International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

ISSN:2347-6567

IJAMSCR | Volume 9 | Issue 2 | Apr - Jun - 2021
www.ijamscr.com

Research Study *Medical research*

Effectiveness of ultrasound and exercises therapy program on lateral epicondylitis

M Shukla[1], J Pandya[2]

[1]Assistant Professor, College of Physiotherapy, SumandeepVidyapeeth an institution Deemed to be University, At & Po: Piparia, Waghodia Road, Ta: Waghodia, Dist. Vadodara, Gujarat-391760, India.
[2]former PG student, College of Physiotherapy, SumandeepVidyapeeth an institution Deemed to be University, At & Po: Piparia, Waghodia Road, Ta: Waghodia, Dist. Vadodara, Gujarat-391760, India.

***Corresponding Author: M shukla**
Email id: maitris741@gmail.com

ABSTRACT

LE- lateral epicondylitis
ECRB-extensor carpi radialisbrevis
VAS-visual analogue scale
RM-repetition maximum
GS-grip strength

Aim: To study the effect of ultrasound combined with exercises Versus cryo-therapy combined with exercises on tennis elbow(lateral epicondylitis).

Material and Method: It is an experimental study conducted on tennis players with lateral epicondylitis. 1week pulsed ultrasound and exercise was given to one group of 15 players and another group of 15 players were given cryotherapy and exercise. Verbal numeric pain scale and grip strength were used as outcome measures and scores were recorded before and after intervention.

Results: There was significant difference ($p<0.001$) in grip strength post intervention (210.66) from pre intervention value of (197.33) in group 1 and also significant improvement seen ($p<0.001$) in group 2 after intervention (220) from pre intervention value(200).There was significant improvement seen in group 1 in VAS after exercise(2.73±0.08) from pre intervention value (4.0±0.65) and also significant changes seen in group 2 after intervention (1.93±.457) from pre intervention value(4.53±.743). For inter group analysis of VAS between the group 1(11.10) and group 2(19.90) shows significant change ($p=0.003$).For inter group analysis of Grip strength between group 1 (18.90) and group 2(12.10) shows significant improvement ($p=0.028$).

Conclusion: Both ultrasound with exercise and cryotherapy with exercise are useful in reducing pain and improving grip strength in patients with tennis elbow. Pulsed ultrasound hasa significant improvement as compared to cryotherapy.

Keywords: Tennis elbow, ultrasound,cryotherapy,tennis playres,Mill's test,Cozen's test,visual analogue scale,grip strength, sphygmomanometer.

INTRODUCTION

Lateral elbow pain described by Runge in 1873 has been known with different terms such as tennis elbow,epicondylosis, lateral epicondylitis, lateral elbow pain and epicondyalgia[1,2].Lateralepicondylalgia (LE) is a clinical diagnosis based on a presentation of tenderness over the common extensor origin and pain exacerbated by repeated wrist extension[3]

Lateral epicondylitis is a syndrome characterized by pain over the outer aspect of the elbow and is usually aggravated by radial extension of the wrist. Tenderness is typically localized to the tendinous origin of the extensor carpi radialisbrevis.Chronic symptoms are commonly

associated withinadequate muscle power and endurance. Most investigators contend that repetitive and cumulative injuryproduces this condition.(3)

The History commonly includes Pain over the lateral humeral epicondyle which manifests during activities involving the forceful and repetitive gripping and painful weakness in the gripping Activities (4-7) or manipulating an object, such as that required when lifting a tea cup, shaking hands, dressingand desk or house work, will to most musculoskeletal health care practitioners signal the provisional diagnosis of 'tennis elbow' or more correctly lateral epicondylalgia (LE). The prevalence of tennis elbow in general population is about 1-3% between 30 and 64 years of age,[8,9]with the peak incidence between 45 and 54 [10].It affect both males and females equally[11-13]though Stasinopoulos and Johnson[14] postulated that it can be more sever and longer lasting in females than in males. There is wide disparity in reported prevalence in occupational populations varying from 2-20%[15, 16] these have been attributed to varying definition; self-reported measures and difference in clinical examination technique[17].

Tennis elbow was first described in 1883 by Major[18] this condition is mostoften work-related and many patients who have this condition do not play tennis[19]. It has been estimated, however, that 10% to 50% of people who regularlyplay tennis will develop the condition at some time during their careers[20]. Arecent study on biomechanics demonstrated that the eccentric contractions of theextensor carpi radialisbrevis (ECRB) muscle during backhand tennis swings,especially in novice players, are the likely cause of repetitive microtrauma thatcauses tears in the tendon and lateral epicondylitis[21]. Some other suggestedcauses of tennis elbow, or lateral epicondylitis, are trauma to the lateral region of the elbow, relative hypovascularity of the region[22], and fluoroquinolone antibiotics[23].

In lateral epicondylitis patients Pain or the fear of pain may prevent patient from generating their true maximal pain free effort during a gripping activity. It is also possibility that the decrease in ability to rapidly generate force and grip strength may be a protective adaptation but it is still need to find out.[24]

There is no proper treatment intervention is defined for tennis elbow in literature[34]. Standard treatments for tennis elbow have focused primarily on the pain management by anti-inflammatory medication[35]and physiotherapy. Various treatments have been attempted for tennis elbow including corticosteroid injection[36], drug therapies, laser[37-41] electrical stimulation[42,43] ergonomics[44,45], counterforce bracing[46], accupuncture[47,48],splintage[49], ultrasound[50], phonophoresis[51] or iontophoresisetc. Surgical treatment is indicated in 5-10%[47] of patients who did not improve from their symptoms with conservative treatment approach. There are manytreatment listed in literature as the ultimate goal of the treatment is to reduce pain but which treatment is most beneficial is necessary to find so this study was conducted to see the effect of ultrasound and cryo-therapy on patients with tennis elbow when combined with exercises.

Aim of the study

To study the effect of ultrasound combined with exercises VS cryo-therapy combined with exercises on tennis elbow (lateral epicondylitis).

Objectives

- To find out the efficacy of exercises program (strengthening exercise and stretching program) when combined with ultrasound and cryo-therapy on lateral epicondylitis on:
  - Pain
  - Grip Strength.

Methodology and Materials

The study was approved by IEC SV on 14th August 2012. After the approval from the ethical committee permission from the Principal, College of Physiotherapy was taken to carry out the study at different sports academy at Baroda as the study was to be carried out among tennis players, Approval was then taken from Akota tennis academy. The letter of approval for the same was submitted to the Principal, College of Physiotherapy.

- Source of Data: Akota tennis academy, Baroda, Gujarat.
- Study Design: Experimental study
- Tennis players having pain over the lateral epicondyle of elbow, No time period of playing tennis, Male and female players.,PositiveMilli's and Cozen's sign, Any age are included in the study.
- Players who have Systemic diseases,A history of upper limb surgeries. any Neurological disorders, Post traumatic stiffness of elbow joint., Radial head subluxion,Cervical spodylosis with radiating pain on lateral elbow are excluded from the study.
- Sampling design: convenient sampling

Outcome Measures

- Visual analogue scale(VAS)
- Dynamic grip strength

METHOD

After receiving ethical approval from Sumandeep vidhyapeeth institutional ethical clearance committee and the College of Physiotherapy, 43 Players from tennis academy having pain over the lateral epicondyle (self-reported) were selected for the study.They were assessed thoroughly for tennis elbow and by using a standard assessment format in that Pain, tenderness, elbow ROM, grip strength were taken and tennis elbow were diagnosed on basis of Mill's and Cozen's test by physiotherapist. 10 subjects had negative Mill's or Cozen's test and were hence excluded from the study. Remaining 33 subjects were explained about the treatment benefits and demerits. A written informed consent was taken from the players (appendix 2). The 1st subject was made to pick up the chit and accordingly was put into the group and the remaining subjects were then alternately divided into 2 groups. In both the group there were 15 players as 2 players were drop out due to personal issue.

Group 1 (U.S + exercise) andGroup 2 (Cryo + exercise)

Grip strength was obtained by using sphygmomanometer. The subject was made to sit in a chair with a standard size pillow in the subject's lap and the affected hand resting on the pillow in mid prone position with elbow flexed. The pressure cuff was the tied to the subject's affect upper limb just above the elbow joint and the pump given in the subjects affected hand. The subject was then asked to inflate the cuff till maximum limit and the readings recorded. This was repeated three times and the top score noted and Pain was assessed one to one by using Verbal Numeric Pain Rating Scale.

Once assessed for outcome measure group 1 was given Ultarsound therapy (pulsed ultrasound (1 MHz) for 7 min (over the painful area) at 1w/cm2).

Following exercises were prescribed to both the groups in common: Ultrasound was given with subject in sitting position in a chair with the affected limb supported on the couch with elbow flexed to 60 degrees. Group 2 was given cryo-therapy for 10 min using a ice pack wrapped in a towel with subject in sitting position.

1. Stretching was given to wrist extensors in sitting with shoulder flexed to 90 degrees, elbow extended, forearm pronated and wrist in full flexion. This was maintained for 10 sec and repeated for 3 times.
2. One RM (maximum weight one can lift for one time) of wrist extensors of each subject was taken and strengthening program started with 60% of the 1RM. Gradually it was progressed from 60% to 90% of 1RM. Subject was made to sit in a chair with the affected limb resting on the couch with elbow flexed and wrist at the edge of the couch with weight hanging in the hand. The exercise was to extend the wrist from full flexion folding the weight in the hand. This exercise was repeated 10 times with 10 seconds hold time and a total of 3 sets.

This intervention was given for 1 week and outcome measure reassessed again at the end of 1 week in similar manner as pre intervention. Statistical analysis was done using SPSS 17.0 statistical package in a password protected computer.

RESULTS

Table -4.1 Intragroup analysis of VAS and GS (grip strength) of group 1

Group1(US +EX)		Mean	Std. Deviation	z	P
VAS	Pre	4.0	±0.65	-3.578	0.000
	Post	2.73	±0.88		
GS	Pre	197.33	±10.99	-3.272	0.001
	Post	210.66	±10.32		

The above table shows with in group comparison of Visual analogue scale (vas) and grip strength by Wilcoxon Signed Rank Test for group 1. p value less than 0.001 shows there is statistically significant improvement after intervention.

Table -4.2 Intragroup analysis of VAS and GS of group 2

Group2(CRYO+EX)		Mean	Std. Deviation	Z	P
VAS	Pre	4.53	± .743	-3.487	.000
	Post	1.93	± .457		
GS	Pre	200	±14.14	-3.499	.000
	Post	220	±11.33		

The above table shows with in group comparison ofVisual analogue scale (vas) and grip strength by Wilcoxon Signed Rank Test for group 2. p value less than 0.001 shows there is statistically significant improvement after intervention.

Table-4.3 Inter group analysis of grip strength and Visual analogue scale

Outcome	Group	Mean rank	Z	P
VAS	Group 1	11.10	-2.95	0.003
	Group 2	19.90		
GS	Group 1	18.90	-2.198	0.028
	Group 2	12.10		

The above table shows between Group comparison of after intervention values of VAS and GS by Mann Whitney U Test. The p values for all the outcome measures are less than 0.001 shows there is statistically significant improvement in group1(us +ex) after intervention in both outcome measures.

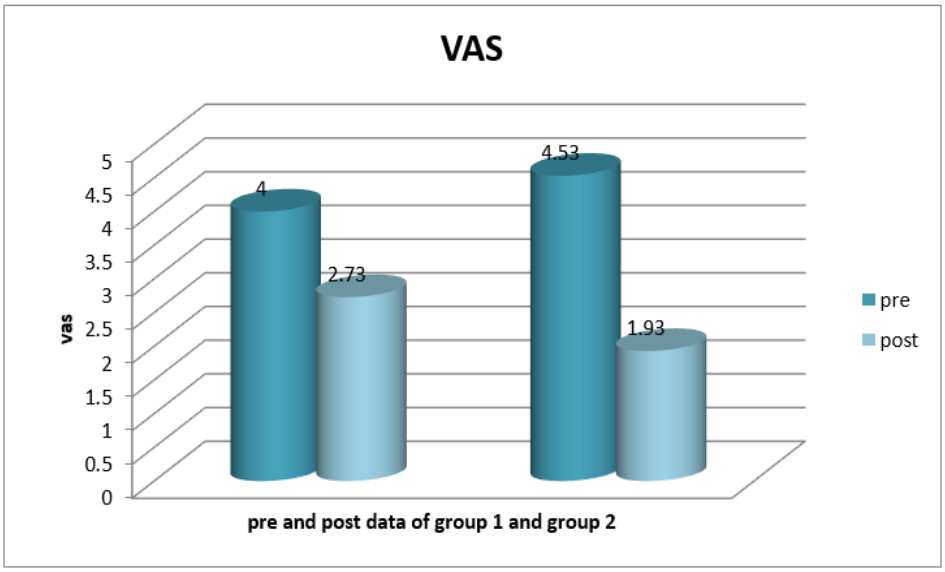


Figure 4.1 shows intra group comparison of Visual analogue scale

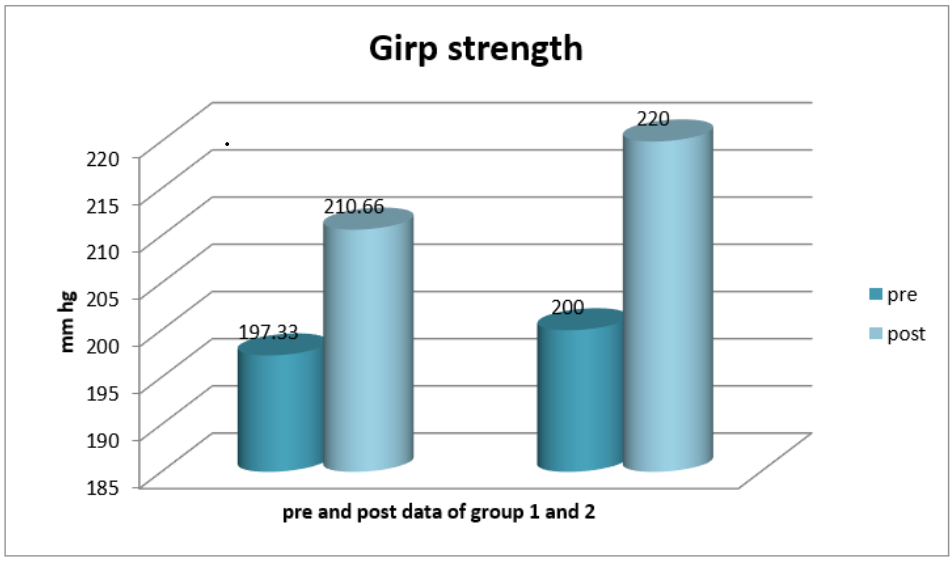


Figure 4.2 shows intragroup comparison of grip stren

The mean value of age is calculated. The mean age in group 1 (mean= 26.50 years) and control group 2 (mean= 33.53 years).

The purpose of this study was to determine the effect of ultrasound with exercise and cryotherapy with exercise on lateral epicondilities. There were 15 subjects in each group which were given exercises in common and one group was given ultrasound and other was given cryotherapy.

There was significant difference ($p < 0.001$)in Grip strength post intervention (210.66) from pre intervention value of (197.33) in group 1 and also significant improvement seen ($p < 0.001$) in group 2 grip strength after intervention (220) from pre intervention value (200).

There was significant improvement seen in group 1 Visual analogue scale (VAS) after exercise (2.73±0.88) from pre intervention value (4.0±0.65) and also significant changes seen in group 2 after intervention (1.93± .457) from pre intervention value (4.53± .743).

For inter group analysis of VAS between group 1 (1.933±0.457) and group 2 (2.73 ±0.88) shows no significant change ($p>0.001$). For inter group analysis of Grip strength between group 1 (220±11.33) and group 2 (210.66±10.32) shows no significant improvement ($p>0.001$).

Ultrasound which was pulsed at 1 mhz for 7 min was given showed statistical significance when compared to cryotherapy, however both the groups at the end of therapy showed significant changes in pain and grip strength following their respective intervention. Multiple interventional trials for chronic Lateral Epicondilities have not shown any benefit for active treatment over placebo. These studies assessed a variety of modalities,

including ultrasound, pharmacological and physical therapies [16–24]. It is not possible to directly compare the outcome of our trial with these previous studies; however, a common conclusion is the lack of distinguishable benefit from active intervention.

Despite the extensive use of cryotherapy in the management of acute musculoskeletal injury, few investigators [33–36] have actually examined the effect of cryotherapy alone on return to participation. The analgesic effect of cryotherapy is one of the primary reasons clinicians use it in the management of acute musculoskeletal injuries. Slowing of nerve conduction velocity is the likely mechanism for the analgesic response to cold. Ice reduces nerve conduction velocity and slows the stretch reflex. The greatest effect of reduced nerve conduction velocity is shown in superficial nerves,[21] and the effect of cold on nerve conduction velocity may last up to 30 minutes after application.

When pain is effectively managed, the patient may be able to begin and progress rehabilitation sooner to address range-of-motion and strength deficits as well as progress to full weight bearing and functional activities more rapidly[21].

Grip strength improved over the duration of the trial. One of the limitations of grip strength is its subjectivity, being reliant on patient effort, which may vary greatly between individuals.

In this study we have compared the effect of ultrasound with cryotherapy and both have its evidences for improving pain, but in our study exercise was given along with these modalities so it is difficult to staunchly state which one of them is better when compared to other. Exercise alone may also have improved both the parameters. Previous studies are in accordance with our study showing effect of pulsed ultrasound but there they have used placebo for control group therefore this study should be compared with caution with other studies.

Pienim¨aki et al. had given exercise programme of stretches and exercises (isometric and isotonic) with a treatment of pulsed ultrasound across the same time span for 6-8 week that showed the SMD for pain visual analogue scale at rest was 0.97 (95% CI 0.30 to 1.63) and 0.66 (95% CI 0.01 to 1.31) for pain visual analogue scale under strain. Maximum grip strength was not significantly different between groups [12].This is not in accordance to our study which shows improvement in grip strength. Here they have not given exercise to one group whereas we have given to both the groups so this contradiction is explainable.

There is significant difference in both NPS and Grip strength post intervention within each group but there is no significant difference in NPS and Grip strength post intervention when two groups are compared to each other. Clinically different combination of us, cryotherapy and exercises can be given to attain the desired results as both are effective.

CONCLUSION

Both ultrasound with exercise and cryotherapy with exercise are useful in reducing pain and improving grip strength in patients with tennis elbow. Pulsed ultrasound has a significant improvement as compared to cryotherapy.

LIMITATION

Limitation of the study was that the number of subjects recruited for the study were less (30), 15 subjects in each group.

REFERENCES

[1]. Assendelft, W., Green, S., Buchbinder, R., Struijs, P. and Smidt, N., 2003. Tennis elbow. *Bmj*, *327*(7410), p.329.

[2]. Shiri, R., Viikari-Juntura, E., Varonen, H. and Heliövaara, M., 2006. Prevalence and determinants of lateral and medial epicondylitis: a population study. *American journal of epidemiology*, *164*(11), pp.1065-1074.

[3]. Hong, Q.N., Durand, M.J. and Loisel, P., 2004. Treatment of lateral epicondylitis: where is the evidence?.*Joint Bone Spine*, *71*(5), pp.369-373.

[4]. LaFreniere, J.G., 1979. "Tennis Elbow": Evaluation, Treatment, and Prevention. *Physical therapy*, *59*(6), pp.742-746.

[5]. Kushner S, Reid DC. Manipulation in the treatment of tenniselbow. J Orthop Sports PhysTher 1986;7:264e72.

[6]. Wadsworth, C.T., Nielsen, D.H., Burns, L.T., Krull, J.D. and Thompson, C.G., 1989. Effect of the counterforce armband on wrist extension and grip strength and pain in subjects with tennis elbow. *Journal of Orthopaedic& Sports Physical Therapy*, *11*(5), pp.192-197.

[7]. Vicenzino, B. and Wright, A., 1996. Lateral epicondylalgia I: epidemiology, pathophysiology, aetiology and natural history. *Physical therapy reviews*, *1*(1), pp.23-34.

[8]. Shiri, R., Viikari-Juntura, E., Varonen, H. and Heliövaara, M., 2006. Prevalence and determinants of lateral and medial epicondylitis: a population study. *American journal of epidemiology*, *164*(11), pp.1065-1074.

[9]. Hong QN, Durand MJ, Loisel P. Treatment of lateral epicondylitis : where is the evidence? Joint, Bone, Spine.2004; 71:369-73

[10]. Vicenzino, B. and Wright, A., 1996. Lateral epicondylalgia I: epidemiology, pathophysiology, aetiology and natural history. *Physical therapy reviews*, *1*(1), pp.23-34.

[11]. Walker-Bone, K.E., Palmer, K.T., Reading, I. and Cooper, C., 2003, December. Soft-tissue rheumatic disorders of the neck and upper limb: prevalence and risk factors. In *Seminars in arthritis and rheumatism* (Vol. 33, No. 3, pp. 185-203). WB Saunders.

[12]. Walker□Bone, K., Palmer, K.T., Reading, I., Coggon, D. and Cooper, C., 2004. Prevalence and impact of musculoskeletal disorders of the upper limb in the general population. *Arthritis Care & Research*, *51*(4), pp.642-651.

[13]. Walker-Bone KE, Palmer KT, Griffin MJ, et al. Prevalence and occupational associations of neck pain in the British population. ScandJ work Environ Health.2001; 27:49-56.
[14]. Stasinopoulos, D. and Johnson, M.I., 2004. Cyriax physiotherapy for tennis elbow/lateral epicondylitis. *British journal of sports medicine*, *38*(6), pp.675-677.
[15]. Allander, E., 1974. Prevalence, incidence, and remission rates of some common rheumatic diseases or syndromes. *Scandinavian journal of rheumatology*, *3*(3), pp.145-153.
[16]. Leclerc, A., Landre, M.F., Chastang, J.F., Niedhammer, I., Roquelaure, Y. and Study Group on Repetitive Work, 2001. Upper-limb disorders in repetitive work. *Scandinavian journal of work, environment & health*, pp.268-278.
[17]. Kryger, A.I., Lassen, C.F. and Andersen, J.H., 2007. The role of physical examinations in studies of musculoskeletal disorders of the elbow. *Occupational and environmental medicine*, *64*(11), pp.776-781.
[18]. Luk, J.K., Tsang, R.C. and Leung, H.B., 2014. Lateral epicondylalgia: midlife crisis of a tendon. *Hong Kong Med J*, *20*(2), pp.145-51.
[19]. COONRAD, R.W. and HOOPER, W.R., 1973. Tennis elbow: its course, natural history, conservative and surgical management. *JBJS*, *55*(6), pp.1177-1182.
[20]. Nirschl, R.P., 1992. Elbow tendinosis/tennis elbow. *Clinics in sports medicine*, *11*(4), pp.851-870.
[21]. Riek, S., Chapman, A.E. and Milner, T., 1999. A simulation of muscle force and internal kinematics of extensor carpi radialisbrevis during backhand tennis stroke: implications for injury. Clinical Biomechanics, 14(7), pp.477-483.
[22]. Schneeberger, A.G. and Masquelet, A.C., 2002. Arterial vascularization of the proximal extensor carpi radialisbrevis tendon. Clinical Orthopaedics and Related Research (1976-2007), 398, pp.239-244.
[23]. Le Huec, J.C., Schaeverbeke, T., Chauveaux, D., Rivel, J., Dehais, J. and Le Rebeller, A., 1995. Epicondylitis after treatment with fluoroquinolone antibiotics. *The Journal of bone and joint surgery. British volume*, *77*(2), pp.293-295.
[24]. Chourasia AO, Buhr KA, Rabago DP, Kijowski R, Irwin CB, Sesto ME. Effect of lateral epicondylosis on grip force development. Journal of Hand Therapy. 2012 Jan 1;25(1):27-37.
[25]. Nagrale, A.V., Herd, C.R., Ganvir, S. and Ramteke, G., 2009. Cyriax physiotherapy versus phonophoresis with supervised exercise in subjects with lateral epicondylalgia: a randomized clinical trial. *Journal of Manual & Manipulative Therapy*, *17*(3), pp.171-178.
[26]. Green, S., Buchbinder, R., Barnsley, L., Hall, S., White, M., Smidt, N. and Assendelft, W.J., 2001. Non□steroidal anti□inflammatory drugs (NSAIDs) for treating lateral elbow pain in adults. *Cochrane Database of Systematic Reviews*, (4).
[27]. Assendelft, W.J., Hay, E.M., Adshead, R. and Bouter, L.M., 1996. Corticosteroid injections for lateral epicondylitis: a systematic overview. *British Journal of General Practice*, *46*(405), pp.209-216.
[28]. Teitz, C.C., Garrett Jr, W.E., Miniaci, A., Lee, M.H. and Mann, R.A., 1997. Instructional Course Lectures, The American Academy of Orthopaedic Surgeons-Tendon Problems in Athletic Individuals. *JBJS*, *79*(1), pp.138-52.
[29]. Basford, J.R., Sheffield, C.G. and Harmsen, W.S., 1999. Laser therapy: a randomized, controlled trial of the effects of low-intensity Nd: YAG laser irradiation on musculoskeletal back pain. *Archives of physical medicine and rehabilitation*, *80*(6), pp.647-652.
[30]. Maher, S., 2006. Is low-level laser therapy effective in the management of lateral epicondylitis?.*Physical Therapy*, *86*(8), pp.1161-1167.
[31]. VasseljenJr, O., Høeg, N., Kjeldstad, B., Johnsson, A. and Larsen, S., 1992. Low level laser versus placebo in the treatment of tennis elbow. *Scandinavian journal of rehabilitation medicine*, *24*(1), pp.37-42.
[32]. Lundeberg, T., Haker, E. and Thomas, M., 1987. Effect of laser versus placebo in tennis elbow. *Scandinavian journal of rehabilitation medicine*, *19*(3), pp.135-138.
[33]. Manchanda, G. and Grover, D., 2008. Effectiveness of movement with mobilization compared with manipulation of wrist in case of lateral epicondylitis. *Indian J PhysiotherOccupTher*, *2*(1), pp.16-25.
[34]. Pienimaki, T., 2000. Conservative treatment and rehabilitation of tennis elbow: a review article. *Critical Reviews™ in Physical and Rehabilitation Medicine*, *12*(3).
[35]. Manchanda, G. and Grover, D., 2008. Effectiveness of movement with mobilization compared with manipulation of wrist in case of lateral epicondylitis. *Indian J PhysiotherOccupTher*, *2*(1), pp.16-25.
[36]. Roetert, E.P., Brody, H., Dillman, C.J., Groppel, J.L. and Schultheis, J.M., 1995. The biomechanics of tennis elbow. An integrated approach. *Clinics in Sports Medicine*, *14*(1), pp.47-57.
[37]. Manchanda, G. and Grover, D., 2008. Effectiveness of movement with mobilization compared with manipulation of wrist in case of lateral epicondylitis. *Indian J PhysiotherOccupTher*, *2*(1), pp.16-25.
[38]. Brattberg, G., 1983. Acupuncture therapy for tennis elbow. *Pain*, *16*(3), pp.285-288.
[39]. Molsberger, A. and Hille, E., 1994. The analgesic effect of acupuncture in chronic tennis elbow pain. *Rheumatology*, *33*(12), pp.1162-1165.
[40]. Cyriax, J.H., 1936. The pathology and treatment of tennis elbow. *JBJS*, *18*(4), pp.921-940.
[41]. Manchanda, G. and Grover, D., 2008. Effectiveness of movement with mobilization compared with manipulation of wrist in case of lateral epicondylitis. *Indian J PhysiotherOccupTher*, *2*(1), pp.16-25Kamien, M., 1990.
[42]. Viswas, R., Ramachandran, R. and KordeAnantkumar, P., 2012. Comparison of effectiveness of supervised exercise program and Cyriax physiotherapy in patients with tennis elbow (lateral epicondylitis): a randomized clinical trial. *The scientific world journal*, *2012*.
[43]. E.Hakers and T.Lundeberge effect of laser versus placebo in tennis elbow scad j rehab med 19 pg 135-38

[44]. Hamilton, G.F., McDonald, C. and Chenier, T.C., 1992. Measurement of grip strength: validity and reliability of the sphygmomanometer and jamar grip dynamometer. *Journal of Orthopaedic& Sports Physical Therapy*, *16*(5), pp.215-219.
[45]. Tuomo T Pienimäki, Tuula K Tarvainen, Pertti T Siira and HeikkiVanharanta'Received 20 October 1995; accepted 16 May 1996. Available online 19 October 2005
[46]. De Smet, L., Van Ransbeeck, H. and Fabry, G., 1998. GRIP STRENGTH IN TENNIS ELBOVV: LONG-TERM RESU ITS OF (OPERATIVE TREATMENT. *Actaorthopaedicabelgica*, *64*, pp.2-1998.
[47]. Wuori, J.L., Overend, T.J., Kramer, J.F. and MacDermid, J., 1998. Strength and pain measures associated with lateral epicondylitis bracing. *Archives of physical medicine and rehabilitation*, *79*(7), pp.832-837.
[48]. Bleakley CM, McDonough SM, Domhnall C MacAuley DC (2008) Some conservative strategies are effective when added to controlled mobilization with external support in acute ankle sprains: a systematic review. Australian Journal of Physiotherapy 54: 7–20.
[49]. Pienimäki, T., Tarvainen, T., Siira, P., Malmivaara, A. and Vanharanta, H., 2002. Associations between pain, grip strength, and manual tests in the treatment evaluation of chronic tennis elbow. *The Clinical journal of pain*, *18*(3), pp.164-170.
[50]. Brosseau, L., Casimiro, L., Milne, S., Welch, V., Shea, B., Tugwell, P. and Wells, G.A., 2002. Deep transverse friction massage for treating tendinitis. *Cochrane Database of Systematic Reviews*, (4).
[51]. Fairbank SR, Corelett RJ. The role of ECB muscle in Lateral epicondylitis, physiotherapy. Am J Sports Med *2003*;31(2):189–95.

How to cite this article: M Shukla, J Pandya. Effectiveness of ultrasound and exercises therapy program on lateral epicondylitis. Int J of Allied Med Sci and Clin Res 2021; 9(2): 349-355.

Source of Support: Nil. **Conflict of Interest:** None declared.