

## Introduction

The golf swing is an excellent example of how the tension based loading of muscles produces great amounts of potential energy that is then utilized in a powerful compact explosion over a short period of time. The three phases of a traditional golf swing should include a backswing, downswing, and follow through. Initially, the golfer should set up in an athletic position with a slight lumbar curve and extended thoracic spine to ensure proper core stability and pressure. This stability and tension of the core and spine is crucial if the golf swing is to be accurate, precise, and repeatable. According to Lindsey & Horton (2010), lumbar stability is highly correlated with low back pain in golfers. In relation to the transverse plane, a great amount of thoracic rotation is required during the initial takeaway and the top of the backswing. At the top of the backswing, and when initiating the downswing, a golfer should have the club locked into the slot position. The slot position is the position where the trail shoulder is properly externally rotated, shoulders are in a vertically stacked position, and the club is close to parallel with the ground (Zheng et al., 2008). During the middle of the downswing, it is optimal for a golfer to create lag of the golf club by maintaining external rotation of the trail shoulder while the hips and knees begin to uncoil, rotate, and produce force. Lag, as it relates to the golf swing, is defined as the ability to create a coiling effect of golf club around the body while the body begins to turn through the ball. If this occurs properly, a massive whipping of the club will occur as the shoulders and wrists are unloaded in the direction of the ball. As the golfer reaches the contact point of the swinging motion, triple extension of the lead ankle, knee, and hip will assist in producing massive amounts of ground reaction force which leads to great amounts of angular velocity and power. This ground reaction force produces torque which will allow the golfer to drive a ball further in distance. As the golfer transfers their potential energy into kinetic energy, massive amounts of eccentric forces are needed to assist the golfer in slowing his body back down to eventually end in a stable, controlled position.

## Backswing

The backswing/takeaway of the golf swing depends upon several crucial factors. The backswing consists of positioning the body in a stance that allows for production of adequate muscular loading that will be readily available for use during the downswing phase. It is imperative for the golfer to maintain proper lumbar and core stability during a golf swing in order to reduce the risk of injury over time and to build proper base of stability for the powerful motion involved in the downswing. According to Lindsey & Horton (2010), "golfers with lower back pain also had less trunk rotation obtained from a neutral posture, which results in a relative supramaximal rotation of the spine when swinging". A high amount of thoracic rotation is preferred during the backswing to ensure that proper loading and optimal position is obtained prior to the downswing. While the thoracic region of the spine is rotated, it is crucial that the proper amount of mobility is observed. According to (Gulgin, 2009), "in other structures, such as the shoulder, an increased risk of soft tissue injury has been associated with high levels of rotational velocity."



## Downswing

The downswing phase of the golf swing typically is initiated from movement of the hips in the transverse plane. This powerful unwinding initiates a chain reaction release of kinetic energy that has been stored in the loading of the body's skeletal muscle. The most important component for a golfer to produce the correct swing is maintaining the proper amount of lag. This is accomplished by maintaining external rotation of the trail shoulder until just before contact is made (Zheng et al., 2008). Around the time that the golf swing is approaching contact, the golfer must create sufficient ground reaction force by performing triple extension of their lead hip knee and ankle. By doing so, a whipping effect is created with the golf club that creates the greatest amount of angular velocity. According to Gatt and associates (1998) the lead hip internal rotation moments are significantly correlated with golfer skill level. Finally, if performed correctly, the ball will respond in a positive manner with enough kinetic energy to travel the distance that is desired by the golfer.



## Follow-Through

Within the follow-through of the golf-swing, there are many things that happen to the human body. The follow-through is essential for the body to slow down the concentric force produced during the downswing. The motion of the follow-through allows the body to stabilize and find terminal balance. Balance is the ability for people to control the bodies equilibrium. Stability is the ability to control the human body when there are outside influences acting upon it. When there is excessive amounts of force being pushed through the body then the body might become unstable and then the person will lose their balance. The slowing of the body is done through eccentric forces. The eccentric forces come from the action of antagonist muscles that influenced the backswing and downswing. Typically, the lead ankle of the golfer will become inverted to allow for greater degrees of freedom and increased power. Also, during the follow through, there is a substantial amount of lead shoulder external rotation as the club comes to a halt around the body.



## References

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