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A Study on Assessing The Effectiveness of Cold Laser Therapy With Neural Mobilization Along with Exercises And Transcutaneous Electrical Nerve Stimulation with Neural Mobilization Along with Exercises in Discogenic Cervical Radiculopathy – Comparative Study.

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Abstract
Objectives: *To assess the effectiveness of LLLT with Neural mobilization along with Exercises AND TENS with Neural mobilizations along with Exercises. By assessing the effectiveness of pain reduction using VAS scale, by assessing the effectiveness of neck ROM using UG, by assessing the effectiveness of neck disability using NDI.*
Back Ground: *Cervical radiculopathy is a dysfunction of a nerve root of the cervical spine, most commonly caused by a cervical disc herniation, spondylotic spur, cervical osteophyte or other space-occupying lesion, resulting in nerve root inflammation, impingement or both which may lead to chronic pain and disability. The average annual incidence rate of cervical radiculopathy is 83 per 100,000 with an increased prevalence occurring in the 5th decade of life (203 per 100,000). Some reports show that it is predominant in men and others shown predominance in women.*
The purpose of the study is to assess "The effectiveness of LLLT with Neural mobilization along with Exercises AND TENS with Neural mobilizations along with Exercises on discogenic cervical radiculopathy".
Method: *In this study 60 patients with both genders were randomly selected satisfying inclusion and exclusion criteria and were divided into two groups each consisting of 30 patients. Group-A: patients received Cold laser therapy (LLLT) with Neural mobilization along with Exercises. Group-B patients received TENS with Neural mobilization along with Exercises. Both the groups were treated for 15 sessions for 3 weeks. Patients were evaluated for pain using VAS, ROM using universal goniometer and functional ability by NDI score on pretreatment, end of 1st week, end of 2nd week and end of 3rd week respectively.*
Outcome Measures: *Pain was measured by VAS scale, ROM was measured by using Universal Goniometer and functional ability was measured by using NDI questionnaire. The values were compared to see which group has better improvement. The values were statistically analyzed to determine their effect in reducing pain, improving ROM and improving functional ability of the neck.*
Result: *Descriptive statistics was used to calculate Mean and SD. Paired t-test was used to compare the effectiveness of Group A with Group B in reducing pain, improving range of motion and functional ability in discogenic cervical radiculopathy. The effectiveness of treatment was calculated by Repeated measures of ANOVA. The scores of VAS, ROM and NDI showed improvement in mean values of Group A when compared to Group B with p value<0.05 and df= 29.*
Conclusion: *By statistical analysis it was found that there is significant improvement seen in (Group A) using-Cold laser therapy (LLLT) with Neural mobilization along with Exercises than (Group B) using TENS with Neural mobilization along with Exercise in reducing pain, improving range of motion and functional ability in discogenic cervical radiculopathy.*

Keywords: *Low Level Laser Therapy(LLLT, Cold Laser),Transcutaneous Electrical Nerve Stimulation(TENS), Visual Analog Scale(VAS), Neck Disability Index(NDI), Range Of Motion(ROM), Universal Goniometer(UG).*

I. Introduction

Definition: Cervical radiculopathy is a dysfunction of a nerve root of the cervical spine, commonly caused by a cervical disc herniation, spondylotic spur, cervical osteophyte or other space-occupying lesion, resulting in nerve root inflammation, impingement or both which may lead to chronic pain and disability.[(1)]

Incidence: The average annual incidence rate of cervical radiculopathy is 83 per 100,000 with increased prevalence occurring in the 5th decade of life (203 per 100,000).[(2)] The prevalence of cervical radiculopathy has been estimated at 3.3 cases per 1000 persons. Peak incidence of it is reported to occur in 4th or 5th decade of life with an annual incidence of 2.1 cases per 1000 of this group.[(3)]

The seventh (C7 60%) and sixth (C6 25%) cervical nerve roots are most commonly affected because the foramina are largest in the upper cervical spine and gradually narrow distally, with the C7-T1 foramina being the most narrow. The most common causes of nerve root compression are spondylosis of facet joint and herniation of intervertebral disc. Hyper mobility of facet joint leads to ligamentous hypertrophy as well as bony hypertrophy. Cervical radiculopathy is a result of a disc herniation or an acute injury causing foraminal impingement of existing nerve. Disc herniation accounts for 20-25% of the cases of cervical radiculopathy. [(4)]

Clinical features: Patients with cervical radiculopathy typically feel pain, weakness or numbness in the areas served by the damaged nerve. Pain can be in one area only, like the shoulder, or progress along the entire arm. The type of pain also can vary, some patients describe dull, all over pain; others describe the pain as severe burning or sharp. Patients may feel tingling, "pins and needles," or numbness. Certain neck movements, like bending the neck back, side to side, or rotating it, may increase the pain.[(5)] C7 radiculopathy (the most common) causes pain and/or weakness from the neck to the hand and can include the triceps (the muscles on the back of the upper arms) and the middle finger. [(5)]

Investigative procedures: Perform a detailed sensory and reflex examination.The neck Spurling's test, Cervical Flexion Rotation Test, Neck Distraction, upper limb tension test, X-rays, MRI'S, CT scan and sometimes EMG and NCV studies are conducted to diagnose radiculopathy.[(5)] In this study the researcher has opted C7 cervical radiculopathy patients, who were treated with, LLLT with Neural mobilization along with Exercises AND TENS with Neural mobilizations along with Exercises.

Cold laser therapy is otherwise known as low level laser therapy. Lasers used therapeutically, emit relatively low light energy [from a few milliwatts (mW) to 100 to 200 mW] for short periods of time (seconds to minutes) which produces insignificant change in tissue temperature (measured to be around 1.0 °C). [(14)] The mechanism of action of LLLT: LLLT reduces oxidative stress in the stressed tissues which in turn lead to a reduction in inflammatory process and increase repair and healing process by increasing the production of ATP. LLLT creates a nerve block in pain pathway, particularly nociceptors. Repeated treatments lead to a reduction in central sensitisation. [(16)]

Transcutaneous Electrical Nerve Stimulation (TENS): Pain control TENS units typically produce a pulsed current at frequencies in the range 1 to 120Hz, some has range of 200Hz. The pulses are normally rectangular, or close to rectangular, in shape, biphasic & the pulse duration is approximately 50-200milli seconds.[(19)] The mechanism of action, selectively activate beta (sensory) nerve fibers and produce an analgesic effect by 'gating' signals produced by pain delta & C fibers. [(19)]

Neural mobilization is one of the method in manual therapy for the neural soft tissue mobilisation, it is used to ease the movement of the nerve between the other tissues, specifically for peripheral neural tissue and tissues surrounding the nervous system.[(1)] Neural mobilization is a set of techniques designed to restore elasticity of the nervous system, defined as the ability of nerve surrounding structures to shift in relation to other such structures. Moreover, it contributes to restoring the ability of neural tissue itself to stretch and stimulates the reconstruction of normal physiological function of nerve cells. [(20)]

Exercise for neck: Isometric exercise involve static contraction of a muscle without any visible movement in the angle of the joint. In simple terms this means during these exercises there won't be any change in the length of the muscle. Repetitively performing these exercises increases intra muscular tension which in turn strengthens the weak muscles to stabilize the joints and the surrounding tissue. [(22)]

Source of Data: Chronic cervical radiculopathy patients (GROUP-A) were referred to Shree Sanjeevini cold laser clinic, Basavangudi, those who fulfil the inclusion and exclusion criteria. And (group-B) patients were referred to out-patient department of Kempegowda institute of Physiotherapy from Kempegowda institute of Medical sciences and Research centre, those who fulfil the inclusion and exclusion criteria.

II. Methods Of Collection Of Data

Study design: Randomized controlled trial. Sample Size: 60 subjects. Sample Method: Randomization with multi-center sampling

Inclusion Criteria: Patients suffering with cervical radiculopathy for more than 3 months. Age group between 50 – 65 years of age. Both gender

Exclusion Criteria: Pregnancy. Pacemakers. Benign or malignant tumours. Any subject currently undergoing any systemic medical or surgical or physical therapy for cervical radiculopathy. Any skin infections. Tb/Cancer at cervical spine. Any post healed cervical fracture. Increased kyphosis and lordosis.

Methodology: Patient consent will be taken and assessed. The patients who fulfill inclusion and exclusion criteria will be included in the study. Treatment protocol and method was explained to the patients. Subjects referred were divided into two groups; Group A and Group B. Each group consist of 30 patients.

Group-A: patients received Cold laser therapy (LLLT) with Neural mobilization along with Exercises. Group-B patients received TENS with Neural mobilization along with Exercises. Pain status, Range of motion and Disability index were measured by using Visual Analogue Scale, Universal Goniometer and NDI- Questionnaire

respectively for all the subjects of both the groups before starting the treatment, at the end of 1st week, end of 2nd and end of 3rd week respectively.

Application of Cold Laser therapy: Calibration of the cold laser (LLLT): TLC 1000 therapeutic laser device. Dual wavelength: 905nm super pulsed and 660nm continuous. Power output: 60mW. Duration: 120s each point. Energy: 3.6 J/cm^2. No. of sessions: 5 sessions/week, 15 treatment sessions for 3 weeks. A brief explanation about treatment procedure is given to patient before the start of the treatment. The patient is instructed about the harmful effects on eye with LASER beam and a precautionary measure is taken by wearing protective Goggles. The therapist set the cold laser calibration, probe held stationary in contact with skin, anatomical site local transforaminal [2.5cm laterally from spinous process of involved C7 and the next two distal spinal segments for 120 seconds at each point. With patient's comfortable position (sitting/ prone lying/ side lying)], treated with cold laser. The cold laser should be applied such that the beam strikes the patient's skin at right angle for deep penetration.

Application of TENS therapy: Calibration of the TENS: Frequency: 5 Hz. Intensity: patient's sensitivity W/cm$^{2.}$ Electrode placement: 2 channel-electrodes are placed above and below focusing the area of greatest intensity of pain. Pulse width: 300 micro sec. Duration: 20 minutes. No. of sessions: 5 sessions/week, 15 treatment sessions for 3 weeks.

A brief explanation about treatment procedure is given to patient before the start of the treatment. Precautionary measure, making sure no metal object is present in and around electrodes placement area. With comfortable position (sitting/ side lying/ prone lying). The skin must be clean before starting the treatment. The electrodes are placed above and below the area of greatest intensity of pain. The therapist set the TENS calibration, a comfortable intensity is adjusted according to patient's sensitivity.

Neural Tissue Mobilization: The patients will be treated by neural mobilization to the ipsilateral upper limb (ULTT method). ULTT 2b: Therapist position: stride standing, facing cephalic and parallel to patient. Patient position: supine, arm by the side, no pillow required and body straight. Shoulder: Depression and abduction -10 degrees. Elbow: Extension. Forearm: Pronation, Shoulder joint: Medial rotation. Wrist: Flexion and Ulnar deviation. Fingers and thumb: Flexion. Cervical spine: Contralateral side flexion

Nerve Bias: Radial nerve. 3 sets of 10 repetitions, 1min rest time, at a moderate pace and a 3 sec hold at the final stretched position.

Exercise Regime: Isometric exercise for neck.
Repetitions: 5 sec hold with 5 reps and increased to 15 reps (As tolerated), twice a day.

III. Results: Statistical Analysis

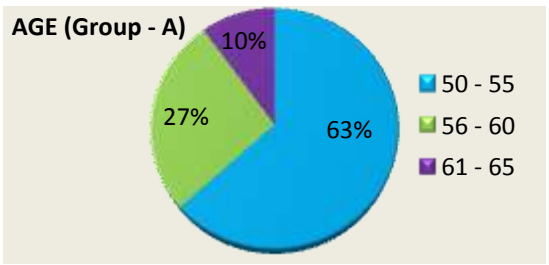
All the analysis were done by using SPSS 20.0 software. Following are the statistical analysis

1. Descriptive statistics were used to calculate Mean, SD
2. In both Group, Patients who received LLLT with Neural mobilization along with Exercises (Group A) and patients who received TENS with Neural mobilizations along with Exercise(Group B) in Discogenic Cervical Radiculopathy, Effectiveness of the treatment were calculated by Repeated measure ANOVA.
3. Paired t-test were used to compare the effectiveness of LLLT with Neural mobilization along with Exercises AND TENS with Neural mobilizations along with Exercises in Discogenic Cervical Radiculopathy.

Section – I

Table: 1 Frequency and Percentage distribution of age for Group-A and Group-B N=30

Age	Group – A		Group – B	
	Frequency	Percentage	Frequency	Percentage
50 – 55 Year	19	63.3	16	53.3
56 – 60 Year	8	26.7	10	33.4
61 – 65 Year	3	10	4	13.3
	30	100	30	100



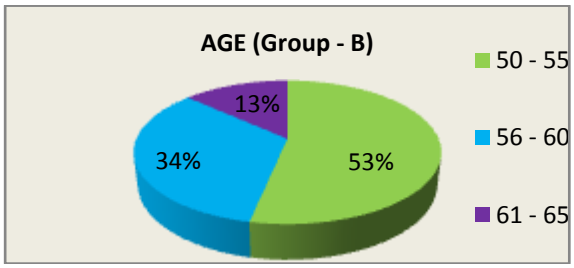


Fig- 1.a Percentage distribution of Age for Group-A **Fig- 1.b** Percentage distribution of Age for Group-B

Interpretation: Above table and graph shows the comparative difference between Frequency and Percentage of

age for Group-A and Group-B. Overall 50 to 65 year age group clients participated in the study. In Group-A about 63.3% of participants belong to the age group 50-55 years and 26.7% participants belong to 56-60 years and 10% belong to 61-65 years and in Group- B about 53.3% of participants belong to the age group of 50-55 years, 33.4% belong to 56-60% and remaining 13.3% were belong to 61-65 years.

Table: 2 Frequency and Percentage distribution of Gender for Group-A and Group-B

N=30

Gender	Group – A		Group – B	
	Frequency	Percentage	Frequency	Percentage
Male	14	46.7	16	53.3
Female	16	53.3	14	46.7
	30	100	30	100

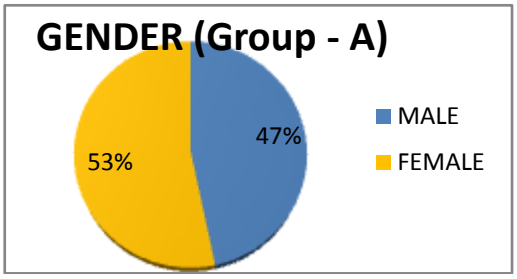


Fig-2.a Percentage distribution of Gender for Group-A

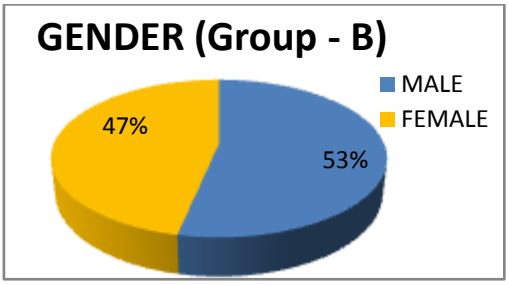


Fig-2.b Percentage distribution of Gender for Group-B

Interpretation: Above table and graph shows the comparative difference between Frequency and Percentage of distribution of gender for Group - A and Group – B. 46.7% male and 53.3% female participated in Group-A and 53.3% male, 46.7% female were participated in Group-B.

Section – II

Comparing the effectiveness of LLLT with Neural mobilization along with Exercises AND TENS with Neural mobilizations along with Exercises in Discogenic Cervical Radiculopathy.

Table: 3 comparison between Group -A and Group -B with VAS score Values

VAS	Group - A Mean	Group - B Mean	Mean Difference	Paired 'T' Value	Significant ('2' Tailed)
Pre Treatment	7.93	8	0.06	0.328	0.745
End of First Week	5.67	6.27	0.6	3.275*	0.003
End of Second Week	2.57	3.5	0.93	3.619*	0.001
End of third Week	1.37	2.8	1.43	6.143*	0.001

*Significant at P<0.05

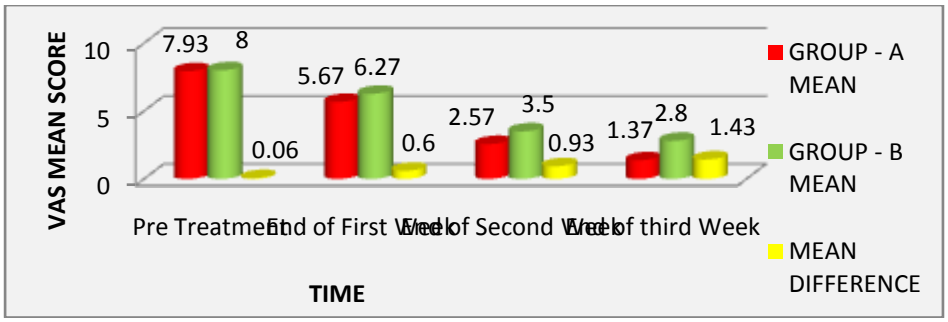


Fig-3. Comparison between Group -A and Group -B with VAS score Values

Interpretation: Above table and graph shows the comparative difference between Group-A and Group - B with VAS score Value. Group -A subject show more improvement than Group-B. On the End of First Week t=3.275, End of Second Week t=3.619, End of third Week t= 6.143 values are significant at P<0.05. It means there is a comparative difference between Group-A and Group-B.

Table: 4. comparison between Group -A and Group -B with NDI score Values

NDI	Group - A Mean	Group - B Mean	Mean Difference	Paired 'T' Value	Significant ('2' Tailed)
Pre Treatment	20.9	20.33	0.57	0.58	0.567

End of First Week	17.63	19.6	1.97	2.485*	0.019
End of Second Week	8.17	10.1	1.93	4.138*	0.001
End of third Week	5.23	8.6	3.37	7.302*	0.001

*Significant at P<0.05

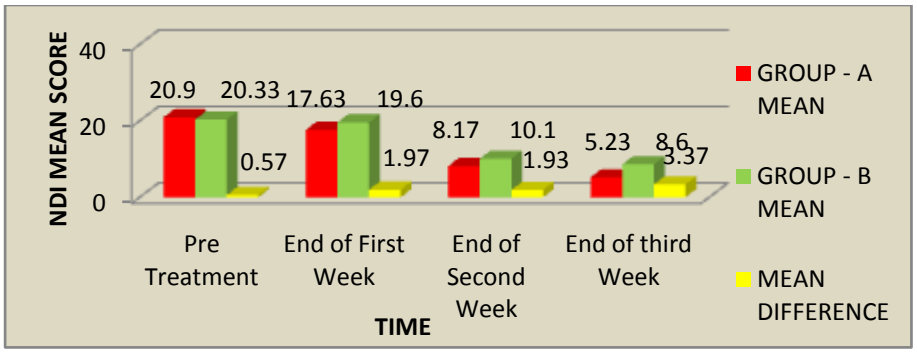


Fig-4. Comparison between Group -A and Group -B with NDI score Values

Interpretation: Above table and graph shows the comparative difference between Group -A and Group - B with NDI score Value. Group -A subjects show more improvement than Group -B. On the End of First Week t=2.485, End of Second Week t=4.138, End of third Week t= 7.302values are significant at P<0.05. It means there is a comparative difference between Group -A and Group -B.

Table: 5 comparison between Group -A and Group -B with Flexion score Values

Flexion	Group - A Mean	Group - B Mean	Mean Difference	Paired 'T' Value	Significant ('2' Tailed)
Pre Treatment	52.5	53	0.5	0.446	0.659
End Of First Week	56.96	54.86	2.1	1.84*	0.075
End Of Second Week	61.43	59.2	2.23	2.09*	0.045
End Of Third Week	65.63	62.83	2.8	2.84*	0.008

*Significant at P<0.05

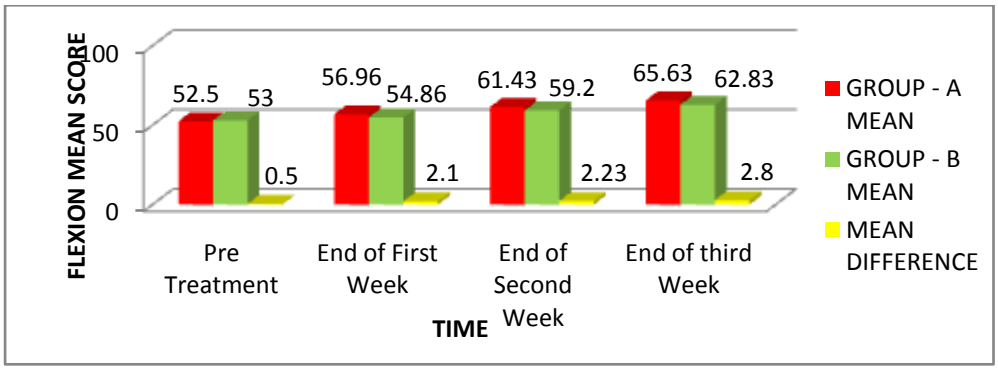


Fig-5. Comparison between Group -A and Group -B with ROM[Flexion] score Values

Interpretation: Above table and graph shows the comparative difference between Group -A and Group - B with Flexion score Value. Group -A subjects show more improvement than Group -B. On the End of First Week t=1.84, End of Second Week t=2.09, End of third Week t= 2.84values are significant at P<0.05. It means there is a comparative difference between Group -A and Group -B.

Table: 6 comparison between Group -A and Group -B with Extension score Values

Extension	Group - A Mean	Group - B Mean	Mean Difference	Paired 'T' Value	Significant ('2' Tailed)
Pre Treatment	46.5	48.5	2	2.26*	0.03
End Of First Week	53.47	50.53	2.93	4.49*	0.001
End Of Second Week	55.53	52.43	3.1	4.416*	0.001
End Of Third Week	58.27	54.3	3.97	4.11*	0.001

*Significant at P<0.05

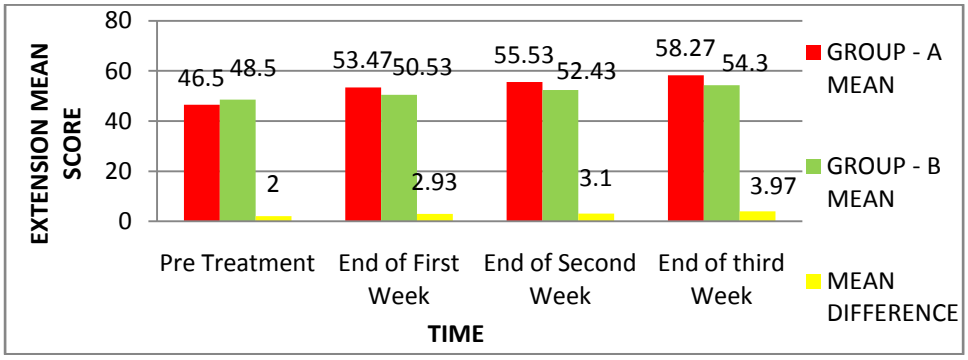


Fig-6. Comparison between Group -A and Group -B with ROM[Extension] score Values

Interpretation: Above table and graph shows the comparative difference between Group -A and Group - B with Extension score Value. Group -A subjects show more improvement than Group -B. On the End of First Week t=4.49, End of Second Week t=4.416, End of third Week t= 4.11 values are significant at P<0.05. It means there is a comparative difference between Group -A and Group -B.

Table: 7comparison between Group-A and Group-B with Right side Rotation score Values

Right Side Rotation	Group - A Mean	Group - B Mean	Mean Difference	Paired 'T' Value	Significant ('2' Tailed)
Pre Treatment	66.37	66.33	0.03	0.01	0.98
End Of First Week	71.07	69.5	1.57	0.85	0.4
End Of Second Week	75.43	72.5	2.93	1.8*	0.08
End Of Third Week	78.07	74.83	3.23	2.14*	0.04

*Significant at P<0.05

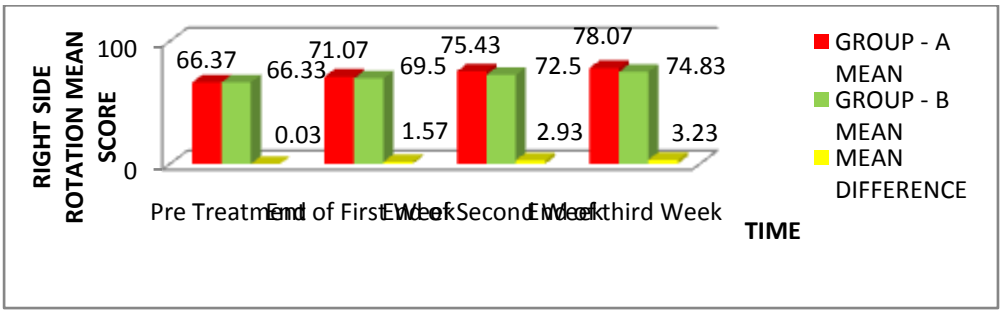


Fig-7. Comparison between Group -A and Group -B with ROM[Right Side Rotation] Values

Interpretation: Above table and graph shows the comparative difference between Group -A and Group - B with Right side Rotation score Value. Group -A subjects show more improvement than Group -B. On the End of Second Week t=1.8, End of third Week t= 2.14 values are significant at P<0.05. It means there is a comparative difference between Group -A and Group -B.

Table: 8. comparison between Group -A and Group -B with Left side Rotation score Values

Left Side Rotation	Group - A Mean	Group - B Mean	Mean Difference	Paired 'T' Value	Significant ('2' Tailed)
Pre Treatment	64.96	65.5	0.53	0.37	0.71
End Of First Week	68.03	67.63	0.4	0.29	0.77
End Of Second Week	73.8	71.03	2.77	2.79*	0.009
End Of Third Week	77.2	73.6	3.6	5.8*	0.001

*Significant at P<0.05

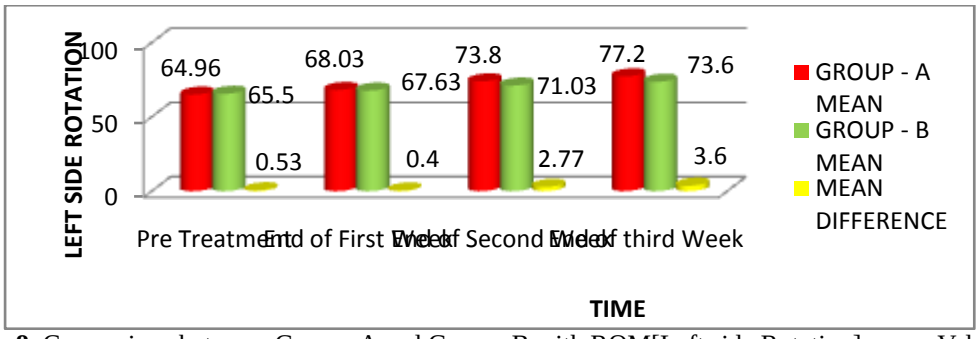


Fig-8. Comparison between Group -A and Group -B with ROM[Left side Rotation] score Values

Interpretation: Above table and graph shows the comparative difference between Group -A and Group - B with Left side Rotation score Value. Group -A subjects show more improvement than Group -B. On the End of Second Week t=2.79, End of third Week t= 5.8values are significant at P<0.05. It means there is a comparative difference between Group –A and Group -B.

Table: 9. comparison between Group -A and Group -B with Right side Lateral Flexion score Values

Right Side Lateral Flexion	Group - A Mean	Group - B Mean	Mean Difference	Paired 'T' Value	Significant ('2' Tailed)
Pre Treatment	37.17	36.33	0.83	0.33	0.73
End Of First Week	40.16	37.23	2.93	1.51	0.18
End Of Second Week	45.76	40.6	5.17	5.28*	0.001
End Of Third Week	49.83	43.07	6.77	7.01*	0.001

*Significant at P<0.05

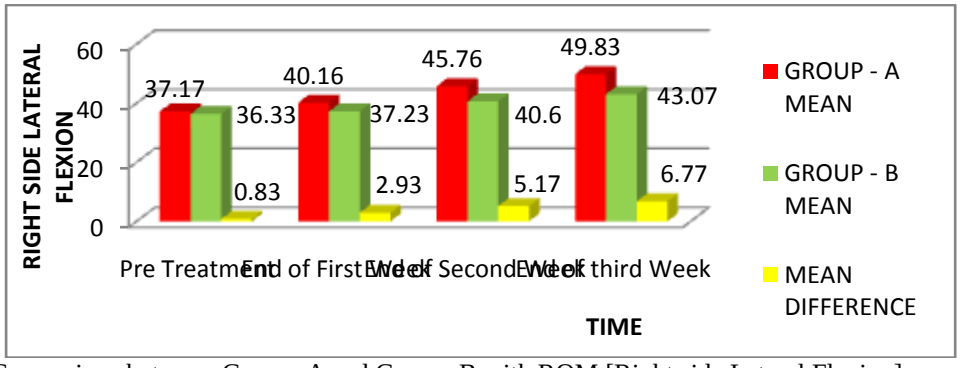


Fig-9. Comparison between Group -A and Group -B with ROM [Right side Lateral Flexion] score Values

Interpretation: Above table and graph shows the comparative difference between Group -A and Group - B with Right side Lateral Flexion score Value. Group -A subjects show more improvement than Group -B. On the End of Second Week t=5.28, End of third Week t= 7.01values are significant at P<0.05. It means there is a comparative difference between Group -A and Group -B.

Table: 10.Comparisonbetween Group -A and Group -B with Left side Lateral Flexion score Values

Left Side Lateral Flexion	Group - A Mean	Group - B Mean	Mean Difference	Paired 'T' Value	Significant ('2' Tailed)
Pre Treatment	33.83	33.6	0.23	0.15	0.88
End Of First Week	39.43	35.9	4.03	3.78*	0.001
End Of Second Week	43.77	39.1	4.67	5.25*	0.001
End Of Third Week	47.47	42.37	5.1	5.84*	0.001

*Significant at P<0.05

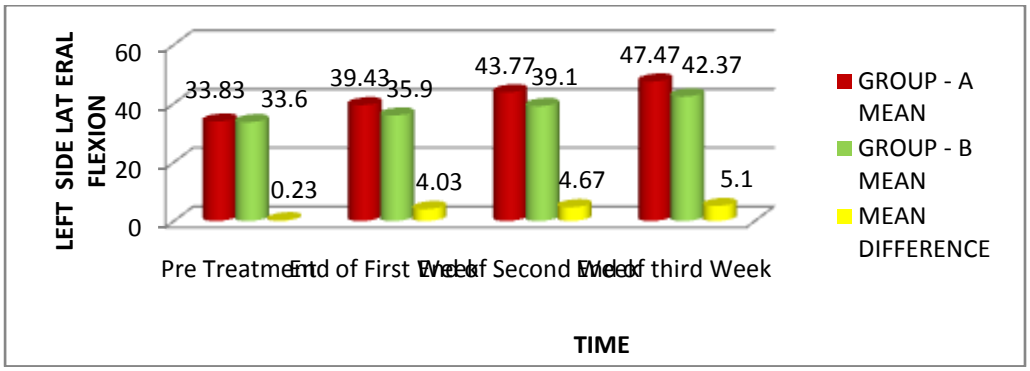


Fig-10. Comparison between Group -A and Group -B with ROM[Left side Lateral Flexion] score Values

Interpretation: Above table and graph shows the comparative difference between Group -A and Group - B with Left side Lateral Flexion score Value. On the End of First Week t=3.78, End of Second Week t=5.25, End of third Week t= 5.84 values are significant at P<0.05. It means there is a comparative difference between Group -A and Group -B. Group -A subjects show more improvement than Group -B.

IV. Discussion

The purpose of the study is to assess "The effectiveness of LLLT with Neural mobilization along with Exercises AND TENS with Neural mobilizations along with Exercises on discogenic cervical radiculopathy".

Group-A: patients received Cold laser therapy (LLLT) with Neural mobilization along with Exercises. Group-B patients received TENS with Neural mobilization along with Exercises the outcome measures of the study were the neck pain, neck range of motion and neck disability.

The pain reduction was measured using VAS scale, the neck ROM was measured using Universal Go-niometer(UG) and the neck disability was assessed using NDI questionnaire.

Pain status, Range of motion and Disability index were measured by using Visual Analogue Scale, Universal Goniometer and NDI- Questionnaire respectively for all the subjects of both the groups before starting the treatment, at the end of 1st week, end of 2nd and end of 3rd week respectively.

Effectiveness of treatment were calculated statistically by Repeated measure ANOVA.

In this study: Distribution of age for Group-A and Group-B: Overall 50 to 65 year age group clients participated in the study. In Group-A about 63.3% of participants belong to the age group 50-55 years and 26.7% participants belong to 56-60 years and 10% belong to 61-65 years likewise in Group- B about 53.3% of participants belong to the age group of 50-55 years, 33.4% belong to 56-60% and remaining 13.3% belong to 61-65 years.

Distribution of Gender for Group-A and Group-B: 46.7% male and 53.3% female participated in Group-A and 53.3% male, 46.7% female participated in Group-B.

In the present study Group-A and Group-B patients VAS score Value at the End of First Week t=3.275, End of Second Week t=3.619, End of third Week t=6.143 were significant at P<0.05. There is a comparative difference between Group -A and Group – B. Group -A subjects pain was statistically decreased than Group -B. Likewise there are so many researchers have used the VAS scale as a measuring tool for neck pain. Donald .R. Murphy et al conducted a study on 31 patients with cervical radiculopathy who received a non-surgical approach which include manipulation, mobilization and exercise therapy to measure the neck disability and pain intensity. The pain intensity was measured using the numerical pain rating scale and he concluded that the mean percentage of improvement in the numerical pain rating score was 72%.[20]

Ljubica M. Konstantinovic, Milisav R. Cutovic et al 2010 conducted a study on Sixty subjects who have received a course of 15 treatments over 3 weeks with an active laser(LLLT)which was applied to the skin projection at the anatomical site of the spinal segment involved with the following parameters: wavelength 905 nm, frequency 5,000 Hz, power density of 12 mW/cm2, and dose of 2 J/cm2, treatment time 120 seconds at each points, at whole doses 12 J/cm2 and they concluded that the Statistically significant differences of pain, in relief of arm pain and increased range of neck extension in patients with acute neck pain with radiculopathy.[2]

Further in the present study, the researcher also found that there was pain reduction due to neural mobilization in both the groups. According to Butler .D. 2000, Shacklock 1995 concluded that the significant pain reduction due to nerve mobilization. The therapeutic movements for neural mobilisation can have a positive impact on improving intraneural circulation, axoplasmic flow and neural connective tissue viscoelasticity.[20]

Group -A and Group -B with NDI score Value, on the End of First Week t=2.485, End of Second Week t=4.138, End of third Week t=7.302 values are significant at P<0.05.There is a comparative difference between Group-A and Group-B. Group-A subject show more improvement than Group-B. Ljubica M. Konstantinovic et

al 2010 conducted a study on Sixty subjects received a course of 15 treatments over 3 weeks with active laser and concluded that the intensity of neck pain statistically decreased and the disability of neck was reduced by improving NDI.[2]

Himanshi Sharma et al 2014 conducted a study on 30 patients with cervical radiculopathy were given TENS with Isometric neck exercises and active neck movements, they concluded that TENS was effective in the management of cervical radiculopathy along with isometric neck exercise, in reducing both neck & arm pain, neck disability & in improving activities of daily living. Whereas in the present study the TENS group patients have not shown statistically better improvement than the LLLT group.[19]

Group -A and Group -B with ROM Flexion score Value, on the End of First Week t=1.84, End of Second Week t=2.09, End of third Week t=2.84 values are significant at P<0.05. There is a comparative difference between Group -A and Group -B. Group -A subjects showed more improvement than Group -B.

Group -A and Group -B with ROM Extension score Value, on the End of First Week t=4.49, End of Second Week t=4.416, End of third Week t=4.11values are significant at P<0.05.There is a comparative difference between Group -A and Group – B. Group -A subjects showed more improvement than Group -B.

Group -A and Group -B with ROM Right Rotation score Value, on the End of First Week t=0.85, End of Second Week t=1.8, End of third Week t=2.14 values are significant at P<0.05. There is a comparative difference between Group -A and Group – B. Group -A subjects showed more improvement than Group -B.

Group -A and Group -B with ROM Left Rotation score Value, on the End of First Week t=0.29, End of Second Week t=2.79, End of third Week t=5.8values are significant at P<0.05. There is a comparative difference between Group -A and Group- B. Group -A subjects showed more improvement than Group -B.

Group -A and Group -B with ROM Right Lateral Flexion score Value, on the End of First Week t=1.51, End of Second Week t=5.28, End of third Week t=7.01values are significant at P<0.05. There is a comparative difference between Group -A and Group-B. Group -A subjects showed more improvement than Group -B.

Group -A and Group -B with ROM Left Lateral Flexion score Value. On the End of First Week t=3.78, End of Second Week t=5.25, End of third Week t=5.84 values are significant at P<0.05. There is a comparative difference between Group-A and Group-B. Group-A subjects showed more improvement than Group-B. Likewise Ljubica M. Konstantinovic et al 2010 conducted a study on Sixty subjects who received a course of 15 treatments over 3 weeks with active laser and concluded LLLT gave more effective result in relief of arm pain and increased range of neck extension in patients with acute neck pain with radiculopathy.[2]

Butler (1991) recommends that neural mobilization been viewed as another form of manual therapy similar to joint mobilization. In order to get an alternate to it manual methods should be used in order to restore the mechanical function of impaired neural tissue. [21]

There is a statistically significant difference in, LLLT with neural mobilization along with neck exercises and TENS with neural mobilization along with neck exercises in cervical radiculopathy using NDI (neck disability index), the VAS (measurement of pain) and UG (measurement of neck movement). Hence null hypothesis is rejected and Alternative Hypothesis is Accepted.

Group A (LLLT with neural mobilization along with neck exercises) showed better improvement in pain reduction, improvement in range of motion and improvement in functional ability in patients with discogenic cervical radiculopathy than Group B (TENS with neural mobilization along with neck exercises).

V. Limitations Of Study

The age group of the patients limits the study. The study was limited to assess only the pain intensity by using VAS, activities of daily living by NDI score, ROM by UG. Sample size also limits the study.

VI. Conclusion

VAS score of group A (LLLT with neural mobilization along with exercises) and group B (TENS with neural mobilization along with exercises) showed drastic pain reduction in both groups, whereas the group A patients showed statistically significant reduction of VAS score compared to group B patients. P<0.05 df=29.

NDI score of group A (LLLT with neural mobilization along with exercises) and group B (TENS with neural mobilization along with exercises) showed drastic pain improvement in their activity of daily living (ADL) in both groups, whereas the group A patients showed statistically significant improvement in their ADL(NDI) score compared to group B patients. P<0.05 df=29.

The neck flexion (ROM) statistically improved in group A patients compared to group B patients P<0.05 df=29.The neck extension (ROM) statistically improved in group A patients compared to group B patients P<0.05 df=29.The neck right side rotation (ROM) statistically improved in group A patients compared to group B patients P<0.05 df=29. The neck left side rotation (ROM) statistically improved in group A patients compared to group B patients P<0.05 df=29. The neck right side lateral flexion (ROM) statistically improved in

group A patients compared to group B patients P<0.05 df=29. The neck left side lateral flexion (ROM) statistically improved in group A patients compared to group B patients P<0.05 df=29.

VII. Summary

Cervical radiculopathy is a disorder of the cervical nerve root. It is most commonly caused by cervical disc herniation, spondyotic spur, cervical osteophyte or other space-occupying lesion, resulting in nerve root inflammation, impingement or both which may lead to chronic pain and disability.

The average annual incidence rate of cervical radiculopathy is 83 per 100,000 with and increased prevalence occurring in the 5^{th} decade of life (203 per 100,000). The prevalence of cervical radiculopathy has been estimated at 3.3 cases per 1000 persons. Peak incidence of it is reported to occur in 4^{th} or 5^{th} decade of life with an annual incidence of 2.1 cases per 1000 of this group. It is unclear whether this predominance based on gender. Some reports show that it is predominant in men and others shown predominance in women. C7 radiculopathy (the most common) causes pain and/or weakness from the neck to the hand and can include the triceps (the muscles on the back of the upper arms) and the middle finger. The effectiveness of LLLT with Neural mobilization along with Exercises AND TENS with Neural mobilizations along with Exercises was assessed by assessing the effectiveness of pain reduction using VAS scale, the effectiveness of neck ROM using UG, the effectiveness of neck disability using NDI.

Study design: Randomized controlled trial; Sample Size: 60 subjects; Sample Method: Randomization with multi-center sampling. Effectiveness of treatment were calculated by Repeated measure ANOVA and were plotted in the graphical manner, using the score. Null hypothesis is rejected and Alternative Hypothesis is Accepted. Therefore the study concludes that the Cold laser therapy (LLLT) with Neural mobilization along with Exercises is more effective in reducing Pain, in increasing cervical spine Range of motion and in improving Activities of daily living.

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