2D Pattern Development of Cycle wear from 3D Human Body Scan Data for Male High School Cyclists

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Introduction

The number of bicycle users is increasing rapidly worldwide owing to the high costs involved in commuting by self-driving, the need to reduce air pollution, and the benefits of a bicycle exercise. The popularity of bicycles has increased not only in public transportation but also as a sport; further, the number of professional athletes has been increasing. High school and semiprofessional team cyclists were active in 2017; the highest number of high school cyclists registered in the Korean Federation of Cycling Federation was 231. However, the commercially available cycle wear products are designed for adults. Therefore, the purpose of this study is to develop cycling shorts considering the lower body surface changes in male high school cyclists according to their cycling postures.

Research of methods

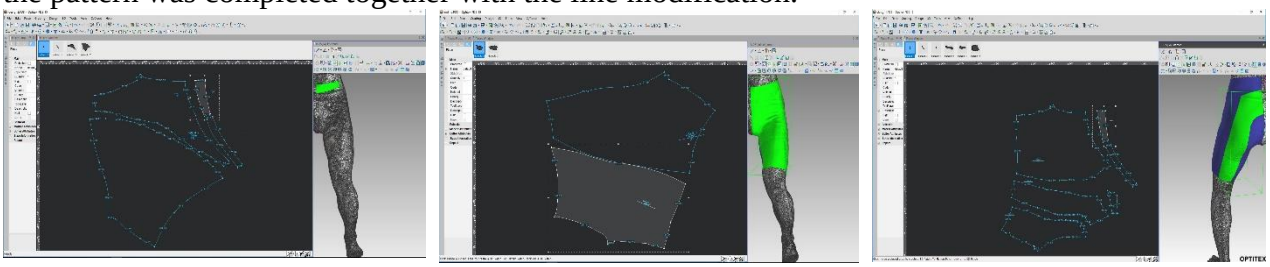
In this method, a male high school cyclist who wears "M" size was selected and the 3D human body scan was performed. In the case of cycling, the lower body posture was shown at various angles by the bending of the body and the rotation of the leg (Cha, 2013). Therefore, the postures of the waist and the knee were set to 145° and 90° in this study. The human body scan was performed using Artec Eva, a noncontact hand scanner. The scanned data were aligned and synthesized using Artec Studio 11 Professional program, and the missing data were supplemented with a Design-X program. The surface changes in the human body were examined according to the normal posture and the cycling posture in the Design-X program.

Results

To develop cycling shorts, we formed a knee baseline over the 3D human body shape and created inseam from the groin area. Kim(2008) and Choi(2011) studied the deformation characteristics of the body surface according to the cycling posture to obtain non-extension lines. As shown in Fig. 1, the dermatomes L1–L4 were generated in a similar direction along the meshes of the normal body and cycling posture.

Fig. 1. Dermatomes

As a result, the lengths of L1 and L2 were more prominent than those of the normal posture, and the lengths of L3 and L4 increased with the motion. In the case of the normal posture of the same position and the body surface length change in the cycling posture, the value between L2 and L3 changes from negative (-) to positive (+). It is assumed that there is a zero between them, and the line of non-extension is set as a portion closer to L3 from the difference value. Tight-fit clothing such as cycle wear may be subjected to restraint from the body owing to the sewing seam caused by the cutting lines; furthermore, the exercise function may be deteriorated. A cutting line on the part where the cycling is severe will interfere with the cycling pattern. Therefore, in this study, the line close to L3 was applied to the design of cycle wear. Finally, we designed three types of cycle wear: tights 1 of the line of non-extension, tights 2 without cutting, and tights 3 with dermatomes. Based on these results, we developed a model in an Optitex program to save the body type as obj file, developing a 2D pattern from a 3D body type. The saved model was flattened based on the selected design using the flattening tool, and the pattern was completed together with the line modification.



Design1 Design2 Design3

Fig. 2. Cycle tights design

Conclusion

In this study, to solve size unsuitability of adolescent male athletes, we developed a 2D pattern from a 3D cycle posture to improve their fitness levels. In addition, it is recommended that the technique of deploying a 3D body type to a 2D pattern be utilized in the clothing industry, suggesting the possibility of designing the optimal athletic suit for each athlete. In future, the cycle wear designed in this study should be verified and compared with the commercial cycle wear.

References

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