

Design and Function Evaluation of the Pants Style Protector

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Abstract. This research develops a new pants style protector, which helps the daily protection of joints for lower limbs. The advanced function for joints protection after sports injuries is also considered. Three kinds of kinetic and kinematic signals are measured in this experiment. The three dimensional motion analysis system, the in-sole plantar pressure measured system, and the electromyogram (EMG) measured system are used to obtain the joint angles, the plantar pressures, and the EMG signals for the purpose of investigating the biomechanics of protector design.

Keywords: Protector, Motion analysis, Plantar pressure, Electromyogram

1. Introduction

The knee joint is very important for human body motions, since it dominates the actions of the lower limbs. The cooperate effort of the tendons, ligaments, capsules, muscles and bones makes the complex function completed. The central nervous system is the driver, while the pelvis and the lower limbs are the locomotors of daily walking. The adaptive adjustment of joint angles and muscle forces are accomplished by the central nervous system in order to prevent the injuries of musculoskeletal system. Even though our body can react quickly to the active load, the passive load happens suddenly may hurt the structures of the musculoskeletal system. Since making exercise a weekly routine has become an important concept for health nowadays, developing a new style protector for joints of lower limbs is imperative.

2. Methods

Four healthy males (age: 20 ± 1 (mean \pm SD) years; height: 1.70 ± 0.05 m; mass: 70.55 ± 7.15 kg) were recruited from the general student population. All subjects have no history of neurological or orthopedic abnormality and any difficulties that could obstruct normal locomotion. The kinematic and kinetic parameters of four conditions: 1. wearing the LP734 knee brace, 2. wearing the LP170XT knee brace, 3. wearing the pants style protector, and 4. un-wearing, are measured for comparing the functions of different protectors. 240 level walking, up-stairs, and down-stairs trials on a walkway ($4.8 \text{ m} \times 0.8 \text{ m}$) and the stairs shown as Fig 1 were conducted for each condition. During the trials, the joint angles, insole plantar pressures, and EMG signal of four muscles are measured.

3. Results and Discussion

The joint angles when wearing different knee braces and the un-wearing condition are shown in Fig. 2. It is indicated that the knee joint angles under different conditions are not obvious. But the hip joint angles are affected by the using of different knee braces since the effects of compensation. Hence we develop a new pants-style protector to restrict the motions of both knee and hip joints. The insole plantar pressures results are shown in Fig. 3. The areas of peak pressure decrease when wearing knee braces than the un-wearing condition.

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Fig. 1: Stairs for experiment

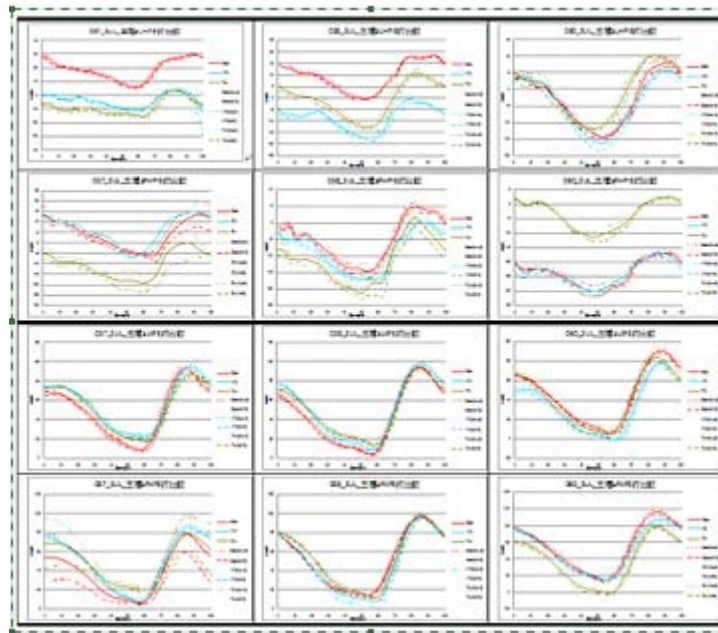


Fig. 2: The joint angles when wearing different knee braces

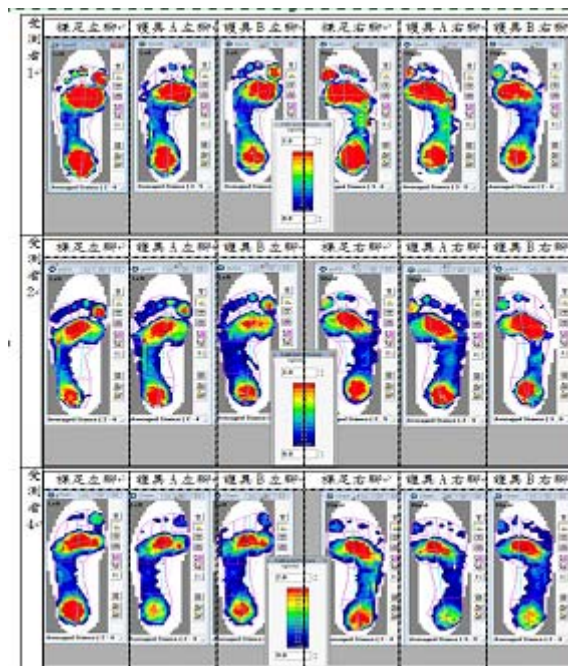


Fig. 3: The foot pressures when wearing different knee braces

4. Conclusion

The pants- style protector can restrict the motions of both knee and hip joints. The comfort is also improved through the special design of the protector than wearing the knee or hip braces independently. More completed comparison of the new pants-style protector and the traditional ones will be investigated in this research.

5. References

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