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ORIGINAL ARTICLE

Shockwave Therapy versus Therapeutic Ultrasound and Kinesio Tape in Lateral Epicondylitis

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Abstract

Background: ***Lateral epicondylitis is a degenerative injury that cannot be diagnosed by blood tests and rarely by X-rays; rather, it is usually diagnosed by the description of the site of the pain and by certain findings from a physical examination.***

Aim of the work: ***To examine the respective contributions of shockwave therapy, therapeutic ultrasound, and Kinesio tape in managing lateral epicondylitis.***

Methodology: ***This research was carried out at Al-Zahraa University Hospital and AL-Matria Teaching Hospital (Rheumatology & Rehabilitation department) on 90 patients were divided into three equal groups: Group I received ESWT, Group II applied kinesio tape, and Group III received ultrasonic therapy. The outcome measures included common extensor tendon (CET) thickness measurement, grip strength (GS), visual analog scale (VAS) for pain, and Patient-Rated Tennis Elbow Evaluation (PRTEE).***

Results: ***VAS and GS after treatment were significantly improved compared to VAS and GS before treatment in the three groups (P value <0.001), with no substantial variation among the three groups. CET after management was substantially reduced compared to CET before treatment in the three groups (P value <0.001). PRTEE after treatment was substantially greater in group US than group ESWT and group KT (P value = 0.002 and 0.001 respectively) and was insignificantly varied between group ESWT and group KT.***

Conclusion: ***Extracorporeal shockwave therapy (EWST), ultrasound therapy (US), and kinesiotherapy (KT) have all demonstrated efficacy in reducing pain and improving functionality among patients with lower extremity (LE) conditions.***

Keywords: Shockwave therapy; Kinesio tape; Lateral epicondylitis

1. Introduction

While not bearing weight, the elbow joint is often regarded as one of the most intricate joints in the human body. The elbow joint is classified as a synovial hinge joint, primarily consisting of the distal humerus and the proximal ulna articulations. Nevertheless, articulations are present across the proximal radius and the humerus and between the proximal radius and ulna. The three articulations are the glenohumeral, radioulnar, and proximal radioulnar joints, respectively.[1]

Many pathological conditions can happen to the elbow joint, including lateral epicondylitis. It affects 1 percent to 3 percent of the population (about 4 to 7 cases per 1000)[2] Approximately 50% of tennis players experience a condition commonly referred to as "tennis elbow" at some point during their professional careers[3] It affects men and women equally, the demographic most commonly affected by this condition falls within the age range of 20 to 50 years, but it may also affect people of any age.[4]

The condition formerly known as lateral epicondylitis or tennis elbow should be redefined, as the current terminology implies inflammation as the underlying cause of the symptoms. However, contemporary knowledge indicates that the ailment is more accurately characterized as degenerative. Furthermore, the findings from histological investigations have revealed the lack of inflammatory mediators across all stages of elbow tendinopathy.[5]

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The lateral epicondylitis diagnosis is typically established using clinical assessment methods supplemented by diagnostic musculoskeletal ultrasonography. Lateral epicondylitis is commonly managed through various treatment modalities in clinical practice. These interventions include physical therapy, forearm bracing to provide tendon rest, rest periods, and administering analgesic medications such as paracetamol for mild pain. Additionally, topical cortisone gel and cortisone injections, ultrasound therapy, Kinesio tape application, extracorporeal shock wave therapy, and surgical intervention may be warranted in a subset of patients (4% to 11%) who experience persistent symptoms.[6]

Ultrasonic therapy (US) is a commonly employed modality in physiotherapy and sports medicine to treat various tissue ailments. Ultrasound waves emitted by the United States (US) can penetrate tissue, generating heat that can boost local blood flow. Additionally, these waves stimulate the production of inflammatory mediators, which can help reduce muscle spasms and alleviate pain. This method primarily emphasizes modifying collagenous tissues' extensibility to enhance the range of motion.[7]

Extracorporeal shock wave therapy (ESWT) is a recently developed therapeutic modality. The process entails the propagation of high-intensity acoustic pressure waves, which are produced by electrohydraulic, electromagnetic, or piezoelectric mechanisms, through a gel medium to reach the desired target region. Additionally, it has been observed to enhance the process of collagen synthesis in various connective tissues such as tendons, bones, and other soft tissues. The initial application of this method was in the medical field, specifically for the therapeutic management of renal calculi. In contemporary practice, this particular intervention has been used in certain soft tissue pathologies, such as calcifying tendinitis affecting the rotator cuff, humeral epicondylitis, plantar fasciitis, and lateral epicondylitis. A study by researchers revealed that the treatment showed efficacy in 75.7% of tennis elbow patients.[8]

Kinesio tapes (KT), which are elastic cotton strips with an acrylic adhesive capable of being stretched to a maximum of 140% of their initial length, were developed by Kenzo Kase, a Japanese orthopedic surgeon, during the 1970s. Following their initial global introduction at the 1988 Seoul Summer Olympics, these specialized tapes rapidly evolved into a commonly employed physiotherapeutic modality for managing diverse musculoskeletal conditions.[9]

This research aims to evaluate the role of shockwave therapy, therapeutic ultrasound, and kinesio tape in lateral epicondylitis.

2. Patients and methods

The study was conducted at Al-Zahraa University Hospital (Rheumatology & Rehabilitation Department) and Al-Matria Teaching Hospital. Ninety patients with lateral epicondylitis from both sexes who were enrolled in the outpatient clinic were included. The Al-Azhar University Faculty of Medicine's Ethics Committee gave the study its blessing. Adequate provisions were made to maintain participants' privacy and the data's confidentiality.

Randomization and Blinding

Following a history taking, clinical examination, and ultrasonography scanning, the patients were randomly assigned into three groups, each consisting of 30 patients (ultrasonic therapy, kinesiology tape, and extracorporal shock wave therapy (ESWT) in a parallel design.

A statistician used a computer-generated randomization program (permuted block technique). The random numbers were placed in sealed, closed, and opaque envelopes.

Inclusion Criteria: Patients who are older than 20 and have lateral epicondylitis symptoms that continue longer than three months. Tenderness felt while directly palpating the common extensor tendon across the lateral epicondyle. During resisted wrist or middle finger extension, elbow pain exists outside the joint.

Exclusion Criteria: Fibromyalgia, patients under the age of 20, and cervical radiculopathy. Radial tunnel syndrome, upper-extremity peripheral neuropathy, steroid-using individuals, PRP or autologous blood injection, and physical therapy tools. Pregnancy, cancer, osteoarthritis, upper extremity surgical intervention, and metallic implantation.

Methods: The following procedures were applied to all patients:

Demographic data and medical history taking: Personal history about name, age, sex, residence, occupation, Martial status, and special habits of medical importance. Previous or present illness (onset, course, etc.…), constitutional symptoms, musculoskeletal manifestations, mucocutaneous manifestations, and neurological manifestations. History of receiving any drugs, steroids, PRP, any injection, or any associated pathological fractures.

Clinical examinations include General examination, neurological examination, articular examination, chest examination, cardiac examination, and abdominal examination.

Inspection: Skin color: erythema, ecchymosis, hypo or hyperpigmentation. Trophic changes, scars, swelling, muscle tone, atrophy, hypertrophy, deformity, asymmetry, and amputation.

Palpation of the lateral epicondyle: The patient was seated at a table with his or her forearm outstretched in front of the examiner. Using light pressure, the test taker examined the patient's lateral epicondyle and the region above and below it. Any pain or tenderness around the lateral epicondyle was considered a positive test as in Figure 1.[10]

Figure 1. Palpation on the lateral epicondyle (Al Matria teaching Hospital).

Range of motion (ROM): Using the universal goniometer is a straightforward, reliable, and popular evaluation method to accurately assess elbow ROM.[11] Flexion values range from 130° to 154° degrees, and extension values range from 6° to 11°degrees. Supination ranged from 80° to 104° and pronation from 75° to 85°.[12]

The examiner provided additional support in the direction of the movement as he measured passive ROM (pROM). Each patient had both arms measured for aROM and pROM. The performance of ROM measures using landmarks is in Figure 2.

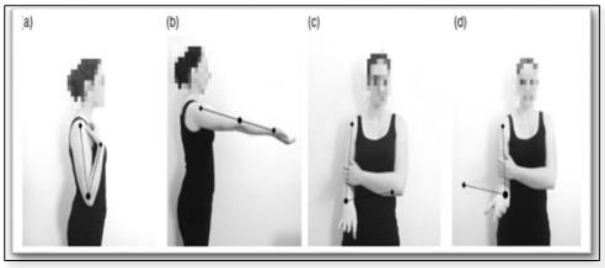

Figure 2. The range of motion land markers for measuring:

a. Flexion b. extension c. pronation d. supination.[13]

Resisted wrist extension test (cozen's test): The patient's elbow extended, the forearm pronated to its maximum, the wrist radially abducted, and the hand clenched. The examiner then extended the wrist dorsally, and moves the wrist in two directions: palmar flexion and dorsal flexion as in Figure 3. The test was positive when there was pain in the lateral epicondyle.[14]

Figure 3. Cozn's test (Al Matria teaching Hospital).

Mill's test:

Patient was seated, with elbow extended, and forearm pronated for that exam. Then, the examiner gently flexed the wrist, extending the extensor muscles as in Figure 4. The test was positive when there was pain in the lateral epicondyle.[15]

Figure 4. Mill's test (Al Matria teaching Hospital).

Middle finger test (Maudsley's):

When the patient was either standing or sitting, the examiner placed one hand on the common extensor tendon. Then, the examiner requested that the patient extended the middle finger of the troubled arm as in Figure 5. If there was pain at the lateral epicondyle or common extensor tendon, the test was positive.[16]

Figure 5. Maudsley's test (Al Matria teaching Hospital).

Chair test:

The patient try to lift the chair with three fingers (the thumb, index, and middle finger) while he was standing behind it. The patient's elbow was fullyextended, and the forearm was supinated as in Figure 6. When the lateral epicondyle hurt, the test was positive.[17]

Figure 6. Chair test (Al Matria teaching Hospital).

Grip strength:

The measurement was conducted utilizing a Jamar dynamometer. The participant was directed to assume a seated position on a chair without armrests, aligning their shoulders at 0° abduction and in a neutral position. Their elbow was to be flexed at 90°, while their forearm maintained a neutral position, as depicted in Figure 7.

The participant exerted maximum force on the dynamometer for a duration of 3 seconds. Three trials were conducted, with a 60-second interval of rest between each trial, and the median value of the three grip measurements was recorded. The mean grip strength for males is 46.9kg, whereas for females it is 29.4kg. The aforementioned quantities fall to 39 kilograms and 23.5 kilograms respectively at the specified point in time.[18]

Figure 7. Dynamometer for grip strength measurement (Al Matria Teaching Hospital).

Assessed Outcomes

Following the patients' allocation into three groups for therapy, baseline assessments were performed at the beginning and after the end of the management course (after three weeks) using common extensor tendon thickness assessment, grip strength, visual analog scale, and patient-rated tennis elbow evaluation.

Shock Wave Therapy (ESWT) group:

Within the ESWT (Extracorporeal et al.) cohort, the participant assumed a seated position with the forearm in a pronated orientation and adequately supported while the elbow was flexed. The patients were subjected to a therapy regimen consisting of many sessions over three weeks. Each session involved the application of a specific treatment protocol, which included an energy density of 0.3 MJ/mm2, a pressure of 1.4 bar, a frequency of 14Hz, and a total of 2500 pulses. The treatment sessions were conducted once per week for the duration of the three weeks. The patients were provided a home exercise program encompassing stretching and strengthening exercises.

Kinesio Tape (KT) Therapy group:

In the KT group, KT was applied once every two days for three weeks, targeting both the muscle and fascia.

Ultrasound Therapy group:

The patient was seated in the US group, with the forearm pronated and supported and the elbow flexed. They received ultrasonic therapy three times each week for three weeks (frequency of 1 MHz, intensity of 1.5 W/cm for 5 min). The patients also received a home exercise program that included stretching and strengthening exercises.

Statistical analysis

The SPSS version 25 program from IBM Inc. in Chicago, Illinois, USA, was utilized for the statistical study. It compared quantitative data between the three groups utilizing the F and the post hoc (Tukey) tests to compare each pair of groups using mean and standard deviation (SD). In the context of statistical analysis, it was determined that a P-value of less than 0.05 was statistically significant. A p-value of 0.001 or less was very significant. A p-value of 0.05 or above was considered statistically insignificant.

3. Results

Age, Sex, BMI, dominated hand, affected hand and disease duration were insignificantly different among the three groups, Table 1.

Table 1. Patient's demographic data and disease duration descriptive among all groups.

		GROUP ESWT (N = 30)	GROUP KT (N = 30)	GROUP US (N = 30)	P VALUE
AGE (YEARS)	Mean ± SD	42.47 ± 7.83	47 ± 7.33	44.03 ± 10.77	0.133
	Range	25 – 51	24 – 53	27 – 59	
SEX	Male	16 (53.33%)	10 (33.33%)	12 (24%)	0.279
	Female	14 (46.67%)	20 (66.67%)	18 (36%)	
BMI (KG/M²)	Mean ± SD	28.1 ± 2.76	27.53 ± 2.65	27.53 ± 2.11	0.605
	Range	25 – 32	24 – 32	24 – 30	
DOMINATED HAND	Right	28 (93.33%)	27 (90%)	26 (52%)	0.695
	Left	2 (6.67%)	3 (10%)	4 (8%)	
AFFECTED HAND	Right	17 (56.67%)	22 (73.33%)	20 (40%)	0.392
	Left	13 (43.33%)	8 (26.67%)	10 (20%)	
DISEASE DURATION (MON)	Mean ± SD	5.5 ± 2.41	6.6 ± 2.9	6.8 ± 3.79	0.219
	Range	3 – 12	3 – 12	3 – 15	

BMI: body mass index. P-value <0.05: significant. P-value <0.001: highly significant. P-value >0.05: insignificant.

VAS after treatment was substantially lower compared to VAS before treatment in the three groups (P value <0.001). GS after treatment was substantially higher compared to GS before treatment in the three groups (P value <0.001). CET thickness after treatment was substantially lower compared to CET thickness before treatment in the three groups (P value <0.001). PRTEE after treatment was substantially lower compared to PTREE before treatment in all groups
(P value <0.001), Table 2.

Table 2. Comparison between before and after treatment values in all groups.

OUT COME	GROUPS	BEFORE TREATMENT		AFTER TREATMENT		P VALUE
		Range	Mean ± SD	Range	Mean ± SD	
VAS	ESWT	7-10	8.1 ±0.99	4-7	5.57 ± 0.94	0.014*
	KT	6-10	8.07 ± 0.94	3-7	5.2 ± 1.06	
	US	6-10	7.67 ± 1.15	4-8	5.47 ± 1.25	
GS (KG)	ESWT	17-33	25.27 ±6.31	20-36	27.9 ± 6.23	<0.001**
	KT	15-39	21.67 ±8.29	18-42	25.27 ±8.28	
	US	17-41	24.2 ±7.77	19-44	26.8 ±7.85	
CET THICKNESS (MM)	ESWT	4.3-6	5.31 ±0.52	3.5-5.3	4.35 ± 0.56	<0.001*
	KT	4-6.5	5.33 ± 0.79	3.5-6	4.83 ± 0.8	
	US	4.5-6.3	5.05 ± 0.58	4-6	4.66 ± 0.63	
PRTEE	ESWT	53.5-81	66.73 ± 9.01	29-55	38.92 ± 8.59	0.023*
	KT	60-84	69.26 ± 8.03	22.8-55	38.12 ± 7.39	
	US	55-87.4	70.99 ± 9.79	30-61.7	46.65 ± 9.56	

ESWT: Extracorporeal Shock Wave, KT: Kinesiology Tape, US: Therapeutic Ultrasound, CET: common extensor tendon, GS: grip strength, , PRTEE: patient rated tennis elbow evaluation. P-value <0.05: significant. P-value <0.001: highly significant. P-value >0.05: insignificant.

VAS before and after treatment was insignificantly different among all groups,
Table 3.

Table 3. VAS before and after treatment in all groups.

		GROUP ESWT (N = 30)	GROUP KT (N = 30)	GROUP US (N = 30)	P ## VALUE
BEFORE	Mean ± SD	8.1 ± 0.99	8.07 ± 0.94	7.67 ± 1.15	0.202
	Range	7 – 10	6 - 10	6 – 10	
AFTER	Mean ± SD	5.57 ± 0.94	5.2 ± 1.06	5.47 ± 1.25	0.408
	Range	4 – 7	3 – 7	4 – 8	
P # VALUE		<0.001*	<0.001*	<0.001*	

ESWT: extracorporeal shock wave, KT: Kinesiology Tape, US: Therapeutic Ultrasound, P # value: p value between before and after treatment in the same group, P ## value: p value among the three groups.

GS before and after treatment were insignificantly different among all groups, Table 4.

Table 4. GS before and after treatment in all groups.

GS (KG)		GROUP ESWT (N = 30)	GROUP KT (N = 30)	GROUP US (N = 30)	P ## VALUE
BEFORE	Mean ± SD	25.27 ± 6.31	21.67 ± 8.29	24.2 ± 7.77	0.168
	Range	17 – 33	15 – 39	17 – 41	
AFTER	Mean ± SD	27.9 ± 6.23	25.27 ± 8.28	26.8 ± 7.85	0.397
	Range	20 – 36	18 – 42	19 – 44	
P # VALUE		<0.001*	<0.001*	<0.001*	

ESWT: extracorporeal shock wave, KT: Kinesiology Tape, US: Therapeutic Ultrasound, GS: grip strength, P # value: p value between before and after treatment in the same group, P ## value: p value among the three groups.

CET thickness before treatment was insignificantly varied among all groups. CET thickness after treatment was substantially lower in group ESWT than group KT (P value = 0.010) and was insignificantly varied between group US and (group ESWT and group KT), Table 5.

Table 5. CET thickness before and after treatment in all groups.

		GROUP ESWT (N = 30)	GROUP KT (N = 30)	GROUP US (N = 30)	P## VALUE	POST HOC
BEFORE	Mean ± SD	5.13 ± 0.52	5.33 ± 0.79	5.05 ± 0.58	0.467	
	Range	4.3 – 6	4 - 6.5	4.5 - 6.3		
AFTER	Mean ± SD	4.35 ± 0.56	4.83 ± 0.8	4.66 ± 0.63	0.022*	P1=0.010* P2=0.761 P3=0.063
	Range	3.5 - 5.3	3.5 – 6	4 – 6		
P# VALUE		<0.001*	<0.001*	<0.001*		

*: Significant as P value ≤ 0.05, ESWT: Extracorporeal Shock Wave, KT: Kinesiology Tape, US: Therapeutic Ultrasound, CET: common extensor tendon, P1: P value between group ESWT and group KT, P2: group US, P3: P value between group KT and group US, P # value: p value between before and after

treatment in the same group, P ## value: p value among the three groups.

PRTEE before treatment was insignificantly different among all groups. PRTEE after treatment was significantly higher in group US than group ESWT and group KT (P value = 0.002 and 0.001 respectively) and was insignificantly different between group ESWT and group KT, Table 6.

Table 6. PRTEE before and after treatment in all groups.

		GROUP ESWT (N = 30)	GROUP KT (N = 30)	GROUP US (N = 30)	P ## VALUE	POST HOC
BEFORE	Mean ± SD	66.73 ± 9.01	69.26 ± 8.03	70.99 ± 9.79	0.186	
	Range	53.5 – 81	60 – 84	55 - 87.4		
AFTER	Mean ± SD	38.92 ± 8.59	38.12 ± 7.39	46.65 ± 9.56	0.003*	P1=0.931 P2=0.002 *
	Range	29 – 55	22.8 – 55	30 - 61.7		P3=0.001 *
P # VALUE		<0.001*	<0.001 *	<0.001*		

*: Significant as P value ≤0.05, ESWT: extracorporeal shock wave, KT: Kinesiology Tape, US: Therapeutic Ultrasound, PRTEE: patient rated tennis elbow evaluation, P1: P value between group ESWT and group KT, P2: P value between group ESWT and group US, P3: P value between group KT and group US, P # value: p value between before and after treatment in the same group, P ## value: p value among the three groups. P-value <0.05: was considered significant. P-value <0.001: was considered as highly significant. P-value >0.05: was considered insignificant.

4. Discussion

Lateral epicondylitis (LE), sometimes called tennis elbow, is a prevalent condition resulting from repetitive strain, manifesting as discomfort and sensitivity in the vicinity of the lateral epicondyle of the humerus. Lateral epicondylitis (LE) refers to a pathological condition affecting the common extensor tendon (CET), which is responsible for attaching to the lateral epicondyle of the elbow.[19]

In our current study, visual analog scale (VAS) after treatment was substantially lower compared to VAS before management in the three groups, GS after management was substantially higher compared to GS before management in all groups, common extensor tendon thickness (CET) after treatment was substantially lower compared to CET thickness before treatment in all groups, and PRTEE after treatment was substantially lower compared to PRTEE before treatment in all groups.

In line with our study,[20] 50 individuals were enrolled; their ages ranged from 27 to 64 on average. With LE, 70.5% of girls and 29.5% of men were among them. Three patients in the ESWT group and one in the US group discontinued treatment. Two groups of patients were randomly assigned. Therapeutic US was performed on Group 1 (n=20; 5 men and 15 females). ESWT was performed on Group 2 (n=24; 8 males and 16 females). Patients were assessed at baseline, post-treatment, and one month later. They showed that both groups' VAS considerably improved over time. After therapy, there was no difference in the groups' VAS values.

In our present study, GS after treatment was substantially higher than GS before treatment in all groups. An intra-group comparison before and after treatment showed that GS did not differ between the groups.

In disagreement with our study,[21] examined the efficacy of shockwave and ultrasound treatments for lateral epicondylitis in patients. One hundred seventeen patients comprised the ultrasound group, 63 were in the shockwave group, and 18 were in the control group. They demonstrated that, compared to assessments taken before therapy, grip strength was noticeably better at the 1-, 3-, and 6-month follow-ups. ESWT had a longer (6 months) lasting positive impact on grip strength than the other two exercises. The discrepancy in results could be the result of our study's short follow-up period and their study's high sample size.

In agreement with our study,[18] It was revealed that the thickness of the CET exhibited a substantial decrease after eight weeks, namely in the group that underwent extracorporeal shockwave therapy (ESWT) (P=0.006).

Our results were in line with [22] The individual or individuals who conducted the study stated that there was a substantial improvement in PRTEE total over time in both groups. All p-values were found to be less than 0.0001. There were no substantial differences in the total scores after treatment between the groups.

4. Conclusion

The interventions of Extracorporeal Shockwave Therapy (EWST), Ultrasound Therapy (US therapy), and Kinesio Taping (KT) have shown efficacy in alleviating pain and enhancing functional outcomes among patients with Lower Extremity (LE) conditions. Notably, no significant superiority was observed among these treatment modalities. The post-treatment CET (Cortisol et al.) exhibited a statistically significant decrease in the ESWT (Extracorporeal et al.) group compared to the KT (Kinesio Taping) group. However, no statistically significant difference was observed in CET between the US (Ultrasound) and ESWT and KT groups.

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Authorship

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There are no conflicts of interest.

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