

COMPARATIVE EFFICACY OF SOFT TISSUE MOBILIZATION AND ULNAR NERVE-SPECIFIC STRENGTHENING EXERCISES IN PATIENTS WITH CUBITAL TUNNEL SYNDROME

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Abstract

Background: Cubital tunnel syndrome is the second most common upper limb entrapment neuropathy and is characterized by pain, sensory disturbances, and functional impairment resulting from compression of the ulnar nerve at the elbow. Conservative physiotherapy is recommended for patients with mild to moderate disease; however, evidence comparing combined rehabilitation approaches with manual therapy alone remains limited.

Objective: To compare the efficacy of soft tissue mobilization combined with ulnar nerve specific strengthening exercises versus soft tissue mobilization alone in patients with mild to moderate cubital tunnel syndrome.

Methodology: A study design used in this research is a double blinded randomized control trial which was carried out on 56 participants of cubital tunnel syndrome with mild to moderate severity level chosen from two Physiotherapy clinics in Lahore, Pakistan. Random allocation of participants took place and two equal groups were created. Group A was treated with soft tissue mobilization and ulnar nerve specific exercises while Group B was treated with soft tissue mobilization only. Three treatments were carried out each week for 4 weeks. The pain intensity, upper limb disability and health-related quality of life were measured through Numeric Pain Rating Scale (NPRS) and Disabilities of the Arm.

Results: Both groups demonstrated statistically significant improvements in pain, disability, and quality of life after four weeks ($p < 0.001$). However, Group A achieved significantly greater improvements than Group B. At week four, NPRS scores were 2.95 ± 1.21 versus 4.94 ± 0.92 and DASH scores were 27.58 ± 8.57 versus 39.64 ± 6.68 (all $p < 0.001$).

Conclusion: However, both treatment methods effectively helped to enhance pain and improve the function of upper limbs of the patients suffering from cubital tunnel syndrome. However, when using the method of soft tissue mobilization in conjunction with ulnar nerve specific strengthening exercises proved to yield better results than only soft tissue mobilization.

1. INTRODUCTION

Cubital tunnel syndrome is caused by ulnar nerve compression in the elbow joint and is recognized as the second most common entrapment neuropathy of the upper extremity after carpal tunnel syndrome. Cubital tunnel syndrome occurs when the ulnar nerve in the cubital tunnel gets irritated and compressed causing numbness and tingling sensations in the ring and little finger, pain in the inner part of the elbow, weakness in the hands and eventually loss of fine motor abilities [1]. Since the ulnar nerve plays an important role in the functioning of the muscles of the hand as well as sensing sensation in the ulnar nerve distribution, chronic compression may lead to problems with gripping, pinching, coordination and other activities. Muscles may also start atrophy and sensory problems may appear indicating serious nerve damage [2].

Apart from the frequency of CuTS, another thing that makes it clinically important is its functional impact on patients. Patients often find it difficult to perform occupations, domestic tasks, and activities related to personal care which require sustained elbow positions and repetitive arm or fine hand movements. According to a recent review article, untreated or inadequately treated CuTS may result in long-term disability, decreased quality of life, and even permanent damage to nerves in certain cases [3]. Hence, early detection and proper treatment of CuTS are essential. Detection of CuTS involves history taking, physical examination with provocation tests and additional investigations when required. Electrodiagnostic testing remains very important in determining the severity and ruling out differential diagnosis, especially in chronic/progressive cases [4].

The treatment for CuTS is conservative especially in mild to moderate cases. It includes activity modification, splinting, medications, exercise therapy, ergonomics and patient education, which are common non-operative treatment options [3]. One good thing about conservative treatment is its non-invasiveness, low cost and the ability to prevent surgery for some people. The reason for such popularity of exercise therapy is the aim of improving mobility of the

nerves and muscles, as well as tolerance to work in the elbow and forearm. Nowadays, ulnar nerve

exercises are being recommended more often in the literature and clinical guidelines as effective in symptom alleviation through movement control, restoring mobility and strength building [5]. Additionally, bracing and splinting may be used to reduce flexion and mechanical pain in daily activities and during sleep [6].

Nevertheless, there is still some diversity in the literature with respect to conservative treatment in CuTS. Even though non-operative care is often prescribed, there is little evidence on the effectiveness of a certain type of physiotherapy over the other. Recent systematic review in a similar entrapment neuropathy situation noted that conservative treatment performance can be inconsistent depending on the severity, chronicity and other related patient factors, indicating that not everyone responds identically to treatment [7]. This is very applicable to CuTS rehabilitation where clinicians tend to integrate multiple techniques in the practice without clear evidence on which aspect can help most in recovery. Consequently, the decision-making process might be more influenced by habit or clinician preference or extrapolation of related conditions rather than a direct comparative evidence.

In the context of physiotherapy, two interventions seem to be particularly applicable to the conservative treatment of CuTS, namely, the soft tissue mobilization and the ulnar nerve-specific strengthening exercises. Soft tissue mobilization is a manual treatment modality that is designed to decrease myofascial tightness, enhance local tissue extensibility, and decrease mechanical interfaces around the nerve, and may increase neural excursion. Despite the evidence of scar and soft tissue management being more extensive than that of CuTS alone, more recent synthesis proposes that physical management of soft tissue constraints can positively affect mobility, symptoms, and tissue behaviors in musculoskeletal rehabilitation [8]. This gives a feasible explanation to the application of the soft tissue mobilization to decrease the undesirable mechanical stress surrounding the cubital tunnel in the context of CuTS.

In comparison, ulnar nerve-specific strengthening exercises are meant to enhance muscular support, neuromuscular control, endurance, and upper limb functioning with minimal excessive strain on the irritated nerve. Such exercises can contribute

to functional performance restoration by enhancing the ability of the surrounding musculature, as well as promoting safe motion patterns. Rehabilitation through exercise is especially attractive in CuTS since the symptoms can be worsened by sustained postures and repetitive loading, which can probably be improved through systematic strengthening and training of motor control [5]. Notwithstanding this justification, the literature still lacks adequate direct evidence in comparison of strengthening-based rehabilitation and manual therapy-based methods in CuTS populations.

This is a significant area of research gap. Much of the published discourse on CuTS either discusses general conservative treatment, issues of diagnosis, or targets surgical treatment instead of a specific comparison of the particular physiotherapy modalities [2,3]. Surgical treatment can be an option when conservative care is unsuccessful or when the progressive neurological deficit occurs [9]. Newer surgical modifications are still being developed, but surgery adds costs, burden of recovery and risk of the procedure, which reinforces the argument of trying to maximize non-surgical care where possible [10]. Hence, the discovery of relative effectiveness of particular types of conservative interventions is both scholarly and clinically useful.

The second gap in the existing evidence base is the absence of standardized rehabilitation procedures of CuTS. Exercises, splints, analgesics and education are often cited as available options, but it is often unclear how much, how much, how comparative or how much better one physiotherapy approach is than another [3,5]. Therefore, it is not clear how much direct soft tissue treatment is more effective than targeted strengthening to increase functional stability and nerve tolerance to improve the symptoms. This ambiguity inhibits the evidence-based clinical decision-making and might slow the creation of more specific rehabilitation guidelines.

Further proof of this requirement is provided by recent studies on peripheral nerve rehabilitation. Even though there have been few randomized control trials done regarding carpal tunnel syndrome instead of cubital tunnel syndrome, the same concepts apply in the treatment of these two syndromes. Ijaz et al. showed that when neuromobilization is included alongside routine

physiotherapy in the treatment of patients with mild to moderate carpal tunnel syndrome, there were significant improvements in pain, symptoms, functionality, and nerve conduction in comparison to routine physiotherapy alone [11]. This finding calls for an investigation in the ulnar nerve rehabilitation.

The more recent randomized controlled trials that have assessed conservative physiotherapy intervention for CuTS are those that compared manual therapy with electrophysical interventions. Wieczorek and Wolny found that manual therapy showed significantly better results in pain intensity reduction, improvement of upper limb function and grip strength, and patient satisfaction. This study indicates that intervention strategies that are aimed at increasing soft tissue mobility and reducing mechanical irritation in the area of the ulnar nerve can be more effective in terms of functional outcome compared to passively applied electrophysical interventions [12]. Another placebo-controlled randomized trial carried out by the same research team indicated that neurodynamic therapy was significantly more effective in terms of decreasing symptoms severity, disability, improving nerve mobility, and recovery [13].

Exercise therapy has also been receiving more attention in recent years. In a study conducted by Nishide et al., ulnar nerve gliding exercises were tested as a non-surgical management approach for cubital tunnel syndrome and revealed significant improvement in symptoms and clinical outcome without any surgery being performed. It is another proof of the idea that specific exercise regimens aimed at reestablishing normal nerve mobility and decreasing nerve irritation are quite capable of treating the disease at early stages and can help avoid surgery [14]. While there is a significant difference between nerve gliding and strengthening exercises, the basic principle remains the same.

The understanding of the degree of the severity of the disease is no less important in choosing conservative treatment. The results obtained in the course of the multicenter study performed by Chung et al. clearly show that patients with conduction block have different levels of functional impairment even having similar electrophysiological parameters. In other words, the clinical picture should be considered in

addition to electrophysiological studies when creating personalized rehabilitation programs [15]. Other evidence supporting the need for conservative rehabilitation is obtained from studies on upper limb neuropathy. In a recent systematic review of studies investigating the effectiveness of cervical traction and neural mobilization for cervical radiculopathy, it was found that neural mobilization substantially improved pain and disability scores when applied to the rehabilitation process [16]. While cervical radiculopathy is structurally different from CuTS, the two pathologies share some characteristics as regards the mechanosensitivity of peripheral nerves.

Outcomes centered on patients have gained more significance in the evaluation of management of CuTS. Córdoba-Mosqueda et al. showed that management success in cubital tunnel syndrome not only involves the resolution of symptoms but also significant improvements in quality of life and patient satisfaction [17]. Likewise, Davidge et al. found that pain and functional deficits continue to occur even post-revision surgery, showing that failure in conservative management and delay in treatment can lead to worse outcomes in the end [18]. All these make even more reason for optimizing non-surgical physical therapy before considering surgery. Epidemiologic data also point out the increasing burden of CuTS in the healthcare system. Osei et al. showed that cubital tunnel syndrome is the second most common upper-extremity entrapment neuropathy and is prevalent among a significant working-aged population, causing increased healthcare costs and lost productivity [19].

In order to evaluate the effectiveness of the treatment, reliable and valid measurement tools need to be used. DASH questionnaire continues to be one of the most recognized measures for assessing the disabilities of the arm, shoulder and hand (DASH). Prodinger et al. proved that DASH and QuickDASH questionnaires have great psychometric characteristics, sensitivity and construct validity when measuring the upper limb musculoskeletal conditions [20]. In a similar fashion, the intensity of pain measured with the Numeric Pain Rating Scale (NPRS) was proven to be reliable, sensitive and clinically useful when working with musculoskeletal rehabilitation patients [22].

Despite the promising preliminary outcomes of the relatively new minimally invasive techniques, such as ultrasound guided hydrodissection in some specific cases of ulnar nerve entrapment, they are still highly complicated and resource-demanding procedures which cannot be applied as the first-line approach in most patients suffering from CuTS [21]. Thus, physiotherapy is still considered the best choice for the initial treatment approach.

The significance of the proposed study lies in the fact that it will help to explore an important, but not fully studied aspect of conservative treatment of cubital tunnel syndrome, which can be applied in practice in physiotherapy. Although different non-surgical techniques exist, there is no scientific evidence about which one of them – soft tissue mobilization or specific ulnar nerve exercises – is more effective. An evaluation of these two treatments is needed to understand how they affect such indicators as pain relief, functioning of the upper limbs, and the course of recovery in case of mild or moderate cubital tunnel syndrome. Comparison of these therapies will increase the knowledge of their effectiveness not only separately but also in combination. This study will focus on evaluating these types of therapy to find out which one will produce the best effect.

2. LITERATURE REVIEW

Lee et al. (2026) conducted a systematic review and meta-analysis to evaluate postoperative immobilization after foveal triangular fibrocartilage complex repair. The review included five comparative studies involving 288 patients and assessed pain, Disabilities of the Arm, Shoulder and Hand scores, wrist range of motion, grip strength, and complications. The authors compared elbow-restricted immobilization with forearm-restricted immobilization that allowed elbow movement. Results showed no significant differences in final pain scores, DASH scores, grip strength, wrist range of motion, or complication rates between the two approaches. However, studies assessing immobilization duration suggested that restriction of pronation and supination for approximately four to six weeks produced better pain relief and functional recovery than immediate forearm rotation. These findings indicate that controlled movement and protection of vulnerable soft tissues may be more

important than unnecessary immobilization of adjacent joints. Although this study focused on postoperative wrist rehabilitation, it supports the broader rehabilitation principle that carefully selected motion restriction and progressive functional loading may improve upper-limb recovery [23].

Wieczorek and Wolny (2025) were able to carry out a randomized interventional trial to determine the effectiveness of manual therapy using neurodynamic techniques versus electrophysical modalities in cubital tunnel syndrome. The first protocol recruited 128 affected upper limbs of which 82 fulfilled the protocol. The participants were grouped into two; experimental group was provided with the sliding and tensioning neurodynamic techniques, and control group was provided with ultrasound therapy and low-level laser therapy. The methodology involved outcome measures which were comprehensive such as nerve conduction studies, ultrasound based (cross-sectional area and shear modulus), pain, sensory thresholds, two-point discrimination and functional ability scales. The findings showed statistically significant changes in the two groups but the neurodynamic group had better results in both physiological and functional parameters. This is a well-designed comparative design that reinforces the information that neurodynamic techniques have a greater therapeutic advantage than electrophysical modalities alone in mild to moderate cubital tunnel syndrome [12].

Wolny and Wieczorek (2025) contributed to the evidence by a single-blinded randomized placebo-controlled trial, which was explicitly aimed at reducing placebo effects. One hundred and thirty-six participants were enrolled and 91 were able to complete the intervention. Structured neurodynamic techniques (sliding and tensioning) and the control group (no real ulnar nerve sequence) were applied, respectively. The research design involved outcome assessment, which was blinded with nerve conduction studies, ultrasound imaging, pain scales, sensory perception test, two point discrimination and functional performance measure. The experimental group had statistically significant increases in all results, but the changes were limited in the placebo group. The current research is a well-designed study as it employs a placebo

control design that establishes that the reported improvements can be explained by neuromobilization but not non-specific therapeutic effects [13].

However, Nishide et al. (2025) performed a prospective intervention study too, where no control group was present, studying the effect of ulnar nerve gliding exercises on cubital tunnel syndrome. For the study, seventeen patients underwent an intervention, where an occupational therapist made repetitive passive movements of the wrist at the maximal elbow flexion twice weekly, each session being 20 min on average within an average period of 5.8 months. Clinical and electrophysiological measures, such as severity of paresthesia, elbow flexion test, sensory status, grip and pinch strength, and nerve conduction velocity were measured. As a result, significant improvement in sensory and motor function as well as reduction in paresthesia took place. However, the internal validity of the study is limited because of the absence of a comparison group and small sample size. Therefore, this research can be considered supporting evidence for conservative treatment of moderate cases of cubital tunnel syndrome [14].

In a multicenter study, which was cross-sectional, Chung et al. (2025) studied the clinical aspects of conduction block in ulnar neuropathy as part of the Surgery of the Ulnar Nerve Clinical Trial. In the study, there were 177 adults categorized under different neurophysiological subgroups according to the electrodiagnostic findings. The design included the thorough clinical exam, motor and sensory tests, electrodiagnostics, and the use of patient reported outcomes. According to the findings, patients with conduction block had poor functional outcomes despite the short duration of the disease compared to axonal loss, which is associated with poor sensory function. Even though the study was not intervention, it has high methodology due to a big sample and comprehensive classification giving useful information about the disease progression and proving the need for early conservative treatment [15].

In their systematic review and meta-analysis of RCTs among 288 patients and seven studies, Wu et al. (2025) evaluated the effects of neural mobilization and cervical traction in cervical radiculopathy. This methodological approach met

all the criteria for a systematic review, including selecting appropriate studies, collecting data, and analysis of pooled data. The results revealed that the combined treatment methods were superior to the control groups in terms of pain and disability relief, and the quality of evidence varied from moderate to very low. There was improvement in the results of range of motion, while grip strength was inconsistent. While this study was conducted among patients with cervical radiculopathy rather than cubital tunnel syndrome, its evidence can be used in neuromobilization in general [16].

Tabbassum et al. (2025) conducted a narrative review assessing the comparative efficacy and costs associated with manual therapy modalities in peripheral nerve entrapment syndromes. This review has synthesized the findings of 32 research papers published during 2021-2024, which comprised randomized controlled trials, quasi-experimental designs, observational studies, case series, and systematic reviews. Interventions under review included neural mobilization, Maitland mobilization, the Mulligan concept, myofascial release, and Cyriax friction massage. It was found that neural mobilization and Mulligan-based techniques were effective treatments in terms of pain and functional outcomes in carpal tunnel syndrome. There was a varied impact of myofascial release and Maitland mobilization on the results of the treatment, whereas the efficacy of the latter technique is still being studied. At the same time, there is no evidence to prove the benefits of Cyriax friction massage. Besides, the authors have pointed out that none of the selected studies assessed the cost-effectiveness of the treatment [24].

Wieczorek and Wolny (2025) performed an interventional randomized controlled trial aimed at comparing manual therapy utilizing neurodynamic techniques to electrophysical modalities in patients with cubital tunnel syndrome. Altogether, 128 affected upper limbs have been included into this study, and 82 have successfully completed the treatment course. Manual therapy consisted of sliding and stretching neurodynamic technique, whereas electrophysical modalities consisted of low-level laser therapy and ultrasound therapy. The parameters which have been studied included nerve conduction studies, ultrasound measures, pain intensity, two-point discrimination, sensory perception threshold,

symptoms severity, functional abilities, and overall improvement. Significant improvement has been observed in both groups; yet, manual therapy group demonstrated better outcomes in nerve conduction tests, ultrasound measures, sensory examination, and function assessment. Therefore, this research indicates that manual therapy and neurodynamic technique can be more effective than passive electrophysical techniques for the treatment of mild to moderate cubital tunnel syndrome [25].

The effectiveness of real neurodynamic techniques in comparison with placebo was tested in the study carried out by Wolny and Wieczorek (2025). A single-blinded, randomized, placebo-controlled trial was used in order to evaluate whether there is an advantage of using real neurodynamic techniques on individuals with mild to moderate cubital tunnel syndrome. Initially, 136 participants were recruited, but only 91 finished the whole course of treatment. In the experimental group, the sliding and tensioning neurodynamic maneuvers for the ulnar nerve were used, and in the placebo group, movements were done from an intermediate position without adhering to the correct neurodynamic technique. The treatments were provided five times a week for 10 sessions. Nerve conduction studies, ultrasound imaging, pain, two-point discrimination, sensory threshold, symptoms severity, function and patient self-reports were used as outcome measures. Significant improvements in all parameters were obtained in the experimental group, whereas only limited improvements were found in the placebo group [26].

The clinical benefits of ulnar nerve gliding exercises in conservative management of cubital tunnel syndrome were evaluated by Nishide et al. (2025). In particular, the study considered patients with this condition who underwent conservative therapy and analyzed whether ulnar nerve gliding could help alleviate the symptoms and enhance recovery. As already mentioned above, ulnar nerve gliding exercises are aimed at achieving normal function of nerves, reducing mechanical irritation and increasing tolerance to elbow and wrist movements. Clinical improvement was obtained by the researchers, which indicates that conservative treatment involving exercises can be helpful for selected

cases of mild-moderate cubital tunnel syndrome. Clinically, the study can be considered significant due to the fact that it provides evidence that specific exercise, rather than rest, bracing or drugs, should be used to manage the disorder. However, nerve gliding is different from nerve strengthening, and the study did not include a comparison of the two approaches. Therefore, more comparative studies are necessary to find out what method works best [27].

ElGendy et al. (2024) performed a double-blinded randomized control trial to assess the effect of chitosan phonophoresis on ulnar nerve conduction velocity, pain, and hand function among patients with mild to moderate cubital tunnel syndrome. They enrolled fifty-four subjects ranging from twenty to thirty-five years of age who were then assigned into either a standard hand therapy regimen or a standard hand therapy along with chitosan phonophoresis. All the subjects underwent the intervention three times a week for five weeks. Ulnar nerve conduction velocity, Numeric Pain Rating Scale, and QuickDASH were used as outcome measures. It was found that there were significantly higher improvements in nerve conduction velocity, pain relief, and hand function in the experimental group than in the control group. Chitosan phonophoresis seems to be an effective supplement for conventional hand therapy; however, this research paid attention only to a specific intervention modality without specifying which one was superior – manual soft tissue therapy or strengthening rehabilitation [28]. Wiczorek et al. (2024) conducted an analysis of conservative physiotherapy for patients with cubital tunnel syndrome. The researchers conducted a literature search through MEDLINE, PEDro, and Google Scholar databases and selected randomized controlled trials, case series, and case reports of physiotherapy for cubital tunnel syndrome. In total, 18 articles with 425 participants were included in the study. According to the results, the majority of physiotherapy procedures were effective in terms of improvement in subjective symptoms, objective symptoms, and functional parameters. However, there was a lack of randomized controlled trials, as only seven such publications were identified; the rest of the literature included prospective studies and case reports. The authors suggest that conservative physiotherapy is quite promising, but

more research is needed since there is little evidence due to small sample sizes, heterogeneous methodology, and different treatment approaches [29].

According to Jiravichitchai (2024), there were outcomes analyzed in supercharged end-to-side anterior interosseous nerve to ulnar nerve transfer in patients suffering from proximal ulnar nerve injuries and cubital tunnel syndrome. The research applied scoping review and Delphi approach to establish recovery characteristics, measurement indicators, and needs of patients after surgery procedures. It became clear that severe ulnar nerve injury leads to complicated disabilities and the necessity of standardized evaluation of sensory recovery, motor recovery, hand function, and patient-centered outcomes. Even though the research dealt with the surgical treatment and not conservative rehabilitation, it is still significant in that it underscores the importance of early intervention to prevent further deterioration of the condition. Moreover, the lack of consensus in outcome measurement in ulnar nerve conditions was established in the research, which proves the necessity of conducting conservative trials applying valid measurement techniques and clinically significant recovery [30]. Quinones et al. (2023) conducted a systematic review and meta-analysis comparing active In their 2023 systematic review and meta-analysis, Quinones et al. compared active and passive approaches in treatment of carpal tunnel syndrome through the Boston Carpal Tunnel Questionnaire. They identified five randomized controlled studies which compared active approaches, including manual therapy and mobilization, to passive treatment, namely splinting, kinesiotaping, and modalities. It was found that active approaches were more effective than passive interventions with respect to improvement of symptom severity and functional status. There was a large effect size noted by the Symptom Severity Scale. The Functional Status Scale also showed a significant increase. While the above-mentioned review examined the effects of active and passive treatment on carpal tunnel syndrome, the findings are relevant to peripheral nerve entrapment rehabilitation as well. This is due to the fact that in both syndromes – the carpal tunnel syndrome and cubital tunnel syndrome –

there are compression, pain, sensory disturbance, and functional restriction involved [31].

The study done by Ijaz et al. (2022) is a prospective randomized clinical trial that compared routine physical therapy to neuromobilization with and without neuromobilization in patients with carpal tunnel syndrome. In the study, the authors conducted a random allocation of 66 subjects into two groups. Both groups were subjected to routine treatments such as ultrasonic treatment, splinting of the wrist and tendon glides, and the other group was subjected to neuromobilization of the median nerve. Pain intensity, range of motion, and manual muscle strength and functionality measured using the Boston Carpal Tunnel Questionnaire were included in the methodology as outcome measures. The findings of the study showed that while both the groups performed better, the group that was subjected to neuromobilization had much greater improvement in terms of pain reduction and functionality. The study has implications for methodology since it directly compares neuromobilization with routine treatment. The finding however applies only to median nerve [11].

2.1. Literature Gap:

In spite of all the existing information about the efficiency of neurodynamic mobilization and nerve gliding techniques as methods in the conservative treatment of cubital tunnel syndrome and carpal tunnel syndrome, many aspects require further elaboration. Firstly, most of the available research comparing these methods has not been performed in relation to usual physical therapy. Instead, most papers comparing the results of applying neurodynamic mobilization and nerve gliding include either sham procedures, electrophysical agents, or nerve gliding techniques. Secondly, a large part of the available data on these topics comes from carpal tunnel syndrome research; therefore, it cannot be applied to cubital tunnel syndrome because of different anatomic and physiologic characteristics of the ulnar and median nerves. Thirdly, well-designed randomized controlled trials comparing routine physical therapy and neurodynamic techniques in patients with mild and moderate cubital tunnel syndrome have not yet been performed.

2.2. Objectives

To compare the efficacy of soft tissue mobilization combined with ulnar nerve-specific strengthening exercises versus soft tissue mobilization alone in patients with mild to moderate cubital tunnel syndrome.

3. RESEARCH METHODOLOGY

3.1 Research Design:

This research was carried out as a double-blinded randomized controlled experiment to assess the comparative effectiveness of two physiotherapy modalities in cases of cubital tunnel syndrome. Randomized controlled experiments are believed to be the optimal method of evaluating clinical interventions and reducing possible biases [16].

3.2. Clinical Settings:

The data was gathered from the Physiotherapy Departments of Nawaz Sharif Social Security Hospital, Multan Road, Lahore, and MoveNow Physiotherapy and Rehabilitation Centre, Lahore.

3.3. Study Population:

The research sample comprised the patients diagnosed with cubital tunnel syndrome, also known as ulnar neuropathy at the elbow. Cubital tunnel syndrome was identified as the second most frequent type of peripheral nerve entrapment neuropathy and is characterized by pain, sensory disorders, and dysfunction of the upper extremity [14,19].

3.4. Sample Size:

The total number of participants was 56 individuals, 28 patients per each group. The total number of participants was calculated on the basis of statistical parameters obtained from a randomized controlled parent experiment, including a confidence level of 95% and statistical power of 80%. Additional 10% of the participants were recruited to compensate for the possible loss to follow-up [16].

Level of Significance ($Z_{1-\alpha/2}$): 95%

Mean Change in Group A (μ_1): 150.1

Mean Change in Group B (μ_2): 150.16

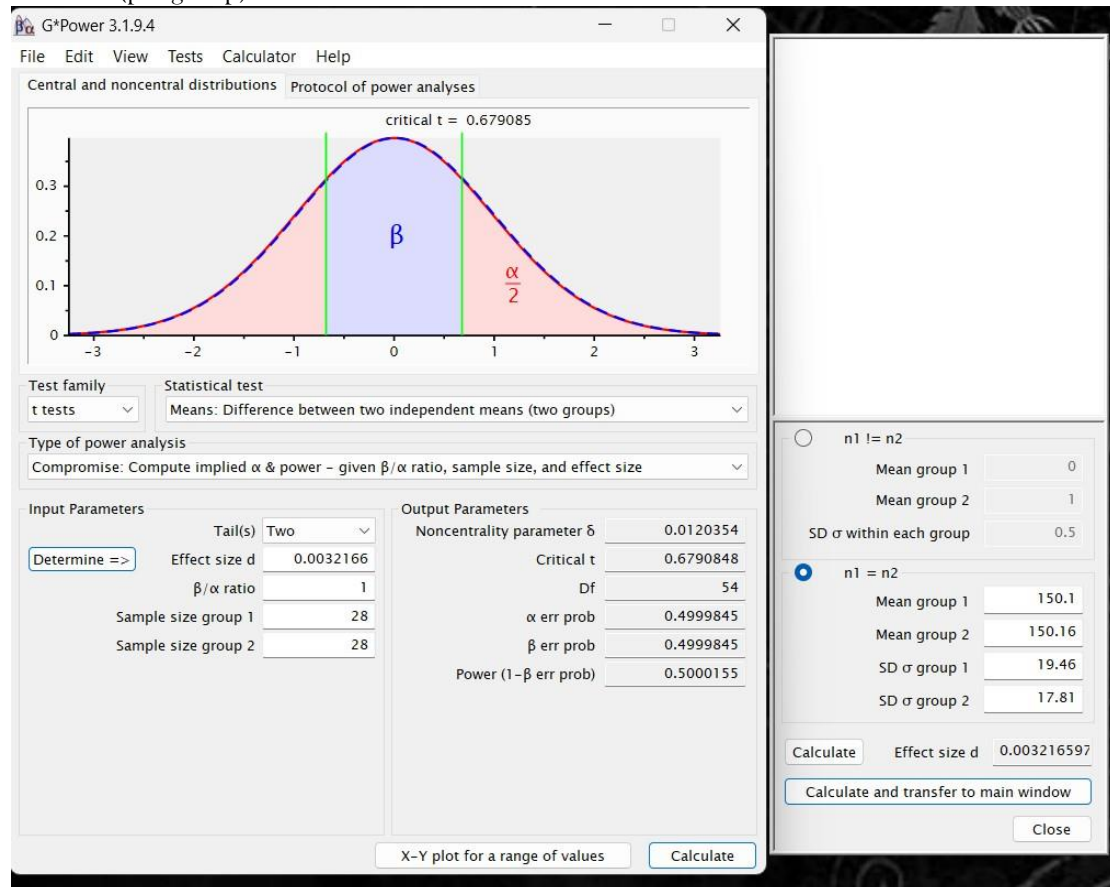
Standard Deviation in Group A (S_1): 19.46

Standard Deviation in Group B (S_2): 17.81

Power of Study ($Z_{1-\beta}$): 80%

Two-tailed test was applied the initial sample size per group is set at 25 participants based on these statistical parameters. $n_a = n_c + (10\% \text{ of } n_c)$
 $n_a = 25 + 3 = 28$ (per group)

Thus, the total sample size becomes: $28 \times 2 = 56$ participants (both groups combined).



3.5. Sampling Technique:

Simple random sampling method would be used to select the sample for the study. Random allocation was done using computers to assign each potential participant to one of the two groups with equal probability.

3.6. Duration of Study:

The total duration of the study was six months, including participant recruitment, intervention, follow-up assessment, and data analysis.

3.7. Selection Criteria:

3.7.1. Inclusion Criteria:

Patients of both genders aged between 30–55 years [14].

Patients diagnosed with mild to moderate cubital tunnel syndrome (ulnar neuropathy at the elbow) [14].

Patients having symptoms for more than one month [15].

Patients who are willing to participate and provide informed consent.

Patients who are able to follow instructions and complete the treatment protocol.

3.7.2. Exclusion Criteria:

Patients with a history of elbow surgery

Patients with severe neurological deficits (e.g., advanced muscle atrophy or complete nerve palsy) [14].

Patients with fracture or dislocation of the elbow joint [15].

Patients with systemic neurological disorders (e.g., stroke, multiple sclerosis) [16].

Patients with rheumatoid arthritis or other inflammatory joint diseases [17].

Patients currently receiving other physiotherapy or invasive treatments for the same condition.

3.8. Ethical Considerations

The rules and laws suggested by the IRB of the university should be abided by researcher during

the process of study and the confidentiality of the subjects should be kept in mind.

A consent form (attached) in written form was signed from the parents of students.

All details and statistics kept secret.

Contributors of the research were nameless in whole process of research.

The members of study notified about no harm or danger due to study process.

Participants were free to opt the study at any time they want to.

Research participants were notified about any physical, social, psychological and any other harm or danger due to study.

The effects of intervention were explained to the participants.

Participants were ensured about the removal of their identity in any publication. We will protect their personal information at any cost.

Participants were free to contribute to study without any compulsion. Participants will be able to leave the study at any time.

Ensure participants that they had any negative consequences if they decide to leave the study. We were respecting their decision without any pressure on them to change their minds.

3.9. DATA COLLECTION PROCEDURE

3.9.1. Screening:

Participants were selected based on the set inclusion and exclusion criteria. Those who qualified were explained the objectives, process, advantages, and drawbacks of the experiment, and they gave written consent before being enrolled in the study. Cubital tunnel syndrome is an entrapment neuropathy that has important implications and therefore requires early conservative management [14,19]. After enrolling the subjects, they were randomly divided into two groups.

3.9.2. Randomization:

Subjects that met the inclusion criteria were randomly allocated to either Group A or Group B, based on a computer-generated randomized sequence to avoid any bias during the process of allocation.

3.9.3. Blinding:

The experiment was performed using a double-blind methodology. This means that both the

evaluator and subjects did not know the group affiliation during the entire experiment.

3.9.4. Assessment:

Baseline data were taken at the beginning of the study and then at the conclusion of the intervention at the fourth week. Pain intensity, upper limb function, and quality of life were evaluated using reliable outcome measures like the Numeric Pain Rating Scale (NPRS) and the Disabilities of the Arm, Shoulder and Hand (DASH) assessment scale. All three of these scales have shown high reliability, validity, and sensitivity to change in people with musculoskeletal and upper limb problems [20,22].

3.9.5. Intervention:

Group A received soft tissue mobilization combined with ulnar nerve-specific strengthening exercises.

Group B received soft tissue mobilization alone.

3.10. TREATMENT PLAN

3.10.1. Baseline (Both Groups):

At baseline, participants received education regarding activity modification, ergonomic correction, and avoidance of prolonged elbow flexion to reduce nerve compression [14].

3.10.2. Group A: Soft Tissue Mobilization + Ulnar Nerve-Specific Strengthening

Frequency: 3 sessions/week for 4 weeks (12 sessions total)

Duration: 30–40 minutes

Patient Position: Supine or sitting with supported arm

Therapist Position: Standing beside affected limb

Technique:

For those individuals who were assigned to Group A, they were exposed to an intervention involving both soft tissue mobilization and ulnar nerve specific strengthening exercise. Soft tissue mobilization involved the use of manual therapy on the medial aspect of the elbow and the flexor-pronator muscles which included myofascial release, longitudinal soft tissue mobilization, and deep transverse friction massage. The goals of such interventions included reduction of restrictions in soft tissue, improvement in tissue extensibility, increased circulation, and reduced mechanical compression around the ulnar nerve. Normal soft

tissue mobility was seen as being vital to the restoration of the mechanical interface of the cubital tunnel [14].

Following the manual therapy session, the participants were engaged in a strengthening program which focused on the musculature that contributes to dynamic stability of the elbow joint, forearm, wrist and hand. This program focused on strengthening the wrist flexors, stabilizers of the forearms, intrinsic hand muscles and grip musculature through gradual resistance training. Exercises like wrist flexion against resistance, hand grip training by using therapeutic putty and hand exercisers, finger abduction and adduction, opposition of the thumb and finger flexion against resistance were done. These exercises were done in two to three sets of 10-15 repetitions with one to two minute rest in between the sets.

To supplement the strengthening protocol, ulnar nerve gliding exercises were performed in order to increase neural mobility and decrease mechanical sensitivity. The participants were made to perform controlled ulnar nerve sliding exercises within pain-free ranges in order to allow for the gliding of the nerves and prevent compression of the nerve. Studies have revealed that rehabilitation programs which involve neural-focused treatment strategies are more effective in terms of improving pain, functional ability, and neural mobilization than traditional physiotherapy alone in peripheral nerve entrapment disorders [16]. In the same way, neurodynamic exercises have been found to be more effective in improving nerve conduction, symptoms and upper limb functionality among patients with mild to moderate cubital tunnel syndrome [15]. Alongside that, the participants were also encouraged to perform a home exercise program involving ulnar nerve gliding and strengthening exercises once per day for four weeks.

3.10.3. Group B: Soft Tissue Mobilization Alone
Frequency: 3 sessions/week for 4 weeks (12 sessions total)

Duration: 20–30 minutes

Patient Position: Supine or sitting

Therapist Position: Standing beside affected side

Technique:

The intervention included the application of standard manual therapies in the area of the

medial elbow joint along with its flexor-pronator muscle groups. The following methods were used for decreasing the tension of muscles, increasing their extensibility, improving blood circulation in the area, and reducing the mechanical irritation of cubital tunnel: myofascial release, longitudinal soft tissue mobilization, effleurage, and deep transverse friction massage. The intervention was conducted using standardized techniques for all participants. These manual therapies are recommended for increasing the mobility of soft tissues and reducing mechanical restrictions in the area [14].

Whereas the patients in Group A were subjected to strengthening, neurodynamics, and ulnar nerve gliding exercises, the patients in Group B had none of the above interventions administered to them during the course of the treatment process. Soft tissue mobilization along with educational programs on how to avoid certain activities was employed as a management strategy. The purpose of this intervention is to allow the comparison of the effect of soft tissue mobilization on its own terms.

3.11. OUTCOME MEASURES

3.11.1. Pain Intensity – Numeric Pain Rating Scale (NPRS)

Pain severity was evaluated with the use of Numeric Pain Rating Scale (NPRS) which a subjective measure is assessing the pain intensity perceived by the patient. Patients were instructed to indicate their level of pain averaged during the last 24 hours on the 11-point numeric scale from 0 to 10, where 0 meant “no pain” and 10 – “the worst possible pain.” NPRS is generally considered to be a reliable and valid measurement tool used for assessing the level of pain in patients suffering from musculoskeletal conditions; it showed high test–retest reliability (ICC > 0.90).

3.11.2. Functional Disability – Disabilities of the Arm, Shoulder and Hand (DASH)

Functional disability in the upper limbs was determined by means of the DASH Questionnaire. The DASH (Disabilities of the Arm, Shoulder and Hand) is a standardized self-administered questionnaire that contains 30 items and assesses the difficulty in performing activities of daily living, symptom severity and impact of upper limb disorders on social participation. The answers to

each item were rated on a five-point Likert scale that ranged between 1 and 5 and the sum score was transformed into a range from 0 to 100; 0 being absence of disability and 100 being the maximum disability. This tool has shown outstanding reliability, validity and responsiveness to assess functional disability in the upper extremities and it was deemed to be a suitable assessment tool in this study [20].

3.12. DATA ANALYSIS

The analysis of the data was done using the IBM SPSS Statistics software. Descriptive statistics were employed to describe the demographics and other

clinical features of the participants, and this was done using means $\pm$ standard deviation (SD) for continuous variables while frequencies and percentages were used for categorical variables. In order to establish whether the data were normally distributed, the Kolmogorov Smirnov test was used. As the data were normally distributed ($p > 0.05$), paired samples t test was used to compare pre-intervention and post intervention results for each of the groups, while independent samples t tests were used to compare the baseline and post-intervention values for both groups. Effect size was calculated using Cohen's d.

3.13. CONSORT FLOW CHART

3.1.4 GANTT CHART

	Months								
Activity	1	2	3	4	5	6	7	8	9
Data collection									
Data analysis and interpretation									
Thesis write up Thesis submission									

4. RESULTS

Table 4.1: Descriptive Statistics of Baseline Characteristics

Variables	Group A (n = 28) Mean $\pm$ SD	Group B (n = 28) Mean $\pm$ SD
Age (years)	43.89 $\pm$ 7.68	42.93 $\pm$ 7.05
BMI (kg/m ²)	25.76 $\pm$ 2.48	26.06 $\pm$ 2.28
Duration of Symptoms (weeks)	22.14 $\pm$ 7.36	21.04 $\pm$ 6.64

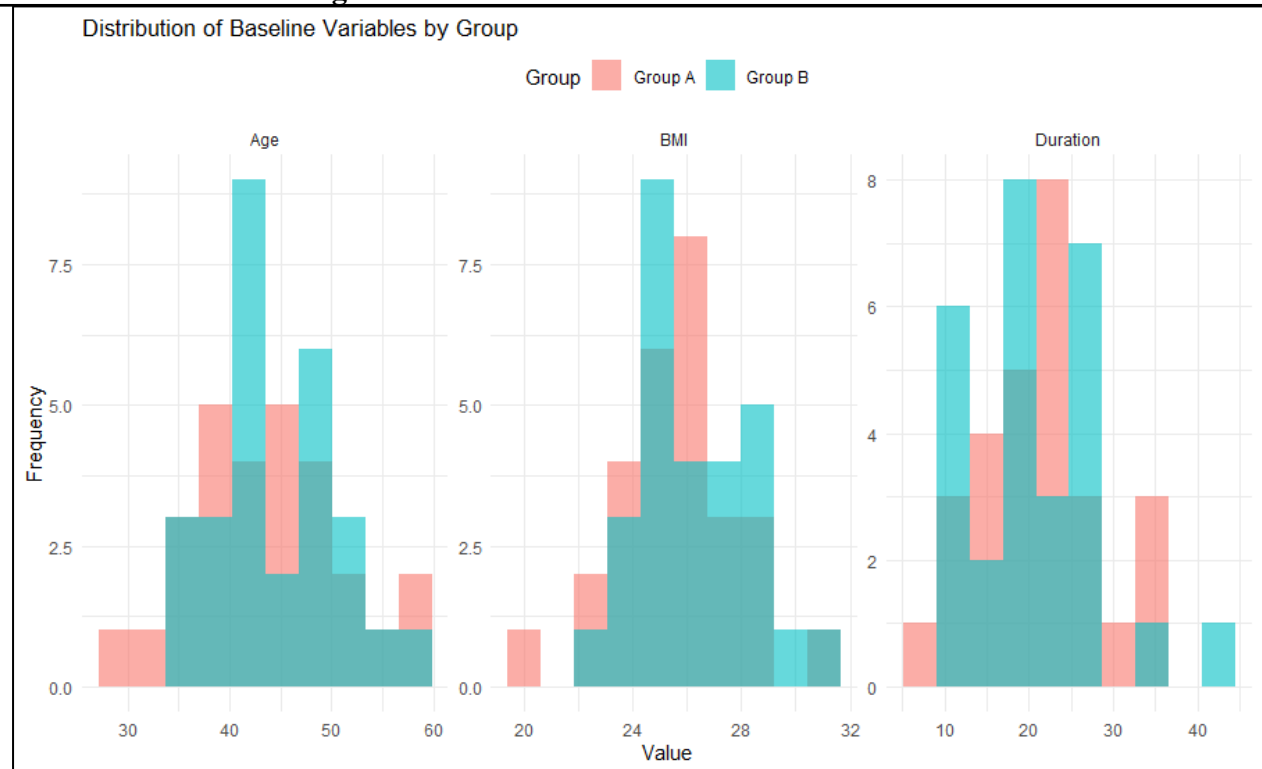


Figure 4.1: Histogram For Baseline Demographic by Groups

The demographic variables indicated that there were no differences between the two groups regarding their ages, BMIs, and lengths of symptoms experienced. The average age of the individuals in Group A was 43.89 ± 7.68 years,

while those in Group B had an average age of 42.93 ± 7.05 years. Regarding their BMIs, there were minor differences between the two groups; Group A had a mean of 25.76 ± 2.48 kg/m², while Group B had a mean of 26.06 ± 2.28 kg/m².

Table 4.2: Baseline Demographic and Clinical Characteristics of Participants

Variables	Category	Group A n (%)	Group B n (%)
Gender	Male	14 (50.0)	14 (50.0)
	Female	14 (50.0)	14 (50.0)
Occupation	Computer Operator	4 (14.3)	6 (21.4)
	Housewife	3 (10.7)	3 (10.7)
	Manual Worker	8 (28.6)	8 (28.6)
	Shopkeeper	4 (14.3)	3 (10.7)
	Driver	2 (7.1)	2 (7.1)
	Student	2 (7.1)	2 (7.1)
	Healthcare Worker	3 (10.7)	0 (0.0)
	Teacher	2 (7.1)	4 (14.3)
Affected Side	Right	18 (64.3)	16 (57.1)
	Left	10 (35.7)	12 (42.9)
Diagnosis	Yes	28 (100.0)	28 (100.0)
Severity	Mild	14 (50.0)	10 (37.0)
	Moderate	14 (50.0)	17 (63.0)
	Missing	0 (0.0)	1 (3.6)
Previous Treatment	Yes	9 (32.1)	10 (35.7)
	No	19 (67.9)	18 (64.3)

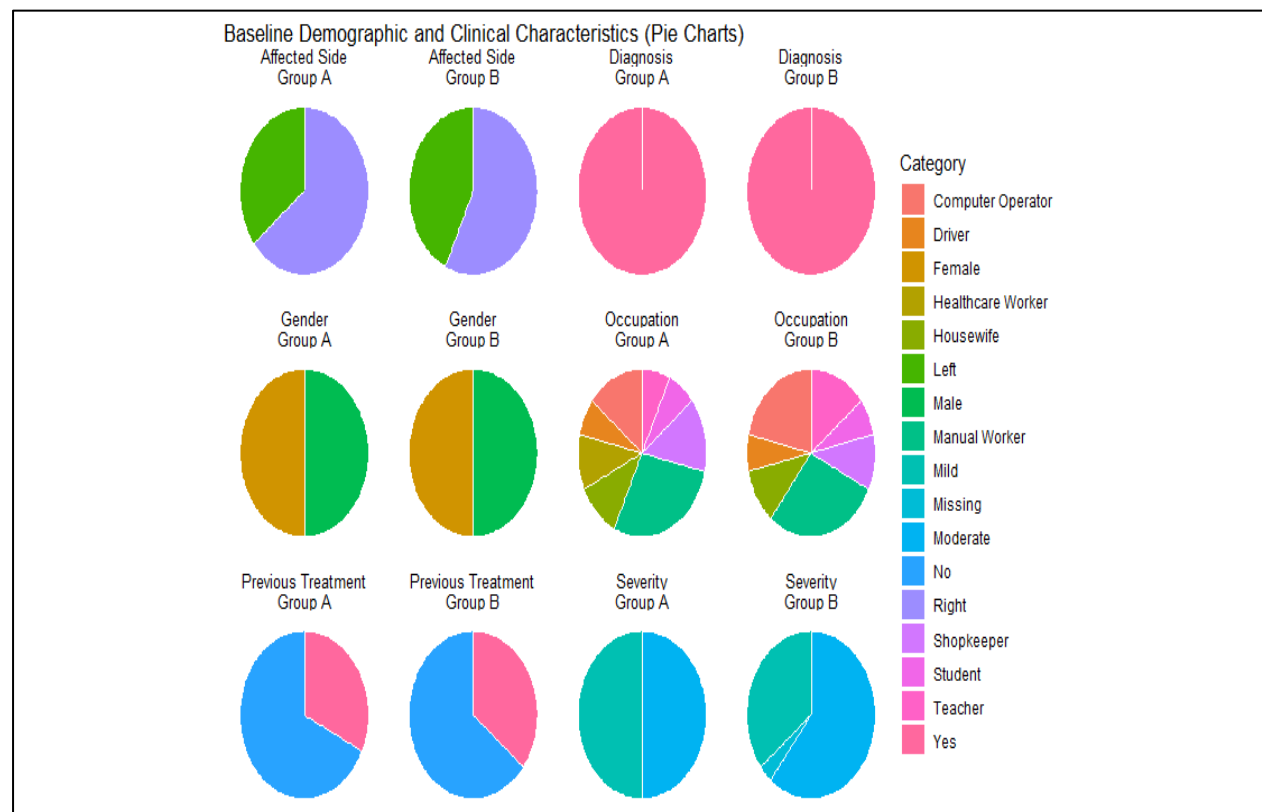


Figure 4.2: Pie Charts

As seen from Table 2, demographic and clinical characteristics of subjects at baseline reveal that there was little difference between Group A and Group B. Both groups were equally distributed in gender (both consisted of 50% males and 50% females). Occupational background, affected

extremity, diagnosis, degree, and history of previous treatments had slight differences but did not affect equality of groups considerably. In sum, data presented in Table 2 prove that Groups A and B were evenly balanced at baseline by demographic and clinical criteria.

Table 4.3: Descriptive Statistics of Outcome Measures at Baseline and Week 4

Outcome Measure	Group A (n = 28) Mean $\pm$ SD	Group B (n = 28) Mean $\pm$ SD
NPRS Baseline	6.75 $\pm$ 0.93	6.81 $\pm$ 0.88
DASH Baseline	54.68 $\pm$ 7.51	53.44 $\pm$ 6.67

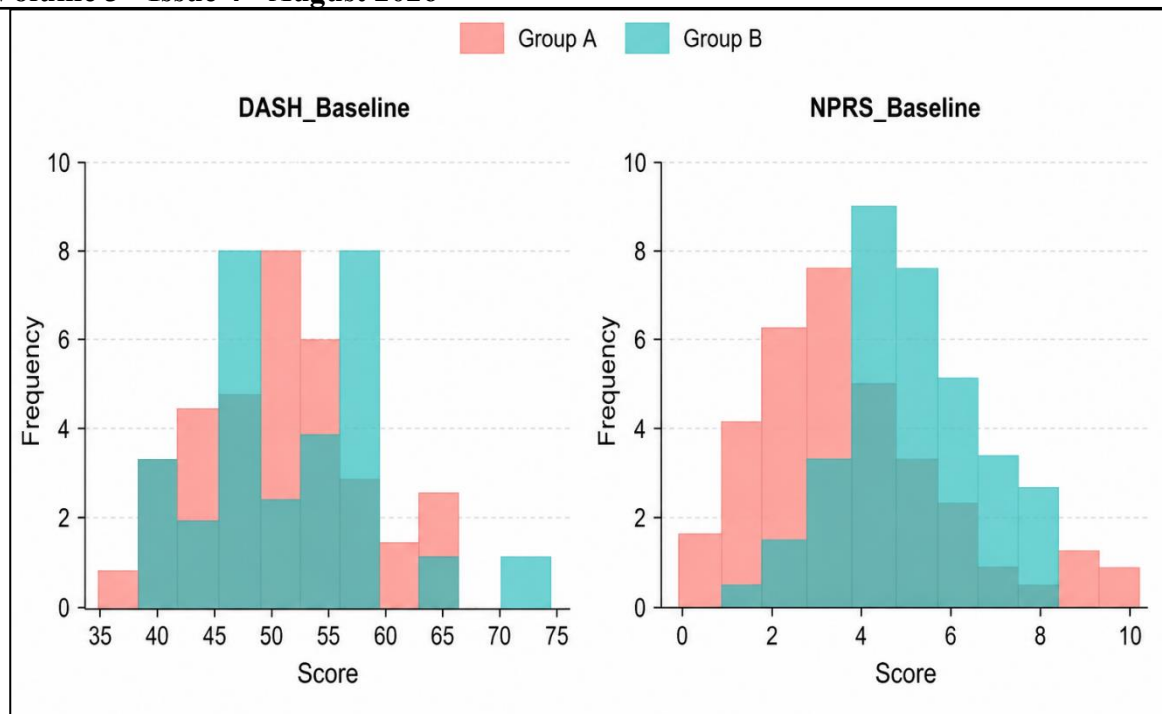


Figure 4.3: Histograms of Outcome measures by Groups

As presented in Table 3, the two groups showed similar baseline values on all variables. The NPRS scores of the two groups were similar at baseline

(Group A = 6.75 ± 0.93 and Group B = 6.81 ± 0.88), as were the DASH scores (Group A = 54.68 ± 7.51 and Group B = 53.44 ± 6.67).

Table 4.4: Kolmogorov-Smirnov Test of Normality

Variables	K-S Statistic	df	p-value
NPRS Baseline	0.115	56	0.061
NPRS Week 4	0.124	56	0.088
DASH Baseline	0.095	56	0.200
DASH Week 4	0.061	56	0.200

Based on the output presented in Table 4, it was found that the Kolmogorov-Smirnov test was performed to check the normal distribution of the variables used as dependent variables. In this regard, all the variables under consideration were normally distributed because all the p-values were

above 0.05. For instance, the baseline NPRS ($p = 0.061$) and the fourth-week NPRS ($p = 0.088$) had no statistically significant deviation from the normal distribution. Likewise, the baseline DASH ($p = 0.200$) and the fourth-week DASH ($p = 0.200$) also had normal distributions ($p > 0.05$).

Table 4.5: Paired Sample Statistics for Overall Participants

Outcome Measure	Baseline Mean $\pm$ SD	Week 4 Mean $\pm$ SD
NPRS	6.78 ± 0.90	3.94 ± 1.46
DASH	54.06 ± 7.07	33.61 ± 9.75

Table 5 depicts that the outcomes of all the indicators improved significantly from baseline to Week 4 across all participants. It is evident from the data obtained from Table 5 that NPRS improved from 6.78 ± 0.90 at baseline to $3.94 \pm$

1.46 at Week 4, which indicates an improvement in the reduction of pain intensity. Likewise, the improvement in the reduction of disability can be seen in the improvement of DASH scores from 54.06 ± 7.07 to 33.61 ± 9.75 .

Table 4.6: Paired Sample t-Test Analysis

Outcome Measure	Mean Difference	95% CI	t	df	p-value
NPRS	2.84	2.55 to 3.12	19.94	55	<0.001
DASH	20.44	18.50 to 22.39	21.09	55	<0.001

Table 6 illustrates that a significant improvement was observed on all the outcome measures from pre-intervention to week 4 through the paired samples t-test analysis. NPRS indicated a statistically significant decline in the level of pain with a mean difference of 2.84 (95% confidence

interval [CI]: 2.55-3.12, $t = 19.94$, $p < 0.001$). Likewise, there was a statistically significant reduction in DASH scores with a mean difference of 20.44 (95% CI: 18.50-22.39, $t = 21.09$, $p < 0.001$).

Table 4.7: Effect Size Analysis for Paired Comparisons

Outcome Measure	Cohen's d	Effect Size Interpretation
NPRS	2.67	Very Large
DASH	2.82	Very Large

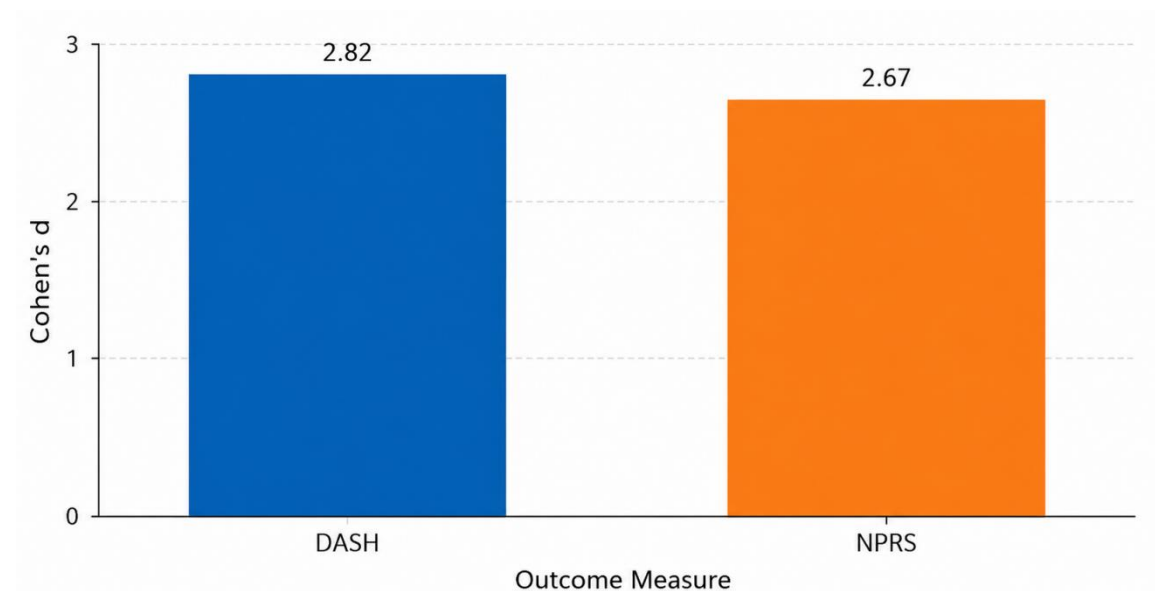


Figure 4.4: Bar Charts

According to Table 7, the effect size test that was performed on Cohen's d showed very large effects of treatment for all the variables. The largest effect size was for DASH ($d = 2.82$) and NPRS ($d = 2.67$).

From the results, it can be concluded that the treatment was clinically effective because of its ability to reduce pain and disability.

Table 4.8: Independent Sample t test

Outcome Measure	t	df	p-value	Mean Difference	95% CI
NPRS Baseline	-0.25	54	0.804	-0.06	-0.55 to 0.43
NPRS Week 4	-6.92	54	<0.001	-1.99	-2.57 to -1.41
DASH Baseline	0.66	54	0.515	1.24	-2.56 to 5.05
DASH Week 4	-5.87	54	<0.001	-12.06	-16.18 to -7.94

As can be seen from Table 8, the results of the independent sample t-test indicated no

statistically significant differences between Group A and Group B on all outcome measures, namely

NPRS and DASH ($p > 0.05$). This implies that both groups were similar in pre-intervention period. Nevertheless, four weeks after the start of the program, there were statistical differences in results achieved by the two groups. Specifically, Group A scored higher improvement in pain (NPRS: mean difference = -1.99, $p < 0.001$) and disability (DASH: mean difference = -12.06, $p < 0.001$).

5. DISCUSSION AND CONCLUSION

This study was an experiment that assessed the effectiveness of soft tissue mobilization as compared to ulnar nerve specific strengthening exercises in individuals with cubital tunnel syndrome within four weeks of intervention. It was found out that both treatments yielded statistically significant improvements in pain levels, upper limb disability and quality of life at week four relative to baseline ($p < 0.001$). Nevertheless, the subjects who were subjected to soft tissue mobilization experienced more improvements in all variables than those who received ulnar nerve specific strengthening exercises only. Specifically, by week four, Group A had lower NPRS (2.95 ± 1.21 vs. 4.94 ± 0.92) and lower DASH (27.58 ± 8.57 vs. 39.64 ± 6.68) scores with all group differences being statistically significant ($p < 0.001$). This means that while both treatment approaches are effective, soft tissue mobilization is more effective in the short term.

In a prospective clinical study of the effect of ulnar nerve gliding exercises in the nonoperative treatment of cubital tunnel syndrome, Nishide et al. (2025) observed a considerable improvement in patients' pain, grip strength, pinch strength, and function after conducting a series of nerve gliding exercises. Our current study also showed that exercise-based treatment led to significant improvement in the clinical outcomes of patients compared to their baseline data, as seen in the reduction in NPRS score from 6.81 ± 0.88 to 4.94 ± 0.92 and in DASH from 53.44 ± 6.67 to 39.64 ± 6.68 in the strengthening exercise group. Nevertheless, our randomized comparison found that soft tissue mobilization was more effective in providing significant improvements than strengthening exercises alone, with a reduction in NPRS to 2.95 ± 1.21 and in DASH to 27.58 ± 8.57 ($p < 0.001$). It is plausible that the additional efficacy of soft tissue mobilization is due to its

ability to relieve mechanical compression, increase tissue extensibility, and allow ulnar nerve excursion besides functional recovery.

According to Wieczorek & Wolny (2025), a randomized controlled trial was performed on patients who had been treated with manual therapy and electrophysical modalities for cubital tunnel syndrome and resulted in remarkable improvement in their pain, function, and physiology of the nerves following conservative therapy. The results indicated that manual therapy plays an essential role in the conservative therapy by ensuring proper mechanics and minimizing neural irritation. The findings agree with the present study, since participants undergoing soft tissue mobilization had shown more improvements in terms of pain and disabilities as well as higher quality of both physical and psychological wellbeing compared with the strengthening exercises. Specifically, patients from Group A had the average NPRS score of 2.95 ± 1.21 , whereas those from Group B scored 4.94 ± 0.92 ; similarly, their DASH score was 27.58 ± 8.57 and 39.64 ± 6.68 , respectively. Although the previous study included the electrophysical modalities along with manual therapy, the results of the current study clearly demonstrate the efficacy of soft tissue mobilization in isolation.

A critical review by Wieczorek et al. (2024) about physiotherapy treatment of cubital tunnel syndrome reported that conservative physiotherapy which includes manual therapy, neural mobilization, exercises and patient education has the potential of relieving pain and improving upper limb function due to limited number of high quality randomized studies. They called for additional comparative clinical studies in order to ascertain the best physiotherapy intervention. In this regard, the current randomized controlled study attempts to fill the evidence gap by conducting a comparison between two conservative interventions under clinical settings. In line with their conclusion, our study also found improvement among both groups after four weeks intervention period. However, in contrast to Wieczorek et al.'s (2024), findings, the current study demonstrates that soft tissue mobilization technique is superior to ulnar nerve strengthening exercises alone.

According to Sun et al. (2024), recent literature on the diagnosis and rehabilitation of cubital tunnel syndrome emphasized the significance of early conservative approaches, especially physiotherapy techniques, which focused on improving nerve gliding and treatment of surrounding tissues, in decreasing symptoms and avoiding or postponing surgery. The authors also mentioned the potential benefits of individualized rehabilitation programs that included both neural and musculoskeletal dysfunctions. The findings obtained in the current work are in line with the findings by Sun et al., since all participants were clinically improved after the four-week period, regardless of intervention type. Nonetheless, the group of patients who received soft tissue mobilization had statistically significant lower pain and disability levels compared to the group of participants who underwent strengthening exercises only.

Reviewing the evidence based management options for ulnar neuropathy at the elbow, McDougall et al. (2024) have found that conservative treatment remains the optimal option in patients with mild to moderate ulnar neuropathy at the elbow. This paper recommended activity modification, splinting, physiotherapy, and strengthening as treatment options; however, the authors also emphasized that the choice of treatment should be individualized, depending on the disease severity and the functional impairment level. This study confirmed those recommendations as it revealed significant clinical improvements in pain, disability, and quality of life in the patients receiving conservative physiotherapy within 4 weeks. Nevertheless, the results of the study showed that not all conservative treatment options provide the same level of clinical improvement. In comparison with strengthening exercises, the soft tissue mobilization provided significantly higher clinical improvement; the mean between groups differences were 1.99 points in NPRS and 12.06 points in DASH at week 4 ($p < 0.001$).

Wolny et al. (2022) performed a systematic review to assess the effects of physiotherapy treatments on cubital tunnel syndrome. They found that manual therapy, neural mobilization, exercise, splinting, and multimodal rehabilitation therapies had a consistent effect on reducing pain and enhancing muscle strength and upper extremity

functioning, though the quality of evidence was low due to heterogeneity and insufficient number of samples. This systematic review confirmed the effectiveness of conservative physiotherapy, but at the same time, the authors noted that further research was required to compare different physiotherapy techniques using well-designed randomized controlled trial designs. The current study contributes to the existing body of evidence through the use of randomized controlled design with similar baseline features and outcomes measured by NPRS and DASH tools. As in the systematic review, significant progress has been achieved in both groups under investigation. But in contrast to previous research where mostly multimodal rehabilitation was analyzed, this study provides the evidence of the superiority of soft tissue mobilization in comparison with ulnar nerve-specific strengthening exercises.

In their case report, Fernández-de-Las-Peñas et al. (2022) highlighted the successful application of ultrasound guided percutaneous electrical stimulation along with manual therapy, soft tissue mobilization and nerve glides exercises in a patient suffering from cubital tunnel syndrome. This patient experienced sustained improvement in pain, function, and symptoms at one year follow up period which indicated the efficacy of multimodal conservative rehabilitation. Likewise, in our randomized controlled trial there were considerable improvements in both groups after four weeks of treatment. But, the group that received soft tissue mobilization showed significantly greater reductions in pain and disability compared to the group which received only ulnar nerve-specific strengthening exercises. For example, NPRS decreased from 6.75 ± 0.93 to 2.95 ± 1.21 and DASH score improved from 54.68 ± 7.51 to 27.58 ± 8.57 in Group A but Group B did not show such great improvements. Although, Fernández-de-Las-Peñas et al. used different modalities of treatment in one single patient, our research provided a better quality of evidence in showing the efficacy of soft tissue mobilization through randomized controlled comparison with fifty six participants.

A systematic review conducted by Romero-Morales et al. (2022) investigated neural mobilization in musculoskeletal disorders and found out that neural mobilization was an effective conservative method of reducing pain

and disability and improving functionality in various peripheral nerves, including cubital tunnel syndrome. Similarly, Çelik (2025) stressed the need to use conservative rehabilitation, which includes neural mobilization, strengthening, splinting, education of the patient, and manual therapy as the first treatment method for patients with ulnar nerve entrapment at the elbow. These results are in line with our study since both experimental groups showed statistically significant improvements in pain, disability, and quality of life after physiotherapy. However, our randomized comparison showed that soft tissue mobilization led to greater improvement compared to strengthening exercises only. Thus, at week four, Group A had significantly better NPRS (2.95 ± 1.21 versus 4.94 ± 0.92) and DASH (27.58 ± 8.57 versus 39.64 ± 6.68) scores ($p < 0.001$).

In their review on the treatment of cubital tunnel syndrome, Shelke et al. (2023) suggest that patients with mild and moderate disease must be managed conservatively, while patients with persisting neurologic deficit or failure of conservative therapy must receive surgical treatment. In addition, Ence and DeGeorge (2023), in their review of failed carpal and cubital tunnel release, highlight the fact that success of conservative rehabilitation can prevent revision surgeries because of improvement in nerve mobility, soft tissue function, and upper limb performance. These reviews strongly corroborate the results of the current study. All patients of both groups experienced considerable changes within four weeks; however, soft tissue mobilization proved more effective than strengthening exercises alone. Between groups comparison revealed considerably better results of pain, disability, physical, and mental health scores in Group A, with mean difference of 1.99 points of NPRS and 12.06 points of DASH (all $p < 0.001$). Thus, the results of our study also confirm that conservative physiotherapy is a good approach prior to surgery.

Kobayashi et al. (2025) documented the success in the rehabilitation of a college baseball pitcher with symptomatic ulnar nerve dislocation through ultrasound-guided physiotherapy. The physiotherapy intervention led to significant gains in grip strength, functional performance, and resumption of sporting activities without surgery.

Similarly, Centaro et al. (2024) documented the success in the treatment of a classical guitarist who had developed overuse syndrome and cubital tunnel syndrome through non-surgical physiotherapy intervention. Though both publications showed positive results from tailored physiotherapy intervention, they are examples of individual patients whose results cannot be used to compare the efficacy of these interventions. In contrast, the current study is a randomized control trial involving fifty-six participants, which shows that the two interventions are efficacious and that soft tissue mobilization was more effective than strengthening exercises alone. These findings thus increase the external validity of previous studies since they provide comparative clinical evidence based on experimental research.

In addition, Rider and Dahl-Popolizio (2023) have noted that conservative treatment of nerve impingement needs to include manual therapy, soft tissue mobilization, exercise therapy, ergonomic interventions, and education of patients to decrease the neural impingement and recover arm functionality. Likewise, Mespl   and L  ger (2025) have underlined that rehabilitation of patients with ulnar nerve entrapment should involve strengthening exercises as well as other procedures that will help to restore tissue flexibility and increase excursion of nerves to bring patients back to their normal functioning. This suggestion is consistent with the results obtained since both treatment groups experienced considerable pain relief and increased functionality after four-week period of conservative therapy. Nonetheless, in our study soft tissue mobilization provided significantly better effects than the group only involving strengthening exercises. Moreover, the very large effect sizes detected for DASH ($d = 2.82$) and NPRS ($d = 2.67$) suggest that soft tissue mobilization provided clinically significant changes. Hence, the results obtained can serve as clinical evidence supporting the use of manual soft tissue interventions in physiotherapy practice.

5.1. CONCLUSION

In the current study, results from this randomized controlled experiment show that both techniques were equally effective in the reduction of pain and disability as well as in improvement of physical and psychological health quality of life among

subjects suffering from cubital tunnel syndrome within four weeks of treatment. Nonetheless, soft tissue mobilization was significantly more effective compared to the ulnar nerve strengthening exercises. This shows that soft tissue mobilization is an effective non-surgical physiotherapy technique for cubital tunnel syndrome in the short run.

5.2. LIMITATIONS

There was a relatively small sample size of 56 patients who took part in the study and all of whom were recruited from one clinic; thus, this might affect the generalizability of the results.

The treatment and follow-up periods lasted four weeks only; hence, there was no way to establish the long-term efficacy and sustainability of the achieved results.

Only mild and moderate cases of cubital tunnel syndrome were studied. As a result, the results of the study are not applicable to severe cases of nerve compression that require surgery.

All outcome measures were obtained through patient reports, i.e. NPRS and DASH scales, but not electrophysiological measures like nerve conduction study or electromyography to check the neural healing process.

Post-intervention analyses, namely, paired and independent samples t-tests were used to assess statistical significance. More sophisticated analytical tools should have been considered, for example, repeated measures ANOVA or mixed effects models.

5.3. RECOMMENDATIONS

Future randomized controlled trials need to use a larger and multicentered sample size in order to increase the external validity and generalizability of the results.

Trials with prolonged interventions and a follow up period are needed to find out whether soft tissue mobilization and strengthening exercises can have beneficial long term effects and whether there is any risk of recurrence.

In future studies, objective electrophysiological parameters, such as nerve conduction velocity or electromyography, as well as ultra-sonographic examination of the ulnar nerve should be included, in addition to subjective outcome measures.

Comparative studies should examine multimodal physical therapy programs that involve soft tissue mobilization, neural mobilization, strengthening exercises, splinting, ergonomic education, etc., in order to find out what conservative rehabilitation program works best for cubital tunnel syndrome. Future research needs to use more advanced statistical tools, such as repeated measures ANOVA or linear mixed models.

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