

Original research article**Role of strengthening exercise with areion arthron series shockwave therapy in cervical radiculopathy****¹Dr. Dinesh Menaria, ²Dr. Jafar Khan, ³Dr. Renuka Pal (PT), ⁴Dr. KM Annamalai**¹M.PTh Scholar, Udaipur, Rajasthan, India²Dean and HOD, Pacific College of Physiotherapy, Pacific Medical University, Udaipur, Rajasthan, India³Associate Professor, Pacific College of Physiotherapy, Pacific Medical University, Udaipur, Rajasthan, India⁴Chancellor, Ghandhi Gram University, Tamil Nadu & HOD Physiotherapy Apollo Hospital, Ahmedabad, Gujarat, India**Corresponding Author:**

Dr. Dinesh Menaria

Abstract

Background: Cervical radiculopathy is a nerve root malfunction in the cervical spine that causes radicular symptoms such as pain, paresthesia, weakness, and numbness in the upper extremities. The annual incidence of cervical radiculopathy has been reported to be 107.3 per 100,000 for males and 63.5 per 100,000 for women. Cervical disc lesions and osteophyte invasion are the most prevalent causes of cervical radiculopathy, which results in nerve root or spinal nerve impingement or inflammation that causes adhesion around the nerve root and tissue which is a major cause of radiculopathy along with recurrent spasm in and around associated tissues.

There is so many electrotherapy modalities for better outcome with physical treatment and Extra corporal shockwave therapy is one of finest tool with new upgradations which claims high success rate and complement the healing process. Aerion Arthron shockwave therapy system is FDA Approved equipment made for better outcome in pain management with physical condition like radiculopathy and spasm.

Objective: The aim of this study was to evaluate the efficacy of Areion Arthron shockwave therapy along with strengthening exercise in patients with cervical radiculopathy.

Methodology: A total of 15 patients of cervical radiculopathy were included in the study. All patients were treated with strengthening exercise and Shock wave therapy (S.W.T). Patients were treated 5 time per week with twice sessions of Areion Arthron shockwave therapy along with strengthening exercise for period of 6 weeks. Treatment duration was 20 to 40 minutes per session.

Result: This study showed significant improvement in patients after treatment. This study showed pre-test ROM Neck Flexion Mean \pm SD was 39.0 ± 3.5 and improve to 47.2 ± 2.1 in post-test. Neck ROM Extension pre-test Mean \pm SD was 69.1 ± 8.1 improve to 78.0 ± 2.0 in post-test. ROM Rotation Right Side Pre-test Mean \pm SD was 73.8 ± 2.7 and improve to 78.9 ± 0.9 in post-test. Rotation to left side pre-test Mean \pm SD was 73.8 ± 2.7 and improve to 78.9 ± 0.9 in post-test. Data Analysis of VAS Scale also signified after treatment. Pre-test Mean \pm SD was 7.2 ± 1.3 and reduced to 2.6 ± 1.0 in post-test.

Conclusion: Studies have shown that Areion Arthron Shockwave Therapy, strengthening exercise improve the functional range of neck in the patient of cervical radiculopathy and also score of VAS scale is decrease in number in patients.

Keywords: Areion Arthron shockwave therapy, Strengthening, VAS.

1. Introduction

Neck pain is the second most prevalent musculoskeletal condition in the general population, after low back pain^[1]. It is estimated that 30-50% of the population is impacted each year, with nearly two out of every three people experiencing neck discomfort at some point in their lives. Approximately 50-80% of people with neck pain do not fully heal from their symptoms, and many of them develop chronic neck pain^[2, 3]. In our everyday practice, cervical or neck discomfort with radiculopathy is a prevalent complaint. Cervical radiculopathy is a nerve root malfunction in the cervical spine that causes radicular symptoms such as pain, paresthesia, weakness, and numbness in the upper extremities.

The annual incidence of cervical radiculopathy has been reported to be 107.3 per 100,000 for males and 63.5 per 100,000 for women^[4]. Cervical disc lesions and osteophyte invasion are the most prevalent causes of cervical radiculopathy, which results in nerve root or spinal nerve impingement or inflammation. As a result, the damaged nerve root causes radicular symptoms in the ipsilateral extremity^[5]. C7 (reported percentages 46.3-69%) is the most prevalent degree of root compression, followed by C6 (19-17.6%); compression of roots C5 (2-6.6%) and C8 (10-6.2%) is less common. One probable

explanation is that, with the exception of the C7-T1 foramen (C8), intervertebral foramina are biggest in the upper cervical region and gradually decrease in size in the middle and lower cervical sections.^[6,7]

To confirm a diagnosis of CR, diagnostic imaging (magnetic resonance imaging) and electrophysiological testing (nerve conduction velocity, electromyography) are often employed. A clinical prediction rule (CPR) was developed employing nerve conduction velocity and electromyographic data as gold standards to determine the existence of CR using a limited group of factors from the clinical examination. The Spurling test, the distraction test, the Upper-Limb Tension Test 1 (ULLT1) (median nerve bias), and ipsilateral cervical rotation of less than 60 degrees are all CPR for diagnosing CR.^[8]

For individuals with cervical radiculopathy, conservative treatment, particularly physical therapy, is often suggested as the first line of treatment. Therapeutic exercises, mechanical and manual cervical traction, and cervical collar are all examples of physical therapy. Previous research has demonstrated that cervical spine mobilization and manipulation are useful in relieving pain, neck mobility, and function in individuals with cervical radiculopathy. These studies looked at the effect of vertebral mobilization using outcome measures such the visual analogue scale (VAS), neck mobility, neck muscular strength, neck disability index (NDI), and the 36-short form health survey (SF-36).^[9]

Shock Wave Therapy has been studied as a cervical radiculopathy treatment due to its non-invasive nature, lack of side effects, and patient acceptance. It provides a therapeutic rehabilitation strategy when other conservative therapies are inadequate. However, no studies have studied a combination treatment.

Shockwave therapy has a wide spectrum in medical field, firstly introduced in year 1982 for treatment of urinary stones. It is a noninvasive technology which shows remarkable effect in pain management, also helps in tissue regrowth with angiogenesis. With this unique effect it is tool of newer choice in rehabilitation with pain management. In last decade, there is so much upgradation happened in shockwave therapy treatment and we found Areion Arthron shockwave therapy system is suitable for treatment in pain with radiculopathy. So, this study specifies the effect of Areion Arthron shockwave therapy for cervical radiculopathy along with strengthening exercise for futuristic usage of such combination treatment options.

2. Material and Methods

2.1 Study Design: The study was conducted under the guidance of Department of Physiotherapy at the Pacific Medical University in Udaipur, Rajasthan, India. The study was carried out from 2021 to 2023.

2.2 Sample size: A total of 15 patients of cervical radiculopathy were included in the study. All patients were treated with strengthening exercise and Shock wave therapy (S.W. T). Patients were treated 5 times per week with twice sessions of areion arthron shockwave therapy for 6 weeks. Treatment duration was 20 to 40 minutes per sitting.

2.3 Inclusion Criteria

- Age – 20 years to 50 years
- Neck pain (more than 2 weeks)
- Diagnosed by MRI
- Positive special test

2.4 Exclusion Criteria:

- Patient with osteoporosis.
- Age less than 20 and more than 50.
- Patient with congenital deformity.

2.5 Clinical examination: The patients of cervical radiculopathy diagnosed by functional examination. Cervical Distraction Test and Foraminal Compression Test was used for diagnosis. VAS (Visual Analogue Scale) was used for measurement of acute pain.

2.6 Procedure: The subjects were fitted according to inclusion criteria and informed consent was taken from the patients and explained the procedure in detail. Appropriate treatment category was chosen according to plan for the patients for better effectiveness, proper treatment and thus better results.

S.W.T protocol for patients:

Pressure – 3-4 bar

Frequency – 10-20 Hz

No of shocks – 1500 – 2500 No

Sessions – 10

2.7 Patients assigned with strengthening exercise and SWT. Following exercise were included

- Deltoid strengthening

- Chin tuck exercise
- Shoulder scaption
- Shoulder Shrugs
- Diaphragmatic Breathing

Note: Pacific Medical University, Institute's ethical approval obtained dated 06/09/22, PMU/PMCH/IEC/2022/233. All participants completed information and consent form at recruitment.

2.8 Data analysis and statistics: The shift in score between pre and post-treatment in VAS and ROM of patients and continuous demographic variables (Age, sex) of patients was evaluated by comparing using an independent t-test. The mean difference+ SD were used to represent the whole data. The paired t-test was performed to analyze the group's pre and post- differences. For a two-tailed (alpha-2) probability (p) value, $p < 0.05$ was deemed statistically significant. Tools used for calculation are mentioned below:

Σx n; Mean

Standard deviation $SD = \sqrt{\Sigma(x-x_1)/n-1}$

Where,

x = the value of data distribution

X_1 = the sample mean

n = total number of sample

Independent t-test

$$t = \frac{x_1 - x_2}{\sqrt{(s_1/n_1 + s_2/n_2)}}$$

Where:

- x_1 is the mean of sample 1
- s_1 is the standard deviation of sample 1
- n_1 is the sample size of sample 1
- x_2 is the mean of sample 2
- s_2 is the standard deviation of sample 2
- n_2 is the sample size in sample 2

For each parameter, a relative percent mean change [from 0 wk. (pretest) to 6 wk. (post-test)] was also evaluated as Further; change fold between the groups was also evaluated by the following formula.

$$\% \text{ change} = \frac{\text{mean}_{4\text{wk}} - \text{mean}_{0\text{wk}}}{\text{mean}_{4\text{wk}}} \times 100$$

Change fold = Experimental % / Change Control % Change

3. Result

This study showed significant improvement in patients after treatment. This study showed pre-test ROM Neck Flexion Mean \pm SD was 39.0 ± 3.5 and improve to 47.2 ± 2.1 in post-test. Neck ROM Extension pre-test Mean \pm SD was 69.1 ± 8.1 improve to 78.0 ± 2.0 in post-test. ROM Rotation Right Side pre-test Mean \pm SD was 73.8 ± 2.7 and improve to 78.9 ± 0.9 in post-test. Rotation to left side pre-test Mean \pm SD was 73.8 ± 2.7 and improve to 78.9 ± 0.9 in post-test.

Data Analysis of VAS Scale also signified after treatment. Pre-test Mean \pm SD was 7.2 ± 1.3 and reduced to 2.6 ± 1.0 in post-test.

Table 1: Outcome measures scores of patients pre and post therapy

No. of Patients (n = 15)	Pre Test	Post Test
	Mean ± SD	Mean ± SD
ROM NECK FLEX	39.0 ± 3.5	47.2 ± 2.1
ROM NECK EXT	69.1 ± 8.1	78.0 ± 2.0
ROTATION RIGHT	73.8 ± 2.7	78.9 ± 0.9
ROTATION LEFT	73.8 ± 2.7	78.9 ± 0.9
VAS	7.2 ± 1.3	2.6 ± 1.0

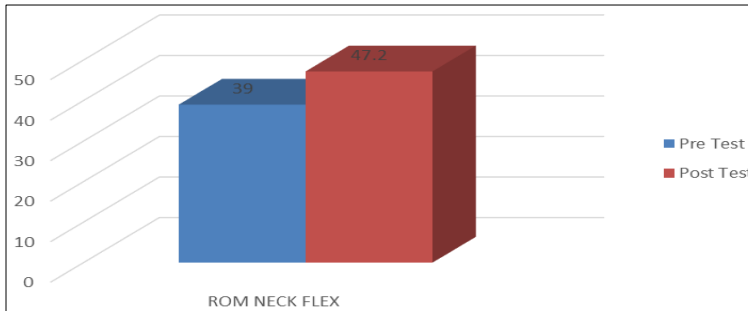


Fig 1: ROM neck flex comparison

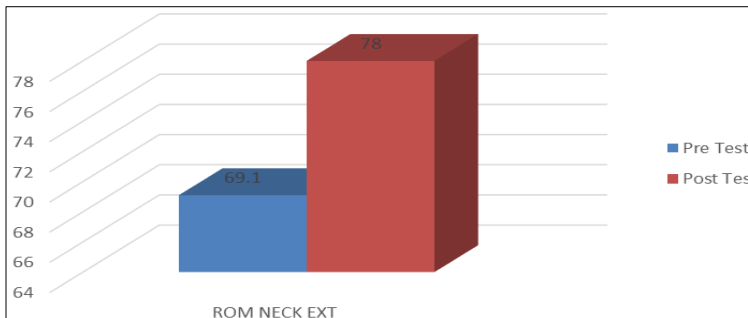


Fig 2: ROM neck Ext comparison

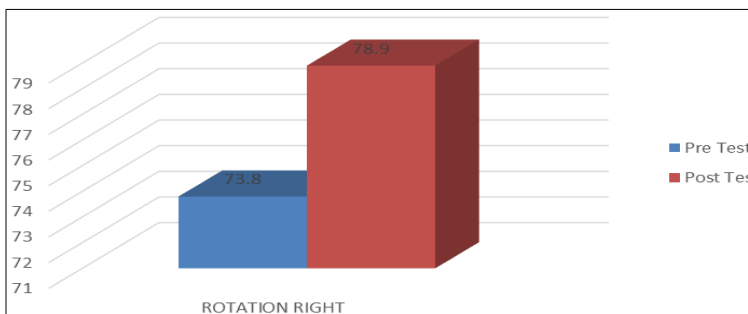


Fig 3: Rotation right comparison

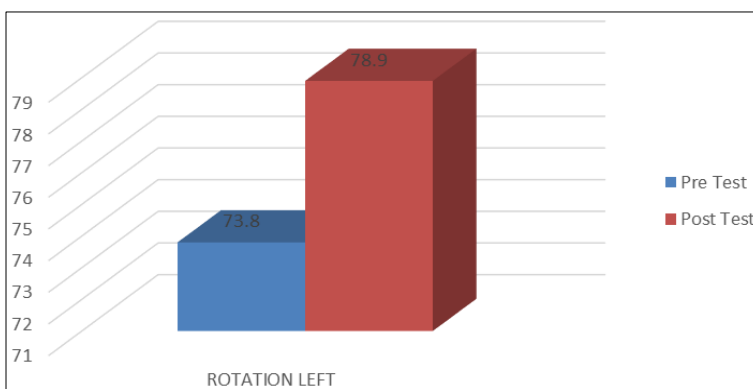


Fig 4: Rotation left comparison

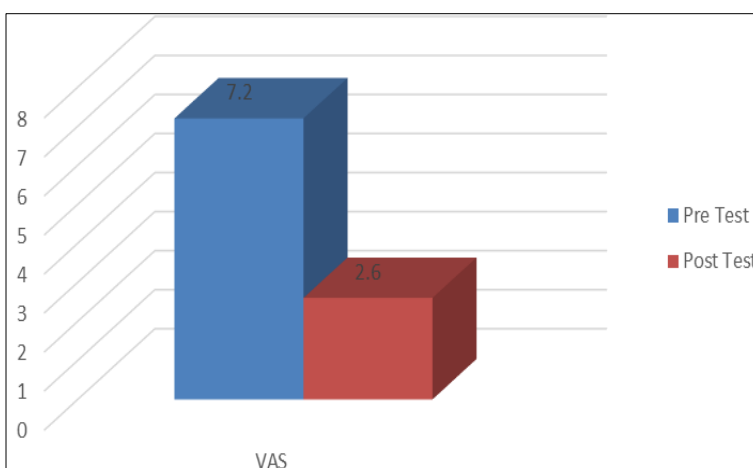


Fig 5: VES comparison

Table 2: Comparison of pre-test and post-test results and statistical significance

Sample Test								
Pre and Post Test (n = 15)	Mean	Standard Deviation	Standard Error Mean	95% confidence interval of the difference		T	df	Sig
				Lower	Upper			
ROM NECK FLEX	-8.1	3.4	0.8	-10.06	-6.2	-9.0(S)	14	P<0.001
ROM NECK EXT	-8.9	7.4	1.9	-13	-4.7	-4.6(S)	14	P<0.001
ROTATION RIGHT	-5	2.9	0.7	-6.6	-3.4	-6.7(S)	14	P<0.001
ROTATION LEFT	-5	2.9	0.7	-6.6	-3.4	-6.7(S)	14	P<0.001
VAS	4.6	0.9	0.2	4.05	5.1	18.0(S)	14	P<0.001

Note: S denotes significant at 5% level $p<0.05$

4. Discussion

The physical therapy care of a patient with cervical radiculopathy is described in this study. Physical limitations such as restricted range of motion, discomfort to rotation, and VAS tests improved significantly after the first session and were stable for the next three weeks.

Emerging data suggests that individuals who match the diagnostic criteria for cervical radiculopathy may benefit from a multimodal treatment plan that combines manual therapy, mechanical traction, and strengthening exercises^[10, 11, 12]. Cleland *et al* recently found that obtaining this multimodal package was

a predictor of a favourable result in individuals with cervical radiculopathy^[13].

Falla *et al.*^[14] showed that patients with persistent neck discomfort improved their capacity to maintain upright posture after participating in an exercise programme that targeted the deep cervical flexors. Neck and shoulder muscular strengthening has also been utilised successfully as part of a multimodal programme for individuals with neck pain^[15] and cervical radiculopathy^[12].

Lima *et al.*^[16] shown that improving cervical function may be accomplished by restoring normal muscular balance by strengthening and extending tight muscles. Stolzman *et al.*^[17] discovered that exercise can activate conditioned pain modulation descending inhibitory circuits, leading to pain alleviation. As a result, this study shows that exercise may be useful in alleviating pain in people with CR.

Ji *et al.*^[18] evaluated the impact of low-level four-session (2-week) targeted ESWT at the taut band of the upper trapezius. The findings revealed a reduction in pain and a considerable improvement in pressure pain threshold in the treatment group had a significantly higher likelihood of success than the control group (Yoo *et al.*, 2020)^[19]. Gur *et al.* (2013)^[20] separated the patients into two groups: therapeutic ultrasound and low frequency ESWT. Myofascial trigger points on the trapezius muscle were seen in all individuals. The authors evaluated the patients at the conclusion of 3 weeks of therapy and 3 months of follow up using the Global Patient Test, Physician Global Assessment Test, Neck Pain and Disability Scale, Nottingham Health Profile, and Hamilton Anxiety Scale. Both therapy approaches offer positive outcomes, according to the authors, but ESWT outperforms therapeutic ultrasound (Huang *et al.*, 2014).^[21]

5. Conclusion

The results of the study showed that shock-wave therapy combined with strengthening exercise has positive effect on pain, pain pressure threshold, cervical range of motion, and disability in patients with chronic cervical radiculopathy pain. On the other hand, strengthening exercises has effect on activity pain. The combined treatment including shock-wave therapy and strengthening exercise would be useful for physical therapists treating cervical radiculopathy in a clinical setting.

6. References

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