

## **MRI Findings of Bone Marrow Edema in a Division I NCAA Women's Soccer Team During a Competitive Season**

**Purpose:** Bone marrow edema (BME) has been associated with the clinical practice problem in athletes of stress fractures and can possibly lead to early-onset osteoarthritis. Our goal was to evaluate the knee joint of the same cohort at two time points during the competitive season.

**Research Questions:** Is BME a normal physiological reaction to stress (training loads) without significant consequences? Or is BME a pathological overuse injury leading to long-term joint degeneration? We hypothesized that the incidence of BME would increase from baseline measurements due to the increase physical demands during the season.

**Synthesis of the Review of Literature:** The clinical significance and time course of development with BME is poorly understood. No study previously tracked a female athletic population over the course of a competitive season to assess the incidence of BME. Current knowledge includes that the appearance of BME is thought to represent microtrabecular fractures, hemorrhage, and edema. If stress is not relieved on the structures and recovery allowed, a stress fracture is a possible sequela.

**Methods:** 42 knees were imaged at baseline and 27 knees immediately post-season. All examinations were performed by an experienced MRI technologist, using a 1.5-T MRI unit, and were read by an experienced radiologist and nurse practitioner.

**Results:** At baseline, 16 of 42 knees (38%) were found to have BME. Post-season, 22 of 27 knees (82%) had BME. GEE analysis resulted in a significant difference between baseline and post-season ( $p < .001$ ). Compared to baseline, the odds of edema increasing was over seven fold (OR= 7.33, 95% CI 2.55-21.05). The incidence of new cases developing during the season was 73%.

**Discussion:** Our research demonstrated that BME was found to be significantly more widespread in the same population after a competitive soccer season. The clinical relevance is that bone marrow edema is thought to be antecedent to stress related injuries. Early evaluation may detect abnormalities that are reversible. Training loads and conditioning plans may have an effect. To enhance existing knowledge, using evidence that BME developed during a competitive season, a practice change may be implemented which includes changing and closer monitoring of athlete training loads.