

# High-energy Piezoelectric Extracorporeal Shock Wave Therapy (ESWT) in the Treatment of Pseudarthrosis – Case Histories

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## Résumé:

In this prospective, single-blind, non-randomised study of the treatment of pseudarthrosis with high-energy, piezoelectric shock wave therapy we included 9 patients. This was a heterogeneous group of patients with postoperative and posttraumatic pseudarthroses of the ilium (1), fibula (1), MT 1 (2), tibia (1), femur (3) and calcaneocuboid following arthrodesis (1). On average, patients underwent three treatments each with 4000 pulses at  $1.2 \text{ mJ/mm}^2$ . Treatment was performed with the piezoelectric PIEZOSON 100 from WOLF in conjunction with the FB12 G5 shock wave applicator. In a follow-up period of at least 3 months, we were able to detect consolidation of the fracture / osteotomy in 71 % of cases. During therapy, no local or systemic side effects were observed. We therefore recommend high-energy piezoelectric shock wave therapy as a safe and effective method in the treatment of pseudarthrosis before revision surgery.

## Introduction

The effectiveness of extracorporeal shock wave therapy (ESWT) in the treatment of fasciitis plantaris and tendinosis calcarea could be demonstrated in recent studies.[2-7] [8;9] From the very beginning of ESWT on the locomotor system, the treatment of pseudarthrosis has been one of the standard indications recognized by the DIGEST.[23] Applying extracorporeal shock waves produces microfractures in bone leading to cell

proliferation and subsequent osteostimulation.[10-12] [13] Pseudarthrosis (PA) is the nonhealing of bone 3 months after fracture / osteotomy that can occur in 10-50% of cases depending on localisation. State of the art in the primary treatment of pseudarthrosis is osteosynthetic repair, when necessary with the grafting of cancellous bone.[14]

## Materials and Methods

The patients we treated within the framework of a prospective, single-blind, non-randomised study were a heterogeneous group of 9 patients with postoperative and posttraumatic pseudarthrosis (PA) of the ilium (1), fibula (1), MT 1 (2), tibia (1), femur (3) and calcaneocuboid following arthrodesis (1). Osteosynthesis had been performed either as the primary treatment or as revision surgery. Only one Weber B fracture was treated using exclusively conservative methods prior to ESWT. After eliminating contraindications, such as loosening of material, local infection or blood coagulation diseases, we performed high-energy, piezoelectric ESWT in our department with the WOLF PIEZOSON 100 in conjunction with the FB12 G5 shock wave applicator following sonographic prelocation. The area affected was treated on average three times at intervals of one week, each treatment consisting of 4000 pulses at  $1.2 \text{ mJ/mm}^2$  and 4 Hz. In 7 patients, we were able to perform an X-ray examination after the initial follow-up time of 3 months. In 2 patients (nos. 8 and 9) the treatment was completed less than 3 months ago. One inclusion criterion for the study was, however, a follow-up period of at least 3 months. These patients are therefore presented separately. We performed the therapy without local anaesthesia on an outpatient basis but observed the patients following treatment. After the therapy, the patients continued partial weight-bearing with the extremity involved.

Patient no.	Age	Sex	Location	PA following	Prev. surgery	Period between surgery and ESWT [months]
1	48	M	MT 1	Osteotomy	1	9
2	28	M	Ilium	Osteotomy	1	13
3	48	F	MT 1	Osteotomy	1	5
4	50	M	Femur	Osteotomy	1	6
5	15	M	Femur	Osteotomy	2	4
6	45	M	Fibula	Fracture	0	6
7	61	M	STJ	Arthrodesis	1	15
8	42	F	Femur	Multifragment fracture	4	4
9	63	M	Tibia	Chronic osteomyelitis	4	3

Table 1: Epidemiological Data of the Patients Treated, Pat. 3 + 6: Case history see below, Pat. 8, 9: Follow-up less than 3 months

## Results

In the 7 patients in which follow-up was possible, a bridge of bone could be seen in the fracture line on anteroposterior and lateral X-rays or tomography in 71% of cases after an average of 5 months. In two cases, we were unable to detect any increased bridging of the pseudarthrosis gap. We will deal with these cases separately in the discussion. No local or systemic side-effects were observed in any of the cases treated. During the follow-up period, we did not see changes to in-situ grafts in any of the patients.

Patient no.	Success	Bone distance [mm]	Follow-up after (months)
1	+	2	3
2	-	9	10
3	+	0.5	3
4	+	3	4
5	-	8	4
6	+	4	5
7	+	3	6
8	ESWT		xx
9	ESWT		xx

Table 2: Therapeutic Success after ESWT, Pat. 3 and 6: Case history see below, pat. 8 and 9: Follow-up less than 3 months

Legend: + = bone stability, -- = no bone stability, ESWT = treatment continues

Case 3: 48 year old female patient, smoker, following MT 1 osteotomy 3.02, inadequate bone stability 7.02, subjective localised pain, followed by 3 x 4000 pulses of high-energy ESWT, adequate stability 10.02, no pain, indication for removal of metal 12.02



3.02



7.02



10.02