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## Extracorporeal shock wave therapy unsuccessful for chronic medial epicondylitis

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**Abstract** Medial epicondylitis is a chronic noninflammatory condition resulting from mechanical injury. Despite many treatment options, including rest, medications, physiotherapy and operative interventions, the results are too often poor; thus new treatment options are sought. We treated 4 men with chronic epicondylitis (5 affected joints) with extracorporeal shock wave therapy after failed attempts of other treatments. The patients' complaints were graded with the Nirschl scoring system prior to and six months after therapy. The treatment consisted of three sessions, at 20-day intervals, of 3000 pulses of ultrasonic shock waves from a Piezolith 3000 unit (energy dosage was gradually increased to reach step 10 equaling 0.9 mJ/mm<sup>2</sup>). At the 6-month follow-up, no patient was pain free. Three cases had slightly lower Nirschl scores than prior to the procedure but the patients rated this difference as insignificant; two cases were unchanged. No compli-

cations were observed but all patients rated the procedure as very unpleasant. The well recognized biologic effects of ultrasonographic waves (heat generation, oscillations, cavitation, etc.) that result in functional and structural changes of cellular membranes with sonochemical reactions (acceleration of normal metabolism, oxygenation and reduction in water solutions, polymer degradation, etc.), even if present in our cases, did not result in a noticeable decrease of symptoms, even though we used high energy and more impulses per session. Significant variations in methodology make inconclusive the results of numerous reports on the use of extracorporeal shock waves in epicondylar degenerative problems, although ineffectiveness of such therapy is the conclusion of a review by Haake and colleagues.

**Key words** Extracorporeal shock wave therapy • Medial epicondylitis • Nirschl scoring system

### Introduction

Medial epicondylitis (ME) is thought to be secondary to degeneration of the common flexor origin. It is now accept-

ed that it is not an inflammatory condition but a fibroblastic and vascular response, pathologically known as angiofibroblastic degeneration although more commonly referred to as tendinosis (instead of tendonitis) [1–3]. Pain is the predominant symptom and is present at this site about half

as frequently as over the lateral epicondyle (“tennis elbow”) [3]. The injury eventually leading to ME is usually caused by active contraction with forearm pronation and wrist palmar flexion, combined with extension at the elbow, resulting in an eccentric, repetitive overload being applied to the flexor-pronator mass. The additional valgus stress being applied with the throwing mechanism exacerbates this mechanical predisposition to overload the flexor pronator mass (“goalies elbow”) [2, 4, 5].

With the diagnosis being mainly clinical, requiring no imaging, this condition usually responds to conservative therapy. Standard initial treatment of soft tissue injuries is based on the principles of RICE (rest, ice, compression, elevation), while avoiding the HARM-ful factors (heat, alcohol, running, massage) [2, 3, 5, 6]. While it is recognized that steroid injections may provide symptomatic relief and create a pain-free window of opportunity to optimize the patient’s rehabilitation exercises, there is no evidence that steroids promote healing. Other treatments such as forms of immobilization (e.g. elbow straps) may even cause deleterious effects rather than cure [5, 7, 8]. More recently, an injection of autologous blood has been described as a treatment for lateral epicondylitis [6].

Numerous reports define physical and biochemical changes in soft tissues and bone interfering with ultrasonographic wave of different characteristics. These are often believed to relieve various soft tissue problems, also epicondyloses [9]. Waves of different energy are sometimes used for degenerative and inflammatory conditions of tendineous insertions [2, 9–13].

The outcome is often dissatisfying and treatment protracted. Although patients may present with acute symptoms, the degenerative nature of tendon pathology means that there has usually been a period of failed tendon adaptation to load through abusive training, for many months before symptoms are felt. Therefore, not only does the condition take months to develop but many months to resolve with bouts of recurrence and vulnerability to reinjury [2].

Our study was designed to prospectively evaluate the results of ultrasonographic shock waves for ME refractory to various other methods of conservative treatment.

## Materials and methods

From 2002 to 2005, four men were diagnosed with ME. One patient (also the first author of this paper) was affected bilaterally (five epicondyloses). No patients responded to conservative treatment (non-steroid anti-inflammatory drugs, rest, steroid injections, stretching exercises and some form of physiotherapy) and all, except the author-patient, were referred from orthopedic and physiotherapy offices. None could recollect an acute injury that initiated their condition and all had a

**Table 1** Nirschl scoring system for elbow tendinosis [10]

1. Mild pain with exercise, resolves within 24 hours
2. Pain with exercise, exceeds 48 hours
3. Pain with exercise, does not alter activity
4. Pain with exercise, alters activity
5. Pain with heavy activities of daily living
6. Pain with light activities of daily living, intermittent pain at rest
7. Constant pain at rest, disrupts sleep

history of at least one previous temporary improvement. The patients complaints were categorized according to the Nirschl scoring system (Table 1) [10].

In 2006, the patients received treatment with extracorporeal shock wave therapy (ESWT). At treatment, their mean age was 42 years (range, 34–45) and the mean time from onset of symptoms was 22 months (range, 12–30). None of the participants had contraindications to ultrasound therapy nor other medical conditions in the vicinity of the elbow. All patients but the author-patient received a single dose of 7.5 mg midazolam sublingually one-half hour prior to each session. Treatment consisted of three sessions, at 20-day intervals, of 3000 pulses of ESWT. The energy dosage was gradually increased to reach step 10 equaling 0.9 mJ/mm<sup>2</sup> depending on the patient’s pain tolerance. Pulse rate was set at 2 Hz. In all sessions, a Piezolith 3000 unit (Richard Wolf, Knittlingen, Germany) with piezoelectric generation of mechanical shock waves was used. We used ultrasonographic (US) localization of the target region in conjunction with clinical findings at site of maximum reproduction of local pain by the subject at initiation of therapy [9, 11].

After six months, all participants had a definitive follow-up examination with Nirschl score grading. Apart from ESWT, all had restrained from activities previously identified as intensifying symptoms. During the 6-month follow-up period, no other form of treatment except withdrawal from pain triggering activities was used.

## Results

All patients completed the three treatment sessions and the 6-month follow-up. After six months, none of the study participants was pain free. Two (three epicondyloses) had a lower Nirschl score (by 1–2 points) than prior to the procedure, while two were unchanged (Table 2). There were no complications during and after the procedure (no subcutaneous haematoma or ulnar nerve damage were observed). All patients rated the procedure as very unpleasant or even painful.

## Discussion

There are numerous reports on the use of ESWT in epicondylar (mainly lateral) soft tissue problems, but the

**Table 2** Clinical characteristics of 4 men with epicondylitis, before and after extracorporeal shock wave therapy

Patient	Age, years	Side	Activity associated with onset of symptoms	Previous treatments	Nirschl score	
					Pretreatment	Follow-up
1	42	Left	Canoeing	NSAIDs, ultrasound, magnetic fields, electrotherapy with topical steroids, orthosis, rest, two local steroid injection	6	5
		Right	Canoeing	As above	6	5
2	34	Right	Biking	NSAIDs, rest (immobilization), acupuncture, dry massage	6	4
3	47	Right	Unknown	NSAIDs, rest, cryotherapy, dry massage, local steroid injection	5	5
4	45	Right	Tennis	NSAIDs, rest, orthosis, dry needling, cryotherapy	4	4

*NSAIDs*, non-steroidal anti-inflammatory drugs

results are inconclusive [3, 12–17]. The methodology varies greatly (number of sessions, energy doses, positioning of the patient, methods of evaluation), so comparisons and conclusions are difficult to make.

Results of US wave-tissue interaction depend mostly on the amount of energy absorbed (Grotthus-Draper law) [18]. The positioning of the patient is also of crucial value due to the physical features of the ultrasonographic wave and the absorbing tissues. In order to enhance the absorption, we used a perpendicular direction of US, using high frequency of the wave (more powerful effect in superficial tissues). Biologic effects of ultrasonographic waves include heat generation in tissues with better absorption coefficient (bone, tendons, muscles) and a plethora of other mechanical consequences (oscillations, cavitation, etc.), resulting in a decrease of the membrane potential and changes in its lipid structure. Sonochemical reactions (acceleration of normal metabolism, oxygenation and reduction in water solutions, polymer degradation, etc.) have also been described [18]. In our group these effects, even if present, did not result in a noticeable decrease of symptoms. According to our patients reduction in the Nirschl score by 1 point is not a significant improvement. Additional bias comes from the significant reduction in patients' activities throughout the study period. Rest is believed to be a major factor involved in receding pain [3, 12–14]. Repetitive estimation of pain intensity as in the Nirschl method has proved its value, for estimation of both the severity of the disease and the results of treatment [3, 19, 20]. Because all our patients were refractory to standard treatment and were referred for ESWT as “unresponsive” cases, forming another bias of our study.

Since few studies have investigated the use of ESWT in ME, we compared our results with those concerning lateral (extensor) problems. According to Fichez [21], ESWT significantly reduced pain and improved function compared

with placebo. The application of extracorporeal shock waves of varying intensity in chronic tendonitis produced subjective pain reduction in 87% of 55 patients treated; however, five patients showed no improvement [21]. Wang and Chen [22] investigated the effects of shockwave therapy in 57 patients with lateral epicondylitis of the elbow. Forty-three patients (24 men and 19 women, average age of 46 years) were treated with 1000 impulses of shockwave therapy to the affected elbow, and six additional patients were treated with a sham procedure as a control group. A 100-point scoring system was used to evaluate pain, function, strength and elbow range of motion. After 1–2 years, 61.4% elbows were free of complaints, 29.5% were significantly better, 6.8% were better, and 1 (2.3%) was unchanged [22]. Similarly, improvement after ESWT was found in many other studies of chronic lateral epicondylitis, despite varying physical features of the therapy. Most often, ESWT is used as 3 weekly sessions of 500 impulses of around 0.18 mJ/mm<sup>2</sup> [12, 13, 15, 16, 20, 22]. We used higher energy and more impulses per session, hoping for a more evident success rate, but we did not see any significant improvement.

Similarly, in a review of 20 published studies concerning the use of ESWT for lateral epicondylitis, Haake et al. [17] found no evidence of a positive effect of the therapy, and concluded that it should not be used as standard therapy but only in high quality studies. Krischek et al. [20] used ESWT to treat 30 patients with chronic ME, and reported good results in only six cases. They also stated that their results were significantly inferior to those in LE patients [20]. A Cochrane systematic review by Buchbinder et al. [25] did not support the use of ESWT in LE, but rather favored steroid injections. Although the small number of “difficult” cases in this study does not permit any absolute conclusion, ESWT seems to be ineffective for the management of chronic ME non-responsive to traditional conservative therapy.

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