**Dingemanse R, Randsdorp M, et al. Evidence for the effectiveness of electrophysical modalities for treatment of medial and lateral epicondylitis: a systematic review. Br J Sports Med. 2014;48(12);957-65.**

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Design: systematic review of randomized clinical trials

Purpose of study: to present an evidence-based overview of the effectiveness of electrophysical modalities such as ultrasound, laser, shock wave, TENS, and pulsed electromagnetic field therapy in patients with either medial or lateral epicondylitis

PICOS:

* Patient population: patients with either medial or lateral epicondylitis
	+ Epicondylitis caused by either acute trauma or by systemic disease was excluded
* Interventions: ultrasound, laser, electrotherapy, extracorporeal shock wave therapy, transcutaneous electrical nerve stimulation and pulsed electromagnetic field therapy
* Comparison/control: placebo/sham intervention, exercise treatment, massage, acupuncture, chiropractic, physical therapy (hot pack, friction massage, etc), and percutaneous tenotomy
* Outcomes: results on pain, function, or global recovery
* Study types: systematic reviews (SR) and randomized controlled studies published in English, French, German, or Dutch

Study selection:

* Databases were Cochrane Library, PubMed, EMBASE, CINAHL, and PEDro up to February 2010 (for SR) and through August 2012 (for randomized trials)
* Two authors independently selected articles for inclusion and two authors independently assessed study quality
	+ Quality considerations were the method of randomization, allocation concealment, blinding of patients, providers, and outcome assessors, adequate retention of patients with adequate accounting for loss to followup, intention-to-treat analysis, freedom from selective outcome reporting, baseline similarity, avoidance of co-intervention bias, acceptable compliance, and similar timing of outcome assessment
	+ If 50% or more of these considerations were satisfactory, the study was rated high quality; otherwise, it was rated low quality
* Five different levels of evidence were created for purposes of the review:
	+ Strong evidence: consistent (i.e., when ≥75% of the trials report the same findings) positive (significant) findings within multiple higher quality RCTs.
	+ Moderate evidence: consistent positive (significant) findings within multiple lower-quality RCTs and/or one high-quality RCT.
	+ Limited evidence for effectiveness: positive (significant) findings within one low-quality RCT.
	+ Conflicting evidence: provided by conflicting (significant) findings in the RCTs (<75% of the studies reported consistent findings)
	+ Evidence of no effect: RCT(s) available, but no (significant) differences between the intervention and control groups were reported
* The authors did not pool data in a meta-analysis due to heterogeneity of interventions and outcome measures, but instead conducted a “best evidence” synthesis, which is a qualitative summary of results from disparate studies whose results do not lend themselves to statistical pooling

Results:

* The initial literature search yielded 12 potentially relevant reviews and 227 RCTs; the final selection included 2 SR and 20 RCTs
	+ The two SR used different but similar quality assessment instruments, and scores of 50% or greater defined high quality
	+ One SR used the Maastricht-Amsterdam criteria list and the other used the Cochrane Library criteria; the essentials of each list are similar to that used by the authors
* The authors’ discussions of the separate interventions first summarized evidence from available systematic reviews, followed by evidence from more recent RCTs
* No reviews or RCTs were found for medial epicondylitis; therefore, all of the evidence assembled was for interventions for lateral epicondylitis (LE)
* The first intervention to be considered for LE was ultrasound (US) versus placebo or no treatment
	+ For US, the authors used one SR (Smidt 2003) and one more recent RCT from 2006
	+ The SR used three high-quality studies of US versus placebo
	+ Two of these studies reported no significant benefits of US on general improvement at 5 weeks followup, but one study found a significant difference on general improvement at 8 weeks
	+ The SR calculated a significant improvement on pain by pooling data from two studies which yielded a standardized mean difference (SMD) of 0.98 with a 95% confidence interval from 0.33 to 1.64 in favor of US
	+ The 2006 RCT found no difference between US and placebo
	+ The authors rated the evidence for US vs placebo as “conflicting”
* The second comparison was between US versus five separate active interventions (not placebo)
	+ US was compared to US plus friction massage in one study (n=9), but no effect was found for friction massage as an add-on to US
	+ Local pulsed US was compared in a low-quality RCT to an exercise program with progressive strengthening and stretching; the exercise program was superior to US at 36 month followup
	+ One high-quality RCT compared three groups of patients, all of whom had an exercise program, but were randomized to US, a daytime brace, and laser; no differences were found between the three groups on pain or grip strength at 6 weeks followup
	+ A low-quality RCT (n=14) found significant results in favor of US versus chiropractic therapy on pain and pain-free function at 6 weeks followup
	+ A high quality RCT (n=16) found no difference between US and acupuncture on pain, grip strength, and hand function at 4 weeks follow-up
* The third comparison was between laser and placebo
	+ There was conflicting evidence from the SR of Smidt 2006 and from two more recent RCTs for laser versus placebo in the short term and evidence of no difference in effect on mid-term and long-term followup
* The fourth comparison was between laser and two separate active interventions
	+ A single high-quality RCT (n=50) compared laser plus plyometric exercises versus placebo laser plus plyometric exercises and reported that the group which received laser had more favorable pain and grip strength scores at 8 weeks than the group which received placebo laser, interpreted by the authors as moderate level evidence of the effectiveness of laser for short term followup
	+ A single high quality study (n=15) compared US plus friction massage versus laser therapy on pain and global improvement, reporting that US plus friction massage was more effective than laser, but the two interventions did not differ with respect to global improvement
* Pulsed electromagnetic field therapy (PEMF) was compared to placebo PEMF; three studies found no difference between PEMF and placebo PEMF
* One low quality trial compared patients in three groups: low-frequency TENS, high-frequency TENS, and sham TENS; both TENS groups had lower pain scores at 2 weeks than the sham TENS, but the high and low frequency groups did not differ; this was interpreted as limited evidence for high or low frequency TENS in the very short term
* A Cochrane review (Buchbinder 2005) of ESWT found nine RCTs of ESWT versus placebo; the high-quality studies found no difference between ESWT compared to placebo at 1, 3, 6, and 12 months of followup
	+ Following the Buchbinder review, four more recent high quality RCTs were found, but there was conflicting evidence from these studies, with two finding no significant differences at 4 and 6 weeks, and two finding significant differences on pain at either 12 or 8 weeks followup
	+ The authors summarized the evidence on ESWT as “conflicting” for ESWT in the short term and as showing evidence of no difference in the mid-term and long term
* ESWT was also compared to percutaneous tenotomy and to physical therapy (combination of hot back, US, and friction massage )
	+ For both interventions, there was evidence of no difference on the effect of ESWT versus the tenotomy or combination PT

Authors’ conclusions:

* Most studies of lateral epicondylitis reported results on short term outcomes and only 30% reported mid-term to long term followup
* There is moderate effectiveness for ultrasound versus placebo on mid-term followup
* Ultrasound plus friction massage shows moderate evidence in the short term compared to laser
* For all other modalities, there is conflicting evidence or evidence of no difference in effect
* High-quality RCTs are required with longer term followup in order for more valid conclusions to be drawn

Comments:

* The evidence system used by the authors requires downgrading due to the weak criteria for grading evidence
	+ “limited evidence” is supported on the basis of one low-quality RCT and should not qualify as a “some evidence” endorsement
	+ Some of the studies listed as high quality may not meet DOWC standards of high quality evidence
		- For example, two of the studies of US (Lundberg 1988, Binder 1985) did not have adequate randomization, and thus cannot be considered high quality
		- In addition, Lundberg 1988 compared US with placebo US with rest, and found no difference between true US and placebo US with respect to global improvement, but was credited as showing an effect of US based on comparing active US with rest; this is an example of selective outcome reporting and is considered a threat to internal validity (high risk of bias)
		- These studies from the 1980s were published prior to the development of consensus standards for reporting of randomized trials, which were adopted by major journals beginning in 1996 but not generally circulated until 2001
	+ For laser treatment of lateral epicondylitis, Vasseljen 1992 is rated as “high quality” but the analysis of results is substandard
		- The authors used a discredited method of comparing groups, stating that the laser group had a statistically significant improvement from baseline but the control group did not; this is an unacceptable method of comparing groups with respect to clinical outcomes; direct calculation of group differences, with confidence intervals, is standard practice and is required in this situation
		- In addition, the authors’ analysis of categorical data in their Table II is incorrect; it compares 7 laser patients and 3 control patients reporting themselves “much better or no pain” but does not calculate a value for chi-square for trend, which is required in this situation
		- That is, all of the data in Table II for the four week followup should have been used, and when the correct analysis is done, the p value for the four week followup is 0.161, a non-significant difference
* Many of the studies cited as evidence are single small studies with too few participants to provide useful estimates of the effectiveness of the interventions under investigation
* The review does highlight the general weakness of the literature concerning electrophysical modalities for lateral epicondylitis and the likely need for consensus of clinicians to revise a DOWC guideline

Assessment: a low quality systematic review (grading of strength of evidence from clinical trials which are incompatible with DOWC standards); the review can be used to show that there is a lack of evidence for the effectiveness of ultrasound, laser, pulsed electromagnetic field therapy, TENS, and extracorporeal shock wave for the treatment of lateral epicondylitis

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