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Effect of Extra Corporeal Shock Wave Therapy on Lateral Epicondylitis

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Abstract **Original Research Article**

Background: Lateral epicondylitis, commonly known as tennis elbow, is a painful condition characterized by localized tenderness over the lateral epicondyle, often associated with repetitive wrist extension activities. Various conservative treatments exist, but none have shown consistent efficacy. This study aimed to evaluate the short-term effectiveness of extracorporeal shockwave therapy (ESWT) in patients with lateral epicondylitis. ***Methods:*** This quasi-experimental study was conducted at the Department of Physical Medicine & Rehabilitation, Dhaka Medical College Hospital, from July to December 2019. A total of 45 patients aged 18–69 years with clinically diagnosed lateral epicondylitis were included using purposive sampling. All patients received ESWT once weekly for four weeks. Outcome measures included handgrip strength and pain severity using the Visual Analogue Scale (VAS) at rest, with compression, and during activities of daily living (ADL). Assessments were done at baseline, after 2 weeks, and after 4 weeks of treatment. ***Results:*** The mean age of participants was 40.29 ± 11.73 years, with a slight male predominance (53.3%). A significant improvement was observed in handgrip strength from 38.98 ± 10.54 Kg at baseline to 45.58 ± 9.66 Kg at 4 weeks ($p<0.05$). Resting VAS, VAS with compression, and VAS during ADL also showed statistically significant reductions over the follow-up period. ***Conclusion:*** ESWT demonstrated significant short-term benefits in improving pain and functional outcomes in lateral epicondylitis and can be considered a promising alternative to conventional therapies. However, further multicenter randomized controlled trials are recommended for validation.

Keywords: Lateral epicondylitis, tennis elbow, extracorporeal shockwave therapy, ESWT, handgrip strength, Visual Analogue Scale.

INTRODUCTION

Lateral humeral epicondylitis, commonly referred to as tennis elbow, is an overuse injury primarily affecting the proximal insertion of the extensor muscles of the forearm, particularly the extensor carpi radialis brevis (ECRB), following minor and often unrecognized trauma (microtrauma) [1]. This condition is prevalent, with an estimated annual incidence of 1% to 3% among adults [2]. In Bangladesh, a population-based study on rheumatic diseases found musculoskeletal complaints in 26.1% of adults, with the incidence of tennis elbow reported at 2.77% [2].

Lateral epicondylitis is associated with significant pain, functional impairment, and reduced quality of life (QOL). Studies have demonstrated a strong correlation between the severity of pain, the extent of functional disability, and overall physical and mental QOL. As pain intensity increases, both physical functioning and mental well-being tend to decline.

While ECRB is the muscle most commonly affected, other muscles like the supinator and wrist extensors may also be involved. Activities requiring excessive or repetitive wrist extension—such as racquet sports, playing musical instruments, prolonged computer use, or manual labor—can lead to tendinosis in these muscles. Furthermore, modifiable risk factors like smoking and obesity have been significantly associated with the development of lateral epicondylitis [3].

Clinically, lateral epicondylitis presents with an insidious onset of pain on the lateral aspect of the elbow, potentially radiating into the forearm. The pain is typically aggravated by resisted wrist extension or repetitive wrist movements, particularly when the elbow is fully extended. Weak grip strength during tasks requiring grasping or lifting with the affected limb is also commonly observed [4]. This condition poses a

treatment challenge due to its prolonged course and tendency for recurrence. The typical episode may last from six months to two years, often impacting daily life and work productivity [5].

Although it is usually a self-limiting condition, around 90% of patients recover within a year without the need for surgical intervention [6]. A variety of non-surgical treatments have been explored, including corticosteroid injections, iontophoresis, botulinum toxin A injections, prolotherapy, platelet-rich plasma or autologous blood injections, bracing, physical therapy, and low-level laser therapy [6]. Among these, extracorporeal shock wave therapy (ESWT) has emerged as a promising, non-invasive alternative for patients with refractory symptoms.

ESWT involves the application of focused acoustic or sonic waves generated externally and directed to the targeted area. These shock waves dissipate energy at tissue interfaces with different acoustic impedance—such as the bone-tendon junction—thereby releasing kinetic energy that can lead to tissue modification. The hypothesized mechanisms of ESWT include stimulation of nerve fibers to provide analgesia and mechanical disruption of degenerated tendon tissue to promote healing [7].

Reported success rates of ESWT in treating lateral epicondylitis refractory to other non-surgical interventions range from 48% to 73% [8]. The procedure's non-invasive nature and low complication rates have contributed to its increasing use. Though the precise physiological effects of ESWT remain under investigation, current hypotheses suggest that it facilitates tissue repair, reduces calcific deposits, and modulates pain through denervation mechanisms.

Despite its widespread adoption, the clinical effectiveness of ESWT remains a topic of debate. Conflicting outcomes in published studies necessitate further investigation [9]. Therefore, the present study aims to evaluate the efficacy of extracorporeal shock wave therapy in the management of lateral epicondylitis.

METHODOLOGY & MATERIALS

This quasi-experimental study was conducted at the Department of Physical Medicine & Rehabilitation, Dhaka Medical College Hospital, over a six-month period from July 1 to December 31, 2019, following ethical approval (Approval No: 0133, dated 24/07/2019). A total of 45 patients with lateral epicondylitis were selected using purposive convenient sampling. Adult patients (≥18 years) of both sexes with lateral elbow pain for more than six weeks and positive Maudsley's, Mill's, and Thomsen's tests were included. Patients with bilateral epicondylitis, recent trauma, inflammatory arthritis, concurrent shoulder or neck pain, local skin lesions, neurological symptoms, prior elbow surgery, recent use of NSAIDs or corticosteroid injections, or prior physical therapy were excluded.

After obtaining written informed consent, demographic and clinical data including age, sex, occupation, and symptom duration were recorded. Baseline pain was assessed using a 10 cm Visual Analogue Scale (VAS), and hand grip strength was measured using a dynamometer, with the mean of three attempts recorded while the elbow was flexed at 90°. Thomsen's, Maudsley's, and Mill's tests were used to confirm diagnosis. Extracorporeal shock wave therapy (ESWT) was administered using the ENDOPULS 811 machine (ENRAF NONIUS, Netherlands) on alternate days for two weeks. Each session involved 1000 shocks at 4 Hz frequency and 2 bar pressure applied to the point of maximal tenderness using an R10 applicator and coupling gel. Patients were monitored for adverse effects such as pain or swelling during treatment.

Pain and grip strength were reassessed at baseline, two weeks, and four weeks post-treatment using the same methods. Data were processed and analyzed using SPSS version 22.0. Descriptive statistics were used for demographic data, with means and standard deviations reported for continuous variables and frequencies for categorical data. Chi-square tests were used for group comparisons, and repeated measures ANOVA was applied to assess changes in VAS and grip strength. A p-value <0.05 was considered statistically significant.

RESULTS

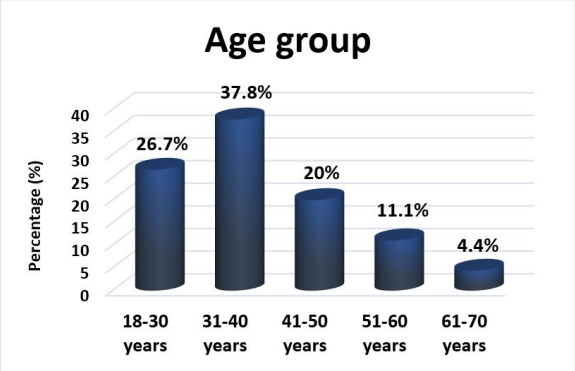

Figure 1: Age distribution of patients with lateral epicondylitis (n=45)

Figure 1 shows the age distribution of patients with lateral epicondylitis. During study period, 45 patients who had lateral epicondylitis were studied. Among them majority (37.8%) were from 31-40 years of age group and 26.7% from 18-30 years group. Mean age was 40.29±11.73 years with range of 18-69 years.

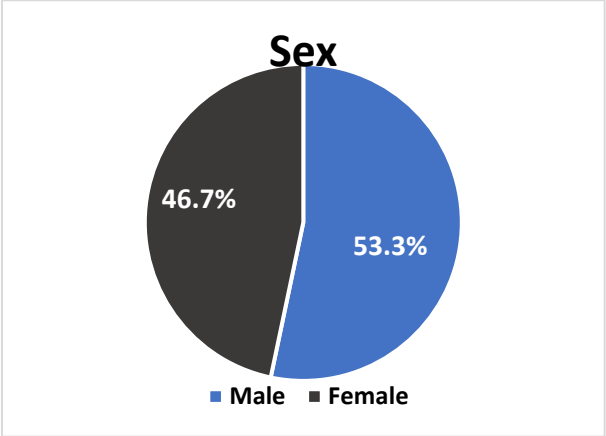

Figure 2: Distribution of study population according to sex (n=45)

Figure 2 shows male (53.3%) were slightly predominant than female (46.7%). Male to female ratio was 1.14:1.

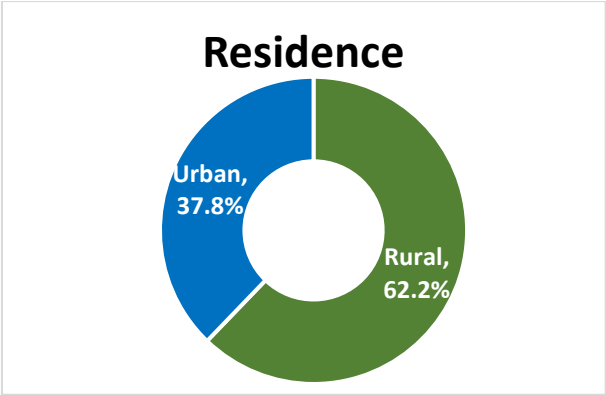

Figure 3: Distribution of patients according to their residence (n=45)

Figure 3 shows the majority of our patients were from rural area (62.5%).

Table I: Distribution of study population according to occupation (n=45)

Occupation	Frequency (n)	Percentage (%)
Housewife	16	35.6
Service holder	13	28.9
Businessman	6	13.3
Unemployed	2	4.4
Sportsman	3	6.7
Other	5	11.1
Total	**45**	**100**

Regarding occupation, 35.6% were housewife, 28.9% service holder and 13.3% were businessman. Others are given in following table I.

Table II: Clinical presentation of patients with lateral epicondylitis (n=45)

Clinical presentation	Frequency (n)	Percentage (%)
Tenderness	43	95.6
Swelling	5	11.1
Elevated local temperature	3	6.7
Crepitus in joint movement	2	4.4
Positive Mill's test	45	100
Positive Maudsley's test	45	100
Positive Thomsen's test	45	100
***Multiple response considered**		

Table II presents clinical presentation of patients with lateral epicondylitis. Out of 45 patients, 95.6% had tenderness, 11.1% had swelling and 6.7% had elevated local temperature. All the patients (100%) were Mill's, Maudsley's and Thomsen's test positive.

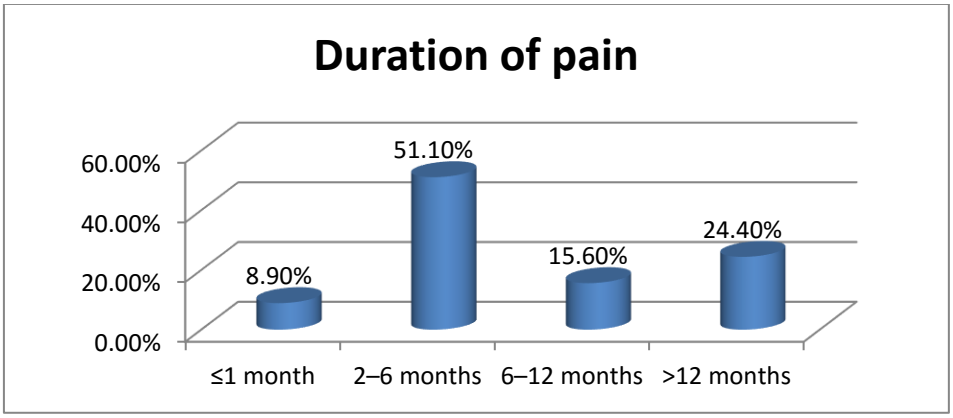

Figure 4: Duration of pain in lateral epicondylitis patients in the study (n=45)

Figure 4 shows the duration of pain in lateral epicondylitis patients in the study. Majority patients (51.1%) had pain duration of 1-6 months and 24.4% patients had >12 months. Mean pain duration was 7.97±8.52 months.

Table III: Different baseline pre-treatment scores (n=45)

Variables	Mean±SD	Minimum	Maximum
Handgrip strength (Kg)	38.98 ± 10.54	19.6	54.9
Resting VAS	4.93 ± 1.75	3	9
VAS with compression	7.44 ± 1.93	3	10
VAS during ADL	6.64 ± 1.82	2	10

ESWT: Extracorporeal shock wave therapy; VAS: Visual analogue score; ADL: Activities of daily living

Table III presents the baseline pre-treatment scores of the patients. The mean handgrip strength was 38.98 ± 10.54 kg, ranging from 19.6 to 54.9 kg. The average resting VAS score was 4.93 ± 1.75, while VAS scores with compression and during activities of daily living (ADL) were higher, with means of 7.44 ± 1.93 and 6.64 ± 1.82 respectively.

Table IV: Statistical comparisons of handgrip strength and resting VAS scores in ESWT group (n=45).

Variables	Pretreatment	After 2 weeks	After 4 weeks	P-value
Handgrip Strength	38.98±10.54	42.28±9.26*	45.58±9.66$^{!§}$	<0.001
Resting VAS	4.93±1.75	2.60±1.29*	1.27±0.89$^{!§}$	<0.001

Pos hoc analysis with Bonferroni adjustment done.
***denotes the significant difference between baseline vs post-treatment**
! denotes the significant difference between post-treatment vs after 2 weeks
§ denotes the significant difference between baseline vs after 4 weeks

Significant difference of handgrip strength and resting VAS between three different timing- baseline pretreatment, after 2 weeks and after 3 weeks ($p<0.05$ in all cases). Moreover, Post-hoc analysis with Bonferroni adjustment was done and denoted by symbol within the table IV.

Table V: Statistical comparisons of VAS with compression and activities of daily living (ADL) in ESWT group (n=45)

Variables	pretreatment	After 2 weeks	After 4 weeks	P-value
VAS with compression	7.44±1.93	4.13±1.66*	2.31±1.29$^{!§}$	<0.001
VAS during ADL	6.64±1.82	4.33±1.35*	1.76±0.77$^{!§}$	<0.001

Pos hoc analysis with Bonferroni adjustment done.
*** denotes the significant difference between baseline vs post-treatment**
! denotes the significant difference between post-treatment vs after 2 weeks
§ denotes the significant difference between baseline vs after 4 weeks

Significant difference of VAS with compression and VAS during ADL between three different timing- baseline pretreatment, after 2 weeks and after 4 weeks ($p<0.05$ in all cases). Moreover, Post-hoc analysis with Bonferroni adjustment was done and denoted by symbol within the table V.

DISCUSSION

Lateral epicondylitis (LE), commonly known as tennis elbow, is a frequently encountered condition characterized by localized pain over the lateral epicondyle, the insertion site for the wrist extensors and forearm extensor muscles [10]. While its precise etiology remains unclear, contributing factors may include aging, chemical and vascular influences, hormonal imbalances, and hereditary predispositions [11]. LE typically affects individuals engaged in repetitive wrist extensor activity, manifesting as pain and diminished grip strength, especially during resisted wrist extension or middle finger extension, often impairing daily activities [12].

Despite being easily diagnosed clinically, treating LE can be challenging due to variable patient responses and physician preferences. Various conservative treatments—such as extracorporeal shock wave therapy (ESWT), non-steroidal anti-inflammatory drugs (NSAIDs), corticosteroid injections, ultrasound therapy, bracing, and exercise—are commonly used, but none have consistently demonstrated superior efficacy based on evidence-based assessments [13, 14]. Nevertheless, some studies have reported success rates between 68% and 91% for ESWT in LE treatment [15]. In the present study, we observed short-term effectiveness of ESWT in improving both subjective measures (e.g., VAS) and objective outcomes (e.g., handgrip strength).

The study included 45 LE patients aged between 18 and 69 years, with a mean age of 40.29 ± 11.73 years. The majority (64.5%) were under 40, with the highest proportion (37.8%) aged 30–40. This aligns with Varghese *et al*., who found most patients between 18–40 years [16]. Coonrad and Hooper observed that LE is four times more prevalent in the fourth decade of life [17]. Age-related decline in tendon elasticity during midlife likely contributes to LE onset [18].

In terms of gender, males slightly predominated (53.3%) over females (46.7%), a pattern consistent with studies by Varghese *et al*., Lapidus *et al*., and Ahmed [16, 19, 20]. However, Samagh *et al*., have reported a female predominance [21]. In our sample, 62.2% were from rural areas versus 37.8% from urban. This contrasts with Ahmed S., who found urban predominance in Bangladesh, while Haahr and Andersen noted no significant difference between urban and rural populations [20, 22].

Occupational analysis showed 35.6% were housewives, 6.7% sportsmen, 4.4% unemployed, and 53.3% in the working population, including 28.9% service holders. Samagh *et al*. reported 71.15% of LE cases among working individuals and 26.92% among housewives [21]. Household chores involving repetitive motion and sustained load may contribute to tendon microtrauma in housewives. Walker-Bone *et al*., found that repetitive elbow movements exceeding one hour per day significantly increased LE risk [23]. Moreover, persistent domestic work despite pain, without adequate rest, may lead to failed healing and functional impairment.

The most common clinical sign was tenderness over the lateral epicondyle (95.6%), followed by swelling (11.1%), elevated joint temperature (6.7%), and joint crepitus (4.4%). Mill's, Maudsley's, and Thomsen's tests were positive in all cases. These findings are consistent with Varghese *et al*., who reported tenderness in 95%, swelling in 13.3%, and elevated temperature in 8.3% [16].

Pain duration was less than one year in 75.6% of patients, with the majority (51.1%) reporting symptoms for 1–6 months. The mean duration was 7.97 ± 8.52 months. Varghese *et al*. observed 61.7% of patients had symptoms for over a year, while 38.3% had shorter durations [16]. Some evidence suggests ESWT may be more effective in chronic cases due to targeted action on abnormal tissue and nociceptors [24].

There was a statistically significant increase in handgrip strength over time: 38.98 ± 10.54 kg at baseline, 42.28 ± 9.26 kg after 2 weeks, and 45.58 ± 9.66 kg after 4 weeks. Similarly, resting VAS scores and those during ADLs and compression significantly improved. This is in line with studies showing similar gains in grip strength and pain relief post-ESWT [8, 25].

However, literature on ESWT's efficacy remains divided. Some studies report clear benefits in pain reduction and functional improvement [26-28], while others argue ESWT provides little or no benefit over placebo [29-32]. Notably, ESWT appears particularly beneficial in chronic or refractory LE cases [33, 34]. Variability in findings may stem from differences in ESWT protocols, such as pulse count, frequency, session duration, interval, and device type, as ESWT lacks a standardized regimen.

Comparative studies have yielded mixed results. In a randomized controlled trial with 93 patients, corticosteroid injections outperformed ESWT at 3-month follow-up, though effects waned by 6 months [35]. Another study by Gündüz *et al*. found no significant difference in pain or grip strength between ESWT and other modalities (e.g., hot pack, ultrasound, friction massage) [35].

Despite conflicting data, ESWT offers a safer alternative to some interventions, particularly corticosteroid injections, and shows promise for pain and function improvement in LE [36]. Although some authors report minimal or no benefit [37, 38], our findings support ESWT as a valuable option, especially in the short term, to improve quality of life and functional capacity in patients with lateral epicondylitis.

Limitations of the study

The present study had certain limitations. Firstly, the sample size was relatively small, which may limit the generalizability of the findings. Secondly, long-term follow-up of the patients was beyond the scope of this study, restricting the evaluation of sustained efficacy and potential recurrence. Therefore, further large-scale, multicenter randomized controlled trials with extended follow-up periods are recommended to validate these results and establish more robust clinical evidence regarding the effectiveness of extracorporeal shockwave therapy in the treatment of lateral epicondylitis.

CONCLUSION

In this study, we observed that extracorporeal shockwave therapy (ESWT) led to significant improvement in handgrip strength, resting Visual Analog Scale (VAS), VAS with compression, and activities of daily living (ADL) scores at 4-week follow-up in patients with lateral epicondylitis. Based on these findings, ESWT appears to be an effective and promising alternative to conventional treatment methods for lateral epicondylitis. However, larger multicenter randomized controlled trials are recommended to validate these results and establish definitive clinical guidelines.

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