THE ANALYSIS OF THE FOOT PRESSURE OF THE GAIT IN DIFFERENT STRUCTURE OF INSTEPS WITH SPORT SANDALS

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Sport sandals are relatively new to the sports market. Different from the normal shoes, the sport sandals are extremely permeable. According to this kind of characteristic, the function of the sports sandal may still can provide stability and comfortable for the user. However, concerning commercial cost and the generality, sports sandal companies still have followed the used designs causing some customers uncomfortable fit and even foot disease. Recently, with the development of the sandals, the exploration of the sandals and the improvement of the standard of design has become the first goal for shoe companies that want to develop the sport sandal. Sneyers (1995) pointed out that foot injury could be avoided by dispersing the pressure equally over the foot. In this study, 40 participants were separated equally in professional and normal player two groups. This study was conducted at the National College of Physical Education using a Medilogic Foot Press measuring System during walking with three different brands of sport sandals to explore the accommodation of the foot for different types of design. Results revealed that the different status of foot pressure from different kinds of instep existed between the three different kinds of sports sandals during walking. This information can supply the makers of sport sandals with a guideline to design better sport sandals that are more suitable for individuals doing exercise in different situations. It can also supply customers with a satisfactory product as well as improve the development of the sports sandal industry.

KEY WORDS: sports sandal, foot pressure, instep

INTRODUCTION: The shape of foot is a key to understanding how to design the sports sandal. After measuring and collecting the basic data of the foot, the designer can adjust the design to fit the skeletal structure of the foot. In this experiment, the dynamic experiment is used to collect kinetic data of subjects wearing different kinds of shoes while doing different kinds of exercises such as walking, running, and vertical jumping. No matter the dynamic experiment or the type of exercise used the instep is the main part of absorbing the percussion. Chiu and Shiang (1996) pointed out that when the foot and ground are in touch, the heel can be divided into the ground reacting force into two parts. The strength peak value was 50 milliseconds after the heel first contacted the ground and the speed of foot was increased fast by strength in time at this moment. This strength peak value causes the vibrations of lower limbs. Therefore, people usually adjust their gait status to avoid maximum pressure when they feel the excessive pressure on the foot. Because soft tissue is too soft to bear the structure of the foot, the instep collapses constituting the flatfoot. For example, an athlete with a low instep usually can't avoid the repetitive pressure placed on the foot for improving the performance and because of this overuse of the foot occurs, Brown (1961) pointed out that the overrepresented foot pressure causes some typess of foot injury such as the breakage of skin from the bottom of the foot and degenerative arthritis. Sneyer (1995) indicated that injury could be decreased when pressure separation of the foot is balanced. From this point of view, the main factors during exercise are excessive foot pressure and centralized pressure. Therefore, the design of sport sandals, the rectification of the instep, and the status of the foot during exercise can be improved to reduce the risk of injury. To create an ideal environment for foot pressure, this study explored the subjects' foot pressure while they wore different brands of sports sandal using the Medilogic Foot Pressure Measurement.

METHODS: Two groups of participants were involved in this study. The first group consisted of twenty non-athletic participants, none of whom were sportsman or had been participating in any exercise program. The other group consisted of twenty elite athletes from professional

or university basketball teams. All participants had their instep measured and reported no prior ankle problems at the time of the test.
Participants were asked to do five minutes of simple warming up then were asked to walk for five minutes of using each of the three sport sandals. The full experiment consisted of five trails and participants had to complete the walking portion three times in each trail. Participants also had one minute rest intervals between trails.
Three different kinds of sport sandals were tested in this experiment. Every sandal had specific functional and exterior characteristics. Participants were required to test all three sport sandals.
The main instrument, Medilogic Foot Press Measurement consisted of trying on many pairs of insoles with inside receptors. This allows for measuring the best possible position for the separation of pressure, the value of pressure for each point on insole, and the gravity line during exercise.

RESULTS: Figure1 shows the foot pressure of one professional basketball player walking while wearing three different sport sandals. The graph reveals that the separation of foot pressure is unbalance and extremely high while wearing the sports sandal A.

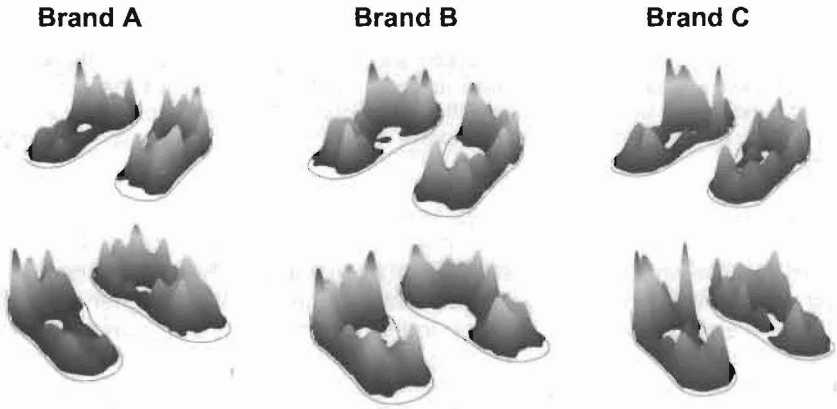
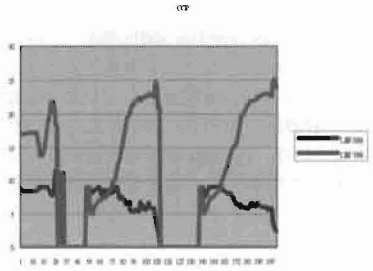
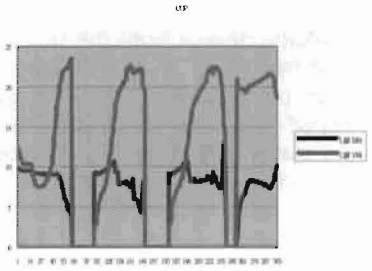


Figure 1 The separation of the foot pressure form the right, left, and back side of the three sampling sport sandals. The red portions show that the peak pressure value and the height of the graph presented the magnitude of the pressure.

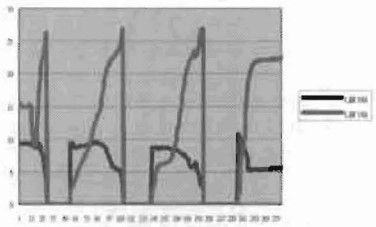
However, while wearing sandal B, we discovered that the separation of foot pressure was more equal than sandal A. Besides, the peak pressure value, the sandal A had relatively no support on the outside of the insole, the heel, and front of the foot; moreover, the sandal B is distributed more equal pressure and an overall better support of the insole.



(a)



(b)



(c)

Figure 2 The COP of (a) sandal A, (b) sandal B, and (c) sandal C during walking experiment.

After doing the gait test, the value of the center of pressure (COP) was calculating into 64 pieces of induction installation (Figure 2). Results revealed that the COP trend (Y axis) when three pairs of sandals move to the front foot of the heel. For the sandal A, the whole insole made contact while striking the ground and the COP didn't move at the beginning portion of the motion and the range was shorter. The steadiest one of three was sandal B. It presented a range of COP that moved forward from the heel which was relatively equal throughout the range of motion. This COP position is similar to sandal C when the foot leaves the ground. Sandal C's COP produced the largest movement range with a forward ample heel. It is the closest to the body foreordained affinity from the COP of shoes in the insole to the ground. It seems that the material on the front of sandal C is relatively soft, so can relatively stick to the ground.

Whether the COP trend of skew of three sport sandals, sandal A in gait though COP is minimized in skew amount, there is a small skew from side to side that shakes. The COP of the sandal B is the largest in skew amount and closest to the COP lean of the foot inboard while leaving the ground. Sandal C produced a minimum skew from side to side, and the COP lean to the foot and towards the inboard while leaving the place.

CONCLUSION: If exercise is in mind while wearing the sport sandals, the design of sport sandals must be top priority in order to disperse foot pressure evenly. The ideal way would be to impel the sole so it is press balanced. This would reduce the peak value of pressure and disperse the pressure evenly. In addition, through the skew view of the movement, the skew can cause a sprain of the inside and outside foot. Therefore, the different group participants with different types of instep will be invited to be participates in this progressive study; moreover, the sneakers can also be involved to this study to compare the stability during exercise with sport sandals.

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