DURABILITY OF RUNNING SHOES WITH EVA AND PU MIDSOLE

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INTRODUCTION: Running shoes may play an important role in preventing injuries by absorbing external shock due to ground impact (Cook et al., 1990; Verdejo and Mills, 2004). Shoe age maybe an important factor in running injuries. One prospective study showed that running injury was associated with shoe age (Taunton et al., 2003). In recent years, different types of foam materials have been developed for running shoe midsoles. Two common types of foam materials, Ethylene Vinyl Acetate (EVA) and Polyurethane (PU), are now widely used in running shoe midsoles. The purpose of the present study was to examine the durability of running shoes with common types of EVA and PU midsole materials.

METHODS: Three types of running shoes, with different midsole materials EVA, PU1 (newly developed material - density and hardness close to EVA), and PU2 (current material with higher density and hardness), were worn by human subjects and shoe cushioning characteristics (peak force and energy return in the impact test) at the heel were measured using a commercial impact tester every 50 km running distance. The mechanical impact test maked equal comparisons across all shoes and every 50 km running distance.

RESULTS: Change of cushioning characteristics was as below:
Peak force: EVA and PU1 shoes had a lower peak force than PU2 shoes at all running distances. The changes of the peak force at 500 km with reference to 0 km were EVA +4.8%, PU1 -2.6%, and PU2: -5.0%.
Energy return: EVA shoes had higher energy return than PU1 and PU2 shoes at all running distances. The changes of energy return at 500 km with reference to 0 km were EVA -0.5%, PU1 +5.5%, and PU2 -1.1%.

DISCUSSION: The benefit of this study is that it provided true information about the durability of current EVA, PU1, and PU2 materials used in conventional running shoes under normal use. The change of cushioning characteristics was smaller when compared with other previous studies that shoes were tested by machine simulated or human subjects. The EVA and PU midsoles didn't deteriorate so much as reported by other previous studies. It maybe due to the improvement in midsole materials and manufacturing processes in recent years provides better cushioning and durable EVA and PU midsoles for running shoes.

CONCLUSION: As the running distance increased, the cushioning characteristics of midsole materials changed continuously. EVA, PU1, and PU2 showed different patterns of positive or negative changes. The change of peak force at the 500 km running distance was only between -5% and +5%. These findings provided useful information to runners about the durability of conventional running shoes with an EVA and PU midsole.

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