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"Effect Of Electrotherapy Versus Nerve Gliding Exercises In The Management Of Acute Carpal Tunnel Syndrome: A Randomized Controlled Trial"

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ABSTRACT

Background and Purpose: *To the best of our knowledge, no study has compared the effectiveness of the nerve gliding exercise approach and Ultrasound therapy approach. Thus, the aim of the present study is to compare the effectiveness of nerve gliding technique versus Electrotherapy in the management of CTS*

Materials & Methods: *A randomized controlled trial in which 40 patients with unilateral CTS (suspected on clinical grounds and diagnosed based on physical examination and orthopaedic diagnostic tests) were enrolled. Patient recruitment was conducted through the non-probability purposive sampling technique. After the acquisition of written informed consents, patients were randomly allocated into 2 groups by a simple randomization method. Group 1 (20 participants) received median nerve gliding technique (tension-type)+ cold pack in the clinic with a home exercise program consisting of median nerve self-mobilization. Group 2 (20 participants) received ultrasound therapy+cold pack on the carpal tunnel with the intensity of 0.8 w/cm2 for 5 minutes during each session. A total of 12 sessions were administered over 4 weeks with 3 sessions per week. A proper consent form was signed by each patient in both groups about their confidentiality and no harm to the patient. After which the data was collected from both groups by using the Boston Carpal Tunnel Questionnaire (BCTQ) including both symptom severity scale and functional status scale and Quick disabilities of arm, shoulder and hand (DASH).*

Results: *According To the results of the study we can found that there was a higher effects can be seen in the subjects treatment in group B with therapeutic ultrasound as the post score for DASH are 52.30±5.895 , Symptom severity are 21.60±2.542 and Functional status are 14.20±1.240.The p value was less than 0.005 in all the post results of the both groups shows that there a effects in both the groups as subject post data was checked.*

Conclusion: *According to the findings of the research, we are able to draw the conclusion that both interventions had a substantial impact; however, Higher effects can be seen on the subjects treated with therapeutic ultrasound as compared with Nerve gliding Exercise. So the study shows that therapeutic ultrasound is a effective treatment for Acute Carpal Tunnel Syndrome*

Key words: *CTS, Neurodynamics, Hand rehabilitation*

Introduction

Symptoms and signs of carpal tunnel syndrome (CTS) are produced by median neuropathy in the carpal tunnel. Due to idiopathic compression of the median nerve as it travels through the carpal tunnel, most occurrences of CTS are caused by the condition (IMNCT). This means that the nerve compression is not caused by any other disease process. Heredity is the most significant risk factor for this condition, since it affects both hands. Wrist fractures and rheumatoid arthritis are two more conditions that have been linked to chronic tension syndrome (CTS). After a fracture, edema, haemorrhage, and deformity all contribute to compressing the median nerve. Tendons in rheumatoid arthritis are compressed because of the bulging synovial lining. There is tingling and numbness in the thumb, index finger, middle finger and ring finger on the thumb side of the hand as its primary symptoms. Pain without tingling is not characteristic of IMNCT, despite the fact that it is often reported as a side effect. In certain cases, the numbness may be so severe that it might be described as painful. Symptoms tend

to be worse at night. If left untreated, IMNCT may lead to a gradual loss of muscular sensitivity, weakness, and atrophy (shrinking).

Vibration, wrist flexion or extension, hand force, and repetition are factors that increase the risk of developing CTS in the workplace. IMNCT can only be caused by a person's genes. All the rest are up for debate. Patients with rheumatoid arthritis should have their IMNCT and CTS evaluated in addition to their symptoms. This disease may be identified with great accuracy thanks to its unique symptoms and indicators. Electro diagnostic testing may be performed to evaluate the IMNCT. – The number of times you wake up in the middle of the night may be reduced with the use of a wrist splint. Whether corticosteroid injections outperform placebo injections is debatable. Corticosteroid injections seem to have minimal effect on the disease's natural progression, which appears to be neuropathy.

The carpal tunnel is a narrow passageway that runs through the palmar side of the wrist. Arch- shaped carpal bones on three of the four sides of the carpal tunnel protect the median nerve and nine flexor tendons. In addition to the thumb, index, long and part of the ring finger, the median nerve transmits sensation to these parts of the digits. Wrist-level median nerve supply permits muscles at the base of the thumb to abduct, move away from other four fingers and move out of the palm plane. Located in the centre of the palm between the scaphoid tubercle and trapezium at the thumb's base and the palpable hamate hook on the ring finger's axis, the carpal tunnel relieves pressure on the wrist. The transverse carpal ligament, also known as the flexor retinaculum, borders the carpal tunnel on its anterior side from an anatomical standpoint. Hamate pisiform and Hamulus are linked by a thick, fibrous band. As far as the proximal and distal limits go, Kaplan's cardinal line serves as a good approximation. In order to draw this line, you must use surface markers, such as skin folds between thumb and index finger. An growth of the tissue around the flexor tendons may cause compression of the median nerve, as can a decrease in the canal's size. In situations when the tunnel becomes swollen, the median nerve is damaged (median neuropathy).The thumb, index, middle, and thumb side of the ring finger lose sensitivity as median neuropathy progresses. The thenar eminence muscles may weaken and eventually atrophy as neuropathy worsens (the flexor pollicis brevis, opponens pollicis, and abductor pollicis brevis). As long as the superficial sensory branch of the median nerve remains close to the TCL, the palm's sensitivity will not be affected by the TCL. Nerve adhesion's relevance is debatable. Electrotherapy is the use of electrical energy in medicine. Medical techniques that employ electrical devices, such as deep brain stimulators, for the treatment of neurological illnesses fall under the umbrella of "electrotherapy." In addition, the use of electric current to speed up wound healing has been included in the term. In addition, the phrases "electrotherapy" and "electromagnetic therapy" have been used to denote a wide range of alternative medical equipment and procedures. For the purposes of this definition, therapeutic ultrasonography is defined as any technique that employs ultrasound for therapeutic purposes. When lithotripsy was first developed in the 1980s, physiotherapeutic ultrasound was already in use. Others, including HIFU and targeted ultrasound medication delivery, transdermal ultrasound drug delivery, ultrasonic haemostasis and cancer treatment, are in different phases of transferring from research to clinical usage. Either FUS or unfocused ultrasound may be utilized in this procedure.

Ultrasound passes into human tissue in the aforementioned applications, where it has the most significant biological effect (the oscillation of abrasive dental tools at ultrasonic frequencies therefore do not belong to this class). Inside the tissue, ultrasound is made up of sound waves with frequencies that are not detectable by humans. Ultrasound is applied to the patient's skin using a transducer or applicator that is in direct contact with the skin. Friction is minimized and ultrasonic waves are transmitted more easily when gel is applied to the whole head. Therapeutic ultrasound is the alternating compression and rarefaction of sound waves at a frequency between 0.7 and 3.3 MHz used in physical therapy. When it comes to soft tissue, the maximum energy absorption occurs between two and five centimetres. Increasing depth reduces the strength of waves. A considerable portion of these substances is taken up by connective tissue, such as ligaments, tendons, and fascia (and also by scar tissue).It is possible to utilize ultrasound to treat many conditions, such as ligament tears, muscle aches, tendonitis and joint inflammation, as well as plantar fasciitis, metatarsalgia and facet irritation. For low back pain, there is no evidence to support the use of ultrasonography, and current professional guidelines warn against its use. Using ultrasound to treat calcific tendinitis for a short period of time proved successful. Ultrasound use did not vary much over time. An ultrasonic treatment for Calcific Tendonitis has been shown to reduce discomfort and shorten the course of treatment. A 2011 review of five small placebo-controlled studies found

no evidence for the use of ultrasound in the treatment of acute ankle sprains, and the potential treatment effects of ultrasound appear to be generally small and of probably limited clinical significance, particularly in light of the typically short recovery period for these injuries. According to a meta- analysis, ultrasound therapy may reduce pain, improve range of motion, and decrease WOMAC functional scores in patients with knee osteoarthritis.
The practice of "nerve flossing" or "nerve stretching," which is another name for "nerve glide," is one that helps keep the nerves in your body moving smoothly and regularly. When the joint moves, the nerve is liberated from compression and may move freely as well. Nerve gliding is impeded by tissue surrounding the nerve in joints that have been injured or inflamed, so it cannot progress. When it comes to rehabilitation and recovery after surgery, nerve gliding exercises are utilized widely. They are also used in combination with other treatments to help reduce symptoms and speed up the process of healing.The radial, median, sciatica, and ulnar nerves all require nerve gliding activities during the healing phase of the procedure. Neurological conditions such as carpal tunnel syndrome, cubital tunnel syndrome, and radial neuropathy are among the most common. Neural-gliding exercises may be recommended by therapists based on an appropriate assessment of symptoms. Strenuous exercise should be avoided since it causes patients more pain than stretching their nerves. Diseases and nerves worsen without a precise diagnosis and treatment. It may be necessary to undertake nerve gliding activities on a daily basis depending on the circumstances. Patients report less pain after a few weeks of regular nerve gliding exercises.

Aims and Objective of study

- To find out the Which among the Ultrasound + cold pack or nerve gliding exercises + cold pack have effects on pain and functional performance in acute carpal tunnel syndrome.

Methodology

Each participant signed an informed consent form. The Institutional Galgotias University has approved the study protocol.

Type of study: Experimental study
Sampling: Simple Random Sampling
Area of Project: Delhi
No of Sample: 40
Groups: Two groups (20 subjects in each group)
Sample place: Multicentre Grounds
Selection Criteria

Inclusion Criteria:
Male and female patients between 20-50 years of age,
Physical examination and positive Phalen's test
Exclusion Criteria:
Patients with other musculoskeletal or neurological problems,
Neoplasms,
Systemic pathologies,
Known psycho-social problems,
Herpes zoster,
Rheumatoid arthritis,
Pregnancy,
Hyperthyroidism, and/or known congenital abnormality of the nervous system.

Equipment:
Boston Carpal Tunnel Questionnaire (BCTQ)
Quick disabilities of arm, shoulder and hand (DASH)
Therapeutic Ultrasound

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Home exercise program cards/charts

Fig1: Ultrasound machine

[Fig-2]: Neural Mobilization Technique

PROCEDURE

A randomized controlled trial in which 40 patients with unilateral CTS (suspected on clinical grounds and diagnosed based on physical examination and orthopaedic diagnostic tests) were enrolled. Patient recruitment was conducted through the non-probability purposive sampling technique. After the acquisition of written informed consents, patients were randomly allocated into 2 groups by a simple randomization method. Group 1 (20 participants) received median nerve gliding technique (tension-type) in the clinic with a home exercise program consisting of median nerve self-mobilization. Group 2 (20 participants) received ultrasound therapy on the carpal tunnel with the intensity of 0.8 w/cm2 for 5 minutes during each session. A total of 12 sessions were administered over 4 weeks with 3 sessions per week. A proper consent form was signed by each patient in both groups about their confidentiality and no harm to the patient. After which the data was collected from both groups by using the Boston Carpal Tunnel Questionnaire (BCTQ) including both symptom severity scale and functional status scale and Quick disabilities of arm, shoulder and hand (DASH).

Fig.3: Depicts nerve gliding mobilization exercise

Fig .4: Showing ultrasound treatment

PROTOCOL

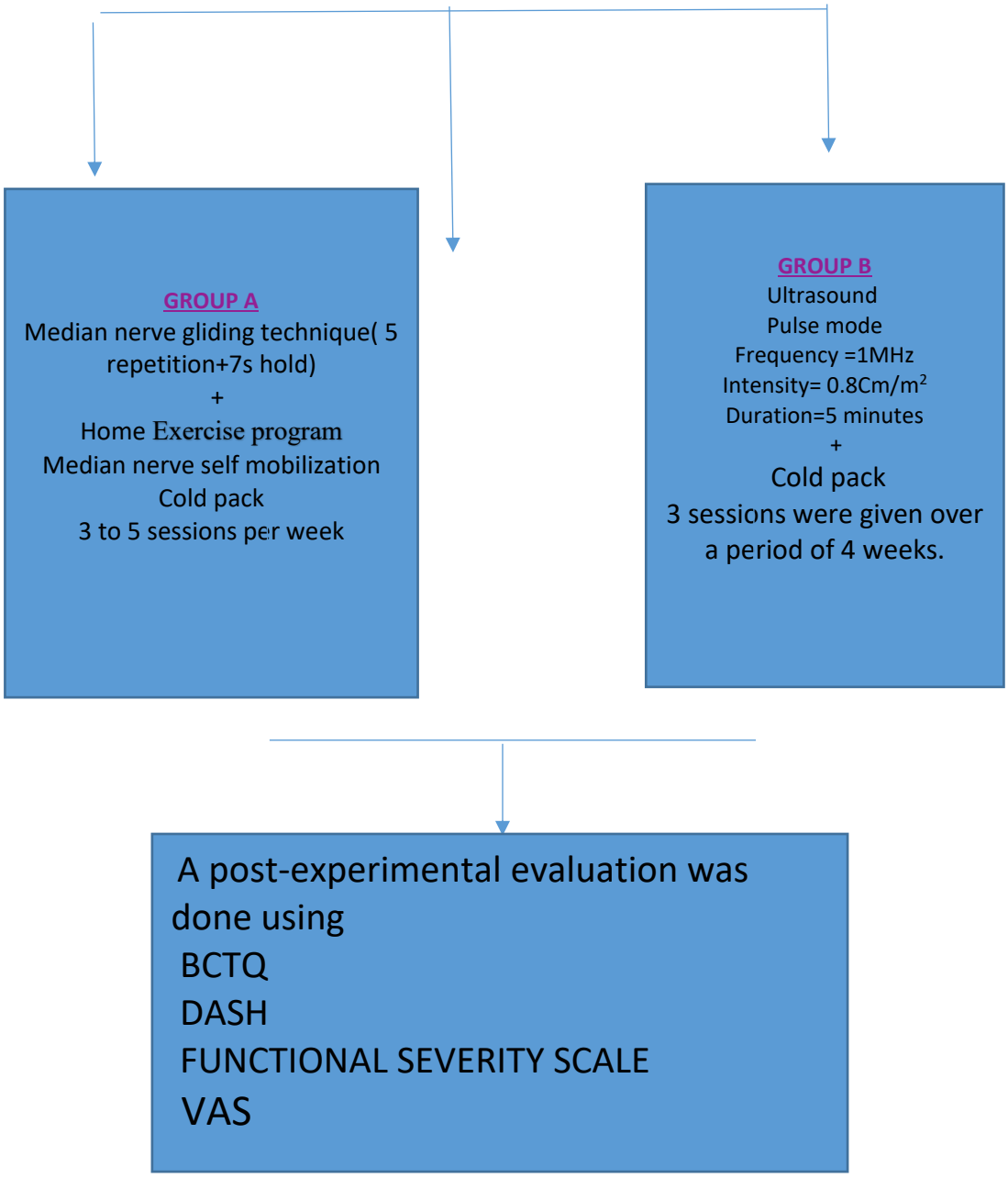
According to inclusion and exclusion criteria study was recruited in a 40 patients

↓

The study aim was explained and willing participants gave their written and informed consent

↓

A pre-experimental evaluation was done before intervention using
BCTQ
DASH
FUNCTIONAL SEVERITY SCALE
VAS



Data Analysis

The data analysis was carried out using the Social Science Packaging Software (SPSS) 26.0 edition of the software. Readings were analyzed using an independent T-test and a paired t-test. This is a graphical depiction created using Microsoft Word 2021

RESULTS

According To the results of the study we can found that there was a higher effects can be seen in the subjects treatment in group B with therapeutic ultrasound as the post score for DASH are 52.30±5.895 , Symptom severity are 21.60±2.542 and Functional status are 14.20±1.240.The p value was less than 0.005 in all the post results of the both groups shows that there a effects in both the groups as subject post data was checked

TABLE NO 1: Demographic Descriptive Statistics.

	AGE

Mean	34.90±5.961

TABLE NO 2- Gender Ratio

	MALE	FEMAE
GROUP A	12	8
GROUP B	8	12

TABLE NO 3. DASH INDPENDENT t test (PRE-POST)

	PRE	POST	P VALUE
GROUP A	136.70±4.21	80.90±9.193	P<0.05
GROUP B	141.20±3.458	52.30±5.895	P<0.05

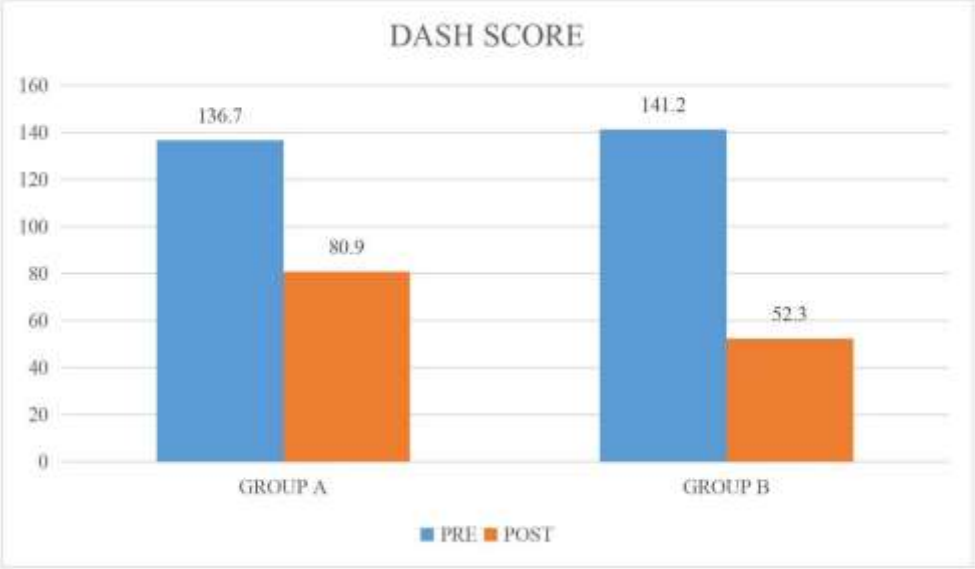
TABLE NO 4. Symptom severity (pre-post)

GROUP A	46.80±2.56	29.85±2.961	P<0.05
GROUP B	48.60±1.875	21.60±2.542	P<0.05

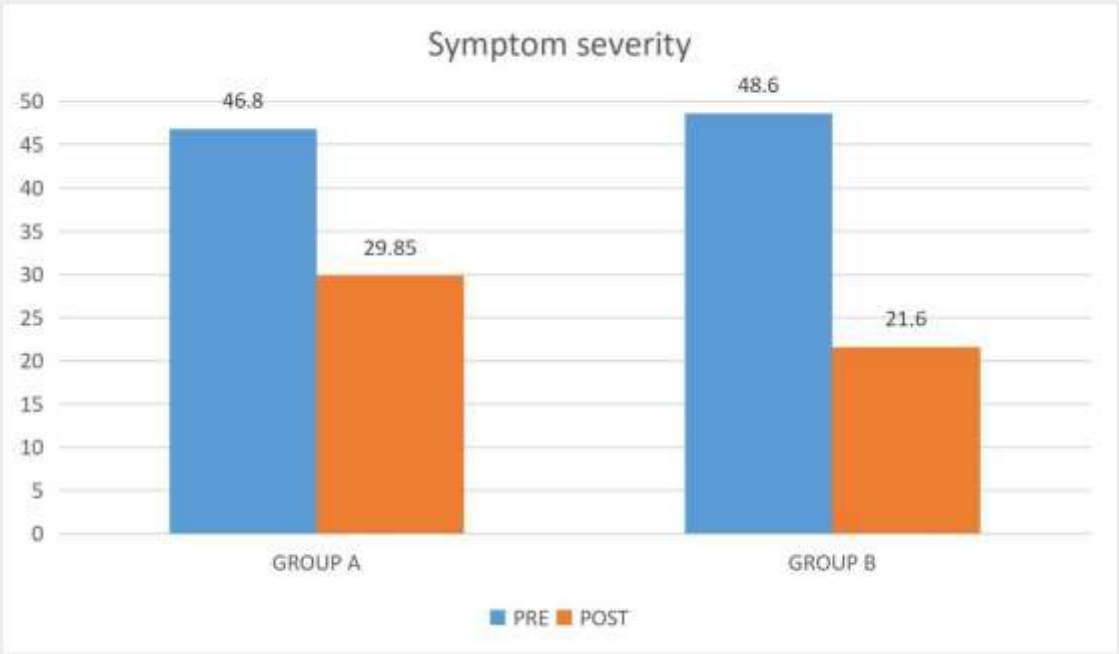
TABLE NO 5. Functional status(pre-post)

	PRE	POST	P VALUE
GROUP A	37.85±1.981	21.95±3.379	P<0.05
GROUP B	38.45±1.538	14.20±1.240	P<0.05

GRAPH 1 DASH Score



GRAPH 2 Symptom severity (Pre and Post)



DISCUSSION

This study was conducted to check to examine and compare the effect of electrotherapy and Nerve gliding exercises on pain and functional performance in Acute Carpal Tunnel Syndrome. According To the results of the study we can found that there was a higher effects can be seen in the subjects treatment in group B with therapeutic ultrasound as the post score for DASH are 52.30±5.895 , Symptom severity are 21.60±2.542 and Functional status are 14.20±1.240.The p value was less than 0.005 in all the post results of the both groups shows that there a effects in both the groups as subject post data was checked. A latest study shows as Fauzia Javed Sheereen et al 2022 - en the median nerve in the wrist is compressed, it may lead to upper limb impairment in both men and women with carpal tunnel syndrome. In the treatment of individuals with persistent carpal tunnel syndrome, Neurodynamics and bone mobilization therapies, as well as tendon gliding activities, should be explored. Patients with persistent CTS were divided into two groups and given either NT or CBMT treatment at random. TGE participants were required to complete three weeks of NT and CBMT in addition to their training. Electromyography and a hand-held dynamometer were used to assess each of the primary outcomes of the study, including pain intensity and functional status, grip strength, and motor nerve conduction. These measurements were gathered three weeks after the intervention, one week after the intervention ended. A 0.05 level of significance was employed for paired and unpaired t-tests to investigate the differences in intervention effects across the various groups. When combined with TGE, the NT was more effective than the CBMT in increasing the speed of nerve conduction and the functional condition of the hand. Both NT and CBMT have been demonstrated to be equally beneficial in lowering pain and increasing grip strength in chronic CTS patients. The addition of TGE to NT and CBMT proved to be both helpful and successful. Significance. As a consequence of this research, physiotherapists who treat chronic CTS patients would be able to make more informed treatment recommendations based on the findings.

Future scope of study

More study can be done with higher sample size in the study.
Further studies can be done with more modalities

Conflict of interest: -None

CONCLUSION

According to the findings of the research, we are able to draw the conclusion that both interventions had a

substantial impact; however, Higher effects can be seen on the subjects treated with therapeutic ultrasound as compared with Nerve gliding Exercise. So the study showsthat therapeutic ultrasound is a effective treatment for Acute Carpal Tunnel Syndrome

REFERENCES

1. Poole M. Surgical Caution With Carpenter's Syndrome. J Craniomaxillofac Surg [Internet]. 1993;21. Available From: Https://Doi.Org/10.1016/S1010-5182(05)80171-4
2. Siva Kumar Ms, Couto ', Bs Pgd, Hm Pgd, Dpmr Mbbs. The Effect Of Ultrasound Versus Nerve AndTendon Gliding Exercise On Pain And Functions In Patients With Carpal Tunnel Syndrome-A Comparative Study Certificate Project Guide Principal.
3. Taravath S, Tonsgard J. Cerebral Malformations In Carpenter Syndrome. Pediatr Neurol [Internet]. 1993;9. Available From:Https://Doi.Org/10.1016/0887-8994(93)90092-Q
4. Kadakia S, Helman S, Healy N, Saman M, Wood-Smith D. Carpenter Syndrome: A Review For The Craniofacial Surgeon. JCraniofac Surg [Internet]. 2014;25. Available From: Https://Doi.Org/10.1097/Scs.00000 00000001121
5. White J, Boldt D, David D, Sheffield L, Simpson D. Carpenter Syndrome With Normal Intelligence And Precocious Growth.Acta Neurochir (Wien) [Internet]. 1981;57. Available From: Https://Doi.Org/10.1007 /Bf01665112
6. Alessandri J, Dagoneau N, Laville J, Baruteau J, Hébert J, Cormier-Daire V. Rab23 Mutation In A Large Family From Comoros Islands With Carpenter Syndrome. Am J Med Genet A [Internet]. 2010;152. Available From: Https://Doi.Org/10.1002/Ajmg.A.33327
7. Bhardwaj M, Grange C. Caesarean Section In A Parturient With Carpenter Syndrome And Corrected Tetralogy Of Fallot. Int JObstet Anesth [Internet]. 2013;22. Available From: Https://Doi.Org/10.1016 /J.Ijoa.2013. 04.009
8. Jenkins D, Seelow D, Jehee F, Perlyn C, Alonso L, Bueno D, Et Al. RAB23 Mutations In Carpenter Syndrome Imply An Unexpected Role For Hedgehog Signaling In Cranial-Suture Development And Obesity. Am J Hum Genet [Internet]. 2007;80.Available From: Https://Doi.Org/10.1086/518047
9. Ben-Salem S, Begum M, Ali B, Al-Gazali L. A novel aberrant splice site mutation in RAB23 leads to an eight nucleotide deletion in the mRNA and is responsible for Carpenter syndrome in a Consanguineous Emirati Family. Mol Syndromol [Internet]. 2013;3. Available from: https://doi.org/10.1159/000345653
10. Jallo G, Kothbauer K, Recinos V (2018) Handbook of pediatric neurosurgery. Thieme Medical Publishers New York.
11. El-Gendy MH, Lasheen YR, Rezkalla WKS. Multimodal approach of electrotherapy versus myofascial release in patients with chronic mechanical neck pain: A randomized controlled trial. Physiotherapy Quarterly. 2019;27(4):6–12
12. Stecco A, Meneghini A, Stern R, Stecco C, Imamura M. Ultrasonography in myofascial neck pain: Randomized clinical trial for diagnosis and follow-up. Surgical and Radiologic Anatomy. 2014;36(3):243–53
13. Tsai WC, Wang CL, Tang FT, Hsu TC, Hsu KH, Wong MK. Treatment of proximal plantar fasciitis with ultrasound-guidedsteroid injection. Archives of Physical Medicine and Rehabilitation. 2000;81(10):1416–21
14. Anwar N, Li S, Long L, Zhou L, Fan M, Zhou Y, et al. Combined effectiveness of extracorporeal radial shockwave therapyand ultrasound-guided trigger point injection of lidocaine in upper trapezius myofascial pain syndrome [Internet]. Vol. 14, Am J Transl Res. 2022. Available from: www.ajtr.org
15. Ghany WA, Elsayed E, Alshimy AM, Shady NA, Hussien MH, Ghany WAA, et al. EFFECT OF HIGH TONE POWER THERAPY ON CARPAL TUNNEL SYNDROME PATIENTS: (RANDOMIZED CONTROLLED TRIAL) Effect of TaskOriented Training on Postural Stability in Patients with Type (II) Diabetic Neuropathy View project Traumatic Brain Injury
16. Ee A, Ba T, Ai A, Sc C. Influence of Nerve Flossing Technique on acute sciatica and hip range of motion [Internet]. Vol. 4,International Journal of Medicine and Biomedical Research. Available from: www.ijmbr.com
17. Salehi S, Hesami O, Rashed A, Hassabi M, Poursaeidesfahani M, Hosein A, et al. The Assessment of Acupuncture and Exercise Therapy in Patients with Carpal Tunnel Syndrome: Randomized Clinical Trial. Vol. 4. 2019
18. Sheereen FJ, Sarkar B, Sahay P, Shaphe MA, Alghadir AH, Iqbal A, et al. Comparison of Two Manual Therapy Programs, including Tendon Gliding Exercises as a Common Adjunct, While Managing the Participants with Chronic Carpal Tunnel Syndrome. Taiar R, editor. Pain Research and Management [Internet]. 2022 Jun 8;2022:1–11. Available from: https://www.hindawi.com/journals/prm/2022/1975803/
19. Salehi S, Hesami O, Esfehani MP, Khosravi S, Rashed A, Haghighatzadeh M, et al. The effectiveness of exercise therapy and dry needling on wrist range of motion, pinch and grip force in carpal tunnel syndrome: A randomized clinical trial. Asian Journal of Sports Medicine. 2019 Dec 1;10(4)
20. Burcu T, Zilan B. The Effects of Sensory Therapy on Pain, Upper Extremity Functions and Sleep Quality in Patients with Carpal Tunnel Syndrome [Internet]. Vol. 1, Ann Yoga Phys Ther. 2016. Available from: https://www.researchgate.net/publication/310266101
21. Bronfort G, Haas M, Evans R, Leininger B, Triano J. Effectiveness of manual therapies: the UK evidence report

[Internet].2010. Available from: http://www.chiroandosteo.com/content/18/1/3
22. Padua L, Coraci D, Erra C. Carpal tunnel syndrome: clinical features, diagnosis, and management [Internet]. Vol. 15. 2016.Available from: www.thelancet.com/neurology
23. O'Connor D, Marshall SC, Massy-Westropp N, Pitt V. Non-surgical treatment (other than steroid injection) for carpal tunnel syndrome. Vol. 2017, Cochrane Database of Systematic Reviews. John Wiley and Sons Ltd; 2003
24. Ali Al-Muhanna N, Shamsi S. Effect Of Ultrasound With Splinting And Splinting Alone For Carpaltunnel Syndrome [Internet]. International Journal Of Medical Science And Clinical Inventions. 2015. Available from: https://www.researchgate.net/publication/342918268
25. Hamzeh H, Madi M, Alghwiri AA, Hawamdeh Z. The long-term effect of neurodynamics vs exercise therapy on pain and function in people with carpal tunnel syndrome: A randomized parallel-group clinical trial. Journal of Hand Therapy. 2021Oct 1;34(4):521–30
26. Nunes GS, Uhlig S, Ribas LMDA, Gonçalves FB, Wageck B, Noronha M de. Influence of neural mobilization of lower limbs on the functional performance and dynamic balance in asymptomatic individuals: A cross-over randomized controlled trial. Human Movement. 2017 Dec 20;18(4):10–6
27. Bartkowiak Z, Eliks M, Zgorzalewicz-Stachowiak M, Romanowski L. The effects of nerve and tendon gliding exercises combined with low-level laser or ultrasound therapy in carpal tunnel syndrome. Indian Journal of Orthopaedics. 2019 Mar1;53(2):347–52
28. Incebiyik S, Boyaci A, Tutoglu A. Short-term effectiveness of short-wave diathermy treatment on pain, clinical symptoms, and hand function in patients with mild or moderate idiopathic carpal tunnel syndrome. Journal of Back and Musculoskeletal Rehabilitation. 2015;28(2):221–8
29. Tamaru Y, Yanagawa A, Matsugi A. Sensory nerve conduction velocity predicts improvement of hand function with nervegliding exercise following carpal tunnel release surgery. Journal of Clinical Medicine. 2021 Sep 1;10(18)
30. Savage NJ, Albano J. Marrying Tendon and Nerve Gliding Exercises with Hydrodissection Following Injection for Carpal Tunnel Syndrome - A New Treatment Approach? J Orthop Case Rep [Internet]. 2020 Dec;10(9):38–46. Available from: http://www.ncbi.nlm.nih.gov/pubmed/34169015
31. Llamas-Ramos R, Pecos-Martín D, Gallego-Izquierdo T, Llamas-Ramos I, Plaza-Manzano G, Ortega-Santiago R, et al. Comparison of the short-term outcomes between trigger point dry needling and trigger point manual therapy for the management of chronic mechanical neck pain: A randomized clinical trial. Journal of Orthopaedic and Sports Physical Therapy. 2014 Nov 1;44(11):852–61
32. Baptista FM, Cruz EB, Afreixo V, Silva AG. Effectiveness of neural mobilization on pain intensity, disability, and physical performance in adults with musculoskeletal pain-A protocol for a systematic review of randomized and quasi-randomized controlled trials and planned meta-analysis. PLoS ONE. 2022 Mar 1;17(3 March)
33. Geler Külcü D, Bursali C, Aktaş İ, Bozkurt Alp S, Ünlü Özkan F, Akpinar P. Kinesiotaping as an alternative treatment method for carpal tunnel syndrome. Turkish Journal of Medical Sciences. 2016;46(4):1042–9
34. Sal OB, Altay Z, Ozcan C, Ertem K, Yologlu S, Kayhan A. Comparison of three conservative treatment protocols in carpaltunnel syndrome
35. Michlovitz SL. Is there a role for ultrasound and electrical stimulation following injury to tendon and nerve? Journal of Hand Therapy. 2005;18(2):292–6
36. Lim YH, Chee DY, Girdler S, Lee HC. Median nerve mobilization techniques in the treatment of carpal tunnel syndrome:A systematic review. Journal of Hand Therapy. 2017 Oct 1;30(4):397–406
37. Carlson H, Colbert A, Frydl J, Arnall E, Elliott M, Carlson N. Current options for nonsurgical management of carpal tunnelsyndrome. Vol. 5, International Journal of Clinical Rheumatology. 2010. p. 129–42
38. Klokkari D, Mamais I. Effectiveness of surgical versus conservative treatment for carpal tunnel syndrome: A systematic review, meta-analysis and qualitative analysis. Vol. 38, Hong Kong Physiotherapy Journal. World Scientific Publishing Co.Pte Ltd; 2018. p. 91–114
39. Sim SE, Gunasagaran J, Goh KJ, Ahmad TS. Short-term clinical outcome of orthosis alone vs combination of orthosis, nerve, and tendon gliding exercises and ultrasound therapy for treatment of carpal tunnel syndrome. Journal of Hand Therapy. 2019 Oct 1;32(4):411–6