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Comparison of two ultrasonographic localization techniques for the treatment of lateral epicondylitis with extracorporeal shock wave therapy: a randomized study

Gianluca Melegati, **Davide Tornese**, **Marco Bandi** and **Manuela Rubini** Center for Sports Rehabilitation, Galeazzi Orthopedics Institute, Milan, Italy

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Objective: To describe and compare two ultrasonographic localization techniques for the treatment of lateral epicondylitis with extracorporeal shock wave therapy (ESWT).
Design: Forty-one subjects selected through clinical examination were randomly assigned to two groups of treatment.
Interventions: Each subject received a three-session ultrasound-guided ESWT (performed weekly). Lateral tangential focusing was used in group A, whereas back tangential focusing was used for group B.
Main outcome measures: Total Elbow Scoring System (TESS) and a visual analogue scale (VAS) were used to evaluate each subject before the treatment and at six months follow-up.
Results: TESS and VAS pretreatment scores were homogeneous between the groups ($p > 0.05$). In both groups there was a significant ($p < 0.05$) increase in the TESS score and a decrease in the VAS score but there was no resolution of the pain. TESS and VAS follow-up scores were homogeneous between the two groups ($p > 0.05$).
Conclusions: There was no difference between the two techniques of using ESWT.

Introduction

Over the past few years, extracorporeal shock wave therapy (ESWT) has been applied to treat lateral epicondylitis. Opinions on its effectiveness in treating tennis elbow are controversial. Some authors such as Rompe *et al.*[1] and Wang and Chen[2] report good results, whereas Crowther *et al.* found that in the medium term, local injection of steroid is more successful and 100 times cheaper than ESWT in the treatment of tennis elbow.[3] Speed *et al.* in a double-blind randomized controlled trial found no evidence of added benefit of ESWT when compared with sham therapy.[4] In addition Haake *et al.* in a randomized multicentre study concluded that previously reported success of ESWT in tennis elbow appears to be attributable to inappropriate study designs and suggest improving the quality of the trials.[5]

The aim of this study was to describe and compare two ultrasonographic localization techniques for the treatment of lateral epicondylitis with

Address for correspondence: Davide Tornese, Istituto Ortopedico Galeazzi, Unità Operativa di Riabilitazione dello Sport, Via R. Galeazzi 4, 20161 Milano, Italy. e-mail: davidzai@tin.it

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ESWT. Such an issue has not been evaluated before.

Materials and methods

Between June and October 2002, 41 subjects affected by lateral epicondylitis were visited at the Center for Sports Rehabilitation of the Galeazzi Orthopedics Institute in Milan. Diagnosis of lateral epicondylitis was done on the basis of clinical examination that included painful palpation of the lateral epicondyle, painful resisted wrist extension (Thomsen test) and painful resisted middle finger extension.

Inclusion criteria were: adults over the age of 18 years with unilateral lateral elbow pain for at least three months. Dysfunction of shoulder–neck and thoracic region, local arthritis, generalized polyarthritis, neurological abnormalities, radial nerve entrapment, pregnancy, infectious diseases, tumours and disorders of coagulation represented the exclusion criteria.

In a previous article we stated that local steroid injections can negatively influence the effects of ESWT in treating painful subcalcaneal spurs[6] due to their related collagen tissue damage.[7] Hence, previous local steroid injections represented an additional exclusion criteria.

The patients included in this study were assigned by exchanged block randomization to two groups: group A consisted of 21 subjects, group B consisted of 20 subjects. Three sessions of ESWT treatment (one session every week) were given to each subject. Each session consisted of 1800 pulses (each treatment) at an energy density of 0.16 mJ/mm^2, which was reached within 400 pulses. None of the patients needed local anaesthesia. ESWT was performed by the same physician for all the subjects in this study. For the ESWT treatment we used an electromagnetic lithotriptor (Epos Ultra; Dornier MedTech, Wessling, Germany), fitted with a linear ultrasonographic probe (7.5 MHz). Ultrasound-guided therapy was performed, positioning the therapeutic head differently depending on the group.

- *Group A*: Lateral tangential focusing; with the patient sitting facing the device, elbow completely bent and forearm on the table, the therapeutic head was positioned on the side of the elbow with the ultrasonographic probe on the lateral epicondyle (Figure 1).
- *Group B*: Back tangential focusing; with the patient sitting with his back towards the device, elbow bent at 90° forearm on the table, the therapeutic head was positioned on the back of the elbow, with the ultrasonographic probe on the lateral epicondyle (Figure 2).

In both cases, the energy flow of the shock waves tangentially crossed the enthesis of wrist extensors, thus avoiding the pain caused by directly hitting the periosteum.

Self-assisted stretching of the extensors of the wrist completed the rehabilitation programme. Subjective data were collected before the treatment and after six months using the Total Elbow Scoring System (TESS) (Table 1).[8]

The evaluations were compiled by the same physician who performed ESWT. In addition all the subjects completed a 10-cm visual analogue scale (VAS) prior to the first ESWT session and at six months follow-up. In such a scale 0 was considered as no pain and 10 as severe pain.

At the beginning of ESWT all the subjects signed an informed consent about the contraindications. The results were statistically evaluated using the Wilcoxon paired rank test. Power analysis, sample descriptive statistics and ANOVA were

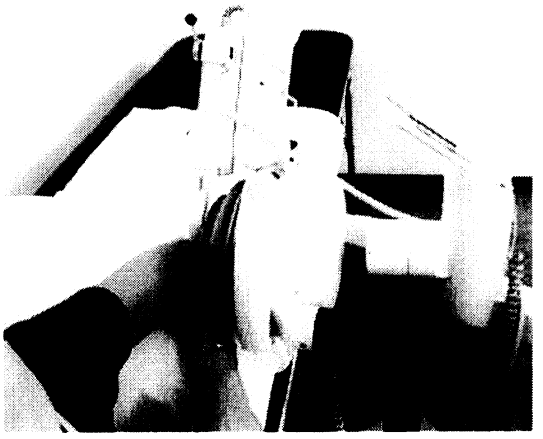

Figure 1 Lateral tangential focusing.

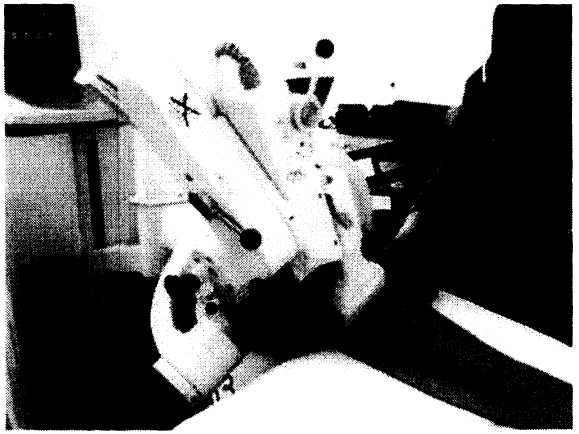

Figure 2 Back tangential focusing.

also used. A flowchart for the study is shown in Figure 3.

Results

In group A there were 13 men and eight women; mean age was 43.8 +/ − 7.5 years. In this group the mean length of symptoms was 9.3 +/ − 3 months. In group B there were 12 men and eight women; mean age was 44.8 +/ − 10.2 years. In this group the mean length of symptoms was 8.1 +/ − 2.7 months.

The scores for TESS and VAS are shown in Table 2. All subjects were evaluated before ESWT treatment and after six months. There was no statistically significant difference between the initial TESS and VAS mean values of groups A and B ($p > 0.05$). The increase in TESS follow-up scores was significant both in group A and in group B ($p < 0.05$). The VAS decrease was significant at the follow-up both in group A and in group B ($p < 0.05$), whereas there was no statistically significant difference between follow-up TESS and VAS mean values of groups A and B ($p > 0.05$).

Discussion and conclusions

Localization of lateral epicondyle and wrist extensors enthesis can be done through a fluoroscopy unit incorporated into the ESWT device[1,9] or through an ultrasonographic device.[2,4] In the Rompe *et al.*[1] and Krischek *et al.*[9] articles there are pictures of the fluoroscopic localization technique, whereas in the Crowther *et al.* and Speed *et al.* articles no details are given on ultrasonographic targeting.[3,4]

Table 1 Total Elbow Scoring System (TESS)

Parameter	Finding	Points
Pain	None or ignores	50
	Slight with occasional pain medication	45
	Moderate with daily pain medication	35
	Moderate with rest or night pain	15
	Severe disabled	0
Function	No limitation	30
	Slight limitation but no restriction in activities of Daily living	25
	Unable to lift object > 10 lb (4.5 kg)	20
	Moderate restrictions of activities of daily living	10
	Unable to comb hair or touch head	5
	Unable to feed self	0
Bending activities	For 30 minutes	8
	For 15 minutes	6
	For 5 minutes	4
	Cannot use elbow	0
Activity	Unlimited	12
	Limited for recreation	10
	Household work and employment	8
	Independent self-care	6
	Invalid	0

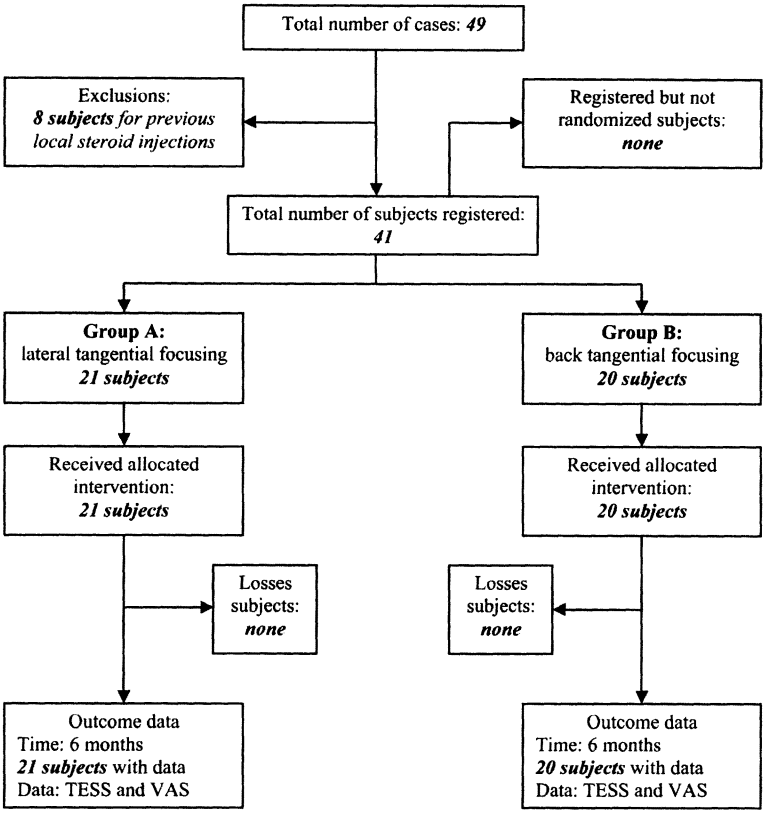

Figure 3 Flowchart of the study.

At the beginning of our ESWT study we used the fluoroscopic localization technique supplied with the ESWT device,[1,9] putting the therapeutic head directly on the lateral epicondyle (we called it the perpendicular technique). Probably because in this technique the shock waves hit the periosteum, the pain during ESWT was intense and often not tolerated by the patients.

In this study we did not use local anaesthesia. In fact, following Russo's suggestions, two parameters are used to focus the ESWT upon the target area: first the ultrasonographic localization of the region of interest and secondly the alterations of the focus while searching for the points of maximum reproduction of local pain.[10] Therefore we tried to use targeting techniques other than the

Clinical messages

- Lateral and back tangential focusing techniques are equivalent as regards therapeutic results.
- Extracorporeal shock wave therapy decreases symptoms but does not eliminate the epicondylalgia.

Table 2 TESS and VAS mean scores and standard deviations

	Group A	Group B
Initial TESS	62.8±12.9	57.8±19.4
Six months follow-up TESS	86.5±15.2	88.3±7.7
Initial VAS	6.9±1.5	7.8±1.6
Six months follow-up VAS	2.3±2.3	3.3±1.7

TESS, Total Elbow Scoring System; VAS, visual analogue scale.

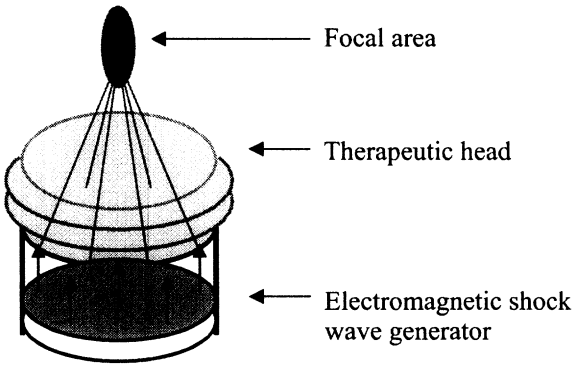

Figure 4 Focal area.

perpendicular one, which were less painful for the patient in order to avoid using local anaesthesia.

The focal area of the shock wave is defined as the area in which 50% of the maximum energy is reached. The focal area of the ESWT device used in this study has an 'elliptical cigar' shape with the greater axis oriented in the same direction of the shock wave flux (Figure 4).

According to TESS and VAS scores both localization techniques gave a decrease of symptoms but did not eliminate the pain. Such assessments are subjective and therefore liable to bias from expectation. In this study there was no control group so no additional conclusions can be drawn about the effectiveness of ESWT.

We have decided to make a maximum six-month follow-up according to the Haake *et al.* hypothesis about possible spontaneous amelioration of symptoms in the long term.[5]

Considering the three-dimensional development of the therapeutic focal area we believe that lateral tangential focusing works better. In fact, through small movements, the enthesis can be completely hit by the pulses. In contrast, with back tangential focusing, the convex profile of the epicondyle could prevent the complete treatment of the enthesis.

Hence we use lateral longitudinal focusing to treat lateral epicondylitis even if both forms of focusing have the same effect.

Acknowledgements

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