Stress Injuries and Orthotic Support

By William M. Austin, DC, CCSP

Stress injuries to bony tissues are common occurrences, especially among our increasingly active population. (1) It is not unusual for a chiropractor to be consulted for the vague pain and non-specific symptoms of an early stress fracture. These injuries respond very well to chiropractic management, especially when it includes the use of appropriate orthotics.

From Overuse to Fracture

With the increasing use of sophisticated advanced imaging procedures, we can now understand much better the developmental process of stress fractures, and we realize that there is a continuum from overuse to stress reaction, and eventually to stress fracture in bone. Specifically, stress fractures result from the inability of bone to withstand repeated traumas which in themselves would not be sufficient to cause a fracture. (2) Stress
fractures are a good example of an “overuse” syndrome, caused by excessive and repetitive microtrauma.

Overuse syndromes such as stress fractures are due to biomechanical stress which exceeds the body’s inherent capacity to repair and adapt. (3) In other words, the repair process cannot keep up with the stressor and is overcome, with the eventual result that the tissue fails, resulting in injury. These conditions must be managed properly by the treating chiropractor, since any delay in establishing an appropriate treatment plan will result in continuing progression and true fracture of bone, placing the patient at risk for a disabling condition. (4,5)

**Microtrauma Sources**

There are four major sources of microtrauma which can result in stress reactions: overuse, poor training techniques, inherent biomechanical stresses, and poor shock absorption (Table 1). Overuse occurs when a body part is exposed to unusual, repetitive trauma such as starting a new running program. In this case, everything is done correctly, but there is just too much stress, too soon. Poor training techniques include running long mileage on one side of the road, resulting in excessive stress due to the angulation of the road. Training techniques can usually be easily changed to reduce physical stress.

Biomechanical stresses are occasionally high due to inherent imbalances or asymmetries. An example is the increased frequency of stress fractures in the metatarsal bones of military recruits with low arches and flat feet found by Simkin et al. (6) Inherent
biomechanical imbalances often require modification of performance or equipment for complete resolution. Poor shock absorption can result from running on unyielding surfaces or in broken-down shoes, or it may be due to inherent factors which interfere with normal shock absorption, such as a high arched foot. The study by Simkin et al. of military basic training found a much higher frequency of femoral stress fractures in recruits who had a “cavus” (high-arched) foot, because this condition tends to transmit heel-strike shock, instead of absorbing the shock as does the foot with a normal arch.

Stress Locations

Since up to 95% of stress fractures occur in the lower extremities (including the hip), (7) most incidents of stress reaction in bone seen by chiropractors will localize to the foot, leg, hip, or pelvis. Typically, the patient will report a dull, aching pain sensation which is poorly localized. The nagging pain will increase during use of the affected area, and often remain for a while after use, then subside or disappear with rest overnight. Involvement of the femoral neck will often cause aching discomfort to radiate into the groin and posterior pelvis. (5) The most important aspect of the symptom pattern for accurate diagnosis is the recurrence of pain with exercise and the relief of pain with rest.

Correcting the Conditions

Since inherent biomechanical imbalances make some people more susceptible, sometimes only a mild change or increase in exercise may initiate a stress reaction. A common source of excessive biomechanical stress to bones of the lower extremity is malalignment or asymmetry. Since during standing, walking, and running the lower
extremities and pelvis form a closed kinetic chain, then torque, shock, tension, and compression forces are transmitted between the bones, joints, and muscles. If imbalances or asymmetries are present (whether developmental or acquired), these forces can reach excessive levels and eventually cause or contribute to a stress fracture. Three specific conditions have been studied which can be easily noted and corrected in the chiropractic office: the high arch, excessive pronation (with a low arch), and inequality of leg lengths.

- The foot with a higher than normal arch (cavus foot) remains too rigid and inflexible during walking and running. This results in poor attenuation of heel-strike shock, much of which is then transmitted up the kinetic chain into the leg and hip. The person with a rigid, high-arched foot is susceptible to developing stress fractures in the sesamoids, calcaneus, femur, and pelvis. (1,6,8) This type of foot requires better flexibility (mobilization, stretching) and custom orthotics with added shock absorption material to dynamically support the arches and help decrease shock at heel-strike. (6)

- Excessive pronation (rolling inwards of the ankle) during walking and/or running may be due to either arch collapse or poor arch development. In either case, excessive torsional (twisting) forces are transmitted from the overpronated foot into the leg with each step taken. (9) The hyperpronating foot tends to develop stress fractures more frequently in the collapsed metatarsals and in the tibia. (1,6,8) Orthotic support for the arches that includes pronation correction at the
heel (a medial or “varus” wedge) will decrease the torque forces on the foot and leg bones and prevent the development of stress reactions. (6)

• Leg length discrepancy is another inherent asymmetry which has been shown to lead to increased frequency of stress fractures. A study using Norwegian military recruits found that 73% of stress fractures occurred in the longer leg, while only 16% were found in the shorter leg, and 11% in a leg of equal length. (10) These results are consistent with other studies which have found that degenerative changes in the hip joint (11) and lumbar spine (12) occur much more frequently on the side of a longer leg. Treatment consisting of a custom-made, flexible orthotic and/or shoe build-up to reduce the discrepancy is appropriate in order to decrease the abnormal biomechanical forces developed during walking and running with asymmetrical leg lengths. (13)

**Care and Support**

Initially, rest of the affected extremity is necessary, in order to allow for healing and remodeling. Bone healing does not demand complete bed rest, but rather a change and moderation of activity. Temporary cessation of the causative exercise with substitution of cross-training will prevent deconditioning of the athlete. Plans to address poor training techniques should be made, including recommendations regarding the amount and frequency of training, as well as methods for achieving competitive goals with less localized stress on the affected body area. Low-stress exercise programs which use
controlled isotonic protocols can provide benefits from the beginning of healing through to
the achievement of previous levels of activity.

In most cases, the use of custom-made orthotic support will significantly speed recovery
and prevent recurrence upon return to full activities. Properly fitted and designed orthotics
can substantially reduce the abnormal forces generated by biomechanical asymmetries
and poor shock absorption. The end result is a happier patient, and a more active athlete.

References


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About the Author

An enthusiastic speaker, Dr. William Austin provides an energetic approach to learning. He draws from over 35 years of healthcare experience, which includes Athletic Training, Emergency Medicine, English Bonesetting, and Chiropractic. Dr. Austin has developed two successful practices. His patients range from newborns to centenarians, couch potatoes to professional athletes. Dr. Austin is a 1986 graduate of Logan College of Chiropractic and is currently Director of Professional Education at Foot Levelers, Inc. of Roanoke, VA.

**CAUSES OF STRESS REACTIONS IN BONE**
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Table 1.