

THE OPPORTUNITY TO COLLECT KINETIC FORCES DURING A ROUND OF GOLF USING WEARABLE DEVICES: SINGLE-PERSON PILOT STUDY

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Introduction

Dynamic balance in the golf swing is essential for golf shot control. Dynamic balance allows individuals to move without falling over. To assess dynamic balance, researchers can use the net center of pressure (CoP), the weighted average of all vertical forces between the individual's body mass and foot, sock, shoe, measuring device, and ground interface during movement. Golf instructors can use several tools to measure these kinetic forces during the golf swing, including force plates and pressure mats. There are significant differences in data output and cost between force plates and pressure mats; however, the convenience of measuring kinetic forces during a round of golf would be very challenging using these tools. Several new wearable solutions offer the opportunity to collect golf swing CoP patterns on the golf course: Salted and Humo Golf. Salted has designed insoles with four pressure sensors and an electronics module under the arch section. Humo Golf smart sock uses two pressure sensors encapsulated into a sock with an attached puck as its electronics module (see Fig. 1). Both solutions provide the opportunity to conduct research on the golf course. Previous studies have examined differences in golf swing CoP on a slope versus flat ground, between age, CoP, and club head speed, professional versus amateurs, and other variables; however, these studies were conducted on a driving range or in a laboratory. Wearable technology enables researchers to move from the lab to the field of play. It appears that this pilot study will be the first of its kind to conduct golf swing CoP analysis during a round of golf.

Methods

Under Mississippi State University's Institutional Review Board study #21-258, researchers will collect outdoor 2D video, CoP, and golf club data from a member of the Professional Golfers' Association of America on the driving range (practice session) and three golf holes using a driver, 7-iron, wedge, and putter. An iPad Pro will capture 2D videos, Humo smart socks will capture CoP, and ForeSight GC2 & HMT launch monitor will capture club head and ball flight data. The practice session will include a warm-up and five shots each with the driver, 7-iron, wedge, and putter. The full swing practice session will take place on the driving range, and the practice putting session will take place on the practice green. Five 10' putts on different slopes include: (a) straight uphill, (b) straight downhill, (c) right to left side hill, (d) left to right side hill, and (e) straight flat putt.

Results and Discussion

This pilot study will identify four key outcomes in practice sessions and on-course play. These key outcomes include: (a) CoP differences between clubs, (b) CoP differences between a practice session and on-course play, (c) CoP relationship to the club head and ball data during a practice session, and (d) CoP relationship to the on-course club head and ball data. There is a lack of golf course-specific data due to the time and cost of acquiring the data, wrangling and tidying the data, and conducting analysis. Findings from this pilot study will prepare future comprehensive studies and help develop future golf applications for both the golf instructor and amateur and professional golfers. Wearable technology offers the opportunity to track golfers over time. Longitudinal data collection of CoP may recognize movement patterns that cause injuries. The golf swing is an asymmetrical movement pattern that can lead to overuse musculoskeletal pain. Understanding CoP traces that lead to musculoskeletal pain can assist in retraining a golfer's movement pattern.

Significance

To optimize the adoption and diffusion of wearable technology, understanding and managing the expectations and experiences of golfers and instructors is necessary to create overall satisfaction, word of mouth recommendations, and repeated usage. Understanding the differences in CoP between practice sessions and on-course golfing can be used to improve a golf instructor's delivery of information and a golfer's game. Individual and expert performance models can be created and incorporated into training software applications. To overcome on-course data collection challenges, future development of an integrated app will incorporate GPS location services to create an on-course game tracking and training platform.



Figure 1. Concept photo of the Humo Golf smart sock.