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## Effectiveness of cold laser therapy with exercises and intermittent cervical traction with exercises in cervical radiculopathy: A comparative study

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### Abstract

**Objectives:** To assess the effectiveness of Cold Laser Therapy with Exercises and Intermittent Cervical Traction with Exercises. By assessing the effectiveness of pain reduction using VAS scale, by assessing the effectiveness of neck ROM using TM, 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 5<sup>th</sup> 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 Cold Laser Therapy with Exercises and Intermittent Cervical Traction with Exercises on 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 (LLLTT) with Exercises. Group-B patients received Intermittent Cervical Traction with Exercises. Both the groups were treated for 15 sessions for 3 weeks. Patients were evaluated for pain using VAS, ROM using Tape measurement and functional ability by NDI score on pretreatment, end of 1<sup>st</sup> week, end of 2<sup>nd</sup> week and end of 3<sup>rd</sup> week respectively.

**Outcome Measures:** Pain was measured by VAS scale, ROM was measured by using Tape Measurement 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 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 (LLLTT) with Exercises than (Group B) using Intermittent Cervical Traction with Exercise in reducing pain, improving range of motion and functional ability in cervical radiculopathy.

**Keywords:** Cold Laser Therapy (LLLTT), Intermittent Cervical Traction (ICT), Visual Analogue Scale (VAS), Neck Disability Index (NDI), Range Of Motion (ROM), Tape measurement (TM).

### 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<sup>[1]</sup>.

**Incidence:** The average annual incidence rate of cervical radiculopathy is 83 per 100,000 with increased prevalence occurring in the 5<sup>th</sup> decade of life (203 per 100,000)<sup>[2]</sup>. 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<sup>th</sup> or 5<sup>th</sup> decade of life with an annual incidence of 2.1 cases per 1000 of this group<sup>[3]</sup>.

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].

A brief explanation about treatment of the ICT is given to patient. Patient will be in supine position, with a towel roll kept under the neck to maintain the neck in 15 degree flexion. A traction force of 1/8 of the body weight in kg was applied. Traction hold time was set at 40 seconds and rest time at 10 seconds. Duration of traction was 15 min/ day [18].

**Exercise Resume:** A graded exercise program is devised with 10 repetition with 3 sets on a daily basis. The exercise program had 2 components: scapula strengthening and cervical strengthening. Cervical strengthening exercise including supine craniocervical flexion to elicit contraction of the deep neck flexor muscles without contraction of superficial neck muscle. The patient was supine with the cervical spine in neutral and instructed to flatten the curve of the neck by nodding the head. This position was held for 10 seconds and repeated 10 times. Scapular retraction against resistance using elastic bands or pulleys could be added [19].

Scapular strengthening exercises including prone horizontal abduction, side lying forward flexion, prone extension, of each shoulder, as well as prone pushups with emphasis on shoulder protraction. The goal was 3 sets of 10 repetitions with resistance added as tolerance [19].

**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.

#### Methods of Collection of Data

**Study design:** Randomized controlled trial. Sample Size: 60 subjects. Sample Method: Quazi experimental 2 groups pre and post test study

**Inclusion Criteria:** Patients suffering with cervical radiculopathy for more than 3 months. Age group between 40 – 60 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 Exercises. Group-B patients received Intermittent Cervical Traction with Exercises. Pain status, Range of motion and Disability index were measured by using Visual Analogue Scale, Tape measurement and NDI- Questionnaire respectively for all the subjects of both the groups before starting the treatment, at the end of 1<sup>st</sup> week, end of 2<sup>nd</sup> and end of 3<sup>rd</sup> 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<sup>2</sup>. 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 C-4,5,6 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 ICT therapy:** A brief explanation about treatment of the ICT is given to patient. Patient will be in supine position, with a towel roll kept under the neck to maintain the neck in 15 degree flexion. A traction force of 1/8 of the body weight in kg was applied. Traction hold time was set at 40 seconds and rest time at 10 seconds. Duration of traction was 15 min/ day.

**Exercise Resume:** A graded exercise program is devised with 10 repetition with 3 sets on a daily. The exercise program had 2 components: scapula strengthening and cervical strengthening. Cervical strengthening exercise including supine craniocervical flexion to elicit contraction of the deep neck flexor muscles without contraction of superficial neck muscle. The patient was supine with the cervical spine in neutral and instructed to flatten the curve of the neck by nodding the head. This position was held for 10 seconds and repeated 10 times. Scapular retraction against resistance using

elastic bands or pulleys could be added. Scapular strengthening exercises including prone horizontal abduction, side lying forward flexion, prone extension, of each shoulder, as well as prone pushups with emphasis on shoulder protraction. The goal was 3 sets of 10 repetitions with resistance added as tolerance.

**Result Analysis**

All the analysis were done by using 16.0 software

**Section I**

To compare and assess the effectiveness of cold laser therapy with exercise and intermittent cervical traction with exercise in cervical radiculopathy were analysed by Paired Sample ‘t’ test.

**VAS scale comparison was done between Group A and Group B**

VAS	Group A		Group B		T Value	Sig
	Mean	SD	Mean	SD		
Pre Treatment	7.97	0.76	8	0.58	0.171	0.86
End of First Week	5.67	0.88	6.27	0.58	2.83*	0.008
End of Second Week	2.63	0.99	3.9	0.92	4.83*	0
End of Third Week	1.27	0.58	2.8	0.81	7.59*	0

Above Table shows Group A is more effective than Group B



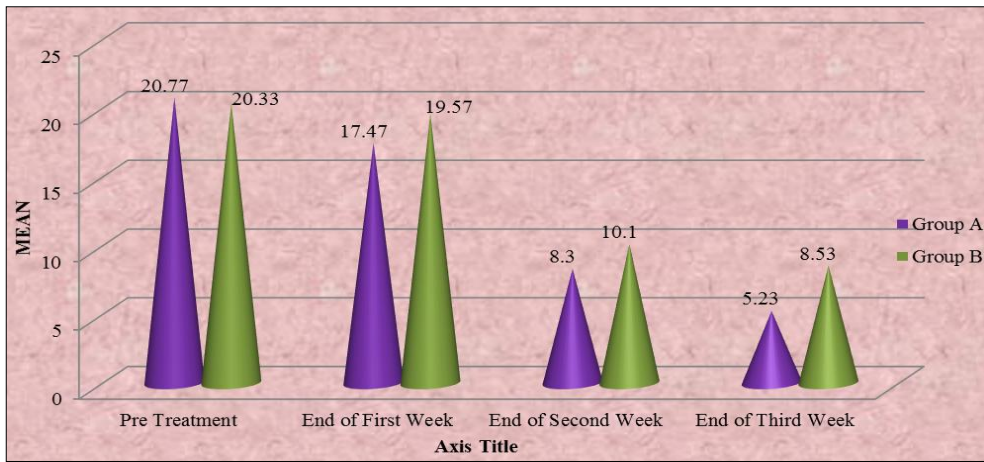
**Interpretation:** Above table shows for comparison of Group -A and Group - B with VAS score Value. Group -A client shows more improvement than Group -B. On the End of First Week t=2.83, End of Second Week t=4.83, End of third

Week ‘t’= 7.59 values are significant at P<0.05. It means there is a comparative difference between Group –A and Group – B.

**NDI scale comparison was done between Group A and Group B**

NDI	Group A		Group B		T Value	Sig
	Mean	SD	Mean	SD		
Pre Treatment	20.77	3.71	20.33	3.96	0.474	0.639
End of First Week	17.47	0.425	19.57	0.67	2.94*	0.006
End of Second Week	8.3	2.19	10.1	2.26	4.06*	0
End of Third Week	5.23	1.65	8.53	1.59	8.52*	0

Above Table shows Group A is more effective than Group B



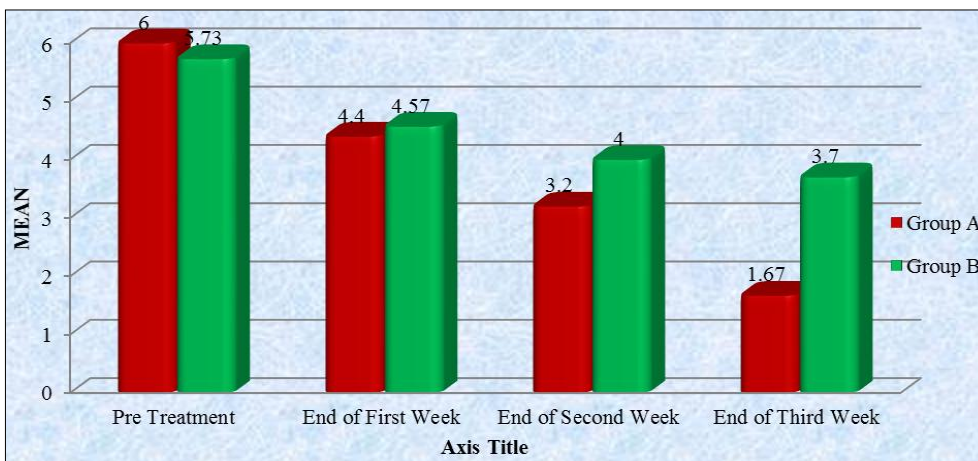
**Interpretation:** Above table shows for comparison of Group -A and Group - B with NDI score Value. Group -A client shows more improvement than Group -B. On the End of First

Week  $t=2.94$ , End of Second Week  $t=4.06$ , End of third Week  $t=8.52$  values are significant at  $P<0.05$ . It means there is a comparative difference between Group -A and Group - B

**Range of motion [Flexion] comparison was done between Group A and Group B**

Flexion	Group A		Group B		T Value	Sig
	Mean	SD	Mean	SD		
Pre Treatment	6	0.83	5.73	0.69	1.246	0.223
End of First Week	4.4	0.67	4.57	0.56	0.961	0.344
End of Second Week	3.2	0.48	4	0.58	4.94*	0
End of Third Week	1.67	0.47	3.7	0.59	12.51*	0

Above Table shows Group A is more effective than Group B



Above table shows for comparison of Group -A and Group - B with Flexion score Value. Group -A client shows more improvement than Group -B. On the End of First Week  $t=0.961$ , End of Second Week  $t=4.94$ , End of third Week  $t=12.51$  values are significant at  $P<0.05$ . It means there is a

comparative difference between Group -A and Group - B.

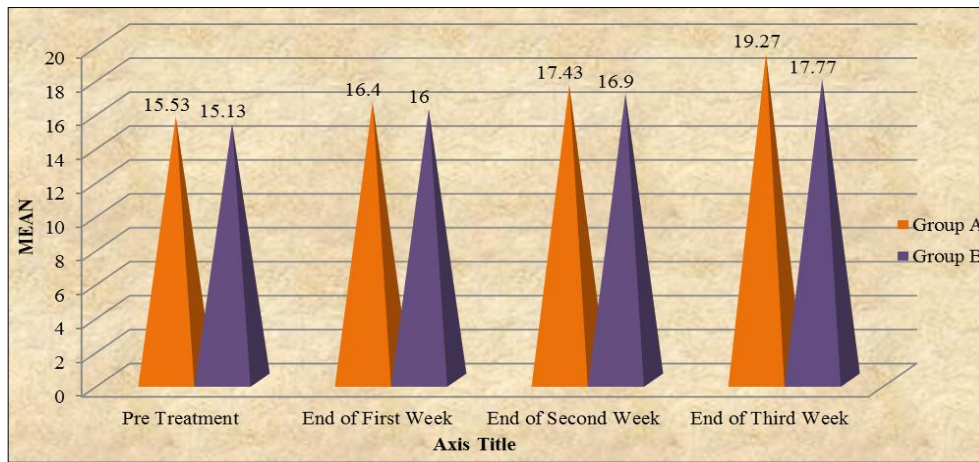
**Range of motion [Extension] comparison was done between Group A and Group B**

Extension	Group A		Group B		T Value	Sig
	Mean	SD	Mean	SD		
Pre Treatment	15.53	0.82	15.13	0.82	1.93	0.06
End of First Week	16.4	1.16	16	0.9	1.58	1,23
End of Second Week	17.43	0.56	16.9	0.8	3.39*	0.002
End of Third Week	19.27	0.64	17.77	0.82	7.04*	0

Above Table shows Group A is more effective than Group B

Above table shows for comparison of Group -A and Group - B with Extension score Value. Group -A client shows more improvement than Group -B. On the End of First Week

$t=1.58$ , End of Second Week  $t=3.39$ , End of third Week  $t=7.04$  values are significant at  $P<0.05$ . It means there is a comparative difference between Group -A and Group - B.



## Discussion

The purpose of the study is to assess “The effectiveness of Cold Laser Therapy with Exercises and Intermittent Cervical Traction with Exercises in Cervical radiculopathy”.

**Group-A:** Patients received Cold Laser Therapy with Exercises. Group-B patients received Intermittent Cervical Traction 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 Measuring Tape and the neck disability was assessed using NDI questionnaire.

Pain status, Range of motion and Disability index were measured by using Visual Analogue Scale, Measuring Tape and NDI- Questionnaire respectively for all the subjects of both the groups before starting the treatment, at the end of 1<sup>st</sup> week, end of 2<sup>nd</sup> and end of 3<sup>rd</sup> 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 40 to 60 year age group clients participated in the study. In Group-A about 0% of participants belong to the age group 40-54 years and 60% participants belong to 50-55 years and 40% belong to 56-60 years likewise in Group- B about 6.7% of participants belong to the age group of 40-45 years, 50% belong to 50-55% and remaining 43.3% were belong to 56-60 years.

Distribution of Gender for Group-A and Group-B. 56.7% male and 43.3% female participated in Group-A and 46.7% male, 53.3% female participated in Group-B.

In the present study Group -A and Group -B patients VAS score Value at the End of First Week  $t=2.83$ , End of Second Week  $t=4.83$ , End of third Week ‘ $t$ ’= 7.59 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%.

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/cm<sup>2</sup>, and dose of 2 J/cm<sup>2</sup>, treatment time 120 seconds, at whole doses 12 J/cm<sup>2</sup> 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.

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.

Subhas Chandra Rai *et al* 2013 conducted a study on 30 patients with cervical radiculopathy were given Intermittent Cervical Traction and TENS with cervical neck exercises, they concluded that Intermittent Cervical Traction was effective in the management of cervical radiculopathy along with TENS and cervical neck exercise, in reducing both neck & arm pain, neck disability & in improving activities of daily living. Whereas in the present study the Intermittent Cervical Traction group patients have not shown statistically better improvement than the Cold Laser therapy group.

Group -A and Group -B with ROM Flexion score Value. On the End of First Week  $t=0.961$ , End of Second Week  $t=4.94$ , End of third Week ‘ $t$ ’= 12.51 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  $t=1.58$ , End of Second Week  $t=3.39$ , End of third Week ‘ $t$ ’= 7.04 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. 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 flexion and extension in patients with acute neck pain with radiculopathy.

There is a statistically significant difference in, Cold Laser Therapy with exercises and Intermittent Cervical Traction with exercises in cervical radiculopathy using NDI (neck disability index), the VAS (measurement of pain) and Tape Measurement (measurement of neck movement). Hence null hypothesis is rejected and Alternative Hypothesis is accepted. Group A (COLD Laser Therapy with exercises) showed better improvement in pain reduction, improvement in range of motion and improvement in functional ability in patients with cervical radiculopathy than Group B (Intermittent Cervical Traction with exercises).

### 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 score, ROM by Tape Measurement. Sample size also limits the study.

### Conclusion

VAS score of group A (Cold Laser Therapy with exercises) and group B (Intermittent Cervical Traction 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 (Cold Laser Therapy with exercises) and group B (Intermittent Cervical Traction 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  $P < 0.05$   $df = 29$ .

### Summary

Cervical radiculopathy is a disorder of the cervical nerve root. It is most commonly caused by 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 5<sup>th</sup> 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<sup>th</sup> or 5<sup>th</sup> decade of life with an annual incidence of 2.1 cases per 1000 of this group. It is unclear whether this predominance is based on gender. Some reports show that it is predominant in men and others show predominance in women.

C4,5,6 radiculopathy (the most common) causes pain and/or weakness from the neck to the hand. The effectiveness of Cold Laser Therapy with Exercises and Intermittent Cervical Traction with Exercises was assessed by assessing the effectiveness of pain reduction using VAS scale, the effectiveness of neck ROM using Measuring Tape, the effectiveness of neck disability using NDI. Study design: Comparative study non randomized parallel open label study; Sample Size: 60 subjects; Sample Method: Quasi experimental 2 groups pre and post-test study. 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 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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