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Original investigation

Comparison and Short Term Effect of Extracorporeal Shock Wave Therapy and Kinesiotaping in Treatment of Lateral Epicondylitis

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ABSTRACT

Introduction: To compare the effects of extracorporeal shock wave therapy and kinesiotaping, performed as the first-step treatments added to physiotherapy, on pain, functionality, and quality of life among newly diagnosed lateral epicondylitis patients.

Patients and Methods: Our study was retrospectively performed. The medical records of 62 patients whose treatment was designed for clinically-diagnosed unilateral lateral epicondylitis were reviewed, they were categorized into two groups each containing 31 patients. The demographic properties, profession, body mass index, dominant hand, symptom duration, and the side of the affected elbow were recorded. Patients were assessed twice; prior to treatment onset and at 1st month after the treatment. Pain intensity was recorded with Visual Analog Scale at rest, at night, during activity (repeated elbow motions). Patients completed quick disabilities of the arm, shoulder, and hand questionnaire for a functional evaluation. Quality of life was assessed by Short Form-36.

Results: There was no statistically significant difference between the two groups in terms of demographic characteristics. When the patients were evaluated at the fourth week after the treatment; the visual analogue scale showing pain severity at rest, at night and during activity, the Q-DASH, and all sub-parameters of Short Form 36 was found significantly difference. There was no statistically significant difference between the two groups in terms of evaluation parameters.

Conclusions: We reported that treatment effect of kinesiotaping to lateral epicondylitis is similar to that of ESWT. Both treatments significantly improved pain score, functional status and patient satisfaction.

Keywords: tennis elbow, kinesiotaping, shockwave, pain

INTRODUCTION

Lateral epicondylitis (LE), also called tennis elbow, is a common upper extremity disorder. Its prevalence is 1–3% in general population and 2–23% in professional population (1, 2). It is more common in people aged 45–60 years, in dominant arm, and in women (3). Mechanical (repeated/excessive mechanical loads, contusions) and structural factors (morphological, cellular, metabolic) are important etiological factors. It is thought to be a process resulting from the overuse of upper extremity and repeated micro-trauma, characterized by angio-fibroblastic degeneration or hyperplasia in the common extensor tendon of the elbow, especially extensor carpi radialis brevis (4). LE usually starts insidiously and in a spontaneous manner. Pain is located to the lateral epicondyle but may spread upwards to upper arm or downwards to forearm. There is tenderness over the epicondyle. Pain is aggravated by wrist dorsiflexion against resistance when the elbow is in extension, and resisted supination may also be painful. Although the disorder may limit itself, it may still produce intense pain and affect daily activities. Joint range of motion is usually spared (5–7).

Although many treatment methods have been recommended to treat LE, no standard therapy exists as a result of its multifactorial etiology and pathophysiology. Conservative treatment options include medical treatment with non-steroidal anti-inflammatory drugs, limiting wrist motions, wrist resting splint reducing stress on wrist extensors, local corticosteroid or non-corticosteroid injections (botulinum toxin, prolotherapy, sodium hyaluronate), acupuncture, forearm stretching and strengthening exercises, various physical therapy modalities (transcutaneous electrical nerve stimulation, laser, iontophoresis, therapeutic ultrasound,

and extracorporeal shock wave therapy), massage, and manipulation-mobilization. Surgery is an option for patients who failed with conservative methods (8–11).

ESWT was first used in 2000 s to treat musculoskeletal injuries. As a result of its noninvasive nature, good tolerability, and a favourable side effect profile, it has been more commonly used to treat LE in recent years (12). Although its mechanism of action is unknown, it is believed that shock wave therapy initiates neovascularization and reduces tendinopathy-induced pain by improving blood flow while initiating repair of chronic inflammation by tissue regeneration (13). However, its superiority over other physiotherapy modalities has yet to be shown (14).

Kinesio taping (KT) was first developed in 1973 by Kenzo Kase using a material called kinesio-tex. It has been increasingly used for myofascial pain syndrome, sub-acromial impingement syndrome, lymphedema, tendinitis, patellofemoral pain syndrome, knee osteoarthritis, and LE. KT possesses some physiological effects including reduction of pain or abnormal sensation, supporting muscular motion, promoting blood drainage and subcutaneous lymphatic fluid propagation, and correcting articular malalignment (15–18).

The present study aimed to compare the effects of ESWT and KT, performed as the first-step treatments added to physiotherapy, on pain, functionality, and quality of life among newly diagnosed LE patients.

MATERIALS and METHODS

Our study was retrospectively performed to assess the effects of ESWT and kinesiological taping therapy on lateral epicondylitis. This study enrolled patients diagnosed with LE who presented to our outpatient clinic between January 2017 and December 2018. LE diagnosis was based on symptoms, i. e. the area of tenderness and intensification of pain with wrist dorsiflexion against resistance with the elbow extended and resisted wrist supination. A total of 62 patients aged 23–74 years who had lateral epicondylitis for at least 6 years were enrolled. Having cervical radiculopathy, cubital tunnel syndrome, carpal tunnel syndrome, pain radiating from the shoulder, inflammatory, autoimmune, endocrinological, or renal disorders, history of LE surgery, elbow deformity, history of upper extremity operations or trauma, history of corticosteroid injections for lateral epicondylitis in the last three months, pregnancy, bleeding diathesis, local or systemic infection affecting upper extremity, pacemakers, sensory disorders of the skin or allergic reactions to kinesiological taping, poor cooperation with the medical team or refusal the treatment were the reasons of exclusion from the study. Prior to the evaluation, the patients or their legal guardians, as appropriate, were given verbal and written information on the nature of the study. Informed consent forms were signed upon admission to the trial. All procedures were conducted in accordance with the Helsinki Declaration of 2004.

The medical records of 62 patients who met the inclusion criteria and whose treatment was designed for clinically-diagnosed unilateral LE were reviewed, and they were categorized into two groups each containing 31 patients (ESWL and kinesiotaping groups) using the simple random sampling method.

The demographic properties, profession, body mass index, dominant hand, symptom duration, and the side of the affected elbow were recorded. To relieve pain, both groups of patients were prescribed relative rest in daily activities, use of splints, stretching and strengthening exercises, ice therapy, and paracetamol as needed. Exercise programs were aimed to strengthen forearm muscles and to provide flexibility and pain-free articular range of motion during daily activities.

Patients with planned treatment were assessed twice, prior to treatment onset and at 1st month after the treatment, when the scales were applied. All patients underwent a check one month after the treatment. No side effect was observed during or after the treatment.

The effectiveness of treatment was assessed as follows:

Pain evaluation using the visual analogue scale (VAS): The visual analogue scale (VAS) was used to rate pain intensity. The latter is rated by using a 10-cm straight line where "no pain" is rated by 0 point and "worst imaginable pain" 10 points. Then, the distance between the point 0 and the point marked by the patient is measured. A score of less than 3 is considered mild pain; 3–6 moderate pain; and >6 severe pain. Pain intensity was recorded at rest, at night, and during activity (repeated elbow motions) at treatment onset and the post-treatment period (19).

Quick Disabilities of the Arm, Shoulder and Hand Questionnaire (Q-DASH): All patients completed 11-item quick disabilities of the arm, shoulder, and hand (Q-DASH) questionnaire for a functional evaluation. Q-DASH is a self-reported questionnaire whose reliability and validity were proven in Turkish and which rates physical function and symptoms in patients with upper extremity disorders. It includes 11 items, of which at least 10 should be replied in order the Q-DASH score to be calculated. Each item contains 5 responses, and the scale score is calculated from the item scores (0, no disability; 100, most severe disability) (20, 21).

Short Form-36 (SF-36): It is a self-assessment scale developed to rate quality of life, which was translated into Turkish and validity and reliability of which were studied by Koçyiğit et al. (22). It consists of 36 items rating 8 dimensions, namely physical condition, social function, role limitations due to physical problems, role limitations due to emotional problems, mental health, energy/vitality, pain, and general perception of health. The rating is Likert type except for some items and takes into consideration the last four weeks. Its sub-dimensions rate health status between 0 and 100, where 0 indicates poor health status and 100 good health status (23).

METHODS of TREATMENT

ESWT Group

ESWT procedure was performed by the same physiotherapist and without using local anaesthesia in all patients. The patients were placed in supine position with their elbows in 90-degree flexion. The shockwave applicator was placed on the point of maximum tenderness, perpendicular to the insertion site of the extensor muscles of the wrist on the lateral epicondyle. An ultrasound gel was used to minimize energy dissipation between the shockwave source and the skin. Shock waves with 2000 impulses were applied using a Dolarclast (Electro Medical Systems, Nyon, Switzerland) device with a low energy flow density ranging at 0.06–0.12 mJ/mm^2. It was applied at a tolerable energy intensity in a total of three sessions each lasting for 5 minutes, performed once a week (24, 25).

Kinesiotaping Group

All patients underwent taping with muscle technique twice a week for three weeks. The taping procedure complied with the criteria proposed by Kase (17). The patients were instructed to remove the tape before attending the next session.

Statistical analysis

In the statistical evaluation of our data, SPSS 17.0 for Windows program was used. Quantitative variables are presented as mean ± SD and categorical variables as number and percentage. The normal distribution among the quantitative variables was ascertained using the Shapiro-Wilk test. The independent samples *t*-test was used for paired comparisons of normally distributed variables of the ESWT and KT groups a pre-treatment and posttreatment. Variables of the ESWT and KT groups without normal distribution were compared using the Mann-Whitney *U* test. Hypotheses were two-tailed, and $P \leq 0.05$ was considered statistically significant.

Figure 1. KT to lateral epicondyle was applied from origin to insertion using the muscle technic.

RESULTS

The demographic characteristics of the patients are given in Table 1. There was no statistically significant difference between the two groups in terms of demographic characteristics.

The results and statistical comparisons of pre-treatment (week 0) and posttreatment (month 1) parameters in ESWT and KT group given in Table 2 and 3.

VAS scores of the pain with resting, night and under stress significantly decreased at posttreatment 1 months when compared with pre-treatment scores in ESWT and KT group ($p<0.05$; Table 2 and 3).

DASH score significantly decreased at posttreatment 1 months when compared with pre-treatment scores in ESWT and KT group ($p<0.05$; Table 2 and 3).

Table 1. Comparison of demographic characteristics between ESWT and KT group

Demographic features	ESWT (n=31), mean ± SD/n	KT (n=31), mean ± SD/n
Age (years)	46.13±11.19 (31/74)	44.29±10.79 (23/64)
Sex (female/male)	19/12 (% 61.3/% 38.7)	23/8 (% 74.2/% 25.8)
BMI (kg/m^2)	27.35±3.79 (21.6/35.4)	26.28±3.87 (18.7/38.1)
Dominant hand (right/left)	30/1 (% 96.8/3.2)	29/2 (% 93.5/6.5)
Disease duration (0–6 month)	3.35±1.79	2.55±1.48
Side of involvement (right/left)	22/9 (% 71/% 29)	24/7 (% 77.4% 22.6)
Occupation		
Housewife	18 (% 58.1)	21 (% 67.7)
Officer	6 (% 19.4)	2 (% 6.5)
Working	7 (22.6)	4 (% 12.9)
Unemployed	0 (% 0)	4 (% 12.9)
Previous treatment		
Physiotheraphy	6 (% 19.4)	1 (% 3.2)
Orthotic	8 (% 25.8)	6 (% 19.4)
Medical	5 (% 16.1)	7 (% 22.6)
Untreatment	12 (% 38.7)	17 (% 54.8)

Values are presented as mean ± standard deviation.
ESWT: extracorporeal shock-wave therapy; **KT:** kinesio taping; **BMI:** body-mass index.

Table 2. Results and statistical comparisons of pre-treatment (week 0) and posttreatment (month 1) parameters in ESWT group (n=31)

Elbow pain and QOL	Pre-treatment	Post-treatment	*P* (post-treatment)
Pain at rest (VAS)	6.3±1.4	3.1±2.8	<0.001*
Pain at night (VAS)	8.6±1.4	4.3±3.5	<0.001*
Pain under strain (VAS)	9.3±1.0	4.5±3.6	<0.001*
Quick DASH	47.4±16.4	24.1±20.1	<0.001*
SF36			
PF	61.8±21.7	80.5±11.4	<0.001*
RLPR	25.0±32.3	66.1±16.5	<0.001*
RLER	38.0±32.8	76.3±24.6	<0.001*
V	51.0±12.6	76.6±6.8	<0.001*
MH	46.2±12.0	69.8±7.4	<0.001*
SF	46.8±18.0	71.0±14.9	<0.001*
BP	39.1±20.0	77.3±12.6	<0.001*
GH	50.5±10.8	71.1±11.2	<0.001*

*p<0.05 by the Mann–Whitney *U* test
ESWT, extracorporeal shock-wave therapy; **VAS,** visual analogue scale; **DASH,** disabilities of the arm shoulder and hand; **PF,** physical functioning; **RLPR,** role limitation-physical reasons; **RLER,** role limitation-emotional reasons; **V,** vitality; **MH,** mental health; **SF,** social function; **BP,** bodily pain; **GH,** general health; **QOL,** quality of life.

Table 3. Results and statistical comparisons of pre-treatment (week 0) and post-treatment (month1) parameters in KT group (n=31)

Elbow pain and QOL	KT Pre-treatment	KT Post-treatment	*P* (post-treatment)
Pain at rest (VAS)	7.0±1.5	3.6±2.9	<0.001*
Pain at night (VAS)	8.8±1.1	4.5±3.3	<0.001*
Pain under strain (VAS)	9.3±0.8	4.8±3.5	<0.001*
Quick DASH	43.1±16.5	25.7±18.2	<0.001*
SF36			
PF	65.5±22.1	83.2±12.7	<0.001*
RLPR	21.8±33.4	65.3±21.1	<0.001*
RLER	53.8±36.2	75.3±22.7	<0.001*
V	49.2±8.1	76.0±6.2	<0.001*
MH	46.8±9.2	73.3±6.7	<0.001*
SF	54.8±9.2	73.4±15.4	<0.001*
BP	40.0±13.8	69.3±13.5	<0.001*
GH	49.2±17.2	74.4±9.8	<0.001*

*p<0.05 by the Mann–Whitney *U* test
KT: kinesio taping; **VAS:** visual analogue scale; **DASH:** disabilities of the arm shoulder and hand; **PF:** physical functioning; **RLPR:** role limitation-physical reasons; **RLER.** role limitation-emotional reasons; **V:** vitality; **MH:** mental health; **SF:** social function; **BP:** bodily pain; **GH:** general health; **QOL:** quality of life.

Table 4. Comparison of ESWT and KT groups on basis of pre-treatment and posttreatment

Elbow pain and QOL	ESWT Pre-treatment	KT Pre-treatment	*P* Pre-treatment	ESWT Post-treatment	KT Post-treatment	*P* Post-treatment
Pain at rest (VAS)	6.3±1.4	7.0±1.5	0.065	3.1±2.8	3.6±2.9	0.484
Pain at night (VAS)	8.6±1.4	8.8±1.1	0.486	4.3±3.5	4.5±3.3	0.824
Pain under strain (VAS)	9.3±1.0	9.3±0.8	0.786	4.5±3.6	4.8±3.5	0.776
Quick DASH	47.4±16.4	43.1±16.5	0.304	24.1±20.1	25.7±18.2	0.735
SF36						
PF	61.8±21.7	65.5±22.1	0.507	80.5±11.4	83.2±12.7	0.373
RLPR	25.0±32.3	21.8±33.4	0.700	66.1±16.5	65.3±21.1	0.867
RLER	38.0±32.8	53.8±36.2	0.076	76.3±24.6	75.3±22.7	0.859
V	51.0±12.6	49.2±8.1	0.512	76.6±6.8	76.0±6.2	0.698
MH	46.2±12.0	46.8±9.2	0.813	69.8±7.4	73.3±6.7	0.056
SF	46.8±18.0	54.8±9.2	0.084	71.0±14.9	73.4±15.4	0.532
BP	39.1±20.0	40.0±13.8	0.840	77.3±12.6	69.3±13.5	0.546
GH	50.5±10.8	49.2±17.2	0.512	71.1±11.2	74.4±9.8	0.223

ESWT: extracorporeal shock-wave therapy; **KT:** kinesio taping; **VAS:** visual analogue scale; **DASH:** disabilities of the arm shoulder and hand; **PF:** physical functioning; **RLPR:** role limitation-physical reasons; **RLER:** role limitation-emotional reasons; **V:** vitality; **MH:** mental health; **SF:** social function; **BP:** bodily pain; **GH:** general health; **QOL:** quality of life.

There were considerably significant improvements in all subscales of the SF36 (general health, physical functioning, physical role functioning, emotional role functioning, social functioning, bodily pain, mental health, and vitality) at 1 month compared to pre-treatment values (P<0.05; Table 2 and 3).

The comparison of ESWT and KT groups on basis of pre-treatment and posttreatment given in Table 4. However, when results for patients in the ESWT and KT groups before treatment (at week 0) and after treatment (at 1 month) were compared, no statistically significant difference was found between the groups in terms of VAS scores for pain at rest, at night, under strain, Quick DASH and evaluating functioning and pain of the affected arm in various daily life activities, or any subscale of the SF36 (P>0.05; Table 4).

DISCUSSION

Lateral epicondylitis is a common upper extremity disorder, for the treatment of which many methods have been proposed. Several studies have investigated the efficacy of available methods to treat LE, but the available evidence is limited, and no standard therapy exists. An effective and successful conservative therapy aims to control pain, promote soft tissue healing, control inflammation, and ensure optimal loading of the extensor tendon (26, 27). Although the effects of ESWT and kinesiotaping in LE treatment have been previously studied, comparative studies between the two have not been performed.

ESWT's efficacy in LE has been studied and success rates ranging between 68% and 91% have been reported (13). However, a number of studies have either shown that ESWT had no therapeutic effect or was less effective than placebo (28).

KT is commonly used for conservative management of musculoskeletal disorders. KT reduces pain at rest, night, and activity, and eases daily life activities (27, 29). According to Kenzo Kase, the taping technique strengthens weakened muscles and improves muscular function; it also facilitates lymphatic drainage and blood circulation by moving muscles and thereby reducing subcutaneous pressure; it reduces pain by stimulating free nerve endings and eliminating fluid accumulated around a tendon; it re-locates joints by displacing subluxed joints; it helps muscle and fascia function return by increasing muscle fibers and promotes sense of proprioception by increasing stimuli to dermal mechanoreceptors (17, 30). Dilek et al. followed patients to whom they applied KT for LE for 6 weeks and demonstrated that patients had their pain reduced and their functions and satisfaction increased at the end of the study period (31).

Eraslan et al. reported that KT, added on top of physiotherapy, reduced pain intensity and increased patient functionality (24). Our study aimed to determine the comparative effects of ESWT and kinesiological taping on pain, functionality, and quality of life in LE.

Our study did not demonstrate any significant difference between both patient groups with respect to demographic and clinical characteristics. Literature data have shown that the prevalence of tennis elbow is equal in both sexes and usually affects the dominant arm (27). We found a female/male ratio of 19/1 in the ESWT group and 23/8 in the kinesiotaping group. In line with the previous reports, the affected elbow region was in the dominant arm. We found that the VAS score, a scale we used to assess pain intensity at rest, night, and activity, was significantly reduced at fourth postoperative week in both the ESWT and kinesiotaping groups at a similar level, which was in accordance with the literature reports (32, 33). Our study employed DASH score for functional evaluation, which showed significant reduction in both groups, again to a statistically similar degree.

To date, many studies have utilized the sub-dimensions of SF 36 to rate quality of life (32, 34–36). In the present study, where the sub-dimensions of SF36 were used, we detected a significant improvement in both the ESWT and KT groups.

Several studies have previously compared available conservative treatments for lateral epicondylitis. A study that compared cryo-ultrasound and ESWT reported that ESWT led to reductions in VAS score at the end of a 1-year follow-up (37). Another study comparing corticosteroid injection and ESWT followed patients for 8 weeks and concluded that ESWT was as effective as injection (38). Another study indicated that, thanks to its ease of use and low side effect profile, ESWT may be used as an alternative to surgical methods (39). Another study comparing ESWT and splint use reported no difference between the conservative methods, with both ESWT and splint use being effective treatments (32).

Conservative therapies are primarily preferred in LE treatment, and the choice of therapy is usually dictated by a patient's status and the experience of a treating physician. We here in aimed to compare the efficacies of ESWT and kinesiotaping methods, which we commonly use in our clinic, in LE treatment. We are of the opinion that, owing to their non-invasive natures, ease of use, low side effect profiles, and favourable patient compliance, both treatment methods can be preferred to treat LE.

Limitations of study

One of the limitations in this study was no follow-up for long-term effect. The follow-up was up to 4 weeks after treatment. Another limitation is that there was no control or plasebo group in this study. We didn't use a hand dynamometer to evaluate grip strength and the analysis of strength of handgrip.

CONCLUSION

In this study, we reported that treatment effect of kinesiotaping to lateral epicondylitis is similar to that of ESWT. Both treatments significantly improved pain score, functional status and patient satisfaction.

Informed Consent: Retrospective research

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - TES; Design - TES, HS; Supervision - TES; Fundings - HS; Materials - HS; Data Collection and/or Processing - TES; Analysis and/or Interpretation - TES; Literature Search - TES; Writing Manuscript - TES, HS; Critical Review - TES

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REFERENCES

1. Calfee RP, Patel A, DaSilva MF, Akelman E. Management of lateral epicondylitis: current consepts. J Am Acad Orthop Surg 2008;16:19–29. [CrossRef]
2. Tosti R, Jennings J, Sewards JM. Lateral epicondylitis of the elbow. Am J Med 2013;126:e1.357–e6. [CrossRef]
3. Shiri R, Viikari-Juntura E, Varonen H. Heliovaara M. Prevalence and determinants of lateral and medial epicondylitis: a population study. Am J Epidemiol 2006;164:1065–1074. [CrossRef]
4. Galloway MT, Lalley AL, Shearn JT. The role of mechanical loading in tendon development, maintenance, injury, and repair. J Bone Joint Surg Am 2013;95:1620–1628. [CrossRef]
5. Hong QN, Durand M, Loisel P. Treatment of lateral epicondylitis: where is the evidence? Joint Bone Spine 2004;71:369–373. [CrossRef]
6. Nordin M, Frankel VH. Basic biomechanics of the musculoskeletal system, 3rd ed. US: Lippincott Williams & Wilkins; 2001. p.340–57.
7. Trentini R, Mangano T, Repetto I, et al. Short- to mid-term follow-up effectiveness of US-guided focal extracorporeal shock wave therapy in the treatment of elbow lateral epicondylitis. Musculoskelet Surg 2015;99:91–97. [CrossRef]
8. Chan HL, Ng GY. Effect of counterforce forearm bracing on wrist extensor muscles performance. Am J Phys Med Rehabil 2003;82:290–5. [CrossRef]
9. Coombes BK, Bisset L, Vicenzino B. Efficacy and safety of corticosteroid injections and other injections for management of tendinopathy: a systematic review of randomized controlled trials. Lancet 2010;376:1751–1767. [CrossRef]
10. Haahr JP, Andersen JH. Prognostic factors in lateral epicondylitis: a randomized trial with one-year follow up in new cases treated with minimal occupational intervention or the usual approach in general practice. Rheumatology (Oxford) 2003;42:1216–1225. [CrossRef]
11. Kochar M, Dogra A. Effectiveness of a specific physiotherapy regimen on patients with tennis elbow. Physiotherapy 2002;88:333–4. [CrossRef]
12. Wong CW, Ng EY, Fung PW, Mok KM, Yung PS, Chan KM. Comparison of treatment effects on lateral epicondylitis between acupuncture and extracorporeal shockwave therapy. Asia Pac J Sports Med Arthrosc Rehabil Technol 2017;7:21–26. [CrossRef]
13. Wang CJ. Extracorporeal shockwave therapy in musculoskeletal disorders. J Orthop Surg Res 2012;7:11. [CrossRef]
14. Buchbinder R, Green SE, Youd JM, Assendelft WJ, Barnsley L, Smidt N Systematic review of the efficacy and safety of shock wave therapy for lateral elbow pain. J Rheumatol 2006;33:1351–1363. https://www.jrheum.org/content/jrheum/33/7/1351.full.pdf
15. Bassett KT, Lingman SA, Ellis RF. The use and treatment of kinaesthetic taping for musculoskeletal conditions: A systematic review. New Zealand J Physiother 2010;38:56–62.
16. Kase K, Tatsuyuki H, Tomoki O. Development of kinesio tape. Kinesio taping perfect manual. Kinesio Taping Assoc 1996;6:117–118.
17. Kase K, Wallis J, Kase T. Clinical therapeutic applications of the Kinesio taping method. Kinesio® 2003; Taping Association, Albuquerque.
18. Kaya E, Zinnuroglu M, Tugcu I. Kinesio taping compared to physical therapy modalities for the treatment of shoulder impingement syndrome. Clin Rheumatol 2011;30:201–207. [CrossRef]
19. Manias P, Stasinopoulos D. Controlled clinical pilot trial to study the effectiveness of ice as a supplement to the exercise programme for the management of lateral elbow tendinopathy. Br J Sports Med 2006;40:81–85. [CrossRef]
20. Gummesson C, Ward MM, Atroshi I. The shortened disabilities of the arm, shoulder and hand questionnaire (Quick-DASH): validity and reliability based on responses within the full-length DASH. BMC Musculoskelet Disord 2006;7:44. [CrossRef]
21. Hudak PL, Amadio PC, Bombardier C, et al. Development of an upper extremity outcome measure: the DASH (disabilities of the arm, shoulder and hand) (corrected). The Upper Extremity Collaborative Group (UECG). Am J Ind Med 1996;29:602–608. [CrossRef]
22. Kocyiğit H, Aydemir O, Fişek G, Olmez N, Memis A. Kısa form-36 (KF-36)'nın Türkçe versiyonunun güvenilirliği ve geçerliliği: romatizmal hastalığı olan bir grup hasta ile calışma. İlac Tedavi Derg 1999;12:102–106.
23. Wang G, Gao Q, Hou J, Li J. Effects of temperature on chronic trapezius myofascial pain syndrome during dry needling therapy. Evid Based Complement Alternat Med 2014;2014:638268. [CrossRef]
24. Eraslan L, Yüce D, Erbilici A, Baltacı G. Does Kinesiotaping improve pain and functionality in patients with newly diagnosed lateral epicondylitis? Knee Surg Sports Traumatol Arthrosc 2018;26:938–945. [CrossRef]
25. Park JW, Hwang JH, Choi YS, Kim SJ. Comparison of Therapeutic Effect of Extracorporeal Shock Wave in Calsific Versus Noncalcific Lateral Epicondylopathy. Ann Rehabil Med 2016;40:294–300. [CrossRef]
26. Theis C, Herber S, Meurer A, Lehr HA, Rompe JD. Evidence based evaluation of present guidelines for the treatment of tennis elbow-a review. Zentralbl Chir 2004;129:252–60. [CrossRef]
27. Waseem M, Nuhmani S, Ram CS, Sachin Y. Lateral epicondylitis: A review of the literature. J Back Musculoskelet Rehabil 2012;25:131–142. [CrossRef]
28. Staples MP, Forbes A, Ptasznik R, Gordon J, Buchbinder R. A randomized controlled trial of extracorporeal shock wave therapy for lateral epicondylitis (tennis elbow). J Rheumatol 2008;35:2038–46. https://pubmed.ncbi.nlm.nih.gov/18792997/
29. Shamsoddini A, Hollisaz MT. Effects of taping on pain, grip strength and wrist extension force in patients with tennis elbow. Trauma Mon 2013;18:71–74. [CrossRef]
30. Aiken AB, Pelland L, Brison R, Pickett W, Brouwer B. Short-term Natural Recovery of Ankle Sprains Following Discharge from Emergency Departments. J Orthop Sports Phys Ther 2008;38:566–571. [CrossRef]
31. Dilek B, Batmaz İ, Sarıyıldız AM, et al. Kinesio taping in patients with lateral epicondylitis. J Back Musculoskelet Rehabil 2016:853–858. [CrossRef]
32. Aydın A, Atiç R. Comparison of extracorporeal shock-wave therapy and wrist-extensor splint application in the treatment of lateral epicondylitis: a prospective randomized controlled study. J Pain Res 2018;11:1459–1467. [CrossRef]
33. Rompe JD, Decking J, Schoellner C, Theis C. Repetitive low-energy shock wave treatment for chronic lateral epicondylitis in tennis players. Am J Sports Med 2004;32:734–43. [CrossRef]
34. Akkurt E, Kucuksen S, Yılmaz H, Parlak S, Sallı A, Karaca G. Long term effects of high intensity laser therapy in lateral epicondylitis patients. Lasers Med Sci 2016;31:249–253. [CrossRef]
35. Kaux JF, Delvaux F, Schaus J, et al. Cross-cultural adaptation and validation of the Patient-Rated Tennis Elbow Evaluation Questionnaire on lateral elbow tendinopathy for French-speaking patients. J Hand Ther 2016;29:496–504. [CrossRef]
36. Nascimento AT, Claudio GK. Arthroscopic surgical treatment of recalcitrant lateral epicondylitis: series of cases. Rev Bras Ortop 2017;52:46–51. [CrossRef]
37. Vulpiani MC, Nusca SM, Vetrano M, et al. Extracorporeal shock wave therapy vs cryoultrasound therapy in the treatment of chronic lateral epicondylitis: one year follow up study. Muscles Ligaments Tendons J 2015;20;5:167–174. [CrossRef]
38. Lee SS, Kang S, Park NK, et al. Effectiveness of initial extracorporeal shock wave therapy on the newly diagnosed lateral or medial epicondylitis. Ann Rehabil Med 2012;36:681–687. [CrossRef]
39. Radwan YA, Elsobhi G, Badawy WS, Reda A, Khalid S. Resistant tenis elbow: shock-wave therapy versus percutaneous tenotomy. Int Orthop 2008;32:671–677. [CrossRef]