UWS Academic Portal

Effect of Fatigue on Hip, Knee and Ankle Proprioception During a Golf Specific Fatigue Protocol.

Hunter, Henry H.; Sorbie, Graeme G.; Grace, Fergal M.; Dello Iacono, Antonio; Baker, Julien S.; Ugbolue, Ukadike Chris

Published: 25/07/2021

Document Version
Publisher's PDF, also known as Version of record

Link to publication on the UWS Academic Portal

Citation for published version (APA):
Hunter, H. H., Sorbie, G. G., Grace, F. M., Dello Iacono, A., Baker, J. S., & Ugbolue, U. C. (2021). *Effect of Fatigue on Hip, Knee and Ankle Proprioception During a Golf Specific Fatigue Protocol.*.

General rights
Copyright and moral rights for the publications made accessible in the UWS Academic Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy
If you believe that this document breaches copyright please contact pure@uws.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

Download date: 09 Aug 2021

Effect of Fatigue on Hip, Knee and Ankle Proprioception During a Golf Specific Fatigue Protocol.

Henry H. Hunter[1], Graeme G. Sorbie[2], Fergal M. Grace[3], Antonio Dello Iocono[1], Julien S. Baker[4], Ukadike C. Ugbolue[1]
[1]School of Health and Life Sciences, University of the West of Scotland, South Lanarkshire, Scotland, UK
[2]Division of Sport and Exercise Sciences, Abertay University, Dundee, DD1 1HG, UK
[3]Faculty of Health, Human Movement & Sport Sciences, Federation University Australia, Ballarat, Victoria, Australia
[4]Department of Sport, Physical Education and Health, Hong Kong Baptist University, Kowloon Tong, Hong Kong
Email: henry.hunter@uws.ac.uk

Summary

The purpose of this pilot study was to determine whether muscle fatigue generated by a golf specific fatiguing protocol would have an effect on proprioception and kinematic parameters of both left and right hip knee and ankle joints during the six phases of the golf swing. Five healthy, right handed male subjects participated in this pilot study respectively. The participants were asked to perform 125 golf swings using various clubs whilst being recorded with a 3D Motion capture System. A subset of swings were calculated as Pre-Fatigue and Post Fatigue for evaluation purposes. All data was then analysed and the results compared using both descriptive and inferential statistics.

Introduction

The golf swing is a complex movement of the whole body that encompasses the Sagittal, Frontal and Transverse planes. Several golf related studies have been carried out to improve performance in this field with regards to physical conditioning, mood, injury prevention and swing mechanics. According to studies [1] and [2] hip and knee mechanics can be substantially altered whilst fatigued. However, [3] points out that both "golf specific fatigue did not relate to the initial lower body sagittal plane angles at address nor was simulated golf specific fatigue related to peak transverse plane pelvis and trunk rotational velocities (or their timings) in a manner that indicates a relationship to resultant club head velocity and shot consistency".

Methods

Five healthy, right handed male subjects participated in this pilot study (Height 176.8 + 27cm, Weight 71.48 + 33.8 kg) respectively. Participants were asked to perform 125 golf swings using various clubs (5 x 5 iron, 60 x 7 iron, 5 x 9 iron, 55 x Driver). Kinematic angle data of both left and right hip, knee and ankle joints in the Frontal (X), Sagittal (Y), and Transverse (Z) planes were recorded using a Vicon Nexus Bonita (Oxford Metrics Ltd) Motion Capture system operating at 250Hz. A Vicon plug in gait Lower Body Model was selected with 16 retro-reflective markers placed on the correct anatomical positions of the lower limbs and four on the shaft of the golf club. This allowed for correct identification of the six golf phases. The first five swings of the Driver and 7 Iron were extracted and used as "Pre-Fatigue" with the last 5 swings of the study stored as "Post-Fatigue" for evaluation and comparison purposes. All joint angle data was stored in Degrees (^{0}).

A paired t-test was used to compare the differences between the Pre-Fatigue and Post-Fatigue swings with respect to their corresponding joint angles. Significance was set to P = 0.05.

Table 1: t-test Pre-Fatigue v Post-Fatigue

		Address		Top of Backswing		Acceleration		Impact		Early Follow Through		Late Follow Through	
Joint Angle (deg)	Coordinate	Driver	7 Iron	Driver	7 Iron	Driver	7 Iron	Driver	7 Iron	Driver	7 Iron	Driver	7 Iron
LAnkleAngles	X	0.074	0.598	0.136	0.593	0.457	0.014	0.427	0.036	0.708	0.066	0.732	0.976
	Y	0.083	0.894	0.008	0.190	0.111	0.063	0.045	0.175	0.249	0.621	0.885	0.119
	Z	0.065	0.761	0.008	0.122	0.155	0.110	0.083	0.248	0.483	0.714	0.444	0.050
LHipAngles	X	0.079	0.925	0.007	0.250	0.411	0.008	0.119	0.008	0.102	0.069	0.212	0.267
	Y	0.587	0.808	0.012	0.253	0.417	0.340	0.084	0.827	0.033	0.940	0.169	0.155
	Z	0.834	0.895	0.067	0.552	0.011	0.785	0.320	0.393	0.472	0.893	0.166	0.174
LKneeAngles	X	0.107	0.912	0.005	0.368	0.361	0.027	0.598	0.029	0.512	0.010	0.064	0.150
	Y	0.645	0.689	0.036	0.100	0.682	0.349	0.385	0.965	0.898	0.522	0.030	0.875
	Z	0.536	0.682	0.606	0.420	0.328	0.580	0.639	0.198	0.885	0.081	0.425	0.928
LPelvisAngles	X	0.651	0.028	0.383	0.163	0.303	0.123	0.285	0.109	0.281	0.137	0.365	0.862
	Y	0.333	0.026	0.381	0.349	0.381	0.001	0.357	0.001	0.380	0.004	0.335	0.004
	Z	0.597	0.058	0.412	0.053	0.760	0.023	0.565	0.027	0.557	0.0496	0.321	0.382
RAnkleAngles	X	0.023	0.415	0.090	0.910	0.326	0.181	0.443	0.195	0.660	0.344	0.425	0.912
	Y	0.473	0.519	0.250	0.114	0.107	0.950	0.232	0.972	0.214	0.907	0.016	0.985
	Z	0.488	0.602	0.325	0.125	0.080	0.963	0.199	0.921	0.172	0.999	0.025	0.715
RHipAngles	X	0.166	0.909	0.245	0.457	0.611	0.005	0.416	0.021	0.339	0.213	0.227	0.895
	Y	0.718	0.760	0.151	0.731	0.451	0.799	0.344	0.334	0.009	0.318	0.405	0.053
	Z	0.323	0.356	0.463	0.187	0.400	0.957	0.375	0.835	0.354	0.407	0.163	0.107
RKneeAngles	X	0.937	0.866	0.521	0.787	0.570	0.085	0.913	0.022	0.875	0.008	0.954	0.139
	Y	0.211	0.398	0.537	0.585	0.599	0.228	0.979	0.321	0.342	0.243	0.298	0.239
	Z	0.209	0.198	0.597	0.642	0.548	0.146	0.470	0.089	0.355	0.130	0.419	0.055
RPelvisAngles	X	0.651	0.028	0.651	0.163	0.278	0.123	0.215	0.109	0.204	0.137	0.587	0.862
	Y	0.333	0.026	0.275	0.349	0.214	0.001	0.264	0.001	0.179	0.004	0.338	0.004
	Z	0.597	0.058	0.066	0.053	0.301	0.023	0.478	0.027	0.468	0.0496	0.881	0.382

Results and Discussion

There were significant differences (P>0.05) observed throughout the study with the exception of the Y and Z axes of the Right Knee Angle during all phases with both Driver and 7 Iron and also the 7 Iron at the Top of the Backswing for all joint angles. However, the scattering pattern of data displayed as significant differences does highlight similarities for both the Driver and shorter 7 Iron club particularly at the phases of the swing with higher Club Head Speed (CHS) (Acceleration, Impact and Early Follow Through).

Conclusions

The results of this study show that there were no significant differences displayed for the Y and Z axes of the Right Knee Angle during all phases with both clubs. The variability in the p values with respect to the joint angle and golf swing phases highlight the changes between the Pre-Fatigue and Post-Fatigue swings.

References

[1] Lucci N et al. (2011). J. Sci. Med. Sport, **14 (5)**: 453–459

[2] Miller PK et al. (1976). *Percept. Mot. Skills*, **42 (1)**: 135–138.

[3] Higdon NR et al. (2012). *Sport. Biomech.*, **11 (2)**: 190–196.