

Corso di Riccione “Michela Boni”

36° CORSO DI AGGIORNAMENTO IN MEDICINA FISICA E RIABILITATIVA

Edema osseo: le terapie fisiche

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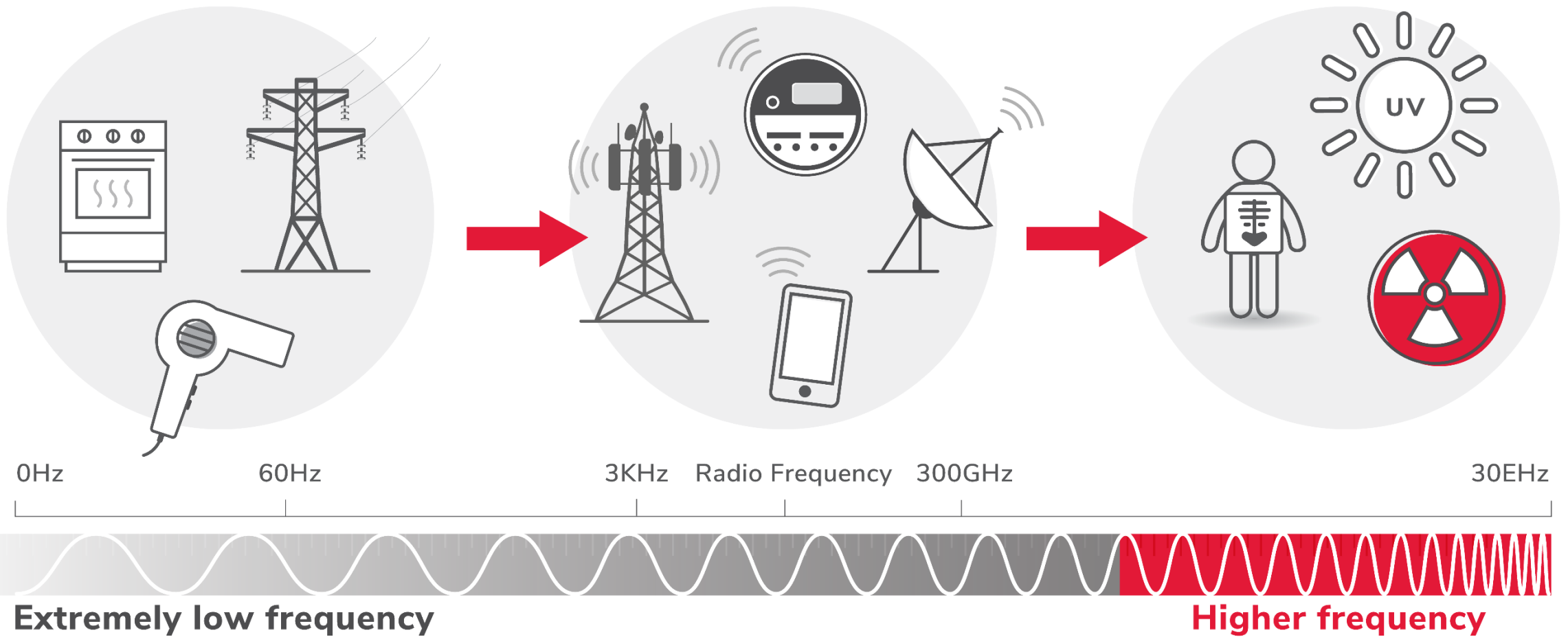






CAMPI ELETTROMAGNETICI

THE ELECTROMAGNETIC SPECTRUM



CEMP/PEMF/Stimolazione Biofisica

CEMP: impulsi magnetici PULSATI

INDICAZIONI...

Dolori (di tutti i tipi...)

Cellulite

Prurito

Gengivite

Insonnia

Acne

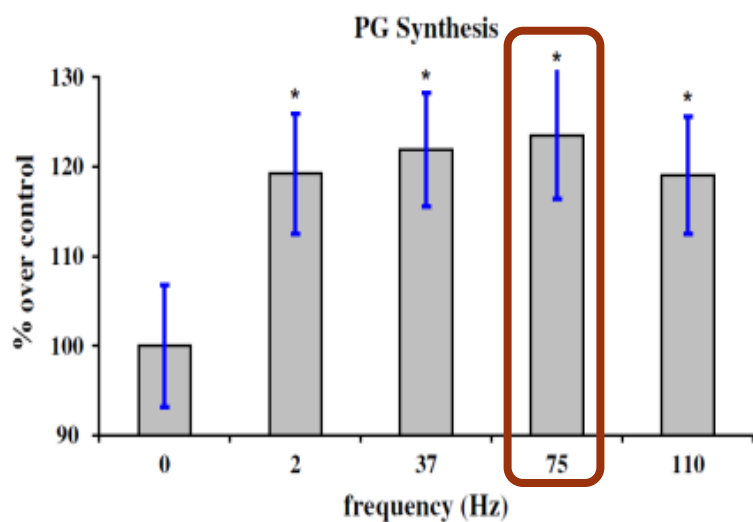
Herpes simplex

Depressione ...

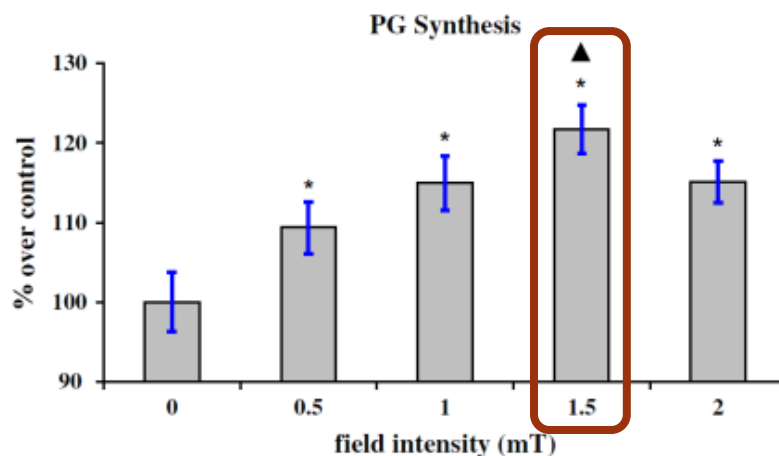
CEMP sui proteoglicani bovini

Specificità del segnale

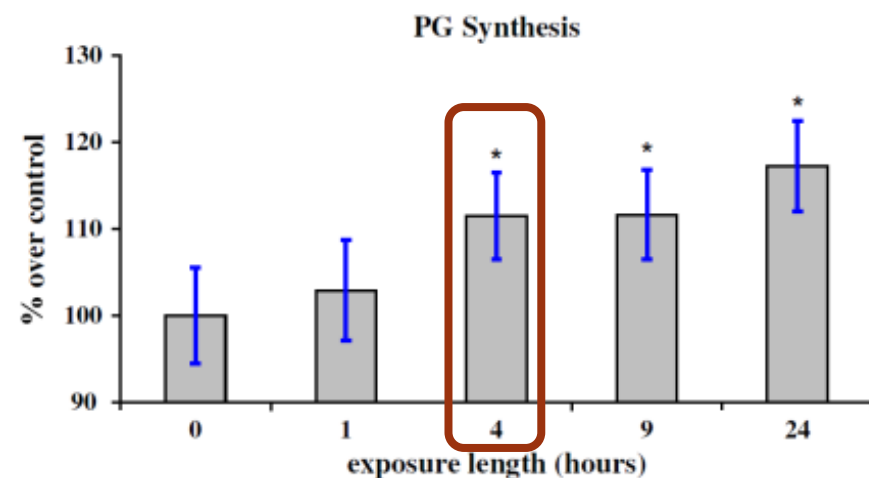
Frequenza



Intensità di segnale



Ore di stimolazione



Effectiveness of Pulsed Electromagnetic Fields on Bone Healing: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Peng L et al. Bioelectromagnetics, 2020 Jul;41(5):323-337. doi: 10.1002/bem.22271.

Moderate quality evidence suggested that **PEMF increased healing rate and relieved pain of fracture**, and very low-quality evidence showed that **PEMF accelerated healing time**. Larger and higher quality randomized controlled trials and pre-clinical studies of optimal frequency, amplitude, and duration parameters are needed.

Biophysical Stimulation

Mechanism of action

Favorisce:

- Proliferazione osteoblasti
- Sintesi matrice ossea
- Rilascio fattori anabolici

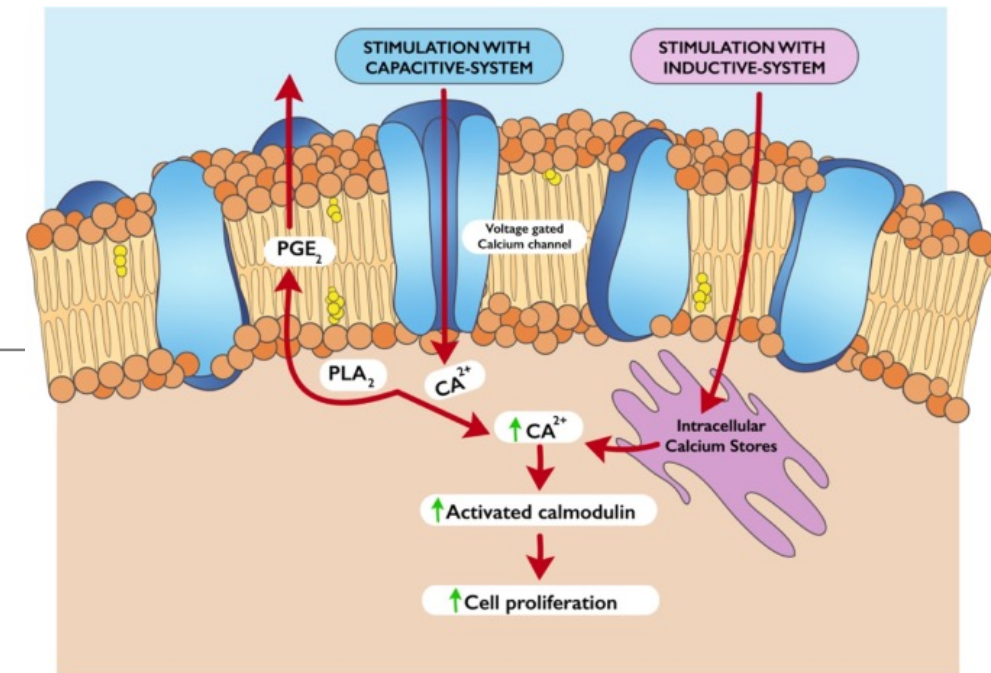


Table 1 Biophysical stimulation on the regulation of bone matrix and growth factors

Author	Physical method	In vitro models	Results
Jansen JH, <i>BMC Musculoskelet Disord.</i> 2010	PEMFs	hBMSCs	↑ TGF-β1 ↑ BMP-2mRNA ↑ Differentiation
Esposito M, <i>In Vivo.</i> 2012	PEMFs	hBMSCs	↑ Proliferation ↑ Differentiation
Ceccarelli G, <i>Biores Open Access.</i> 2013	PEMFs	hBMSCs	↑ Proliferation ↑ ECM deposition
Zhou J, <i>Bioelectromagnetics.</i> 2013	PEMFs	Rat calvarial osteoblasts	↑ Proliferation
Hartig M, <i>Eur Biophys J.</i> 2000	CCEF	Osteoblast from periosteum explants	↑ Proliferation ↑ Differentiation
Wang Z, <i>J Bone Joint Surg Am.</i> 2006	CCEF	Osteoblastic cells (MC3T3-E1)	↑ BMP-2,4,5,6,7 mRNA
Bisceglia B, <i>Bioelectromagnetics.</i> 2011	CCEF	Osteoblast-like cell lines (SAOS-2)	↑ Proliferation
Clark CC, <i>J Orthop Res.</i> 2014	CCEF	Human calvarial osteoblasts	↑ BMP-2,4 mRNA ↑ TGF-β1, β2, β3 mRNA ↑ FGF-2



CURRENT CONCEPTS REVIEW

Bone Marrow Edema

Overview of Etiology and Treatment Strategies

Umberto Tarantino, MD, Chiara Greggi, PhD, Ida Cariati, PhD, Patrizio Caldora, MD, Rodolfo Capanna, MD, Antonio Capone, MD, Roberto Civinini, MD, Stefano Colagrande, MD, Pietro De Biase, MD, Francesco Falez, MD, Giovanni Iolascon, MD, Davide Maraghello, MD, Laura Masi, MD, Marco Matucci Cerinic, MD, Giuseppe Sessa, MD, and Maria L. Brandi, MD

Recommendations

- It is essential to identify the different clinical manifestations **early** → to avoid the surgery
- It is necessary to identify “**neoadjuvant**” **therapy** → to **reduce BME before surgery** or a treatment that allows surgery to be avoided completely.

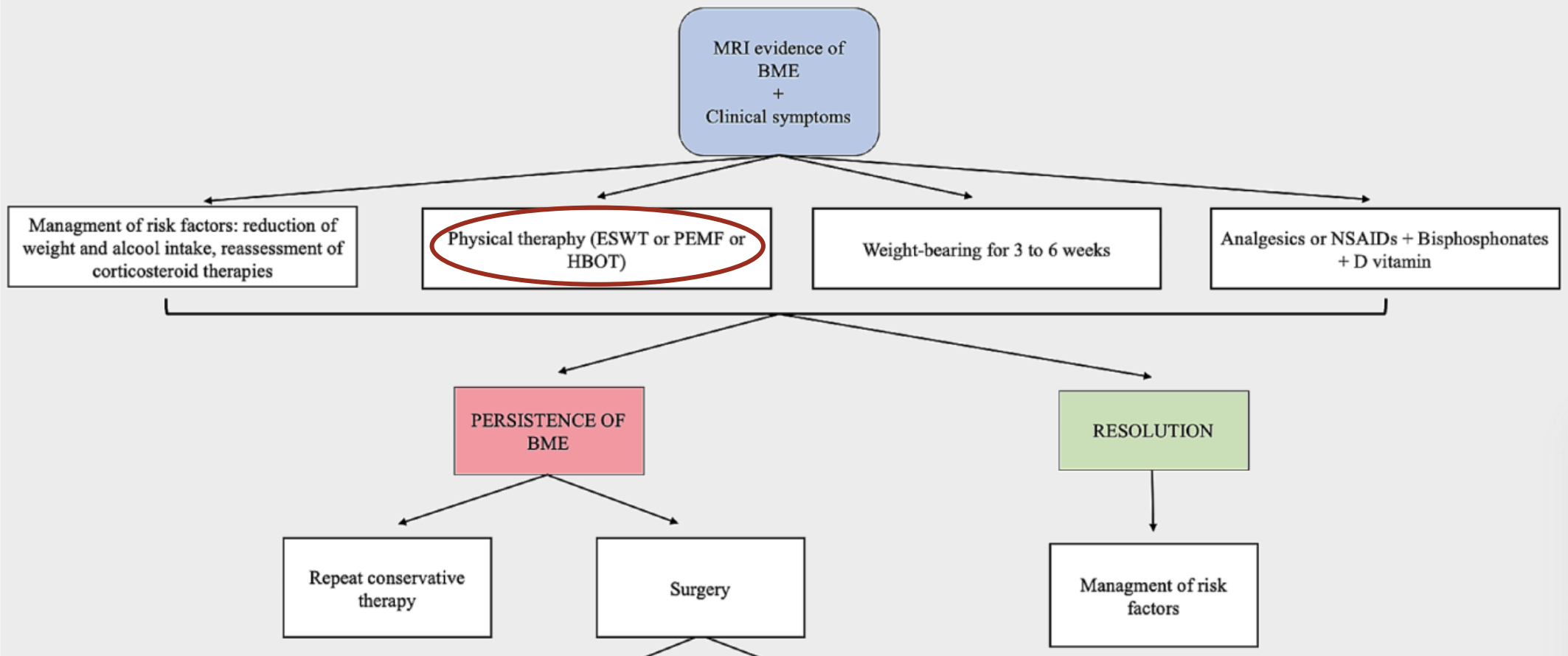
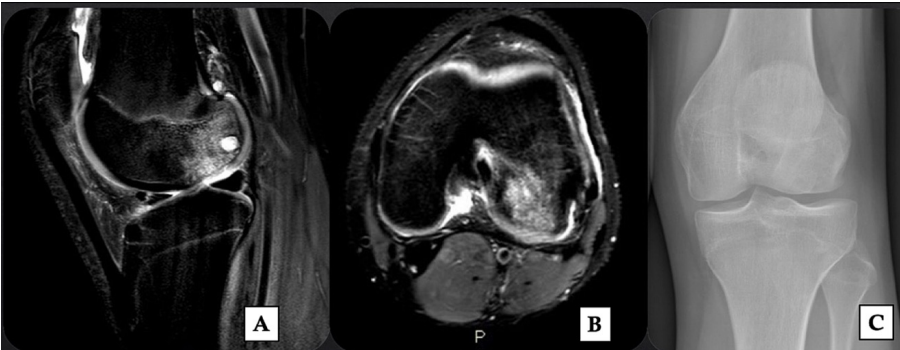
TABLE III Treatment Strategies for BME*

Treatment Strategies	Pathology	Phase
Physical modalities		
Mechanical unloading	Osteonecrosis	Early
PEMF	ONFH	
ESWT	ONFH	



Bone marrow edema of the knee: a narrative review

Eleonora Villari¹ · Vitoantonio Digennaro¹ · Alessandro Panciera¹ · Riccardo Ferri¹ · Lorenzo Benvenuti¹ · Faldini Cesare¹



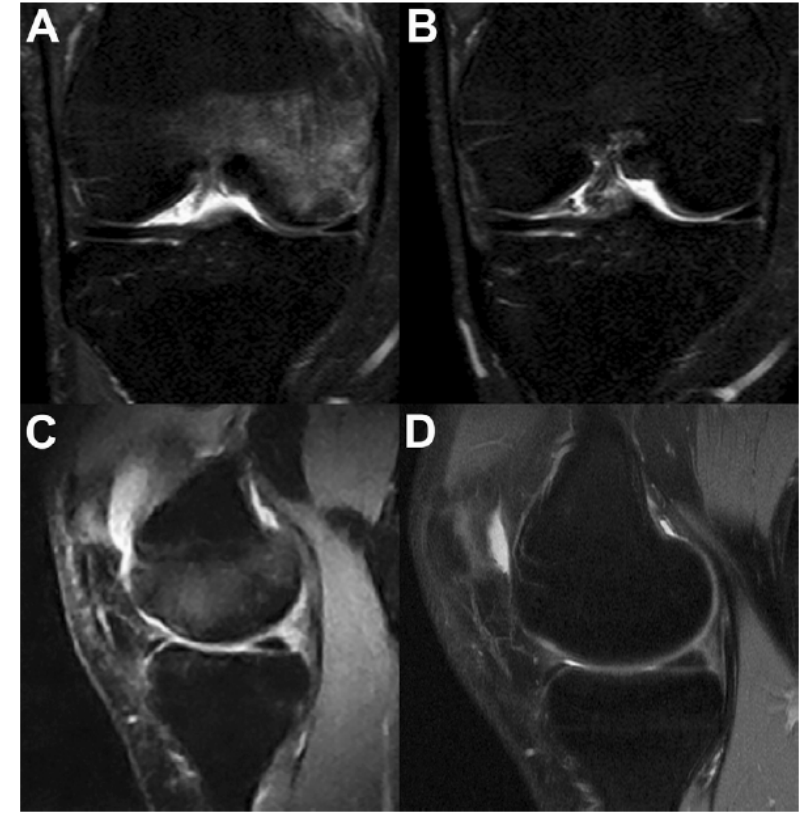
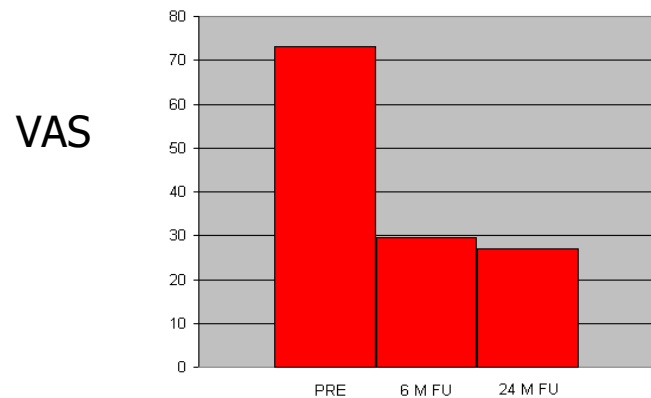
Stimolazione biofisica

SIF/SONK

30 patients (no control group): Pain **significantly reduced** at 6 months
Tegner median level **increased** from baseline to 6-month follow-up.

MRI: significant **reduction** of total **Worms** mean

PEMF stimulation (peak magnetic field of 1.5 mT, frequency 75 Hz) significantly reduced knee pain and necrosis area in Koshino stage I SONK already in the first 6 months, **preserving 86% of knees** from prosthetic surgery at 24-month follow-up.



Parametri



Frequenza: 15-75 hz

Durata = 30-60 minuti, 5 volte/sett
per 20-30 sedute



Frequenza: 50-75 hz

Durata = 4 ore/die, 7 volte/sett
per 30-90 giorni



**Cochrane
Library**

Cochrane Database of Systematic Reviews

Electromagnetic fields for treating osteoarthritis (Review)

Li S, Yu B, Zhou D, He C, Zhuo Q, Hulme JM

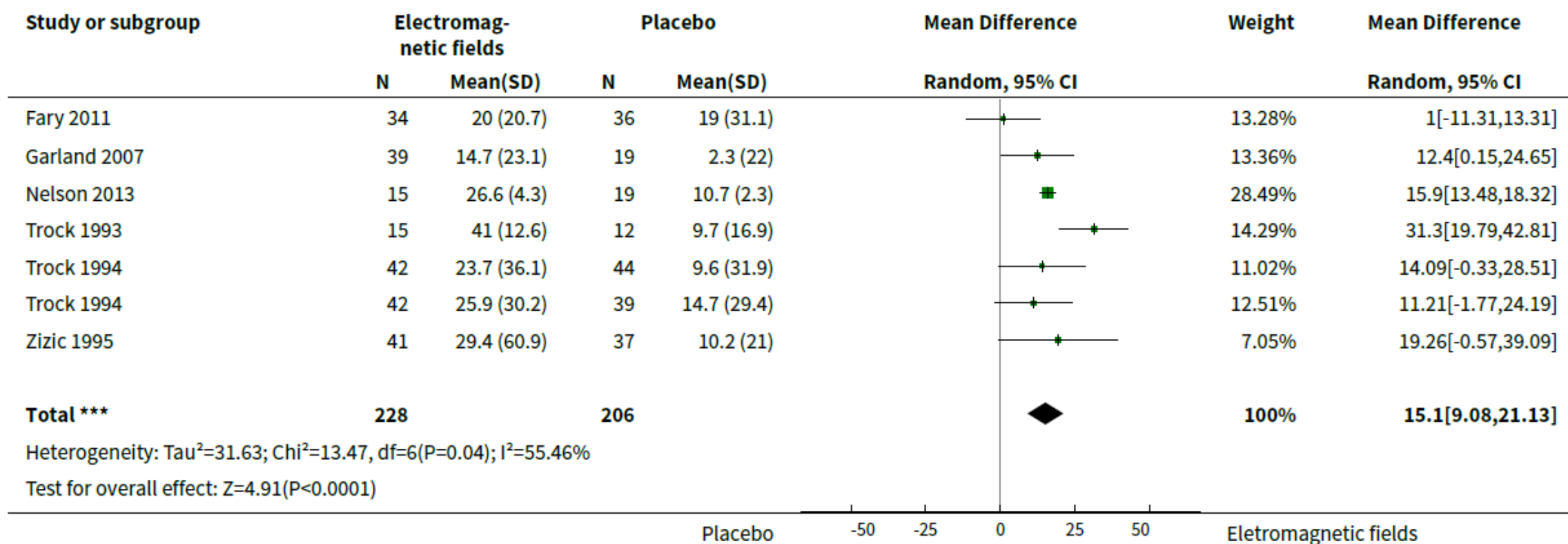
Li S, Yu B, Zhou D, He C, Zhuo Q, Hulme JM.
Electromagnetic fields for treating osteoarthritis.
Cochrane Database of Systematic Reviews 2013, Issue 12. Art. No.: CD003523.
DOI: [10.1002/14651858.CD003523.pub2](https://doi.org/10.1002/14651858.CD003523.pub2).

Key results

Pain (on a 0 to 100 scale; higher scores mean worse or more severe pain)




- Electromagnetic fields probably relieve pain in osteoarthritis.
- People who received electromagnetic field treatment experienced pain relief of 15 points more compared with people who received fake treatment (15% improvement).

Analysis 1.1. Comparison 1 Electromagnetic fields versus placebo for osteoarthritis, Outcome 1 Pain.



Systematic Review

Current Evidence Using Pulsed Electromagnetic Fields in Osteoarthritis: A Systematic Review

Luigi Cianni ^{1,2}, Emidio Di Gialleonardo ¹, Donato Coppola ¹, Giacomo Capece ^{1,*}, Eugenio Libutti ³,
Massimiliano Nannerini ³, Giulio Maccauro ^{1,2} and Raffaele Vitiello ^{1,2}

PEMF therapy. Seventeen studies (1197 patients) were included. (3) **Results:** PEMF therapy demonstrated positive outcomes across various anatomical districts, primarily in knee osteoarthritis. Pain reduction, assessed through VAS and WOMAC scores, showed significant improvement (60% decrease in VAS, 42% improvement in WOMAC). The treatment duration varied (15 to 90 days), with diverse PEMF devices used. Secondary outcomes included improvements in quality of life, reduced medication usage, and enhanced physical function. (4) **Conclusions:** Diverse PEMF applications revealed promising results, emphasizing pain reduction and improvement in the quality of life of patients. The variability in the treatment duration and device types calls for further investigation. This review informs future research directions and potential advancements in optimizing PEMF therapies for diverse osteoarthritic manifestations.

Controindicazioni

Gravidanza

Pace-maker o altri dispositivi elettronici impiantati

Neoplasie

Malattie infettive

Epilessia

Quale garanzia per l'utente a domicilio?

I dispositivi medici devono essere certificati **CE** e rispondere agli standard previsti nel **Regolamento Europeo 2017/745** sui dispositivi medici.

Documentazione sperimentale.





Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net



Review

Shock wave as biological therapeutic tool: From mechanical stimulation to recovery and healing, through mechanotransduction



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^a ESWT Center, Rehabilitation Department, Humanitas Research Hospital, Rozzano, Milan, Italy

^b Compass Health Associates, Auckland, New Zealand

Le onde d'urto promuovono nel tessuto osseo una sorta di “autoguarigione”:


- stimolazione degli osteoblasti e cellule periostali e riduzione dell'attività osteoclastica
- incremento di ossido nitrico sintetasi + fattori di crescita endoteliali vascolari e quindi aumento della vascolarizzazione

SYSTEMATIC REVIEW

Open Access

The use of extracorporeal shock wave therapy for the treatment of bone marrow oedema — a systematic review and meta-analysis



Jonathan Häußer^{1*}, Juliane Wieber^{1,2*}  and Philip Catalá-Lehnen¹

Dolore, funzione e imaging migliorati indipendentemente dal tipo di studio (RCT, non-RCT)

Dolore

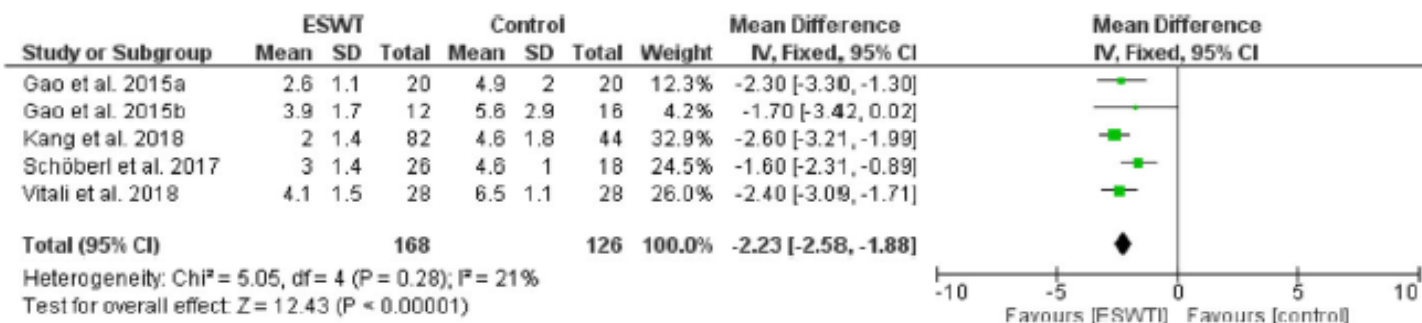


Fig. 2 Forest plot comparing the pain outcome after ESWT treatment (short-term; 1 month)

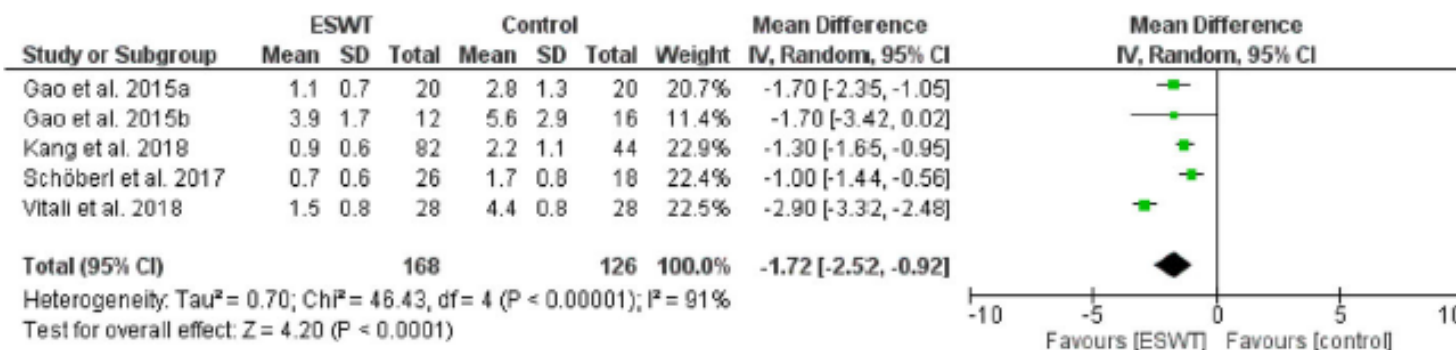


Fig. 3 Forest plot comparing the pain outcome after ESWT treatment (mid-term; 3-6 months)

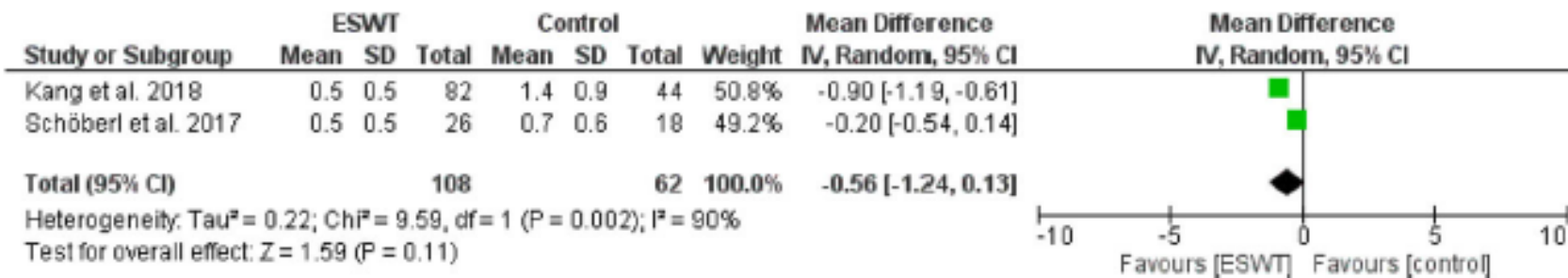


Fig. 4 Forest plot comparing the pain outcome after ESWT treatment (long-term; ≥ 12 months)

Funzione

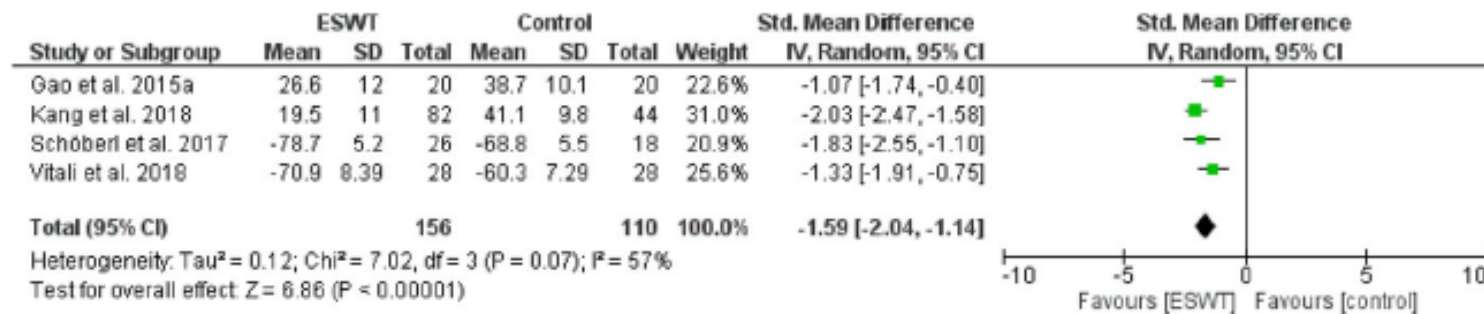


Fig. 5 Forest plot comparing the functional outcome after ESWT treatment (short-term; 1 month)

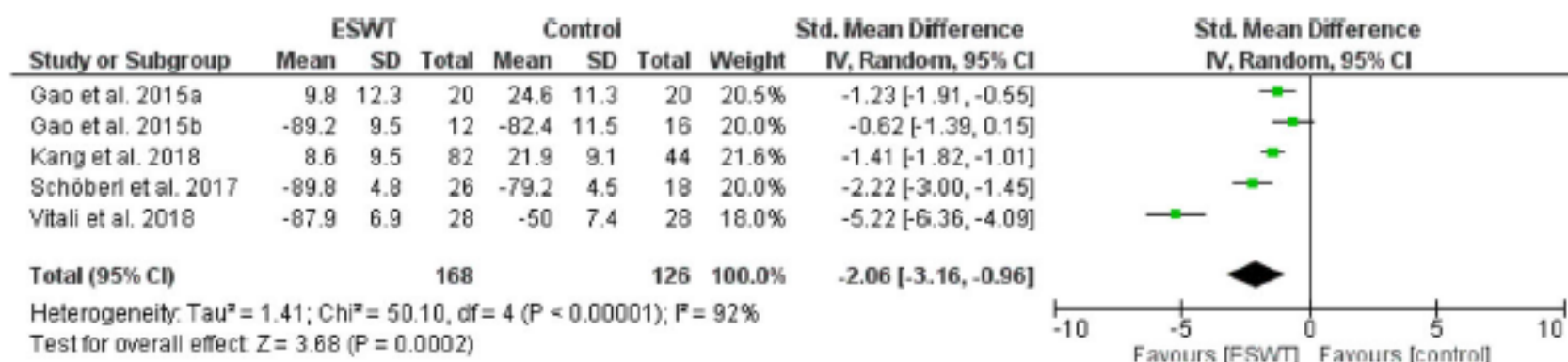


Fig. 6 Forest plot comparing the functional outcome after ESWT treatment (mid-term; 3–6 months)

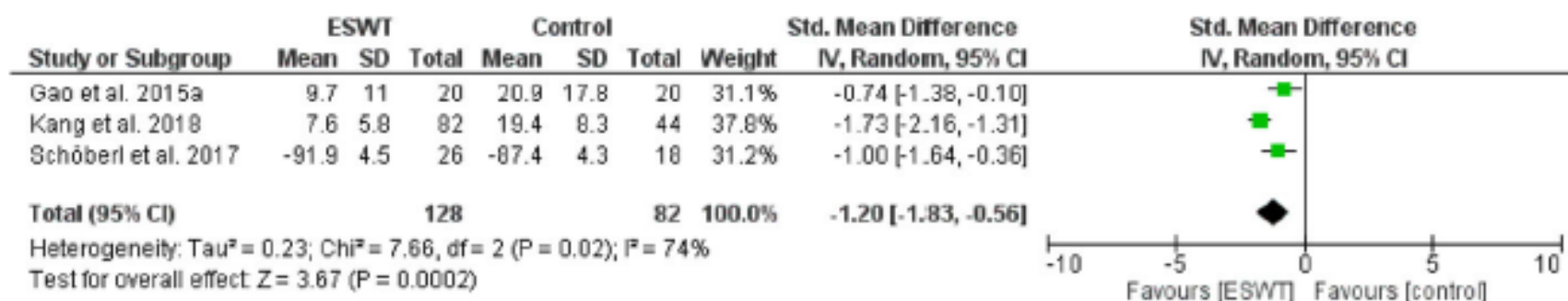


Fig. 7 Forest plot comparing the functional outcome after ESWT treatment (long-term; ≥ 12 months)

1 solo RCT

nella revisione sistematica?

RESEARCH ARTICLE

Open Access



CrossMark

Extracorporeal shock wave therapy in the treatment of primary bone marrow edema syndrome of the knee: a prospective randomised controlled study

Fuqiang Gao^{1,2}, Wei Sun^{1,2*}, Zirong Li¹, Wanshou Guo¹, Weiguo Wang¹, Liming Cheng¹, Debo Yue¹, Nianfei Zhang¹ and Amanda Savarin¹

Methods: This study compared the outcomes of ESWT (Group A) ($n = 20$) and intravenously applied prostacyclin and bisphosphonate (Group B) ($n = 20$) in the treatment of BMES of the knee in our department between 2011 and 2013. The Visual Analog Scale for pain (VAS, 100 mm), the Western Ontario and McMaster University Osteoarthritis Index (WOMAC), the SF-36 scores and MRI scans as well as plain radiographs were obtained before and after therapy between two groups.

Results: Compared with Group B, we found greater improvement in VAS, the WOMAC Osteoarthritis Index and SF-36 score at 1, 3 and 6 months post-treatment in Group A ($P < 0.05$). Furthermore, MRI scans showed a higher incidence of distinct reduction and complete regression of bone marrow edema at 6 months in Group A (95 vs. 65 %; $P = 0.018$). The MRI at 1 year follow-up showed complete regression in all patients in Group A. However, two cases in Group B continued to normalize over the subsequent follow-up period.

EFD (Energy Flux Density) $> 0.44 \text{ mJ/mm}^2$

3000-4000 impulsi, con frequenza 2-3 Hz

2 sedute a distanza di 7 giorni

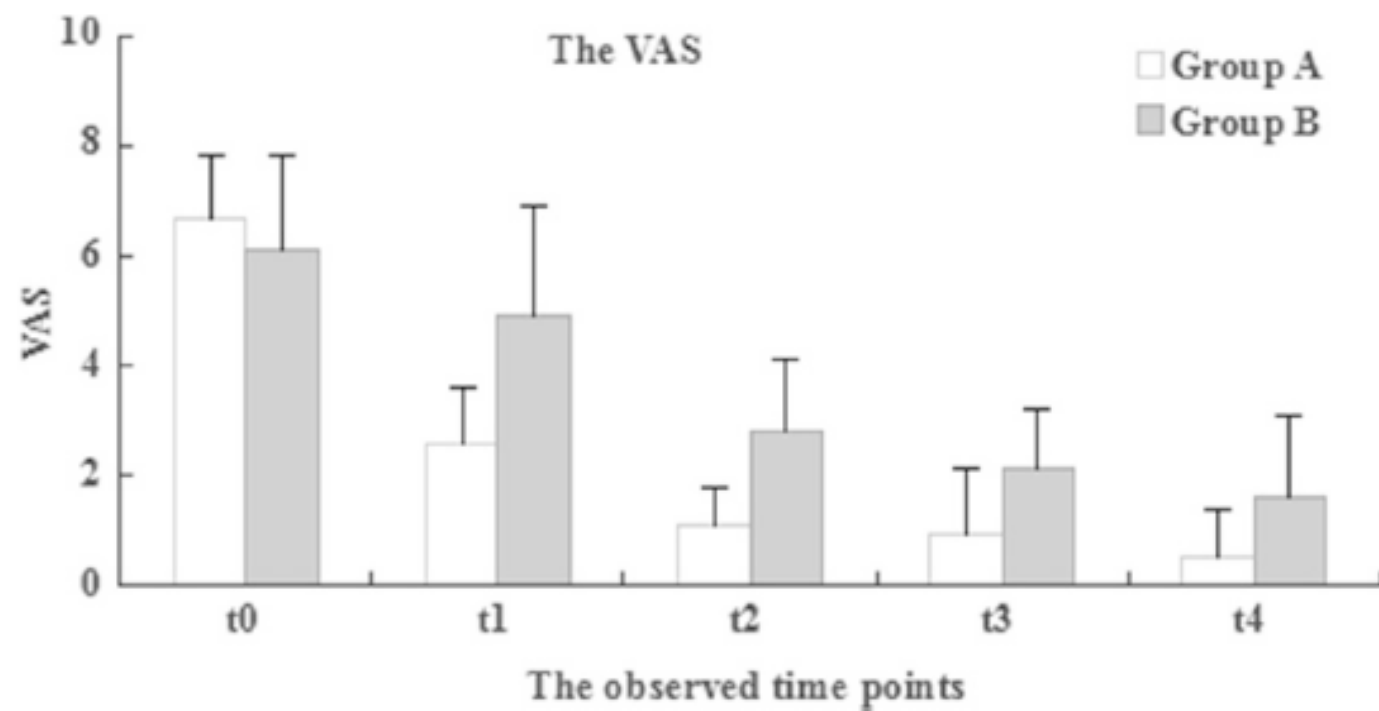


Fig. 2 The development of the VAS during therapeutical intervention between two Groups

Controindicazioni (per edema osseo del ginocchio)

Disturbi significativi della coagulazione

Cartilagine di accrescimento

TAKE-HOME MESSAGE

Società Scientifica: Medicina FISICA e Riabilitativa

Disciplina: Medicina FISICA e Riabilitazione

