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GOLF PUTTING GRIP DESIGN INFLUENCES ON PUTTING KINEMATICS

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Putting is considered one of the most important skills in golf. Golf club designs have been consistenly introducing new design to enhance performance. The purpose of this paper was to look into the effects of grip sizes on putting kinematics. Ten (n=7) male, right-handed, novice-skilled golfers (height 172.4±3.4cm, weight 72.3±2.4kg, age 38.6 ±1.3yrs, and handicap 9.5 ±1.1) were recruited for the study. Research results suggest that larger grip design have affect on the kinematics of the putting characterics, with trait of shorter backswing, decrease in total rotation during downswing and shorterened rhythm &timing. Future study focuses on the cordinate change of body joints in relation to phase and relative club position, and synchronize with EMG data between various skill level.

KEY WORDS: Golf, putting kinematics, grip size

INTRODUCTION

Putting is considered one of the most important factors for scoring of professional Tour players (Alexander & Kern, 2005), and accounts for 43% ± 2% per round (Pelz & Frank, 2000). Unlike the long game, where distance and dispersion are discussed, short game like putting, is focused on accuracy and consistency (Hume, Keogh & Reid, 2005). Putting requires accurate and repeatable stroke especially under pressure, and one of the recent golf equipment design were the introduction of larger than oversize grips, the jumbo grip.

The putting stroke is divided into three phases, phase one (P1), the backswing (BS) is deifined from address position(ADR) to the top of backswing (TOB); phase two (P2), impact (IMP), is from top of backswing to impact (IMP), and phase three (P3), follow-through (FT), is from impact to finish (Delay et al., 1997). Coordination and relation of putiting stroke are defined as rhythm (RHYTHM, relation of BS / FS time) and impact timing (TIMING, the relation of Impact time / FS time), are both important factors for consistency and feel (Marquardt, 2007). Past researches mainly focused putting stroke between competency levels, and results have showed significant difference in putting stroke between skill levels, with the better-skilled golfers having shorter BS, longer amplitude for DS, and longer stroke duration (Marquardt, 2007; Lee et al., 2008); and some studies suggested a slower velocity at impact for better-skilled players (Marquardt, 2007).

Past studies on grip effects were mostly done with racquet sports, tennis (Hatch et al., 2006; Ohguni et al., 2009); and golf were the grip pressure change during the swing (Komi, Robeerts, & Rothberg, 2007) which mostly focuses on muscle activation and sequencial timing. Past researches focused on correlation of grip with golf swing indicated that peak grip pressure occures right around impact (Komi, Robeerts, & Rothberg, 2007); higher in leading, left, than trailing, right, hand (Komi, Robeerts, & Rothberg, 2007). However, past golf-related researches mainly focuses on full-swing (Schmidt, Roberts, & Rothberg, 2006; Komi, Roberts, & Rothberg, 2007) or putting pressure (Chen et al., 2008) but fail to investigated the intervention of equipment and its effects on golf stroke kinematics. The purpose of this study was to examine the influence the of grip sizes on the characteristics of the putting stroke.

METHODS

Subjects: Subjects were ten (n=10), male, right-handed, novice golfers (height 172.4±3.4cm, weight 72.3±2.4kg, age 38.6 ±1.3yrs, and handicap 9.5 ±1.1), and all with conventional grip style and mallet type heads. All subjects were informed of the experimental procedures and all agreed before participating in the research.

Procedure: Subjects first asked to stretch, followed by warm-up practice with own equipment for five minutes before experiment. Cross-over design was implemented between subjects. Ten putts from six feet (6ft) were recorded per session. Subjects were asked to perform each putt with pre-shot routine (MacPherson, Collins, & Morris, 2008). Experiment setting took place in an indoor studio on an artificial turf surface (Tourlink LLC., USA) with Stimp 9.

Equipment: ARESO Classic 10 (ARESO Golf GmbH, Germany) mallet-typed head with, lie of 68 degree, loft of 2.5 degrees, and length of 34 inches were used for this study. Swing-weight were adjusted to same standard for both grips. Measurement of grips, with Standard (STD) 23.1mm width and the Jumbo (JMB) 41.4mm width, at the butt section.

Data processing: Strokes were measured PuttLab 2010 (SAM PuttLab system, Science & Motion Sports GmbH), with three sensors attached to the shaft, and distanced 25cm from the sitting point of the club. The sampling rate of the positional data was 70 Hz per marker. The analysis was done with SAM Puttlab 2010 software which includes specific data analysis and filtering techniques for processing human movement data (Marquardt & Mai, 1994).

Statistics : Data were processed with SPSS 19.0 software. Mean values of the trials for each grip were computed and analysis with repeated measurement. Significant level set at α=0.05.

Table I : Summary of Characteristics of Participants (n=10)

Gender	N	Age (years)	Height (cm)	Mass (kg)	Handicap
Men	10	38.6 ±1.3	172.4±3.4	72.3±2.4	9.5 ±1.1

RESULTS

Results suggest that grips were not significantly in amplitude with BSTIME (p=.061) and FSTIME (p=.937) but JBO has slower time to impact (TIMP) than STD, but both grips were within range of good players (Marquardt, 2007). JBO has significantly shorter displacement in BSPATH (p=.042), but FSFATH (p=.656) were not. Velocity at impact (VIMP) for JBO was slightly slower (p=.199) but not significant.

STD have longer time to impact (TIMP), but both type of grips shown trait of good player (Marquardt, 2007). Grips weren't significant with rotation from top of backswing to IMP (ROTIMP) (p=.400) nor were they significantly differ during impact (ROTRATE) (p=.926). The only significant difference was the total rotation of the downswing (DS) (ROTTOT) (p=.000).

Significant difference were seen with RHYTHM (p=.000), with JBO shorter. Temporal of the DS (TIMING) for the JBO was shorter than STD, but both grips shown trait of good player (Marquardt, 2007). Details as shown in Table 2.

Table 2:

Summary of Statistically Analysis of Putting Kinematics between Grips Types

(mean±SD)

	Unit	STANDARD (STD)	JUMBO (JBO)
Back-Swing Duration(BSTIME)	**(Sec)**	0.754 ±0.050	0.717±0.080
Forward Swing Duration (FSTIME)	**(Sec)**	0.865±0.110	0.862±0.140
Back-swing Length (BSPATH)	**(m)**	0.176. ±0.010	0.168±0.020*
Forward-swing Length(DSPATH)	**(m)**	0.516±0.060	0.527±0.100
Time-to-Impact (TIMP)	**(sec)**	0.321±0.020	0.341±0.030*
Rotation-to-Impact(ROTIMP)	**(°)**	1.170±1.380	0.886±1.300
Rotation TOTAL (ROTTOT)	**(°)**	4.900±2.840	2.200±3.580*
Rotation during Impact (ROTRATE)	**(°)**	-5.390±14.30	-5.183±7.140
Impact Velocity (VIMP)	(m/s)	1.010±0.080	0.977±0.100
RHYTHM		2.280±0.120	2.110±0.240*
TIMING		0.346±0.040	0.334±0.090*

*Significantly level (p<.05)

DISCUSSION

During BS, both amplitude and temporal were shorter for JBO compared with STD. This suggest that JBO only showed sign of profiency with significantly shorter the ampitude in the BS (Marquardt, 2007; Lee et al., 2008), while the DS amplitude and longer stroke duration were not significant. Only temporal parameters that were significant was TIMP which were signs of the proficency but within range of Tour level (Marquardt, 2007). Angular accelaration of rotation was only significantly with the ROTTOT, while partial DS angluar acceleration, ROTIMP and ROTRATE, were not significantly affected with the larger JBO. The finding was similarly discussed with equipment effects on kinematics (Wu et al., 2012). Subjects all revealed feeling as more difficulty to accelerate the club head during DS, and less feel of club head, even though VIMP weren't significantly smaller. But it could be interesting as distance increase and JBO's effect on the putting kinematics. Rhythm was significantly shorter with JBO while all within range of Tour players rhythm of 2.2±0.11 (Marquardt, 2007).
Overall, JBO showed partial characteristics of proficiency but have significantly shortens BS, difference in rhythm, timing, and total rotation of the downswing.

CONCLUSIONS

The grip sizes of the golf grip have altered putting kinematics, kinematics of the putting characterics, with trait of shorter backswing, decrease in total rotation during downswing and shorterened rhythm and timing. Research results suggest that JBO eliminate the some part of the stroke like BS, due to limitation of wrist movement. JBO also eliminate the rotation during the downswing and thus less energy transfer. Also, subjects' feedback on the feel of lightness of the putter head, even though swing weight was similar which concide with slightly lower impact velocity.
Future study focuses on the cordinate change of body joints in relation to phase and relative club position, and synchronize with EMG data between various skill level. Lastly, standardize of weight of grips should be better looked into to better controlled.

Figure 1: Illustration of Grip Designs

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