ENERGY MEDICINE MODALITIES
“THE FUTURE OF REGENERATIVE MEDICINE”

SEBASTIAN KLISIEWICZ, D.O.
ESTERO, FL
No Financial Disclosures
OBJECTIVES

• Identify what is energy medicine
• Explore several energy medicine modalities
  • Light therapy (Laser/LED)
  • Microcurrent electrical stimulation
  • Pulsed Electromagnetic Field (PEMF)
• Identify proposed mechanisms of action
• Review scientific literature on energy medicine
INTEGRATIVE REHAB MEDICINE

A WHOLE PERSON APPROACH TO TREATING PAIN, INJURIES AND FUNCTIONAL IMPAIRMENTS

www.iRehabMed.com
INTEGRATIVE REHAB MEDICINE

A WHOLE PERSON APPROACH TO TREATING PAIN, INJURIES AND FUNCTIONAL IMPAIRMENTS
ENERGY MEDICINE TECHNOLOGY
MODELS OF RECEPTOR ACTIVATION

19th & 20th Century
The Old Theory:
Structural, lock and key; Chemical/Molecular Physical Communication

21st Century
The New Theory:
Physical/Atomic Electromagnetic Communication

The ligand matches the receptor, induces receptor conformational changes, triggers the cascade of cellular events.

Proximity favors co-resonance of specific bioelectrical signals with frequencies that match the resonance of the receptor, molecular conformational changes, triggers cascade of cellular events, even from long distances (like tuning in a radio).

THE BI-PHASIC DOSE RESPONSE

Arndt-Schultz Curve
LIGHT AS MEDICINE
COMMONLY RECOGNIZED LIGHT THERAPY

Blue light (420-470 nm) converts bilirubin so it can be excreted in jaundiced babies.

Bright white full spectrum light for seasonal affective disorder (SAD).

UVB (280 – 315 nm) phototherapy for psoriasis and vitiligo.
TYPES OF LIGHT SOURCES FOR HEALING

LASER = Light Amplification by Stimulated Emission of Radiation

LED = Light Emitting Diode

Coherent Laser Light

Incoherent LED Light
# Laser Classification

<table>
<thead>
<tr>
<th>Class</th>
<th>Power</th>
<th>Heat</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>&lt;0.4 micro Watts</td>
<td>No</td>
<td>LEDs/SLDs</td>
</tr>
<tr>
<td>Class II</td>
<td>0.4 micro Watts to 1 mW</td>
<td>No</td>
<td>LEDs/SLDs</td>
</tr>
<tr>
<td>Class IIIa</td>
<td>1 to 5 mW</td>
<td>No</td>
<td>Laser Pointers</td>
</tr>
<tr>
<td>Class IIIb</td>
<td>5 to 500 mW</td>
<td>No</td>
<td>Most Therapeutic Lasers</td>
</tr>
<tr>
<td>Class IV</td>
<td>&gt;500 mW</td>
<td>Yes</td>
<td>Surgical Lasers / Thermal (hot) Lasers</td>
</tr>
</tbody>
</table>

**Eye injury hazard**

- **Low**: Class 2 (0-1 mW), Class 3R (1-5 mW)
- **Medium**: Class 3B (5-500 mW)
- **High**: Class 4 (500 mW+)
- **Severe**
LIGHT AS MEDICINE
ELECTROMAGNETIC SPECTRUM

Blue ~ 400  Red ~ 600  IR ~ 800-900
PHOTOACCEPTORS (CHROMOPHORES)

Plants
- Chlorophyll
- Carotenoids

Humans
- Rhodopsin (vision)
- Hemoglobin (blood)
- Myoglobin (muscle)
- Cytochrome (most cells)
LOW LEVEL LASER THERAPY (LLLT) PHOTOBIOMODULATION

Cytochrome C Oxidase

- Enzyme in the mitochondria that acts as a photoacceptor of the energy from red and NIR light
- Transduces energy to Oxygen electron transport
- Increases mitochondrial membrane potential
- Increases production of ATP and cAMP
- Brief burst of ROS in normal cells
- Modulates cellular redox state
- Affects signaling pathway
OPTICAL WINDOW

- Hemoglobin
- Melanin
- Water
- Epidermis

Wavelengths:
- Ultraviolet (400 nm)
- Visible Spectrum (650 - 900 nm)
- Near Infrared (1000 nm - 2500 nm)
MODULATION OF GENE EXPRESSION
UPREGULATION OF GROWTH FACTORS

• Platelet Derived Growth Factor (PDGF)
• Transforming Growth Factor Beta (TGF-B)
• Basic fibroblast growth factor (bFGF)
• Keratinocyte growth factor (KGF)
• Nerve Growth Factor (NGF)
• Brain Derived Neurotrophic Factor (BDNF)
• Vascular Endothelial Growth Factors (VEGF)
Angiogenesis & Neovascularization
An increase in oxygenated blood to the injured tissue accelerates tissue healing.

Collagen Production
Proper alignment and remodeling of collagen reduces internal scar formation and enhances tissue elasticity.

Muscle Regeneration & Muscle Atrophy
Repair of damaged muscle fibers and activation of myogenic satellite cells leads to regeneration of muscle tissue.

Inflammation & Edema
Increase in inflammatory mediators such as macrophages, neutrophils and lymphocytes accelerates and resolves the inflammatory process.

Nerve Regeneration
Proliferation of growth factors promotes neuronal sprouting and myelin formation for optimal nerve recovery.

Cartilage Production
Increase in chondrocyte and collagen production allows for improved cartilage deposition and joint function.

Bone Formation
Proliferation of osteocytes and remodeling of bone extracellular matrix results in accelerated bone repair.
BI-PHASIC RESPONSE TO LLLT

Low-Level Light Therapy: Photobiomodulation
LOW LEVEL LASER THERAPY (LLLT)

Literature Review
LLLT AND WOUND HEALING

LLLT effect on skin and wound:

• Increases cell proliferation (fibroblasts, keratinocytes)
• Accelerates collagen deposition
• Increases production of growth factors
• Accelerates cross linkage of collagen fibers
• Accelerates wound contraction
• Improves wound tensile strength
LLLT FOR WOUND HEALING – ANIMAL STUDY

• 68 rabbits- divided into 4 groups: C, R, IR, R+IR
• full-thickness incision 1.5cm long, 2cm lateral to spinous process L2-3 on each side
• Laser R- HeNe 632nm 10mW, IR 904 nm 50mW
• Laser irradiation daily for 20 days, measurements on day 21

* p<0.05 vs. control

FIG. 5. Animal study results of tensile strength of four

104 patients with mechanical overload injuries of soft tissues (no bone injury) randomly assigned to laser vs control

All had surgery within 24hrs of injury

Ages 18-75, no DM nor vascular disease (otherwise healthy)

Laser: Red 632nm, IR 830nm and 904nm

6 d/week x3 weeks
"The use of LLLT on wound healing with proper dose and application technique can significantly improve healing process, functional recovery and pain relief. Over-irradiation or under-irradiation doses can lead to no or even negative effects."


**Table 3. Local clinical symptoms observed in the clinical study and the scoring points, which were used to evaluate the presence of those symptoms in all patients.**

<table>
<thead>
<tr>
<th>Local clinical symptoms</th>
<th>Scoring points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swelling (edema)</td>
<td>0 = complete absence of symptom</td>
</tr>
<tr>
<td>Hematoma (haemathoma)</td>
<td>5 = presence of symptom is mild</td>
</tr>
<tr>
<td>Pain (dolor)</td>
<td>10 = presence of symptom is moderate</td>
</tr>
<tr>
<td>Heat (calor)</td>
<td>15 = presence of symptom is severe</td>
</tr>
<tr>
<td>Itching (pruritus)</td>
<td></td>
</tr>
<tr>
<td>Loss of function (functio laesa)</td>
<td></td>
</tr>
</tbody>
</table>

• Group treated w LLLT initiated passive and active movement 35% earlier
LLLT FACILITATES SUPERFICIAL WOUND HEALING IN HUMANS

- 22 healthy subjects (age = 21 ± 1 years) received two standardized 1.27-cm² abrasions on the anterior forearm
- Each subject then received either LLLT (820 nm, 8 J/cm², 2 minutes) or sham laser to 1 of the 2 randomly chosen wounds for 10 days
- Subjects reported back to the laboratory on days 2 to 10 to be photographed and receive LLLT and on day 20 to be photographed

LLLT FOR POST OP HEALING

Wound, muscle, ligaments, bone, nerve

Mrs. V case
LLLT FOR BONE FRACTURE HEALING

“Studies indicate that low power laser irradiation can enhance biomechanical properties of bone during fracture healing in animal models”

LLLT FOR BONE FRACTURE HEALING

LLLT effect on bone and bone healing:

- Increase of collagen and DNA synthesis
- Faster removal of necrotic tissue
- Increase of Ca deposition
- Increase of periosteum cells function
- Increase of osteoblast and osteocyte function
- New vascularization
- Stimulation of enchondral ossification
- Earlier differentiation of mesenchymal cells
- Increase of pre-osteogenic cells
- Stimulation of callus formation

LLLT FOR CLOSED BONE FRACTURE IN HUMAN WRIST & HAND

• 50 pts with Fx of the hand or wrist
• Randomized, Double-blind, controlled
• 830nm, 60mW, 36 J total
• 10 mins/day, 5 days/week, 2 weeks
• Assessed before, after LLLT, 2 week follow-up

On radiographic evaluation, the laser group had greater increase in cortical bridging (CB) after treatment (detectable in 76% vs 32% of participants) and at two week follow up (92% vs 48%)

Meta-Analysis in 2010:

“LLLT can potentially be effective in treating tendinopathy when recommended dosages are used. The 12 positive studies provide strong evidence that positive outcomes are associated with the use of current dosage recommendations for the treatment of tendinopathy.”

LLLT + EXERCISES FOR CHRONIC ACHILLES TENDINOPATHY

• Double Blind RCT
• 52 recreational athletes with chronic Achilles tendinopathy randomized EE/LLLT or EE/sham
• LLLT (820 nm) was administered in 12 sessions (2x/week for 4 weeks, then 1x/week for 4 weeks)
• 60 mW/cm² and a total dose of 5.4 J per session

"Low-level laser therapy, with the parameters used in this study, accelerates clinical recovery from chronic Achilles tendinopathy when added to an EE regimen"
“Based on the results, low-power laser therapy with the parameters and dosage used in this study is recommended as a useful treatment for tendinitis”

LLLT FOR KNEE ARTHRITIS

- Blinded RCT
- 27 subjects with mild/moderate knee OA randomized to LLLT vs Sham
- LLLT 2x/week for 4 weeks
- 830nm, 50mw, 6 points, 48J/cm²
- Pain, tenderness, flexion, microcirculation

“Our results show that LLLT reduces pain in KOA and improves microcirculation in the irradiated area”

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>2 weeks</th>
<th>2 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Pain LLLT</td>
<td>5.75</td>
<td>1.05</td>
<td>1.18</td>
</tr>
<tr>
<td>Joint Pain Sham</td>
<td>5.62</td>
<td>4.07</td>
<td>4.12</td>
</tr>
<tr>
<td>Pressure Pain LLLT</td>
<td>2.33</td>
<td>0.33</td>
<td>0.77</td>
</tr>
<tr>
<td>Pressure Pain Sham</td>
<td>2.11</td>
<td>1.44</td>
<td>1.44</td>
</tr>
<tr>
<td>Joint Flex LLLT</td>
<td>105.83</td>
<td>124.33</td>
<td>122.94</td>
</tr>
<tr>
<td>Joint Flex Sham</td>
<td>107.22</td>
<td>116.11</td>
<td>112.11</td>
</tr>
</tbody>
</table>

INTEGRATIVE REHAB MEDICINE
LLLT FOR NERVE HEALING AND PAIN

LLLT effect on nerves:
• Decreases neurogenic inflammation
• Inhibits substance P
• Improves nerve cell metabolism
• Induces axonal sprouting
• Increases Schwann cell proliferation
• Increases axonal growth & myelinization
• Decreases post-traumatic retrograde degeneration
• Decreases neural and perineural scar tissue formation
• Improves recovery & functional activity of injured peripheral nerve

Dr. Shimon Rochkind
- Neurosurgeon at Tel Aviv Sourasky Medical Center
- Director of the Peripheral Nerve Reconstruction Division of the Department of Neurosurgery at the Tel-Aviv University
- Researcher on laser therapy for nerve regeneration and nerve transplantation

www.internationallaser.org
LLLT IMPROVES FUNCTIONAL RECOVERY POST NERVE INJURY

- 18 pts with traumatic peripheral nerve/brachial plexus injury >6 months discharged by their surgeons
- Randomly divided to laser vs sham
- 780nm laser, 5hrs/day (3 to injury area, 2 hrs to spinal segment), 21 consecutive days, 750J/mm²
- Mean motor function of dominant muscle
- EMG recruitment

LLLT IMPROVES FUNCTIONAL RECOVERY POST NERVE INJURY

Photographs of semi-thin sections of the rat sciatic nerve (distal to injury) 10 weeks after anastomosis
A, Laser. B, Control

Statistically significant increase in large-diameter axons in the laser-irradiated group ($p = 0.021$), compared to the non-irradiated control group.

SSEPs recorded 1.5 months after complete transection and suturing of the right sciatic nerve of rats.
• Laser - 9/13 (69.2 %) had positive SSEP responses, 4/13 (30.8%) had no response
• Control - 2/11 (18.2 %) had a positive SSEP response, 9/11 (81.8 %) had no response

LLLT FOR CARPAL TUNNEL SYNDROME

- 54 subjects with CTS (60 hands)
- Divided to laser vs surgery
- Laser 632nm, 12mW, 3J/cm², 2x/week for 6 weeks
- Surgery- open release of transverse carpal tunnel ligament
- Re-evaluated at 6 months

### Table 4: Subjective complaints before and after treatment

<table>
<thead>
<tr>
<th>Subjective complaints</th>
<th>Group A (n=30 hands)</th>
<th>LASER</th>
<th>Group B (n=30 hands)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before Treatment</td>
<td>After</td>
<td>p Values</td>
</tr>
<tr>
<td>Pain</td>
<td>17</td>
<td>3</td>
<td>≤0.01</td>
</tr>
<tr>
<td>Tingling</td>
<td>26</td>
<td>3</td>
<td>≤0.01</td>
</tr>
<tr>
<td>Numbness</td>
<td>29</td>
<td>3</td>
<td>≤0.01</td>
</tr>
<tr>
<td>Night awakening</td>
<td>20</td>
<td>3</td>
<td>≤0.01</td>
</tr>
</tbody>
</table>

### Table 5: Objective findings before and after treatment

<table>
<thead>
<tr>
<th>Objective findings</th>
<th>Group A (n=30 hands)</th>
<th>Group B (n=30 hands)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before Treatment</td>
<td>After</td>
</tr>
<tr>
<td>Positive Tinel’s</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Positive Phalen’s</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Decreased light touch</td>
<td>22</td>
<td>3</td>
</tr>
<tr>
<td>Median nerve compression</td>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>Thenar atrophy</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Positive NCSs</td>
<td>20</td>
<td>8</td>
</tr>
</tbody>
</table>

Systematic review and meta-analysis of RCT (2009):

“Our results show moderate statistical evidence for efficacy of LLLT in treatment of acute and chronic neck pain in the short and medium term. LLLT reduces pain immediately after treatment in acute neck pain and up to 22 weeks after completion of treatment in patients with chronic neck pain.”

LLLT FOR BACK PAIN AND RADICULOPATHY

- Mrs. R - L5 Radic
- Mrs. T - L3-4 annular tear
- Mr. J – Lumbosacral sprain
ELECTRICAL STIMULATION

Microcurrent Electrical Stimulation (MES)
BIO-ELECTRICITY
THE BODY’S NATURAL CURRENT FLOW
CURRENT OF LIFE
MICROCURRENT USE IN MEDICINE

- Improves Tissue Healing
- Reduces Pain
- Reduces Inflammation
- Reduces Swelling and Edema
- Reduces Muscle tension/spasticity
- Improves Depression and Anxiety
- Facial Rejuvenation
CURRENT OF INJURY

Figure 4. The current of injury is thought to be significant in initiating repair. Undamaged human skin has an endogenous electrical potential and a transcutaneous current potential of 20–50 mV. This is generated by the movement of sodium ions through Na+/K+ ATPase pumps in the epidermis. The current of injury is generated through epithelial disruption. Following an injury to the skin, a flow of current through the wound pathway generates a lateral electrical field and this is termed the “current of injury” or “skin battery” effect.

Injured areas have higher resistance (decreased conduction), microcurrent augments endogenous current flow, reduces resistance, allowing bioelectricity to flow.

MICROCURRENT FOR HEALING

• Increases cellular ATP
• Facilitates cellular mobilization (Galvanotaxis)
• Stimulates Cellular proliferation (leukocytes, fibroblasts, keratonicites, vascular endothelial cells, chondrocytes, osteoblasts)
• Stimulates protein and collagen synthesis
MICROCURRENT FOR CHRONIC WOUNDS

The role of electrical stimulation in the management of chronic wounds

- **Inflammatory Phase**
  - Blood flow
  - Tissue oxygenation
  - Oedema
  - Antibacterial effect

- **Proliferative Phase**
  - Membrane transport
  - Collagen matrix organisation
  - Wound contraction
  - Stimulation of DNA and protein synthesis

- **Remodeling Phase**
  - Epidermal cell reproduction
  - Fibroblast stimulation


MICROCURRENT FOR ACUTE WOUNDS


MICROCURRENT FOR POST-OP HEALING & PAIN

- 28 Pts undergoing THA randomized to MCT vs standard care
- MES was continuous for 36 hrs
- Compare would healing and use of opiate medication

Grade 1- dry suture line, no redness
Grade 2- wet suture line, minimal redness
Grade 3- wet/draining suture, redness + edema

Animal Studies have shown that Microcurrent:

• increased proline and hydroxyproline incorporation into healing tendon
• Increases tensile strength
• Decreases edema

MICROCURRENT IN TENNIS ELBOW

- RCT
- 60 pts w chronic lateral epicondylitis <1 year
- MES + exercise vs Sham + exercise 2x/week (MES 30 mins)
- Evaluated for pain, disability, grip strength

MICROCURRENT IN TENNIS ELBOW

**Table (1): Pain intensity, disability and grip strength at baseline for both groups.**

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Group</th>
<th>Mean±Standard deviation</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>1</td>
<td>7.93±1.31</td>
<td>1.68</td>
<td>0.098</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>6.73±1.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disability</td>
<td>1</td>
<td>62.33</td>
<td>1.112</td>
<td>0.271</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grip Strength</td>
<td>1</td>
<td>22.5±8.37</td>
<td>0.197</td>
<td>0.844</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>21.1±7.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table (2): Pain intensity, disability and grip strength at 6 weeks for both groups.**

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Group</th>
<th>Mean±Standard deviation</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>1</td>
<td>2.76±1.16</td>
<td>-6.64</td>
<td>0.0005</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>5.16±1.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disability</td>
<td>1</td>
<td>41.66±13.17</td>
<td>-2.93</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>51±13.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grip Strength</td>
<td>1</td>
<td>30.16±9.16</td>
<td>2.85</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>24.16±6.98</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“Microcurrent stimulation accelerates tissue healing in experimental muscle damage animal and human models”

- Increases muscle satellite cells
- Increased muscle protein synthesis

MICROCURRENT DECREASES MUSCLE DAMAGE POST INJURY

30 healthy men, eccentric exercise, MES wore for 4 days

MICROCURRENT APPLICATION METHODS
THE EFFECTS OF MES ON THE FOOT BLOOD CIRCULATION AND PAIN OF DIABETIC NEUROPATHY

• 29 subjects randomly assigned to MES vs control
• Both groups walked on a treadmill for 50 mins/day, 5d/week, 4 weeks
• MES group had shoes with 300uA
• Blood flow and pain score (VAS) measured before and after 4 weeks of intervention

THE EFFECTS OF MES ON THE FOOT BLOOD CIRCULATION AND PAIN OF DIABETIC NEUROPATHY

<table>
<thead>
<tr>
<th>Change of Blood Flow</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>Pre</td>
<td>Post</td>
<td>Difference</td>
</tr>
<tr>
<td>MES</td>
<td>2.21 +/- 1.5</td>
<td>3.40 +/- 2.31</td>
<td>1.19 +/- 2.11 *</td>
</tr>
<tr>
<td>Control</td>
<td>3.51 +/- 2.98</td>
<td>4.03 +/- 2.13</td>
<td>0.52 +/- 2.32</td>
</tr>
</tbody>
</table>

* p<0.05 compared to control

<table>
<thead>
<tr>
<th>Change of VAS</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>group</td>
<td>Pre</td>
<td>Post</td>
<td>Difference</td>
</tr>
<tr>
<td>MES</td>
<td>6.69 +/- 2.00</td>
<td>3.25 +/- 1.73</td>
<td>3.44 +/- 2.16 *</td>
</tr>
<tr>
<td>Control</td>
<td>7.31 +/- 1.80</td>
<td>6.85 +/- 2.11</td>
<td>0.46 +/- 2.47</td>
</tr>
</tbody>
</table>

* p<0.05 compared to control

51 pts, 40% back pain, Abdominal scar 65%, knee 15

Mrs. G case - CRPS

MICROCURRENT THERAPY FOR CONGENITAL TORTICOLLIS

- Control: 8 infants – 30 mins of stretching and u/s
- Active: 7 infants – 30 mins Microcurent, 2 mins stretch
- Treatment 3x/week for 2 weeks
- Outcome: Tilt angle in supine, neck ROM to affected side

Kim, Min Young, Dong Rak Kwon, and Hak Il Lee. "Therapeutic effect of microcurrent therapy in infants with congenital muscular torticollis." *PM&R* 1.8 (2009):
The therapeutic effect of microcurrent therapy in infants with congenital muscular torticollis was investigated by Kim, Min Young, Dong Rak Kwon, and Hak Il Lee. Their study was published in PM&R 1.8 (2009).

**Figure 2.** Mean head tilting angle at supine of experimental group and control group. *P < .01.

**Figure 3.** Mean neck rotation ROM to the affected side of experimental group and control group. *P < .05.
CRANIAL ELECTRICAL STIMULATION (CES)

- Change in brain wave activity, increases alpha activity (relaxation, focus), decreases delta (deep sleep)
- Decrease in activation of pain processing centers in the brain (cingulate, prefrontal cortex)
- Increase in plasma serotonin and B-endorphin levels
- Alpha Stim- FDA approved for: pain, anxiety, depression, insomnia

Cumulative Improvement in Pain After 1-5 CES Treatment Sessions

42% 50% 54% 64% 71%

Anxiety
83.7% of the active group reported at least 50% improvement.

Depression
82.2% of the active group reported at least 50% improvement

PULSED ELECTROMAGNETIC FIELD (PEMF)

The Five Elements:
1. Earth/Food
2. Water
3. Fire/Sun
4. Air/Oxygen
5. Aether/Akasha- Earth’s PEMF
PULSED ELECTROMAGNETIC FIELD (PEMF)
PULSED ELECTROMAGNETIC FIELD (PEMF)
PULSED ELECTROMAGNETIC FIELD (PEMF)

**Cellular Benefits of Earth’s PEMF:**

1. Recharges the Trans-Membrane Potential
2. Increases ATP production in the mitochondria
3. Enhances sodium-potassium pump
4. Increases cellular pH (makes cells more alkaline)
5. Increases oxygen uptake and assimilation into cells
6. Lowers blood viscosity and improves microcirculation
7. Improves electroporation (improves nutrient transport and waste elimination)
PULSED ELECTROMAGNETIC FIELD (PEMF)

- Promotes healing and regeneration
  - Bones
  - Cartilage
  - Tendons
  - Ligaments
  - Muscles
  - Skin
  - Nerves
- Decreases pain
- reduces inflammation
- Improves physical function
- Improves recovery
PULSED ELECTROMAGNETIC FIELD (PEMF)

- Promotes healing and regeneration
  - Bones
  - Cartilage
  - Tendons
  - Ligaments
  - Muscles
  - Skin
  - Nerves
- Decreases pain
- Reduces inflammation
- Improves physical function
- **Improves recovery**
PEMF effect on wound:

• Augments endogenous electrical field
• Increases proliferation and differentiation of skin fibroblasts and endothelial cells
• Increases collagen synthesis
• Increases angiogenesis
• Has bacteriostatic properties
• Decreases inflammatory mediators
PEMF- IMPROVES CHRONIC WOUND HEALING

- Double blind RCT
- 31 subjects with full thickness leg ulcers with unsatisfactory healing for at least 4 weeks
- PEMF (n 18) vs Sham (n 13)
- PEMF 3hrs/day 8 weeks
- Wound area and depth

PEMF- IMPROVES CHRONIC WOUND HEALING

PEMF- FOR POST-OP WOUND HEALING

Post-op Benefits of PEMF

- Decreases immediate post-op pain
- Decreases post-op narcotic use
- Decreases wound exudate volume
- Decreases exudate interleukin-1B concentration


PEMF STIMULATES TENDON/LIGAMENT REGENERATION

PEMF effect on tendons and ligaments:

• Stimulates fibroblast proliferation
• Stimulates collagen production
• Improves collagen orientation
• Decreases inflammation and edema
• Enhances microcirculation
• increased tensile strength
PEMF FOR PERSISTENT ROTATOR CUFF TENDONITIS

- Double blind, RCT
- 29 subjects with RCT >3 months resistant to conservative care (including inj)
- PEMF vs Sham for 4 weeks (5 hrs/day)
- Week 5-8, all received PEMF
- Week 8-16 no treatment

PEMF FOR LATERAL EPICONDYLITIS

- RCT, 20 PEMF (group 1), 20 Sham (group 2)
- PEMF - 6mT, 25Hz and 4.6 Hz, 30 mins 5x/week for 3 weeks
- Eval at 3 weeks and at 3 months

PEMF STIMULATES BONE GROWTH

- Stimulate osteoblast proliferation
- Increase transforming growth factor B1
- Increase alkaline phosphate
- Activates endothelial nitric oxide synthase (eNOS)
- Enhances bone marrow mesenchymal stem cell proliferation
PEMF – FOR DELAYED/NON-UNION FRACTURE HEALING

- Double blind RCT
- 45 pts with non-union tibial shaft fracture >16 weeks
- PEMF (n 20) vs Sham (n 25)
- Square wave, freq 15Hz
- 10 hrs per day
- Re-evaluation by radiologist and orthopedist at 12 weeks

**Table V. Radiological state of the fractures in the two treatment groups at the 12-week assessment**

<table>
<thead>
<tr>
<th>State of fracture</th>
<th>Active (n = 20)</th>
<th>Control (n = 25)</th>
<th>Comparison of treatment groups*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiologist’s assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full union</td>
<td>3</td>
<td>0</td>
<td>Full union, probable union and progress to union compared with no progress p = 0.002</td>
</tr>
<tr>
<td>Probable union</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Progress to union</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>No progress</td>
<td>10</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Orthopaedic surgeon’s assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United</td>
<td>9</td>
<td>3</td>
<td>United compared with improved but not united and no progress p = 0.02</td>
</tr>
<tr>
<td>Improved but not united</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>No progress</td>
<td>9</td>
<td>17</td>
<td></td>
</tr>
</tbody>
</table>

* p value based on Fisher’s exact test

PEMF FOR SURGICAL LUMBAR FUSION

- Double blind RCT
- 195 subjects undergoing interbody lumbar fusion
- PEMF (n 98) vs Sham (n 97)
- 12 month follow-up
- Evaluated by blinded orthopedist and radiologist

Review in 2008: “Low-frequency PEMFs relieves the pain of primary osteoporosis quickly and efficiently, enhances bone formation and increases BMD of secondary osteoporosis. But the effects of PEMFs on bone mineral density of primary osteoporosis and bone resorption were controversial.”

RCT Trial 2013: “Results suggested that a course of PEMFs treatment with specific parameters was as effective as alendronate in treating postmenopausal osteoporosis within 24 weeks”


PEMF IMPROVES JOINT HEALTH

PEMF effects on joints and cartilage:

- Increases proliferation of chondrocytes
- Increases Transforming Growth Factor (TGF) B1
- Increase Collagen 2 synthesis
- Increase synthesis of proteoglycans (ex: hyaluronic acid)
- Inhibits inflammatory and catabolic mediators (collagenase, IL -1B)
PEMF PRESERVES ARTICULAR CARTILAGE

- Guinea pigs exposed to PEMF 1 h/day for 6 months, beginning at 12 months of age
- Tibial articular cartilage was examined with histological/histochemical grading of the severity of arthritis
- “PEMF appears to be disease-modifying in this model of osteoarthritis, PEMF preserves the morphology of articular cartilage and retards the development of osteoarthritic lesions”

EFFECTIVENESS OF PULSED ELECTROMAGNETIC FIELD THERAPY IN THE MANAGEMENT OF OSTEOARTHRITIS OF THE KNEE: A META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

“Pulsed electromagnetic fields improve clinical scores and function in patients with osteoarthritis of the knee and should be considered as adjuvant therapies in their management”

PEMF FOR KNEE OSTEOARTHRITIS

• Double blind, RCT
• 34 subjects w knee OA (+imaging), knee pain >3 months, daily 2hrs standing physical occupation, pain > 4/10
• divided to PEMF vs sham
• 6.8MHZ portable device, 15 mins, 2x/day
• Mean Max VAS

PEMF FOR CERVICAL OSTEOARTHRITIS

- Double blind, RCT
- 34 subjects divided up into PEMF vs sham
- 30 min, 2x/day, 3 weeks
- 40uT, 0.1-64Hz
- Outcomes: Pain, cervical ROM, Neck Pain Disability Score (NPDS)

OUR CLINICAL EXPERIENCE

- Mr. A - lumbar radic and knee OC
- Mrs. J – Sacroilitis
- Mrs. B - EDS – polyarthritis and myalgia
PEMF IMPROVES NERVE REGENERATION

PEMF on experimental nerve injury

• Increases regeneration and maturation of myelinated axons

• Increased cross-sectional area of intranural blood vessels

• Reduces intraneural, epineural and perineural fibrosis (scaring)

• Pretreatment (7 days) or post injury treatment (3 days) increased sciatic nerve growth (p to 6 days post tx)


PEMF FOR LUMBAR RADICULOPATHY

• RCT
• 40 subjects, mean age 40y/o
• Unilateral lumbar radiculopathy ~ 12-14 months
• MRI findings of disc prolapse (most at L4-5 or L5-S1)
• PEMF vs Sham 20 mins/day for 3 weeks
• PEMF: 5-15 Gauss (G), freq 7Hz to 4 kHz
• Pain (VAS), Neuro Exam, Electrodiagnostic Exam

PEMF FOR LUMBAR RADICULOPATHY

Table 2: Comparison of both groups relative to VAS and total OSW before and after treatment

<table>
<thead>
<tr>
<th>Variable</th>
<th>Study group (n = 20)</th>
<th>Control group (n = 20)</th>
<th>P-value (t-test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS (0–10)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>7.1 ± 0.97</td>
<td>7 ± 0.9</td>
<td>0.755</td>
</tr>
<tr>
<td>After</td>
<td>3.6 ± 1.5</td>
<td>5.8 ± 2.7</td>
<td>0.024*</td>
</tr>
<tr>
<td>Modified OSW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before</td>
<td>75.4 ± 10.07</td>
<td>73.8 ± 1.7</td>
<td>0.862</td>
</tr>
<tr>
<td>After</td>
<td>33.4 ± 9.04</td>
<td>48.2 ± 10.9</td>
<td>&lt; 0.001**</td>
</tr>
</tbody>
</table>

*Significant at P < 0.05; **Highly significant at P < 0.001. OSW, Oswestry Low Back Pain Disability Questionnaire; VAS, visual analogue score; NS, not significant at P > 0.05.

Table 3: Neurological evaluation after PEMF intervention in both groups

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Study group (n = 20) Number (%)</th>
<th>Control group (n = 20) Number (%)</th>
<th>χ² test</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypoesthesia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present</td>
<td>4 (20)</td>
<td>11 (55)</td>
<td>5.22</td>
<td>S</td>
</tr>
<tr>
<td>Absent</td>
<td>16 (80)</td>
<td>9 (45)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep sensations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>↓ Present</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>–</td>
<td>NS</td>
</tr>
<tr>
<td>↓ Absent</td>
<td>20 (100)</td>
<td>20 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muscle power</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 4</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>–</td>
<td>NS</td>
</tr>
<tr>
<td>Grade 5</td>
<td>20 (100)</td>
<td>20 (100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ankle reflex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>20 (100)</td>
<td>14 (70)</td>
<td>7.06</td>
<td>NS**</td>
</tr>
<tr>
<td>Hyporeflexia</td>
<td>0 (0)</td>
<td>6 (30)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knee reflex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>20 (100)</td>
<td>18 (90)</td>
<td>2.11</td>
<td>NS</td>
</tr>
<tr>
<td>Hyporeflexia</td>
<td>0 (0)</td>
<td>2 (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLR test</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>2 (10)</td>
<td>8 (40)</td>
<td>4.80</td>
<td>S*</td>
</tr>
<tr>
<td>Negative</td>
<td>18 (90)</td>
<td>12 (60)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SLR, straight leg-raising; NS, non-significant at P > 0.05; S, significant at P < 0.05; HS, highly significant at P < 0.001.

PEMF FOR LUMBAR RADICULOPATHY

SSEP = Somatosensory Evoked Potential

- Decrease in latency (faster conduction)
- Increased amplitude (axonal growth)

PEMF REDUCES NEUROPATHIC PAIN

- Pilot Study
- 24 consecutive patients with refractory and symptomatic PN from diabetes, chronic inflammatory demyelinating, polyneuropathy (CIDP), pernicious anemia, mercury poisoning, paraneoplastic syndrome, tarsal tunnel and idiopathic sensory neuropathy
- 9 consecutive 1-h treatments
- comparison of VAS
- scores at the end of 9 days and the end of 30 days follow-up
- mean pain scores decreased 21% from baseline to end of treatment
- At 30 day follow up- 49% reduction of pain scores from baseline

CLINICAL CASE - MR. D

54 y/o Male with CMT type 1, numbness, twitching, “tightness of legs”, weakness

Comprehensive Treatments Plan
• PEMF 2x/week for total 32 min
• Mitochondrial Diet (IFM)
• Exercise
• Turmeric and Fish oil
• Positive outlook
ENERGY MEDICINE
EVIDENCE BASED MEDICINE

INTEGRATIVE REHAB MEDICINE
A WHOLE PERSON APPROACH TO TREATING PAIN, INJURIES AND FUNCTIONAL IMPAIRMENTS

Thank You

Sebastian Klisiewicz, D.O.
Integrative Rehab Medicine
Estero, FL
www.iRehabMed.com