

Putt It Here

The Ergonomics of Golf: Part II

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Most golf injuries are preventable with appropriate equipment, proper swing technique, a good conditioning program, and a daily warm-up and stretching routine. In Part I of this article, we discussed equipment and swing technique. This second part of the article addresses golf-specific conditioning (i.e. warm-up, stretching and strength training), identifies the source of pain you may be experiencing and gives advice for treating injuries.

Common Injuries and Medical/Orthopedic Considerations

Low back injuries account for 33% of injuries associated with golf, while injuries of the hand and wrist comprise 27%, elbow (13%), shoulder (7%), and knee (6.5%).¹ It is important to note that men and women appear to suffer different types of injuries:

Injuries: Amateur Men		Injuries: Amateur Women	
Back	36%	Elbow	51%
Hand/Wrist	32%	Shoulder	25%
Elbow	8%	Back	12%
Knee	8%	Wrist	12%
Ankle	6%		
Other	6%		
Shoulder	4%		

Conditioning

In order to prevent injuries and to play a good game of golf, a regular strength and fitness training program is necessary to improve strength, cardiovascular endurance, coordination, and balance. However, the exercise program of a 65-year-old golfer with a total hip replacement should be very different from that of a young golfer with no previous medical problems.¹ Prior to starting a strength and conditioning program, it is necessary to have an assessment to determine your areas of strength and weakness.² You need to know your flexibility, muscle strength, balance, and areas that need improvement when designing a program to correct these problems. The program should be designed specifically with the demands of golf in mind.

Warm up

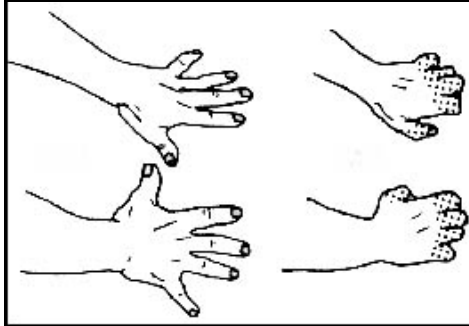
Warming up for golf is as important as it is for any other sport. Brisk walking, stationary cycling or jogging for 10 minutes is generally sufficient to increase body temperature a degree or two and allow greater flexibility of tissues. Warming up greatly decreases the chance for injury, especially if combined with moderate stretching prior to playing.^{1,3} Unfortunately, golf courses do not usually provide facilities that encourage warm-up and stretching, so go for a walk and stretch before you play, or warm up a bit before you leave home.

Stretching & Flexibility

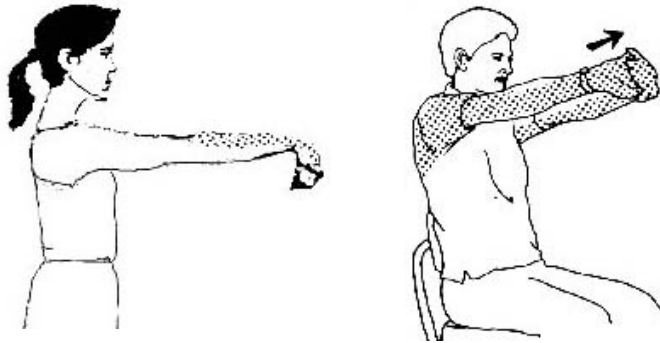
Improving flexibility increases the ability of joints to move through their full range of motion smoothly and efficiently. Flexibility training also improves neuromuscular coordination resulting in a more synchronized and coordinated golf swing.² Stretching (following adequate warm-up) should focus on the muscle groups needed to play the game.^{1,3,5}

Suggested stretches include:

- Thumb extensors – fan fingers



- Wrist extensors and flexors



- Shoulder rolls – Pull shoulder blades together, hold stretch, and relax. Repeat. Do not raise shoulders and rotate backwards. Simply pull shoulders back and hold.
- Horizontal stretches - Grab each elbow with the opposite hand and pull it across your body to stretch the outside capsule of each shoulder.
- Trunk/spine stretches.
 - ❖ Side bends – Drop shoulder from one side to the other while holding trunk stationary.
 - ❖ Trunk rotation - Start slowly and gradually increase the speed and range of motion.
- Hip rotations and hamstring stretches. These can be done in the setup position.
- Feet and ankle rotations and flexing
- Swing practice - Start swinging the club gently.

Functional Strength Training and Cardiovascular Fitness

Aerobic exercise for 20 minutes a day, three times a week, and strength training twice a week, are the minimum necessary to maintain adequate fitness to avoid golf injuries.⁶

Use of free weights and rubber tubing is recommended in training for golf. Use full range of motion and incorporate diagonal and/or rotation patterns. If you don't have access to a fitness professional who can help you design a golf-specific strengthening and stretching routine, please refer to the excellent Exercise Database website: www.exercisedb.com. You can choose the type of strengthening you want to do, whether it's elastic band, resistance training with a machine, pilates, or ball exercises and watch animations of each exercise for each body part. Try to choose exercises that strengthen many muscles in a continuous movement rather than isolating one specific muscle to more closely simulate natural movements of the body.

Address the following muscle groups to improve golf fitness and minimize injury:

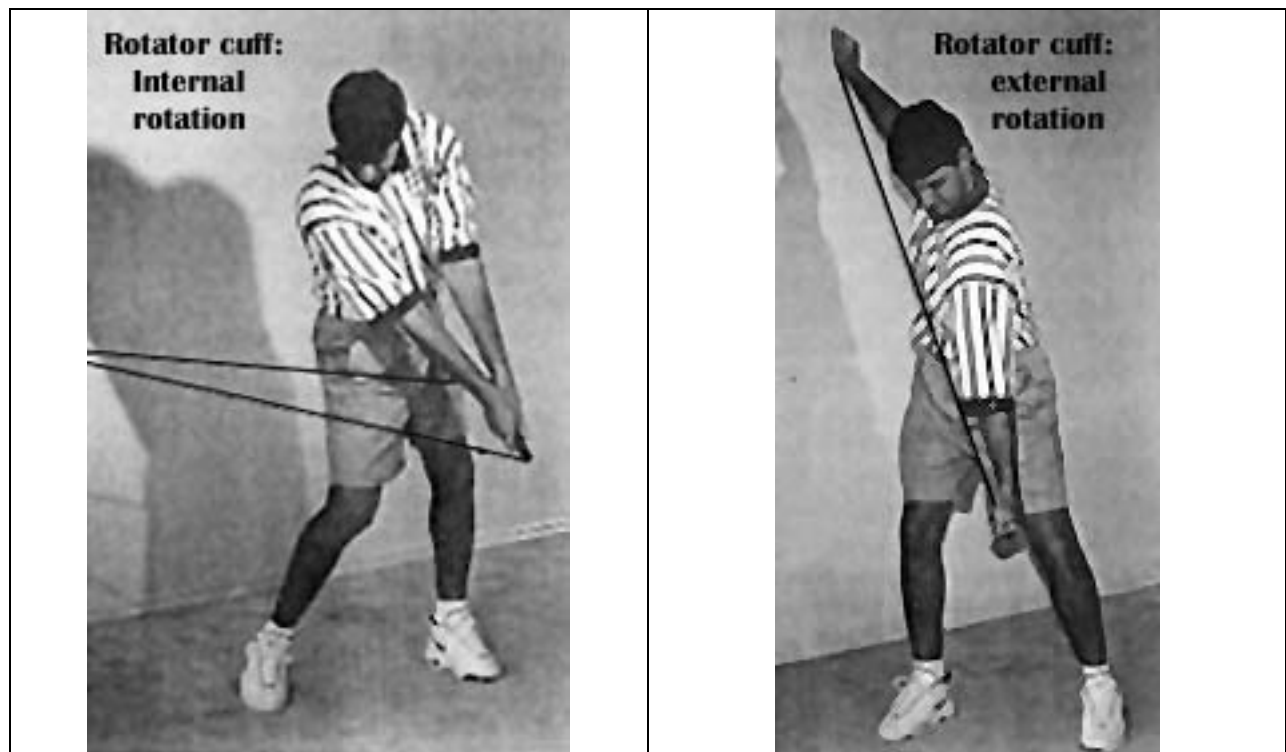
Upper body:



- Wrist extensors and flexors (both hands)



- Rotator cuff (especially the lead side). Note: golf is an underhand rotation, not an overhand rotation of the shoulder.



- Latissimus dorsi and pectorals (both sides), such as chin-ups, lat pull-downs. Note: the deltoids are the least active muscle throughout the swing, so it is less important to focus on strengthening them.⁷
- Trapezii, rhomboids, and other upper back and neck muscles (both sides).

It is also recommended to practice hip hinge for correct primary spinal angle.

Lower body:

The legs do not provide a lot of power or club-head speed during the golf swing. Endurance is needed, however; so brisk walking and biking are excellent for golfers. This will help delay postural muscle fatigue toward the end of a round or when weather is extreme. As mentioned in the previous section, stretches for the hip rotators and flexors, the hamstrings, and the calves should be incorporated into the program.

Core exercises:

Strengthening the abdominal internal and external obliques and the lumbar muscles is very important for all activities. It is desirable to use standing abdominal exercises to ensure that the strengthening transfers to the position and activity of golf. It is difficult for the body to translate horizontal crunches to the motions needed in the golf swing, plus crunches focus on only one exterior muscle group of the abdomen. Again, please refer to the Exercise Database website (exercisedb.com) for excellent demonstrations of complete abdominal training.

Other Factors

- **Smoking.** Nicotine reduces the blood supply to the spine. This deficiency may increase the potential for injuries especially to the lower back.²
- **Diet, hydration and weight control.** Eating for overall health, staying hydrated and keeping weight down are all very important for injury prevention.² For more information on nutrition, see "Sports Nutrition"⁸. Excess weight puts tremendous pressure on the spine which adds to the stress of the golf swing.⁶
- **Adequate rest.** Giving your body time to rest and recover between days of practice and play will reduce the chances of overuse injury.⁵
- **Avoid golf carts.** The sitting position in golf carts puts 40% more pressure on the spinal discs than standing. Sitting also causes you to cool down between shots. It is best to walk the course with a pull-cart. This will keep you warmed up between shots and it will also help you manage your weight.⁶
- **Use pull-carts.** Golfers who carry their own bag suffer significantly more injuries to the lower back, shoulder, and ankle than those who use a pull-cart or caddie.⁹

Troubleshooting Pain

Specific problems in the golf swing technique lead to pain in specific parts of the body. In Attachment 1, we provide a table with physical symptoms and potential solutions to correct your swing and resolve the source of the pain. Unfortunately, modifying technique can relieve not all symptoms. Even professionals with an excellent swing experience injuries and pain largely due to overuse. The breaking point of "how much is too much" appears to be playing over 2-3 rounds of golf per week. People who practice and play more than this will likely experience problems simply due to the repetitive nature of golf and the forces exerted to the various body parts.

Dealing with Injuries

Most golf injuries are easy to resolve with immediate avoidance of golf and proper treatment. However, golfers are often so zealous about the sport that they continue to play, despite symptoms, or are anxious to return as soon as possible.¹⁰ Stop playing immediately when a problem or pain occurs and do not resume playing until you have completely recovered from injury.¹¹ Apply PRICE (Protect, Rest, Ice, Compression, and Elevation) as described in our article on injuries (No Pain, No Gain?). If this does not diminish the pain, consult with a health professional. Appropriate chiropractic health care that reduces muscle tension in the back, neck, shoulder, elbow and hand is effective, as is deep tissue massage, especially for chronic injuries. As with all injuries, proper treatment, rehabilitation, and working closely with qualified instructors to understand the underlying mechanics leading to injury help to prevent recurrence of injuries and their debilitating effects. In other words, take care of yourself now so you don't have to limit your enjoyment of the sport later!



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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ATTACHMENT 1

Troubleshooting Pain^{1,6,7,10}

SYMPTOM	POTENTIAL PROBLEM/SOLUTION
Neck pain	<p>Problems:</p> <ul style="list-style-type: none"> • Attempting to keep head still or down during backswing. • Arthritis in the neck is aggravated by head rotation. <p>Solutions:</p> <ul style="list-style-type: none"> • Golfer should allow head to move off the ball and rotate the head, especially during the backswing. • Use neck rolls to warm up the neck prior to playing.
Shoulder: Lead shoulder pain. (Left shoulder in right-handed golfer)	<p>Problems:</p> <ul style="list-style-type: none"> • Overuse. Downswing stresses the rotator cuff muscles as they pull the left arm forward and rotate the arm. • Taking too large a divot. Downswing plane is too steep/vertical.

	<ul style="list-style-type: none"> • Mishits. eg. hitting a root or rock. • Arthritic degeneration or limitations in left shoulder motion may cause pain. <p>Solutions:</p> <ul style="list-style-type: none"> • Develop a "grooved swing". Work on coordinated firing of the shoulder and shoulder blade muscles. (This is often lacking in amateurs.) Strengthening exercises for pectorals and latissimus dorsi. • Work on shortening the swing by ending backswing at the 1 or 2 o'clock position rather than 3 o'clock
Elbow pain	<p>Problems:</p> <ul style="list-style-type: none"> • Too tight a grip, smashing the ball, overuse. • Incorrect swing plane. Too steep, "fat shot" and large divots. Too flat, elbows are stressed more. • Tight grip inhibits function of forearm muscles and increases stress on elbow tendons. Larger club grips may help. <p>Solutions:</p> <ul style="list-style-type: none"> • Try cavity-backed irons with larger heads and sweet spots to dampen vibration from off-center hits. Graphite shafts may dampen impact from fat shots. • <i>Most importantly, improve your swing!!</i>
Lead elbow pain. (Left elbow in right-handed golfer)	<p>Problems:</p> <ul style="list-style-type: none"> • "Golfer's elbow". Tendinitis in the flexors (lower forearm muscles) • Bowing of the left wrist during preimpact. • Overuse. • Too much motion squaring club face at impact. <p>Solutions:</p> <ul style="list-style-type: none"> • Work on correcting swing mechanics. • Stretch flexor muscles throughout the day, especially while playing.
Back elbow pain. (Right elbow in right-handed golfer)	<p>Problems:</p> <ul style="list-style-type: none"> • "Tennis elbow" tendinitis in extensors (top of forearm). • Swinging over the top of the plane in the downswing. • Too much motion squaring club face at impact <p>Solutions:</p> <ul style="list-style-type: none"> • Work on correcting swing mechanics. • Stretch.
Wrists, hands	<p>Problems:</p> <ul style="list-style-type: none"> • Mishits. eg. hitting a root or rock. • Taking too large a divot (fat shot). Downswing plane is too steep or vertical. Causes excessive strain on hands and wrists and can cause fractures. • DeQuervain's (tendinitis of the thumb tendon through wrist). Caused by forceful grasp, sideways (ulnar) deviation of the wrist, repetitive use of thumb. Amateurs may use "casting maneuver" or premature uncocking of wrists during downswing rather than at ball-strike. • Trigger finger in leading hand. Finger locking caused by excessive grip tension.

	<ul style="list-style-type: none"> • “Golfer’s Wrist” (hook of hamate stress fracture). Leading hand gripping weakness, pain in little finger. Fat shots and/or mishits using club that is too short. Butt of club is forced against the leading hand on impact causing fracture. Often ignored by golfers, but usually requires surgery to remove bone fragments. <p>Solutions:</p> <ul style="list-style-type: none"> • For DeQuervain’s, change grip following adequate healing and rest. • For trigger finger, <ul style="list-style-type: none"> ❖ Use larger, softer club grips. ❖ Use neutral grip rather than strong grip to change placement of the club in the palm and reduce irritation of tendons. <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Strong grip</p> </div> <div style="text-align: center;">  <p>Neutral grip</p> </div> </div> <p>In the strong grip, the leading hand is rotated with the wrist bent. In the neutral grip, the wrist is straight.</p> <ul style="list-style-type: none"> • For Golfer’s Wrist <ul style="list-style-type: none"> ❖ use proper club length and grip size. Butt of the club should extend slightly beyond the palm of the leading hand. ❖ If you think you have this problem, see a doctor immediately to avoid surgery.
<p>Upper back, ribs, shoulder blades</p>	<p>Problems:</p> <ul style="list-style-type: none"> • Insufficient lower back flexibility causes more rotation and stress on upper torso. • Insufficient strength especially in trapezius and rhomboid muscles (shoulder and large mid-back muscles). • Frequent large divots • Stress fractures due to rapid increase in playing/practice time. <p>Solutions:</p> <ul style="list-style-type: none"> • Work on increasing strength and flexibility. • Increase playing time gradually.
<p>Lower back, lumbar</p>	<p>Problems:</p> <ul style="list-style-type: none"> • Poor swing mechanics • Failure to use hip-hinge/primary spinal angle. Slumping, arched back rather than neutral spine. • Failure to maintain secondary spinal angle and too

	<p>much weight shift.</p> <ul style="list-style-type: none"> • Limited flexibility in the neck and/or upper back may result in greater rotation of the lumbar spine and hips to keep eyes on the ball during backswing...and resulting loss of secondary spinal angle. • Smoking, overweight, poor diet, lack of flexibility and strength. <p>Solutions:</p> <ul style="list-style-type: none"> • Maintain primary and secondary spinal angles throughout swing. • Back off 10% in intensity of swing and cut down length of backswing. • Avoid the reverse-C position in follow-through and finish position. Keep spine perpendicular to the ground on follow through. • Keep knees slightly bent to unload spine. • Minimize the difference between shoulder rotation and hip rotation, reducing the rotation of the lumbar spine. • Avoid back strain caused by golf cart; walk and use pull-cart or caddy. • Warm up. • Try long putter to reduce bent-over position while putting.
<p>Knee pain</p>	<p>Problems:</p> <ul style="list-style-type: none"> • Weight shift or rotation during follow-through. <p>Solutions:</p> <ul style="list-style-type: none"> • Maintain center of balance throughout swing. • Consider functional rehabilitation, orthotics, and bracing if pre-existing condition is present, especially on the left (leading) side.

Ankle/foot pain

Problem:

- Inadequate strength, stabilization, and proprioception (balance).

Solution:

- Stop playing to allow healing, then work on balance and strengthening exercises prior to returning to golf.