

PEMF Therapy for Soft Tissue Repair and Cartilage Regeneration

Soft tissue and cartilage injuries are common and mostly occur in athletes, older adults, and individuals with chronic conditions. But sometimes, a simple everyday task or physical activity can cause such injuries. According to the Centers for Disease Control and Prevention (CDC), around 8.6 million soft tissue injuries occur every year because of sports or recreational activities. The most common are sprains, strains, bursitis, and tendinitis.

With the body's natural healing process, soft tissue injuries heal on their own over time, but certain injuries like ligament tears may require longer healing periods. In cases of cartilage damage, the tissue cannot regenerate naturally; thus, medical intervention is needed to treat cartilage damage.

Research suggests that pulsed electromagnetic field (PEMF) therapy can speed up soft tissue and cartilage regeneration, ensuring you get back to your active lifestyle sooner. PEMF therapy can alleviate pain by promoting the repair of damaged tissues without the need for strong medicines, which can have serious side effects and become an addiction. In some cases, it can also eliminate the need for surgery.

Let's learn what soft tissue and cartilage injuries are. This will help us understand how PEMF therapy can help.

What are soft tissue injuries?

Soft tissue injuries can occur during various activities and affect muscles, ligaments, and tendons, causing pain, swelling, and sometimes bruising. Soft tissue injuries like sprained ankles, twisted knees, or muscle tears trigger the body's natural healing process, which involves four main stages:

Bleeding phase

Bleeding happens right after the injury, which lasts for about 6-8 hours after minor injuries and up to 24 hours after a major injury. The amount of bleeding that occurs depends on the extent of the injury and its management. Muscles have a good blood

supply and tend to bleed more and for longer, resulting in larger bruises. Ligaments bleed less as they have a weaker blood supply.

Inflammation phase

Inflammation begins within 1-2 hours of the injury, peaks at 1-3 days, and generally lasts a couple of weeks. It is a natural and necessary part of the healing process, marked by swelling and warmth around the area. It triggers the next stage of healing.

Proliferation phase

This stage starts within 24-48 hours of the injury, peaks at 2-3 weeks, and continues for about 4-6 months. During proliferation, your body creates scar tissue to repair the injury. This is why you may still experience some symptoms after a couple of weeks, as the healing process is still ongoing and new scar tissue is being formed.

Remodeling phase

The new scar tissue formed during the proliferation phase is not of high quality or very functional. In this phase, lasting up to 2 years, your body remodels the scar tissue to make it behave as closely as possible to the original one.

The usual treatment of soft tissue injuries involves rest, ice, compression, elevation, and in some cases, surgery or injections.

The entire tissue healing process takes much longer than expected, especially for more severe injuries. Even a year after a significant injury, minor problems may still persist.

How can PEMF therapy help with soft tissue injuries?

PEMF is known for its ability to enhance blood circulation, which is a significant benefit of this therapy. This improved circulation plays a crucial role in healing your body at a cellular level. It helps reduce swelling, enhances the delivery of oxygen and nutrients to injured soft tissues, and boosts immune function.

Good circulation can boost the healing process, especially in cases of ligament injuries where blood supply is limited. Increased blood flow can also assist in the removal of waste products and toxins, supporting the healing process.

PEMF also stimulates collagen production, which is a crucial component of connective tissues like ligaments and tendons. Collagen acts like a scaffold, giving structure for new cells to grow and repair the injured area. This reparative protein not only stabilizes the injured area but also provides a framework for new cells to grow and flourish. This is essential for tissue repair and strengthening, potentially aiding in the remodeling phase of the healing process.

More collagen in the blood promotes the resynthesis of tendons and soft tissue. It has also been shown to alleviate pain associated with injuries, prevent soft tissue injuries, and aid in the treatment of osteoarthritis.

PEMF frequencies for soft tissue injuries:

Periostitis: Duration: 20 minutes; frequency: 6 Hz

Tendinitis: Duration: 10 minutes; frequency: 8 Hz

Ligament injuries: Duration: 20 minutes; frequency: 10-15 Hz

Sprains: Duration: 20-30 minutes; frequency: 10 Hz

Strains: Duration: 20 minutes; frequency: 11-15 Hz

Bruises: Duration: 15 minutes; frequency: 10-14 Hz

What are cartilage injuries?

Cartilage is a tough but flexible tissue that covers the ends of bones and forms important structures like the ears, nose, and larynx. It plays a vital role in your joints by providing support to your bones and minimizing friction between them, enabling smooth and comfortable movement.

When cartilage is damaged, you might experience pain, stiffness, swelling, and limited movement in the affected joint with a clicking or grinding sensation. It often happens in the knee but can also affect other joints like the elbow, wrist, or hip.

Cartilage can be damaged due to a direct blow to a joint (during sports, a fall, or a car accident), long-term wear and tear (such as in case of osteoarthritis), or chronic conditions like rheumatoid arthritis. Cartilage damage can worsen over time, making it

harder to move and causing more pain. Small cartilage problems can turn into osteoarthritis, a condition that affects the joints.

Unlike soft tissue or bone injuries that can heal, cartilage damage doesn't naturally repair itself. Even in individuals who are otherwise healthy, damaged cartilage does not regrow. Consequently, those left with a cartilage lesion are at risk of developing arthritis because it is compromised. This leads to a chain of events that can further cause complications. Restoring cartilage is challenging due to a lack of blood supply and the absence of stem cells, which are crucial for tissue regeneration in other parts of the body.

Lacking blood supply means that cartilage cannot initiate the formation of new tissues, unlike soft tissue injuries, where there is bleeding, inflammation, and new tissue formation. Cartilage is also surrounded by a perichondrium-like fibrous membrane that is not efficient at regenerating, resulting in slow recovery after an injury.

Treatment involves nonsurgical (conservative) or surgical options. Conservative treatment includes exercises, anti-inflammatory drugs, and sometimes injections. Surgery involves procedures such as smoothing damaged parts, stimulating new growth, or transplanting healthy cartilage.

There are several innovative techniques where surgeons take cartilage from one part of a joint where it is not needed and transplant it to the lesion where it is needed. There are also technologies where cartilage cells are taken from the patient, grown outside the body, and then reintroduced through cell therapy. Another method is tissue engineering. However, these techniques are very expensive and labor-intensive, involving major surgery. Experts believe there's a lot of room for improvement.

How can PEMF help with cartilage injuries?

PEMF therapy uses biological techniques to authentically grow cartilage within the body. This approach does not involve growing cells outside your body and then reintroducing them. This therapy is noninvasive, stimulates cartilage regeneration, and promotes authentic growth.

PEMF therapy can stimulate chondrocytes, the cells responsible for producing and maintaining cartilage. When exposed to PEMF, these chondrocytes grow, transform, and produce more substances that form the structure around cells (known as the

extracellular matrix). It does this by releasing certain helpful substances (anabolic morphogens like bone morphogenetic proteins and anti-inflammatory cytokines) and interacting with specific receptors in the cells (adenosine receptors A2A and A3). By encouraging the functions of healthy cells, PEMF supports cartilage regeneration.

Evidence supporting PEMF's efficacy in cartilage regeneration

Several studies have investigated the effects of PEMF on cartilage regeneration.

Research published in the *Journal of Orthopaedic Research* (2015) [PS1] found that PEMF might increase chondrocyte proliferation and differentiation, showing its potential for cartilage regeneration.

The regenerative benefits of PEMF on injured cartilage were highlighted in a study published in the *journal Bioelectromagnetics* (2019), indicating its significance in accelerating the healing process.

PEMF frequencies for cartilage repair:

Duration: 20-30 minutes

Frequency: 50-75 Hz

Conclusion

Soft tissue and cartilage injuries can significantly affect your daily life, causing pain, discomfort, and limited mobility. While your body has its own natural healing mechanisms, they often require time and can sometimes fall short, especially in case of cartilage damage, which doesn't regenerate naturally.

Not everyone can afford expensive surgical treatments, especially older people who are at risk of complications. Thus, PEMF is a cheaper alternative that is not only noninvasive but also has minimal or no side effects.

References

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- Xu Y, Wang Q, Wang XX, et al. The effect of different frequencies of pulsed electromagnetic fields on cartilage repair of adipose mesenchymal stem cell-derived exosomes in osteoarthritis. *Cartilage.* 2022;13:200-212.