COMPARISON OF PROPRIOCEPTION PERCEPTION TEST BETWEEN GOLFER AND NON-GOLFER USING TILTING PLATFORM

Jun Sung Park[2,3], Moon-Seok Kwon[1,2], Jae Woo Lee[2,3], Young-Tae Lim[1,2]

College of Biomedical and Health Science, Konkuk University, Chungju, Korea[1]
Konkuk Univ. Sports Convergence Institute, Chungju, Korea[2]
Graduate School of Konkuk University, Chungju, Korea[3]

The purpose of this study was to test proprioception perception and compare between collegiate golfers and non-golfers using tilting platform. Sixteen male and fourteen female golfers and fifteen male and thirteen non-golfers were participated. All participants were performed perception test on the tilting platform. Frequency analysis and independent t-test were performed using SPSS 24.0. Alpha set at .05. Most participants were perceived from 1° to 2° of slopes and perceived left-right (target direction) slope than forward-backward slope. Repeated practice such as walking on the uneven ground or standing on sloped ground might help to improve proprioception perception. Further research using a tilting platform will be to develop the training program.

KEY WORDS: Proprioception, Perception, Tilting Platform, Golf Putting.

INTRODUCTION: The proprioception perception is one of the most important human nervous system in order to maintain the balance and to determine the motor skills during the movement (Poltavski, 2015). Proprioception has an important effect to performance and balance is essential for good golf performance. Especially, putting is an important to improve the golf score in golf. The method of checking the green slope may be different for each golfer, but it is the same as checking the slope using their eyes and foot. In a well-executed golf putting, understanding the slope of the green is a factor that increase the rate of success for putting in golf (Park, 2012), the ability to obtain information is considered to be a very important factor in recognizing the angle of the green on which the golfer stands when putting as the proprioception sense in somatosensory system. Objective and accurate measurement and analysis methods for human senses that recognize the inclination angle of green during golfers' putting decision process are required, training is needed to improve their cognitive abilities. However, most golfers use the process of determining the slope of the green based on the qualitative criteria and making the stroke, and this method is not objective, depending on subjective judgement and experience, and can vary depending on the situation. Thus, there is a lack of research on the cognitive reaction of the supporting surface inclination. For above this reason, it is necessary to quantify the proprioception sense. Therefore, the purpose of this study was to test human proprioception perception and compare between golfer and non-golfer using tilting platform. We hypothesized that there was no different between golfers and non-golfers because they blocked audio-visual factors.

METHODS: Sixteen male and fourteen female collegiate golfers (22.87±2.39 years, 170.27 ±7.60 cm, 68.53±13.41 kg, 4.73±4.83 handicap) and fifteen male and thirteen female non-golfers (22.61±2.01 years, 168.75±7.66 cm, 65.25±10.42 kg) were volunteered and participants had free of any musculo-skeletal injury or pathology that them from tilting test. The participants were signed an inform consent approved by the University IRB (7001355-201705-HR-177) and health history questionnaire. Also, the participants were supplied compression clothing, and were taken off own shoes. The participants warmed up during ten minutes before participants start experimentation. Each participants was collected anthropometric data and recorded. Participants blocked audio-visual factors with eye patch and noise cancelling headphone (Quietcomfort 35, BOSE, USA) for sensory perception testing. Tilting platform (torque: 7.2Nm, rotation velocity: 2000r/min) was used to randomly set the inclination (forward, backward, left, right 0.5°~2°). Because of blocked eyes and ears, one of the researcher took the participants to the tilting platform. A safety bar was installed to

prevent participants falling down. Participants were standing on flat ground and measured on the platform when the researcher gave the angle of the platform. Tilting platform was operated to left (target direction), right, forward, and backward by researcher. All participants were verified whether they were inclined by verbal or hand gesture (figure 1). Frequency analysis was performed using SPSS 24.0 (IBM Corp, Armonk, NY) to determine the perception response according to the grade, and performed using independent t-test to compare sensory perception between collegiate golfers and non-golfers. Statistical significance was set at 0.05.

Figure 1: Proprioception perception test using tilting platform.

RESULTS: Table 1 showed that group1 was perceived 26.7% and group2 was perceived at the forward 0.5°. At the forward 1°, group1 was perceived 46.7% and group2 was perceived 28.6%. The group1 accounted for 73.3% and group2 was 60.7% at the forward 1.5° and group1 was perceived 86.7% and group2 was perceived 92.9% at the forward 2°. At the backward 0.5°, group1 was accounted 36.7% and group2 was accounted 35.7%. The group1 was showed 76.7% and group2 was showed 53.6% at the backward 1°. At the backward 1.5°, the group1 was perceived 93.3% and group2 was perceived 78.6%. Finally, group1 accounted 90% and group2 accounted 78.6% at the backward 2°.

Table 1: Forward and backward sensory perception test

Degree	Group	Perception(n)	Non perception(n)	%
Forward 0.5°	Group1	8	22	26.7
	Group2	6	22	21.4
Forward 1°	Group1	14	16	46.7
	Group2	8	20	28.6
Forward 1.5°	Group1	22	8	73.3
	Group2	17	11	60.7
Forward 2°	Group1	26	4	86.7
	Group2	26	2	92.9
Backward 0.5°	Group1	11	19	36.7
	Group2	10	18	35.7
Backward 1°	Group1	23	7	76.7
	Group2	15	13	53.6
Backward 1.5°	Group1	28	2	93.3
	Group2	22	6	78.6
Backward 2°	Group1	27	3	90.0
	Group2	22	6	78.6

Note: group1 is golfers and group2 is non-golfers.

Table 2: Left and right sensory perception test

Degree	Group	Perception(n)	Non perception(n)	%
Left 0.5°	Group1	16	14	53.3
	Group2	11	17	39.3
Left 1°	Group1	28	2	93.3
	Group2	19	9	67.9
Left 1.5°	Group1	29	1	96.7
	Group2	25	3	89.3
Left 2°	Group1	29	1	96.7
	Group2	27	1	96.4
Right 0.5°	Group1	8	22	26.7
	Group2	8	20	28.6
Right 1°	Group1	23	7	76.7
	Group2	12	16	42.9
Right 1.5°	Group1	24	6	80.0
	Group2	20	8	71.4
Right 2°	Group1	29	1	96.7
	Group2	25	3	89.3

Note: group1 is golfers and group2 is non-golfers.

Table 2 indicated group1 showed 53.3% and group2 showed 39.3% at the left 0.5°. group1 accounted 93.3% and group2 accounted 67.9% at the left 1°. At the left 1.5°, group1 perceived 96.7% and group2 perceived 89.3%, and group1 showed 96.7% and group2 showed 96.4% at the left 2°. Group1 indicated 26.7% and group2 indicated 28.6% at the right 0.5°, and group1 showed 76.7% and group2 showed 42.9% at the right 1°. At the right 1.5°, group1 accounted 80% and group2 accounted 71.4%, and group1 was perceived 96.7% and group2 was perceived 89.3% at the right 2°.

Table 3: Comparison of sensory perception test between two groups

Variable	t value	*p* value	Effect Size
Forward 0.5°	0.459	0.360	0.12
Forward 1°	1.419	0.017*	0.37
Forward 1.5°	1.015	0.057	0.27
Forward 2°	-0.764	0.124	0.20
Backward 0.5°	0.074	0.883	0.02
Backward 1°	1.873	0.002*	0.50
Backward 1.5°	1.639	0.001*	0.43
Backward 2°	1.195	0.017*	0.31
Left 0.5°	1.064	0.315	0.28
Left 1°	2.569	0.000*	0.67
Left 1.5°	1.101	0.026*	0.29
Left 2°	0.049	0.923	0.01
Right 0.5°	-0.159	0.751	0.04
Right 1°	2.754	0.005*	0.72
Right 1.5°	0.753	0.138	0.20
Right 2°	1.101	0.026*	0.29

*Statistically significant at $p<0.05$

Table 3 showed that the results indicated that forward 1 degree was significantly difference between golfers and non-golfers. In the backward slope, there was significantly difference at

1°, 1.5°, and 2° between two groups. In left slope, 1° and 2° were indicated significantly difference. Finally, there was significantly difference right 1° and 2°.

DISCUSSION: The purpose of this study was to compare proprioception perception test between golfer and non-golfer using tilting platform. Proprioception helps to maintain correct posture by measuring the position and movement of each part of the body, measuring the muscles, ligaments, skin, and joints and then delivering them to the brain (Shumway-Cook & Horak, 1986). In order to success for putting on the green, it is required to recognize slope of the green (Pelz, 2000; Park, 2000). As a result of frequency analysis, the golfer group has more ability to recognize the slope than non-golfer group. It may be due to the experience and continuous practice of the slope compare to the non-golfer. Similarly, golfers indicated better sensory organization test (SOT) results than non-golfers because the repeated practice (Gao, Hui-Chan, & Tsang, 2011), and the finding of Teasdale et al. (1999) indicated that sense of ankle, knee, and hip joints sensory perception were higher at the left-right direction. According to Tsang and Hui-Chan (2010), walking and standing uneven ground might develop vestibular system to improve balance control and performance. The golfer has the ability to perceive the slope of the green compare to the non-golfer because the training to perceive the environmental condition of the green.

CONCLUSION: Most participants were perceived from 1° to 2° of slopes. Furthermore, it was perceived left-right slopes than forward-backward slopes. As previous studies, repeated practice such as walking on the uneven ground or standing on sloped ground might help to improve proprioception perception. Further research using a tilting platform will be to develop the training program.

REFERENCES:

Gao, K. L., Hui-Chan, C.W., & Tsang, W.W. (2011). Golfers have better balance control and confidence than healthy controls. *European Journal of Applied Physiology, 111*(11), 2805-2812.

Park, J. (2012). A Study of ball movement characteristics on the sloped green while putting stroke. *Journal of Golf Studies, 6*(1), 41-48.

Park, J. (2000). Swing time analysis during the putting stroke. *Korean Journal of Sports Biomechanics, 9*(2), 187-193.

Pelz, D. (2000). *Dave Pelz's putting bible: the complete guide to mastering the green* (Vol.2). Doubleday Books.

Poltavski, D. V. (2015). The use of single-electrode wireless EEG in biobehavioral investigations. Mobile Health Technologies: *Methods and Protocols*, 375-390.

Shumway-Cook, A., & Horak, F. B. (1986). Assessing the influence of sensory interaction on balance. *Physical Therapy, 66*(10), 1548-1550.

Teasdale, N., Nougier, V., Barraud, P. A., Bourdin, C., Debû, B., Poquin, D., & Raphel, C. (1999). Contribution of ankle, knee, and hip joints to the perception threshold for support surface rotation. *Perception & Psychophysics, 61*(4), 615-624.

Acknowledgement: This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIP) (No. 2017R1A2B4010785).