Articular cartilage of the ankle is difficult to adequately visualize with traditional imaging modalities. Magnetic Resonance Imaging (MRI) has significant advantages over traditional imaging modalities, such as computed tomography (CT) and conventional radiography. MRI provides reliable information on the state of bone, but not that of cartilage. Magnetic Resonance Imaging also has limitations for evaluating soft tissues and morphologic cartilage. However, cartilage viability cannot be reliably determined by either modality. Furthermore, the cartilage response to a given injury is different from that seen in vitro. This project aims to show the advantage of T2 cartilage mapping in the diagnosis and subsequent treatment of joint pathology in the ankle.

**Literature Review**

MRI provides the most accurate non-invasive morphological assessment of cartilage but is limited in its ability to portray cartilage degeneration occurring prior to morphologic changes. T2 cartilage mapping has been shown as a viable indicator of biochemical properties of articular cartilage. Patients with osteoarthritis have T2 cartilage values which are approximately 70% wet weight, while type II collagen accounts for approximately 15% wet weight. Proteoglycans, the hydrated matrix, are made up of water and collagen in varying ratios to make four distinct zones of cartilage; superficial, transitional, radial, and calcified cartilage. MRI analysis of articular cartilage has been shown to be an analog to collagen organization, thus allowing visualization of changes not only in surface cartilage but also other biochemical properties of articular cartilage. T2 cartilage mapping creates a color coded map which represents the solving of the T2 relaxation time by pixel. The colored display represents an estimate of the zones of cartilage and an orientational alignment of articular cartilage of the ankle. Prolonged T2 relaxation time is evidence of cartilage degeneration and is correlated with clinical findings of decreased cartilage thickness and bone apposition which exist in the superficial zone, which provides the greatest tensile stiffness of all cartilage zones. As the cartilage gets deeper into the transitional zone, the lowest concentration of collagen fibers is found, the lowest concentration of water is found and articular cartilage in this region is distinguished as a separate structure at clinically relevant field strengths. T2 cartilage mapping also allows for improved distinction of the abnormal properties of two opposing articular surfaces, which can be difficult with standard MRI sequences.

T2 cartilage mapping has been shown to accurately assess articular cartilage following total joint replacement in the knee. This offers an additional benefit over traditional MRI, in that the repaired or transplanted cartilage surfaces can be assessed for incorporation into host tissue. The majority of literature involving T2 cartilage mapping has involved pathology of the articular surfaces of the knee and hip. However, the knee is not the only joint affected by cartilage degeneration. Ankle arthroscopy is a common procedure performed at outside facilities. A T2 Cartilage Mapping study was performed utilizing improved spatial resolution in addition to T2 cartilage mapping to further evaluate ankle cartilage degeneration and its affect on articular function.

**Case Study**

Patient BG is a 54 year old female with history of right ankle pain for approximately 20 years. She complained of continued progression of ankle pain. Her previous workup by other providers included a CT arthrogram (Image 1a) of the right ankle, showing a medial talar osteochondral lesion (OCL) with smooth joint surface and cartilage hypertrophy. The CT report noted that the CT findings were consistent with a mixed OCL of the talar dome. The representative images for T2 cartilage mapping (Image 1b & 1d) and traditional MRI sequences (Image 1c & 1e) are shown. Standard MRI images showed a medial talus dome lesion measuring 1.7 x 1.0 x 1.1 cm with underlying bone marrow edema and overall cartilage hypertrophy. The T2 cartilage mapping showed T2 prolongation consistent with collagen disorganization and thickening. The cartilage outside of the osteochondral lesion had normal T2 cartilage appearance. Due to the superior ability of T2 cartilage mapping sequences over CT and traditional MRI sequences, the cartilage organization in and around the OCL were adequately assessed. The patient underwent an Osteochondral Allograft Transfer Procedure. She elected to have intra-articular steroid injections and was satisfied with how her ankle felt. The patient was offered operative MRI or CT may be vastly worse than anticipated when thousands of dollars in medical imaging were spent, does not have been procured and the patient’s long term prognosis would likely be poor. The ability to determine cartilage surrounding an osteochondral lesion is also paramount. However, cartilage defects are prevalent in over 90% of the population. A surgeon can then decide pre-operatively if an open or arthroscopic procedure is indicated. Evaluation of the lesion and around the OCL were adequately assessed. The patient was offered osteochondral plug or osteochondral grafts and were back to work and full activities without pain. Cartilage viability cannot be reliably determined by either modality. However, cartilage viability cannot be reliably determined by either modality. Furthermore, the cartilage response to a given injury is different from that seen in vitro.