

## **Daily High Heel Use and Injury Prevention in Women**

Raymond Arias, PED 763: Biomechanics, Fall 2005

### **Introduction**

Despite the steady decline since the 1980s in the percentage of women who wear high heels on a daily basis, it is not uncommon for many American women to spend an entire workday and, not to mention, an evening or a night out in heels. While women have made giant leaps in nearly all aspects of American society with increased educational and professional opportunities, they are still compelled to rock stilettos in both professional and social settings. Media and advertising depict the heel as a symbol of power, success, sex appeal, and femininity. And for this, the price is high.

Thirty-three joints, over one hundred muscles, a network of blood vessels and nerves, and one quarter of all the bones in the human body make up the intricate structure of the foot and the ankle. Moreover, the foot, pelvis, and spine are structurally and neurologically linked, providing balance, support, and mobility. Women who wear high heels on a daily basis not only increase their risk for developing foot deformities and arthritis, but may also be adversely affecting their posture and musculoskeletal system.

Nonetheless, while advances in research and technology have heightened awareness of the potential risks high heels cause, the fashion statement that made its way onto the scene a millennia ago is no passing fad. Increased documented data and research on high heels and the developing understanding of the biomechanics of high heel use can, however, help us to develop ways to prevent or minimize injury.

### **Biomechanical Issues**

Walking is a fine, synchronic interplay of the feet, hips, and pelvis. (13) High heels disrupt this interplay by dramatically altering the gait cycle, affecting stride parameters, kinematics, muscle activity, energy consumption, and plantar foot pressure. High heels decrease stride length and walking velocity and increase stance time percentages. High heels cause a decreased range of motion (ROM), forcing the foot into plantar flexion and limiting the ankle's ability to dorsiflex, the key motion in force absorption. Furthermore, the body compensates for this altered gait by increasing other muscle activity, including the rectus femoris and soleus. (1)

In addition to altering the gait cycle, high heels distort the natural, balanced distribution of weight on the foot and ankle, forcing the bulk of the weight onto the forefoot. Of the twenty six bones and thirty three joints in the foot and ankle, high heels place the burden of the body weight onto just two joints, the metatarsal phalangeal (MTP) and the metatarsal sesamoid (MTS) joints, and six bones. "Both kinematic and kinetic changes occur at first MTP joint and at the metatarsal-sesamoid joint as result of wearing high heels." (7) Increased loads on the MTP and MTS joints increase the risk for developing problems, injuries, and arthritis in the foot and the ankle. The often thin and narrow design of high heels also make heel contact unstable which may lead to over-inversion of the foot and ankle. Consequently, the AMPA survey reports 59% of women have toe pain and 54% have pain on the ball of the foot. (3) Moreover, the forced positioning of the foot in heels shorten the Achilles tendon and the gastroninems, rendering the foot incapable of efficiently leveraging or recoiling. This increases oxygen consumption of the muscle and causes abnormalities in postural adaptations, leading to

injuries due to stress and overexertion of all joints and muscles that are engaged in maintaining balance and posture.

### **Application**

Injury from high heels is a process that develops over time. Short-term pain or discomfort might be a forewarning of future injuries. Minor injuries are blisters that can develop into calluses or bunions that might even require surgery. Foot or knee pain can be minor at first but can later lead to hammertoe or arthritis given that long-term injuries occur because of daily high heels use. However, most heel-related injuries can be avoided if proper preventative measures are taken.

To start, it is recommended to limit high heel usage to a maximum of four hours no more than three times a week. Find proper fitting shoes that do not compress the toes. Also, try to find shoes that are made of stretchy material to prevent soft tissue injury. New shoes should be slowly worn in.

Longer-term injuries to the lower body can be avoided with daily exercise. Strength-training for the leg muscles, i.e., squats and calf raises will help the body maintain posture while walking in heels. Hyper extension of the lower back should also be included in the strength-training program.

Adopt new exercises training schedules slowly and always allow adequate rest time between workout sessions. Rest to allow the body to heal itself. Time is required to develop peak bone growth during adolescence years, particularly in the metatarsals. Box jumps are a classic example of plyometrics, a bone strengthening exercise that should be practiced with caution with all ages. Additionally a cardiovascular program will help combat muscle fatigue by providing more oxygen to overused muscle.

Stretching is the most neglected part of any fitness program. For high heel wearers, special attention should be giving to quadriceps. The muscles around the ankle and foot should be stretched manually. These exercises will prevent arthritis development. Proper conditioning will also aid in preventing injury and must be done in conjunction with the other parts of the training program. Examples of conditioning exercises are to walk forward and backward on your toes with your eye closed and to perform squats on your toes with your heels off the ground.

### **Summary**

Although most women are aware of the risks of wearing high heels, many still choose to pay the price. Fortunately, the human body has an incredible and immeasurable ability to adapt to stress, of course, varying with each individual. If the body is gradually introduced to the stressors of wearing high heels it can perform better. Adaptation is specific to the type of stress and will only occur at load bearing sites. With proper exercise, conditioning, and stretching, women can work toward lowering their risk in developing short and long term problems and injuries correlated with chronic high heel use.

Diagram

ROM-Range of Motion

IC-Initial Contact

MS-Midstance

TO-Toe off

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