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# The Effects of Toning Shoes on the Postural Stability of Women

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# THE EFFECTS OF TONING SHOES ON THE POSTURAL STABILITY OF WOMEN

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## INTRODUCTION

Postural stability is the ability to maintain an upright posture and to keep the center of pressure (COP) within the limits of the body's base of support. It is maintained through the dynamic integration of muscle activity and joint position. The foot, and therefore footwear, also plays a critical role in postural stability. The plantar surface of the foot contains cutaneous mechanoreceptors that detect tactile stimuli and relay this information to the central nervous system. Stimulation of cutaneous mechanoreceptors is believed to improve postural stability and proprioception (an awareness of where one's limbs are oriented in space). While traditional walking footwear is designed to provide stability and support to the foot, one of the hottest trends in the footwear industry has been "toning" shoes which have an intentionally unstable sole design. This unstable sole design forces the wearer's body to constantly work to find equilibrium or balance points. The manufacturers claim that this instability helps the wearer burn more calories, tone muscles, improve posture, and improve overall health. The goal of this study is to determine the effects of toning shoes on the postural stability of women.

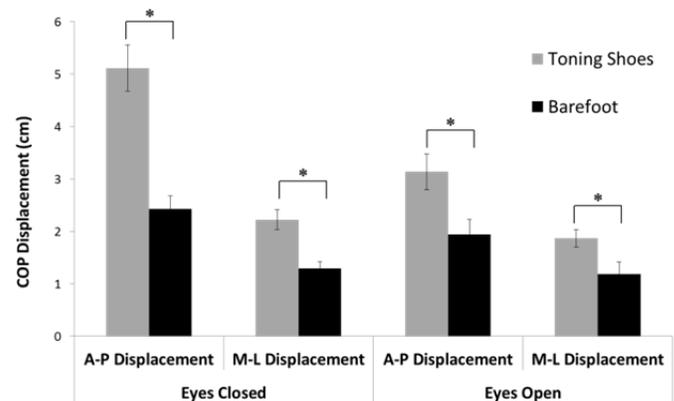
## METHODS

The study protocol was approved by the Institutional Review Board (#RHS-0160). Using a MatScan<sup>®</sup> Pressure System (TekScan, Boston, MA), dynamic balance data was collected for 55 women (18 – 65 yo, average =  $34 \pm 14$  yo) wearing three types of footwear: toning shoes, tennis shoes and no shoes (barefoot). The order of footwear testing was randomized and the center of gravity was recorded for 30 seconds for repeated trials (with eyes open and eyes closed). In addition to medial-lateral (M-L) and anterior-posterior (A-P)

displacement during quiet standing, the velocities of the sway was analyzed in the M-L and A-P directions. All statistical analyses were completed using student's t-tests and the two sample t-tests with a 95% significance level.

## RESULTS AND DISCUSSION

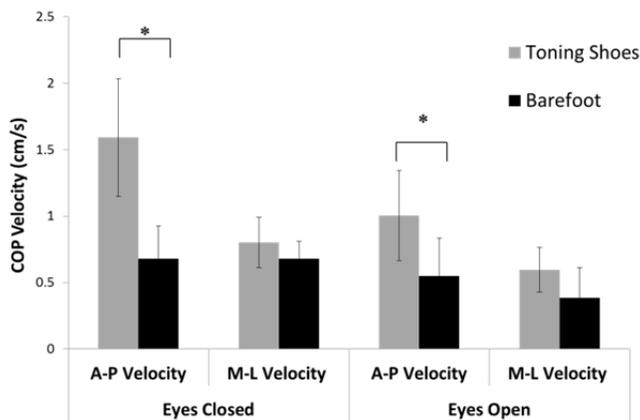
The subjects demonstrated more balance and stability in the barefoot condition (i.e. A-P and M-L displacements were the smallest); therefore, the barefoot condition was the baseline of comparison for analyzing the other two footwear types. Subjects experienced a statistically significant increase ( $p < 0.05$ ) in A-P and M-L displacement when wearing toning shoes as compared to the barefoot data for eyes open and closed (Figure 1). The A-P and M-L displacement experienced while wearing tennis shoes fell between the toning shoe and barefoot data and no statistically significant differences were found.



**Figure 1:** A-P and M-L displacements for eyes open and closed during quiet standing for barefoot and toning shoes. \* indicates  $p < 0.05$ .

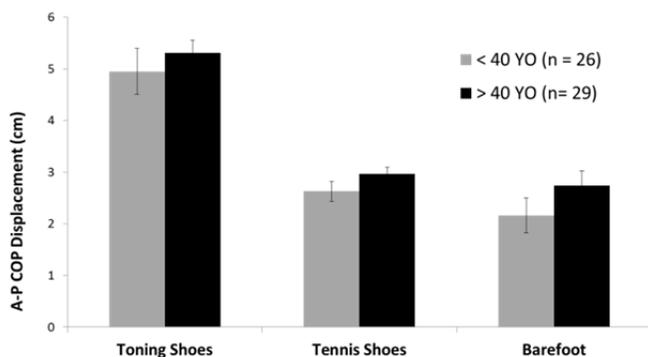
There was a statistically significant increase ( $p < 0.05$ ) in the A-P velocity of the sway of the subjects for both eyes open and eyes closed (Figure 2). Note that there was a slight increase in M-L

velocities, but the finding was not statistically significant.

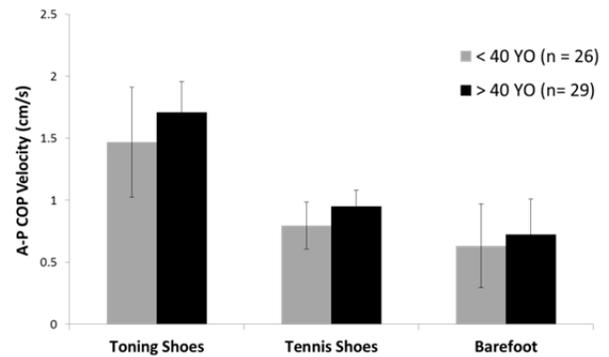


**Figure 2:** A-P and M-L sway velocities for eyes open and closed during quiet standing for barefoot and toning shoes. \* indicates  $p < 0.05$ .

Age also played a role in subject stability. Women over the age of 40 experienced increased A-P displacements and velocities when compared to women under the age of 40 (Figures 3 & 4).



**Figure 3:** A-P COP for women younger and older than 40 for each type of footwear during quiet standing with eyes open.



**Figure 4:** A-P COP velocity for women younger and older than 40 for each type of footwear during quiet standing with eyes open.

## CONCLUSIONS

In this study stability was defined by measurements of the A-P and M-L displacements, as well as the velocity of the sway in each of these directions. This study provides evidence that toning shoes affect the balance of the women who wear them, regardless of age. However, researchers also observed that toning shoes might have a greater influence on the balance and stability of older women. The manufacturers of the toning shoes equate the decreased stability of customers as an opportunity for the customers to improve muscle tone as they work towards improving their balance. However, the increased instability of older women may be problematic as extreme instability may lead to falls and injuries in an older population. While the implications of the effects of footwear on static balance in this study are limited, an increased understanding of how different factors alter a subject's balance can be useful in further studies of footwear.

## ACKNOWLEDGEMENTS

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