BIOMECHANICAL ASPECTS OF BADMINTON SHOE DURING A LUNGE

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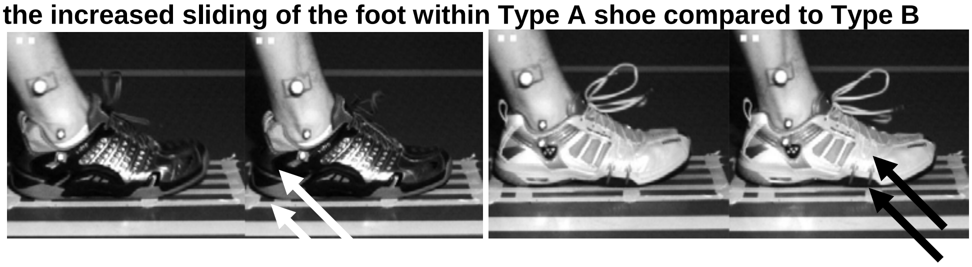
INTRODUCTION: Athletic footwear can influence performance, injury and comfort. Badminton is a dynamic sport characterized by quick movements such as lunges, side cuts and jumps. As a result, many aspects are important for badminton footwear. Therefore, the purpose of this project was to determine biomechanical differences between newly developed badminton shoes and its competitive badminton shoes.

METHODS: A variety of analyses were performed on the two different shoe models (Figure 1). Type B was selected as a high quality shoe for benchmarking of Type A. Measurements of shoe shape and dimensions (both internal and external), foot movement within the shoe (using high speed camera at a sampling rate of 500 Hz), cushioning of ground reaction forces (using Kistler force plate at a sampling rate of 1000 Hz), in-shoe pressure (using a Pedar pressure sys. at a sampling rate of 100 Hz) and outsole traction (using Automated Footwear Testing sys.) were performed. In addition, subjective feedback (VAS: Mündermann et al., 2002) of the fit and function of the shoes was quantified for 17 recreational badminton players (age: 28.12±13.44 yrs, height: 174.53±10.36 cm, mass: 67.53±9.49 kg).

Figure 1: the increased sliding of the foot within Type A shoe compared to Type B



Type A: Newly designed badminton shoe **Type B:** Competitive badminton shoe

RESULTS: Type A shoe had a much higher heel (103.4 mm vs 101.9 mm) and shallower heel cup, so the heel was not secured well in the shoe and the ankle joint was higher off the ground. Figure 1 shows relative translation of the foot with respect to the shoe from the markers on the shoe and the lateral malleolus: left (initial foot plate), right (maximum foot movement. Foot slippage was up to 40% greater in Type A shoe than Type B shoe ($p<0.01$). The flexion axis of Type B shoe occurred in the midfoot, not at the ball of the foot like Type B, where they would want the shoe flexion to occur. Impact forces and peak pressures under the foot were higher with Type A shoe compared to Type B shoe ($p<0.05$).

DISCUSSION & CONCLUSION: Initial biomechanical tests performed on newly designed shoe compared to its competitive shoe led to some recommended design changes. These suggestions include: 1) lowering the heel height and improving the influence of the heel counter to provide better stability, 2) improving the rearfoot cushioning, 3) a narrower toe box and/or modified lacing system to decrease foot slippage in the shoe and 4) a stiffer arch to provide the appropriate flexion axis at the toes rather than under the arch of the foot. It is recommended that in order to improve the shoe in the future, focus should be given to making it a lower profile (closer to the ground).

REFERENCES: Mündermann, A., Nigg, B.M., Stefanyshyn, D.J. & Humble, R.N. (2002). *Gait & Posture,* 16(1), 38-45.