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Letter to the Editor

The Effect of Shoe Outsole Containing Nanoilica Particles on Knee Valgus Angle in Athlete Females with Anterior Cruciate Ligament Injury during Drop Jump and Single Leg Landing

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Dear Editor in Chief

It is a well-known fact that the verisimilitude of sustaining the anterior cruciate ligament (ACL) injury in a noncontact situation is greater for females than for males, dramatically (1). In sports science, many researchers have studied the mechanism and the risk factors of ACL injury, and excessive knee valgus angle (KVA) has received considerable attention as a reason of higher incidence of ACL injuries athlete females (2, 3). But, the majority of studies in KVA focused on its gender and sport differences (2, 4) and although shoe properties has been shown to affect kinematic and kinetic motion patterns during high impact activities (5), the effect of it on KVA as a risk factor of ACL injuries is still under debate. Furthermore, the likelihood of ACL re-injured during reconstruction or during return to competition in female is more than their male counterparts (6). In ACL injuries reconstruction, a standardized testing procedure in collecting biomechanical data and designing training programs is necessary for therapists to decide test patients in which type of footwear. We investigated the effect of shoe hardness on KVA in active females during drop jump (DJ) and single leg landing (SLL).

We tested Eight active healthy women had experience of anterior cruciate ligament injury in their right leg, right dominant leg, which participated in sport activities for the past 4 years. They performed DJ and SLL from a 40cm box in a pairs of shoe with Ethylene Vinyl Acetate (EVA) outsole and hardness of 45 Shore A and another with Thermoplastic elastomer based on Styrene-Butadiene and Silica nanoparticles (TPEN) outsole and hardness of 70 Shore A. Three markers were placed at the midpoint of the ankle malleoli for the center of the ankle joint, midpoint of the femoral condyles to approximate the center of the knee joint and on the proximal thigh at the midpoint along a line from the anterior superior iliac spine to the knee marker of right leg (4). The angle subtended between the lines formed between the markers at the Anterior Superior Iliac spine and middle of the knee joint and that formed from the markers on the knee joint to the middle of the ankle joint was recorded as the valgus angle of the knee. We collected Kinematic data using the SIMI motion software, filtered them at 12 Hz with a low-pass fourth order Butterworth filter, calculated using Microsoft $Excel_{2010}$ and $MATLAB_{2010}$ and analyzed using Paired t-tests by SPSS-v20 software.

Our results were wonderful. The KVA reduced in TPEN compare to EVA in both DJ and SLL, significantly. As TPEN was harder than EVA had more viscoelasticity properties than EVA due to

containing silica nanoparticles. Therefore, it could be concluded that harder and more viscoelastic shoes may cause better control of knee motion in frontal plane. Moreover, TPEN outsole had lower thickness than EVA and it can possibly close the ankle to the ground and change the ground reaction force moment arms. We think it could be a useful advice for therapists to train and test their patient in TPEN shoes. This reduction of KVA in TPEN landing compared to EVA plays a very important role in efficiency of rehabilitation exercises and prevention of ACL injuries or re-injuries.

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