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Original Article

Effect of Radial Nerve Mobilization on Pain and Functional Activities Among Adult Computer Users with Lateral Epicondylitis

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ABSTRACT
Background: Lateral epicondylitis is a prevalent condition among computer professionals, characterized by lateral elbow pain due to nerve entrapment.
Objective: The study aimed to evaluate the effectiveness of radial nerve mobilization on mitigating pain and enhancing the functional capabilities of adult computer users with lateral epicondylitis.
Methods: In a quasi-experimental study at Akhtar Saeed Trust Hospital, 44 adult patients diagnosed with lateral epicondylitis were recruited. The subjects were allocated into two groups: Group 1 received radial nerve mobilization alongside conventional therapy, while Group 2 was provided with conventional therapy alone. The Numeric Pain Rating Scale and the Patient-Specific Functional Scale were employed to gauge treatment outcomes.
Results: The participants, within the age range of 19 to 44 years, showed a statistically significant improvement in pain levels ($P < 0.0001$) after one week of radial nerve mobilization treatment compared to those who received only conventional therapy.
Conclusion: Radial nerve mobilization, when combined with conventional therapy, proved significantly effective in reducing pain and improving functional activities in individuals with lateral epicondylitis. The intervention group experienced considerable pain relief and enhanced function relative to the control group.
Keywords: Lateral Epicondylitis, Radial Nerve Mobilization, Computer Professionals, Numeric Pain Rating Scale, Patient-Specific Functional Scale, Quasi-Experimental Study, Physical Therapy, Rehabilitation.

INTRODUCTION
Lateral Epicondylitis, commonly known as tennis elbow, is a condition characterized by inflammation of the elbow's common extensor tendon, particularly affecting the extensor carpi radialis brevis. This condition governs the movements such as finger extension, wrist dorsiflexion, and supination rotation of the forearm, all of which are integral to the function of muscles connected to the lateral epicondyle of the humerus (1).

The prevalence of Lateral Epicondylitis is notable among computer users, particularly programmers, contributing to a significant portion of musculoskeletal injuries in this demographic. Epidemiological data indicates that 7% of affected individuals, primarily Windows users, are diagnosed with radial tunnel syndrome, while 33% suffer from Lateral Epicondylitis (2). Overall, this condition affects 1% to 3% of the general population, predominantly between the ages of 35 and 54, with equal gender distribution but a noted increased severity in women. The condition significantly impacts daily activities and occupational performance due to pain and dysfunction, although it is not considered a disabling condition (4).

The increasing use of laptop computers in modern occupations raises concerns about musculoskeletal disorders, which, if unaddressed, could lead to early dysfunction and impairment. Studies have shown that students who frequently use handheld digital devices are at a heightened risk of developing these issues (5). Complications such as distal humeral fractures and displaced distal nerve palsies are commonly associated with these disorders (6), with even minor stress during fracture surgical procedures posing significant risks to the radial nerve (7).

Shamsi H et al.'s analysis of randomized controlled trials (RCTs) from 2000 to 2020 highlighted the potential of neuromobilization techniques in improving nervous system dysfunctions. However, the mixed methodological quality of these studies indicates that neural mobilization may not offer significant advantages over conventional treatments or placebos (8). Neural mobilization, particularly the sliding technique, has been developed to mobilize the nervous system without exacerbating symptoms (9). Riya Gupta et al.'s research further supports this, demonstrating the efficacy of dry needling and neural mobilization in functional recovery of individuals with Lateral Epicondylitis (10).

A study in an American college revealed that 67% of respondents experienced upper limb stiffness or soreness due to computer use (5). Pain associated with Lateral Epicondylitis is typically induced by repetitive forearm, wrist, and hand motions, particularly affecting the lateral aspect and common extensor tendon origin. Neurodynamic treatment has been reported to improve mobility and function in individuals with persistent elbow pain (11).

Recent randomized controlled trials conducted by Szu-Ying Wu et al. in May 2019 (12), Shaji J Kachanathu et al. in August 2019 (13), and J Nowotny et al. in 2018 (14), as well as a study by Rosemary Yi et al. in 2018 (15), have contributed to our understanding of various treatment modalities for Lateral Epicondylitis, ranging from acupuncture to wrist splinting and deep friction massage. These studies highlight the varied responses to treatments and emphasize the need for a comprehensive approach to managing this condition.

Despite some cases resolving spontaneously without structured medical intervention, Lateral Epicondylitis is still considered a significant impediment to daily life activities. There is a lack of research exploring whether individuals with Lateral Epicondylitis seek and adopt mobility adaptations for spontaneous recovery (16).

The present study aims to fill this gap by focusing on the impact of radial nerve mobilization on both pain and functional outcomes in computer users with Lateral Epicondylitis. This research is vital for the rehabilitation and management of this condition, providing insights into effective treatment strategies that address both pain relief and functional recovery.

MATERIAL AND METHODS

The study was conducted at Akhtar Saeed Trust Hospital over a six-month period following the approval of the synopsis. Adopting a quasi-experimental design, the research aimed to explore the effectiveness of radial nerve mobilization on pain and functional activities among adult computer users diagnosed with Lateral Epicondylitis. A total of 44 participants were enrolled, with the anticipated mean improvement after radial nerve mobilization (μ) being 7.13, and the variance of improvement (σ2) being 2.56. The test value of the population mean (μa) was set at 6.13. The desired level of significance (Z 1-α/2) was 90%, with a sample size (n) of 44 and a sample error of 5%.

Participants were selected based on specific inclusion and exclusion criteria. The inclusion criteria encompassed subjects presenting with an acute condition of lateral epicondylitis, individuals working on computers for approximately 6 to 8 hours per day, and patients who had been experiencing lateral elbow pain and radiating pain for 1 to 2 months, aged between 19 to 44 years. The exclusion criteria ruled out individuals with predominant systemic illness, neurological or psychological disorders, a history of severe spine fractures leading to potential lifelong neurological impairment, those who had undergone surgery on their spine or upper limbs, and those with limited mobility or diseases that could reduce the mechanical usefulness of the neural tissue tension test (13).

A non-probability convenience sampling technique was employed for participant selection. Upon recruitment, all participants provided written informed consent. They were then divided into two groups: Group 1 (Experimental Group) consisting of 22 participants, and Group 2 (Control Group) also with 22 participants. Group 1 underwent radial nerve mobilization combined with traditional therapy approaches, including stretching, elbow bracing, and range of motion exercises. Meanwhile, Group 2 received only conventional therapy. The treatment lasted for one week.

The procedure for radial nerve mobilization involved positioning the patient in a supine lying posture, with shoulder girdle pressed, elbow and arm rotated internally, and flexing wrist, thumb, and fingers. These movements loaded the radial nerve, and shoulder depression was maintained through elbow flexion and wrist extension. Before the elbow extension test, the wrist and fingers were fixed, and the elbow was gently extended for about 2 seconds to the point where the participant felt tension but no pain, then flexed. This process was repeated in three sets of six to eight oscillations. Pain and functional activities were assessed before and after the intervention using the Patient-Specific Functional Scale and the Numeric Pain Rating Scale, both recognized for their validity and reliability, with the Patient-Specific Functional scale demonstrating a reliability of 82%.

Data analysis was conducted using the Statistical Package for the Social Sciences version 21. Descriptive statistics were documented, and qualitative characteristics were represented using percentages. To assess differences in pain and functional activities between the groups, a paired t-test was performed on the Numeric Pain Rating Scale and Patient-Specific Functional Scale scores. Additionally, an independent t-test was applied to determine the differences between the two groups.

Ethical considerations were rigorously adhered to throughout the study. Participants were provided with a written consent form, and confidentiality of participant information was maintained to the highest standards.

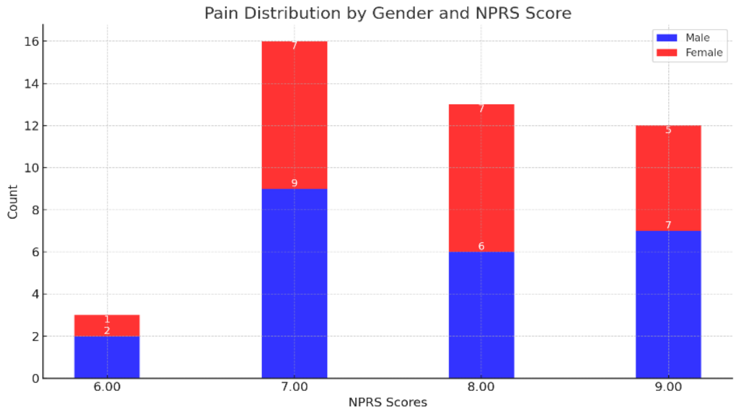

Figure 1 Pain Distribution among Genders

RESULTS

Gender and Pain Distribution: The bar graph distinctly illustrates the initial Numeric Pain Rating Scale (NPRS) scores across genders, with males reporting higher instances of the most severe pain rating (9.00). Specifically, 24 male participants and 20 female participants were involved, with 7 males and 5 females experiencing the highest pain level (NPRS score of 9.00).

Comparative Analysis of Pain Scores: Table 1 highlights the mean NPRS scores before and after treatment for Group 1 and Group 2. Initially, Group 1 had a mean NPRS score of 7.50 with a standard deviation of 0.96, which significantly decreased to 3.41 (SD = 1.01) post-treatment ($P < 0.000$). In contrast, Group 2 started with a higher initial mean NPRS score of 8.05 (SD = 0.84), which was reduced to 5.23 (SD = 1.02) following treatment.

Table 1: Comparative Analysis of Pain Scores (NPRS) Between Group 1 and Group 2

Group	Measurement Point	Mean NPRS Score	Standard Deviation	P Value
1	Initial (NPRS1)	7.50	0.96	0.052
2	Initial (NPRS1)	8.05	0.84	-
1	Post-Treatment (NPRS2)	3.41	1.01	0.000
2	Post-Treatment (NPRS2)	5.23	1.02	-

Table 2: Comparative Analysis of Functional Activities Between Group 1 and Group 2

Functional Activity	Time Point	Group	Mean	Standard Deviation	P Value
Grocery Handling	Initial (GROCERY1)	1	3.68	1.04	0.681
		2	3.55	1.14	
	Post-Treatment (GROCERY2)	1	7.14	1.08	0.000
		2	2.27	0.63	
Personal Activity	Initial (PERSONALACTIVITY1)	1	3.36	1.22	0.150
		2	3.82	0.80	
	Post-Treatment (PERSONALACTIVITY2)	1	6.86	0.94	0.000
		2	2.59	1.05	
Work Activities	Initial (WORK1)	1	3.50	1.22	0.046
		2	4.14	0.77	-
	Post-Treatment (WORK2)	1	6.55	0.96	0.000
		2	2.64	0.66	
Recreation	Initial (RECREATION1)	1	3.36	1.40	0.041
		2	4.09	0.81	
	Post-Treatment (RECREATION2)	1	6.09	1.06	0.000
		2	3.41	0.85	
Turning a Doorknob	Initial (TURNDOOR1)	1	3.32	1.62	0.000
		2	4.86	0.77	
	Post-Treatment (TURNDOOR2)	1	5.95	1.40	0.000
		2	3.41	0.80	
Lifting a Coffee Cup	Initial (LIFTCOFFEE1)	1	2.82	1.44	0.000
		2	5.18	0.80	
	Post-Treatment (LIFTCOFFEE2)	1	5.50	1.19	0.003
		2	4.50	0.86	-
Opening a Jar	Initial (OPENJAR1)	1	3.32	1.62	0.000
		2	5.59	0.91	-
	Post-Treatment (OPENJAR2)	1	6.14	1.46	0.000
		2	3.41	0.85	-

Comparative Analysis of Functional Activities: Table 2 provides detailed results of the effects of treatment on various functional activities, such as grocery handling and personal activities. Notably, Group 1 showed a significant improvement in grocery handling from an initial mean score of 3.68 (SD = 1.04) to 7.14 (SD = 1.08) post-treatment ($P < 0.000$). Similar trends of significant improvement were observed in other activities like work, recreation, and more complex tasks such as turning a doorknob and lifting a coffee cup, with all post-treatment P values indicating a level of 0.000 to 0.003.

Table 3: Comparative Analysis of Paired Samples Test for Group 1 and Group 2

Group	Pair	Functional Activity	Initial Mean	Post-Treatment Mean	N	Std. Deviation (Initial)	Std. Deviation (Post-Treatment)	P Value
1	1	NPRS	7.5000	3.4091	22	0.96362	1.00755	0.000
2	1	NPRS	8.0455	5.2273	22	0.84387	1.02036	0.000
1	1	Grocery	3.6818	7.1364	22	1.04135	1.08213	0.000
2	1	Grocery	3.5455	2.2727	22	1.14340	0.63109	0.000
1	2	Personal Activity	3.3636	6.8636	22	1.21677	0.94089	0.000
2	2	Personal Activity	3.8182	2.5909	22	0.79501	1.05375	0.000
1	3	Work	3.5000	6.5455	22	1.22474	0.96250	0.000
2	3	Work	4.1364	2.6364	22	0.77432	0.65795	0.000
1	4	Recreation	3.3636	6.0909	22	1.39882	1.06499	0.000
2	4	Recreation	4.0909	3.4091	22	0.81118	0.85407	0.01
1	5	Turning a Doorknob	3.3182	5.9545	22	1.61500	1.39650	0.000
2	5	Turning a Doorknob	4.8636	3.4091	22	0.77432	0.79637	0.000
1	6	Lifting Coffee Cup	2.8182	5.5000	22	1.43548	1.18523	0.000
2	6	Lifting Coffee Cup	5.1818	4.5000	22	0.79501	0.85912	0.04
1	7	Opening a Jar	3.3182	6.1364	22	1.61500	1.45718	0.000
2	7	Opening a Jar	4.0909	3.4291	22	0.81118	0.84407	0.000

Paired Samples Test: Table 3 consolidates the paired samples test results for both groups, emphasizing the marked improvements within Group 1. For instance, the mean NPRS score for Group 1 improved dramatically from 7.50 to 3.41 (N = 22, SD initial = 0.96362, SD post-treatment = 1.00755, P < 0.000). Group 2 also showed improvement, but less pronounced, with their NPRS scores reducing from 8.0455 to 5.2273.

DISCUSSION

The present study sought to evaluate the efficacy of radial nerve mobilization (NM) in reducing pain and enhancing functional activities in computer users diagnosed with lateral epicondylitis. The outcomes demonstrated notable improvement in pain management and a significant decrease in activity limitations, suggesting enhanced functional levels post-treatment.

In concordance with our findings, Kim et al. reported favorable outcomes in pain reduction using both physiotherapy and electrotherapy (17). Similarly, Joseph M et al. found that incorporating scapular muscle strengthening alongside local therapy yielded substantial improvements in pain relief, function, and hand strength over various follow-up periods, thus supporting multifaceted therapeutic approaches for managing lateral epicondylitis (18).

Yen-Ting Cho et al. explored the effectiveness of taping therapy—a commonly utilized intervention for racquet sports players suffering from lateral epicondylitis. Their study reported immediate pain relief following application, affirming the utility of this non-invasive treatment modality (19). Such findings are complemented by research indicating that both elastic and non-elastic therapeutic taping can alleviate pain and enhance functional capabilities in conditions such as osteoarthritis of the knee (20) (21).

The literature underscores the value of training programs in teaching patients to modify detrimental movements in their daily activities, with ergonomic management criteria being pivotal in such educational interventions (16). Furthermore, NM has garnered robust support for its immediate mechanical hypoalgesic effects across a spectrum of musculoskeletal and nerve-related distresses, presenting a viable non-pharmacological alternative devoid of drug-associated adverse effects (22).

Chiropractic care, incorporating biomechanical applications and NM techniques, has shown positive results in cases of radial nerve impingement, and for irreversible radial nerve damage, forearm tendon transfers have been endorsed as a suitable treatment strategy (23) (24) (25). Additionally, Rathod N et al.'s study highlighted the prevalence of neck pain among students and educators due to laptop use, linking musculoskeletal discomfort with usage patterns (26).

In this study, functional activity levels were assessed using patient-specific functional scales across five different activities. The experimental group, treated with radial nerve mobilization in conjunction with standard treatment protocols, demonstrated significantly improved functional levels compared to the control group, which received only standard treatments. This suggests that NM is a potent adjunctive therapy for lateral epicondylitis.

A cross-comparison of numeric pain rating scores with patient gender revealed more pronounced effects of NM in females than in males, indicating a gender-specific response to the mobilization technique.

In summary, the assessment of radial nerve mobilization as a treatment for pain and activity limitation in individuals with lateral epicondylitis indicates that it can substantially mitigate pain and enhance functional status, with effects more significant in females. This underscores the treatability of pain and functional impairment, although further detailed research is warranted.

CONCLUSION:

It can be concluded that radial nerve mobilization is an effective intervention for improving pain and functional activities in adult computer users suffering from lateral epicondylitis. The group undergoing radial mobilization exhibited reduced pain and improved mobility compared to the group that did not receive this treatment.

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