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Comparison of the Capability of proprioception perception between collegiate golfer and non-golfer

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Abstract : The purpose of this study was to verify prprioception perception and compare between collegiate golfers and non-golfers using tilting platform. Thirty golfers and twenty-eight non-golfers were participated. All participants were performed perception test on the tilting platform. Frequency analysis was performed using SPSS(ver. 24.0) to determine the perception response according to the grade, and performed using independent t-test. Most participants were perceived from 1° to 2° of slopes and perceived left-right 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. Future research using a tilting platform will be to develop the training program.

Keywords : Proprioception, Perception, Tilting Platform, Golf, Putting

1. Introduction

The proprioception perception was one of the most important human nervous system in order to maintain the balance and to determine the motor skills during the movement [1-3]. Proprioception had an important effect to performance and balance was essential for good golf performance [4]. Especially, putting was an important to improve the golf score in golf. The method of checking the green slope may be different for each golfer, but it was the same as checking the slope using their eyes and foot [5, 6]. In a well-executed golf putting, understanding the slope of the green was a factor that increase the rate of success for putting in golf.

The putting technique requires not only the ability to maintain accuracy and consistency during stroke, but also the ability to accurately recognize information about the direction or distance of the hole depending on the state of the green [7]. The ability to obtain information was 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 [6, 8]. The proprioception

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sense refers to the unconscious sensory perception of the joint's position or movement. This sensation measures the position and movement of each part of the body through muscles, ligaments, skin, and joints, and then transmits it to the brain, helping to maintain and maintain correct posture [9]. Objective and accurate measurement and analysis methods for human senses that recognize the inclination angle of green during golfers' putting decision process were required training was needed to improve their cognitive abilities [10, 11].

However, most golfers used the process of determining the slope of the green based on the qualitative criteria and making the stroke, and this method was not objective, depending on subjective judgement and experience, and cab vary depending on the situation [4, 6, 12]. When the golfer is not sure about the slope angle of the green when checking the distance to the ball and the hole cup before putting, the risk of losing the distance information to the hole cup is increased [13]. Thus, there was a lack of research on the cognitive reaction of the supporting surface inclination. For above this reason, it was 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 different between golfers and non-golfers because they blocked audio visual factors.

2. Methods

2.1. Subjects

Thirty collegiate golfers (age = 22.87±2.39 years, height = 170.27±7.60 cm, weight = 68.53±13.41 kg, handicap = 4.73±4.83 stroke) and twenty-eight non-golfers (age = 22.61±2.01 years, height = 168.75±7.66 cm, weight = 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.

2.2. Procedure

After sufficient stretching to prevent injury to the subjects, which could occur due to the sudden change of direction, the direction change operation was performed for 10 minutes. 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. The participants blocked audio-visual factors with eye patch and noise cancelling headphone (Quietcomfort 35, BOSE, USA) for sensory perception testing. A customized tilting platform (torque: 7.2Nm, rotation velocity: 2000r/min) was used to randomly set the inclination (forward, backward, left, right 0.5° ~2°) (Fig. 1).

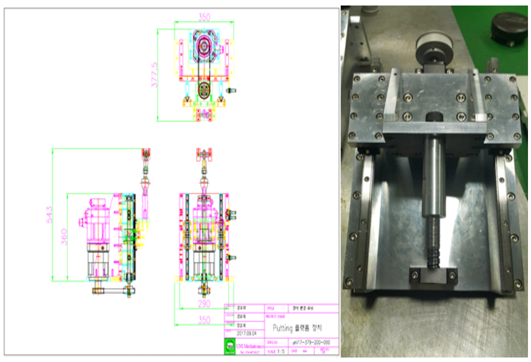

Fig. 1. Servo-motor layout.

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. The participants were standing on flat ground and measured on the platform when the researcher gave the angle of the platform (Fig. 2).

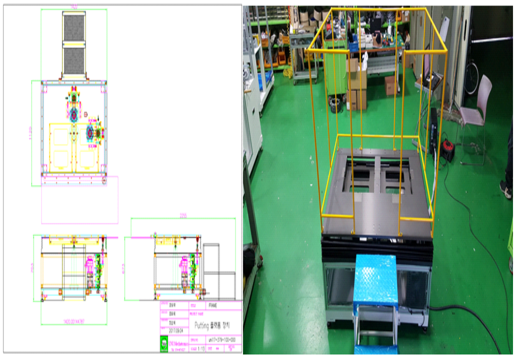

Fig. 2. Tilting platform layout.

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 (Fig. 3).

Fig. 3. Test using tilting platform.

2.3. Statistics

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 .05.

3. Results and Discussion

Table 1 showed that group1 was perceived 26.7% and group2 was perceived 21.4% at the forward 0.5°. There was no significant difference between group1 and group2 at the forward 0.5° (t=.459, p=.360). At the forward 1°, group1 was perceived 46.7% and group2 was perceived 28.6%. There was significantly difference between group1 and group2 at the forward 1° (t=1.419, p=.017). The group1 accounted for 73.3% and group2 was 60.7% at the forward 1.5°. There was no significantly difference between group1 and group2 at the forward 1.5° (t=1.015, p=.057). The group1 was perceived 86.7% and group2 was perceived 92.9% and there was no significantly difference between group1 and group2 at the forward 2° (t=-.764, p=.124). At the backward 0.5°, group1 was accounted 36.7% and group2 was accounted 35.7%. There was no significantly difference between group1 and group2 at the backward 0.5° (t=.074, p=.883). The group1 was showed 76.7% and group2 was showed 53.6% at the backward 1°. There was significantly difference between group1 and group2 at the backward 1° (t=1.873, p=.002). At the backward 1.5°, the group1 was perceived 93.3% and group2 was perceived 78.6%. There was significantly difference between group1 and group2 at the backward 1.5° (t=1.639, p=.001).

Finally, group1 accounted 90% and group2 accounted 78.6% at the backward 2°. There was significantly difference between group1 and group2 at the backward 2° (t=1.195, p=.017). Table 2 indicated group1 showed 53.3% and group2 showed 39.3% and there was no significantly difference between two groups at the left 0.5° (t=1.064, p=.315). The group1 accounted 93.3% and group2 accounted 67.9% and there was significantly

Table 1. Forward and backward sensory perception test

Direction	Slope Angle	Group(n)	Perception (%)	Non perception(%)	t-value	p-value	Effect Size
Forward	0.5°	Group1(30) Group2(28)	8(26.7) 6(21.4)	22(73.3) 22(78.6)	.459	.360	0.12
	1°	Group1(30) Group2(28)	14(46.7) 8(28.6)	16(53.3) 20(71.4)	1.419	.017*	0.37
	1.5°	Group1(30) Group2(28)	22(73.3) 17(60.7)	8(26.7) 11(39.3)	1.015	.057	0.27
	2°	Group1(30) Group2(28)	26(86.7) 26(92.9)	4(13.3) 2(7.1)	-.764	.124	0.20
Backward	0.5°	Group1(30) Group2(28)	11(36.7) 10(35.7)	19(63.3) 18(64.3)	.074	.883	0.02
	1°	Group1(30) Group2(28)	23(76.7) 15(53.6)	7(23.3) 13(46.4)	1.873	.002*	0.50
	1.5°	Group1(30) Group2(28)	28(93.3) 22(78.6)	2(6.7) 6(21.4)	1.639	.001*	.043
	2°	Group1(30) Group2(28)	27(90.0) 22(78.6)	3(10.0) 6(21.4)	1.195	.017*	0.31

Note: *$p < .05$. Group1 is golfers and Group2 is non-golfers.

Table 2. Left and Right sensory perception test

Direction	Slope Angle	Group(n)	Perception (%)	Non perception(%)	t-value	p-value	Effect Size
Left	0.5°	Group1(30) Group2(28)	16(53.3) 11(39.3)	14(46.7) 17(60.7)	1.064	.315	0.28
	1°	Group1(30) Group2(28)	28(93.3) 19(67.9)	2(6.7) 9(32.1)	2.569	.000*	0.67
	1.5°	Group1(30) Group2(28)	29(96.7) 25(89.3)	1(3.3) 3(10.7)	1.101	.026*	0.29
	2°	Group1(30) Group2(28)	29(96.7) 27(96.4)	1(3.3) 1(3.6)	.049	.923	0.01
Right	0.5°	Group1(30) Group2(28)	8(26.7) 8(28.6)	22(73.3) 20(71.4)	-.159	.751	0.04
	1°	Group1(30) Group2(28)	23(76.7) 12(42.9)	7(23.3) 16(57.1)	2.754	.005*	0.72
	1.5°	Group1(30) Group2(28)	24(80.0) 20(71.4)	6(20.0) 8(28.6)	.753	.138	.020
	2°	Group1(30) Group2(28)	29(96.7) 25(89.3)	1(3.3) 3(10.7)	1.101	.026*	0.29

Note: *$p < .05$. Group1 is golfers and Group2 is non-golfers.

difference between two groups at the left 1° (t=2.569, p=.000). The group1 perceived 96.7% and group2 perceived 89.3%. There was significantly difference between two groups at the left 1.5° (t=1.101, p=.026). The group1 showed 96.7% and group2 showed 96.4%, there was no significantly difference between two groups at the left 2° (t=.049, p=.923). The group1 indicated 26.7% and group2 indicated 28.6%. There was no significantly difference between group1 and group2 at the right 0.5° (t=-.159, p=.751). The group1 showed 76.7% and group2 showed 42.9% at the right 1°. There was significantly difference between two groups a the right 1° (t=2.754, p=.005). At the right 1.5°, group1 accounted 80% and group2 accounted 71.4%. There was no significantly difference between two groups at the right 1.5° (t=.753, p=.138). The group1 was perceived 96.7% and group2 was perceived 89.3% at the right 2°. There was significantly difference between group1 and group2 at the right 2° (t=1.101, p=.026).

Furthermore, Table 1 and Table 2 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°.

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 [14-16]. In order to success for putting on the green, it is required to recognize slope of the green [11, 12].

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 [4, 7, 10], and the finding of Teasdale's study indicated that sense of ankle, knee, and hip joints sensory perception were higher at the left-right direction [17]. According to Tsang and Hui-Chan, walking and standing uneven ground might develop vestibular system to improve balance control and performance [18]. 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. It was found that detecting ability at the left-right rotations was higher than forward-backward passive angle in both golfer and non-golfer groups. This result may have been designed to be more sensitive to medial-lateral tilting for falling prevention [17, 19]. In addition, the golfer group showed a slightly lower perceiving ability than the non-golfer group when the angle was given to the right. This result indicated that the golfer group participating in this study was right-handed so their right shoulder was lower than left through the repeated practice. Thus, golfer group seems to have low perceiving ability to right-side angle.

4. Conclusions

Most participants were perceived from 1° to 2° of slops. 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.

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