



RESEARCH ARTICLE

IMPACT OF DEXAMETHASONE PHONOPHORESIS THERAPY ON PATIENTS WITH CERVICAL RADICULOPATHY A CONTROLLED RANDOMIZED TRAIL

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ABSTRACT

Background: Cervical radiculopathy is a common cause of axial neck and arm pain, and is characterized by symptoms that radiate to the upper extremities in a dermatomal distribution. Nerve root impingement can be secondary to an acute disc herniation, or also from chronic spondylosis. annual incidence, approximately 83 cases per 100,000 persons (1). **Purpose:** Aim of current study was to investigate the effect of dexamethasone Phonophoresis Therapy on pain , range of motion and physical performance with cervical Radiculopathy patients. **Participants and methods:** The study was performed on thirty Patients (16 males & 14 females) aged 35 to 55 years suffering chronic cervical radiculopathy. They were divided into two equal groups; Group (A) received phonophoresis of dexamethasone ampoule (in each session with half of 8mg ampule and 35 g ultrasound gel) , Ultrasound device (Chattanooga-Ultrasound Combo Unit) was applied over the paravertebral neck region (1 MHz frequency and 1.5 Wt/cm² power and duration 10 min)in addition to conventional physical therapy program include corrective exercise programme in the form of two strengthening(deep cervical flexors and shoulder retractors) , two stretching (cervical extensors and pectoral muscles) exercises and hot packs Were performed for 10 min to the cervical area for local superficial heat .This conventional treatment was to be repeated three times per week for four weeks . Duration of treatment was 3sessions (45 min per session)/week. One session day after day for 4 weeks. Group (B) received a placebo dexamethasone phonophoresis (The ultrasound probe was held over the paravertebral neck region using topical gel containing (half of 8mg ampule of dexamethasone and 35 g ultrasound gel in each session) which was the same as in group A. Ultrasound device seemed to be working for 10-min period with light-off position in addition to conventional physical therapy program which was the same as in group A. Three evaluation procedures applied before and after the treatment program through visual analogue scale (VAS), The cervical range of motion (CROM) device and Neck disability index. **Results:** There was a significant increase in cervical ROM of the group A compared with that of the group B post treatment ($p < 0.01$), and a significant decrease in VAS and NDI of the group A compared with that of the group B ($p < 0.001$). **Conclusion:** The results suggested that dexamethasone phonophoresis is effective in treating cervical radiculopathy that causes a greater improvement in their quality of life.

INTRODUCTION

Cervical radiculopathy is the lower motor neuron and sensory manifestation of neurologic dysfunction in the distribution of a given cervical nerve root. is caused by a cervical disc herniation or other space-occupying lesion (eg, osteophytic encroachment associated with cervical spondylosis), that may result in nerve root impingement, inflammation, or both.(2). These lesions can trigger pain receptors in the soft tissues and joints of cervical spine that can lead to both sensory or the motor changes in upper extremity along with loss of sensation, numbness, tingling, fragility in upper end point, motor defects in neck and few times in scapula, and pain along

the nerves pathway into the hand and arm, relying on where the affected roots are located. The radiation of pain can be unilateral or bilateral, although bilateral cases occurred only in 5- 36%of patients with cervical radiculopathy(3). The average annual incidence rate of cervical radiculopathy is 83 per 100000 of population, with an increased prevalence occurring in the fifth decade of life (203 per 100000). Cervical radiculopathy affects both the genders equally but males show early changes in cervical spine and subsequently leading to cervical radiculopathy, where as in females, the problem arises after the menopause (4). Phonophoresis (PP) uses high-frequency sound waves (i.e., ultrasound) to deliver therapeutic medications, usually topical analgesics or steroids, through the

skin to deeper tissues. Topically applied drugs therapeutic effects depend on different factors such as rate, amount, drug penetration dept of the skin, and the potential drug toxicological hazards on the tissues. PP and US therapy has been used in musculoskeletal disorders and it is well tolerated, noninvasive, painless method. The PP therapy has been predominantly used as a pain reduction modality in musculoskeletal disorders such as myofascial pain syndrome, knee osteoarthritis, carpal tunnel syndrome, tendinitis and tenosynoviti (5). Exercise is the most appropriate tool in the process of rehabilitation for cervical pain patients, as they help in improving the neuromuscular control, and the flexibility which is required for soft tissue proliferation and to improve daily activities [6]. Neck pain management exercises are affected by many factors including intensity, frequency, and types of exercise. Strengthening exercises in the form of isometric and isotonic exercises approved to have significant effects on the outcomes in some previous studies(6). Static stretching is a technique that places a muscle joint complex in a specific ROM until a stretch is perceived. The position is held for a specific period of time and repeated as necessary to increase joint ROM. The optimal number of stretch repetitions is four and the optimal amount of time that the static stretch should be held between 6 -30 seconds (7). The purpose of this study was to investigate the effect of dexamethasone Phonophoresis Therapy on pain , range of motion and physical performance with cervical Radiculopathy patients.

Participants and methods Study design: The study was designed as a randomized controlled trial.

Participant: This study was conducted on thirty Patients from both sexes with chronic cervical radiculopathy. The patients were diagnosed, and referred from a neurologist. The patients were selected from out patient Clinic of the medical complex in new cairo during the period from August 2020 to February 2021. Patients were randomly assigned into two equal groups (A and B). They were selected according to the following inclusion criteria: Their age ranged between 35 to 55 years, They were suffering from unilateral lower cervical radiculopathy (C4-C7) referred by neurologist, Duration of symptoms more than three months to avoid acute stage of inflammation and All patients were medically stable. Exclusion criteria of the study were as follows: patients were excluded from the study if they had : Cervical myelopathy , Cervical myelo-radiculopathy, Acute cervical radiculopathy, Diabetic neuropathy, Previous cervical or shoulder surgery , Presence of VBI syndrome, Cervical trauma, Any tumours involving cervical spine, Double crush syndrome, a history of neurologic disease, Rheumatoid arthritis, Thoracic outlet syndrome and any contraindications for ultrasound uses. All participants were subjected to clinical examination, and investigation to confirm inclusion criteria and distract excluded cases.

METHODS

The subjects were randomly distributed into two equal groups: Group A: It consist of 15 Patients(8males and7 females) had cervical radiculopathy received phonophoresis of dexamethasone ampoule(in each session with half of 8mg ampule and 35 g ultrasound gel), Ultrasound device (Chattanooga-Ultrasound Combo Unit) was applied in circular movements with a 4 cm² US head over the paravertebral neck region (from C4-C7 paraspinal) with 1 MHz frequency and 1.5 Wt/cm² power while Patients was

instructed to lie in prone or sitting comfortable position , the treatment duration was 10 min and Conventional selected physical therapy program were:

Hot packs Were performed for 10 min to the cervical area for local superficial heat. The strengthening exercise program was conducted according to the protocol described in Harman et al and based on Kendall et al's approach. Strengthen deep cervical flexors through chin tucks in the supine position with the head in contact with the plinth . The progression of this exercise involved lifting the head off the plinth in a tucked position and holding it for varying lengths of time (this process progressed in two second increments starting at two seconds, ie, 2, 4, 6, and 8 seconds). Strengthen shoulder retractors first while standing using a theraband by pulling the shoulder back. The patient was asked to pinch the scapulae together without elevation or extension in the shoulder, holding this position for at least six seconds and then relaxing. The first progression involved conducting the shoulder retraction from a prone position using weights. The second progression used elastic resistance and weights. Participants performed each progression for two weeks. For serratus anterior strengthening, the patient was instructed to stand at the wall with arms approximately shoulder width apart and was then asked to push the wall away until the elbows are fully extended and the scapulae are protracted as far as possible. Stretching cervical extensors through a chin drop while sitting (the progression of this exercise was to drop the chin with hand assistance). Unilateral and bilateral pectoralis stretches alternating each two-week period. For bilateral pectoralis stretching, the patient was seated comfortably with their hand behind their head, from this position, the patient's elbow was moved up and out to the end of the available range. For unilateral stretching, the arm on the involved site was moved into abduction and external rotation. To stretch the costal division, the arm should be elevated to approximately 135 degrees. For sternal division, the arm abducted to 90 degrees. For clavicular division, the arm was rested at the side (8,9).

Participants were instructed to complete three sets of 12 repetitions of the strengthening exercises and three stretching exercises held for 30seconds each. This exercise program will be repeated Three times per week for 4 weeks. Duration of treatment was 3sessions (45 min per session)/week. One session day after day for 4 weeks Group B: It consist of 15 Patients(8males and7 females) had cervical radiculopathy received Placebo phonophoresis therapy The ultrasound probe was held over the paravertebral neck region using topical gel containing (half of 8mg ampule of dexamethasone and 35 g ultrasound gel in each session)which was the same as in group A. Ultrasound device seemed to be working for 10-min period with light-off position in addition to conventional physical therapy program which was the same as in group A. All participants were subjected to full history taking, clinical examination, and investigation to confirm inclusion criteria and distract excluded cases.

Outcome measures: The assessment of the participants in the two groups (A and B) was carried out before, after 4 weeks through visual analogue scale (VAS), The cervical range of motion (CROM) device and Neck disability index (NDI). visual analogue scale (VAS) : Measurement of pain was performed by using a visual analogue scale (VAS). It is a responsive pain scale that yields reliable and valid data.

Table 1. Comparison of subject characteristics between the group A and B:

	Mean ±SD		MD	t- value	p-value
	Group A	Group B			
Age (years)	41.8 ± 6.14	40.26 ± 5.48	1.54	0.72	0.47
Weight (kg)	74.03 ± 5.47	72.83 ± 5.53	1.2	0.59	0.55
Height (cm)	163.2 ± 4.81	162.13 ± 4.3	1.07	0.64	0.52
BMI (kg/m ²)	27.84 ± 2.53	27.72 ± 2.13	0.12	0.14	0.88
Sex, n (%)					
Females	5 (33%)	6 (40%)			0.7
Males	10 (67%)	9 (60%)			

SD, Standard deviation; MD, Mean difference; p value, Probability value

Table 2. Mean cervical ROM pre and post treatment of the group A and B:

	Group A	Group B	P value
	Mean ±SD	Mean ±SD	
ROM (degrees)			
Flexion			
Pre treatment	65.33 ± 7.66	66.46 ± 6.32	0.66
Post treatment	84.66 ± 4.54	71.8 ± 5.73	0.001
	<i>p</i> = 0.001	<i>p</i> = 0.002	
Extension			
Pre treatment	55.53 ± 7.02	53.33 ± 6.55	0.38
Post treatment	67.66 ± 4.17	59.86 ± 5.19	0.001
	<i>p</i> = 0.001	<i>p</i> = 0.001	
Right bending			
Pre treatment	30.06 ± 5.65	30.53 ± 5.01	0.81
Post treatment	42.33 ± 3.19	36.6 ± 4.15	0.001
	<i>p</i> = 0.001	<i>p</i> = 0.001	
Left bending			
Pre treatment	30.26 ± 6.54	29.46 ± 4.32	0.69
Post treatment	43 ± 2.53	37.33 ± 4.71	0.001
	<i>p</i> = 0.001	<i>p</i> = 0.001	
Right rotation			
Pre treatment	61.66 ± 7.23	60.8 ± 8.29	0.76
Post treatment	77.8 ± 3.12	71.46 ± 2.56	0.001
	<i>p</i> = 0.001	<i>p</i> = 0.001	
Left rotation			
Pre treatment	63.73 ± 4.87	62.33 ± 6.39	0.51
Post treatment	78.26 ± 3.51	71.33 ± 4.8	0.001
	<i>p</i> = 0.001	<i>p</i> = 0.001	

SD, Standard deviation; p value, Probability value

Table 2. Median values of VAS and ODI pre and post treatment of the group A and B:

	Group A	Group B	U- value	p-value
	Median (IQR)	Median (IQR)		
VAS				
Pre treatment	6 (7-5)	7 (7-6)	86.5	0.26
Post treatment	2 (3-1)	4 (5-3)	19	0.001
Z- value	3.5	3.45		
	<i>p</i> = 0.001	<i>p</i> = 0.001		
NDI				
Pre treatment	44 (46.6-42)	40 (50-35)	0.78	0.78
Post treatment	16 (20-14)	30 (35-24)	11	0.001
Z- value	3.41	3.41		
	<i>p</i> = 0.001	<i>p</i> = 0.001		

IQR, inter quartile range; U- value, Mann-Whitney test value; Z- value, Wilcoxon signed ranks test value; p-value, level of significance

The patients were asked about the perception of pain using a 10-cm line with 0 (no pain) on one end and 10 (worst pain) on the other. Patients were asked to place a mark along the line to denote their level of pain (9). The cervical range of motion (CROM) device : device is one of the tools available clinically to measure cervical ROM. The CROM device consists of a plastic frame placed on the head over the nose and the ears, secured by a Velcro strap. Two independent inclinometers, in the sagittal plane and 1 in the frontal plane, are attached to the frame and indicate the position of the head with respect to the line of gravity.

A third inclinometer is positioned in the horizontal plane and indicates the position of the head in rotation, with respect to a reference position (10). Neck disability index (NDI): The NDI was derived from the Oswestry Disability Index and it consists of ten items related to pain intensity, headache, concentration and different physical activities (lifting, personal care, recreation, work, driving, reading and sleeping) with six possible responses per item. The score of each item ranges from 0 to 5. The highest total possible score is 50, and this score is converted to a percentage. Higher scores represent higher levels of disability.

The NDI has been shown to be a valid and reliable questionnaire for patients with neck pain (11)

Statistical analysis: Unpaired t-test were conducted for comparison of subject characteristics between groups. Normal distribution of data was checked using the Shapiro-Wilk test. Levene's test for homogeneity of variances was conducted to test the homogeneity between groups. Mixed design MANOVA was performed to compare within and between groups effects on cervical ROM. Post-hoc tests using the Bonferroni correction were carried out for subsequent multiple comparison. VAS and NDI were compared between groups by Mann-Whitney U test and between pre and post treatment in each group by Wilcoxon Signed Ranks. The level of significance for all statistical tests was set at $p < 0.05$. All statistical analysis was conducted through the statistical package for social studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).

RESULTS

Subject characteristics: Table (1) showed the subject characteristics of the group A and B. There was no significant difference between groups in the mean age, weight, height, BMI and sex distribution ($p > 0.05$).

Effect of treatment on cervical ROM, VAS and NDI: Mixed MANOVA for the effect of treatment on cervical ROM revealed that there was a significant interaction of treatment and time ($F = 6.66, p = 0.001$). There was a significant main effect of time ($F = 49.83, p = 0.001$). There was a significant main effect of treatment ($F = 3.24, p = 0.01$).

Within group comparison: There was a significant increase in all cervical ROM post treatment in both groups compared with that pre treatment ($p < 0.001$). Also, there was a significant decrease in VAS and NDI post treatment in both groups compared with that pre treatment ($p < 0.001$). (table 2-3).

Between group comparison: There was no significant difference between groups pre treatment ($p > 0.05$). Comparison between groups post treatment revealed a significant increase in cervical ROM of the group A compared with that of the group B post treatment ($p < 0.01$), and a significant decrease in VAS and NDI of the group A compared with that of the group B ($p < 0.001$). (table 2-3).

DISCUSSION

The results of this study confirmed that there was a significant increase in cervical ROM of the group A compared with that of the group B post treatment ($p < 0.01$), and a significant decrease in VAS and NDI of the group A compared with that of the group B ($p < 0.001$). The results of this study agreed with those of Durmus et al., 2013(12) who investigated that the impact of determined that a combination of Phonophoresis with exercise therapy can be used to obtain optimal clinical results regarding improving pain, disability in the patients with chronic neck pain. Results of present study were supported by Ahmed et al., 2019 (13) who provided that dexamethasone phonophoresis resulted in a greater improvement in pain and function in patients with knee OA. As showed by Mehrotra & Tripathi 2020 (14) that There was a

significant improvement in pain and function in patients with knee OA than therapeutic ultrasound combined with exercise and TENS. Phonophoresis is the use of ultrasound waves (US) to enhance the absorption of topically applied drugs by increasing skin permeability to topical medications. Few studies have been done on phonophoresis of topical corticosteroids in reducing the symptoms of articular degenerative diseases and comparison between the efficiency of these treatments on reduction of inflammation diverse regions. On contrast to the study Reinking., 2016(15) found that phonophoresis with dexamethasone did not appear to augment pain relief associated with exercise intervention. These studies do not support the use of phonophoresis for patients with patellar tendon pain.

Conclusion

Based on the scope and findings of this study, the following conclusion appeared to be warranted: a combination of dexamethasone phonophoresis with conventional physiotherapy (exercise therapy and hot packs can be used to obtain optimal clinical results regarding improving pain, range of motion and physical performance in patients with cervical Radiculopathy.

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