Stress Fractures of the Second Metatarsal in Female Ballet Dancers

Overview
Stress fractures are the most common injuries sustained in ballet dancers, with the second metatarsal fracture having the highest incidence. The injury is caused by predisposing risk factors superimposed on repetitive loading while dancing 'en pointe'.

Objectives
1) What are the predisposing factors that a physical therapist would address concerning the development or recurrence of this injury?
2) What are the recommendations for intrinsic muscle strengthening of the foot and important points with respect to biomechanics and alignment?

Predisposing Factors to Stress Fractures
1. High training volume and intensity, and decreased rest
2. Decreased nutrition and poor eating habits
3. Environmental factors such as noncompliant floor
4. Weak intrinsic muscles and poor biomechanics of the foot
5. Improper postural alignment

Clinical Practice Guidelines
1) Provide education regarding training volume, rest, proper footwear and orthotics, environmental factors such as floor, nutrition and eating habits and referral to appropriate healthcare professionals. Rest periods should be implemented throughout the day with sufficient nutrition breaks and an adequate lunch period. Training volume is dependent on level of dance and dance school philosophy. Significant rest period(s) within the year should be implemented. Dancers should be fitted for pointe shoes to ensure comfort and safety. Dance floors should have shock absorbing properties. Floors should either be spring mounted or include numerous layers of cushioned vinyl covering.

Loading, Biomechanics and Alignment
The following factors increase the risk of stress fractures of the second metatarsal in ballerinas:
1. Repetitive overloading of the bone
2. High impact and quick movements involving the lower extremities
3. Incorrect posterior positioning of body weight and incorrect weight transference
4. Toe length discrepancies and incorrect weight transference

Intrinsic Muscles of the Foot
Includes the dorsal and plantar interossei, lumbricals, flexor hallucis brevis, flexor digitorum brevis, abductor hallucis, abductor digit minimi, flexor digit minimi brevis

Late Stage Rehabilitation
Maintenance of cardiovascular endurance, flexibility and strength without excessively increasing force through the metatarsals

Important Features of a Pointe Shoe
http://www.webshots.com/search/search.fcgi?words=pointe+shoe&noRedir=1&page=2

2) Prescribe exercises to strengthen intrinsic muscles of the foot as well as correct muscle imbalances. Exercises include: toe curls, toe abduction/adduction and toe flexion with Theraband. These exercises should be performed 3-6 days/week depending on training regime.

3) Ensure proper biomechanics and musculoskeletal health by correcting malalignment and reducing repetitive overloading. Correct the weight-back position by bringing body weight forward. Reduce repetitive overloading by addressing factors such as pointe shoe fit, floor construction, rest intervals and intrinsic muscle strength.