WHAT ARE VALUES OF SHOELACES IN RUNNING?

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INTRODUCTION: Shoelaces are widely thought to make running shoes more comfortable and well-fitted. Studies on the effects of lacing patterns of running shoes on plantar pressure distribution, shock attenuation, and rearfoot motion found that shoe lacing patterns had a remarkable influence on foot-shoe coupling in running (Hagen & Henning, 2008). Their results showed that tighter shoelaces or lacing these closer to the ankle joint resulted in better use of running shoe features. Recently, a type of no-lace running shoes, in which an elastic material is used to replace the traditional lace structure, has been designed by a shoe company. However, there is no available information on the effects of shoes with or without lace structures on foot biomechanics during running. As such, the purpose of this study was to examine if there were differences between running shoes with and without the lace system on perceived comfort, plantar pressure distribution, and rearfoot motion control in running.

METHODS: 15 male experienced runners of 21.44±1.97 years old (60.70±4.76kg body weight, 1.69±0.03m body height) participated in the study. Two pairs of running shoes with the same design, one with the lace structure and another without it, were provided to each participant. For the comfort evaluation, questionnaires containing nine questions and featuring the visual analogue scale were completed by the participants after running 450m on a track at their preferred running speed. The rearfoot movement was filmed using a video camera (9800, JVC Inc. Japan) positioned posteriorly to the participant, with a sampling frequency of 200Hz when the participants ran on the treadmill at 3.8m/s. The APAS system was used in analyzing the video images and calculating the maximum rearfoot pronation angle. Plantar pressure signals during treadmill running were recorded and analyzed by an in-shoe force sensor system (Novel Pedar System, Germany). Paired t-tests were employed to determine if there were any differences in the measurements between the shoes with and without laces. Statistical significance was set at $p<0.05$.

RESULTS: A comparison of the measurements between two shoe conditions revealed that in the condition of the shoes without laces, perceived comfort ratings in shoe length, width, heel cup fitting, and forefoot cushioning were significantly lower. The peak plantar pressures on the lateral side of the midfoot and the 3rd to 5th metatarsal heads were higher, while the contact areas of the 3rd to 5th toes to the insole were significantly larger (204.83±46.58 Kpa vs 223.52±53.38Kpa, $p=0.005$). Maximum rearfoot pronation angle during running wearing shoes without laces was significantly larger than the conditions in which shoes with laces were wore (13.47±2.68° vs 14.15±3.40°, $p=0.013$).

DISCUSSION: The study demonstrated that shoelaces make shoes more comfortable and well-fitted during running. The evidences of higher pressure distribution on the lateral side of the midfoot and the 3rd to 5th metatarsal heads in the shoes without laces coincided with the results of comfortable evaluation. Larger maximal pronation in the shoes without laces suggests less function in terms of motion control.

CONCLUSION: A shoelace structure must be a necessary feature of running shoes toward achieving improved comfort and motion control during running.

REFERENCES

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