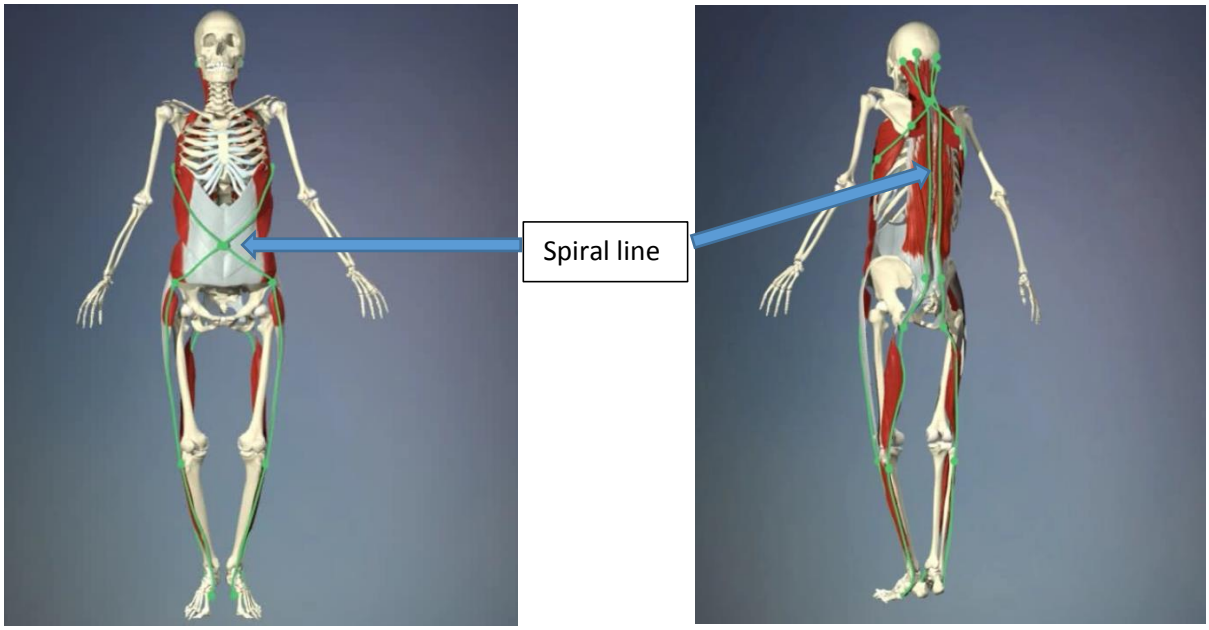
The role of stretch shortening cycles in golf.

Recently we discussed the role of the movement at the start of the downswing some refer to as 'X Factor stretch (XFS)'. In the short review, we discussed how this move can be helpful for some and of minimal influence and occasionally of harm to others due to influences such as the player's anatomy, physiology, neural patterns and swing concepts. These constraints will essentially help determine the players ability to create this move however as previously discussed, the value of this move in isolation is questionable as a substantial amount of players have been observed that produce significant driving distance with negligible amounts of XFS. Only recently I was fortunate enough to test a world long drive champion, throughout the session the maximum XFS they produced at any time was 0.4° and he manages to do ok!

XFS as it is referred to by some is an example of a stretch shortening cycle. The easy and short definition of a stretch shortening cycle is when a muscle eccentrically lengthens before concentrically shortening. This 'elastic recoil' is what helps produce increased muscular force which ultimately correlates to the ability to produce club head speed. However this description as it is, would be at best misleading as muscles do not work in isolation for multiple reasons, one such reason being the connective tissue called fascia which muscles live in and help connect them all together to form a global myofascial web. Therefore, it may be a more accurate definition to describe the myofascial system as the body having one muscle which is divided into 642 separate pockets due to this fascial network, also when discussing anatomical function, a more precise understanding of movement is to see most movements that the human makes as a global move as 'everything connects to everything' therefore 'everything effects everything'. There are multiple fascial connections that run and exist throughout the entire human body, both superficially and also deep between areas such as muscle septums. A way of understanding fascia is a little like an orange, when you peal back the skin, you have the white piff that holds the segments together, however when you take a segment away, you will also observe the piff lays deep inside the segment helping to connect it all together. Fascia is like the piff. One of the connections that runs through the body is the deep spiral line (www.anatomytrains.com), this runs from the ankle, up the leg, across the front of the pelvis, wraps around the back of the ribcage, across the scapula and attaches into the skull. In the image below, you can trace the spiral line (green line) and follow this fascial connection which is indeed a global chain that connects ankle, through knee, pelvis, posterior section of ribcage, scapula and back on the skull in the images below.



Images courtesy of www.anatomytrains.com.

Therefore is it not a muscle stretch that we create, however a muscle and fascial stretch – myofascial.

Relating this to the XFS, this explores and describes the activity that occurs across the pelvis and ribcage, however to achieve this the human has to create a global stretch shortening cycle across the entire deep spiral line making it a global movement across almost every segment. Whilst the XFS is describing the interaction between pelvis and ribcage, it is a little misleading and only provides a small understanding as to create this movement this entire deep spiral connection goes through this lengthening and contraction which produces the elastic recoil, in short to produce separation across the pelvis and ribcage, significant activity much happen across all the segments that the deep spiral line crosses, therefore perhaps a more accurate definition is not XFS, but a spiral line stretch/recoil? With this in mind, to produce separation/stretch across the pelvis and ribcage many considerations need to be acknowledged when attempting to achieve this, not just the soft tissue influence that we are describing in this short review. However, the deep spiral line is one of many fascial connections that exist across the human structure. Another connection of great influence is the arm line that attaches from little finger to little finger via the scapula and back of the ribcage which through the information we now have available within the 3D data, we are now able to explore and examine the levels of elastic recoil, activity and ranges being produced across the thorax and lead arm and lead arm and lead hand. This is helping us understand how players move the segments and how they interact to produce force alongside what amount segments contribute to create elastic recoil in the golf swing. In short, XFS happens across most segments, not just the pelvis and ribcage.

The arm line, this connects little finger to little finger creating a stretch/recoil across both arms and scapula during many movements that had hands and arms make.

Images courtesy of www.anatomytrains.com.

Additionally, what is vital in helping understand the value of elastic recoil in golf is not just the amount of separation/stretch that occurs across the segments but also the speed the elastic stretch occurs at along with the rate of recoil then produced. In the samples below of short and long hitters, what is being observed now through the 3D data is a clearer correlation as to what influences driving distance and force production – it's not necessarily the amount of separation and stretch that happens across the segments however it is the rate that the myofascial connections lengthen at and then recoil at. Being able to produce high levels of elastic recoil is ultimately what correlates to the players ability to produce maximum speed and force at the distal end, which in the case of golf at is the club head.

So when exploring the XFS, it would be more accurate to describe this pattern not as a pelvic-thorax separation/stretch but a global separation/stretch as to create the stretch across the pelvis-thorax requires activity throughout the entire fascial connections. Historically, what this provided us with was an understanding of what activity was happening across a very small section of the deep spiral line which for many created confusion as to why they achieve significant distance without displaying high values of XFS and when they attempted to increase this, it often came at huge cost and disruption elsewhere.

Lets look at what activity exists across the segments and joints we can now explore along with the peak stretch and peak recoil speeds being produced.

Below is a sample of a long hitter and short hitter of similar height, weight and anatomical frames. They have very different current anatomical abilities, however for point of comparable the two subjects displayed similar overt frames.

Short hitter

PT peak stretch
Pelvis Thorax Stretch: 0.0 d/s
PT peak recoil
Pelvis Thorax Recoil: 59.9 d/s
TA peak stretch
Thorax Lead Arm Stretch: -0.2 d/s
TA peak recoil
Thorax Lead Arm Recoil: 261.7 d/s
AH peak stretch
Arm Hand Stretch: 0.0 d/s
AH peak recoil
Arm Hand Recoil: 294.0 d/s

Long hitter

PT peak stretch
Pelvis Thorax Stretch: -37.1 d/s
PT peak recoil
Pelvis Thorax Recoil: 163.2 d/s
TA peak stretch
Thorax Lead Arm Stretch: -40.2 d/s
TA peak recoil
Thorax Lead Arm Recoil: 338.2 d/s
AH peak stretch
Arm Hand Stretch: -74.8 d/s
AH peak recoil
Arm Hand Recoil: 491.9 d/s

PT – pelvis thorax, TA – thorax lead arm, AH – lead arm and lead hand. d/s- degrees per second.
You will note that the stretch values are preceded by a – symbol, this defines the direction the stretch is occurring in.

From this we can clearly see that the longer hitter has significantly higher levels of elastic recoil which is reflected by the greater segment stretch and recoil values. Each segment has a faster peak stretch and recoil which reflects substantially more elastic recoil therefore producing more myofascial force.
In the data below, the most influential value is the stretch being achieved. You will note that significant more stretch is being achieved across the thorax/lead arm and lead arm/hand in the long hitter, although similar values are being produced through pelvis and thorax. However, clearly for some high amounts of pelvis/thorax stretch has huge influence and of clear evident gain, however the purpose of this review is to discuss and highlight that these stretch shortening cycles occurs across most joints in the human structure, however understanding which ones are of most benefit and influence to the individual is surely a greater priority than having everyone attempt to achieve the same move?

Short hitter

Pelvis-Thorax Separation
Pelvis-thorax top: 41.4 deg
Pelvis-thorax max: 41.5 deg
Pelvis-thorax stretch: 0.0 deg
Thorax-lead arm Separation
Thorax-lead arm top: 53.6 deg
Thorax-lead arm stretch: 3.5 deg
Lead arm-lead hand Separation
Lead arm-lead hand top: 82.2 deg
Lead arm-lead hand stretch: 6.2 deg

Long hitter

Pelvis-Thorax Separation
Pelvis-thorax top: 57.4 deg
Pelvis-thorax max: 58.6 deg
Pelvis-thorax stretch: 1.3 deg
Thorax-lead arm Separation
Thorax-lead arm top: 60.7 deg
Thorax-lead arm stretch: 17.7 deg
Lead arm-lead hand Separation
Lead arm-lead hand top: 100.5 deg
Lead arm-lead hand stretch: 13.2 deg

Ok, so how can we best achieve this and improve elastic recoil in golf?

Considerations…

1. How we train – avoid, repetitive mechanical movements (unless there is a clear objective being achieved), humans are problem solvers who move through continual changing planes and directions in response to the ever adapting task and environment. One of my favourite movers on the planets are snakes, the continual multi directional movement, the smoothness of how they glide and when necessary, the explosiveness of movement is staggering. A real definition of elastic recoil. There's not a great deal they can't do, apart from fly! When describing how the spine moves in the golf swing, I occasionally use the way snakes move as a reference, scale by scale, in essence this is how the spine rotates when it moves well in golf, vertebrae by vertebrae through cervical and thoracic spine, into the hip joints fully lengthening and loading the myofascial lines that cross over it. A question for you whilst reading this, in your own understanding define good movement?

2. Start position and backswing. How we stand at set up and the way we move and organise and match up the segments through the backswing will help lengthen the myofascial connections and place joints in positions where they have the most anatomical options available. Along with pain avoidance, club delivery is possibly the most important objective in the golf swing however understanding the anatomical influences as to what helps increase club head speed needs to be acknowledged therefore the start position and backswing is crucial for many in placing the segments and tissues they can optimally move and work from. In short, how the player achieves the movements is crucial in helping obtain gains and avoiding things ever becoming a problem.

3. Muscle stiffness and mobile joints. Often the word we use can create the problem as when a word is used we use retrospective interpretation to best understand it. For example, stiffness. There are many ways of defining the word stiff, in golf and in particular when discussing elastic recoil, muscle stiffness is a good thing. The more stiffness in the muscles, the more we increase the recoil ability and property of the muscle. Therefore once a force is applied to the muscle to make it lengthen, when we 'let go' the muscle has significant energy stored within which helps create high levels of recoil. Use an elastic band as an example, if you take a strong rubber band vs. a thin/light band and stretch them a similar length and let go, which one will recoil with more force and energy? What we are trying to produce is a viscoelastic myofascial system that when deformed, it has the properties to quickly and explosively return to its resting position. However in golf, stiffness is often seen as a bad thing, therefore what we need to help create elastic recoil is stiff muscles and mobile joints (many people have a reduction in muscle stiffness and stiff joints, this is not ideal!). The more the joints can move and the more we can load the muscles then the more advantageous in producing elastic recoil.

4. Neural signals. When working with players it becomes evident that the signals the brain is sending the system is vital in helping maximise their ability to produce elastic recoil. In short, often what we are attempting to do in golf is actually what is creating the problem. Having precise, well defined non-contaminated concepts with clear intellect behind them can only help in allowing segments and the myofascial connections to move well and be loaded correctly to allow for maximum levels of elastic recoil. The neuromuscular connection is crucial in helping improve movement through the use of task, concept and motor pattern.

The world of myofascial connections is an extremely deep and involved subject that needs thorough investigation and understanding before any attempt to describe is accurately. What is evident is every player is different and has their own unique set of movement strategies and anatomical constraints. It would be unadvisable and not helpful to employ the approach that 'to achieve distance you have to do this' and 'this is what all long hitter's do' This type of strategy and tactic, in short the pied piper effect can help some but often harm and create much disruption around many. Responsible development of players and helping them achieve gains in areas such as driving distance must be taken as a case study of one approach as perhaps the most important consideration that we sometimes forget is in front of us is a human being, and at what point did this not become the most important factor?

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