In 1954, Yasuda described piezoelectricity of bone. When mechanical strain is placed on bone, electronegative potentials form on the compression site and electropositive potentials form on the tension side. Furthermore, the electronegative sites triggers cells to form bone and bone resorption occurs at the electropositive sites. Because this phenomenon, stimulation on bone healing using electric field can be effective. Inductive coupling stimulation uses external coil (either one or two) that connects to a signal generator. This apparatus then produces a pulsed magnetic field. The pulsed electromagnetic field (PEMF) is made up of either repetitive pulsed burst with frequencies typically range from 1 to 100 bursts/second or single pulsed signals. Several animal studies have shown that PEMF stimulates healing on non-unions, osteotomies, and fresh fractures. It also promotes angiogenesis which creates increasing vascularization in the early stages of bone healing. In cellular and tissue studies, inductive coupling stimulation has enhanced osteoblastic activities as well as bone and cartilage cell matrix production. It also inhibits osteoclastic resorption. Specifically, PEMF increases expression of growth factor TGF-B1 as well as bone morphogenic proteins (BMPs) like BMP-2, BMP-4, BMP-5, and BMP-7.

Pathogenesis of osteochondral lesion of the talus is still not clearly defined. Some lesions develop as result of trauma as described by many authors, including the classic article by Berndt and Harty in 1959. They used the term “Transchondral Fracture of the Talus” for this problem. Other lesions develop idiopathically without an association of an injury to the talus. In 1966, Campbell and Ranawat explained that osteochondritis occurs when pathologic fracture develops in necrotic bone as a result of poor blood supply. Regardless of the true etiology of osteochondral lesion of the talus, the treatment of this problem can be challenging because it involves problems with both bone and articular cartilage. In orthopaedic literature, many surgical options have been described: Reduction and fixation of a true osteochondral fracture, arthroscopic lavage, abrasion, drilling, or microfracture, osteochondral autografts, osteochondral allograft, autologous chondrocyte implantation, matrix/membrane autologous chondrocyte implantation, stem-cell mediated cartilage implants and scaffolds. The success rate of these procedures ranges from 28% to 100%.

Some patients with osteochondral lesion of the talus are asymptomatic. This is evident by presence of osteochondral lesion of the talus on MRI or CT scans and the individual does not have pain, locking, catching, or giving way due to the lesion. In those patients that have symptomatic osteochondral lesion, typically there is presence of marrow edema surrounding the lesion on T2-weighted images on MRI. Frequently the size and the intensity of the marrow edema can be significant. The surrounding marrow edema indicates stress reaction of the bone marrow to either the osteochondral lesion or microtrauma to the talus. Surgery is indicated for those patients who fail the usual non-surgical treatment options. In those patients who fail non-surgical treatment and do not have mechanical symptoms of locking or giving away, application of PEMF bone stimulation is an alternative treatment option to help to heal the bone marrow injury. By applying the science of PEMF on bone healing to the treatment of certain types of osteochondral lesion of the talus, it can be successful in healing of the stress reaction, microtrabecular injury or fracture around the osteochondral lesion. Pulsed electromagnetic field does not restore articular cartilage or create new bone in a bone cyst. Therefore, the use of PEMF is indicated in some patients with certain types of osteochondral lesion of the talus. After reviewing the short-term study, in order to better understand the effect of PEMF treatment on osteochondral lesion of the talus, further clinical studies need to be conducted.
References:


