

Putt It Here

The Ergonomics of Golf: Part I



Golf has quickly grown in popularity since the early 1990's and is now recognized as a sport rather than a leisure game.^{1,2} Golf requires a unique combination of strength, flexibility, and endurance. It is not a game to play to achieve fitness, however. The swing itself is a high-speed, explosive action and the repetitive nature of the sport predisposes participants to overuse injuries. Unlike many other sports, though, people who have physical limitations, are out of shape or who were never athletic, can enjoy golf.

The things you need to do improve your game will also reduce your risk of overuse injuries. Golf injuries generally occur as a result of both improper form and lack of fitness. 18 holes of golf can take over 4 hours to complete, may involve walking 4-6 miles and involves coiling and uncoiling the body approximately 100 to 130 times.^{1,2} If you are not fit, you will be challenged to keep up the pace physically and to focus mentally. Not only that, but muscular fatigue will cause sloppy posture and lack of controlled movement patterns. Combined with poor swing mechanics, the golfer is an "injury waiting to happen". In one study, 80% of golf injuries were overuse injuries.³ Excessive play/practice and poor swing mechanics are the most frequent causes of injury.¹ Various reports of injury rates indicate that 57-62% of amateur golfers have experienced at least one golf injury. Golfers over 50, who make up 25% of the golfing population and are responsible for 50% of the total rounds played every year, experience an injury rate of 65%.¹

Injury prevention

Most golf injuries are preventable with appropriate equipment, proper swing technique, a good conditioning program, and a daily warm-up and stretching routine.

Choose proper equipment.

Golf Clubs

- **Materials.** Modern shafts made out of alternative materials are lighter and more flexible, and are reported to be capable of absorbing more vibratory forces than steel. Golfers with degenerative arthritis and other upper extremity problems may be able to reduce the stress to their joints by using graphite, titanium, and other force-dampening shafts. Unfortunately lighter and more flexible shafts are much more expensive and typically do not perform as consistently as their steel counterparts.¹
- **Shaft length.** Due to the prolonged periods of time golfers are in a forward flexed, and somewhat rotated, position, long-shafted putters are recommended for golfers with lumbar (lower back) problems.^{1,6}
- **Cavity-backed irons.** If you have elbow pain, using cavity-backed irons, which have larger heads and "sweet spots", will dampen the vibrations transmitted to the wrists and forearms from off-center hits.

Shoes

Golfers with knee or hip joint problems should experiment with soft-spike shoes and the newer "sneaker" type of golf shoes that have molded, non-spike soles.¹ Shoes with metal spikes are designed to create more friction and torque between the ground and the golfer. They can produce more torque in the knee and hip joints as well.

Take lessons and attend clinics. The best way to develop proper swing mechanics is to work with a PGA professional instructor who can watch your swing and give you specific guidance to improve your technique and reduce your risk for injury.^{5,6} There are lots of books on the subject of golf, but you will never be able to see what you are doing wrong by reading books. The help of a professional observer can correct problems with your swing.

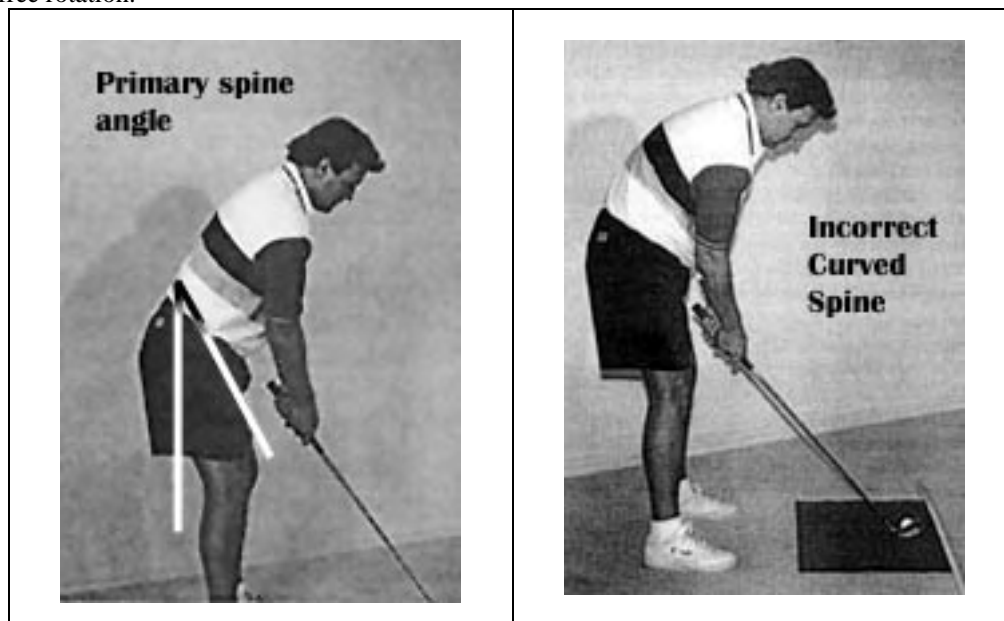
Know The Golf Swing

The golf swing is broken down into four major phases: setup (or address), backswing, downswing, and follow-through. The chain of events and body movements involved is important in understanding the source of overuse injuries. Electromyographic (EMG) studies have helped to discover what muscles are active throughout the swing. They have helped to dispel many myths about the source of injuries and stresses.

Setup

Setup is the first, most important, and often the most neglected phase of the golf swing. The initial starting position should align the golfer with the target, establish his/her dynamic and static balance, and place the golfer in a biomechanically sound position to execute the golf swing.¹ Golfers who initiate their swing from a compromised setup position increase the complexity of their movement as well as their chance for injury. The resulting motion will be forced, stressful, and will require compensation for the incorrect starting position.

Scientific studies show that golfers should have 50-60 percent of their weight on the back foot. The knees should be flexed about 20-25 degrees, and the golfer must form and maintain two angles with the upper body. The **primary spinal angle** is created by hinging the hips. The hip joints serve as the axis of rotation, keeping the back straight in a neutral position. Rounding the back and failing to rotate from the hips increases the stress on the spine and decreases free rotation.



The **secondary spinal angle** is created with a combination of lateral bending to the right (for a right-handed golfer) and the slight dropping and rotation of the shoulder-line. This results from the hand placement on the club grip where the right hand is lower than the left.



Many people think that trunk rotation is the main cause of low-back stress, but actually, injuries arise as a result of the combination of rotation and the need to maintain the primary and secondary spinal angles *throughout* each swing.

Backswing

The backswing initiates movement to create maximal kinetic energy in preparation for the downswing. The backswing movement should be initiated with a "one-piece takeaway" where the triangle that is formed with the two arms and chest at setup are maintained throughout the first 1-2 ft. of the backswing. These first 2 ft of the golf swing are identical in motion to a long putt or a short chip shot. Many instructors feel that the first 2-3 ft. of takeaway are directly responsible for many downswing flaws of amateur golfers.



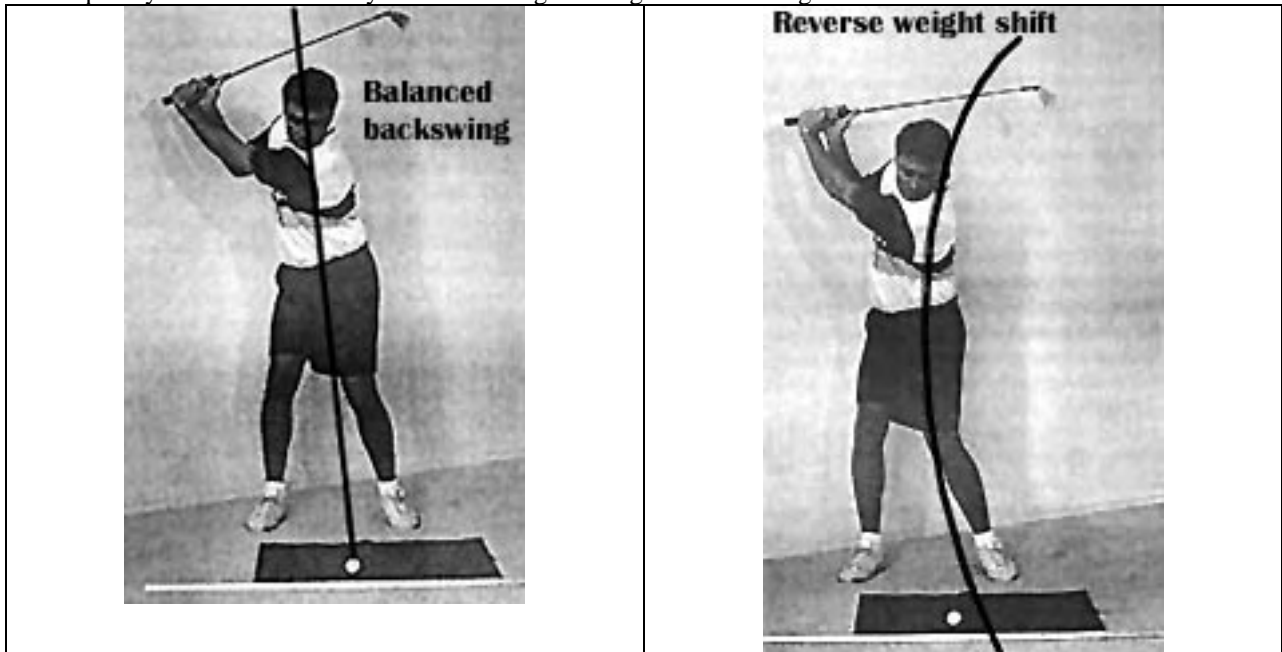
About the time the hands reach hip level, the right arm begins to rotate, bend, and flex; an unnatural move and another source of swing mechanics error. If the early backswing is not correct, the remaining backswing will require compensation to get back on track before the downswing. A highly efficient swing will keep the club on

plane throughout the entire swing and will reduce stress associated with off-plane movements. Understanding the swing plane is a very important concept to understand and refine.



As the backswing continues, the shoulders pull the pelvis clockwise, away from the target line. This motion is accompanied by a change in the position of the center of gravity. If the golfer has good rotary flexibility and maintains the secondary spine angle during this motion, the center of gravity will stay well within the base of support. Too much lateral shift -- having too much weight on the front foot at the top of the backswing -- is usually an attempt to maintain swing balance, but moves the golfer's center of gravity outside the base of support.

At the top of the backswing, the left elbow remains extended but not locked, the left shoulder joint rotates inward and moves across the chest. The resulting stretching and rotating can result in pain, especially in older golfers or those with previous shoulder problems. The available range of motion in the left shoulder and the amount of spinal rotation will determine the height of a particular golfer's backswing. A reverse weight shift or pivot during the backswing means there is too much weight on the front foot and there is a lot more stress on the spine. The golfer must quickly shift the lower body toward the target during the downswing.

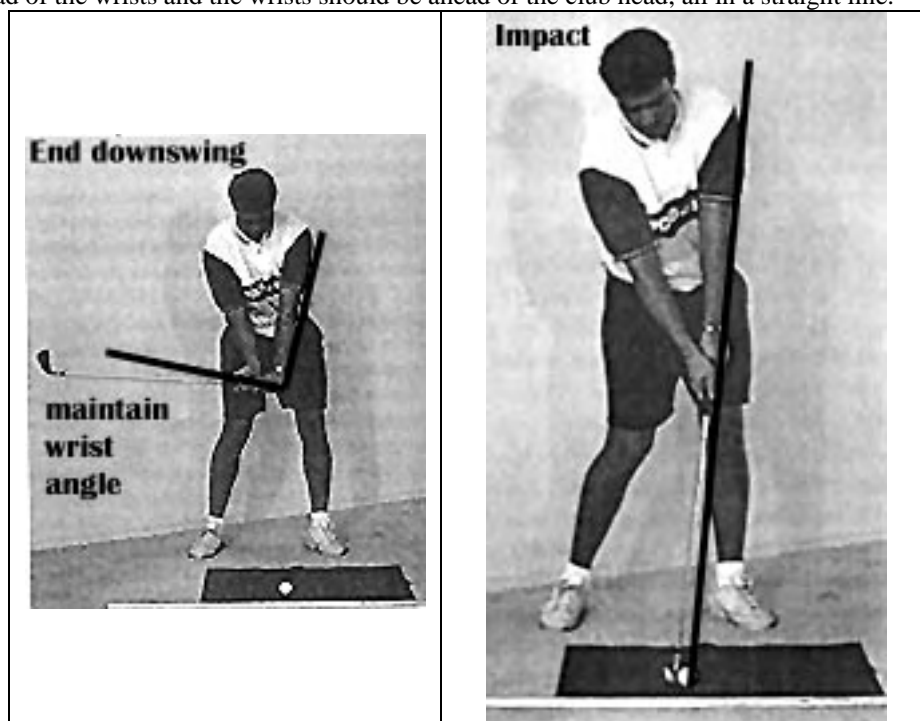


Again, it is important to maintain both the primary and secondary spinal angles throughout the backswing. Losing the secondary spine angle places the player's body in the way of the downswing path and will require a very complicated and stressful maneuver during the downswing to get the body out of the way.

Downswing

The downswing produces approximately 3 1/2 times the speed of the backswing...and also produces the highest percentage of injury in both professional and amateur golfers.¹ The purpose of the downswing is to return the club back to its original starting position with maximum speed to produce a crisp, powerful, and accurate golf shot. Knee and pelvic girdle actually start rotation to the left before the shoulders and wrists have completed the backswing movements. Once the downswing has started, the hips and shoulders continue rotating to the left while the arms and hands gradually flow into the swing, generating club-head acceleration. This twisting places a lot of stress on the spine, but it is a necessary evil to play golf. Proper coordination of this flow allows for a gradual and natural summation of forces to occur so that a tremendous amount of kinetic energy is transferred into the club. Research shows that shoulder and arm actions are responsible for a majority of the club-head speed. Unfortunately, this also means that the shoulders, arms, and hands receive most of the stress during the downswing. Proper rotator cuff and scapular function is necessary during the violent aspect of the downswing.

An uncoordinated and off-plane downswing with exaggerated hip, torso, or hand positions makes it difficult to get the clubface square at the right time and causes unnecessary stress on all of the body parts involved. Many amateurs try to force the downswing too early and/or too fast with the hands and arms to generate the club head speed. They uncock the wrists too soon, decelerating the entire speed of the downswing. At impact with the ball, the shoulder should be ahead of the wrists and the wrists should be ahead of the club head, all in a straight line.¹



Lateral, compression and rotational forces on both the leading knee and the back-side knee are greatest during the downswing. Golfers with ligament and cartilage injuries, as well as those with total hip or knee replacements, should be very wary of their strength and stability before returning to golf.

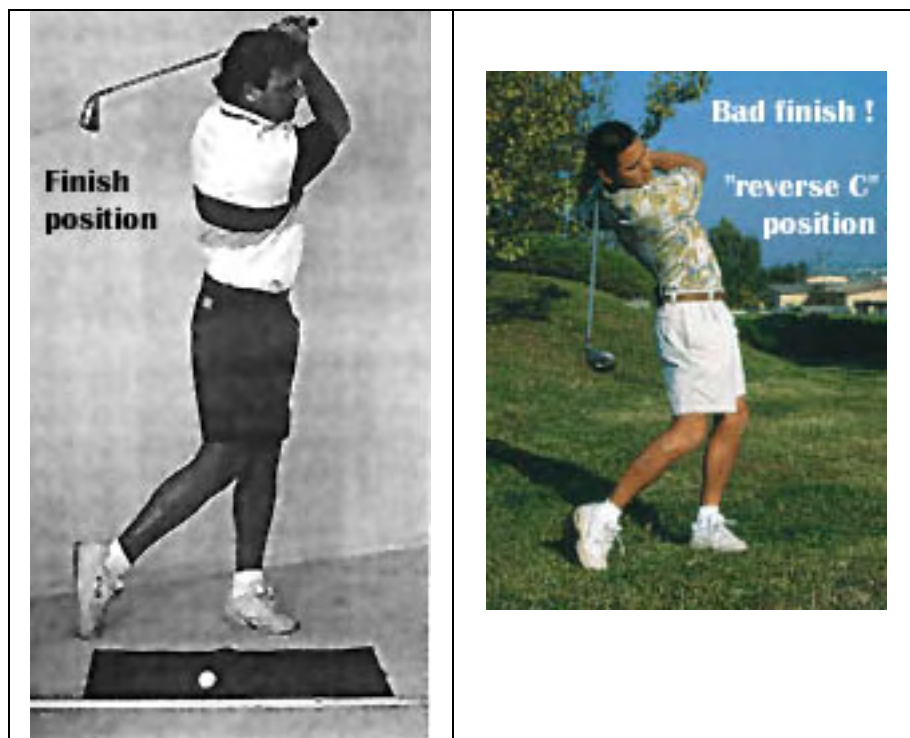
Follow-through

Once the club has made contact with the ball, the golfer enters the follow-through phase where maximum effort has subsided and the body is attempting to decelerate. Immediately following impact, the head is still down and the club and hands extend down the target line. The pelvic girdle, trunk and spine continue to rotate. The left leg absorbs more weight and rotates inward at the hip. The left lower leg and ankle are being rotated and stressed outwardly.

Golfers with instability or degeneration of the left hip, knee or ankle require stabilization of these joints while playing.



It is important to maintain posture and balance throughout the follow-through phase, which requires strength in the core trunk muscles.



What's Next?

The next article will continue our discussion of injury prevention for golf. We will discuss a good golf conditioning program, a pre-golf warm-up and stretching routine as well as common injuries, medical/orthopedic considerations, and troubleshooting possible sources of pain.

This article and all of our articles are intended for your information and education. We are not experts in the diagnosis and treatment of specific medical or mental problems. When dealing with a severe problem, please consult with a healthcare or mental health professional and research the alternatives available for your particular diagnosis prior to embarking on a treatment plan. You are ultimately responsible for your own health and treatment!

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