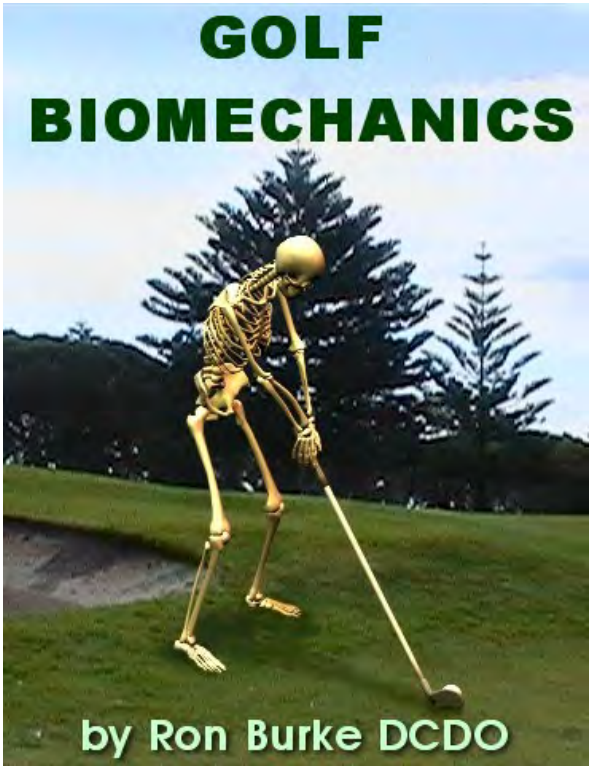


www.getfittogolf.com

This e-book explains the basics of golf biomechanics and how Get Fit to Golf's ChiroFit™ Program can determine and assist in eliminating the underlying physical faults affecting a golfer's biomechanics that cause swing faults.

"Better Body, Better Golf"

www.biomechlabs.com www.getfittogolf.com www.icgolfbiomechanics.com.au

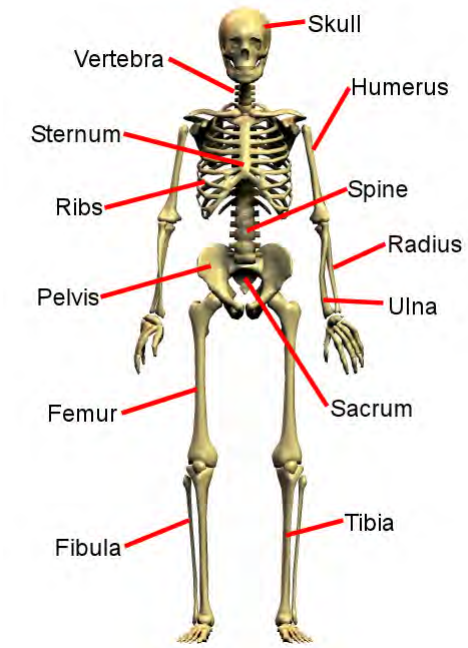
THE BIOMECHANICS OF GOLF

ANATOMY OF A GOLFER

To begin explaining the anatomy of a golfer it is important to understand why anatomy is so important. Anatomy is the study of the structure and function of the body. If your structure is faulty, your golf game will not be 100%. The study of anatomy can be very complex and takes many hours of study to learn. Therefore we will keep this very simple and restrict this anatomy discussion to the musculoskeletal system, especially the feet, hips, spine, and other supporting structures. Once you learn about the anatomy, we are confident, you will be able to understand how ***Get Fit to Golf*** can not only help improve your golf game, but also prevent injuries.

The Study of Anatomy

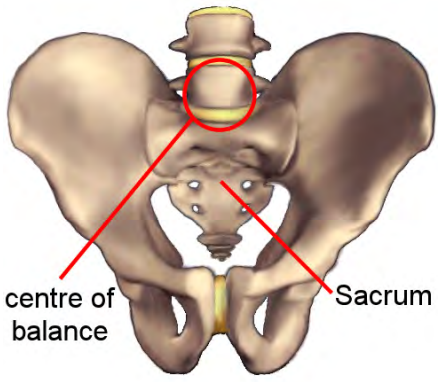
We will begin with the foundation that supports your entire body...your skeleton.



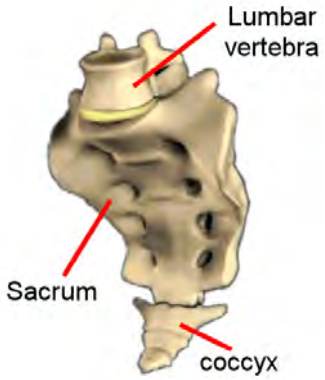
The hips and pelvis provide a foundation for the spine to sit upon. The spine is made up of 33 bones called vertebrae stacked upon each other which interact with the legs and arms to allow for proper movement. The sacrum (see left diagram below) acts as the foundation for your centre of balance. Your spine consists of lumbar, thoracic, cervical spine (see diagram below).

For correct posture you need a spinal angle of lumbar 40 degrees, thoracic 35 degrees and sacral 45 degrees. If these change, our total centre of balance is altered. Our spine is under pressure and our centre of gravity changes. Our spine will try to return to its centre of balance, compensations will occur, and a spine curve developed, e.g. Scoliosis (see diagram below) and lordosis. Our biomechanics can be permanently altered.

To the left is a diagram of a skeleton labelling some of the major bones. The spine is the central area between the pelvis and the base of the skull.



The Pelvic Arch



The Sacrum

The Spine

Scoliosis

The next feature of anatomy to discuss is the feet…

The Feet

Your feet are the foundations which supports your entire body. The foot is made up of 28 bones, 58 joints, over 107 ligaments and 19 intrinsic muscles and 13 extrinsic muscles. All of these bones and muscles make up 3 arches within the feet. Often these arches can "collapse" or "flatten" and thus create muscle imbalances which can carry all the way up the feet to the legs to the hips and spine. If this complex foot structure is off even a few millimetres, it will be magnified to centimetres of imbalance at the pelvis and head! Imagine if a few millimetres can make that big of a change in the metre between your feet and pelvis, imagine the imbalance they make when you are driving at a 450 metre par 5.

To help you appreciate how a small amount of imbalance is magnified the further away from its supporting structure, take a metal rod and tip it 2 cm, and see the difference it makes on the other end of the one metre rod. Golfers are more prone to developing feet conditions due to the increased stresses placed on the foot when swinging the club. The foot imbalance will create a "twisting" effect on the shin and leg bones, which will not allow the pelvis to stabilized, and thus the rest of the spine, arms, shoulders and head.

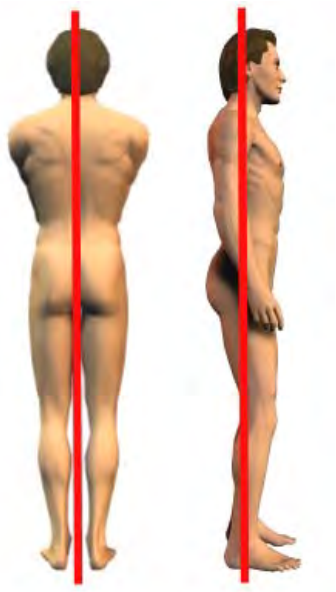
Golf Spine Angle

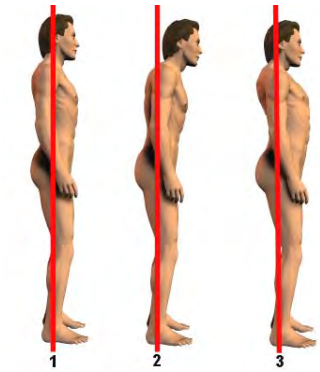
So simply place an orthotic (arch support) into the shoe and support your "collapsed" arch and you fix the problem and your golf game, right? Wrong, the twisting on the leg bones will also create muscle imbalances all the way up the legs, hips, buttocks, spine and shoulders. Only a proper ***ChiroFit***™ assessment will help to determine the muscle imbalances you have and thus give you a program to correct them.

Structural integrity is so crucial in producing a solid golf swing and controls every part of your game. It provides the power needed to drive the ball and maintain control and consistency. If these vital structures are misaligned, your spine angle will change. When the pelvis and hips are imbalanced, you will develop many muscle imbalances throughout your back, neck, and shoulders. These biomechanical faults will lead to a poor swing.

Strains of Gravity on the Body

The human body is often placed in a state of strain, which causes a loss of proper balance between parts of the body and gravity. Such imbalance or postural distortion usually indicates physical changes long before any body functions appear disturbed.
All parts of the body are situated so that they can interact efficiently with one another as well as with gravity. If the centre of gravity changes due to a biomechanical change, postural distortion occurs. The body is able to repair itself and adjust to the many forces to which it is subjected, both internally and externally. This relationship produces a feeling of physical well-being.



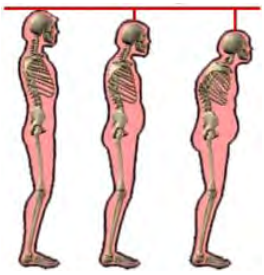


The diagram to the left shows typical posture distortions. Several problems are clearly evident:
(1) correct posture;
(2) crowding of the lungs and heart;
(3) sagging abdominal organs and muscles constantly fighting the pull of gravity. In addition, diaphragm movement is hindered, thereby decreasing the amount of air taken into the lungs and requiring the heart to work harder to pump the blood, which, in turn, creates congestion and back pressure of circulation in the pelvis and legs.

This explains why many of us suffer from aches, pains, headaches and other medical problems. This frequently results in the feeling of getting old before our time and so the saying "posture is more a determiner of age than years," is correct.

Good posture is achieved by correcting the internal strains that are the causes of many problems with your well-being.

It is evident that from a postural change due to a biomechanical fault, the imbalance causes stress on the body, creating injury, aches, pains, and from a golfing point of view, faulty swing mechanics. This is certainly evident as we get old and this is the primary cause for swing mechanics to change with age in senior golfers.



The diagram to the right shows the common changes that occur in the body with age, like shortened height due to wear and tear of joints and increased spinal curvature, sagging of the abdomen and change of balance.

MECHANICS OF THE GOLF SWING

The Golfer's Back Paradigm

Biomechanical faults cause imbalances in the hips, pelvis and feet, which affect us in our movements and walking. These imbalances become more pronounced in a golfer as golf is a one-sided sport. These problems can be recognized through muscle testing and other methods, but the easiest way to evaluate is combining this with an evaluation of the golfer's game. These imbalances will cause the golfer's swing plane to change which will create problems such as hooking the ball, slicing the ball, as well as reduce the power and speed of the swing.

FIGURE 1

FIGURE 2

First let's discuss this paradigm and get a better understanding of the underlying problems.

Begin with this example, find an object which ways approximately 10kg. Lift this object keeping it close to your body, not too difficult is it? Now extend your arm in front of you with the object still in your hand. You will find it becomes almost impossible to do. See Figures 1 and 2.

The amount of force becomes nearly 5 times the weight of the object at the shoulder joint. Now imagine this occurring in your body while playing golf. This is what happens when you have a skeletal misalignment causing an imbalance increasing these kinds of stresses on your hips, knees, feet, and back. Let's now change that 10kg object to something you can relate to, such as your head. If you have forward head posture, such as seen in Figure 2, you can easily see how you can increase the stress in the upper back and shoulders. This will lead to weakness in the shoulders and arms.

Alternatively, imagine your imbalance hips causing an increase of weight on one side of your body as compared to the other side, (a very common problem). This is similar to having a misalignment in the front end of your car, the increased stresses will wear the ball joints and tires out very quickly. Well, the same happens to the spinal, knee, and other joints in your body with pelvic misalignments.

This discussion addresses the first part of the Golfer's Back Paradigm; part two addresses the musculature of the spine and related joints. The muscles help to hold the skeleton together and really function like giant rubber bands. However, when we have biomechanical or skeletal structural problems, these rubber bands will become lengthened on one side and shortened on the other, as seen in the diagram to the right where the muscles have been simplified to represent rubber bands. The change in the soft tissues will lead to weaknesses occurring in muscles which will then affect your golf game, (i.e. slice, hook, decreased drive distance, etc.), that will eventually show up as back pain in your body.

Now the big question. HOW DO WE FIX THESE PROBLEMS? Get Fit to Golf's ChiroFit™ Program gives you a series of simple assessments to be filled out online, which will allow us to analyse all the information about your golf game and any structural problems you may have. The assessment process includes muscle testing which will allow us to develop a program to correct your structure and improve your golf game. You will receive your own personalised ChiroFit™ biomechanics remedial training program catering to your individual needs and fitness level.

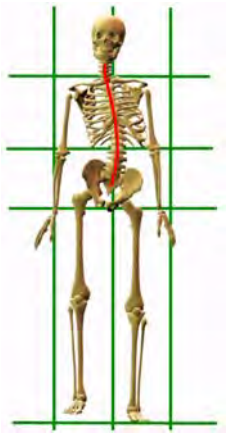
Improving Your Swing

"The key to better golf is maintaining your swing with a level of consistency"

The basis of maintaining your swing is definitely sound swing mechanics. If you don't have the correct posture and spine angle during a round of golf, you will develop an inconsistent swing and poor ball contact due to muscular tiredness and decreased flexibility.

The anatomy that *Get Fit to Golf's ChiroFit™ Program* assesses to help you improve your golf game included the muscles, ligaments, and bones which determine the structure of your body, commonly called the musculoskeletal system. The musculoskeletal system's primary function is locomotion (movement of the body and its associated structure) and support. If your body's locomotor (musculoskeletal system) and structure are imbalanced, it is impossible for any golfer at any level, to play at their peak.

To give you a simple example of how imbalanced muscles can affect your structure, think of a telegraph pole which is being pulled to one side by a tight guide wire. If your body has imbalanced muscles that are weak on one side and strong on the other, it will look like the imbalanced pole.



Imagine that your spine consists of 24 small building blocks with the muscles acting as bands, which hold it all together. If you have a spinal fault, this will create a muscle imbalance resulting in a biomechanical fault that leads to stress and fatigue on muscles as well as poor flexibility and an inconsistent swing.

In adults there are about 208 bones in your body and about 90% of your body weight is comprised of muscle. The muscles are like rubber bands attached to the bones. If the bones are out of alignment, then the rubber bands can be pulled tight on one side, while being loose on the other (see left diagram) This is how muscle imbalances begin. When you have a tight muscle (rubber band) or a loose muscle, you can develop muscle imbalances where one side is stronger than the other, thus producing more pull on one side of the bone than the other. This will further enhance a muscle imbalance, and thus further interrupt your game.

If you become physically tired during a round of golf you will be less mentally relaxed and focused as your swing mechanics deteriorate. Even if you exercise regularly, if you have a spinal fault it will create specific muscle weaknesses that you might not even be aware of until you put it under the stress of playing a round of golf. To maintain balance in the spine you need to specifically isolate what muscles are weak and exercise those particular muscle groups to maintain a consistency in your swing plane.

One of the most important aspects of golf is the basic stance and setup position but to maintain this consistently it takes muscular ability to get in the right setup position to maintain posture and spine angle. The golfers who can maintain their spine angle and posture will have a consistent swing during a round of golf. Therefore, the best equipment that we can use in golf is a physically fit human body. That is a body with the correct biomechanics and the right muscular skeletal system.

If your posture and musculoskeletal system is in balance, your key muscle groups will be working in harmony to maintain both consistency and power. You will have less fatigue and stress on the body and you will recover quicker and eliminate injuries. So before you embark on a physical training program to help your golf, it is important that your spine mechanics and musculature are analysed to get the maximum benefits of your training. Therefore, if you combine this with a personalised physical training program you will achieve maximum benefits.

The Get Fit to Golf ChiroFit program is specifically aimed at targeting your individual muscle weaknesses to correct your posture and spine angle. Receive your very own personal program designed by our Get Fit to Golf professionals.

CAUSES OF INCORRECT POSTURE

A brief look at the differences in "stress" and "strain" will helps to understand posture distortion.

STRESSES: These are pressures the body is subjected to during a round of golf usually for long periods of time, which push the system beyond its normal limits. With rest, the body can usually return to normality. These periods of taxing the body beyond its normal limits, by the biomechanical stresses applied by golf, are called the "elastic limit." It usually leads to growth and strength. If everything being equal the exercise we place the body under should lead to the development of physical well-being. But if there is a structural fault, fatigue and stresses will dominate.

STRAIN: This occurs when the body is pushed beyond its "elastic limit," usually gradually sometimes explosively during golf. The function and tone of the musculoskeletal system is damaged and permanent change within the tissue can occur, as the body is unable to recover from the strain without intervention. The eventual result of the strain is injury with subsequent biomechanical faults due to postural change. From a golfing point of view, it will lead to faulty swing mechanics. The better the posture, the better your swing mechanics, resulting in better golf.

Usually the first manifestation of strain can be found in the **sacrum**. A bone that carries the normal **centre of balance**.

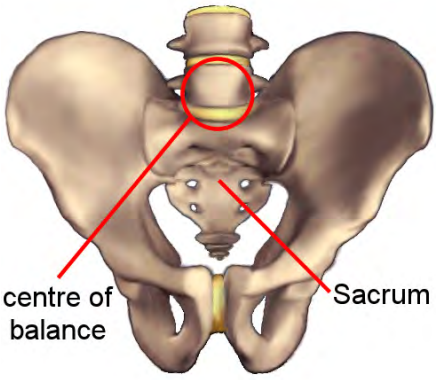


FIGURE 1: The Pelvic Arch

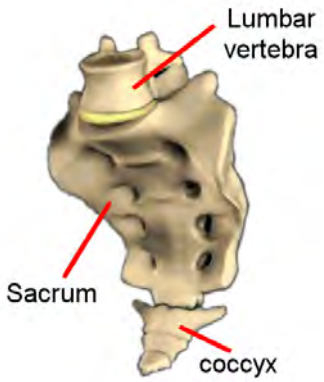


FIGURE 2: The Sacrum

During a round of golf you put a tremendous strain on your body and are sometimes pushing your normal elastic limit. (See *Figures 1 and 2*). The sacrum has the responsibility of supporting the spine. It also acts as a kind of keystone for the pelvic arch, and it is connected to all other parts of the body by a system of eight major muscles. Because of the sacrum's delicate balancing role in the body, any strain, gradual or sudden, is transmitted partly or wholly to it, thus distorting the normal body posture. When this happens, the position of the spine angle is altered so the musculoskeletal system is place under strain, thus a strain-distortion strain cycle is established. This is a critical factor in the development of a poor golf swing and will lead to ongoing injuries and possible permanent damage to the musculoskeletal system.

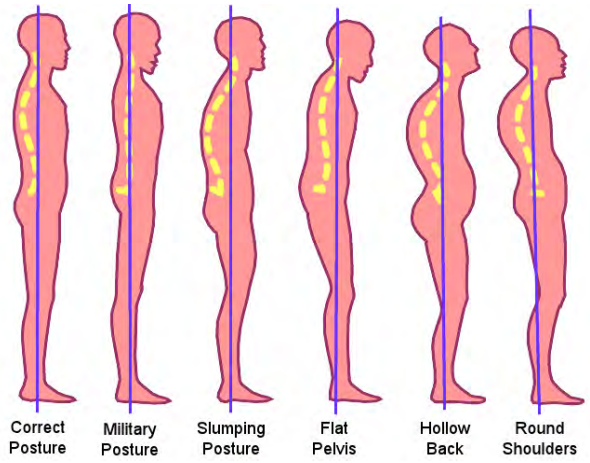
Spine Angle

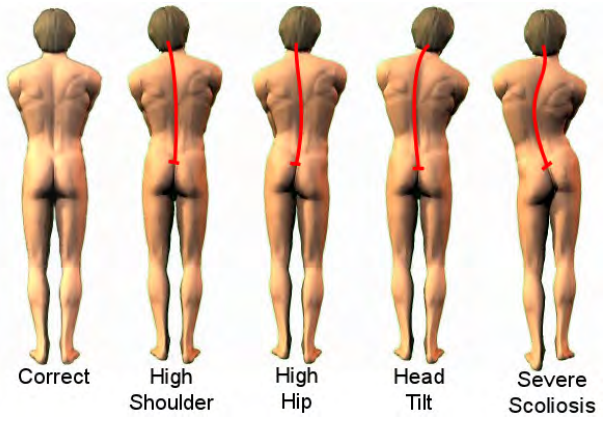
Simply by measuring and analysing a person's posture and then correcting the distortions in the spine angle, correcting the existing strain, we know that by maintaining the spine angle we can reverse the effects of degeneration of the musculoskeletal system. We can prevent injury improve physical well-being and from a golfing point of view the better the swing mechanics the better the golfer.

In the stance and setup the hips have a slight tilt forward and the spine is in line over the hips. If you have a biomechanical fault due to a fault in your posture you will have too much bend in your knees, back too straight, pelvis too far forward and hips too far forward. This means even if you know how to get in the correct stance and alignment etc., your spine will only allow you to assume the position that it is capable of.

FIGURE 3: Golf Spine Angle

Posture





The stance and setup in golf is essential. The majority of a good golf swing is the stance. You are standing stationary but you are using a number of different muscle groups and without a good musculoskeletal system being in balance, you can't get into that stance and maintain it.

Movements in the golf swing require that certain elements of the posture be maintained throughout the swing. The golfer with the best posture will swing the best. Without the right posture your swing mechanics will alter. Your strength and endurance will deteriorate from the stresses on the key muscle groups and your swing will be inconsistent.

EXAMPLE OF NORMAL POSTURE AND THE MOST COMMON POSTURAL FAULTS

Understanding postural shifts help you understand the mechanics of a golf swing.

To the left are illustrations of common postural distortions.

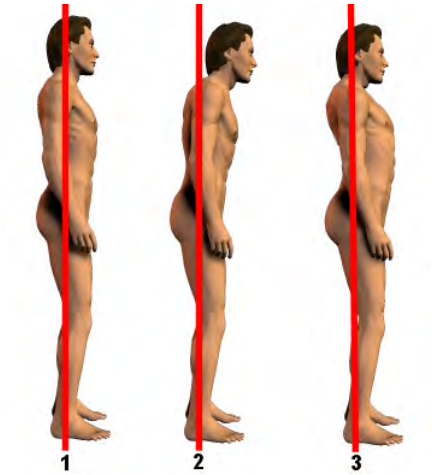
Note: Most people fit into one or more of these postural faults.

GOLF INJURY PREVENTION

Golf has become a hugely popular sport attracting participants of both gender and ages. With this popularity there also has been a large increase in golfing injuries. Professional golfers have a team of coaches, physical therapists, and trainers to advise them on how to maintain their level of physical well being.

The Get Fit to Golf ChiroFit™ Program *will* concentrate on the area of lower back injuries, as this is the most common area of injury and is a particularly vulnerable area in golf. Poor posture is the most significant contributor to a golfer's lower back pain. A biomechanical fault affecting your spine angle will increase an already stressed spine due to the mechanics of a golf swing. In the presents of a postural fault, the repetitive action of a golf swing predisposes the golfer to muscle strains, herniated disks and facet joint injuries.

Poor posture will prevent the trunk from rotating effectively and increasing the stress on the lower back. If to compensate for poor posture a golfer develops a lateral hip slide instead of a rotation, this will increase the shear forces on the lower spine during the swing. This will result in the "C" curve and is recognised as one of the major causes of lower back pain in golfers. It will also lead to hip, knee, and leg injuries from the unequal stresses placed on the lower extremities. The cause of this is a rotation of your pelvis causing your lower spine angle to change, forcing you to slide instead of rotating the hips. Some golfers will develop an exaggerated forward swing hip thrust to create more power to compensate for this, which creates excessive stress on the lower right side of the lumbar spine.



Some golfers combine the two high-speed rotations of the hips with an exaggerated hip slide. These will all result in spinal faults, muscle imbalance and injury. Also take note that towards the end of a round of golf, if the body is trying to compensate for faulty swing planes, eventually it has to be stretched past its elastic limit. The resulting fatigue on the muscles will have to create a fault in the golfers swing contributing to a poor shot.

Poor posture will also contribute to many major injuries. During a period of rest, you may adequately function with a poor centre of gravity and balance. However, injuries will occur when you are put under extreme stress caused by the segmental rotation of the trunk at high velocity, if you have a spinal fault causing muscle imbalance. Poor hip rotation will create weak shoulder muscles the lower back weakness will create leg and knee injuries.

So for a golfer to develop an injury free swing, they need their spinal mechanics assessed and this will not only lead to greater physical well being, but better golf. The Get Fit to Golf ***ChiroFit*™ Program** was designed to assess the golfer's anatomy to **maximise a golfer's physical capabilities**.

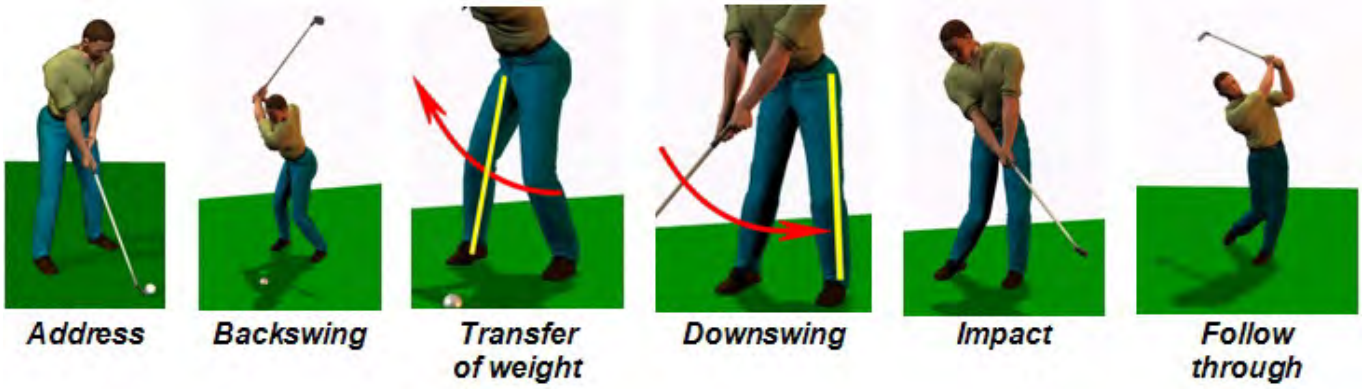
THE SWING

The object of the golf swing is to hit the back of the ball with the centre of the club face, which at the point of impact should be aimed directly at the target, with the club moving along the right line at the right speed. But rarely is it achieved consistently even by the best golfers. The Get Fit to Golf ChiroFit™ Program was developed to show you why you don't hit the ball consistently and how you can rectify this.

We assume you know how the basics work:

- how to hold the club
- the grip
- the stance
- the alignment

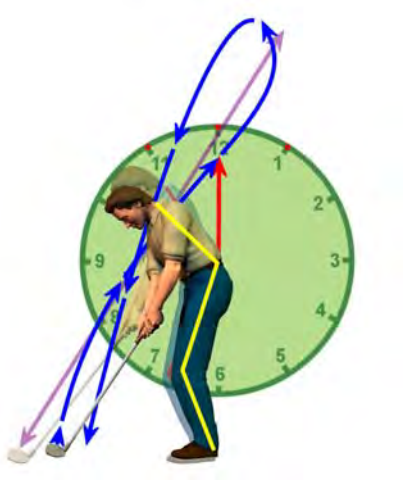
So you know how to start your swing, what we want to show you is **what goes wrong** from there.



The Perfect Swing

1. As the shoulders and hips rotate away from the target your arms will turn inward, the left arm remains straight and the wrists will cock from the weight of the club head.
2. The back swing is completed when the hips have made the maximum comfortable rotation, provided the club doesn't go too far past horizontal.
3. At the top of the back swing your weight must be on your right side to position you to correctly begin your down swing. At this point your back leg should be firm and only slightly bent to prevent rigidity in the swing.
4. The downswing is initiated by transfer of weight from the right side of the body to the left, the hips begin to move laterally towards the target which forces the shoulders to unwind. At the onset of this weight shift, the club remains at the same position as it was at the conclusion of the back swing, but as your hips and shoulders continue to turn towards the target they take the arms with them.
5. At the point of impact, the hips should be slightly open and shoulders should again be square with the target, as at the original position at setup.
6. The transfer of weight and the rotation of the body combine to give you maximum power, the weight is then transferred almost fully to the left side and the hips and shoulders turn to face the target at the completion of the swing. At this stage your left leg should be fairly firm and straight.

The Poor Swing



The problem with most amateurs and even professionals is that they can't maintain a consistent swing, as pointed out in "the perfect swing" above, due to a biomechanical fault affecting their centre of gravity and spine angle. By correcting the centre of balance and biomechanical faults, a golfer will have a consistent posture and spine angle at setup and be able to swing through to the ball square to the target consistently. Correcting biomechanical faults will assist in **getting your handicap down** as you are able to get a lot let more distance with a lot less effort. If the centre of balance changes, your weight transfer during the swing, as noted above in point four of "the Perfect Swing", will be incorrect. This will cause your swing mechanics to be faulty resulting in a poor shot with loss of power and inconsistency. Your swing will develop major faults that **lessons and new equipment will not fix**.

At ***Get Fit to Golf*** our aim is to analyze your swing, pinpoint your faults, rectify your swing mechanics and create consistent golf which will quickly **lower your handicap**.

Common Swing Faults

A major factor in swing faults is incorrect posture effecting spine angle and creating poor swing mechanics. ***Get Fit to Golf*** concentrates on some of the most common swing faults that golfers are plagued by and all of them are directly related to postural and muscle faults as well as poor balance as a result of these problems. In other words these problems cause a "biomechanical fault".

The most common Swing Faults are the following. Please click on each swing fault for a detailed explanation of the causes and cures for each swing fault.

- **hitting fat**
- **hitting skinny**
- **hooking** (straight flight then hooking or push/duck hook)
- **slicing** (causes over the top)
- **pushing** the ball (or push-slicing)
- **pulling** the ball (or pull-hooking)
- **dipping or reverse tilt** (or the Reverse Pivot or Tilt or Lack of Power)

All these listed common swing faults we have shown can be attributed to a biomechanical, structural or spinal faults. If you want to find the key to more consistent golf this is the beginning.

All golfers are looking to maximise their swing, which is to maximise their power to create maximum distance. To maximise distance you must make an efficient back swing. The golfer with the best posture will have the best swing mechanics and will create the most efficient and powerful swing.

Some of the common faults in the swing causing lack of power are:

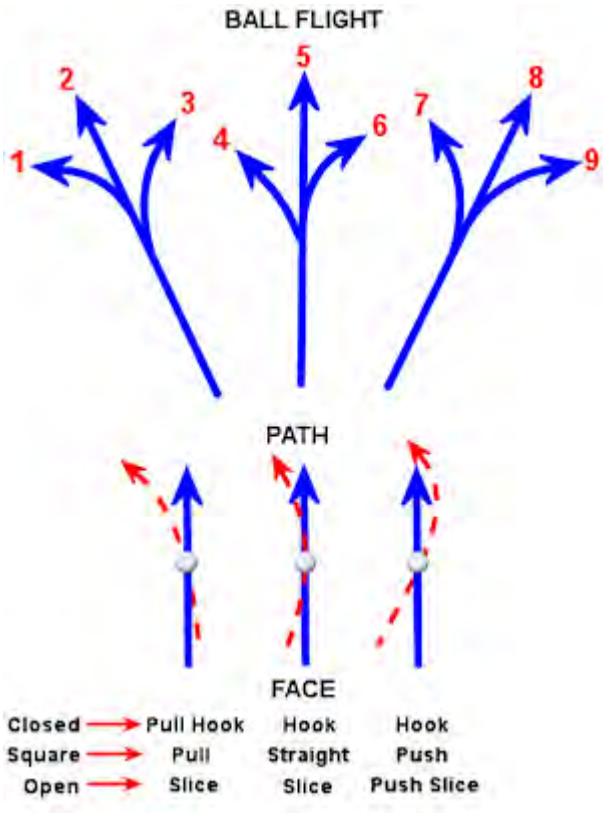
- the lift
- reverse tilt
- poor balance
- sway
- dipping
- lack of movement
- too much hip movement

Each of these faults has a biomechanical cause. For example, if your posture is poor with lack of rotation of the neck causing lack of flexibility and a poor stance, it will also cause a poor centre of gravity. You will not be able to

rotate your hips combined with no movement of the neck or too much, which results in weak arms only swing. The "C" curve or reverse tilt (dipping) is caused by a poor rotation of hips causing the centre of gravity to push the weight on your front foot. When you try to compensate you cause a reverse pivot by sliding the hips instead of rotating. You move the ball forward but still have the same problem because the problem is created by poor centre of gravity created by a spinal fault.

If you are one of the many golfers with an existing spinal fault, improve your biomechanics first and then work on your swing. At ***Get Fit to Golf*** we can give you a personalised fitness program catered to your own individual needs to achieve this. Correcting your problem areas can also reduce the risk of injury and improve your overall well-being.

Definition of Swing Plane, Swing Path and the Swing Arc



Ball Paths Diagram

What is the Swing Arc and the Swing Path?

A **swing path** is dictated by **the arc** the club-head follows during a golf swing! The arc starts in the takeaway and works around the body until the club-head reaches the top of the swing. As the club head works back down to the ball toward the target the club 'should' follow the same arc down. When the bottom of the arc reaches the impact zone the arc dictates what path the club will follow.

The **swing path** is the direction the club-head is traveling towards the target at impact. The swing path at impact can be either traveling **right**, **left** or **straight** at the target.

Swing paths that move too far left 'or' right of the target line are considered to be caused by faults in posture, set-up or the swing motion.

The perfect swing will have a swing arc that travels along the ideal swing plane, does not deviate from that swing plane and has a swing path traveling straight at the target.

Ball Flight Laws

The path of the hands in the hitting area provide the initial direction of the ball and the club-face angle at impact provides the curve or final destination that the ball will seek. The ball can start either towards the target, to the right of the target (push), or to the left of the target (pull). Off each path the ball can curve right (slice), left (hook), or continue straight. This gives us nine possible flight patterns of which only one is straight, as seen in the diagram to the left.

1. Pull Hook
2. Pull
3. Pull Slice
4. Hook
5. Straight
6. Slice
7. Push Hook
8. Push
9. Push Slice

There are 2 important factors to keep in mind.

1. The path of the hands in the hitting area or the path of the club-head in the hitting area
2. The club-face angle at Impact. (see diagram to left).

Ball flight laws only apply when proper alignment is observed.

The diagram to the left shows how the ball comes off the club-face if the club-head isn't moving in the same direction that it is facing.

"A golfer's posture can define his swing path, most notably due to the take-away".

For example:

1. An inside takeaway (club head moving inside too quickly) will likely cause a flat swing plane and a path through impact that goes to the right of the target.
2. An outside takeaway (club-head moving outside too quickly) will likely cause an upright swing plane and a path through impact that goes to the left of target.

By stabilising the posture and body alignment you can create a neutral take-away and stop swing fault inconsistencies.

What is a Swing Plane?

A swing plane is the angle that the shaft of the club travels around the body during a golf swing.

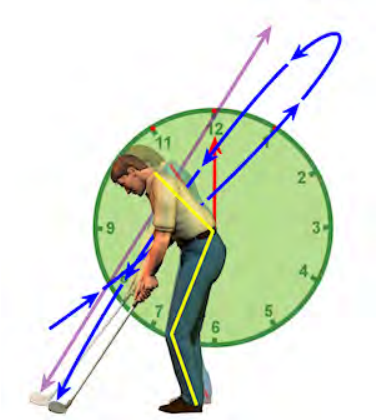
Take-away

Down-swing

Follow-through

THE GOLF SWING PLANE

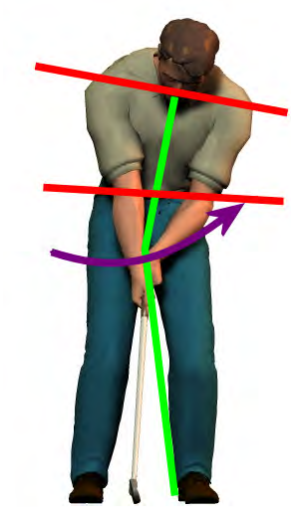
The above 3D illustrations show the **swing plane in blue shading and blue line** and the **swing arc in red**. The yellow arrow indicates the swing path pointing towards the target.



NOTE: The clock diagrams in the Get Fit to Golf program and web site illustrate both the incorrect **swing arc** indicated by the **blue line with arrows** and the faded golfer (dressed in blue) with the **purple line with arrows** that shows the correct swing arc traveling along the correct swing plane at impact.

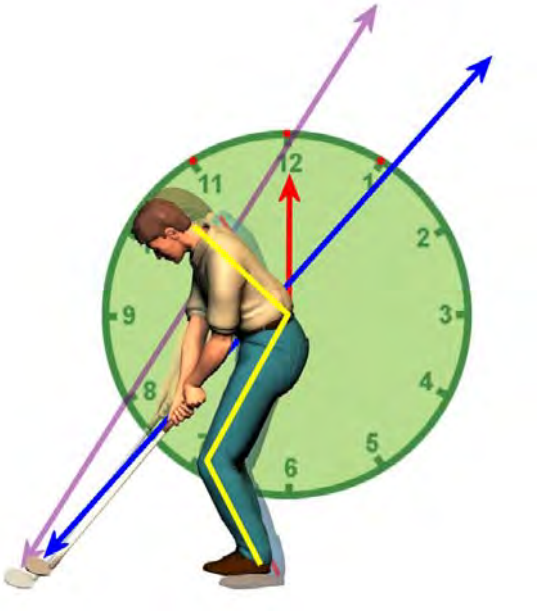
HITTING FAT

Hitting Fat is caused by incorrect posture effecting spine angle and creating poor swing mechanics. Some of the common problems are listed below are:



Your centre of gravity is on your front foot so you can't move through the shot with your hips and legs. This means your balance will be poor with your head too far forward**.** With the centre of gravity, weight will be too far forward in your stance, your legs will move before you complete your back swing, consequently power supplied by your arms and shoulders only.

If the centre of balance is wrong due to disturbed posture, as indicated in the diagram (above left) by the yellow line, your head will move too far down on the right away from the target during the downswing or the back-swing resulting in a distorted swing arc. You will drop your left shoulder causing you to chop down on the ball, thus causing you to hit fat.



Poor biomechanics will also cause you to sway your body back during your back swing and then not coming forward to your original position during your back swing, will result in your shot hit fat or you will top the ball through poor distribution of weight as you swing through the ball. With poor posture causing the wrong centre of gravity the body will sway causing lack of balance and this will lead to backward movement on the back-swing and forward movement on the follow through. The hips will not rotate but will slide creating an exaggerated flat swing.

The diagram (above left) shows the typical hitting fat posture at impact with the red lines indicating the shoulder and hip relationship and the green line indicates the centre of gravity. The purple arrow indicates the direction the hips are turning at the point of impact.

Note: The centre of gravity (COG) refers to the line in the midline from your forehead to the centre of your stance. Changes in the centre of gravity, as indicated by the green line, will alter your centre of balance (COB).

The diagram, (above right), shows the typical hitting fat posture with the centre of balance indicated by the yellow line. The swing arc is indicated by the blue line, which in this case travels along the flat swing plane. The faded golfer dressed in blue is the correct posture, with the red lines indicating the centre of balance, and a straight and correct swing arc traveling along the ideal swing plane is indicated by the purple line. The correct posture should have a spine angle of 30 degrees, or as demonstrated in the diagram by the red lines (red lines also indicate the centre of balance), at 11 o'clock or 1 o'clock depending if you are right or left handed.

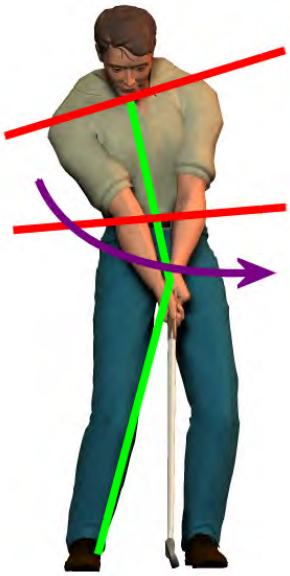
Swing Summary: Changes in centre of gravity are due to; the body leaning too far forward (i.e. the wrong spine angle) and too much weight being supported on the target-side leg.

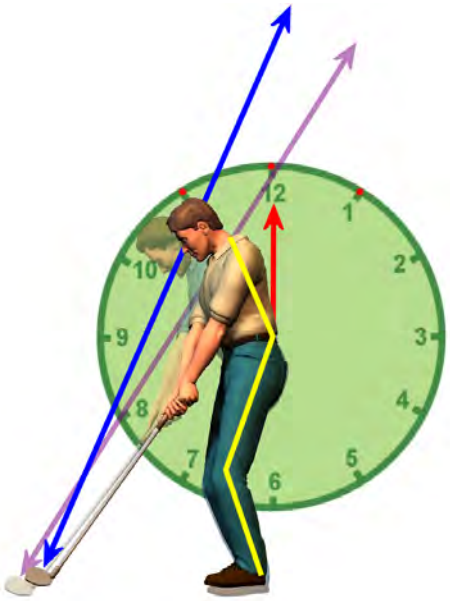
Note: The clock diagram indicates a general swing arc for hitting fat and both diagrams illustrate the posture at the point of impact.

HITTING SKINNY

Hitting Skinny is caused by incorrect posture effecting spine angle and creating poor swing mechanics. Some of the common problems listed below are:

Your centre of balance isn't distributed evenly when you take your setup due to a postural fault or musculoskeletal problem. Your balance will be poor with due to your posture causing you to have a more upright swing arc and swing plane. This will cause you to loose control of your shot with an incorrect transfer of weight during the swing causing you to hit topped skinny shots. With the centre of gravity, your weight will be too far back in your stance, your legs will move before you complete your back swing, consequently power is supplied by your arms and shoulders only.





As you come off the shot you will hit many top or skinny shots. If the centre of balance is wrong due to disturbed posture your head will move too far down on the right away from the target during the downswing or the back-swing resulting in a distorted swing arc.

Poor biomechanics will also cause you to sway your body back during your back swing and then not coming forward to your original position during your back swing, will result in your shot hit skinny, or you will top the ball through poor distribution of weight as you swing through the ball. With poor posture causing the wrong centre of gravity, as indicated in the diagram (above left) with the green line, the body will sway causing lack of balance and this will lead to backward movement on the back-swing and forward movement on the follow through. The hips will not rotate but will slide.

The diagram (above left) shows the typical hitting skinny posture at impact with the red lines indicating the shoulder and hip relationship and the green line indicates the centre of gravity.

Note: The centre of gravity (COG) refers to the line in the midline from your forehead to the centre of your stance. Changes in the centre of gravity, as indicated by the green line, will alter your centre of balance (COB).

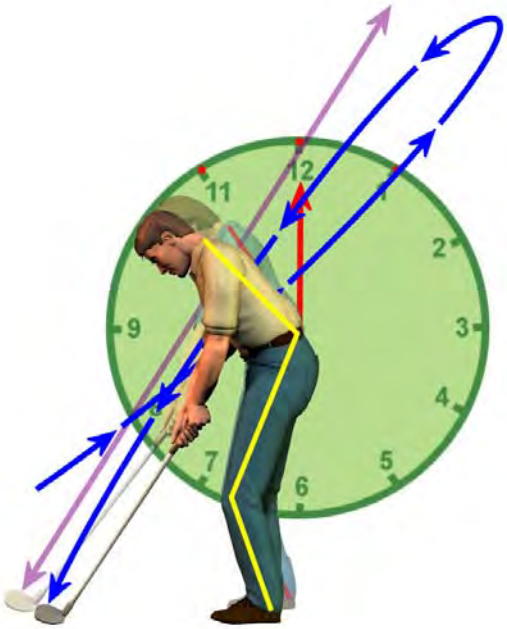
The diagram, (above right), shows the typical hitting skinny posture with the centre of balance indicated by the yellow line. The swing arc is indicated by the blue line and travels along an upright swing path. The faded golfer dressed in blue is the correct posture, with the red lines indicating the centre of balance, and a straight and correct swing arc traveling along the ideal swing plane is indicated by the purple line. The correct posture should have a spine angle of 30 degrees, or as demonstrated in the diagram by the red lines (red lines also indicate the centre of balance), at 11 o'clock or 1 o'clock depending if you are right or left handed.

Swing Summary: Poor weight transfer due to non-neutral centre of balance. Weight too far back in stance at set-up and too upright at setup. Exaggerated body sway during swing.

Note: The clock diagram indicates a general swing arc for hitting skinny and both diagrams illustrate the posture at the point of impact.

HOOKING (straight flight then hooking or push/duck hook)

Hooking is a result of hitting the ball in counter clockwise swing which forces the ball to move both in the air and on the ground from right to left. If you hook regularly your score will greatly improve if you can transform your stroke into a draw or straight hit.



The most common cause of hooking is swinging from the inside of the correct line of impact to the outside of the correct line. This can be caused by a close stance and this is when feet are aimed to the right of the target by a flat swing. Poor posture will cause the hips to rotate back right with weight on your back foot. You will immediately push right or hook. The centre of gravity, as seen by the red line in the diagram on the left, is changed to the back foot with your hip rotated it will cause you to have an in to out swing plane and you won't be able to square the club face at impact.

The diagram (left) shows the typical hooking posture at impact with the red lines indicating the shoulder and hip relationship and the green line indicates the centre of gravity. The green shading indicates that the weight at impact is on that side of the body.

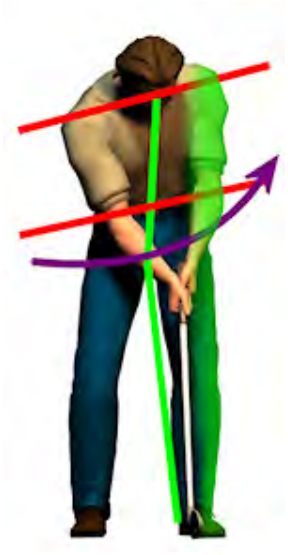
Note: The centre of gravity (COG) refers to the line in the midline from your forehead to the centre of your stance. Changes in the centre of gravity, as indicated by the green line, will alter your centre of balance (COB).

The diagram, (right), shows the typical hooking posture with the centre of balance indicated by the yellow line. The swing arc is indicated by the blue line which travels in and out of the swing plane. The faded golfer dressed in blue is the correct posture, with the red lines indicating the centre of balance, and a straight and correct swing arc traveling along the ideal swing plane is indicated by the purple line. The correct posture should have a spine angle of 30 degrees, or as demonstrated in the diagram by the red lines (red lines also indicate the centre of balance), at 11 o'clock or 1 o'clock depending if you are right or left handed. The correct swing plane is shown in purple.

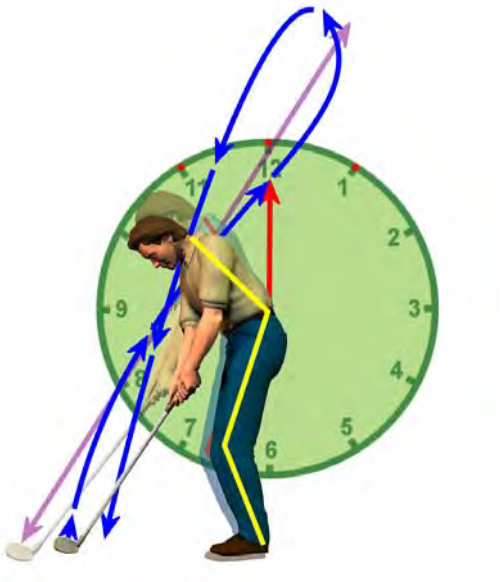
Swing Summary: There is a noticeable 'tilt' in the pelvis towards the rear leg, causing the player's COG to shift to the rear. The hips are in an closed position while the shoulders are in an exaggerated 'closed' position. The back-swing comes up high (near 12 o'clock) while the downswing is at a much lower angle (or inside). The swing arc finishes well outside the plane of the back-swing – that is, inside to out swing path. It produces a flat swing around the body. The body doesn't turn and the arms swing around the body.

Note: The clock diagram indicates a general swing arc for hooking and both diagrams illustrate the posture at the point of impact.

SLICING (causes over the top)



Slicing is the opposite to hooking and a result of hitting the ball clockwise rather than a counterclockwise spin. Which force the ball to move both in the air and the ground from left to right. Surveys have shown the approx. 80% of all golfers slice the ball. It is interesting to note also from a doctor of chiropractic's point of view that 8 out of 10 people have one leg slightly shorter than the other. So I believe that one of the major factors effecting slicing is a biomechanical fault that causes a rotation in your pelvis affecting your posture, your spine angle, and thus your swing arc.



If you are a right handed golfer and you have an apparent left leg shortening due to a lateral rotation of the pelvis can be the result of a flexion-extension of the pelvis at the s-i joint. We can determine this with an examination. With your poor biomechanics the club is being forced into an out to in swing so you will hit the ball with a clockwise spine. Correcting you hip and spine angle will square the club face at impact so you can hit the ball with an anti-clockwise spin. Hips and shoulders must return to a square position this will not only cure your slice but you allow distance from more power being generated from the correct body turn and the square club face. If your hips are rotated at address you will not be able to align your feet, hips and shoulders square to the target. If your posture is corrected your muscles will groove your new swing so you will naturally return to a stance with a square club face.

Also if your hips are rotated your centre of gravity will not be right this will force your shoulders to turn too quickly with an open stance due to a poor hip rotation the body will be in front of the ball. If your spine angle is wrong you will not setup with your head behind the ball you will begin your downswing before you have complete your back-swing with your arms.

The diagram (above left) shows the typical slicing posture at impact with the red lines indicating the shoulder and hip relationship and the green line indicates the centre of gravity. The green shading indicates that the weight at impact is on that side of the body.

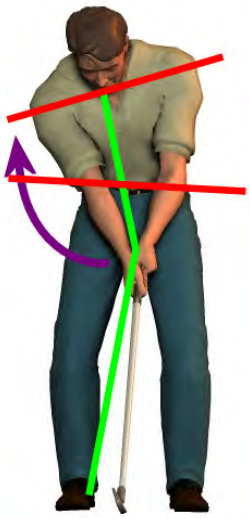
Note: The centre of gravity (COG) refers to the line in the midline from your forehead to the centre of your stance. Changes in the centre of gravity, as indicated by the green line, will alter your centre of balance (COB).

The diagram, (above right), shows the typical slicing posture with the centre of balance indicated by the yellow line. The swing arc is indicated by the blue line which travels in and out of an upright swing plane. The faded golfer dressed in blue is the correct posture, with the red lines indicating the centre of balance, and a straight and correct swing arc traveling along the ideal swing plane is indicated by the purple line. The correct posture should have a spine angle of 30 degrees, or as demonstrated in the diagram by the red lines (red lines also indicate the centre of balance), at 11 o'clock or 1 o'clock depending if you are right or left handed.

Swing Summary: The head is not in the correct position at set-up – it is too far forward and more ‘over the ball’ than ‘slightly behind’ it. A hip weakness causes the hips to tilt, at address, and a subsequent compensation during the swing causes the arms to begin the downswing before the back-swing has been completed. The down-swing cuts across the ball (towards the player’s body) - coming from outside to in. This shot is typically referred to as over the top.

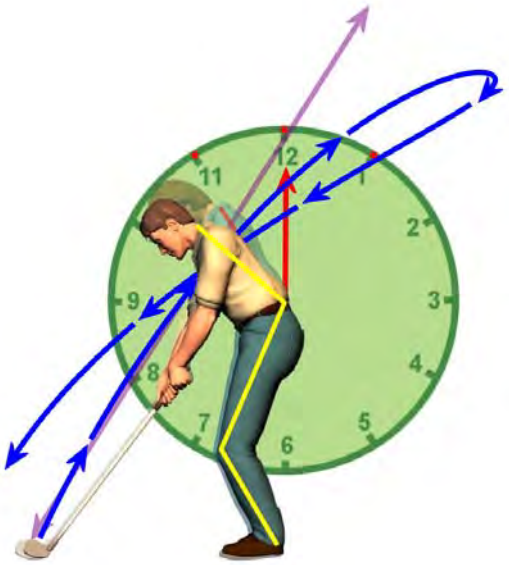
Note: The clock diagram indicates a general swing arc for slicing and both diagrams illustrate the posture at the point of impact.

PUSHING (or push-slicing)



Rotation of the hips opposite to a slice causing an in-to-out swing path. The club face is square but your hips are rotating to the right so you will push the ball to the right. If the hips can't turn due to poor posture you will turn the hips too late in the downswing causing a hook or slice. Your hips and shoulders will not turn together so you will not be square at impact. You will also tend to compensate by either closing or opening the club face too much.

The diagram (left) shows the typical pushing posture at impact with the red lines indicating the shoulder and hip relationship and the green line indicates the centre of gravity.



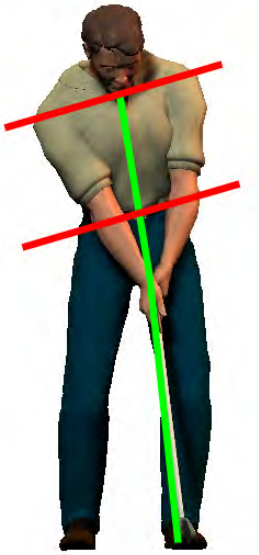
Note: The centre of gravity (COG) refers to the line in the midline from your forehead to the centre of your stance. Changes in the centre of gravity, as indicated by the green line, will alter your centre of balance (COB).

The diagram, (right), shows the typical pushing posture with the centre of balance indicated by the yellow line. The swing arc is indicated by the blue line which also travels in and out of a flat swing plane. The faded golfer dressed in blue is the correct posture, with the red lines indicating the centre of balance, and a straight and correct swing arc travelling along the ideal swing plane is indicated by the purple line. The correct posture should have a spine angle of 30 degrees, or as demonstrated in the diagram by the red lines (red lines also indicate the centre of balance), at 11 o'clock or 1 o'clock depending if you are right or left handed.

Swing Summary: The hips slide and move into an open position. The hands get in front of the ball and the weight is on the left side, pushing ball to the right.

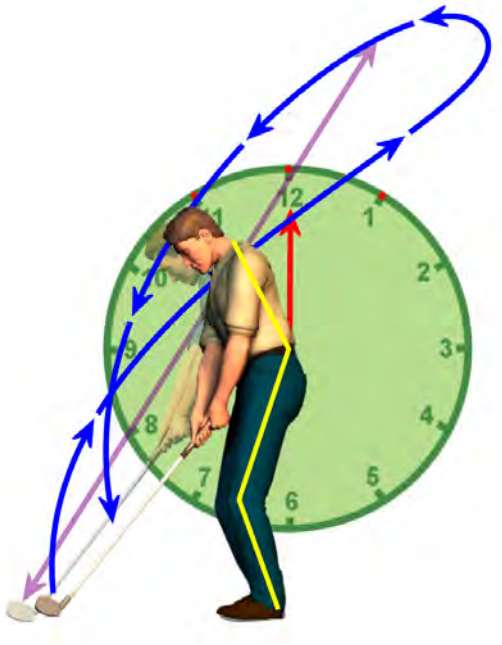
Note: The clock diagram indicates a general swing arc for pushing and both diagrams illustrate the posture at the point of impact.

PULLING (or pull-hooking)



Pulling is due to poor alignment and not being square. Your hips are rotated to the left, your biomechanics faulty, you have an out to in swing plane caused by the body rotating too far left and if your centre of balance is too far left you will close the club face causing the hook.

If you are just rotating too far left with a square club face you will pull because of your poor posture. You think you are square but your shoulders will align left and overcompensate with your hip. If you try to square the hips on the downswing you will create a pull or push hook rotating the shoulder. Rotating more to the left will cause an open club face.



The diagram (left) shows the typical pulling posture at impact with the red lines indicating the shoulder and hip relationship and the green line indicates the centre of gravity.

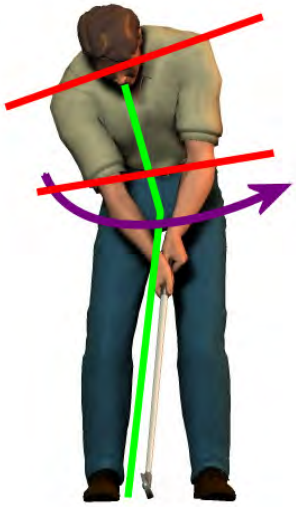
Note: The centre of gravity (COG) refers to the line in the midline from your forehead to the centre of your stance. Changes in the centre of gravity, as indicated by the green line, will alter your centre of balance (COB).

The diagram, (right), shows the typical pulling posture with the centre of balance indicated by the yellow line. The swing arc is indicated by the blue line which also travels in and out of the upright swing plane. The faded golfer dressed in blue is the correct posture, with the red lines indicating the centre of balance, and a straight and correct swing arc travelling along the ideal swing plane is indicated by the purple line. The correct posture should have a spine angle of 30 degrees, or as demonstrated in the diagram by the red lines (red lines also indicate the centre of balance), at 11 o'clock or 1 o'clock depending if you are right or left handed.

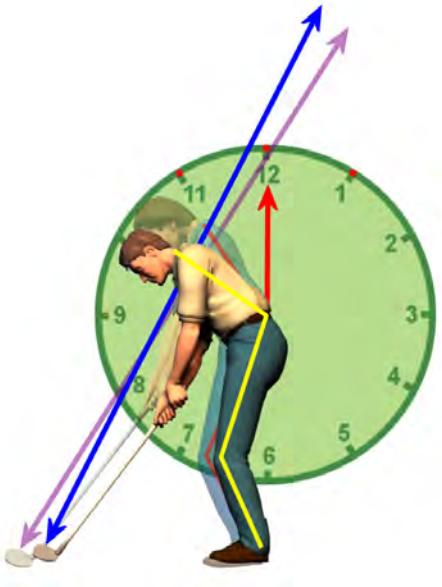
Swing Summary: The downswing comes across the ball (towards the body), then swings up to create an exaggerated 'outside to in' swing path.

Note: The clock diagram indicates a general swing arc for pulling and both diagrams illustrate the posture at the point of impact.

THE DIP (Lack of Power, Reverse Tilt or Reverse Pivot)



If you have a spinal fault which is scoliosis, kyphosis, loss of lumber curve i.e., standing too tall, you will either dip out of reflex the torso drops down during the back swing or at address you are already at this poor postural position due to a spinal fault. To have a powerful pivot to enable you to turn away from the target letting the weight move inside the left foot, push off the right foot, rotate back towards the target and finish toward the back leg with the head straight up. This is the perfect case scenario if you have an existing spinal fault this will be impossible to achieve until it can be corrected.



A good swing has to have a proper setup with the proper balance from start to finish. If you have hip or spinal complaint you will not be able to rotate the hips the hips slide instead of turn the body weight slide from the outside of the right foot the player loses his balance. The result will be a poor swing with lack of power.

The diagram (left) shows the typical dip or reverse tilt posture at impact with the red lines indicating the shoulder and hip relationship and the green line indicates the centre of gravity.

Note: The centre of gravity (COG) refers to the line in the midline from your forehead to the centre of your stance. Changes in the centre of gravity, as indicated by the green line, will alter your centre of balance (COB).

The diagram, (right), shows the typical dip or reverse tilt posture with the centre of balance indicated by the yellow line. The swing arc is indicated by the blue line and in this case the arc travels along an upright swing plane. The faded golfer dressed in blue is the correct posture, with the red lines indicating the centre of balance, and a straight and correct swing arc traveling along the ideal swing plane is indicated by the purple line. The correct posture should have a spine angle of 30 degrees, or as demonstrated in the diagram by the red lines (red lines also indicate the centre of balance), at 11 o'clock or 1 o'clock depending if you are right or left handed.

Swing Summary: The torso drops (badly) on the back-swing, or the down-swing, causing an upright cut, across the ball and big divots.

Note: The clock diagram indicates a general swing arc for dipping and both diagrams illustrate the posture at the point of impact.

About the Get Fit to Golf Program

The 'Get Fit to Golf' Program has been designed by highly qualified and experienced, Chiropractic Health Care Professionals who share your keen interest in Golf and have treated numerous Golfing Professionals. So a visit to the 'Get Fit to Golf' website is almost as good as a visit to your friendly Chiropractor.

The Get Fit to Golf Program is an easy to access on-line assessment process which will assess your biomechanics, posture problems and muscle imbalances which are commonly the underlying physical causes of golf swing faults. Then it automatically generates a tailor-made training program (The 'Chirofit'™ Program) that you can print out and explains the biomechanical reasons behind any physical faults found. It can also be integrated into golf lessons with a teaching professional – making improvement, not only easier but far more achievable.

Best of all, the 'Get Fit to Golf' Program helps do all this without needing to know all the scientific and technical details required for biometric analysis.

Unlike other programs that analyse your swing biomechanics and show you that your swing is wrong compared to a perfect swing with no explanation why your swing has developed that way, the Get Fit to Golf program actually finds out what the underlying physical problems are affecting your swing and gives you a correctional program to fix it. It may also pick up physical problems that you aren't even aware that you may have.

Four Simple Steps to Curing Your Swing Fault

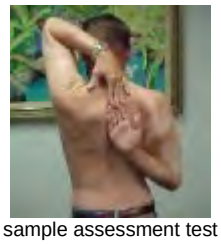
STEP1: The way Get Fit to Golf diagnoses your physical faults is through a series of online questionnaires that are part of the simple assessment process that can be done at home, in the office, or with a golf instructor to build up your swing, muscle and posture profile.

STEP 2: Our system then analyses your data and automatically generates a report determining a major swing fault and posture fault as well as the muscle problems, current fitness level and any extra problems areas contributing to the faults showing you how your golf swing is affected by your body being out of alignment.

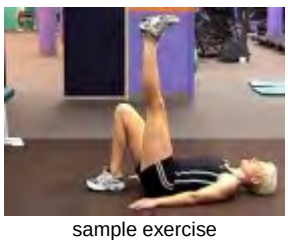
STEP3: Now that you know what your results are and are aware of your problem areas the program provides you with easy to understand information and gives you a tailor-made personal fitness program of simple stretches and exercises to eliminate the muscle and posture faults that are causing your biomechanical faults that are ultimately affecting your swing.

STEP 4: Follow your individualized program regularly to achieve the best results. All it takes is 30 minutes of your posture and muscle balancing programs three times a week to dramatically change your golf swing and improve your game for life as well as reducing the risk of injuries.

Your personalised program can also be easily done at home, at a gym or even integrated into lessons with your local golf pro for a more effective result.


sample assessment test


sample stretch


sample exercise

TO SIGN UP TO FIX YOUR SWING >> CLICK HERE

www.getfittogolf.com

How the ChiroFit™ Program Can Work For You

Get Fit to Golf's ChiroFit™ Program* fits your body type and posture to your swing!** A body type like this one illustrated to the left, will most likely cause you to slice. Does that mean you will always be a slicer? No! ***Get Fit to Golf can help eliminate your physical problems causing your swing problems.

Muscle imbalance = poor posture = poor swing

For Example, if you are a right handed golfer with a left short leg, as seen in the diagram (right), and a slumping posture as seen in the diagram (left), it will cause you to have an open stance and an out-to-in swing path. If this is causing you to slice or push the ball, WE CAN HELP YOU CORRECT THIS!

For the first time a golf fitness program that recognises that each golfer is different and offers a tailor-made solution to your individual problem areas.

TO SIGN UP TO FIX YOUR SWING GO TO>> www.getfittogolf.com

Golf Professional Testimonials

NIKKI GARRETT - LET 2006 Rookie of the Year

"Hi. I'm Nikki Garrett. 2006 was my first year on the European Tour and I became Rookie of the Year. Get fit to Golf helped me achieve my goals through the ChiroFit™ Program. It analysed my golf swing, posture and biomechanics and gave me a program to correct my physical faults and swing faults. It also helped me and my golf coach Darren Chivas take my game to the next level".

- *3rd in 2006 LG Bing Lee NSW Women's Open Championship, Sydney, Australia*
- *6th in Women's World Cup of Golf at Sun City in South Africa, January 2007.*
- *One of Australia's leading Golf Professionals*
- *May 2007 Back-to-Back Ladies European Tour titles and currently leading money winner.*

***Nikki Garrett ,** One of Australia's leading women Golf Professionals*
www.nikkigarrettgolf.com.au

ROGER PODMORE – Australian Golf Teaching Professional

"*The purpose of this letter is to congratulate you on www.getfittogolf.com and the ChiroFit™ Program and how it has helped my students identify their body weakness and improve their fitness. The report my students receive from Get Fit to Golf makes it easy for me to help improve their Golf Swings. Most Golfers don't know the importance of Golf Biomechanics or understand how it affects 90% of their Golf Swing.*

My family has been teaching Golf for over 70 years, I watched my Father teach Amputees, Disabled and the Blind to play Golf. He always said to me, Son you must know everything about your student before you begin each lesson. If you don't know a student has a bad back, Neck, knee, hip, foot, wrist or hand problem you could do them more damage when giving a lesson...

There is a lot more to teaching a client a Stack and Tilt Golf Swing or a Right-sided Swing or any other Golf swing. If you don't know your client has a physical problem you shouldn't be creating a new swing. I believe that all Golfers should use the ChiroFit™ Program to analyze their body to improve their swings."

Kind Regards,
Roger Podmore
Master Golf Teacher and Golf Biomechanics Specialist, Aussie Golf Solutions & Golf Biomechanics Golf Academy
www.golfbiomechanics.com.au

DARREN CHIVAS - Australian Golf Professional

"The Get Fit to Golf ChiroFit™ swing analysis and biomechanics training program is used by me personally and my students. At present I am working with one of Australia's leading professional golfers Nikki Garrett. Nikki was having a reoccurring swing fault due to leg and foot injuries. Get fit to Golf's ChiroFit™ Program analysed the fault and helped me setup a training program to correct the problem. By using Get Fit to Golf I am able to get a much more professional result with my students. I can highly recommend the ChiroFit™ Program."

Darren Chivas, *Australian Golf Professional, Central Coast NSW.*
Leading Australian PGA Golf Coach & former NSW Open Champion
www.chivogolf.com.au

TO SIGN UP TO FIX YOUR SWING >> CLICK HERE

www.getfittogolf.com

GLOSSARY OF TERMS

A

abdomen — Frontal, middle aspect of torso, between pubic bone and ribs

abdominals — Muscles found within the abdomen, including rectus abdominus, external oblique, internal oblique

abducted /abduction — Movement of a limb away from the mid-line of the body or another body part or laterally.

abductor machine

An apparatus that resists against the leg as you lift your leg towards away from your body from a standing position to a wide-leg position .

Note: The same apparatus can also be changed to work as an adductor machine by manipulating the position of pins to cause resistance in a different direction.

abductor muscles — Muscles of the outer hip that is responsible for lifting your leg away from the body

adducted /adduction — Movement of a limb inwards towards the midline of the body or another body part or medially.

acceleration — In physics, acceleration is defined as the rate of change of velocity, or as the second derivative of position (with respect to time). It is then a vector quantity with dimension length/time^2. In SI units, acceleration is measured in meters/second^2 (ms-2). In other words it is an increase of motion or action.

adductor machine

An apparatus that resists against the leg as you contract your leg towards your body from a wide-leg position to the standing with legs together position.

Note: The same apparatus can also be changed to work as an abductor machine by manipulating the position of pins to cause resistance in a different direction.

aerobic — Brisk exercise that promotes the circulation of oxygen through the blood. Examples include running, jogging, and swimming.

alternate — To change between i.e. change (alternate) arms

anaerobic — Low impact exercises and stretches that do not promote the circulation of oxygen through the blood. Eg. yoga, tai chi

anatomy — The study of the structure (or form) of the body - its parts and how they fit together.

angular momentum — The 'hidden' force inside an object which is accelerating constantly due to constant changes in direction - because it is traveling along a curved path, or in a circle. Objects with angular momentum attempt to conserve the relationship between their speed, their weight and the radius of the curve along which they are traveling. This is called the 'Conservation of Angular Momentum'.

anterior — Referring to the front of your body or body part or the front half of the body in the coronal plane.

anterior tilt Forward tilt, or forward positioning of structure

apparent force The visible effect of a force which has been transferred from one object to another when they interact. For example, the effect which a golf club has on a golf ball is ‘apparent’.

apex Highest point, or furthest point from reference

articulated To unite by forming a joint or joints.

asymmetrical When the shape of an object is different on both sides of its mid-line.

axillae line lateral armpit or underarm area

B

back extension bench

balance

Balance in golf: The ability of the neuromuscular system to maintain the optimum alignment and center of gravity during biomechanical rotation in a golf swing.

Balance in general: The ability of an object to stay upright or avoid being tipped over. Maintaining balance involves readjusting the body's weight by using the muscles to perform, often tiny, movements (especially in the feet) which take up any changes in the body's centre of gravity. Sometimes these movements involve moving the limbs to act as counter-weights.

Balance is easiest when an object's 'point of balance' is directly below its centre of gravity, however, balance can usually be maintained as long as the 'point of balance' is anywhere within the objects 'base of support' - a triangle shaped area below the centre of gravity.

base of support

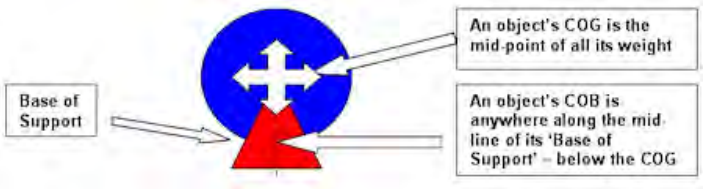
The area below an object's centre of gravity (COG) which allows it to stand without losing balance - or tipping. The base of support is usually triangular in shape; getting wider the lower it is below the COG. For example, a person standing with both feet wide apart is able to withstand being tipped over better than a person standing with both feet together - or on one foot. Basically, the lower an object's base of support (and the more central it is), the more balanced the object will be - and the less easily it will tip over. The best place for balance is along the mid-line of the 'base of support'.

The closer the COG is to the mid-line of the 'base of support' the more easily a body can be balanced. This is what is sometimes referred to as the 'Centre of Balance'. The further away it is from the mid-line of the 'base of support', the more difficult balance becomes. In some cases, trying to maintain balance when the COG and the

	mid-line of the base of support are far apart can lead to strain on the biomechanical system. And, if the COG of an object gets too far away from its 'base of support', it will lose its balance and fall over.
basket hang	Exercise performed taking your body weight on your forearms with your feet off the floor.
bilaterally	Pertaining to both sides of body
biomechanical fault	Fault due to abnormal biomechanics within the body
biomechanics	The study of the mechanics of a living body, especially of the forces exerted by muscles and gravity on the skeletal structure. The mechanics of a part or function of a living body, such as of locomotion. In this program "biomechanics" is referring to the movement of your muscles and skeletal structure during the rotation of the golf swing and the forces affecting them like centre of balance and gravity. A **biomechanical fault** is due to abnormal biomechanics within the body**.**
bones	Rigid structures composed of calcium, minerals, collagen and other compounds which act primarily to provide a skeletal framework for the body. There are 206 bones in your body.
buttocks / bottom / posterior	The lowest part of the torso which you sit on.
Backswing	When the golfer takes the club away from the addressed ball, continues until the club is moved back towards to ball.
barbell	Bar with two round weights on either end and is held by both hands on the bar. More weights can be added to the bar.

C

caudal	The lower half of the body in the transverse plane.
centre of balance (COB)	A line, directly below the body's centre of gravity, along which the body can be most easily balanced. It varies in people but, generally, is located in line with the front of the second sacral segment. In this course it refers to the biomechanical mid-line of the body's 'base of support' and the way in which the body maintains the alignment of this line during a golf swing. Different body sections may have their own centres of balance. For example, if the upper torso (and head) has a very different centre of balance from the lower torso, a conflict is created between the two - and the biomechanical system has work to overcome for this. Overcoming such a 'balance conflict' requires extra effort - which may lead to stress and early fatigue - or even strain and injury.
centre of gravity (COG)	Centre of Gravity (or COG) - The point at which the weight of an object is equal in all directions. The 'mid-point' of a body's weight – or the 'average point' of an object's weight distribution.



In this course, the term 'COG' is often used interchangeably with the term 'Centre of Balance' (COB), however, an object's 'COB' can be below its COG – anywhere along the mid-line of the object's 'base of support'.

cervical Pertaining to the neck region

cervical spine Series of vertebrae which make up the spinal column in the neck region. It comprises 7 vertebrae named C1 to C7, from top to bottom

chili dipping When the top of the ball is struck by the bottom of the club, causing it to jump straight up and plonk back down.

coccygeal spine (Coccyx or Tailbone) made of between 3 and 5 fused small bones.

compensation An attempt by the body to re-adjust its weight distribution in response to a shift in the body's centre of gravity (or balance) - normally located at the base of the spine, in the sacrum. This shift in the COG may be due to a bone misalignment or muscle imbalance in some other part of the body.

concave Projecting inwards, the area within a curve

contact force The force transferred between two objects when they interact by contacting each other. For example, a golf club hitting a golf ball.

contractile tissues More often referred to as muscle cells. Specialist cells in the body which have the ability to stretch and shorten in length. By contracting (and shortening) they are able to move bones at the joints. By stretching (getting longer) they release joints and allow them to move.

convex Projecting outwards, the area outside a curve

coronal plane The imaginary plane which divides the body into two halves - upper and lower (cranial and caudal).

coronal spine distortion A spine distortion which affects the front to back (anterior to posterior) alignment of the vertebrae. For example, a kyphosis (an over-rounded convex curve of the thoracic spine causing 'rounded shoulders') or a lordosis (an over-rounded concave curve in the lumbar spine causing a 'sway-back').

coronal tilt The angle at which the spine and hips are tilted forward during the set-up and the swing. The coronal tilt should remain almost constant throughout the swing.

cranial The top half of the body in the transverse plane.

cumulative stress When several different forms of stress combine - often resulting in the development of strain which exceeds the body's 'elastic limits' - causing damage to biomechanical system.

D

dumbell	Hand weight
draw	To induce topspin onto the ball causing in to move from outside to in on your swing and is the opposite to fade.
divot	A piece of turf lifted when ball is struck - typically on fairway, played to create backspin.
dipping / reverse tilt / lack of power	Lack of power during a golf swing where the golfer is not be able to correctly rotate the hips and have poor balance.
distant force	The force transferred between two objects when they interact without contacting each other. For example, the effect of gravity on a golf ball traveling through the air.
distortion	A change to the normal shape or position of a bone, joint, muscle or body part.
dorsiflexor muscle	A dorsiflexior muscle is used for the movement at the ankle joint in trying to bring the foot in proximity to the leg.

E

effort	The amount of energy or force which is put into moving an object with a lever.
elastic limit	The threshold of strain for the biomechanical system. Up to the 'elastic limit' the body is able to repair and even benefit from any stress placed on it. Beyond the 'elastic limit' the biomechanical system is being placed under strain which can lead to damage - often permanent.
elevate / elevated	To lift up
explosive stress	When the body goes beyond its elastic limit due to a single incident which causes damage to biomechanical system.
extremeties	Arms and legs
extrinsic muscles	Muscles that originate outside of the body part on which they act.
extension	Movement of straightening a joint or bending the spine backwards
external auditory meatus	The outer ear (external part of ear that is visible)
extensor muscles	A skeletal muscle whose contraction causes the straightening or stretching of a limb or other body part.

F

facet joint The facet joints are small joints that are located on the back of the spine with one on each side. Each vertebra is connected by facet joints and they provide stability to the spine by interlocking two vertebrae together.

fade To induce backspin onto the ball causing it to travel through the air following inside to out swing and is the opposite to draw.

fat (hitting) When the club strikes the ground well behind the ball.

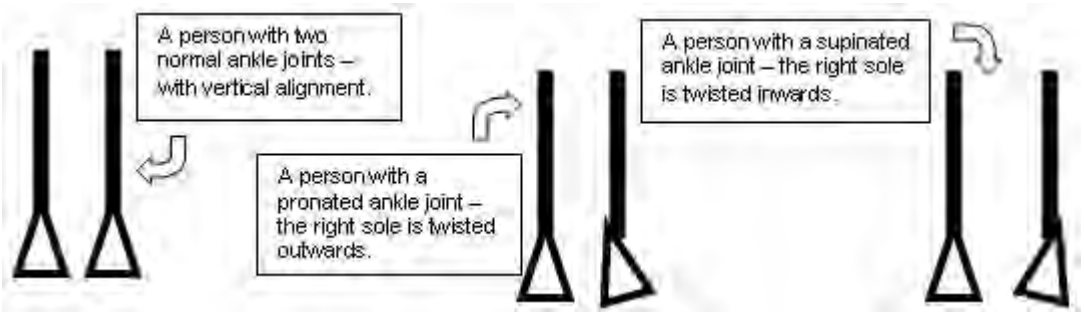
Fine Motor Skills Movements of minor and small limbs (fingers, hands and toes etc) which is required for performance of Fine Motor Skills such as writing, cutting or re-balancing (especially in the feet).

flat feet Flat Feet (or 'Fallen Arches') - Caused when one or more of the foot's three arches collapses due to an injury, weakness or muscle imbalance.

When the foot 'flattens' the arch (which is on the inside of each foot) collapses and the foot rolls inwards. This turns the ankle inwards and forces the soles to point outwards. This is called a 'pronation' of the foot.

'Flat feet' can be examined in 3 main ways.

- Method 1 - By having the person stand on a flat hard floor and observing the inside of each foot to see if it has a raised arch. Two fingers should be able to fit in the space created by each arch.
- Method 2 - By having the person stand on a flat hard floor and observing the ankles from behind (as shown in the diagrams below). Normally, the feet should be vertically aligned (at 90 degrees) to the feet, at the ankles. If there is a pronation the ankle will be tilted inwards and the sole will be tilted away outwards. If the sole faces inwards it is called a 'supination'.



- Method 3 - By examining the individual's shoes to see where the greatest ware has occurred. A 'pronation' would mean more ware on the insides of the soles – especially at the heels, where most of the weight is supported. A 'supinated' ankle would mean greater ware on the outside of the shoes.

flat pelvis Pelvis which has little or no forward tilt

flex / flexion / flexed Decreasing the angle between two points

flexibility Flexibility is a joint's ability to move freely through a full and normal range of motion. In this program flexibility mainly refers to the ability to move correctly in the rotation of a golf swing.

Flexor muscle A flexor muscle is one which decreases the angle between two bones. For example, bending the arm at the elbow or raising the leg toward the stomach.

force The amount of energy transferred from one object to another during an interaction. Calculated by the formula; Force = Mass x Acceleration, it is measured in units called

Newtons.

fulcrum A pivot or hinge through which an effort can be transferred to a load via a lever.

G

gluteal muscles / glutes Primarily pertains to the gluteus maximus muscle, which forms the bulk of the buttocks shape. Other gluteal muscles include gluteus medius and gluteus minimus

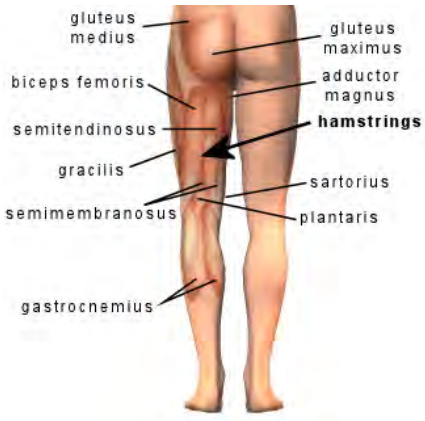
gradual strain When the body goes beyond its elastic limit due to the gradual accumulation of stresses until they create strain - causing damage to biomechanical system.

Gross Motor Skills Movements of major limbs (arms, legs, etc) which is required for the performance of Gross Motor Skills - such as kicking, throwing or hitting.

gyroscope A heavy fixed wheel spinning at high speed which generates a large amount of angular momentum. This angular momentum creates a resistance to any change in the gyroscope's position - because of the Law of 'Conservation of Angular Momentum'.

H

Hamstring



A hamstring refers to one of the tendons that make up the borders of the space behind the knee in the leg. The hamstrings cross and act upon two joints - the hip and the knee. The three muscles of the posterior (or back) thigh (semitendinosus, semimembranosus, biceps femoris) flex (bend) the knee, while three of the four other muscles extend (straighten) the hip.

Herniated disk Slipped disc (medical term: prolapsed intervertebral disc) is a condition in which, due to a tear in the outer fibrous ring, the central part of the intervertebral disc is protruding into the spinal canal. Most commonly this occurs in the lowermost part of the spine, especially between the fourth and fifth vertebral bodies and between the fifth vertebral body and the sacrum. This protrusion usually occurs to one side of the spinal canal, at the point where a nerve root leaves the canal.

hidden force A force which has not yet become 'apparent'. This energy has not been transferred to another object because there has been no interaction. For example, the inertia of a stationary object or the momentum of a moving object - before they have interacted with any other objects. The force exists but it is not yet visible - therefore it

remains 'hidden' until an interaction occurs.

hip bones The two separate bones found on either side of the pelvis. Together with the sacrum, they help form the bowl shaped structure called the pelvis. The sacrum forms the keystone at the top (and back) of the pelvic arch and keeps the two hip-bones separated, aligned and level. If the sacrum was not able to support the hip-bones they would flounder.

hip flexor Muscles which act to flex the body at the hips

hook /hooking To induce topspin onto the ball causing in to move from outside to in on your swing and is the opposite of a slice.

Hook-lying Position in which you are on your back, arms by your side, knees and hips flexed to approximately 90 degrees

Hypertonic Increased muscle tone beyond the normal

Hypotonic Decreased muscle tone beyond the normal

I

imbalance Without balance, unequal

inertia The 'hidden' energy held within a stationary object due to its weight (or mass).

intrinsic muscles Refer to deeper lying muscles within body

Ipsilateral On same side as point of reference

J

K

Kyphosis Natural posterior curve of spine ie. thoracic curve

Kinesthetic memory Kinesthetic memory is the awareness of one's orientation in space, and the way the body and muscles move without having to no longer think about the movement as repetition of that movement is

remembered by the body parts and muscles.

kinetic energy

Kinetic energy is the energy of motion. An object which has motion - whether it be vertical or horizontal motion - has kinetic energy.

Kinetic energy of an object is the extra energy which it possesses due to its motion. It is defined as the work needed to accelerate a body of a given mass from rest to its current velocity. Having gained this energy during its acceleration, the body maintains this kinetic energy unless its speed changes. Negative work of the same magnitude would be required to return the body to a state of rest from that velocity.

kinetic link principle

Reaching the very high 'end-point' speeds needed for golf, requires the sequential acceleration (and then deceleration) of a series of adjoining links. As each link slows down it passes it's momentum onto the next until, the final link in the chain receives the accumulated energy from all those before it. This is the ***Kinetic Link Principle*** and, to achieve it, requires the muscles at each stage in the series to 'fire' in a very specific sequence.

Kinetic links in golf can are the elbows, the wrists, the knees or the ankles.

L

lateral

Towards the side or towards the outside of the body's sagittal plane.

lateral trunk

Side of the trunk

laws of motion

Sir Isaac Newton was the first person to bring together many of the ideas about the Physics of moving objects.
He did this by coming up with the three 'Laws of Motion' which are explained over the next few pages. These Laws are;

- Newton's First Law -The Laws of Inertia and Momentum
- Newton's Second Law -The Laws of Acceleration
- Newton's Third Law -The Laws of Interaction

levator scapulae

Muscle located in the posterior neck region

lever

A device (usually a rigid bar) which can be used to transfer a given effort to a desired load with some kind of an advantage - known as a mechanical advantage. Levers may be classified as either Class 1, Class 2 or Class 3.

- Class 1 levers have their fulcrums in the middle - between the effort and the load.
- Class 2 levers have their load in the middle - between the fulcrum and the effort.
- Class 3 levers have their effort in the middle - between the fulcrum and the load.

ligament

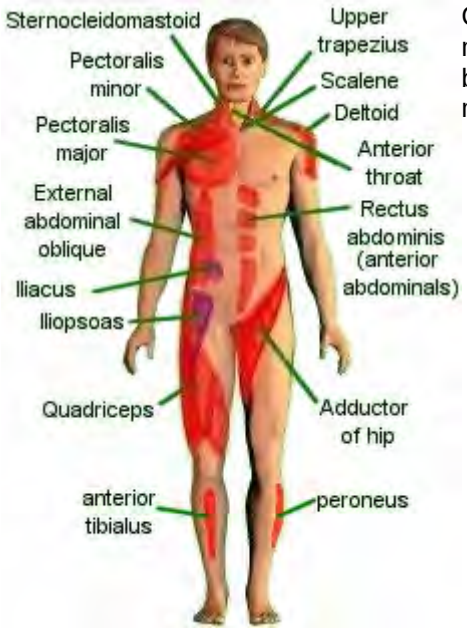
A sheet or band of tough fibrous tissue connecting bones or cartilages or supporting muscles or organs

linked transfer	Transfer of energy by the kinetic link principle through linked body parts through the muscles.
load	The amount of force which can be exerted by a lever from a given amount of effort.
locomotion	Refers to motion or movement of some kind
locomotor	Object or muscle which acts to move body ie. attain locomotion
lordosis	Natural anterior curve of spine ie. lumbar curve
lumbar/ lumbar spine	Pertaining to the lower back, beneath the ribs. The section of the spine between the thoracic spine and the sacral spine. It comprises 5 vertebrae named L1 to L5, from top to bottom.
lumbar vertebrae	Area of the spine in the lower back, beneath the ribs. There are 5 lumbar vertebrae. The lumbar vertebrae are situated between the thoracic vertebrae and the sacral vertebrae in the spinal column. The 5 lumbar vertebrae are represented by the symbols L1 through L5.

M

mass	The force transferred between two objects when they interact by contacting each other. For example, a golf club hitting a golf ball.
mechanical advantage	The amount by which effort (to move a load) is improved when using a lever.
medial	Towards the mid-line of the body's sagittal plane.
misalignment	When two adjacent bones are not joined in the correct position at the joint. This makes movement of the joint difficult and also places pressure on the muscles on either side of it. On one side the muscles become over-stretched and on the other they become under-stretched - causing a muscle imbalance.
momentum	The 'hidden' energy held within a moving object due to its weight (or mass) and its speed (or velocity).
muscle imbalance	Position in which muscles in an agonist/ antagonist relationship, or bilateral muscles do not have equal tone, and thus are imbalanced
muscle pairing	When two muscles have to work in unison to allow the smooth movement of a joint. While one muscle contracts, to create a desired movement, the other (paired) muscle has to relax in order to allow the desired movement to proceed. If the paired muscle does not relax and extend, the desired movement will be impaired.

muscles



Contractile tissues used for many physiological functions, but primarily assist in movement

muscle strain An injury that damages the internal structure of the muscle. It is a partial tear of some of the small fibres that make up the muscle.

musculoskeletal system Body system comprised of skeletal bones and muscles which has many functions but acts primarily to attain locomotion and balance. If any part of this system is not in alignment then a musculoskeletal imbalance will occur causing postural faults. Ie. the system of bones which support the body, the muscles which move them and the tissues which join the two together

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N

neuromuscular system relating to nerves and the muscles they stimulate

Newton The units by which force is measures - named after Sir Issac Newton, the 'father' of modern Physics. 1 Newton is the force required to move a 1 Kg weight, 1 metre in 1 second.

O

oblique /oblique direction Direction at 90 degrees

occipital bone The bone that forms the back of the skull including the rear and the rear bottom of the skull. It encloses a large oval hole, the foramen magnum, the opening through which the spinal cord becomes continuous with the brain.

orthotics Structures used to correct foot position imbalances and affect posture. A mould is taken of the feet and from that tailor-made inserts are created to put in the shoes to correct posture.

P

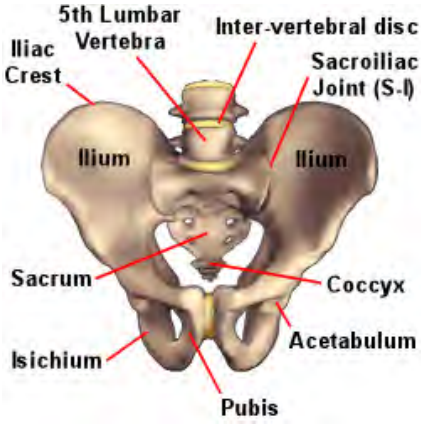
pec / pectoralis

Upper chest muscles attached to the front of the chest wall and extending to the upper arms and under the breast area. They are divided into the pectoralis major and the pectoralis minor muscles.

pec dec machine

A weight resistance training machine that enables unilateral and bilateral chest, back, and shoulder conditioning.

pelvis / pelvic / pelvic arch



The pelvis is a bowl shaped structure made up of the two hip bones separated by the sacrum. The pelvis has two separate halves which can act independently if not stablised by the sacrum. The sacrum forms the keystone at the top (and back) of the pelvis - keeping both halves separated, aligned and level. The bowl shape of the pelvis helps hold the organs of the abdomen in place.

Pelvic arch - the opening at the back of the pelvis, between the two hips. This gap is filled by the sacrum which acts as a keystone for the pelvis - keeping the whole bone rigid and stable.

physiology

The study of the way the parts of the body function (or work) - both individually - and in combination with each other.

posterior

Referring to the back of your body or body part or the back half of the body in the coronal plane.

posture

Attitude of body as expressed by the musculoskeletal system

posture distortion

When the body is forced to adopt a posture which is not 'normal', in order to compensate for an imbalance in the musculoskeletal system. Often associated with incorrect spinal curves - either 'Coronal Spine Distortions' (changes to the angles of the Thoracic, Lumbar or Sacral spines) or 'Sagittal Spine Distortions' (left-right misalignments of the spine).

posture fault

Fault within the posture of the body

projectile

An object designed to be moved in a certain direction by a force which has be applied to it. (e.g. a golf ball, a bullet, a rocket or an arrow). The angle at which a projectile leaves its original position (or is launched) is called its 'trajectory'.

pronated position

The act of turning the palm or palmar surface of the forefoot downward. That motion of the forearm whereby the palm or palmar, surface is turned downward. The position of the limb resulting from the act of pronation.

pull

When the ball flies in an inward direction after being stuck. Not the same as draw / hook as these are shots affected by spin.

push

When the ball flies in an outward direction after being stuck. Not the same as fade / slice as these are shots affected by spin.

Physics

The study of the forces and interactions which occur between objects - either through direct contact or over a distance. Originally referred to as the Laws of Statics and Dynamics they are now dealt with by Newton's Three Laws of Motion - often known as the Laws of

Physics.

Laws of Physics - The 3 basic Laws set down by Newton. The 1st Law has to do with the way force causes movement. The 2nd Law has to do with force causing objects to accelerate and the 3rd Law has to do with how objects interact with each other.

Physiology — The study of the way the parts of the body function (or work) - both individually - and in combination with each other.

Q

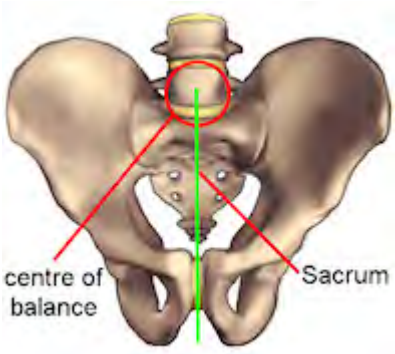
R

radioulnar joint — The radio-ulnar joint's axis is an oblique line that connects the superior and inferior radio-ulnar joints in the arm.

S

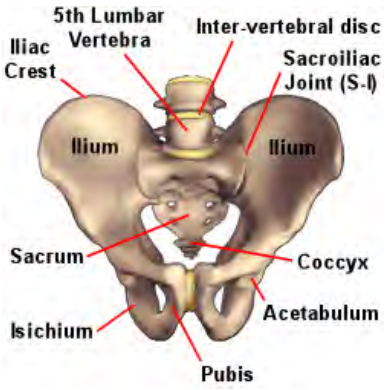
sacral spine — The final section of the spine between the lumbar spine and pelvis. It comprises 5 fused vertebrae named S1 to S5, from top to bottom.

sacrum



Large triangular area of spine at base of spinal column, above the coccyx and in line with the hips. The sacrum acts as the body's centre of balance.

sacro-iliac joint or S-I joint



The S-I joint is the ***Sacro-iliac joint*** - where the 'sacrum' meets the 'ilium' (or pelvis) which are joined by ligaments. Even more simply, it is where the spine meets the pelvis. It is a strong, weight bearing synovial joint with irregular elevations and depressions that produce interlocking of the bones.

sagittal plane The imaginary plane which divides the body into two halves - right and left (side to side).

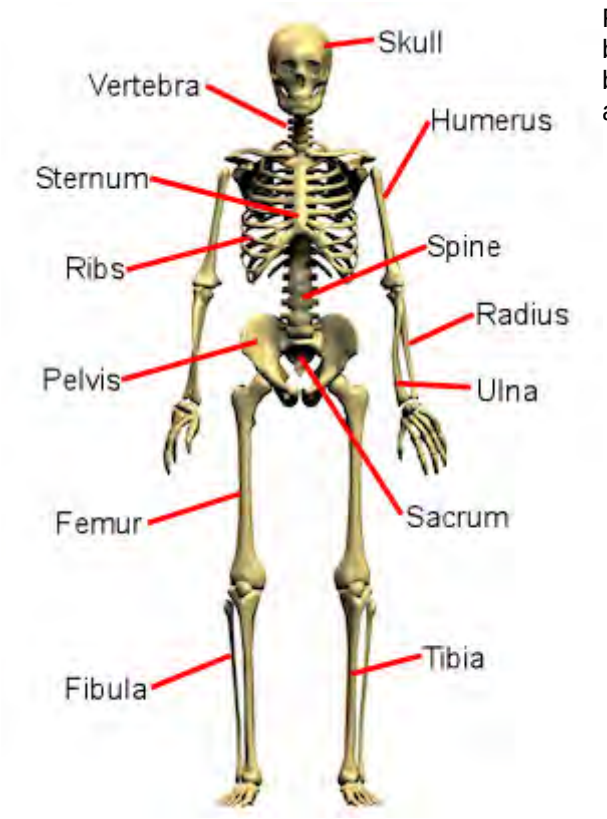
sagittal spine distortion A spine distortion which affects the left to right (lateral) alignment of the vertebrae. For example, a scoliosis of the spine.

sagittal tilt The angle at which the spine is tilted to one side during the set-up and the swing. The sagittal tilt should begin with a slight lean towards the back-swing side and finish, almost, vertical after the follow through.

scoliosis Lateral deviation of of spinal column (curvature of spine)

shoulder blades Two large flat bones of the shoulder on either side of the upper back connected to your arms and to which the humerus is articulated...the scapula.

skeleton / skeletal system



Framework of bones providing support for your body. There are approximately 206 bones in your body (depending on what is included in the count as some bones are grouped).

Skinny (hitting) To strike the ball above its centre causing it to skip and bounce along the ground rather than rise through the air.

slice / slicing To induce too much backspin onto the ball causing it to travel through the air following inside to out swing and is the opposite to hooking.

Smith Machine

Apparatus with a bar fixed to the side supports and can only move vertically up or down, therefore being of support when executing moves where your body weight is not centred. The weight is adjustable on the bar.

spinal curve *Definition 1:* Natural antero/ posterior curves of spine ie. kyphosis, lordosis... a spinal distortion

Definition 2: The correct angles of curvature for the three largest sections of the spine are; Thoracic Spinal Curve (35 degrees), Lumbar Spinal Curve (40 degrees) and Sacral Spinal Curve (45 degrees). These curve angles refer to the coronal (front to back) plane of the body. Therefore,

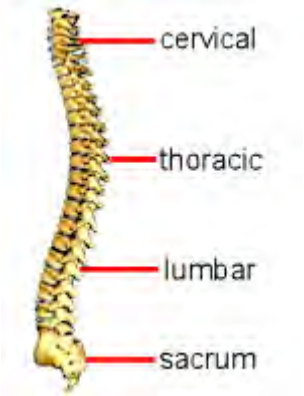
distortions in either of these spinal curves can be referred to as 'Coronal Spine Distortions'.

In the sagittal plane (from right to left) the spine should be perfectly vertical. Any variation from this can be called a 'Sagittal Spine Distortion' (e.g. a scoliosis).

Either Coronal or a Sagittal Spine Distortions can cause changes in the body's centre of gravity and can lead to 'posture distortions'. Spine distortions may be due to faults in the spine itself, or to misalignments in any of the structures which support the spine - the feet, the pelvis or the sacrum. They may also be caused by imbalances in any of the muscles which support these structures.

spinal scoliotic curve Lateral curvature of spine which is not natural

spine



A series of between 31 and 34 (varies with method of counting) bones (called vertebrae) - separated by inter-vertebral discs - which provide the central supporting structure for the body. It forms the spinal canal which carries the spinal cord, the major connection in the body's neurological system. The spine is divided into 3 sections: cervical, thoracic, and lumbar (lower back).

spine angle

The optimum positioning of your spine in your golf posture that will enable an optimum and accurate golf swing. In an optimum swing the angle of the spine remains constant throughout the swing until the follow-through. Deviations from the optimum spine angle will cause a swing fault. The correct posture should have a spine angle of 30 degrees.

stability The tendency for an object to keep traveling in the same direction - or along the same line.

strain *Strain (mechanics):* the deformation of materials caused by stress induced by applied forces.

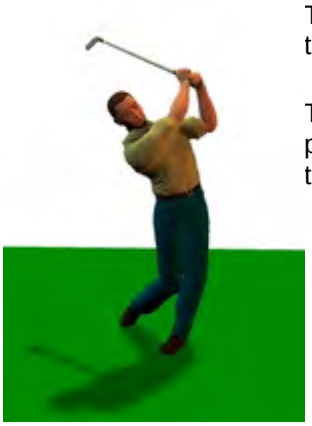
Strain (injury):, an injury to a muscle in which the muscle fibers tear as a result of over stretching

stress *Physical stress:* A force that produces strain on a physical body.

Stress in Physics: Stress is a measure of the average amount of force exerted per unit area. It is a measure of the intensity of the total internal forces acting within a body across imaginary internal surfaces, as a reaction to external applied forces and body forces.

supinated position Applied to the hand, the act of turning the palm forward (anteriorly) or upward, performed by lateral rotation of the forearm. Applied to the foot, it generally implies movements resulting in raising of the medial margin of the foot, hence of the longitudinal arch.

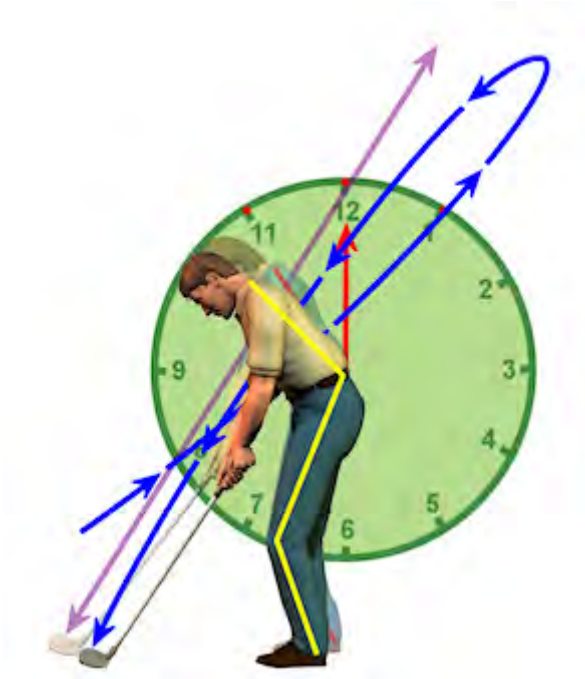
Swing



The action of hitting the golf ball with the golf club which includes the takeaway, backswing, downswing, and follow through.

The perfect swing will have a swing arc that travels along the ideal swing plane that does not deviate from that swing plane and with a swing path travelling straight at the target.

swing arc



The swing arc is the arc the club head travels along during a golf swing. A **swing path** is dictated by **the arc** the clubhead follows during a golf swing! The arc starts in the takeaway and works around the body until the clubhead reaches the top of the swing. As the club head works back down to the ball toward the target the club 'should' follow the same arc down. When the bottom of the arc reaches the impact zone the arc dictates what path the club will follow.

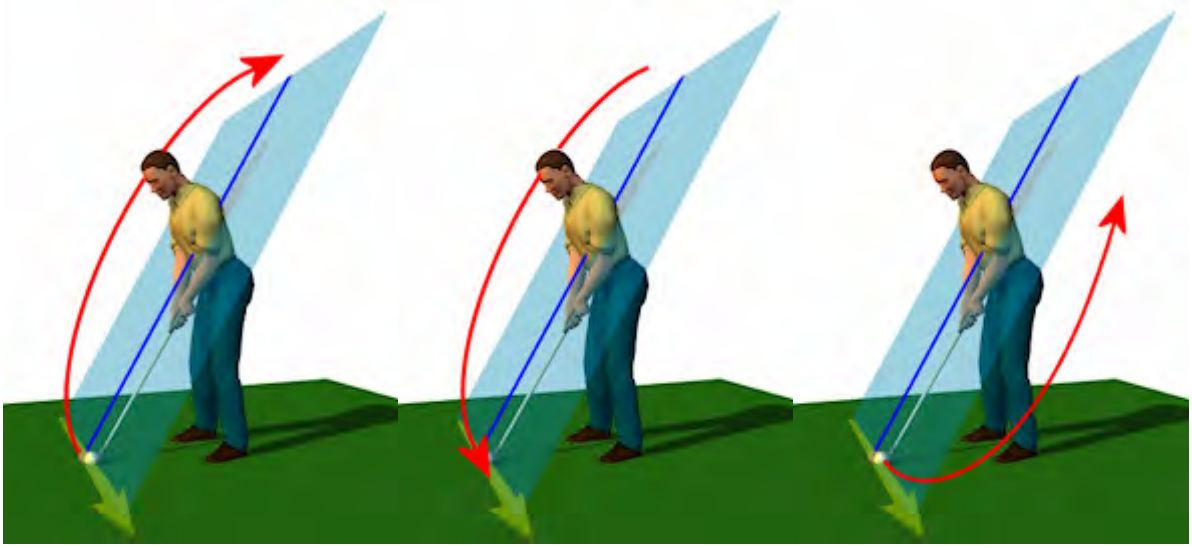
This diagram illustrates both the incorrect and incorrect swing arc. The incorrect swing arc is indicated by the **blue line with arrows** (that deviates in and/or out of the swing plane), and the faded golfer (dressed in blue) with the **purple line with arrows** shows the correct swing arc travelling along the correct swing plane.

swing path The direction the clubhead is moving towards the target in the impact zone during a golf swing. When the bottom of the swing arc of the downswing reaches the impact zone the arc dictates what path the club will follow. The swing path at impact can be either travelling **right**, **left** or **straight** at the target.

Swing paths that move too far left 'or' right of the target line are considered to be caused by faults in posture, set-up or the swing motion.

See the diagram below in "swing plane."

swing plane A swing plane is the angle that the shaft of the club travels around the body during a golf swing.



Take-away ***Down-swing*** ***Follow-through***

The above 3D illustrations show the **swing plane in blue shading and blue line** and the **swing arc in red**. The yellow arrow indicates the swing path pointing towards the target.

swiss ball

symmetrical When the shape of an object is exactly the same on both sides of its mid-line.

T

tendon A cord or band of inelastic tissue connecting a muscle with its bony attachment.

thermo-band

Approximately 1 metre length of elastic band that can be stretched to give extra resistance in exercises and stretches.

thin (hitting) To strike the ball above it's centre causing it to skip and bounce along the ground rather than rise through the air.

thoracic spine Upper back area behind the chest. The section of the spine between the cervical spine and the lumbar spine. It comprises 12 vertebrae named T1 to T12, from top to bottom.

thorax /thoracic	Region of torso above abdomen and beneath shoulders, most easily visualised by the ribs...chest area
torso	Trunk area of the body...between neck and pelvis
trajectory	The angle at which a projectile has been launched. Usually the most effective trajectory for a projectile, to gain the greatest distance, is 45 degrees.
transverse plane	The imaginary plane which divides the body into two halves - front and back (anterior and posterior).
trapezius	Muscles from back of neck and shoulders spreading to the mid back area in the thoracic spine area.
trunk	Area of the body consisting of the thorax, abdomen and pelvis.

U

V

velocity	The speed of an object - usually measured in metres per second for scientific studies.

W

X

Y

Z

SOURCES AND REFERENCES

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