# BIOMECHANICAL CHARACTERISATION OF LEG MOVEMENT DURING THE GOLF SWING FOLLOWING KNEE SURGERY

Ian C. Kenny[1], Darragh Madden[1], Jennifer Downey[1], Paraic Murray[2], Jane Campbell[2] and Sarah Breen[1]
[1]Biomechanics Research Unit, University of Limerick, Ireland
[2]The Galway Clinic, Doughiska, Galway, Ireland
email: ian.kenny@ul.ie; web: ul.ie/pess/bru

## INTRODUCTION

The forces transmitted through the knee throughout the golf swing have been found to be as high as those associated with running (Colwell *et al.*, 2005) therefore playing golf with a knee that has undergone surgery may place extra stress on the previously damaged area leading to variances in the golf swing. While it has been established whether it is safe to return to golf after knee surgery (Jackson *et al.,* 2009), the actual effect that knee surgery has on golf movement has as not been researched adequately. The aim of the current study was to characterise knee kinematics for previously knee injured and non injured subjects during the golf swing to ascertain any residual differences in movement, despite full clinical rehabilitation of injured subjects.

## METHODS

10 previously injured recreational golfers (SURGICAL) (5 female, 5 male, 17.0 ± 5.5 handicap) and 5 control non-injured recreational golfers (CONTROL) (3 female, 2 male, 21.8 ± 2.3 handicap) were recruited. Previously injured subjects had all undergone left (lead) knee surgery for either ACL reconstruction, arthroscopy or total Knee Replacement (TKR) more than six months prior to testing. All subjects were considered fully rehabilitated and had returned to playing golf at the time of testing. Each subject performed 8 swings with their own driver in an indoor golf testing facility. Ethical approval for this study was obtained from EHS-REC and all participants were familiarised with the experimental procedure before providing written consent. Eleven retro-reflective leg markers were tracked at 400 Hz by a 6-camera 3D motion analysis system (MotionAnalysis Eagle, CA, USA); all data were filtered at 12 Hz (Mitchell *et al.*, 2003). Analysis concentrated on sagittal plane knee flexion for the entire swing and a 1-way ANOVA was applied to examine any difference between groups.

## RESULTS

Data demonstrated no significant difference in swing timing between the surgical and the control subjects. Table 1 shows significant differences ($p<0.05$) in mean knee flexion between groups for the whole swing and Fig.1 displays variable motion for knee flexion for the Surgical group early in the swing.

Table 1: Mean knee flexion for the whole swing

| | SURGICAL | | CONTROL | |
|---|---|---|---|---|
| | Lead Knee | Trail Knee | Lead Knee | Trail Knee |
| Knee Flexion (°) | 18.03 ± 8.99* | 21.59 ± 11.12* | 12.38 ± 6.16* | 12.87 ± 6.05* |
| Range (°) | 25.40* | 25.68* | 11.29* | 20.14* |

*Significant difference between groups ($p<0.05$)

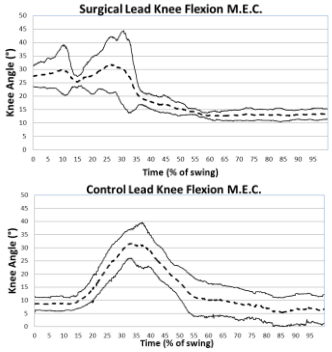


Figure 1: Mean ensemble curve (M.E.C.) for knee flexion for all subjects

## DISCUSSION

Results from this preliminary study showed that golfers who have undergone previous knee surgery display more within-subject variability in knee movement. Surgical subjects showed deeper knee flexion perhaps as a residual muscle control response to the rotational shear forces experienced at the knee during the golf swing.

## CONCLUSION

Rehabilitated surgical patients were able to comfortably perform the golf swing maneuver but with greater knee flexion variability compared to a healthy control group.

## REFERENCES

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