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COMPARATIVE STUDY OF ULTRASOUND AND LASER THERAPY FOR TREATMENT OF STENOSING TENOSYNOVITIS

Orthopaedics

KEYWORDS: de Quervains tenosynovitis, low level lasers, ultrasonic therapy

DR AMIT KUMAR — 2nd year resident, orthopaedics, B.J.MEDICAL COLLEGE, CIVIL HOSPITAL, AHMEDABAD

DR.PIYUSH MITTAL — associate professor ,department of orthopaedics, B.J.MEDICAL COLLEGE, CIVIL HOSPITAL, AHMEDABAD

DR.GAURANG BHABHOR, — 3rd year resident, orthopaedics, B.J.MEDICAL COLLEGE, CIVIL HOSPITAL, AHMEDABAD.

ABSTRACT

Background: de Quervain's tenosynovitis is an inflammation of abductor pollicis longus (APL) and extensor pollicis brevis (EPB) muscle tendon sheaths at the level of radial styloid process. Its conservative management includes nonsteroidal anti-inflammatory drugs, wrist and thumb immobilization, ultrasonic therapy (US Th.) and low level laser therapy (LLLT). Literature is scanty on comparative efficacy of US Th. and LLLT for its management. This prospective study evaluates outcome of US Th. versus LLLT in de Quervain's disease. **Materials and Methods**: Thirty patients clinically diagnosed de Quervains tenosynovitis were included in the study and randomly assigned to two groups.The average age was 36 years (range: 21-45 years). One group was given LLLT and the other US Th. for a total of 7 exposures on alternate days. The clinical criteria used were Finkelstein's test, tenderness over radial styloid (Ritchie's tenderness scale), grip strength, pain (visual analog scale [VAS]) and radiological criteria was ultrasonographic assessment of change in thickness of APL and EPB tendon sheath. They were measured before commencement and at the end of seven sessions of therapy, as per standard procedure. **Results:** Significant improvement was seen within both groups in the following outcome measures assessed: Ritchie's tenderness scale, grip strength and VAS. Finkelstein's test was not significantly improved in either groups. Ultrasonographic measurement of tendon sheath diameters, the mediolateral (ML), and anteroposterior (AP) diameters was not found to be significantly different in the US Th. group and the laser therapy group after treatment. On comparing both the groups, no statistically significant difference was found. However, looking at the mean values, the grip strength and VAS showed better improvement in the US Th. group as compared to the laser therapy group. assigned to two groups.The average age was 36 years (range: 21-45 years). One group was given LLLT and the other US Th. for a total of 7 exposures on alternate days. The clinical criteria used were Finkelstein's test, tenderness over radial styloid (Ritchie's tenderness scale), grip strength, pain (visual analog scale [VAS]) and radiological criteria was ultrasonographic assessment of change in thickness of APL and EPB tendon sheath. They were measured before commencement and at the end of seven sessions of therapy, as per standard procedure. Results: Significant improvement was seen within both groups in the following outcome measures assessed: Ritchie's tenderness scale, grip strength and VAS. Finkelstein's test was not significantly improved in either groups. Ultrasonographic measurement of tendon sheath diameters, the mediolateral (ML), and anteroposterior (AP) diameters was not found to be significantly different in the US Th. group and the laser therapy group after treatment. On comparing both the groups, no statistically significant difference was found. However, looking at the mean values, the grip strength and VAS showed better improvement in the US Th. group as compared to the laser therapy group.

INTRODUCTION:

Dequervains disease named after the Swiss surgeon Fritz de quervain,who identified first in 1895[3].It is an inflammation of the sheath or tunnel that surrounds two tendons that controls thumb.It is caused by repetitive use of the thumb in combination with radial deviation of the wrist.(pinching.wringing. lifting. gardening, knitting.

Dequervains'tenosynovitis (inflammation of abductor pollicis longus[APL] and extensor pollicis brevis[EPB] muscle tendon sheath) is a repetitive strain injury or a cumulative trauma disorder[1].
Patient usually presents complaining of radial wrist pain with thumb movement and tenderness over the first dorsal compartment. Diagnosis is usually concluded by a positive Finkelstein's test ,as well as the presense of tender nodule over radial styloid. Finkelstien's test was first described in 1930 and has recently been described as being performed in four stages: first with the application of gravity assisted gentle active ulnar deviation at a wrist, then the patient actively deviates the wrist in an ulnar direction, then further passive ulnar deviation by the examiner and in the final stage the examiner passively flexes the thumb into the palm. The reliability ,specificity, sensitivity has not being reported, but it was claimed that staged method of testing may be more accurate with higher sensitivity and specificity.Other tests are indicative of this condition including a decrease in pinch and thumb strength measurenments on the symptomatic site.

It is commonly managed nonoperatively by non–steroidal anti-inflammatory drugs,wrist and thumb immobilization,ultrasonic therapy and low level laser thearapy(LLLT)[2-4].

Ultrasound therapy is a therapeutic modality widely used for management of various soft tissue and musculoskeletal disorders. Although its mechanism of action is not clearly understood.[5-8].

Its efficacy has been questioned in the past[9].Most of the reviews and metaanalysis conducted on ultrasound therapy are lacking in specific information regarding the description of randomization methods,an ultrasound apparatus,mode of delivery,size of ultrasound head,treatment time and dropouts[9-12].
Well-designed research studies are required to justify the use of ulstrasound,especially in vivo.

Lasers have been used for photobiomodulation[13].
The available literature gives conflicting results regarding the efficacy of the modality in management of soft tissue disorders[14-17] and lack of descriptive information,further makes analysis difficult.

Low level laser therapy is effective in the management of the Dequervains'tenosynovitis[2].

As demonstrated ultrasonographically,however,studies on comperative efficacy of Low level laser therapy and ultrasound therapy in management of soft tissue disorders are not many[18].

This study assessed and compared the efficacy of ultrasound therapy and low level laser therarapy in Dequervains'tenosynovitis.

MATERIAL AND METHODS:

Aims and Objectives

To compare the two different conservative modality of management between ultrasound therapy and low level laser therapy for De quervains' tenosynovitis.

Study designs:

30 consecutive patients attending the orthopaedics out patient department having clinically diagnosed De quervains' tenosynovitis on the basis of positive Finkelstein'stest[23].were included in this prospective study.

There were 28 females and 2 males patients.The average age was 36.6 years (range 21-45 years).

- Inclusion criteria: females and males ages between 21-45 years
- Exclusion criteria: cervical spondylosis with or without radiating pain,hypertension,diabetes mellitus ,Carpel tunel syndrome,first CMC joint arthritis,Superficial radial neuritis fracture of upper extremity or any other chronic condition like rheumatoid arthritiss

An informal consent for participation in the study was taken.The study was approved by the institutional ethical committee.

Level of study:

Prospective comparative study [therapeutic];
A study in which patient group are separated non randomaly by exposure or treatment with exposure occurring after the initiation of study.

The patients included in the study were randomly divided in two groups,one group (n=15) received ultrasound therapy and the other group(n=15) received low level laser therapy.

The clinical diagnosis was done by the orthopedician.Application of therapy was done by the physiotherapist.Finkelstein's test which involves grasping the patients's thumb and quickly moving the hand ulnarward was performed.Tenderness elicited over the tip of the radial styloid process was taken as a positive test.

Tenderness or pressure over the radial styloid was graded by Ritchie's tenderness scale[25].-The grades were grade-1 -tolerable pain,grade-2- patient winces on pressure and grade-3-patient winces and withdraws hand.

Grip strength[24] was measured by a standard mercury sphygmomanometer. The elbow and arm were supported on a table and the elbow flexed to 90^0.The cuff was then pressed in the cylindrical grasp.The elevation of the mercury column was recorded 3 times.The average of three readings was taken.

An endolaser 476 with a pencil probe (wave length 830nm,power 30-40 mw,beam diameter 40mm at 10mm from the probe, angle of divergence 2.5^0. Exposure time for 2 min. Energy in joules $37/cm^2$ was used for treatment. The low level laser therapy was applied twice per session. Once the probe was held stationary in contact with skin at radial styloid and second time along tendon sheath. The laser probe and the part to be treated were cleaned with 70% alcohol to remove any oil and dirt from the skin surface for better penetration. Protective goggles were worn by patients and therapist. 3Mhz ultrasound generation was used for ultrasound therapy.Anaquasonic gel was used as a coupling medium. For ultrasound therapy, the pulsed mode to expose the area over radial styloid by 5ms and 5ms off. A space average intensity of $0.8w/cm^2$(depth of lesion 0.5 cm approximately)for a period of 3 min was delivered.

The following outcome measure were used namely Finkelstein's test,tenderness over radial styloid (Ritchie's tenderness scale),grip strength ,pain as assessed by visual analogue scale(VAS).

All the outcome measure were done before commencement and after the end of therapy.

Clinically,the improvement was assessed subjectively by the patient, using VAS(26) (0=no pain,10=severe pain).

The clinical tests were repeated before raducing the dosage of laser/ultrasound therapy if improvement was observed. The patients were given ultrasound therapy /low level laser therapy for 21 days.

Testing of optical output was performed regularly before and the end of treatment.

Precautions regarding avoidance of forceful movements of the thumb were explained to the patients.

DISCUSSION:

30 cases of De Quervains tenosynovitis were treated by ultrasound and low level laser therapy. The purpose of the our study was to compare the effectiveness between ultrasound and low level laser therapy in De quervains tenosynovitis.

De quervains tenosynovitis is more commonly seen in perimenopausal women and women of childbearing age and hence the age range taken that is 20–45 years. Women are seen to have a significantly higher rate of occurance of De quervains tenosynovitis as compared to men.There were only 2 male patients in this study.

Faithful and Lamb observed that the nondominant hand is generally more affected. The greater involvement of the nondominant extremity in our patients, who do all kinds of manual work associates well with the findings of Gousheh *et al*..They found that occupation has no relationship to occurrence of De quervains tenosynovitis on the dominant side.

Mardiman S, Wessel J, Fisher B observed that ultrasound therapy and Low level laser therapy cause a decrease in pain,decrease in Ritchie's tenderness scale and VAS scale improvement in all the patients and was found to be statistically significant.

Finkelstein's test is the classic diagnostic test for De quervain's disease. Finkelstein hypothesized that entrapment of the extensor pollicis brevis (EPB) and abductor pollicis longus (APL) tendons into the first extensor compartment was responsible for the pain over the radial styloid.we had also used this test as a clinical parameter for diagnosing the De quervains' tenosynovitis.

Correa F, Lopes Martins RA observed that ultrasonic therapy and Low level laser therapy both produce similar bio stimulatory effects, both modalities reduce inflammation and promote healing and should be useful in the management of tenosynovitis.

A study conducted by Saunders[18] compares ultrasound therapy versus Low level laser therapy in the treatment of supraspinatus tendinosis.Measurements were taken before and after treatment for muscle weakness secondary to pain (Pain analog scale),disability, SSand tenderness. The treatments were given for 3 weeks. They found that Low level laser therapy is the treatment of choice in supraspinatus tendinosis. Ultrasound also improved symptoms but was not significantly different from the controls who received advice only.

In our study, both Low level laser therapy and ultrasound therapy. showed an improvement in De quervains tenosynovitis. The ultrasound therapy group showed marginally better improvement as compared to Low level laser therapy.

RESULTS:

The difference in the age ($P = 0.521$), in low level laser and ultrasound therapy groups were not statistically significant implying that the

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groups were comparable as regards to [Table 1].

Of the thirty patients taken up for the study, the left side was involved in 17 (59%), and the right side (dominant extremity) was involved only in 13 patients. Bilateral involvement was seen in two patients. However only the more affected extremity was included in the study.

Finkelstein's test conducted before and after treatment was not statistically significant in both the groups, that is, low level laser therapy and ultrasound.

Grip strength was found significantly improved in the ultrasound therapy ($P = 0.006$) and low level laser therapy group ($P = 0.002$) (as per the Bonferroni criteria,the threshold critical P value is considered as <0.013 since there are four comparisons in total). Grip strength for both the groups, before and after the treatment values were significantly different from each other within the groups, but not between the groups.

Visual analog scale when compared between groups, the change was not found statistically significant though within groups it was found significant Looking at the mean values, the grip strength and VAS showed better improvement in the uktrasound therapy group as compared to the low level laser therapy group. The results imply that ultrasound therapy is slightly more effective than low level laser therapy.

Demographic data	Ultrasound therapy(n=15)	Low level laser therapy (n=15)		
Extremity involved(right /left)	8/7	5/10		
Sex(female/male)	15/0	13/2		
	Mean SD	Mean SD	P(Mann-whitney U-test)	Significance
Age	34.4 6.20	36.4 7.5	0.521	Not significant

Table 2: Grip strength

Grip strength	Ultrasound therapy (n=15)		Low level laser therapy(n=15)		P(Mann-whitney U-test)	Significance
	Mean	SD	Mean	SD		
Before treatment	116.60	59.58	111.15	42.40	0.830	Not significant
After treatment	152.32	69.78	132.40	49.45	0.561	Not significant
P(sign-test)	0.006		0.002			
Significance	Significant		Significant			

Table 3: VAS for pain

VAS Scale	Ultrasound therapy(n=15)		Low level laser therapy (n=15)		P(Mann-whitney U-test)	Significance
	Mean	SD	Mean	SD		
Before treatment	9.10	1.35	8.75	1.55	0.560	Not significant
After treatment	4.41	3.00	4.20	3.44	0.709	Not significant
P(sign-test)	0.001		0.0015			
Significance	Significant		Significant			

Conflict of interest : nil
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REFRENCES:

1. Ahuja NK, Chung KC. Fritz de Quervain, MD (1868-1940): Stenosing tendovaginitis at the radial stylosid process. J Hand Surg Am 2004;29:1164-70.
2. Sharma R, Thukral A, Kumar S, Bhargava SK. Effect of low level lasers in de Quervains tenosynovitis. Prospective study with ultrasonographic assessment. Physiotherapy 2002;88:730-4.
3. Bjordal JM, Couppé C, Chow RT, Tunér J, Ljunggren EA. A systematic review of low level laser therapy with location-specific doses for pain from chronic joint disorders. Aust J Physiother 2003;49:107-16.
4. Byl NN, McKenzie A, Wong T, West J, Hunt TK. Incisional wound healing: A controlled study of low and high dose ultrasound. J Orthop Sports Phys Ther 1993;18:619-28.
5. Haker E, Lundeberg T. Pulsed ultrasound treatment in lateral epicondylalgia. Scand J Rehabil Med 1991;23:115-8.
6. Gan BS, Huys S, Sherebrin MH, Scilley CG. The effects of ultrasound treatment on flexor tendon healing in the chicken limb. J Hand Surg Br 1995;20:809-14.
7. Pienimäki TT, Tarvainen TK, Siira PT, Vanharanta H. Progressive strengthening and stretching exercises and ultrasound for chronic lateral epicondylitis. Physiotherapy 1996;82:522-30.
8. Kurtais Gürsel Y, Ulus Y, Bilgiç A, Dinçer G, van der Heijden GJ. Adding ultrasound in the management of soft tissue disorders of the shoulder: A randomized placebo-controlled trial. Phys Ther 2004;84:336-43.
9. Gam AN, Johannsen F. Ultrasound therapy in musculoskeletal disorders: A meta-analysis. Pain 1995;63:85-91.
10. van der Windt DA, van der Heijden GJ, van den Berg SG,ter Riet G, de Winter AF, Bouter LM. Ultrasound therapy for musculoskeletal disorders: A systematic review. Pain 1999;81:257-71.
11. Robertson VJ, Baker KG. A review of therapeutic ultrasound: Effectiveness studies. Phys Ther 2001;81:1339-50.
12. Baker KG, Robertson VJ, Duck FA. A review of therapeutic ultrasound: Biophysical effects. Phys Ther 2001;81:1351-8.
13. Baxter GD. Low intensity laser therapy. In: Kitchen S, Bazin S, editors. Electrotherapy: Evidence Based Practice. 11th ed. London: Churchill Livingstone; 2002. p. 171-90.
14. Basford JR. Low intensity laser therapy: Still not an established clinical tool. Lasers Surg Med 1995;16:331-42.
15. Beckerman H, de Bie RA, Bouter LM, De Cuyper HJ, Oostendorp RA. The efficacy of laser therapy for musculoskeletal and skin disorders: A criteria-based meta-analysis of randomized clinical trials. Phys Ther 1992;72:483-91.
16. De Bie R, Verhagen A, Lenssen T, de Vet R, Van den Wildenberg F. Oral presentation: Efficacy of 904 nm laser therapy in musculoskeletal disorder: A systematic review. In:The Cochrane Library. Chichester: John Wiley and sons; 1996.
17. Tunér J, Hode L. It's all in the parameters: A critical analysis of some well-known negative studies on low-level laser therapy. J Clin Laser Med Surg 1998;16:245-8.
18. Saunders L. Laser versus ultrasound in the treatment of supraspinatus tendinosis. Physiotherapy 2003;89:365-73.
19. Aversi-Ferreira, Tales Alexandre; Maior, Rafael Souto; Carneiro-e-Silva, Frederico O.; Aversi-Ferreira, Roqueline A. G. M. F.; Tavares, Maria Clotilde; Nishijo, Hisao; Tomaz, Carlos (2011). "Comparative Anatomical Analyses of the Forearm Muscles of Cebuslibidinosus (Rylands et al. 2000): Manipulatory Behavior and Tool Use". PLoS ONE 6 (7/e22165).doi:10.1371/journal.pone.0022165. PMC 3137621. PMID 21789230.
20. Bravo, Elena; Barco, Raul; Bullón, Adrian (May 2010). "Anatomic Study of the Abductor PollicisLongus: A Source for Grafting Material of the Hand". ClinOrthopRelat Res. 468 (5): 1305–1309. doi:10.1007/s11999-009-1059-4. PMC 2853646. PMID 19760470.
21. Hazani, Ron; Engineer, Nitin J.; Cooney, Damon; Wilhelmi, Bradon J. (2008). "Anatomic Landmarks for the First Dorsal Compartment". Eplasty 8 (e53): e53. PMC 2586286.PMID 19092992.
22. Platzer, Werner (2004). Color Atlas of Human Anatomy, Vol. 1: Locomotor System (5th ed.). Thieme. ISBN 3-13-533305-1.
23. Kutsumi K, Amadio PC, Zhao C, Zobitz ME, Tanaka T, An KN. Finkelstein's test: A biomechanical analysis. J Hand Surg Am 2005;30:130-5.
24. Quin CE, Mason RM, Knowelden J. Clinical assessment of rapidly acting agents in rheumatoid arthritis. Br Med J 1950;2:810-3.
25. Ritchie DM, Boyle JA, McInnes JM, Jasani MK, Dalakos TG, Grieveson P, et al. Clinical studies with an articular index for the assessment of joint tenderness in patients with rheumatoid arthritis. Q J Med 1968;37:393-406.
26. Price DD, Bush FM, Long S, Harkins SW. A comparison of pain measurement characteristics of mechanical visual analogue and simple numerical rating scales. Pain 1994;56:217-26.
27. Jump up to:a b c d O'Neill, Carina J (2008). "de Quervain Tenosynovitis". In Frontera, Walter R; Siver, Julie K; Rizzo, Thomas D. Essentials of Physical Medicine and Rehabilitation: Musculoskeletal Disorders, Pain, and Rehabilitation. Elsevier Health Sciences. pp. 129–132. ISBN 978-1-4160-4007-1. Retrieved 9 August 2013.
28. Jump up^ Stahl, Stéphane; Vida, Daniel; Meisner, Christoph; Lotter, Oliver; Rothenberger, Jens; Schaller, Hans-Eberhard; Stahl, Adelana Santos (December 2013). "Systematic Review and Meta-Analysis on the Work-Related Cause of de Quervain Tenosynovitis". Plastic and Reconstructive Surgery 132 (6): 1479–1491. doi:10.1097/01.prs.0000434409.32594.1b.PMID 24005369.
29. Jump up^ "Risk factors for de Quervain's disease in a French working population". Scand J Work Environ Health 37 (5): 394–401. Sep 2011. doi:10.5271/sjweh.3160.
30. Jump up^ van Tulder M, Malmivaara A, Koes B (May 2007). "Repetitive strain injury" (PDF).Lancet 369 (9575): 1815–22. doi:10.1016/S0140-6736(07)60820-4. PMID 17531890.