Long-Term Effects of Focused Pulsed Electromagnetic Field Therapy on Peri-Implantitis: A Multicenter Trial

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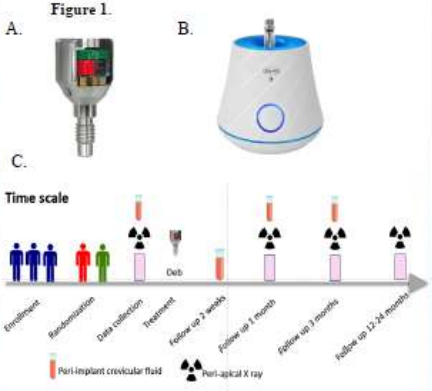
Introduction

Pulsed electromagnetic field (PEMF) therapy, renowned for its immunomodulatory effects and established efficacy in orthopedics, shows promise for managing peri-implantitis by reducing soft tissue inflammation and marginal bone loss. This study aimed to compare the long-term clinical and radiographic outcomes of non-surgical peri-implantitis treatment with and without PEMF therapy.

Materials

Thirty-one patients, with 45 implants displaying peri-implantitis with pocket probing depths (PPD) of 6-8mm, bleeding on probing (BoP%), and bone loss ranging from 3-5 mm, completed this multicenter study. A novel healing abutment integrating active (15 test) or inactive (19 control) PEMF was employed, delivering PEMF at an exposure ratio of 1/500 – 1/5000, intensity: 0.05-0.5 mT, and frequency: 10-50 kHz for 30 days. Non-surgical debridement of implant surfaces was conducted before abutment placement. Patients were evaluated at baseline (T0), 3 months (T1), and 12-24 months (T2), assessing plaque index (PI), bleeding on probing (BoP), pocket depth (PD), recession (REC), suppuration (SUP), and radiographically measured vertical bone loss (VBL).

Figure 1.



Results

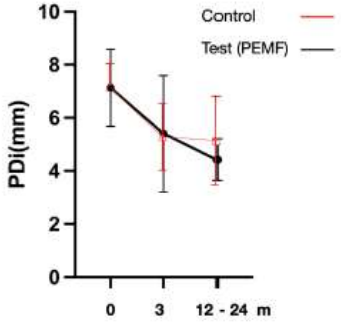
Follow-up revealed significantly lower mean BoP, and SUP in the test group after 12-24 months compared to the control (17.1% vs. 97%, and 0 vs.10%, respectively; $p < 0.05$). Furthermore, Within the test group, PD at the deepest site and mean PD decreased significantly between T0 and T2 (7.1mm±0.90mm to 4.4mm ± 0.79, 5.3mm±1.3mm to 3.7mm ± 1.2mm, respectively; $p < 0.05$). Also, a decrease was observed in the mead PPD in the control group for the latter (6.0mm ±1.4mm to 4.5mm±0.49mm; $p < 0.05$). Although not significant, a positive trend was observed for VBL after one year in the test group compared to the control (0.2mm ± 0.4mm vs. -0.3mm ± 0.11mm).

Table 1 . Clinical parameters

Clinical Parameter	Control Group			PEMF Test Group		
	T0	T1	T2	T0	T1	T2
PI %	100	56 ± 50.0	44 ± 50.0*	100	20 ± 32*	0*‡
PDi mm	7.1 ± 0.90	5.3 ± 1.3	5.1 ± 1.7	7.1 ± 1.5	5.4 ± 2.2	4.4 ± 0.79*
Pdii mm	6.0 ± 1.4	4.6 ± 1.0	4.5 ± 0.49*	5.3 ± 1.3	4.1 ± 1.7	3.7 ± 1.2*
ΔPDi mm	_	_	2.0 ± 1.9	_	_	2.7 ± 0.71
Reci mm	0.0	0.03 ± 0.7	0.0	0.09 ± 0.24	0.09 ± 0.16	0.83 ±1.6
Recii mm	0.0 ± 0.36	0.17 ± 0.53	0.33 ± 1.2	0.14 ± 0.36	0.14 ± 0.53	0.67 ± 1.2
Bop %	100	97 ± 7.6	97 ± 7.6	100	49 ± 45	17.1 ± 19*‡
Sup %	30 ± 27	10 ± 22	10 ± 22	16 ± 21	5.5 ± 12	0*‡
VBL (mm)	3.63±1.55	3.75±1.53	3.10± 1.63	2.84±1.14	2.39±1.02	3.19±1.14
ΔVBL T0-T2 (mm)	_	_	-0.3 ± 0.11	_	_	0.2 ± 0.4
Treatment Success %	-	-	50	-	-	71.42

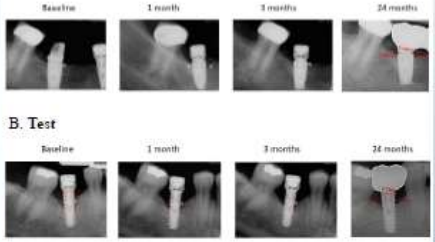
*(i): probing pocket depth at the deepest site; (ii): relative to the mean of 6 sites evaluated per implant. Wilcoxon Test, *$p < 0.05$ vs. T 0; Mann-Whitney U Test, ‡$p < 0.05$ experimental vs. control group.

Figure 2. probing depth



*Mann-whitey test ($p>0.05$).

Figure 3. Radiographic bone level



Conclusion

Focused PEMF therapy could offer a nonsurgical solution for peri-implantitis that can achieve clinical goals. Nevertheless, larger samples and longer follow-ups are needed to understand its long-term benefits and limitations.

Acknowledgements

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Long-Term Effects of Focused Pulsed Electromagnetic Field Therapy on Peri-Implantitis: A Multicenter Trial

A long-term, controlled clinical study evaluated the effectiveness of Magdent's Pulsed Electromagnetic Field (PEMF) healing abutment in the treatment of peri-implantitis, a common and challenging condition in implant dentistry characterized by inflammation, pocket formation, and bone loss around dental implants.

Study Design and Objective

The objective was to compare the performance of the PEMF-based healing abutment with a control group undergoing standard treatment, assessing multiple clinical parameters over an extended period of 12–24 months. Patients were monitored for improvements in soft tissue health, inflammation, and bone stability around the implants.

Key Clinical Outcomes

1. Plaque Index (PI%)

- PEMF Group: Reduced from 100% to 0% (*statistically significant; $p<0.05$*)
- Control Group: Reduced only to 44%
- Interpretation: The PEMF abutment achieved complete plaque elimination, highlighting its strong antimicrobial or plaque-controlling benefits. This may relate to improved tissue health and easier hygiene access due to inflammation reduction.

2. Proximal Pocket Depth (PDi mm)

- PEMF Group: Reduced from 7.1 mm to 4.4 mm
- Control Group: Reduced to 5.1 mm
- Interpretation: The PEMF group showed a greater reduction in probing depth, reflecting superior resolution of peri-implant inflammation and improved clinical attachment.

3. Distal Pocket Depth (Pdii mm)

- PEMF Group: Reduced from 5.3 mm to 3.7 mm
- Control Group: Reduced from 6.0 mm to 4.5 mm

- Interpretation: Both groups improved, but the PEMF group exhibited more consistent and deeper pocket reductions, supporting its effectiveness in managing deeper inflammatory lesions.

4. Gingival Recession

- A slight increase in gingival recession was noted in the PEMF group.
- Interpretation: This is within the expected range during inflammation resolution and surgical or non-surgical treatment. Recession often follows shrinkage of swollen tissues once inflammation subsides.

5. Bleeding on Probing (BoP%)

- PEMF Group: Reduced from 100% to 17.1%
- Control Group: Remained at ~97%
- Interpretation: This dramatic decrease in BoP in the PEMF group is a strong clinical indicator of reduced inflammation and improved soft tissue health, while persistent BoP in the control group suggests ongoing disease.

6. Suppuration (SUP%)

- PEMF Group: Reduced to 0%
- Control Group: Persisted at 10–22%
- Interpretation: The PEMF group demonstrated complete elimination of suppuration, indicating resolution of active infection. The control group, by contrast, still showed signs of exudate and active inflammation.

7. Vertical Bone Level (ΔVBL T0–T2)

- PEMF Group: Slight bone gain (+0.2 mm)
- Control Group: Bone loss (–0.3 mm)
- Interpretation: While modest, the gain in vertical bone height in the PEMF group versus loss in the control group is highly relevant. In peri-implantitis, preventing further bone loss is a major success; achieving bone regeneration is rare and noteworthy.

8. Overall Treatment Success Rate

- PEMF Group: 71.4%
- Control Group: 50%
- Interpretation: A nearly 40% improvement in treatment success with PEMF therapy. Success was likely defined based on absence of bleeding/suppuration, reduced pocket depths, and radiographic bone stability, according to common peri-implantitis success criteria.

Conclusion

This study provides compelling evidence that Magdent's PEMF healing abutment significantly enhances clinical outcomes in peri-implantitis treatment compared to standard care. Key benefits include:

- Complete plaque elimination
- Substantial reduction in probing depth and bleeding
- Elimination of infection
- Stabilization or regeneration of bone
- Higher overall success rate

The results support the integration of PEMF technology as a therapeutic adjunct in the management of peri-implant diseases, particularly in difficult or refractory cases.