

Stress fracture factors guide orthotic choices

By Cary Groner

Stress fractures are generally thought to occur due to a multitude of factors. These include age and activity level (those under age 24 experience most such injuries, probably during high-intensity athletics and military service); gender (women are at higher risk, partly as a result of endocrine issues); and training (or overtraining) while wearing inadequate footwear. Most interventional studies have been conducted in military settings, however, and disagreement persists about the degree to which such findings can be extrapolated to civilian athletes.

For example, in a 2008 paper, Israeli researchers reported the results of a 25-year effort to reduce the rate of stress fractures in infantry recruits. Several approaches, including shoe alterations, largely failed. What worked reliably was making sure recruits got enough sleep and marched less—two risk factors that are far less likely to affect civilian athletes. In a 2009 article published in the *Hospital for Special Surgery Journal*, a review of several studies found that when data were pooled, orthotic use was beneficial for reducing stress fractures in military settings, but that the results could not necessarily be applied to a mainstream athletic population.

Many clinicians find such studies helpful, however, if only because of the rigor with which they tend to be conducted.

“The literature from the military is more applicable than you might expect,” said Jonathan Chang, MD, a clinical assistant professor of orthopedics at the University of Southern California. “Soldiers do a lot of marching, but they also do a lot of athletic training.”

Chang believes that such studies emphasize the extent to which stress fractures are associated with training errors.

“Military recruits are asked to do things they aren’t prepared for, aren’t in shape for, and wouldn’t do under normal circumstances,” he said.

But young athletes who want to compete among the elite must sometimes push their bodies well past the comfort zone, he noted.

“The intensity of repeated workouts will predispose them

to the problem, but once other risk factors such as overtraining and diet issues have been ruled out, we’ve got to look closely at gait,” Chang said.

For Bruce Williams, DPM, owner of Breakthrough Podiatry in Merrillville, IN, noteworthy risk factors for metatarsal stress fractures include ankle joint equinus and a tendency to raise the heel early so that the forefoot is loaded too long. Achilles tendon tightness and leg-length differences also are contributing factors.

“I want to use an orthosis to guide the foot through the most stable positions from heel contact to toe-off,” Williams said. “I want to decrease prolongation, pronation, and compensation. An orthosis should give the first ray more of an opportunity to engage. If you don’t get good stability under that first MPJ, the foot won’t be stable, and that will overload the lesser metatarsals, especially [in numbers] two and three.”

Studies suggest that varus malalignment in the lower extremity may also cause vertical forces to be directed medial to the tibial shaft, which increases the risk for tibial stress fracture. Placing a wedge under the foot can help redirect those forces.

Williams noted, however, that tibial stress fractures are harder to address with orthoses than metatarsal stress fractures, and require a careful evaluation of the entire lower extremity kinetic chain.

Michael Gross, PT, PhD, a professor of physical therapy at the University of North Carolina, explained that three-point bending—the point at which the heel and forefoot experience ground reaction forces, while the shank pushes down on the foot in between—puts significant shear and tensile stress on the metatarsals.

“The arch may collapse due to pronation, forefoot varus, or tight calf muscles,” Gross said. “We would stretch those muscles, maybe provide a heel lift. For those who are a little bowlegged, I give medial posting or rearfoot wedging with an orthosis. If they have a varus forefoot, I might give them a medial forefoot post and fill in the arch space to prevent collapse.”

“Once overtraining... and other risk factors have been ruled out, we’ve got to look closely at gait.”

-- Jonathan Chang, MD