Body Mass Index in Relation to Foot Pronation

Ashley M. Lentz
Faculty: Jeremy A. Patterson

Department of Human Performance Studies, College of Education

Abstract. Excessive pronation of the foot may create an imbalance over time, potentially leading to injuries of the lower limbs. It is important to understand what causes overpronation and how to prevent or correct this issue. The purpose of this study was to examine effects of body mass on foot pronation. Subjects were examined according to BMI, sex, age, shoe size and amount of regular running activity. Each participant completed a Sit-to-Stand Navicular Drop Test (SSNDT) to measure individual foot pronation. It was concluded that using the SSNDT is a reliable way to measure foot pronation. No correlation was observed between BMI and degree of pronation, suggesting that obesity is not a predictor of poor walking mechanics and many factors must be considered during assessment of overpronator subjects.

1. Introduction

Excessive pronation of the ankle or foot is an abnormal rotation of the foot during the act of walking. Pronation is a normal part of our gait and it consists of collapsing the arch of the foot and moving the sole outward. When pronation becomes extreme or excessive it is referred to as “overpronation”. Overpronation is common amongst those with flexible feet. If left untreated or unnoticed, overpronation can cause the medial muscles of the ankle to lengthen and the lateral ankle muscles to shorten or tighten [1].

We must have a stable and balanced foundation to keep our hips and knees in alignment. Overpronation may lead to serious injuries of the ankle and foot, knees, hips and spine. It is important to understand what causes overpronation, whether or not one is an excessive “pronator”, and how to treat, correct and prevent overpronation.

Several studies have utilized either the Navicular Drop Test (NDT) or the Feiss Line Test (FLT) to measure degree of foot pronation. Sporndly-Nees et al. examined differences in reliability of these tests and found the NDT to be of higher reliability when compared to the FLT [2]. In addition, Hannigan-Downs found the NDT to show better validity and reliability evidence, while the FLT had poor validity and moderate reliability evidence [3]. Further, McPoil & Cornwall found that a Sit-to-Stand NDT (SSNDT) proved to have an even higher level of reliability and validity than the traditional NDT. Due to these findings, the Sit-to-Stand NDT was ultimately the chosen method for this study [4].

There is currently little research that examines the correlation between body mass index (BMI) and foot pronation. The purpose of this study was to examine factors such as BMI, age, sex and shoe size and determine their effect on degree of foot pronation in adults. It was hypothesized that increased age and increased BMI would result in a higher degree of pronation in the foot.

2. Experiment, Results, Discussion, and Significance

Healthy adult subjects were asked to voluntarily participate in this study. Volunteers consisted of either YMCA members or WSU students. 79 individuals (38 male, aged 31 ± 12.2 years) were examined. Subjects were weighed on a digital scale and weight was rounded to the nearest half-pound. BMI was calculated using the BMI Calculator on the American Institute for Cancer Research website (www.aicr.org). Shoe size, age and gender were also recorded for each participant. Subjects also estimated their weekly running or jogging activity. Three or more bouts per week of running or jogging classified the subject as a runner.

After consent forms were signed and all preliminary information was recorded, subjects participated in a Sit-to-Stand Navicular Drop Test (SSNDT). To assess degree of foot pronation, subjects removed both shoes and
socks. The Navicular bone on the right foot was palpated and identified with a marker. The distance from the Navicular to a flat surface was measured to the nearest millimeter while in a seated position. Then each subject stood upright with equal weight in both feet and the distance from the Navicular to the floor was measured to the nearest millimeter. Once both measurements were recorded, the distance between the two was calculated. Any distance of ten millimeters or more was considered excessive pronation.

Only three participants experienced a negative difference (supination) from seated to standing. Five subjects had no change at all from seated to standing. The remaining 71 volunteers experienced some degree of foot pronation from the SSNDT (Change = 13% ± 6). 17 of the subjects were considered “excessive pronators” (measuring a difference of 10 mm or more). The BMI readings of the overpronation group ranged from underweight to obesity levels (26.9 ± 5.4). Thus, no trends were observed between BMI and excessive pronation. Age of the excessive pronator group was relatively young (33.1 ± 12.3 years), therefore no correlation between increased age and pronation was observed. Ten of the 17 (59%) excessive pronators were female, which is not high enough to conclude that females tend to excessively pronate more than males. Lastly, 8 of 17 (47%) excessive pronators were classified as runners. This shows no difference between runners and non-runners and degree of foot pronation.

3. Conclusions

The SSNDT is a reliable way to measure foot pronation. Most individuals naturally pronate to some degree. From these results, foot pronation cannot be identified as a direct result of obesity or increased Body Mass Index, and those with an increased BMI do not necessarily have poor lower body walking mechanics. These findings suggest that there is no specific predictor of the degree to which a person will pronate his or her foot. Each treatment and prevention plan must be assessed on an individual basis.

4. References


