

## FACT SHEET (summary)

### The effect of shockwave on pseudoarthrosis / non-union

#### INTRODUCTION

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Pseudoarthrosis/non-union is a condition in which connective tissue – a false joint – is deposited in the fracture line instead of bone tissue, resulting in a chronic instability in the bone. The incidence of this condition is stated to be between 5-10% of all fractures, but varies greatly, e.g. a rate of 50% is stated for scaphoid fracture.(1)

The purpose of the use of ESWT in connection with non-union, even after surgery, is multiple:(2)

- 1) "Reset" the healing processes
- 2) Activate osteoblasts (promote the formation of bone tissue) and suppress osteoclasts (break down bone tissue)
- 3) Promote angiogenesis

## METHOD

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Extracorporeal Shockwave Therapy AND Treatment of Nonunion Bones: Filters: Meta-Analysis, Review, in the last 5 years, Humans, English Sort by: Most Recent

Then "similar articles".

ESWT and the effect of bones are probably some of the best documented. We will therefore only present a brief summary of the meta-analysis from 2022. The meta-analysis includes a total of 23 randomized or cohort studies, in English, Italian and German.(3)

Sansone, V., Ravier, D., Pascale, V., Applefield, R., Del Fabbro, M., & Martinelli, N. (2022). Extracorporeal Shockwave Therapy in the Treatment of Nonunion in Long Bones: A Systematic Review and Meta-Analysis. *Journal of clinical medicine*, 11(7), 1977.

## CONCLUSION

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The authors' own conclusion:

"This review demonstrated that extracorporeal shockwave therapy is a promising approach to successfully treat non-unions. The healing rates achieved with ESWT are comparable to those of surgery but do not carry the risk of possible complications. Orthopedic practitioners should consider ESWT as a viable alternative to surgery in the treatment of nonunion."

To this we must add the conclusion of the review article by Wang et al. (2). The article describes the effect after ESWT on non-union fracture after surgery:

" The present review summarizes the efficacy and safety of ESWT in patients with PSFN, showing that ESWT was effective and tolerable. Furthermore, the current review considered the potential prognostic factors for the fracture nonunion and efficacy of ESWT in patients with Post-surgical fracture nonunion, which mainly included demographic characteristics, such as tobacco usage, recovery status of the fracture nonunion, time interval between fracture and first shock wave treatment or surgery, and intramedullary stabilization status. These findings could provide a theoretical basis for orthopedics specialists to

improve individualized treatments and the application of ESWT in clinical practice for patients with PSFN. Further high-quality studies are required to validate these findings.”

The following should be noted in the study from Wang (2).

- The shorter the time after the fracture and the first treatment, the better the result is seen in the patient group where comorbidities (e.g. smoking, diabetes, fracture type, cortisone treatment) can lead to impaired healing.
- The shorter the time between surgery (e.g. osteosynthesis) and subsequent ESWT treatments, the better the outcome.
- Adequate and correct dose is important. Too small a dose has no effect, too large a dose can do more harm than good (see suggested dose later)

This is supplemented by the following from Sansone et al. (3)

” Our results showed that there is a higher success rate if the treatment is implemented closer to the time of injury (rather than later).

Thus, it seems advisable to propose ESWT treatment as soon as there is evidence that the fracture is not healing properly, without waiting 6 or more months, especially in patients that have multiples risk factors for nonunion (e.g., diabetes, Cushing syndrome, corticosteroid therapy, smokers, etc.).

Previous studies reported that shockwaves seem to have the potential of promoting bone healing and thus reducing the rate of nonunion in acute high-energy fractures of the lower extremities. “

## RECOMMENDATION

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Dosis jfr. Sansone et al. (3) is very different. In general, it turns out that smaller energy doses are more effective than higher energy doses. There is a single study conducted with rESWT with good effect, but as a starting point, fESWT is recommended for the treatment of bones.

**Dose fESWT:** 1-3 treatments, 2500 – 3500 strokes, 0.25-0.35 mJ/mm<sup>2</sup>.

As the studies have all been carried out in the secondary sector with equipment other than those used in Denmark, the following procedure can be recommended, cf. the only study that has so far been carried out in the primary sector.(4)

The patient is positioned so that the fracture site can be treated in the best possible way and is freely accessible. The site is located using X-ray, ultrasound scan or from imaging description that indicates the exact location of the fracture, if there is no access to X-ray or ultrasound at the clinic.

The fracture is marked with marker. If there is osteosynthesis material in the area, these are also marked so that these are not treated. The 2500 – 3500 pulses are distributed evenly over the fracture site. The fracture is dealt with on a case-by-case basis. 250 pulses per pain point before the next pain point is treated. Reduce the number of pulses per point if the patient cannot tolerate that number of pulses due to pain. The treatment probe is held perpendicular to the fracture. The intensity to the patient's maximum pain threshold. 3 treatments one week apart. X-ray control is an option after 4-6 weeks. If there is no bone growth, the treatment can be repeated.

## REFERENCES:

1. Giannoudis P V., Atkins R. Management of tong-bone non-unions. Injury. 2007; 38(suppl 2):S1-S2.
2. Wang H, Shi Y. Extracorporeal shock wave treatment for post-surgical fracture nonunion: Insight into its mechanism, efficacy, safety and prognostic factors (Review). Exp Ther Med. 2023; 26(1):1–9.
3. Sansone V, Ravier D, Pascale V, Applefield R, Del Fabbro M, Martinelli N. Extracorporeal Shockwave Therapy in the Treatment of Nonunion in Long Bones: A Systematic Review and Meta-Analysis. J Clin Med [Internet]. 2022; 11(7). 1977
4. Jorgensen JE, Larsen P, Elsoe R, Mølgaard CM. Callus formation and bone remodeling in a tibial nonunion after minimal invasive percutaneous screw fixation followed by extracorporeal shockwave therapy 17-months after initial trauma - A case report. Physiotherapy and Theory Practice. online ed. 2022; 1–13.

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