



GOLF MECHANICS AND INJURY REHABILITATION:

HOW TO IMPROVE YOUR PATIENTS GAME THROUGH CHIROPRACTIC CARE

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INTRODUCTION

Over the years, golf has become an increasingly popular sport, attracting new players from all ages and socio-economic groups. Golf is practiced by up to 10 to 20% of the overall adult population in many countries. In fact, over 25 million Americans partake every year (1). Beyond the enjoyment of the sport itself, the health-related benefits of the exercise involved in walking up to 10 km and of relaxing in a pleasant natural environment are often reported to be the main motives for adhering to this activity by recreational golfers.

Golf is considered to be a moderate risk activity for sports injury. However, excessive time spent golfing and technical deficiencies lead to overuse injuries. These are the two main causes of injuries among golfers, and each has specific differences in the pattern in which they occur in professional and amateur golfers. Golf injuries originate either from overuse or from a traumatic origin and primarily affect the low back, shoulder, elbow and wrist.

Professional and weekend golfers, although showing a similar overall anatomical distribution of injuries by body segment, tend to present differences in the ranking of injury occurrence by anatomical site; these differences can be explained by their playing habits and the biomechanical characteristics of their golf swing. Many of these injuries can be prevented by a preseason, and year round, sport specific conditioning programme including:

- 1) Muscular strengthening, flexibility, coordination and aerobic exercise components.
- 2) A short, practical pre game warm-up routine.
- 3) The adjustment of an individuals golf swing to meet their physical capacities and limitations through properly supervised golf lessons.

Finally, the correct selection of golf equipment and an awareness of the environmental conditions and etiquette of golf can contribute to making golf a safe and enjoyable lifetime activity.

GOLF INJURIES

Casual observers of the game may think that golf does not require much physical skill or athletic ability. However, any experienced golfer knows that you need strength, agility, coordination, and endurance to play well.

Touring professionals make golf look easy, but the golf swing requires considerable repetition and craftsman like precision to produce accurate results.

- The golf swing is a very fast and complex motion that produces high levels of stress in the joints.
- The speed of the golf swing can reach values over 50 m/s.
- Injuries cause professional golfers to lose, on average, more than five weeks of playing time a year.
- Approximately 90 percent of tour professionals get injured playing golf and that one-third of these players continue to play. In other words, approximately 35 players in any given full-field tournament (144 players) are playing injured. This negatively affects their playing and performance potential.

Club professionals are not immune from golfing injuries either.

- 85 percent of club pros have been injured playing golf.
- Each player averages two injuries during their professional career.
- Club pros most commonly suffer injuries to the left wrist, lower back, and left hand.
- Female professional golfers have more hand injuries than men do.
- Men have more back injuries than women.
- Spinal dysfunction, intervertebral disk degeneration, fractures, tendinopathy, ligamentous sprains, muscle strains, and other fatigue-related injuries are the most common injuries among competitive golfers.

Amateur golfers are also susceptible to injuries, although they play and practice less.

- Nearly half get injured directly, or experience pain, while playing golf.
- Half of the injuries are back related: poor posture, chronic wear and tear, and lack of physical conditioning.

INJURY PATTERNS

What are the most common golf injuries and the mechanisms for injury?

Every injury has its own set of circumstances and factors that contribute to its severity, complexity, and symptoms. To best assess the potential for injury or an existing problem, a complete investigation of the history, signs, and symptoms, and thorough examination is required. However, imperative to resolving the underlying cause is a thorough analysis of the golf swing pattern. It is important to note that many injuries in a sport like golf start out as "harmless" aches or pains, then

worsen because of improper attention and treatment. To minimize the risk of significant injury, golfers must be taught learn to listen to their body.

Injury Incidence Among Professional and Amateur Golfers

Table II. Actual injury incidence (absolute number and percentage in brackets) and anatomical location of injury in professional and amateur golfers^[9, 10, 18, 45]

Incidence of injury	Back and lower back	Shoulder	Wrist	Wrist and hand	Elbow	Knee	Ankle	Neck	Neck and high back	Feet	Hand and fingers	Ribs	Other
Professional golfers (n = 851)	255 (30)	81 (10)	148 (18)		71 (8)	52 (6)	28 (3)		105 (12)	19 (2)	48 (6)	12 (1)	32 (4)
Amateur golfers (n = 969)	257 (27)	88 (9)		160 (17)	242 (25)	70 (7)	21 (2)	30 (3)		14 (1)		22 (2)	65 (7)

MECHANICAL LOW BACK DYSFUNCTION

It is estimated that 62% of over 25 million young and old golfers in America incur injury directly related to their sport (1). Although injuries to the shoulder, elbow, and wrist are evident, injuries to the low back appear to be the most prominent among professional and amateurs alike (2,3,4).

- The most common cause of low back injury in both professional and amateur golfers is the repetitive swing motion (5,6).
- Second is the result of poor swing mechanics (5-7).

Evidence suggests that prolonged overuse of back muscles and the ligamentous attachment at spinal joints and/or a constrained posture may lead to gradual weakening and atrophy of the structures around the joint (8,9). In addition to torsional and bending loads, the low back must contend with compression loads that can reach more than 8 times body weight in both professionals and amateurs (10). In contrast, running and rowing appear to generate only 4 and 7 times body weight, respectively (10). As such, health care and golf experts have long suspected that back pain in the game of golf is as much related to the swing imposed axial torques on the spine as it is to poor swing mechanics (6,8,11). Therefore, in an effort to prevent back injury it is necessary to focus on strengthening and flexibility exercises, and spinal stabilization, as well as on the mechanics of the golf swing.

An Efficient, Low Energy Golf-Swing: In order to minimize the risk of sustaining, nagging or debilitating back discomfort, is to develop an efficient golf swing – essentially a swing that maintains healthy spinal positions. In fact, it is suggested that proper swing mechanics can decrease 50-80 percent of the stress on the spine with every swing.

GOLF SWING FAULTS TO AVOID

1. A reverse-C occurs when a golfer slides the hips forward during the downswing, resulting in a "C" position of the spine at impact with head well behind the lower body at the finish (Figure 1). This places a lot of stress on the spine, which can lead to pain and in many cases injury. The reverse-C position is the most common golf swing fault and the primary cause of lower-back injury.



Figure 1: A commonly seen improper golf swing – The Reverse ‘C’

2. The reverse pivot is the opposite of the reverse-C. The reverse pivot occurs when the lower body shifts away from the target while the head stays stationary, resulting in the spine tilting toward the target at the top of the backswing. The body must compensate on the downswing to return to its original tilted position.
3. Excessive lateral motion is a common error that ultimately results in excessive stress on the spine. Although the lateral movement is an attempt to reduce torsional stresses to the body, momentum results in a rotational follow-through placing the spine in a compromised position.

Research Study: ***The Short Golf Backswing: Effects on Performance and Spinal Health Implications.*** Journal of Manipulative and Physiological Therapeutics (11)

- Suggest that the full recoil golf swings may cause back pain in golfers.
- Current evidence suggests that a restricted backswing may reduce the potential for injury without compensating performance.

- Their data supports the idea that shortened backswing (by $46.5^{\circ} \pm 24.7^{\circ}$) may reduce trunk muscle activation and possibly reduce back injury without negatively impacting swing accuracy and club head velocity.
- However, the short swing increases shoulder muscle activation and may, in turn, promote the risk for shoulder injury.

Research Study: ***The Influence of a Chiropractic Manipulation on Lumbar Kinematics and Electromyography During Simple and Complex Tasks: A Case Study.*** Journal of Manipulative and Physiological Therapeutics (12)

- Investigated the short-term influence of an adjustment on spine biomechanics employing a case design methodology for a PGA golfer.
 - Following the adjustment, changes were seen in all 3 axes of motion during a golf swing.
 - Increases in all total ROM for each plane of movement was found during a golf swing after the adjustment.
 - EMG activity of the right upper erector spinae (RUES) and the right lower erector spinae (RLES) decreased during the golf swing.
 - Complex motor tasks (e.g., golf swing) in which a greater number of biologic variables need to be coordinated to effect movement demonstrated greater changes in muscle activity after an adjustment compared with simple movement tasks.
 - The ability to draw a causal link between an adjustment and the changes found in this study is limited due to the fact that the study design was based on a single case with few trials.
-

An efficient golf swing cannot act alone to reduce the incidence of injury. An individual that lacks spinal stability and muscular strength and coordination will lack the ability to maintain a natural motion in the golf swing. Thus, specific strengthening and flexibility exercises for the trunk and proprioceptive enhancement are required to complete the picture. This will be discussed later in the presentation.

HOOK OF HAMATE FRACTURES

The hamate, a small, irregularly shaped bone with a small protruding hook like structure extending into the hypothenar region of the wrist lies under the "fat pad" of the palm on the 5th digit of the hand. In the typical golf grip, the hook presses directly on the butt of the club during the downswing and impact. Violent impacts involving a steep angle of attack and deep divots can cause the hook to fracture off the main bone.

The ulnar nerve passes near the hamate. It can easily be irritated by a fractured hook, producing sharp, burning pain (neuritis) in the 4th and 5th digits. A lot of practice from driving range mats can cause this problem, so golfers who practice exclusively on these mats should be cautious. Surgery is usually the only way to correct hook of hamate fractures.

ULNAR LIGAMENT IMPINGEMENT SYNDROME

As the hands and club release near impact, the ligaments of the lead hand (the left in a right-handed golfer) are pinched and compressed at a very high speed between the end of the ulna (styloid process) and the carpal bones. Hitting balls off hard surfaces and repetitive irritation from prolonged play and practice can increase the stress placed on these tissues. Selective rest is indicated.

- About 10 percent of the population is born with abnormally long ulnar bones.
- Appropriate diagnosis is based on radiographic analysis.
- Chronic, long-term dysfunction caused by this condition can be corrected only with surgery to trim the ulnar styloid process.

MEDIAL EPICONDYLITIS: GOLFER'S ELBOW

A golfer's elbow is highly susceptible to injury because of its poor ability to handle repetitive stress. Golfer's can sustain muscle tears (sprains) and a tendinopathy to the medial or lateral attachments at the elbow articulation.

- Right-handed golfers who swing on plane and bow the lead wrist just prior to impact can over stretch the lateral extensor muscles of the left forearm. Golf swings that require excessive left hand supination at impact in order to square the club also increase stress on the lead elbow.

- Golfers who tend to swing over the top with a steep angle of attack can damage the inside ligaments and muscles of the backside elbow (the right elbow in a right-handed golfer).
- Hitting off mats which simply cover the hard cement underneath it can magnify the stress caused by an over-the-top swing plane, and can cause further damage to the elbow, hand, or wrist.
- Strengthen the forearms, shoulders, and wrists while practicing the grip and swing plane. Teeing up the ball when you hit off mats is a good idea too.

ROTATOR CUFF TENDINITIS OR STRAIN

The lead shoulder is perhaps the most important, yet least understood, body part in the golf swing.

- During the backswing, the arm is taken all the way across the body, potentially pinching off the soft-tissue structures on the front side of the shoulder joint (rotator cuff tendons and bursa). At the same time, the posterior muscles and ligaments of the shoulder and shoulder blade are stretched to their maximum length. These two positions commonly contribute to what is known as "rotator cuff impingement syndrome."
- During the golf downswing, the lead arm must maintain the downswing plane, simultaneously resisting the dominating power of the right arm and shoulder. As this happens, the lead rotator cuff muscles must contract to rotate the arm to a square, neutral position and to stabilize the socket joint.
- Poor posture, poor shoulder mechanics, muscle imbalance in the shoulders, and poor shoulder flexibility are other possible causes of rotator cuff dysfunction.
- Improve your posture and strengthen the rotator cuff muscles, and curtail, if necessary, the number of balls you hit in practice.

AN EFFICIENT, LOW INJURY GOLF SWING

The "Eight Commandments of Golf Performance" are constructed to structure practice and play. The Eight Commandments are not strict rules. They are simple concepts to follow to improve the level of performance with as little pain and frustration as possible. Incorporating the "Eight Commandments of Golf Performance" into the game may help simplify learning and practice by reducing anxiety and curtailing expectations. The golf swing is a very complex movement. When

done successfully, it's a series of precise, coordinated, high-speed joint actions and muscle contractions. When each kinetic link (joint, muscle, etc.) works with the proper timing, speed, and energy, an efficient and reproducible swing is generated, in much the same way that the rowers of a crew move in perfect harmony, contributing equal speed, power, and timing, in helping the boat to run smoothly. But the very complexity of the swing means the chances for error and for physical breakdown are high.

Although a golfer may understand the physics of the golf swing, most don't realize that the body is not designed to produce such physics repeatedly. Complicated machines such as computers work only well when all parts are working properly. Both the hardware and the software need to function properly for the computer to work. If the software is not designed properly, the computer's latest and greatest hardware technology won't perform to its potential. Likewise with the golf swing. One misfiring link early in the swing, caused by fatigue, improper motion, or injury can drastically affect other links in the chain.

THE EIGHT COMMANDMENTS OF GOLF PERFORMANCE

BY PAUL R. GEISLER, MA, ATC

1. The full golf swing is not a natural motion for the human body.
2. The full golf swing is the most physically complicated motion of any sport.
3. The golf swing involves keeping both feet on the ground for most of the motion and is thus a closed-chain event. Closed-chain events are more mechanically complex and dynamic, and thus present more opportunities for the human body to compensate and break down.
4. The golf swing is a closed skill, which means that it requires the golfer to self-pace his play. This places psychological demands on golfers that are greater than those of other sports.
5. The constant elements involved in hitting a good golf shot are the club path and face. Skilled golfers can reproduce the proper path and square the face at the proper time, regardless of the quality and/or complexity of the motion required.
6. The only thing that can interfere with a golfer's path is the golfer's body. The more the body gets in the way, the more complicated the swing becomes. As the swing becomes more complicated, more practice is required to ensure reproducibility; higher levels of stress on the body are produced, which causes more injury; and higher levels of physical talent and mental toughness are required to sustain the swing under pressure.
7. All players fall into one of two categories with respect to biomechanics:
 - a. Those with biomechanically sound golf swings that produce successful results with minimal maintenance. These players require less swing tuning and tweaking and have lower injury rates over time.
 - b. Those with biomechanically complicated golf swings that require high skill levels to reproduce, and result in significantly higher levels of physical

stress and injury.

8. Everyone has an ideal golf swing. It is difficult to reproduce the golf swing of any one player on the professional tour. Trying to do so will result in frustration and possible injury. The player then must constantly revamp the swing, undergo cyclical periods of improvement and regression, and perhaps sustain injury or suffer higher levels of pain.

The backswing, and that the rest of the swing becomes merely a series of compensations to correct the initial error. A weak link in the swing can cause a bad shot or cause compensations in the swing to produce a good shot. Either scenario leads to inconsistent performance and a higher chance of injury.

AN ANATOMICAL AND BIOMECHANICAL ANALYSIS OF A FULL GOLF SWING

The full golf swing is the primary foundation upon which all other golf swings are based. It is the swing most often used when teeing off or hitting long shots from the fairway. All movements of the body must be made in a sequence, and at a pace that allows the golf club to be swung in a rhythmic motion in the simplest possible arc, and on a path that produces on-centre hits and maximum club head speed without great effort.

For many years golfers were taught a swing in which the hips slid (rather than rotated) from side to side, with the lumbar spine finishing in extreme hyperextension or a reverse 'C' (See Figure 1). However, the reverse 'C' swing is not only harmful but also inefficient because the off-balance golfer loses the power generated by the trunk and hip muscles.

In contrast, the athletic swing is a golf swing in which the larger muscles of the trunk dictate the golf swing. David Leadbetter, a world-renowned golf teacher, describes the athletic swing as "the efficient coiling and uncoiling of one's torso in a rotary or circular motion which maximizes centrifugal force. Centrifugal force is the force created away from the body (trunk and hips) out through the arms and hands. This creates club head speed and maintains the club on a steady orbit or arc" (13). This is an important concept in the rehabilitation of the golfer's spine, because if the neutral position of the lumbar spine is lost (excessive lumbar flexion or extension) during the golf swing, power and speed also will be lost and, more important, the steady arc of the club head will be disrupted as it travels on an incorrect plane.

The athletic golf swing not only maximises the power generated but also causes less stress on the lower back. Thus, an amateur or patient with a spinal injury can imitate the athletic swing, because it does not require excessive flexibility in the trunk and hip region. The finish in an athletic golf swing is much more upright (lumbar spine still in neutral) than the reverse 'C' (Figure 2).

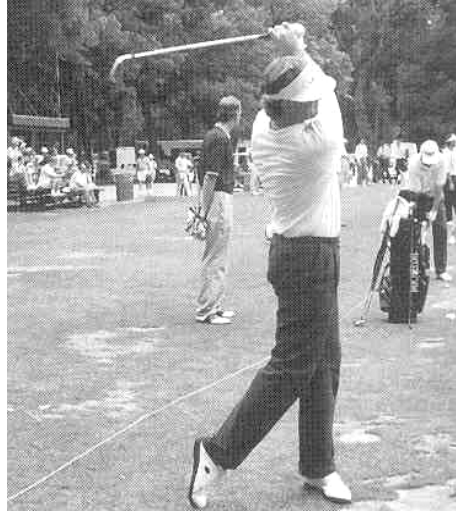


Figure 2: The Athletic Golf Swing

Mechanical Analysis of the Full Swing

The full swing consists of three major phases. These are:

1. **The Preparation Phase;** consisting of the grip, posture, stance, and ball position.
2. **The Execution Phase** (i.e.: backswing, transition, and downswing).
3. **The Recovery or Follow-Through Phase.**

Note: The following analysis is for a right-handed golfer who is executing a drive for maximum distance and accuracy.

Preparation Phase:

The Grip

The grip is the foundation of a good golf swing. Its primary purpose is to insure that the hands and wrist work together in order to transfer the force generated by the body and leg actions during the swing to the ball.

There are three grips commonly used by golfers: the Vardon (over-lapping), the ten-finger and the interlocking. However, the basic fundamental principles are the same for all three grips.

When gripping the golf club the back of the left hand and the palm of the right hand must face the target. The club is held in the palm and the fingers of the left hand. The club is held primarily by the last three fingers of the left hand and the thumb is placed slightly right of centre of shaft. A "V" is formed by the index finger and thumb. This "V" should point to the right shoulder. The left hand is the support hand and provides the strength.

The right hand applies the hit. The right hand grip is taken more in the fingers than the left hand. The middle two fingers apply the greatest pressure: this ensures greater control and feel. The thumb and index finger close around the shaft so that they gently touch each other. The hands must be kept firmly together but not rigid, and properly aligned with the clubface. The major muscles used in gripping the club are presented in Figure 3 (next page).

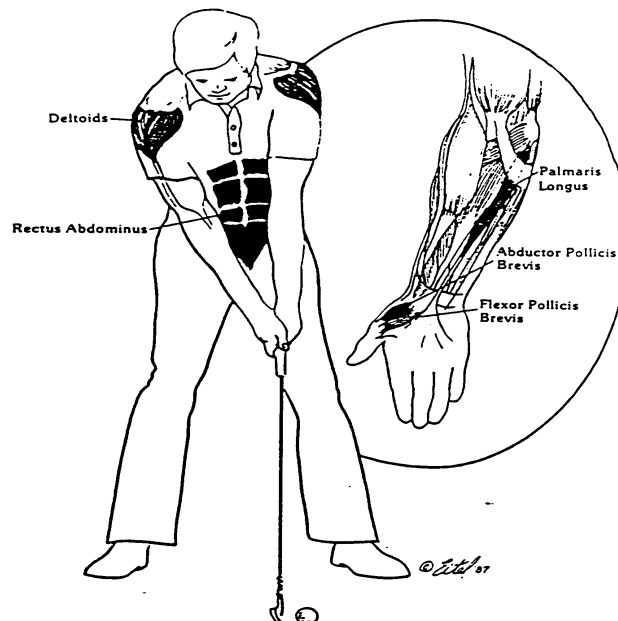


Figure 3: Major Muscles Used When Gripping a Golf Club

The Stance

- The set-up provides the basis of movement. It is the only aspect of the swing in which the golfer has 100 percent conscious control. When in the golf stance, key considerations must be given to posture and balance.
- How the golfer places his feet is directly linked with the way he generates power to swing the golf club (15).

- Improper placement will place the golfer at a greater risk for injury.
- The ideal foot placement in the stance is accomplished by setting the insides of the heels approximately shoulder width apart (16,17).
- Weight should be distributed evenly over both feet during the address.
- Keep the centre of gravity within and directly above his support base. Balance can be improved by learning to relax; excessive tension must be avoided during the preparation phase (18). The golfer's knees must be slightly flexed in the preparation phase. This lowers the golfer's centre of gravity that in turn increases his balance by placing the centre of gravity closer to his base. Slightly flexing the knees also enables the golfer to: 1) produce greater torso rotation, 2) place the leg extensor muscles on stretch, 3) flatten the swing arc (i.e., increase the number of impact areas) and, 4) gradually absorb force during the follow-through (18).

Stance Alignment

Alignment influences the golfer's ability to rotate properly, transfer weight and maintain good balance during the swing (8). To assume the correct stance, the golfer draws an imaginary straight line through the ball to the target (i.e., target line). The golfer then aligns himself so that his feet, hips, and shoulders are parallel to the target line. While in this position, the feet are shoulder width apart, knees slightly flexed, the back is straight (to enhance trunk rotation) and the hips should be slightly rotated forward. Slightly rotating the hips forward assists in facilitating a more upright swing and allows the arms to swing through more freely.

- The golfer's left arm must be straight while the right elbow is slightly flexed and held close to the side of the body.
- A straight left arm enables the golfer to increase the speed and range of motion through which the club head may move.
- The club head must be soled directly behind the ball and perpendicular to the target line.
- The golfer's head should be positioned directly over the ball. The eyes should focus directly either over the ball or slightly behind and on target-line.

Ball Position

The basic objective in positioning the golf ball is to place it at the lowest point of the full swing. This is accomplished by locating the ball on the left side of the target line centre, and toward the left inside heel.

Execution Phase:

The golf swing occurs in two planes, the plane of the back swing and the plane of the down swing. Also, the swing evolves around three dimensions (21):

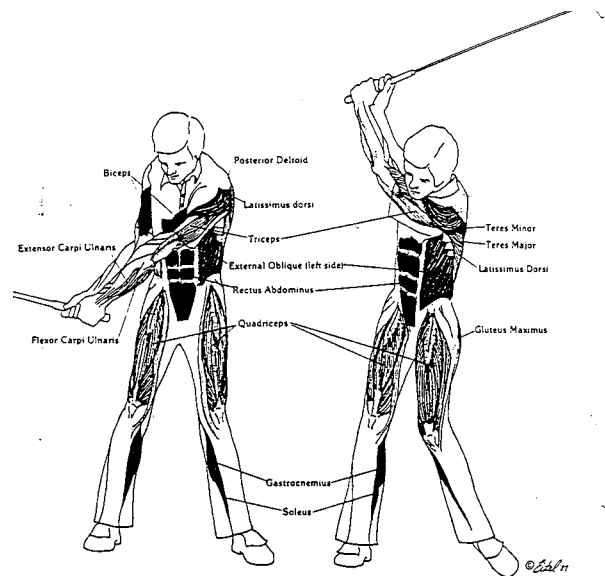
- 1) Vertical, the up and down movement,
- 2) Lateral the side-to-side movement, and
- 3) Rotary, the movement around the body.

The golfer's hands control the vertical dimension. The lateral and the rotary movements are controlled by the pivot of the body (22).

The Backswing (*Figures 4 and 5*)

The plane of the backswing is simply described as an angle inclination running from the ball to the shoulders. This angle is pre-determined by two factors: 1) the height of the golfer's shoulders and 2) the distance he stands from the ball at address (21). How tall the golfer is and the length of the club determines this distance.

Figures 4 & 5: Major Muscles Used
During the Backswing
of a Proper Golf Swing



In the backswing the club head, the hands, and the shoulders must start in one motion. The weight of the feet in the stance is shifted laterally from the front foot to the rear foot. This shifting of weight increases the range of hip rotation (22). It also flattens the arc of the swing (18). As the weight is shifted to the back foot, lateral rotation at the left hip turns the pelvis away from the ball's flight. At the top of the backswing, the shoulders are coiled, the hands are swung high, and the arms are extended.

As a rule of thumb, a golfer needs a 2:1 ratio (shoulder turn to hip turn). This coiling is needed to put the trunk muscles (lumbar rotators and abdominal obliques) in an optimal stretch position to achieve maximal firing of those muscles.

In order to develop maximum acceleration in the downswing phase, the golfer can apply or develop the following principles:

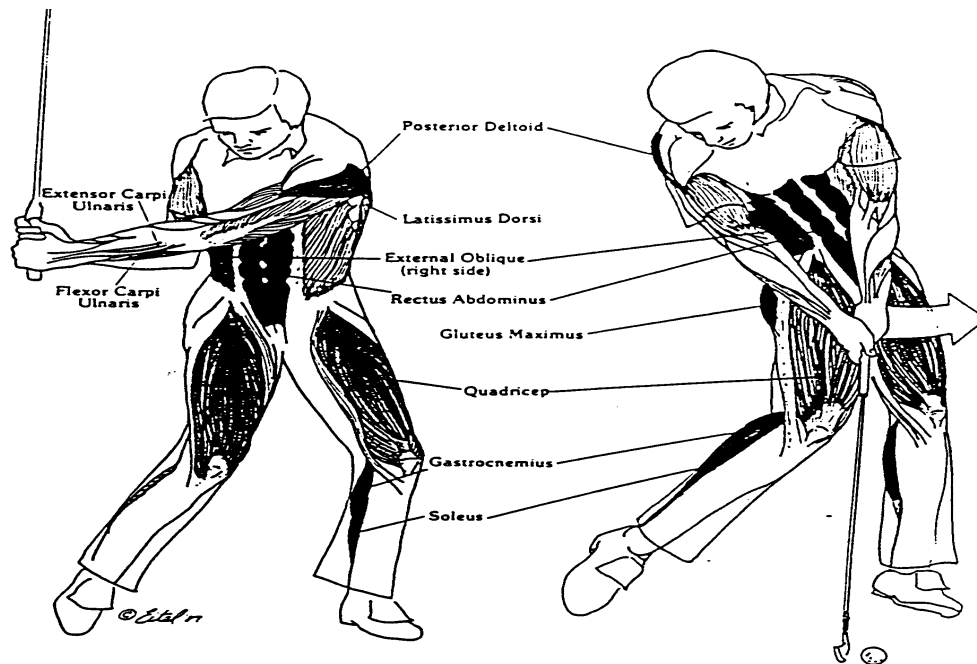
- The stretch reflex principle- when the whole muscle is stretched, the stretch of the muscle spindles causes a reflex contraction of their host muscle(s) (20).
- The greatest acceleration is at the beginning of the skill (i.e. top of the backswing). The golfer does this by bending his right elbow during the backswing.

Transition

The transition is the period of time from the end of the backswing until the arms are horizontal. A smooth transition from backswing to downswing depends on the movement in the lower portion of the body, specifically the legs (23). The hips begin the swing as the left leg pulls and the right leg pushes the pelvis forward. In the right leg the gluteus, biceps femoris, and the semimembranosus muscles push the pelvis forward for power (24). Tightness in the hip flexor muscles can hinder the amount of hip extension. Therefore, it is imperative that the hip flexors be loosened (e.g., stretching, massage, myofascial release) on a regular basis. In the left leg, the adductor magnus is most active as it pulls the pelvis forward. This pushing and pulling results in pelvic rotation (24).

The Downswing (Figures 6 and 7)

The downswing is initiated by the rotation of the hips. At this point the golfer must lengthen the lever arm, which results in an increased acceleration of the club head (18). Almost simultaneously with the hip turn, a transfer of weight occurs. The weight is shifted laterally on to the front foot and thus, the transfer of weight position flattens the swing arc. In turn, it increases the impact area and improves accuracy in beginners (18). The downswing is on the same plane as the backswing and is the reaction phase of Newton's action-reaction law. Ideally, the hands and arms move the club, and the swinging of the arms turns the shoulders. When the hips initiate the downswing, and the turning hips unwind the upper part of the body, the shoulders, arms and hands flow easily into the swing. This is referred to as the summation of forces principle (18).



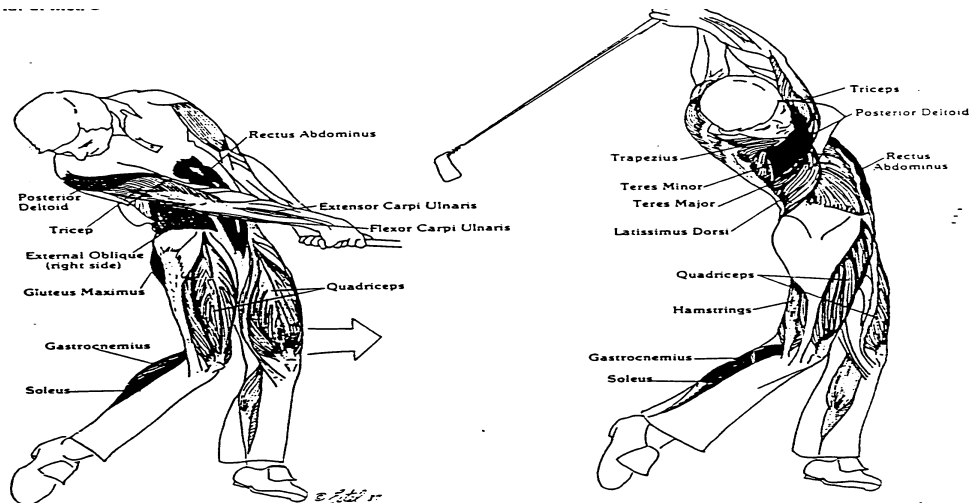
Figures 6 & 7: During the Downswing the Golfer Relies on the Larger Muscles of the Body to Generate Power (Summation of Forces).

At impact, the wrists straighten and with force produced by the trunk and other body parts, produce a maximum hitting effort. At impact, the angle of the lumbar spine should be at neutral.

The wrists are an important factor in maintaining maximum club head velocity. The un-cocking of the wrists at the appropriate moment of the downswing is an important mechanical element of the swing, one that cannot be overemphasized.

The Recovery or Follow-Through Phase: (Figures 8 and 9)

During the recovery or follow-through phase of the golf swing, maximum effort has subsided. Just after impact, the golfer should feel the left side 'firm up' because the hip muscles are used to stabilize the hip and pelvis as the weight and torque are transferred to the left side (24). Weakness in the left hip region increases the risk of hip injury to the left sacroiliac joint and lumbar spine because there is no control or support as the body rotates through the swing. If a player uses the lower body to support the hip and pelvis, the upper body will be able to rotate through the ball.



Figures 8 & 9: The Follow Through.

Many times golfers complain of “not being able to stay down on the ball” or of having a “hard time getting through the ball”. This is sometimes due to problems in the hips. Some patients with hip problems (e.g., restrictive capsule, muscular tightness) may find it easier to swing by turning the left foot outward (externally rotating) to allow for more freedom and less stress on the hips during the follow-through phase.

The golfer's head, which remained stationary throughout the swing, is finally pulled up and rotated forward by the turning trunk and the momentum of the swing (24).

Although maximum effort has subsided, it is still extremely important that the golfer accelerate through impact. The reason for this is three-fold. First, it reduces the danger of decelerating at impact. Second, it decreases the possibility of injury, and finally it increases accuracy (17,18).

A HEALTHY SETUP AND ADDRESS POSITION: The Key to Ensuring a Healthy and Effective Golf Swing

A set-up position, the first link in a golfer's kinetic chain, should look like that in **Figure 10**.

- The back should be straight with a vertical alignment of the shoulders, arms, kneecaps, and feet.
- This is the “Primary Spine Angle” promoting maximal anatomical rotation and stability of the spine.



- The correct primary spinal angle, often referred to as the “athletic ready position,” also creates a natural-looking angle at the hip and torso, called a “hip-hinge.”
- A proper hip hinge provides a relaxed and proper flexion angle in the knee joints. A correct hip hinge is an important attribute of all fine motor athletic movements.

Figure 10: A Healthy Set-Up Position



Many golfers lose this position by bending their spine into a curve during the set-up (**Figure 11**). Many golfers automatically position themselves in a way that feels natural but is not necessarily functional. A slouched posture, called “spinal flexion,” makes the golf swing less efficient. Spinal flexion causes problems for many golfers including placing the golfer’s body weight on his heels; decreasing the spine’s ability to rotate by 20 to 50 percent; placing higher stress on the spine; and interfering with the backswing path.

Slouched posture places the hands closer to the body, causing the legs to interfere with the hands at the start of the backswing. Consequently, the golfer is forced to either manipulate the hand position at set-up (pushing the hands out toward the ball) or re-route the backswing path in an example of poor primary spine angle.

Figure 11: Improper Set-Up.

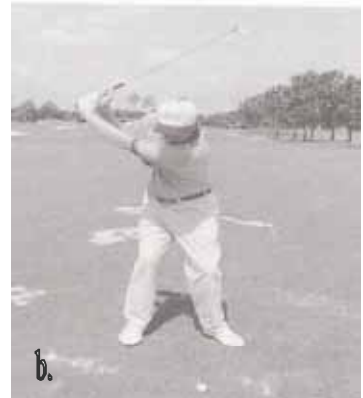
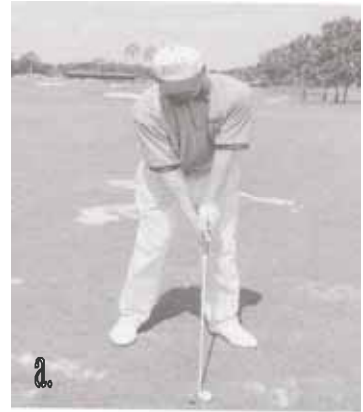
The first step in optimizing the golf swing is to evaluate the two key kinetic links in the swing: the primary spine angle and the secondary spine angles. Once these two links are correct, the golfer can work on the rest of the swing more effectively and dynamically with the help of your PGA or LPGA teaching professional.

THE IMPORTANCE OF THE SECONDARY SPINE ANGLE

The secondary spine angle is the angle of your spine that results from the right hand being lower than the left in the grip of a right-handed golfer (see Figures 11a. and 11b.). Most golfers naturally achieve this spine angle at set-up, but golf instructors say that a player must maintain this angle during the backswing to avoid a reverse pivot. There are two reasons for this:

Mechanically maintaining the secondary spine angle allows for a natural swing path during both the backswing and downswing, with minimal compensations. Any change of angle during the backswing causes a lateral shift during the downswing as the body tries to re-establish the original spine and club positions.

Anatomically, a correct secondary spine angle improves free rotation and decreases the stress placed on the spine. Amateur golfers generate between 50 and 80 percent greater spinal loads than professionals do, which requires 50 percent greater activity of the trunk muscles and produces a swing with 34 percent less club-head speed than that of the professionals. Professional golfers generally do a much better job of maintaining the secondary spine angle throughout the swing, whereas many amateurs do a combination of reverse-pivot and lateral slide motion.



Figures 11 a. and b.:

- a. Proper Secondary Spine Angle at Address
- b. Proper Secondary Spine Angle at the Top of the Swing

Exercises For Improving Secondary Spine Angle

Performing this drill will help to solidify the secondary spine angle, and simplify the golf swing. This drill should be continued a minimum of 10 to 15 minutes every day until it can be done with a club in the hands and then with a ball placed in front of the golfer.

1. Stand in a proper hip hinge with a club held across your chest, as shown. Stand in front of a mirror to watch your motion and angles.

2. Lower your right shoulder as you would when gripping the club in your hands. Be careful not to open your shoulders as you do this to remain square to the target line.

3. Align your head with your torso so that your chin bisects your chest in a parallel fashion.

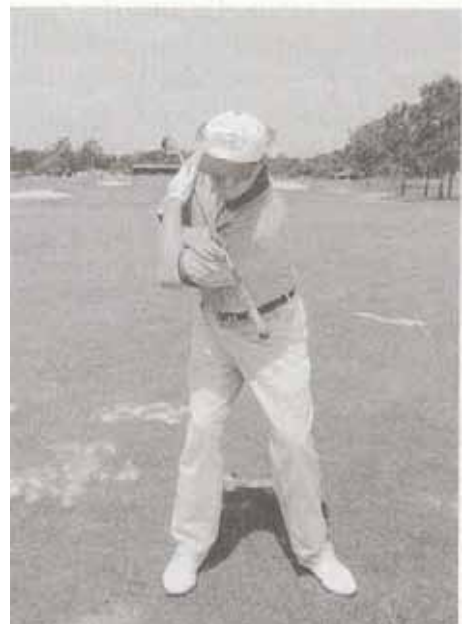
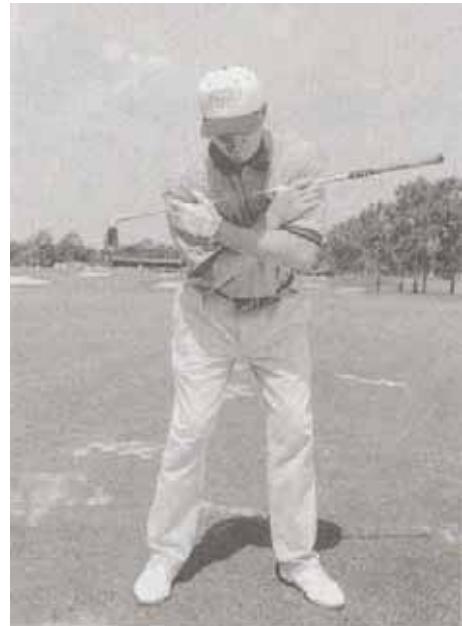
4. Keeping your legs and hips still slowly rotate your shoulders to the right so that your left shoulder replaces your right. Be sure to keep your head still, and be careful not to drop your left shoulder toward the ground.

5. Rotate on a plane so that if you shot a bullet out of the butt end of the club, it would hit you in the chest (in the mirror). Don't let it hit you in the hips or legs, as this will cause you to lose your spine angle.

6. Be sure to stop rotating when your body "wants to," and don't over-rotate. Signs of over-rotating are losing your spine angle and/or losing your initial rear-knee angle. Watch your motion in the mirror; don't look down to check yourself.

7. When you can do this, gradually add speed to mimic the true speed of your backswing. Slow down if your motion begins to become poor-quality is more important than speed. As you improve, do the drill with your eyes closed.

8. Perform the same drill with the downswing and finish position from the backswing position, keeping your shoulders and hips the same horizontal level throughout.



Improving the primary and secondary spine angles may seem like a simplistic approach to improving the golfer's game and reducing the likelihood of injury, but it is the best place to start. As mentioned earlier, the shoulders, wrists and hands react to the preceding actions of the torso, hips, and legs. Therefore, if improper rotation and loss of spine angle are corrected, the physical stress on the spine and upper extremities is lessened and so is the chance of injury. In short, improving spine angles produces a simple, efficient, and reproducible golf swing.

CONCLUSION: GOLF INJURIES AND MECHANICS

As is true of all sports, some golf injuries are the result of pre-existing physical weaknesses that become manifest following a specific activity. Some injuries are due simply to the nature of the sport and exemplify the axiom "if you play something long enough, you will get hurt." Finally, some injuries are due to the body's breakdown from improper swing mechanics. Therefore, you should combine proper conditioning and training techniques with an approach to the golf swing that is biomechanically sound and fits your body's specific anatomical makeup.

EXERCISE THERAPY FOR GOLF

Exercise therapy has been shown to be an effective method in the management of any musculoskeletal injury caused through participation in sport. The following presentation highlights how an extensive and specific dynamic exercise programme, which incorporates golf-specific rehabilitation, is an effective method of managing and preventing golf injuries.

These programmes need to be both golf specific and yet at the same time consider other factors including the age, gender and the level of the golfer. To effectively determine the contributing factors to any injury, the clinician must have a thorough understanding of normal swing mechanics together with a working knowledge of the musculoskeletal requirements to be able to swing a golf club. The effects of implementation of a core stabilization, flexibility, and strengthening programme are 2-fold:

- Firstly, the recruitment of the multifidus and transverse abdominis muscle groups allows the individual to develop a segmental stabilisation of their lumbar spine.
- Secondly, a consequential effect is the improved stabilization on the individual's golf swing. Rotary tension is stored during the back swing in the flank of golfers who can stabilize their lumbar spine and pelvis effectively. The greater the ability to stabilize the spine, the more significant the elastic tension, and subsequently the greater the increase in power that can be used to strike a golf ball.

Flexibility Exercises

Flexibility is very important for golfers, especially those with poor posture, inactive players, players with chronic injuries, and older players since everyone loses their flexibility with age. A generalized flexibility program should be performed daily with special emphasis placed on stretching the trunk musculature (e.g., hip flexors need to be flexible to extend forward in the transition phase or you get left hip rotation).

There is strong evidence now that stretching prior to an athletic endeavour does NOT reduce the incidence of injury. Furthermore, there is strong support in the literature that stretching does NOT enhance performance. In fact, several studies now suggest that stretching prior to competition may impede performance. This is not to say that stretching is not important. In fact, it is evident that a certain amount of flexibility is required to perform the necessary movements of each particular sport. In golf, for example, flexibility is particularly important in the hip flexor muscles since tightness will restrict full hip extension during the downswing, restricting pelvic and place increased anterior stress on the lumbar spine.

Therefore, although stretching as part of a warm-up, is not an essential ingredient, stretching on a regular basis will help to ensure full range of movement and maintain muscular flexibility.

Points to Remember:

- Moving slowly with subtle motion is fine as long as long as there is no bounce introduced to the stretch.
- Breathing through the stretch promotes relaxation that is essential to an effective stretch.
- Stretching the muscles until a pain response is produced is counterproductive as the individual will be unable to fully relax.
- Gains in flexibility may be made over a period of a few weeks but not over a few days.
- Genetics, posture, activity, and growing patterns all have a large influence on flexibility levels and gains.
- There is a distinct growing trend towards dynamic stretching. Ensuring a dynamic component to the stretching program may provide the basis for greater flexibility gains.

Strengthening Exercises

Physical fitness in golf is as important as in any other sport. However, its importance is often overlooked. Not too long ago, most golfers thought that strength training was harmful to one's swing because it developed larger, tighter muscles. But we know that's not true. The idea behind weight training is to strengthen the muscles and joints- not just to build bulk. A strengthening and condition program's objectives must be designed to improve the golfer's muscular strength and endurance. A well-designed specific program of strengthening exercises will decrease the risk of injury and improve the golfer's potential to play better golf.

A full description of a complete strengthening program is beyond the scope of this presentation. However, some description is necessary.

The program should be tailored to address all the major muscles groups of the body and also to strengthening a specific body region in the case of injury rehabilitation.

Periodization concerns must be met. During the off-season, a program that initially focuses on affecting hypertrophic changes to the muscle tissue should be adhered to. As a general rule of thumb, 8 – 12 repetitions with 8 – 10 sets of various exercises for each major muscle group is recommended for best results. Later in the off-season, a focus on strength gains will result in adapting the program to include sets of 4 – 5 for each major muscle group with the repetitions being 2 – 6 per set. This approach emphasises the neurological adaptation of the muscle with noticeable gains from each training session.

In-season training should be restricted to maintaining gains in the off-season with the number of exercises, sets, repetitions, and sessions reduced.

As the golfer becomes comfortable with involvement in strength training, the exercise program should shift towards a more functional approach. The use of machines allows for specific training of the muscle group indicated but does little to developing the stabilizing musculature and neurological control of movement. Thus, employing free-weights, cables, and more functional exercises (e.g., squats, lunges, dead lifts, performance of upper body training with the Swiss Ball) is more beneficial and relates more to real life situations.

Below is a very basic example of an off-season strength-training exercise program that focuses on the major muscle groups of the body. This program may be adapted to include such exercises as cable work or lateral lunges for the hip adductors and abductors, more complex movement patterns, and/or addresses specific identified weak points and areas of vulnerability for chronic problems.

Strength Training Program
Frequency: Three times per week (every other day)
Intensity: 50 – 70% of 1 RM
Duration: four to six sets, eight to twelve repetitions per set

Exercises	General Muscle Groups
1. Bench Press	Pectoralis Major Anterior Deltoids, Triceps
2. Rotator Cuff External Rotation Internal Rotation	Rotator Cuff Muscles
3. Lateral Arm Raise Abduction)	Deltoids & Trapezius
4. Triceps Extension	Triceps
5. Squats (to 90o)	Quadriceps
6. Leg Extension	Quadriceps
7. Leg Curls	Hamstrings
8. Calf Raises	Gastrocnemius, Soleus, Peroneus (Fibularis)
9. High Lat Pulldown	Latissimus Dorsi
10. Bicep Curls	Biceps
11. Wrist Extension	Forearm Muscles
Flexion	Wrist Flexors
Supination	Wrist Extensors
Pronation	
12. Abdominal Muscles (Bent Knees)	
One quarter Sit-Ups	
One quarter Sip-Ups with rotation to opposite knees	
Seated knee to chest	
Swiss Ball Exercises *****	

Stabilization Through Proprioceptive Enhancement And Core Strength

The foundation to an efficient and injury minimizing golf swing is stability and balance. These are fundamental to any athletic skill and golf is no exception. Improved balance allows the golfer to perform the difficult task of swinging a club with higher accuracy and consistency. Improved stability further enhances the balance of the swing, at the same time as increasing power.

Importance of Trunk Stabilization

Athletes who are hard to convince or unwilling to listen can profit from an explanation of the efficiency of movement and increased power produced by trunk stabilization. This explanation can be made for any sport so that the athlete better understands the concepts of stabilization. In martial arts, for example, most people understand the concept that one individual is transferring energy through the body to affect another individual. This transfer occurs through a blow or throw that displaces or injures another person. The energy force created by the martial artist usually begins

with the feet and legs against the ground. The energy is then carried through the trunk to the upper extremities that deliver the blow. If the martial artist has a weak trunk that bends or twists during these activities, energy will be dissipated and the desired effect will be lessened. This also applies to the golfer. If the trunk is weak with uncoordinated movement patterns (such as a push-up), the mechanics of each golf swing will be different, leading to poorer golf performance and placing undue stress on the body as a compensation measure.

Definition of Trunk Stabilization

In its simplest form, trunk stabilization may be defined as tightening the abdominal muscles or creating an increased inter-abdominal corset by using the diaphragm to increase inter-abdominal pressure. Such a manoeuvre is typically protective for a boxer who is being hit hard in the abdomen. This abdominal setting, however, is only part of the program. The most important part of the program is having the athlete hold the spine in a neutral, balanced position while performing active athletic endeavours. In swinging a golf club, it is quite natural to swing through the waist using maximal rotatory spinal capabilities. Athletes can learn to set their abdominal muscles, place their spine in a neutral and balanced position, and use substitute body mechanics to accomplish any given task. Substitute body mechanics entail bending from the hips rather than from the lumbar spine and blocking the spinal motion that results from excessive lumbar lordosis and rotation. Golfers, like any other athlete can learn these new body mechanics very quickly and can control and prevent most spinal problems.

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