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Research Article

Comparison of Radial Shock Wave and Ultrasound Therapy in Lateral Epicondylitis

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Abstract

Background and Purpose: Lateral epicondylitis is a musculoskeletal disorder characterized by pain over lateral epicondyle that is aggravated by gripping activities. Radial shockwave therapy (RSWT) and ultrasound therapy (UST) are two effective modalities that are used for reducing pain and improving function but their superiority over one another is still controversial.

Methods: 30 subjects were included and randomly assigned into two groups. Group 1 (n = 15) received 4-sessions of Radial shock-wave therapy once a week for four week. Group 2 (n = 15) were treated with 12 sessions of Ultrasound therapy thrice a week for four weeks. Supervised exercise program were given to both the groups.

Outcome Measures: Pain intensity was measured using a Numerical pain rating scale (NPRS), Tenderness was assessed by pain pressure threshold (PPT), Pain free grip strength was measured and functional status was evaluated by patient rated tennis elbow evaluation (PRTEE) questionnaire.

Result: Result showed improvement in both groups for all the outcome parameters and statistically significant (P< 0.05). In between group comparison all the parameters showed statistically insignificant changes except PPT which is significantly decreased in group 1.

Conclusion: This clinical trial demonstrated that RSWT and UST are equally effective modality for the management of chronic lateral epicondylitis; however RSWT has shown more improvement in PPT.

Keywords: *Radial Shock Wave Therapy (RSWT); Ultrasound Therapy (UST); Lateral Epicondylitis (LE); Dynamometer*

Abbreviations

LE: Lateral Epicondylitis; RSWT: Radial Shock Wave Therapy; UST: Ultrasound Therapy; RM: Repetition Maximum; ECRL: Extensor Carpi Radialis Longus; EDC: Extensor Digitorum Communis; ECRB: Extensor Carpi Radialis Brevis; ECU: Extensor Carpi Ulnaris; NPRS: Numerical Pain Rating Scale; PPT: Pain Pressure Threshold; PFGS: Pain Free Grip Strength; PRTEE: Patient-Rated Tennis Elbow Evaluation; HHD: Hand-Held Dynamometer

Introduction

Lateral epicondylitis (LE) is a musculoskeletal disorder often encountered by healthcare practitioners, such as physical therapists [1]. The prevalence of lateral epicondylitis in the general population is approximately 1.0 - 1.3% in men and 1.1 - 4.0% in women [2]. Although the term epicondylitis implies that inflammation is present, it is in fact present only in the initial stages of the disease. Musculotendinous structures of extensor carpi radialis brevis (ECRB) is the primary pathological tissue of lateral epicondylitis [3].

The clinical presentation of lateral epicondylitis varies between individuals and possibly over the time course of the disorder. Common clinical features are pain over or near the lateral epicondyle and decrease grip strength. Some subjects with acute lateral epicondylitis may exhibit increased involvement of the pain system, while others, with more recalcitrant conditions, may present with marked local tendon pathology. Pain-free grip force is reduced by an average of 43 - 64% in comparison with the unaffected side [4,5]. It is our contention that healthcare practitioners should seek to identify the relative expression of local pathology, pain and motor system dysfunction in individual subjects, so that treatment strategies may be better matched to the clinical presentation [6].

It has been stated that lateral epicondylitis is a self-limiting condition. Management may be divided into two groups: conservative or operative. Conservative treatment consists of oral non-steroidal anti-inflammatory medication, corticosteroid injection, physiotherapy and brace. Physical therapy interventions include Deep Transverse friction massage, manipulation, movement and activity modification. other physiotherapeutic approach include cryotherapy, phonophoresis, electrical stimulation, ultrasound, iontophoresis, laser therapy and Radial shock wave therapy (RSWT).

Ultrasound, which is a deep heating modality, is effective in reducing pain and increasing range of motion. With its thermal and mechanical effects, it increases local metabolism, blood flow, soft tissue flexibility, regeneration, membrane permeability, and changes nerve conduction [7].

Shock wave therapy is a relatively new mode of treatment. It involves focused single-pressure pulses of microsecond duration. In the 1990s, Shock wave therapy became popular in Germany for certain soft-tissue disorders, including calcifying tendonitis of the rotator cuff, humeral epicondylitis and plantar fasciitis. It is now employed worldwide for the treatment of musculoskeletal complaints [8].

The benefits of Radial shock wave therapy and Ultrasound Therapy are widely described in literature for treatment of lateral epicondylitis but which is more effective is still controversial.

This study is designed to compare the effectiveness of Radial shock wave therapy and ultrasound therapy for the management of patients with chronic lateral epicondylitis.

Methods

After ethical clearance the subjects were assessed and screened for inclusion and exclusion criteria. The eligible subjects were approached with the proposal of the study. Aim and procedure of the study was explained to the subjects and a written informed consent was taken from every subject.

After that demographic data was collected from every subject and baseline data (pre intervention) of pain intensity with the help of numerical pain rating scale (NPRS), pain pressure threshold (PPT) with the help of algometer, pain free grip strength (PFGS) with the help of hand-held dynamometer and patient rated tennis elbow evaluation (PRTEE) questionnaire were collected before the commencement of the treatment procedure. Then the subjects were randomized through a lottery method to group 1 and group 2, each consisting of 15 subjects. Post intervention data of all the outcome parameters (pain intensity, pain pressure threshold, pain free grip strength and patient rated tennis elbow evaluation) were recorded after completion of treatment procedure at the end of 4th week (Figure 1).

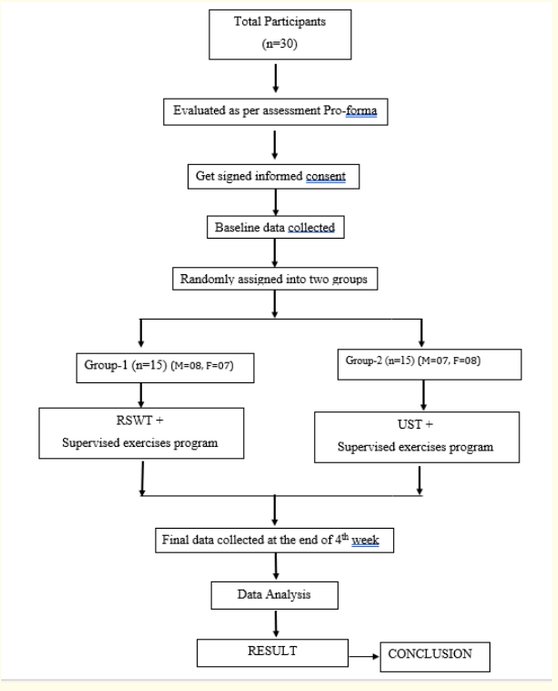

Figure 1: *Flow diagram.*

Intervention

Group 1 received radial shock wave therapy whereas group 2 received ultrasound therapy. Both the group also received supervised exercise program which consisted of static stretching and eccentric strengthening of wrist extensors.

Group 1: Radial shockwave therapy was applied to subjects in sitting position with their elbow 90^0 flexed and shoulder flexed 45^0. All subjects in this group received 4 sessions of treatment over lateral epicondyle for 4-weeks (once in a week), 2000 impulses for each session of RSWT was applied. These 2000 impulses were divided into 500 and 1500 impulses. A pressure of 1.2 bar was given for first 500 impulses and then 1 bar were used for next 1500 impulses [9]. RSWT application was then followed by supervised exercise program [10,11].

Supervised exercise program: Static stretching was performed in the seated position with elbow extension, forearm pronation, and wrist flexion with ulnar deviation. According to the subject pain tolerance stretch force was applied. This stretch position was held for the duration of 30 - 45 seconds and was performed 3 times before and 3 times after the eccentric exercise. There was 30-second rest interval between each stretching exercise [12].

Eccentric strengthening exercise was performed in the seated position with full elbow extension, forearm pronation, and maximum wrist extension. From this position, the subject was asked to slowly lower the wrist into full flexion for a count of 30. Then, using the contra-lateral hand tested wrist was returned to the starting position (i.e. full extension). Subjects were instructed to continue the exercise even if they experience mild discomfort and to stop the exercise if the pain worsens and becomes disabling. Load was increased using free weights based on the subjects 10 RM (Repetition Maximum). Three sets of ten repetitions were performed during each treatment, with a one-minute rest interval between each set [13].

Group 2: Subjects in group 2 (n = 15) had received 12 sessions of US Therapy with frequency of 3 MHz at 0.5 W/cm^2 with a pulse ratio of 1:5 for 3 minutes thrice in a week over four weeks [14] followed by supervised exercise program as described for group 1.

Result

Statistical an,alyses for all subjects in both the groups were done using SPSS version-19. Descriptive analysis was used to calculate Mean and Standard deviation. The between group comparison were performed using "Independent t-test". Within group outcome variables were analyzed using "Paired t-test". The demographic details of age and distribution of gender was homogenous

NPRS, PPT, PFGS and PRTEE within group comparison shows statistically significant result ($p < 0.05$) (Table 1).

Variables	Group	Pre Mean ± SD	Post Mean ± SD	t-test	
				t-value	p-value
NPRS	Group-1	6.33 ± 0.612	1.47 ± .516	36.500	.000
	Group-2	6.20 ± 0.77	1.40 ± .910	16.216	.000
PPT	Group-1	8.8840 ± 2.18	15.26 ± 2.91	-11.248	.000
	Group-2	6.79 ± 3.20	11.55 ± 3.74	-12.332	.000
PFGS	Group-1	39.30 ± 11.20	52.46 ± 10.87	-13.566	.000
	Group-2	31.01 ± 15.88	48.24 ± 17.84	-6.745	.000
PRTEE	Group-1	58.47 ± 6.28	25.00 ± 3.84	21.151	.000
	Group-2	65.20 ± 8.63	27.20 ± 7.23	17.573	.000

Table 1: *Within groups comparison.*

Between group comparison shows statistically significant result for NPRS and PPT (p = 0.067) and (p = 0.005) respectively. Whereas between group comparison for PFGS (p = 0.440) and PRTEE (p = 0.307) was statically insignificant (Table 2).

Variables		Group-1 Mean ± SD	Group-2 Mean ± SD	t-test	
				t-value	p-value
NPRS	Pre-test	6.33 ± 0.617	6.20 ± 0.775	0.521	.133
	Post-test	1.47 ± .516	1.40 ± .910	.247	.067
PPT	Pre-test	8.88 ± 2.18	6.79 ± 3.20	2.085	.046
	Post-test	15.26 ± 2.91	11.55 ± 3.74	3.028	.005
PFGS	Pre-test	39.30 ± 11.20	31.01 ± 15.88	1.652	0.110
	Post-test	52.46 ± 10.87	48.24 ± 17.84	.783	0.440
PRTEE	Pre-test	58.47 ± 6.27	65.20 ± 8.63	-2.442	.021
	Post-test	25.00 ± 3.83	27.20 ± 7.23	-1.041	.307

Table 2: *Between groups comparison.*

Discussion

Results of this study showed that both the groups improved from baseline values for all analyzed parameter i.e. NPRS scores, PPT, PFGS and PRTEE after 4-weeks of intervention and the improvements were statistically significant. However, between groups analysis showed statistically insignificant result for NPRS, PFGS and PRTEE whereas PTT showed statistically significant in favor of group 1.

Reasons behind improvement in NPRS score in both the group are different due to different mechanism of action. Ultrasound wave is typically biphasic and has a peak pressure of 0.5 bar whereas Shockwave pattern is uni-phasic with the peak pressure as high as 500 bar [15].

There are two basic effects of shockwave. The primary effect is the direct mechanical forces that result in the maximal beneficial pulse energy concentrated at the target point where treatment is provided and the secondary effect is the indirect mechanical forces by cavitations which may cause negative effect or damage to the tissues [15-18]. Many researchers investigated the effect of shock wave therapy on pain and have postulated that shock wave provokes an intense stimulation or hyper stimulation which activates the small diameter pain fibers and modulates transmission of pain stimuli through posterior horns; this improves pain tolerance of subjects above their existing pain level [19-22].

The probable reason for reduction in pain intensity in Group 2 may be because the analgesic effect of ultrasound therapy is attributed to thermal and non thermal physical effect in human tissue. Thermal effect of ultrasound includes increased blood flow, reduction in muscle spasm and increased extensibility of collagen. According to Binder (1985) [23] the non-thermal effect of ultrasound, includes cavitations and micro-streaming which may lead to decrease pain perception by slowing the conduction velocity of pain carrying fibers and by provoking pro-inflammatory response.

Thus, the present study supports the finding of above mentioned studies which investigated the effect of Ultrasound Therapy and concluded that UST alleviates pain and tenderness in subjects with lateral epicondylitis. PPT of group-1 showed more improvement as compare to group-2, this may be due to direct mechanical forces of radial Shock wave that results in maximal beneficial pulse energy

concentrated at the target point where treatment is provided and also peak pressure of Shockwave (500 bars) is very high as compare to UST (0.5 bar) [24].

Both the groups showed significant improvement in pain free grip strength from the baseline. Rationale behind improvement in pain free grip strength can be due to decrease in pain intensity in both the groups. Pain-related inhibition or fear of pain was decreased which may be a reason to increase pain free grip strength. This study supports the results of many researchers who concluded that shock wave therapy decreases pain and increases pain free grip strength and hence improved functional status of subjects with lateral epicondylitis [25,26]. It also supports the finding of other studies who investigated the effect of UST in lateral epicondylitis and concluded that UST is effective decrease pain and hence improving pain free-grip strength [27,28].

PRTEE improvement might be due to reduction in pain perception by the subjects and improvement in functional capacity may be due to ease in pain and increased pain free grip strength, consequently lessened suffering in daily activities, pain with specific tasks and difficulty in gripping and lifting actions. In this study it has also been assumed that supervised exercise program has added beneficial effect in improving pain and pain free grip strength in both the groups.

Thus, it can be use as an adjunct along with Radial Shock Wave Therapy or Ultrasound Therapy for reduction in pain and improvement of functional status of subject with chronic lateral epicondylitis. Both radial shockwave therapy and ultrasound therapy are well accepted and recognized methods for reduction in pain and improvement of functional status in subjects with chronic lateral epicondylitis. Hence physiotherapists treating subjects with chronic lateral epicondylitis may choose any one therapy. However sufficient experience and expertise is necessary.

Conclusion

This study demonstrated that both RSWT and Ultrasound Therapy are equally valuable and can induce a significant reduction in pain intensity and improve pain free grip strength with function in subjects with chronic Lateral Epicondylitis.

It is, therefore, concluded that there is no significant difference between Radial Shock wave therapy and Ultrasound therapy for the treatment of patients with chronic Lateral Epicondylitis.

Conflict of Interest

No conflict of interest.

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