

**Study of Tour Player
Positions at Address and During the Golf Swing**

Date: 6/30/2011

Steve Bosdosh, PGA

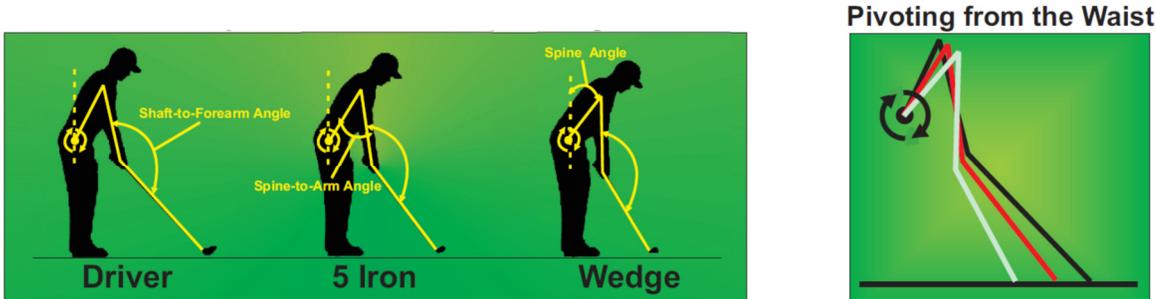
David Kardos, M.E.

Players Lab Technician, Major Golf Equipment Manufacturer

Previously unidentified trends in the body positions, both static and dynamic, of professional golfers as they setup and swing the golf club, have been discovered and confirmed by independent research and study. The results are presented in this paper. This paper is a summary of the findings during a 12 month study both in the field, and in the swing laboratory. The fundamental discoveries and conclusions drawn in this study are the correlation between consistent body positions and the consistency demonstrated by professional golfers. These concepts are explored in more depth in this paper.

Body Orientation Patterns

At one of its most basic levels, the golf swing is the rotation of the golf club about the spine of a golfer. Therefore, it stands to reason that the position of the arms and club, relative to the spine, in the address and take-away positions, will greatly affect how the swing will be executed and the striking of the golf ball. If a golfer changes the position of the arms and golf club, relative to the spine, when changing from a driver to a wedge, they will be executing a dramatically different swing for each club. In essence, the golfer will be creating a more complex 'mechanical system', which will increase the difficulty in recreating a consistent ball striking for each club. These ideas and this reasoning was explored in this study, and the primary variable correlation that was identified and tracked was the shaft-to-forearm angle. The definitions of the primary variables that this study focuses on, is the club to spine to forearm angles, and are illustrated below.



Set-up / Address Measurements

For this study, we looked at the address positions of 201 professional golfers. The positions were measured by multiple methods, including placing markers at different places on the body, and then using a camera/computer system we able to calculate the different positions and relative orientations, as well as photographing the golfers, and then measuring positions on screen. The summary of data is shown below.

Professional Golfers - Men

Average Values from Field of 105 Male Golfers

| Group # | Avg Shaft-to-Forearm Angle (deg) |
|---------|----------------------------------|
| A | 143 |
| B | 142 |
| C | 146 |

Professional Golfers - Women

Average Values from Field of 96 Female Golfers

| Group # | Avg Shaft-to-Forearm Angle (deg) |
|---------|----------------------------------|
| A | 142 |
| B | 145 |
| C | 144 |

Note: The 3 groups of male and female golfers, A, B and C, represent 3 different methods used to measure the positions, i.e. photo analysis, video analysis, real-time camera/computer mapping. Each group was analyzed with a single particular method of measurement. Tolerance of measurements is +/- 0.1 degrees.

The consistency of the body positions and orientations was discovered in the research, and seems to be an important component that allows professional golfers to achieve incredible accuracy and consistency. The top professionals are setting certain precise body positions exactly the same for more than one club, and therefore reducing the overall complexity when you consider their entire catalogue of swings. The top pros set essentially the same address and take-away positions for every club they swing, in terms of the club to forearm to spine angles. Amateurs on the other hand, set 10 or so vastly different variations of these orientations, and therefore have to master 10 significantly different address positions and swings.

Considering the set-up and swing complexity, and the associated variations that the average amateur has to learn, it makes sense why amateurs are far from achieving great consistency. We postulate that after years of practice and constant feedback from professional teachers and coaches, the professional golfers have inherently adopted certain body positions for each of their swings. When you examine the body orientations of dozens of professional golfers, there are certain consistent patterns that began to emerge, as shown in the data that was discovered. The only major body position that changes when moving from the driver to the wedge (as viewed from the side), is the spine angle (or bending from the hips/waist). The spine angle changes as a result of bending, to account for the shorter or longer club. The top professionals have reduced the number of set-up and swing variables to the bare minimum and have simplified the golf swing dramatically. Of course our data shows averages, and certain individual golfers body positions vary from the averages.

Swing Application

Many golfers have never had a serious golf lesson, and take a haphazard and inconsistent approach to improving their golf game. They make assumptions, set random body positions, and are constantly trying something new. Even if a golfer has the correct information, and tries to implement proper technique, chances are their address position is constantly changing. There is one level of knee-bend for a 3 Iron, and a different one for the 5 Iron. One shaft-to-spine angle for the driver, and a different one for the 7 Iron. Very few swing variables are carried over from club to club, which raises the overall system complexity. It is very hard for a golfer to systematically improve their game, when they don't have a constant and consistent foundation to work from.

Many of the best professional golfers in the world essentially set the exact same address position in terms of the orientation of the club, hands and arms, to the spine (as viewed from the side.) As the club gets shorter, they simply bend a little more from the waist. The knee bend stays the same and the angle between the shaft and forearm stays the same. However, we don't believe that they consciously set a specific angle between the shaft and forearm. The professionals rely on their incredible skill, muscle memory, and knowing what it 'feels like' to be in the position that has produced the most consistency over time.

Based on our research, the top professional golfers all maintain a shaft- to- forearm angle that averages about 144 degrees for every club they swing. The astonishing part is that each golfer maintained his or her particular shaft to forearm angle within 2 degrees for every club from the driver to the wedge. In

our preliminary research of amateurs, we found a relative correlation between the deviation of the shaft to forearm angle from club to club, and the consistency of the golfer. The lower the deviation of the shaft-to-forearm angle across all of their clubs, the more consistent the golfer tended to be. The drawing below illustrates the astonishing body orientation consistency a top professional can achieve from the driver to the wedge. We are not concluding that the shaft-to-forearm in itself is the key, but it does indicate a consistent spine, arm, and shaft orientation. The exact angle does not seem to be as important as choosing an angle within the range of 140-149, and maintaining that particular angle exactly the same for every club.



Consistency Across Clubs for a Top Pro

As illustrated, this study reveals that as the professional moves from Driver down to Wedge, they bend from the hips, and maintain the shaft to forearm angle, thereby maintaining very similar swing mechanics for all clubs. Tolerance of measurements is +/- 0.1 degrees.

Summary

This study was able to identify certain levels of consistency among professional golfers as it relates to the forearm to shaft, to spine, orientations. The primary consistency identified, is the consistency of the shaft to forearm angle that a professional golfer achieves for every club they use. This consistency was previously not explored, but we hope that this discovery will help golfers of all skill levels improve their golf game. The average angle of the shaft to forearm angle of 144 degrees proves to be a key factor in the golf swing.