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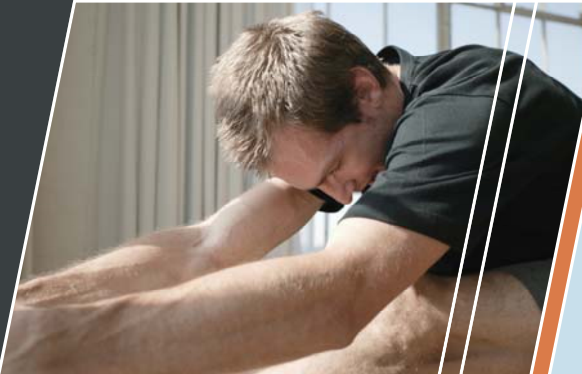
Current Comments

Report on Stress Fractures

contributing
risk factors

The following factors contribute to the incidence of stress fracture either directly or indirectly via their influence on bone strain and commensurate relationship to bone remodeling:

- Training changes (e.g. terrain, shoes, activity, training intensity)
- Running and jumping activities
- Inappropriate footwear
- Muscle inflexibility
- Muscle weakness
- Excessive muscle strength
- Lower extremity alignment anomalies
- Poor running technique
- Previous history of injury
- Low bone mineral density (in women, often secondary to inadequately circulating estrogen.)



Diagnosis

Positive symptoms of stress fracture include local tenderness, pain with direct and/or indirect percussion and pain with weight bearing, (particularly hopping on the affected limb.) Signs of swelling at the injury site may be present. Confirmation of clinical diagnosis may be obtained via triple-phase Technetium 99 bone scans (often considered the standard diagnostic tool), and magnetic resonance imaging (MRI). Plain x-rays are normally inadequately sensitive for the purposes of early diagnosis. Generally, historical symptoms and physical signs are enough for diagnosis.

Written for ACSM by Belinda R. Beck, Ph.D.

ACSM Current Comment

Stress fractures are a recognized complication of the chronic, intensive, weight-bearing training familiar to athletic, dance and military populations. Bones are most susceptible to stress fracture when weakened by remodeling-related porosity, a primary stage in the adaptive response of bone to changes in patterns of loading. Prevention is the most appropriate management approach, best achieved through graduated training increments. The goal of stress fracture treatment is to facilitate the natural progression of bone remodeling by reducing loads on the injured site to the greatest extent. Thus, rest from pain-provoking activities remains the most effective, if often prolonged, intervention approach at this time.

Stress Fractures

An ACSM Report

Stress fractures comprise between 0.7 and 15.6 percent of all athletic injuries. Athletes particularly at risk of stress fracture are runners and jumpers, gymnasts and dancers. Stress fracture incidence among U.S. military recruits is also high, ranging from approximately one to 20 percent, with higher rates reported for women than for men. In general, the bones most commonly injured are the metatarsals, fibula and tibia.

Etiology

Normal physiological loading provokes a range of deformation reactions (strains) in bone, including compression, tension, shear, torsion, and vibration. Bone exhibits an intrinsic ability to adapt to alterations in chronic loading to withstand future loads of the same nature, a phenomenon commonly referred to as Wolff's Law. Adaptation of bone to load changes occurs via increased modeling and/or remodeling. Modeling is a process whereby bone tissue is either deposited or removed to modify the shape and size of a bone.

Remodeling describes a process of bone resorption, followed (after a delay of roughly one month) by deposition of new bone (for approximately six months). While some level of remodeling is constantly occurring in normal bone, in bone undergoing adaptation to altered loading, the degree of remodeling increases substantially. The initial increase in resorption will render a bone relatively porous until the process of deposition can replace the lost tissue in full. During this prolonged replacement phase, bone is more susceptible to stress fracture by virtue of increased porosity.

New Direction

Preliminary evidence suggests that the application of electric and electromagnetic fields or sound waves may enhance the healing of stress fractures. A number of bone stimulatory devices are currently on the market, and research in the field of stress fracture application is ongoing.