Advanced Science and Technology Letters
Vol.49 (ICSS 2014), pp.42-45
http://dx.doi.org/10.14257/astl.2014.49.10

Three Dimensional Analysis of Carving Turn of Snowboarders

Jinho Back, Hyomin Kang, Wonil Son, Senghak Jo, Jusung Lee★, Siddhartha Bikram Panday

Department of Leisure Sports, Kangwon National University,
Gyodong 1,Samcheok City, Kangwondo Province ,Republic of Korea
taijiljs@nate.com.

Abstract. This paper deals with the comparative analyses of the carving front turn of alpine and boarder-cross snowboarders through kinematical approaches, Alpine and Boarder-cross athlete from Korean National Team for 2018 Pyeongchang Winter Olympics were chosen as subjects. 90 coordinate points and body segment parameters were selected. The turn was divided into 3 events and 2 phases. Three dimensional motion pattern analysis of each segment was performed and was analyzed with kinematical variables such as elapsed time, distance, velocity and angular variables. Analysis was conducted and the result of the 3D motion analysis indicated the major features in snowboard carving turn in two different sporting events. The proposed method can be used as a reference for improvement of the training method and skills in snowboarding.

Keywords: Biomechanical Analysis, Three Dimensional, Snowboard, Carving turn.

1 Introduction

The technical phase of a snowboard turn starts from the traverse up and un-weighting the pressure down through the fall line. Different stances and balancing are used for various centering situation [2], [6]. Especially, in carving turn, edging is very important for the smooth operation of a perfect carved turn. A snowboarder starts the turn from the neutral position where in the first phase adequate inclination is gained by applying pressure to the edge of the board, then moving on to the second phase where the snowboarder rides by shifting the weight to the edge and performs a smooth clean turn [7]. Even though very few researches have been conducted on kinematical and kinetic analysis snowboarding, research analyzing the characteristics of different winter sporting event or the comparative analysis between two different

This research project was supported by the 2013 Sports Promotion Fund of Seoul Olympic Sports Promotion Foundation from Ministry of Culture, Sports and Tourism |
★ Jusung Lee

ISSN: 2287-1233 ASTL

events hasn't been conducted. Hence, the objective of the research is to analyze the motion pattern and behavior in each segment of carving front turn.

2 Methods

Four alpine snowboarders from Korean National Team for 2018 Pyeongchang Winter Olympics participated in the experiment. The test took place in the advanced ski slope at P ski resort, Kangwondo Korea. A three dimensional rectangular 5m (width), 8m (length), and 2m (height) calibration frame was constructed and were positioned properly to capture the entire turn from the camera's field of view. The experimental slope was 866m in length at an altitude of 238.7m with average pitch of 15.41°to maximum pitch of 36.0° in the advanced course. All the data obtained were processed using Kwon 3D 3.1 [4]. 90 coordinate points were selected for analysis. Central body joint coordinates is defined as a rigid body system of 23 coordinates of human body model and 16 body segments connected to it. Body segment parameters [9] were referred to calculate the CM and Position of CM in different segments.

3 Results

Three dimensional video analysis was performed on the snowboarder's front caving turn. Elapsed time, Distance, Velocity and Angular variables were chosen as kinematical variable were analyzed. Elapsed time in each phases were divided into two phases and calculated i.e. P1 and P2. In P1, alpine snowboarder measured 0.53 sec whereas, boarder-cross snowboarder measured 0.43sec which is about 0.1 sec faster. However, In P2 alpine snowboarder was 0.24 sec faster than boarder-cross snowboarder. In distance Variable, Medial and lateral displacement of CM appeared 1.85m in E1 , 0.27m in E2, –5.8m in E3 of alpine snowboarder whereas, 2.11m in E1, 1.29m in E2, –6.13m in E3 of boarder-cross snowboarder. Especially, Maximum inclination of CM in E2 appeared lower in alpine than boarder-cross snowboarder with 0.27m and 1.29 m respectively which is considered as an effective execution of a turn while approaching closer to the gate. The forward- backward displacement of CM appeared -3.09m in E1, 3.45m in E2, and 9.5m in E3 of alpine whereas, -3.59m in E1, 1.58m in E2 and 9.39m in E3 of boarder-cross snowboarder. In velocity variable, the value of medial–lateral velocity of CM appeared highest in boarder-cross than alpine snowboarder. The forward-backward velocity value appeared higher in alpine than boarder-cross snowboarder. Among the angular variable; angle of ankle, knee and hip-joint appeared lower in alpine than boarder cross as a whole in E2 (the point of maximum inclination of CM). The degree of twist of the upper and lower body represents the angle of board-shoulder and angle of hip twist which gives natural flow between two consecutive turns. Alpine snowboarder completed the turn with higher value in angle of shoulder-twist whereas, boarder-cross completed the turn with higher value in angle of hip-twist.

4 Conclusion

Comprehensive analysis was conducted and results were drawn. Our research pointed out few suggestions to the snowboarders which are as follows:

1) Alpine snowboarder: To perform an effective turn, alpine snowboarders should decrease the time of flexion (down).In order to control the increasing speed, the snowboarder should lower the stance. Moreover, rotating and pivoting the upper body can increase the stability in a turn. In addition, applying strong edging through angulations can reduce slipping thus increasing the effectiveness of a turn.

2) Boarder-cross snowboarder: Similarly, in order to overcome centrifugal force in faster speeds, boarder-cross snowboarder should lower the stance. In order to perform an effective turn, the snowboarder should increase the inclination and apply strong edging through angulation which will control the board from getting slipped. In addition, through rapid change in angle and speed of hip-twist and proper use of edging will enhance the performance of the snowboarder.

References

1. Doki, H., NagaiI, C., & Hokari, M.. "A Study on the Dynamic Analysis of Snowboarding Turn." Transactions of the Japan Society of Mechanical Engineers. C 72.713, pp190-196, Japan, (2006).
2. Canadian Association of Snowboard Instructors, Canadian Association of Snowboard Instructors guide book, www.casi-acms.com, (2000).
3. Platzer, H. P., Raschner, C., Patterson, C., & Lembert, S. Comparison of physical characteristics and performance among elite snowboarders. Journal of Strength and Conditioning Research, 23(5), 1427-1432, (2009)
4. Young-Hoo, Kwon. Kwon 3D 3.1 for windows motion analysis package, visol company, Korea, (2003).
5. Suk-Hwan Youn, “Dynamic analysis and scientific education effect of Snowboard,” M.PE. Thesis, Department of Physical Education, Hankuk University of Foreign Studies, Korea, (2007).
6. Jo Hyun-Dae, “The Kinematic Comparative Analysis of the Snowboard turn’” M.PE. Thesis, Graduate School of Korea National University of Education, Korea, (2011).
7. Moo-Sung, Hyun, Sung-Chul, Lee. Kinematic Analysis of Novice Turn and Carving Turn in Snowboard. Journal of koreawellness, Vol. 7. No.1, Korea, (2012).
8. Bum Yeon, Lee. Snowboard turn control strategy according to expertise. M.PE. Thesis, Graduate School of Seoul National University, Korea, (2011)

9. Chandler, R. F., Clauser, C. E., McConville, J. T., Reynolds, H. M., & Young, J. W. Investigation of Inertial properties of the Human Body, No. AMRL-TR-74-137 Final Rpt.. (1975).