explained principles and practice*; 4th edition.
16. Reis SR, Medrado AP, Marchionni AM, et al. Effect of 670-nm laser therapy and dexamethasone on tissue repair: A histological and ultrastructural study. *Photomed Laser Surg* 2008; 26: 307–13.
17. Vasheghani MM, Bayat M, Rezaei F, Bayat A, KarimipourM. Effect of low-level laser therapy on mast cells in deep second-degree burns of rats. *Photomed LaserSurg* 2008; 26: 1–5.
18. Gigo-Benato D, Geuna S, Rochkind S. Phototherapy for enhancing peripheral nerve repair: A review of the literature. *MuscleNerve* 2005;31(6):694–701.1176.
19. Rochkind S, Barrnea L, Razon N, Bartal A, Schwartz M. Stimulatory effect of He-Ne low dose laser on injured sciatic nerves of rats. *Neurosurgery* 1987; 20: 843–7.
20. Rochkind S, Drory V, Alon M, Nissan M, Ouaknine GE. Laser phototherapy (780 nm), a new modality in treatment of long-term incomplete peripheral nerve injury: A randomized double-blind placebo-controlled study. *Photomed Laser Surg* 2007; 25: 436–42.
21. Foster. A. et al,: " Clayton's electrotherapy", theory and practice, 9<sup>th</sup> ed, AITBS, India, 1996.102-109.
22. <http://www.graphpad.com/quickcalcs/randomnl.cfm>.

23. Ljubica, M.Konstantinovic, Milisav,AlexanderLow-Level Laser Therapy for Acute neck pain with Radiculopathy: A Double - Blind placebo-Controlled Randomized study; Pain medicine 2010;11:1169-1178.
24. Smati Sambyal, Sandeep Kumar "Comparison between Nerve Mobilization and Conventional Physiotherapy in Patients with Cervical Radiculopathy." www.ijird.com August, 2013 Vol 2 Issue 8.
25. Anna Maria Carlsson. Aspects of the reliability and validity of the visual analogue scale.pain.Volume16, Issue1, May1983, Pages 87-101.
26. Vernon H, Mior S. The Neck Disability Index: a study of reliability and validity Manipulative Physiol Ther.1991 Sep; 14(7):409-15.
27. Roberta Tchaw, Mark/ JohnsonEfficacy of low-level laser therapy in the management ofneck pain: a systematic review and meta-analysis of randomised placebo or active treatment controlled trialsNovember 13, 2009 DOI:10.1016/S0140-6736(09)61522-1.
28. Yesim Dusunceli, MD, Cihat Ozturk, MD, Funda Atamaz, MD, Simin Hepguler, MD and Berrin Durmaz, md. Efficacy of neck stabilization excersises for neck pain: a randomized controlled study. Journal of rehabilitation medicine 2009; 41: 626-31.
29. Thorsen H, Gam AN, Swensson BH, Jess M, Jensen MK, Picullel I, Schack LK, Skjott K. LASER therapy formyofascial pain in the neck and shoulder girdle. A double-blind, cross-over study. Scand J Rheumatol 1992; 21(3):139–141.