MULTIPLE LOWER EXTREMITY STRESS FRACTURES IN A FEMALE DIVISION I CROSS COUNTRY RUNNER: A CASE STUDY. Pollard C. D., McClay I. S., Hamill J. Biomechanics Laboratory, University of Massachusetts, Amherst, MA.

Background and Purpose. A stress fracture in the high performance collegiate athlete presents a difficult problem. The tibia is the most common site of stress fractures in runners accounting for between 32-56% of total stress fractures reported. The purpose of this case report is to describe a case of multiple lower extremity stress fractures over time. **Case Description.** The patient is a 20-year-old female Division I collegiate cross-country runner who reported a history of five lower extremity stress fractures over the past three years. The stress fractures were located at bilateral tibias, bilateral first metatarsals, and the right third metatarsal. The right tibial stress fracture was diagnosed during the cross-country season, while the others were diagnosed during the off-season. The patient reported complying with the recommended rest period of 6-10 weeks following each stress fracture diagnosis. The patient has trained and competed in custom orthotics since recovery from the first stress fracture. The patient has been evaluated by a registered dietician and determined to have adequate nutrition and eating habits. The patient is eumenorrhoeic and had two separate DEXA bone density scans over the past two years that demonstrated normal bone density. Area moments of inertia were measured for the distal third of both tibias and were 30% lower than average values. Bilateral peak tibial accelerations were measured during running (3.70 m/s) and were also within normal range (5-8 g's). However, the right peak tibial acceleration was on the high end of normal values (8.3 g's). Upon a recent physical therapy evaluation, the patient presented with significant bilateral static genu varum and excessive bilateral static calcaneal eversion (right: rearfoot angle 18°, tibial varum 11°; left: rearfoot angle 15°, tibial varum 10°). Over the past three years, the patient has been followed by a sports medicine physician and has participated in numerous physical therapy treatment progressions. **Outcome.** Although this patient has attempted to do everything indicated to prevent the reoccurrence of a lower extremity stress fracture, she has not been successful. **Discussion.** It is thought that overuse injuries occur when tissues do not adapt normally to repetitive stress. There can be numerous underlying reasons that these tissues do not adapt normally and result in a stress fracture. Anatomic malalignment has been implicated in the etiology of stress fractures. Matheson et al. (1987) noted that varus malalignment (genu & tibial) was often present in athletes with stress fractures. This patient exhibits significant lower extremity malalignment. Bone structure is thought to contribute significantly to the overall risk of stress fractures. Milgrom et al. (1989) has suggested that stress fractures may occur in regions where high bending loads are found. This patient exhibits lower than average tibial area moments of inertia (resistance to bending). In an attempt to prevent future stress fractures, following her first stress fracture, this patient made multiple adaptations in her training, strengthening, and flexibility programs and implemented the use of orthotics. These adaptations did not result in the avoidance of further stress fractures. Even though this patient has followed all recommendations, she seems to have bilateral anatomic alignment and structural limitations that may not allow her tissues to tolerate the training demands of a Division I cross country runner.

References.

1. Matheson G. *et al., Am J Sports Med* 1987. 15:46-58.
2. Milgrom C. *et al., J Biomechanics* 1989. 22:1243-1248.

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