# ZUSAMMENSTELLUNG VON WISSENSCHAFTLICHEN PUBLIKATIONEN ZUR WIRKUNG VON PULSIERENDER MAGNETFELDTHERAPIE BEI PSEUDARTHROSEN

## 1982

### Congenital pseudarthrosis of the tibia: treatment with pulsing electromagnetic fields


**Abstract**

Ninety-two patients with congenital pseudoarthrosis (infantile nonunion) were treated with pulsing electromagnetic fields (PEMF) in the United States and Europe in the past eight years. This represents the largest group of patients with infantile nonunions in which a common treatment modality has been used. Excluding the ten lesions (11%) which healed with refracture 48 lesions (59%) healed whereas 34 (41%) failed to heal. The success rate in 23 type I and 34 Type II lesions was 77% and 76%, respectively. Surgery in association with PEMF treatment did not improve the results of treatment. The most important variable was the radiographic morphology of the nonunion gap. Patients with spindled bone ends, a large gap and a grossly mobile lesion had a very poor prognosis relative to patients with a cystic or sclerotic transverse fracture line with a gap of less than 5 mm. The key to success in the treatment of infantile nonunions has been the combination of PEMF treatment with good orthopedic management, consisting of rigid immobilization, a nonweight-bearing status and rehabilitation with impact loading exercise. Infantile nonunion remains a major challenge to the orthopedic surgeon, but PEMFs appear to offer some important advantages for overcoming this pernicious condition. Dr. Harold Boyd's discussion of this paper follows. It was his final address to the AAOS.


## 1986

### Slow healing fractures: can they be prevented? (Results of electrical stimulation in fibular osteotomies in rats and in diaphyseal fractures of the tibia in humans)


**Abstract**

The purpose of the study was to evaluate the possibility of preventing delayed union in fractures by the use of low-frequency pulsing electromagnetic fields (PEMFs). The study was conducted in two parts, both with control groups. Fibular osteotomies in rats and diaphyseal fractures of the tibia in humans were treated with and without electrical stimulation (PEMF). The rats were sacrificed on the 8th and 23rd days respectively in order to evaluate the histological picture of the repair callus and its mechanical resistance. In the human subjects, the clinical and radiological follow-up took into account various factors known to affect the rate of union in the various fracture groups. The results obtained suggest that PEMF stimulation is capable of accelerating and modulating the physiological process of union by its favourable effect on osteogenesis.





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**1991**

## Long-term pulsed electromagnetic field (PEMF) results in congenital pseudarthrosis


### Abstract

Ninety-one patients with congenital pseudarthrosis of the tibia have been treated with pulsed electromagnetic fields (PEMFs) since 1973 and all except 4 followed to puberty. Lesions were stratified by roentgenographic appearance. Type I and type II had gaps less than 5 mm in width. Type III were atrophic, spindled, and had gaps in excess of 5 mm. Overall success in type I and II lesions was 43 of 60 (72%). Of those 28 patients seen before operative repair had been attempted, 7 of 8 type I lesions healed (88%), whereas 16 of 20 type II lesions healed (80%) on PEMFs and immobilization alone. Only 19% (6 of 31) type III lesions united, only one of which did not require surgery. Sixteen of 91 limbs (18%) were ultimately amputed, most before treatment principles were fully defined in 1980. Fourteen of these 16 patients (88%) had type III lesions. Refracture occurred in 22 patients, most as the result of significant trauma, in the absence of external brace support. Twelve of the 19 refractures, retreated with PEMFs and casts, healed on this regime. Episodic use of PEMFs proved effective in controlling stress fractures in several patients until they reached puberty. PEMFs, which are associated with no known risk, appear to be an effective, conservative adjunct in the management of this therapeutically challenging, congenital lesions.


**1991**

## Long-term follow-up of fracture nonunions treated with PEMFs


### Abstract

One hundred thirty-nine established fracture nonunions were treated using a pulsed electromagnetic field (PEMF) device that also recorded patient usage. Patients who used the device less than an average of three hours a day had a success rate of 35.7% (5/14), while those who used the device in excess of three hours daily had an 80% success rate (108/135). The difference in the success rate was statistically significant at p less than .05. Treatment success was unaffected by long versus short bone, open versus closed fractures, nonunion of nine to 12 months duration compared to one to ten years, age of patient (whether less than or greater than age 60) , gender, recalcitrant versus first time treatment, infected versus noninfected nonunions, fracture gaps up to 1cm, or weightbearing versus nonweightbearing. Ninety-seven fractures in 90 patients (90% follow-up) who averaged more than three hours of PEMF treatment daily and were originally classified as healed were reevaluated clinically and radiographically at four years following treatment (range: 3.6-5.4 years; mean: 4.1 years). Eighty-nine (92%) maintained a solid union. The success rate of PEMF treatment for nonunion repair demonstrated no statistically significant change over long-term follow-up.





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**1994**

## Treatment of delayed unions and nonunions of the proximal fifth metatarsal with pulsed electromagnetic fields


### Abstract

Nine delayed unions and nonunion of the proximal fifth metatarsal were treated with pulsed electromagnetic fields (PEMF). All fractures healed in a mean time of 4 months (range 2-8 months). Those fractures treated with both pulsed electromagnetic fields and a nonweightbearing cast healed in a mean time of 3 months (range 2-4 months). The average duration of follow-up was 39 months (range 24- 60 months). There were no refractures. When compared with reported healing times and morbidity for conventional casting, medullary curettage with inlay bone, and closed axial intramedullary screw fixation, pulsed electromagnetic fields provided an effective alternative for the treatment of delayed unions and nonunion of the proximal fifth metatarsal.





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