Ground Reaction force (GRF) is important in human movements and GRF measurements are one of the most frequently used tools in biomechanical studies. In the studies of the golf swing motion, people refer to GRF as weight transfer. A successful golf swing motion requires many segments activation sequences which are controlled by the nerve system. Due to the inter- and intra-individual variability of the human movement and the movement strategies, reliability of the measurements are important in human movement studies. Previous golf researches were based on group studies and certain events' values were analyzed. The purposes of this study were to determine the number of trials for the reliable golf swing GRF data collection, to reveal the variability level of the meaningful components of the golf swing GRF, and to classify the types of the golf swing GRF patterns. Twenty-three male professional golfers (26.4 ± 6.6 years, 174.3 ± 5.2 cm, 71.3 ± 6.5 kg) signed an informed consent form prior to participation in this study. GRFs of driver swings were collected with Kistler 9285 force platform and 9865A amplifier, and calculated by the KwonGRF program (Visol, Korea). Sampling frequency was 1080 Hz. GRF data were trimmed from 1.5 s prior to the impact to 0.5 s after the impact. The number of trials for the reliable GRF collection was determined when the change in floating mean overs the 25% of the standard deviation of that variable. Variabilities of the variables were determined by the coefficient of variation (CV) of 10%. The types of GRF patterns were determined by visual inspection of the peak GRF shapes. The minimum number of trials for the reliable golf swing GRF data collection was five. Ten-trial seems more conservative. The value of the peak GRF was more reliable than the value of the impact GRF. The CV of the peak GRF and impact GRF were 7.4%, 15.2%, respectively. Because of the +/- sigh of the peak GRF appearance time, it was impossible to calculate CV of the peak GRF appearance time. Golf swing GRF patterns were classified as sing peak type, double peak type, and plateau peak type. This classification suggests the presence of the different golf swing weight transfer strategies.


Ground reaction force data were collected for a duration of eight seconds from the portable force platform which was interfaced with a laptop and recorded using Bioware software (Version 5.11; Kistler Instrument Corporation, Winterthur, Switzerland). Minimal pre-tension was allowed to ensure there was no slack in the body prior to initiation of pull and subjects were instructed to be as still as possible during the weighing period, without initiating a pull on the bar, until given the instructions to ‘pull’. In physics, and in particular in biomechanics, the ground reaction force (GRF) is the force exerted by the ground on a body in contact with it. For example, a person standing motionless on the ground exerts a contact force on it (equal to the person's weight) and at the same time an equal and opposite ground reaction force is exerted by the ground on the person. Ground reaction forces and center-of-pressure patterns were obtained by alternately placing each foot on a Kistler force platform while subjects hit golf balls on artificial turf in an indoor golf station. Four force trials for each foot were recorded and subsequently averaged from shots made with each of three clubs (driver, 3-iron and 7-iron), while wearing standard golf shoes. The 10 subjects were assigned to three groups based on a handicap (0–7, 8–14, 15+). All motion capture data was collected at 100Hz using 6 infrared cameras. Carry distance, club speed, ball speed, smash factor, launch angle, and spin rate were collected from radar-based device, TrackMan.