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COMPARISION OF SHOCKWAVE THERAPY AND ULTRASOUND ON PAIN AND FUNCTION IN DQ TENDINOPATHY PATIENTS

Physiotherapy

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KEYWORDS

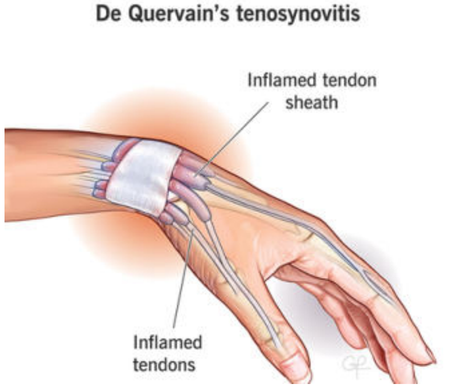
INTRODUCTION

Chronic tendinopathy is usually caused by lifestyle factors. Micro-damages that occur in professional work or daily life, as well as pre-existing pathologies of the shoulder cuff, such as subacromial impingement syndrome, decentralization of the head of the humerus, or disruption of the scapulohumeral rhythm, left untreated over time, can lead to the development of inflammation [1,3]. Age is also a significant risk factor. The frequency of rotator cuff inflammation in patients aged 20 ranges from 5% to 10%, while in those aged 80, it exceeds 60%. Additional risk factors include obesity, the use of certain medications, and tobacco smoking [4]. Diagnosis is primarily based on clinical tests of the shoulder joint and imaging techniques such as X-rays, ultrasound, and magnetic resonance imaging (MRI)

De Quervain's disease (DQD) is stenosing tenosynovitis involving Abductor pollicis longus (APL) and Extensor pollicis brevis (EPB) in first extensor compartment of wrist . These muscles cross styloid process on its outer part and merge on the base of thumb. The first extensor compartment is formed by radius and dorsal carpal ligament. This disorder is caused by resisted gliding of APL and EPB in fibroosseous canal of the wrist. It can be regarded as tendinosis rather than tendonitis as the pathophysiology of the disease involves degenerative thickening of extensor retinaculum with narrowing of tendons of APL and EPB in extreme cases. DQD was described for the first time by Fitz de Quervain in 1895. Prevalence of this disorder has been reported to range from 0.7% to 36% in working population with gender-based incidence of 2.8/1000 in active women whereas 0.6/1000 in active men . Moreover, about 40% of patients with DQD are referred for physiotherapy.

DQD is caused by work-related postures and activities involving overuse, forceful manual exertion such as forceful grasping with ulnar deviation, sustained awkward postures, increased repetitive activities involving use of thumb, and combination of them. The disorder has also been linked to several conditions and occupations such as pregnancy and lactation, dentists, musicians, video gaming, and athletic pursuits. DQD presents with swelling and pain near base of the thumb often noticed while grasping, pinching and other thumb movements as well as with radial deviation of wrist. The pain may develop gradually with varying intensity and is localized above radial styloid process however, it may radiate to dorsal aspect of thumb and radial aspect of forearm. Patients may also present with tenderness over first dorsal compartment . Moreover, the condition may last from months to years. Finkelstein test is classical and widely accepted test for DQD. It is considered positive if pain is reproduced and a tender nodule is felt over radial styloid however, the test lacks specificity and may be positive in other disorders of hand and wrist . The diagnosis is further supported and confirmed by presence of pain for four days a week, decreased thumb and pinch strength on affected side, decreased thumb ROM on bilaterally with more pronounced decline on affected side and positive EPB entrapment test.

Conservative treatment options are advocated after acute phase and they include but are not limited to ultrasound, galvanization, iontophoresis, rest and early immobilization with thumb spica splint, transverse friction massage, anti-inflammatory medications including corticosteroid injections. However, active treatment options can be AROM exercises, tendon gliding, strengthening, and eccentric training Along with these well-known therapies for musculoskeletal disorders, new treatment methods are suggested and evaluated every day, one of which is extracorporeal shockwave therapy. Primary studies on the efficacy of this modality in fracture healing utilized animal models.



Extracorporeal shockwave therapy (ESWT) began with an incidental observation of osteoblastic response pattern during animal studies in the mid-1980 that generated an interest in the application of ESWT to musculoskeletal disorders. In the past 10 to 15 years, shockwave therapy had emerged as the leading choice in the treatment of many orthopedic disorders including proximal plantar fasciitis of the heel [1-6], lateral epicondylitis of the elbow [7-10], calcific tendinitis of the shoulder [11,12] and. nonunion of long bone fracture [13-15]. More recently, the use of ESWT had expanded to the treatment of patellar tendinopathy (jumper's knee) and Achilles tendinopathy [16-19], and avascular necrosis of the femoral head [20-22].

ESWT has gained significant acceptance from Europe (Germany, Austria, Italy and others) to South America (Brazil, Columbia, Argentina and others), Asia (Korea, Malaysia, Taiwan and others) and North America (Canada and USA), and this had led to the change of European Society for Musculoskeletal Shockwave Therapy to International Society for Musculoskeletal Shockwave Therapy (ISMST) in 2000. In USA, FDA (Food and Drug Administration) first approved the specific shockwave device, OssaTron (High Medical Technology, Lengwil, Switzerland, now Sanuwave/Alpharetta, GA) for the treatment of proximal plantar fasciitis in 2000 and lateral epicondylitis of the elbow in 2003. FDA also approved Epos (Dornier Medical System, Kennesaw, GA) for the treatment of plantar fasciitis and Sonocur (Siemens Medical Systems, Iselin, NJ) for the treatment of lateral epicondylitis of the elbow in 2002, Orthospec (Medispec, Germantown, MD) and Orbasone (Orthometrix, White Plains, NY) for the treatment of plantar fasciitis in 2005. In the meantime, many off-label uses of ESWT were also studied including calcific tendinitis of the shoulder, patellar tendinopathy, Achilles tendinopathy, and non-union of long bone fracture, avascular necrosis of the femoral head and others.

The vast majority of the published papers including randomized control trials and cohort studies showed positive effects and evidence base medicine in favor of ESWT [1-6,8-12,23]. However, a few studies reported that ESWT is ineffective or less effective with the results comparable to the placebo effect [7,24,25], and this has stirred up the debate and controversy. This article reviews the current status of ESWT in the treatment of musculoskeletal disorders.

Low-intensity pulsed ultrasound (LIPUS). LIPUS refers to pulsed-wave ultrasound with a spatial-averaged, temporal-averaged intensity (ISATA) equal to or lower than 100 mW/cm2 . Such ultrasound has predominantly been used during bone healing where it has been shown by three well-designed clinical studies to reduce fracture healing times by 30–38% . There is growing evidence from in vitro and animal-based models that LIPUS may also have beneficial effects on non-mineralized tissues, such as ligaments and tendons. For instance, using these models LIPUS has been found to accelerate knee medial collateral ligament healing.augment tendon repair and modulate tendon cell activity.

Study Design And Setting :-

- **Population:**- Patient diagnosed with DQ tendinopathy
- **Study Design**: Comparative Study
- **Study Population**: Patient diagnosed with DQ tendinopathy
- **Sample Size**: 40
- **Study Duration**: 4 Weeks
- **Study Setting**: This study was conducted at Arihant Hospital, Gandhinagar.
- **Sampling Technique** : Simple random sampling Bhoyan Rathod

Selection Criteria

Inclusion criteria:

- Patient diagnosed with DQ tendinopathy
- **Gender :-** Male and Female
- **Age :-** > 18 Years
- Thumb pain since last 3 months
- Subject willing to participate

- **Exclusion Criteria:**
- Post surgical pain
- Recent trauma
- Recent fracture
- Patients with neurological problems
- Patients with psychological problems

Outcome Measures :

Disabilities of the Arm, Shoulder and Hand (DASH) Reliability = (0.70 to 0.96) The **Disabilities of the Arm, Shoulder and Hand (DASH)** questionnaire is a 30-item questionnaire that looks at the ability of a patient to perform certain upper extremity activities. This questionnaire is a self-report questionnaire that patients can rate difficulty and interference with daily life on a 5 point Likert scale. The DASH has been translated in many different languages and has demonstrated to be a valid and reliable questionnaire for a variety of upper extremity disorders.

Visual Analogue Scale (VAS): A Visual Analogue Scale (VAS) is one of the pain rating scales used for the first time in 1921 by Hayes and Patterson[1]. It is often used in epidemiologic and clinical research to measure the intensity or frequency of various symptoms. For example, the amount of pain that a patient feels ranges across a continuum from none to an extreme amount of pain. From the patient's perspective, this spectrum appears continuous; their pain does not take discrete jumps, as a categorization of none, mild, moderate and severe would suggest. It was to capture this idea of an underlying continuum that the VAS was devise

Methodology

This was an experimental study design . after taking informed consent subject wereassessed for inclusion & exclusion criteria & after selection they were randomly collocated into 2 groups by simple random samples.

- **Group A**: Hot Pack+Shock Wave therapy.
- **Group B**: Hot Pack+UltraSound

Group A: **Hot Pack+Shock Wave therapy.**

The intervention included heat therapy for 15 minutes followed by the shock wave therapy, each patient first sat on a chair, and the hand with the disorder was placed on a surface. After rubbing the gel, a conductive medium to guide the waves, the probe of the device was placed on the spot to transmit the waves to the site. There were three therapeutic sessions with a week interval for each patient. The treatment protocol utilized in the intervention group was 1000 impulses with 2 bar pressure at a frequency of 15 Hz on the radial head and focused on the tissue surrounding the maximal pain point.

Group B: Hot Pack+UltraSound

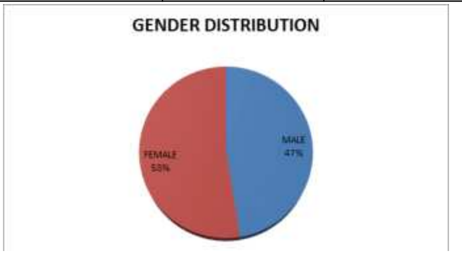
The intervention included heat therapy for 15 minutes followed by ultrasound therpay at Frequency 1 MHz Mode Continuous Effective radiation area (ERA) 7 cm2 Spatial average – Temporal peak (SATP) 1,2 W/cm2 Time (t) 8 min Energy (E) 4032 J / per application Beam non-uniformity ratio (BNR) 3:1 Application speed Slow (± 4 cm/s)

RESULT

The purpose of this comparison analysis was to see how successful the Shock wave therapy and Ultrasound on the pain and functional disability in DQ Tendinopathy patients. There were a total of 40 subjects in this study, with 20 subjects in each group meeting the inclusion criteria.

Table No 1. Gender Distribution

	Group A	Group B
Number	20	20
Mean Age	38.10	36.30
Standard Deviation	12.01	11.06



Graph 1: Graph Of Gender Distribution

Table No 2. Intra Group Comparison Of VAS Group A

VAS Group A	Pre	Post
Mean	5.80	4.50
Standard Deviation	1.15	1.05
p-Value	< 0.01	

Table No 3. Intra Group Comparison Of VAS Group B

NPRS Group B	Pre	Post
Mean	5.6	3.25
Standard Deviation	0.99	1.06
p-Value	<0.01	

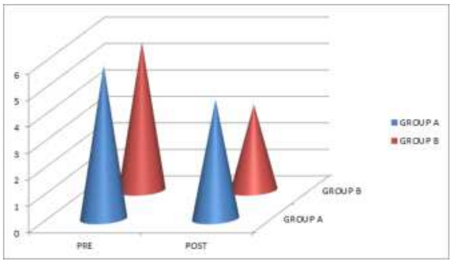
Table No 4: Inter Group Comparision Of VAS

		MEAN	STD.DEVIATION	MAN WHITNEY	P-VALUE
NPRS	GROUP A	4.50	1.05	84.00	0.01
	GROUP B	3.25	1.06		

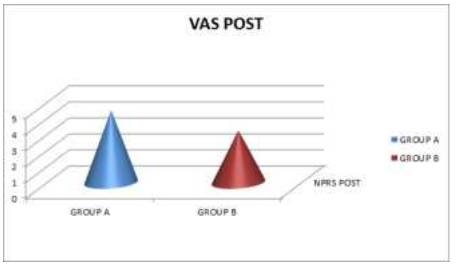
Interpretation Of Results:

1) **Inter Group Analysis:** The above table shows the inter group comparison of pain score in Group A & B. This comparison is done through non parametric **Man-whiteny U test**. At baseline the p value is >0.05. It shows that there is no significant difference between the pre treatment score of NPRS. The p value comparing at post treatment score of Group A and B is 0.01 which is suggestive of significant improvement between groups.
2) **Intra group Analysis**: The above table also shows the intra group

comparison of pain Score in group A and B. This comparison is done through **Wilcoxan signed rank test**. The intra group comparison of pain score shows significant difference ($p<0.05$) in all groups (Group A: P=<0.01; Group B: P=<0.01). It shows that treatment of group A and B is effective. So null hypothesis H01, H02, is rejected and alternate hypothesis H11, H12, is accepted.



Graph 2 : Mean Value of VAS



Graph 3 : Mean Value of POST VAS

Table 5: Intra Group Comparison Of Dash Group A

DASH Group A	Pre	Post
Mean	20.00	16.75
Standard Deviation	1.46	1.65
p-Value	<0.01	

Table 6: Intra Group Comparison Of Dash Group B

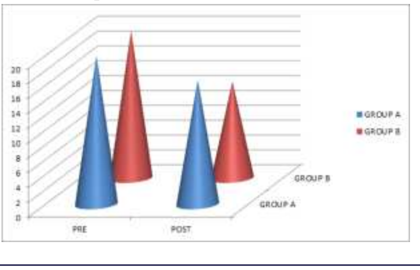
DASH Group B	Pre	Post
Mean	19.85	13.00
Standard Deviation	1.46	1.74
p-Value	<0.01	

Table No 7: Inter Group Comparision Of Dash

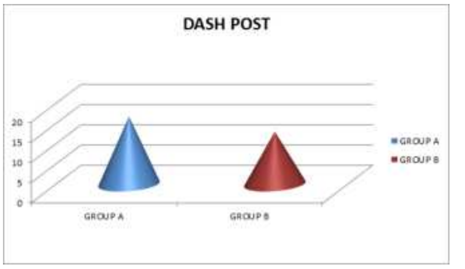
		MEAN	STD.DEVIATION	MAN WHITNEY	P-VALUE
ODI	GROUP A	16.75	1.65	132	0.04
	GROUP B	13.00	1.74		

Interpretation of Results:

1) **Inter Group Analysis:** The above table shows the inter group comparison of functional disability in Group A & B. This comparison is done through non parametric **Man-whiteny U test**. At baseline the p value is >0.05. It shows that there is no significant difference between the pre treatment score of DASH. The p value comparing at post treatment score of Group A and B is 0.04 which is suggestive of significant improvement between groups.
2) **Intra group Analysis**: The above table also shows the intra group comparison of pain Score in group A and B. This comparison is done through **Wilcoxan signed rank test**.The intra group comparison of functional disability score shows significant difference ($p<0.05$) in all groups (Group A: P=<0.01; Group B: P=<0.01). It shows that treatment of group A and B is effective. So null hypothesis H01, H02, is rejected and alternate hypothesis H11, H12, is accepted.



Graph 4 : Mean value of DASH



Graph 5 : Mean Value of POST DASH

DISCUSSION

The outcomes of the present study indicate that shockwave therapy achieved significant improvements in pain, the functionality after the completion of the therapeutic intervention and the 4-week follow-up in patients with DQ tendinopathy. Accordingly, significant improvements in pain, functionality were also observed when patients were treated with therapeutic ultrasound, but these findings were less pronounced compared to ESWT. Thus, the present study clearly indicated that ESWT is more effective than therapeutic ultrasound in pain alleviation and improvements in both functional ability for DQ tendinopathy.

In a randomized control trial, Rompe et al. treated 50 patients with chronic recalcitrant insertional Achilles tendinopathy comparing the effect of eccentric exercise versus low-energy radial ESWT. Three sessions of low energy ESWT using 2.000 shocks once a week (0.1 mJ/mm2 , 8 Hz) were administered. Low energy ESWT therapy was found superior to eccentric loading at four-month follow-up, and these results remained stable at the one-year follow-up. Similarly, Rompe et al. also showed an improvement in the VISA-A scale, which assesses pain, function and activity of Achilles tendon both after the completion of the therapy and the 4-month follow-up and these outcomes were better when ESWT was used together with eccentric loading than the eccentric loading alone. Similarly, Mansur et al. treated patients suffering from insertional tendinopathy with radial shockwaves (2.000 to 3000 pulses, 7 to 10 Hz frequency and 1.5 to 2.5 bar of intensity) together with an eccentric exercise protocol where they found significant improvements on VAS, AOFAS and VISA-A scores after the 24-week follow up. Vulpiani et al. also presented a significant improvement on pain ($p< 0.001$) and subjective clinical evaluation two months after the end of treatment where the pain decreased further, and this improvement continued until 12 months post-treatment.[16-19]

Furthermore, Pavone et al. also treated 40 patients suffering from chronic insertional Achilles tendinopathy with 4 sessions of low-energy ESWT at a 2-week interval by using 800 shocks per session (4 Hz, 14 KeV) together with eccentric exercises. At the 12-month follow-up, 65% of the patients got back to normal activities without any pain complains, 27.5% of the patients also got back to normal activities despite the pain experienced (VAS score 2-4), and only 7.5% of the patients still complained of pain with a VAS score higher than 4. Thus, therapy with low-energy ESWT together with eccentric exercises is effective in both reducing pain as evaluated by VAS score and function recovery as assessed by AOFAS score.[20-21]

Furia investigated the clinical outcomes of a single dose of high-energy ESWT (3,000 shocks, 0,21 mJ/mm2 , total energy flux density 604 mJ/mm2) for the treatment of chronic insertional Achilles tendinopathy. A significant reduction was observed in pain as assessed by Visual Analogue Scale compared to control. Twelve months post-treatment, the number of patients with improved Roles and Maudsley scores was statistically higher in the ESWT group compared to the control group.[15-16]

Fatima et al. conducted an analysis of the effectiveness of ESWT in combination with routine physiotherapy; however, there is a lack of studies comparing it with other physiotherapeutic methods. In the study by Castillo-Gonzalez et al., the effectiveness of treatment between two different interventions was assessed, but they significantly differ in methodology.[16-17]

US may enhance the results obtained with the rehabilitation program proposed in this study, as well as stimulate some repair responses in individuals undergoing treatment for patellar tendinopathy. The current literature shows increases in patellar tendon temperature after the application of US , an effect that could raise the pain threshold and improve collagen extensibility . These effects could favor the viability of the proposed exercises, optimizing the results. The add-on (chronic) effect promoted by high-energy US could also influence the tissue structure of the tendons, making them more resistant and better able to absorb and dissipate energy, thus improving function in individuals with tendinopathy.[7]

Although there is evidence in the literature showing a lack of clinical benefits from US in the treatment of tendinopathy , there is a lack of research with good methodological design testing the use of highenergy US combined with rehabilitation programs for this clinical condition. In addition, the lack of positive US results for the treatment of the most diverse conditions has been related to dosimetric errors. In this context, Alexander et al. demonstrated that doses of 2250 J (J) of energy (per treatment session) promoted improvement in pain in individuals with painful shoulders, while doses of 750 J or less rarely generated positive results. The treatment of elbow tendinopathy and calcaneal tendinopathy with a TUS dose of 18,250 J promoted significant improvement in pain and function . Similarly, the application of doses of 1290 J, 2580 J, and 11,250 J was effective for the treatment of calcific tendonitis of the shoulder, resulting in lower pain rates, improved motor function, and regression of pathological calcification.[24-25]

Due to these characteristics, the US dose will be combined with a rehabilitation program based on current and scientifically developed clinical guidelines. The dosage for the application of US is one of the most difficult factors to translate from animal studies to the clinical setting. The results from the animal studies open the way for the investigation of the effects of TUS in humans; however, the dosimetric factor is complex and there is no direct correlation between animals and humans. Therefore, the energy parameter (J) is being used as a facilitator to the replication of these parameters.

CONCLUSION

Shock Wave Therapy is an effective tool in the treatment of DQ tendinopathy in both short-term observations. However, attention should be paid to the need for conducting a greater number of reliable randomized clinical trials to establish clear procedural parameters.

Limitations

- Study was conducte at small sample size.
- Long term effects of SWT and Ultrasound were not observed

Future Recomendentions

Further studies are needed to Evaluate Long term effects of SWT and Ultrasound on DQ tendinopathy With larger sample Size.

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