

# Extracorporeal shockwave therapy for non-unions and delayed healing fractures

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## Device and producing company:

Orthowave 280c, MTS, Konstanz, Germany

## Introduction:

The objective of every fracture treatment is to reunite the fracture fragments in an anatomical position and completely restore the function of the injured section of the skeleton as quickly as possible. Despite today's sophisticated technologies and good primary treatment, 1-3% of all bone fractures develop into pseudarthrosis. Surgical treatment with debridement of the pseudoarthrotic tissue, cleaning of the fragment edges, insertion of autologous spongiosa and stabilization with osteosynthesis material is considered the "gold standard" for the treatment of pseudarthrosis. However, these surgical procedures are extremely traumatic for the patient, costly, time-consuming, and associated with a high rate of complications. Therefore after successful pilot studies, the Trauma Centre Meidling began, in December 1998, to treat non-unions with shockwave therapy on a regular basis. Since August 2004 we have used the Orthowave 280, MTS, Konstanz, Germany for such treatments and have analyzed the results.

## Methods:

Treatment was basically envisaged as a single treatment. Depending on the region to be treated, shockwave therapy was administered under general, regional or local anesthesia. Thus far 232 patients have been treated, and the results of 174 patients with complete followup are available to date (April 2007). The patients were referred from 26 different hospitals, and consisted of 67 females (39%) and 107 males (61 %). The mean age was 50.6 years with a range from 20-87 years. The average delay between the injury or the last operation and the shockwave therapy was 20.9 months (131 / 75% patients had more than 6 months delayed healing; 43 / 25% patients had between 3 and 6 months delayed healing). Seven of the nonunions were infected. Depending on the localization, between 2,000 and 4,000 pulses were applied (1,000 pulses per treatment location). We used an energy flow density (EFD) of 0.41 ml/mm<sup>2</sup> for all bone treatments. For evaluation, the bony consolidation of the fracture/non-union on plain radiography or CT was judged.

Following shockwave therapy the pseudarthrosis was immobilized like a fresh fracture. This was usually done with a plaster cast or plastic splint; in 2 patients with especially mobile tibia non-unions, an external fixator was used. Fixation is not necessary when the pseudarthrosis has been treated with appropriate osteosynthesis material and this material exhibits no signs of loosening upon clinical or radiological examination. It can be assumed that the healing process is initially accompanied by neovascularization; for this reason, we try to prevent micro movements of the non-union during the first 3-4 weeks after treatment to preclude tearing of the new capillaries. It may be necessary in some cases for the patients to avoid full weight bearing on the affected extremity during this period. The patient's cooperation must be elicited by a detailed briefing since most patients are asymptomatic directly after the treatment, owing to the analgesic effects of the shockwaves, and want to put their full weight on the affected extremity again.

A pseudarthrosis gap with a width greater than 5 mm shows a poor prognosis.

In cases where bony remodelling of the non-union could not be demonstrated after 3 to 6 months, patients were given the option of surgical repair. Numerous patients, especially those who had undergone multiple operations previously, refused this option. This led to a relatively high number (14%) of repeated treatments. In exceptional cases (2), a third treatment was carried out. The

group of patients undergoing repeat ESWT included patients for whom a complicated pseudarthrosis operation was contraindicated for internal reasons or could have been carried out only at considerable risk to the patient.

**Results:**

Osseous union was achieved in 142 (82%) of the pseudarthroses. No complications occurred other than the adverse reactions that have already been observed following shockwave therapy (i.e. localized swelling, petecheal bleeding, hematoma).

**Discussion:**

Even though the mechanism of action of shockwave therapy has not yet been fully explored, we are convinced that ESWT is an effective, inexpensive and time-saving therapeutic modality with an almost zero rate of complications.

**Conclusion:** Therefore, in Austria, ESWT is considered the first choice therapy for nonunions and delayed unions that do not require surgical realignment.