

Injuries in Golf

Kristinn Heinrichs PhD, Med, BSPT

TITLE SLIDE:

Good afternoon ladies and gentlemen. I would like to take this opportunity to thank the Kinesio Taping Association for the kind invitation to be with you today and for the hard work that has been done on our behalf in organizing this symposium in every detail. Thank you very much for your kind hospitality. I am very much looking forward to the exchange of good ideas for both clinical practice and research. These first pictures are of Savannah Georgia, where I make my home along the southeastern coast of the United States. The golf swing one of the most complex to correctly analyze, particularly with regard to the cause of many golf injuries. The topic is far too broad to discuss the injury mechanism, management, and analysis of all the injuries in this short talk. Today I would like to show you how three dimensional (I will refer to this as “3D”) motion analysis can be used to detect the underlying biomechanical problem in the golf swing that contributes to wrist injuries in the golfer. This kinematic analysis method is used to understand characteristics of movement including static and dynamic joint position, movement direction, amount and type of movement, kinematic sequence, velocity, and acceleration. A discussion of the forces acting on the body, the kinetics of motion, is beyond the focus of today’s presentation. 3D motion analysis can be a very powerful clinical and research tool in documenting the effects of Kinesiotape. In the case of golf and other sports, 3D analysis is used to analyze a sport movement to correct the cause of an injury, prevent it from occurring in the first place, and most importantly improving performance.

SLIDE: GOLF INJURIES AND BLACK MULTIPLE:

Wrist injuries, especially stenosing tenosynovitis (DeQuervain’s Disease) occur frequently in golfers. These injuries are often caused by faulty golf swing mechanics which can be clearly seen on 3D motion analysis. I will also show you how other subtle factors contribute to stenosing tenosynovitis in golfers. Although the Kinesiotaping application for DeQuervain’s Disease is not difficult, the abnormal swing mechanics, musculoskeletal dysfunction, and faulty motor patterns must be corrected in order to

solve the problem. Successful management of injuries, prevention, and performance enhancement are all based on a comprehensive evaluation, including physical examination, golf-specific functional performance evaluation, 2D and 3D motion analysis, and dynamic force plate analysis of balance.

SLIDE: 3-D MOTION ANALYSIS RESEARCH AND CLINICAL PRACTICE

I know many of you do not work in a sport environment. The effects of Kinesio Taping on motion can be easily and objectively measured using 3D technology. In addition to sports such as golf and baseball batting and pitching, for which we already have databases of normative values, “Real time” 3D data can be used to quantify movement characteristics following work injuries such as this firefighter, spine injuries, gait analysis, and movement as shown by this image of the lower limb and pelvis relationship during walking. These graphs of good and poor kinematic sequence (also known as the kinetic link) for baseball batting provide the sports scientist, coach, or sports health care professional with information that is invisible on video analysis.

SLIDE OUTDOOR SET UP:

This picture shows the motion analysis set up to analyze the golf swing. The SkillTech system consists of a four sensor Polhemus FastTrack System. The arrows show the location of the four motion sensors placed on the forehead, 2nd to 3rd thoracic vertebra, sacrum, and the proximal shaft of a graphite club or the dorsum (back) of the left hand. The subject stands with his heels against the white line. The electromagnetic field covers approximately 2 square meters. The transmitter is visible behind the athlete. You can ignore the globe to the right as we no longer use it in today’s data collection methods. Before the athlete assumes the starting “address” position, the system is calibrated with him in a relaxed standing position so the transmitter will know the exact orientation of the sensors space.

SLIDE SENSOR LOCATIONS:

The sensors detect motion in any direction along the red x, green y, and blue z axes once the four sensors are calibrated to the transmitter. The eight locations shown on the skeleton are used in the full body and research systems. The data collected is analyzed and the motion is shown in “real time” using artificial intelligence. The first image shows the body from the front and you can see the position of the axes in the address position. Now you see the address position from a side view showing the orientation of the four sensors. This image shows you the top of the backsweing, just

before reversing the motion into the downswing. The final view is from the top, looking down, just impact and at the beginning of the follow-through.

SLIDE: CLUB PATH OVERLAYS

Here is an example of the multiple overlay mode of a novice, or inexperienced, golfer on the left and an expert golfer on the right. The red, green, and blue lines trace the motion path in the multiple overlay image. Let's compare the qualitative differences between these two people. The inexperienced golfer demonstrates more side to side movement of the head and a greater excursion of the club while the head of the experienced golfer remains relatively stationary.

SLIDE KINEMATIC SEQUENCE EXPERT

The kinematic sequence graph is very important because it gives us an idea of how the rotational speed of the body is transferred from the pelvis (shown by the red line) to the upper torso (green line) to the wrist and hands (blue line) and finally to the club (the yellow line). The "A" on the left side of the graph represents the "address" position. Between A and T is the time for the backswing. "T" represents the top of the backswing where all the lines return to zero for an instant. In an expert you can see that the pelvis and hips are the first to rotate with a sharp rate of increase. The velocities of the other segments are also increasing during this time. When the pelvis reaches its peak velocity, the energy is transferred to the upper torso, which, in turn, transfers the peak velocity to the wrist and hands. In order for the proper sequencing to occur, each segment must slow down immediately after it peaks. Ideally, peak club head velocity should occur at the time of impact, shown by the "I". An analogy to demonstrate this is the towel snap. The followthrough occurs from "I" to "F".

SLIDE KINEMATIC SEQUENCE NOVICE

This graph represents the kinematic sequence of a novice, or inexperienced golfer. You can see that the timing sequence is "out of synch" and there is no definite transfer of energy between the pelvis and the upper torso. Peak pelvis velocity occurs after impact. The upper torso and wrist/hand velocities appear to peak at the same time, suggesting that this golfer is using the upper body to generate all the speed. The club head velocity steadily increases to peak near the point of ball impact. The segments don't decelerate as quickly or as smoothly as in the expert golfer. This is similar to snapping a towel with a "wimpy" wrist. Poor core strength of the pelvis and torso is often responsible for this type of kinematic sequence. The pelvis is unable to act as a

stable base for the rest of the body. This is similar to attempting to stand upright on a boat in rough seas: there is no stable base for the rest of the movement to occur. At this moment you are wondering why this is important for the wrist injury I promised I would talk about. Improper timing, as evidenced by the kinematic sequence, is one causative factor for wrist injuries. The next factor is the “wrist set”.

SLIDE EXPERT 3 FIGURES

The wrist set refers to the angle between the club shaft and a line drawn from the shoulder to the wrist/hand. The effect of the wrist set in golf to increase club head velocity at impact to make the ball travel faster and further is exactly the same as the wrist snap that occurs when a person cracks a whip. The wrist is maintained in its position and then released suddenly to generate a rapid increase in angular velocity. You can see that the angle between the club shaft and the arm at horizontal is less than 90° . Let's see what a graph of this will look like.

SLIDE EXPERT WRIST SET

This graph shows the wrist set angle of an expert player vs. time. Between the top of the back swing and impact is the area of interest. Notice how the curve is flat for more than half of the down swing. The wrist angle then decreases slightly and rises rapidly to impact. The sharp rise indicates a sudden, aggressive release of the wrist angle. This is known as the wrist snap and results in a very high club head speed at impact with the golf ball.

SLIDE NOVICE 3 FIGURES

Rather than “cracking the whip”, the novice is “waving a wet noodle” or “casting the club” as if casting a fishing line. The novice shows a much larger angle compared to the expert golfer when the arm is parallel and “open up” early in the downswing.

SLIDE: NOVICE WRIST SET

The novice golfer often does not demonstrate the rapid release of the wrist set. The wrist angle begins opening immediately from the top of the downswing and continues to open until impact. You can see this as the novice curve increases steadily from the top of the back swing until impact. No flat spot followed by a sharp rise is seen as with the expert. The novice is “casting” the club from the beginning of the down swing and will not generate much power.

SLIDE CASTING THE CLUB “GONE FISHING”

When a golfer “casts” the club as if casting a fishing line, they may also complain of these problems with their golf swing: slice to the right, pull left, over-the-top, or elbow and wrist pain. In addition to torso and pelvic stability problems (which are beyond today’s discussion), the golfer has an outside-in swing path visible on the 3-D motion analysis — I’ll show you this in the next set of pictures. The angle between the left arm and the club shaft should be less than 90° , and should decrease early in the downswing. Casting occurs when this angle increases early in the downswing. The club head is released too soon and causes a decrease in the angular velocity of the club. If you consider the graphs I showed you earlier, you can visualize this decrease in angular velocity at impact. Although wrist problems may occur with this swing fault, the problem is NOT ONLY with the wrist, but also with an unstable lower body. Both problems must be corrected.

SLIDE SWING FAULTS RELATED TO CASTING

In this picture, the golfer’s hand comes down over the plane that it went up in. The black and green arrows show this “over the top” swing fault. This illustrates the path of the club as it travels from the outside to the inside — you can see this path along the top of the curve. The ball will not go straight when it is hit! In this case, the ball will go to the left in a “pull” because the club made ball contact with a closed (or even straight) face.

SLIDE HAND AND KINESIOTAPE APPLICATION

Wrist injuries, particularly stenosing tenosynovitis of the extensor pollicis brevis and abductor pollicis longus, occur because of the “too much” syndrome: too much practice, too much play. The second cause of tenosynovitis is due to the poor mechanics and the chronic ulnar deviation as seen in the “casting” swing fault. The left wrist should also remain in neutral through the backswing and impact but often goes into extension or flexion. Overuse combined with faulty biomechanics cause the tensile overload on the extensor pollicis brevis and the abductor pollicis longus. A final cause of wrist and hand pain is the “death grip” that golfers use to compensate for losing the grip at the top of the backswing. This picture shows the anatomical structures involved in stenosing tenosynovitis and the orthopedic surgeon’s solution to the problem. A more conservative treatment approach is the DeQuervain’s Kinesiotape application shown here. The tape starts at the IP joint with the thumb extended and abducted. Direct the tape toward the lateral epicondyle while the patient flexes the wrist and

adducts and flexes the thumb. The central portion of the x piece is slightly stretched as it is laid down at the base of the wrist. Successful treatment of the problem also includes applied kinesiology methods, soft tissue/scar tissue release techniques, flexibility, eccentric strengthening, core stabilization, and correction of the faulty motor pattern.

SLIDE CONCLUDING PHOTOGRAPHS

In today's example of 3D motion analysis of the causes of wrist injuries in golf you can see the enormous amount of information available for correct interpretation. It is important to combine the data obtained by physical examination, video analysis, functional performance testing, and 3 dimensional motion analysis into a complete picture of the golfer. For those of you in clinical practice and research, I hope I have given you some ideas to measure the results of Kinesiotaping. This is a picture of the port of Savannah. On another trip to Japan I saw this statue of the little girl with the red shoes in the harbor of Yokohama. In Savannah we have the waving girl to greet every ship and visitor that arrives in our port city. I leave you with another image of the marshes of Cumberland Island off the coast of Georgia. Thank you very much for your kind attention. I would be happy to answer any questions you might have.