

THE STRETCH SHORTENING CYCLE IN THROWING AND STRIKING SPORTS.

By Leith Darkin.

(FEB 2002)

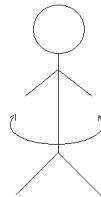
While looking at improving technique and optimizing power in my own sports (kickboxing & boxing) I was faced with the problem of finding literature related to the various kicks and punches used in these sports. As the desired outcome for a fighter in these sports is either a kick knockout or a punch knockout I'm sure you can appreciate how important it is to a fighter to maximize their power potential which in turn will help them excel in their sport. Over the years I'd collected various articles and books on plyometrics, although they were a good read, they were all lower body specific (jumping and sprinting). Around 18 months ago I brought Ian Kings book and three video set "Understanding Plyometrics", although they were mainly jumping and sprinting specific they were presented in a way which changed my way of thinking on Plyometrics, In particular a passage on page 5 "Perhaps the most important aspect of this book about plyometric training is the presentation of plyometrics as an integral part of almost all training movements."

I started looking at the various techniques and movement patterns used in other throwing and striking sports (striking being either with an implement such as a bat or racket etc or striking with a punch or a kick). I was hoping that there might be certain patterns of movement and techniques used to optimize maximum or near maximum power which were similar or the same as the movement patterns and techniques I used and taught. By looking at different techniques used in other throwing or striking sports where max power or near max power was the objective and comparing them to the techniques and movement patterns I taught to maximize kicking and punching power I was hoping to either reassure my self that what I was teaching was correct and or modifying technique where possible to improve power output.

While looking at movement patterns and techniques used to maximize power in my sports and other throwing and striking sports I observed three main variations of the use of the Stretch Shortening Cycle.

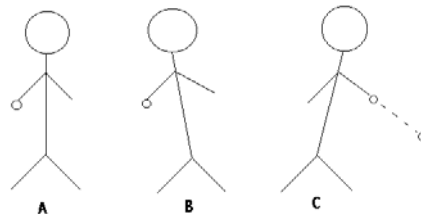
1) The SSC in trunk movement.

1A) Trunk rotation.



Eg. Right-handed tennis player hitting powerful forehand. Athlete withdraws racket and at the same time rotates concentrically (Left ext oblique, Right int oblique) minimal pause then second concentric contraction of (Right ext oblique, Left int oblique) as the athlete strikes the ball.

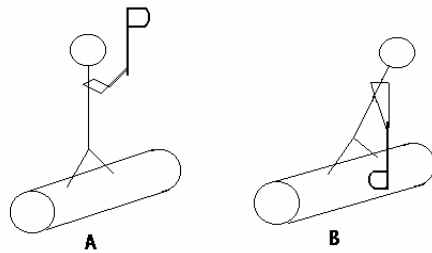
1B) Trunk lateral flexion/extension.



Eg. fast bowler cricket. As bowler approaches the crease their trunk will eccentrically flex laterally B) then with minimal pause will concentrically flex laterally C).

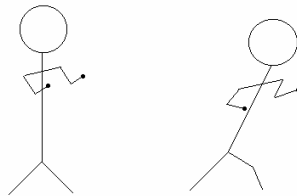
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1C) Trunk flexion/extension.

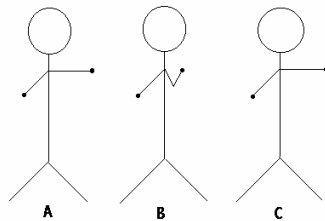


Eg. Wood chopping event. Axe man lifts axe over head (concentric, trunk extensors A) then from over head drives axe into chopping block (concentric, trunk flexors B).

- 2) When looking at generating maximal power, often an athlete will lead with their body just before release/impact (as if to hold the throwing/striking limb back temporarily), which in turn puts the throwing/striking limb under a pre stretch, giving a sling shot effect.



- 3) When an athletes throwing/striking limb follows the same path through both contractions using opposing muscle groups.



Eg. A boxer concentrically withdraws his striking limb A) to B) then with minimal pause using the opposing muscles will strike concentrically B) to C)

When looking at throwing and striking sports you'll find that most sports involve at least one of the above methods for generating max power.

Eg. Hammer thrower will generate velocity (speed of movement) through rotation around an axis with a long lever, then just before release of the hammer he will lead with his body to put the throwing limbs under a pre-stretch which will result in a sling shot effect. (Example2)

Often in throwing and striking sports you find a combination of two of the above methods.

Eg. Fast bowler cricket, as well as the power generated from the eccentric/concentric contraction of the trunk, (example 1B) the bowler will then use that power to explosively lead with their body and put their bowling arm under an even greater pre stretch pre stretch (Example2).

Another good example of a combination of two of the above methods to generate a greater pre stretch is a baseball pitch.

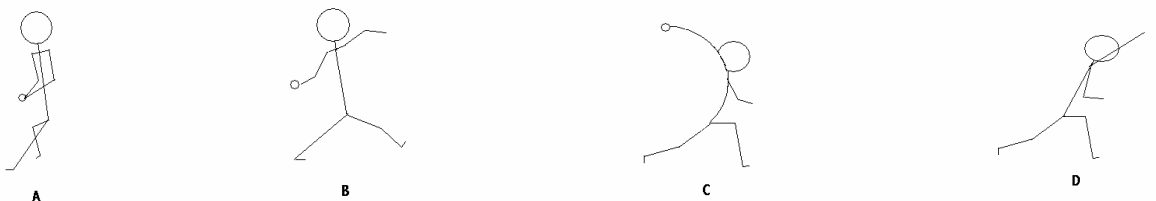


Figure A) is the starting position of the pitch. Here our body weight is over our rear leg (right leg) and our pitching arm has begun its wind up.

In figure B) our body starts to accelerate forward. Note in figure B) the ball is still positioned directly over the right foot as in figure A)

In figure C) our throwing arm is fully externally rotated which in turn puts our internal rotators under a pre stretch (SSC) our pre stretch is brought about by a contraction from our external rotators (Figure 3) and our body accelerating forwards while our throwing arm is held back (Figure 2)

Figure D) is the release of the ball.

You'll find that there are many variations and combinations of the above examples of the SSC in throwing and striking sports. (in particular 1A, 1B & 1C)

Eg. 1C) could be reversed if the desired out come was to throw an object over head.

Eg. 1B) and 1C) could be combined. A tennis player serving could start their serve in a side on position and with some body rotation follow through in a front on position.

ESSETRIC/CONCENTRIC OR CONCENTRIC/CONCENTRIC

ESSETRIC/CONCENTRIC. "When an external force is used to set up a pre-stretch."

To date every thing I've read on the SSC (plyometrics) states rapid eccentric contraction, minimal pause or ground contact and an explosive concentric contraction. The main reason for this is because most SSC literature is about sprinting and jumping which means that the limbs used to generate power are in the vertical position resisting against a force (gravity) which sets up a pre-stretch.

Clap pushups are an example often used when discussing the SSC in the upper body drills, once again the limbs used to generate power (arms) are in the vertical position resisting an external force (gravity).

Medicine ball drills (when ball is thrown horizontally). When catching a medicine ball, we are decelerating an external force, which in turn sets up the pre stretch. (The force being the velocity generated by another person throwing the ball to us).

CONCENTRIC/CONCENTRIC. "When an athlete generates their own force to set up a pre-stretch from the opposing muscle groups."

Examples from above 1A, 1C & 3.

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ISSUES WHICH EFFECT THE SSC AND/OR POWER OUTPUT.

SPEED. When looking at maximizing power through use of the SCC it is important to address the sub qualities of power, being speed and strength.

When addressing speed we are looking at speed being speed of movement, in particular the speed of the first and second contraction.

- 1) **The speed of the first contraction which sets up the pre stretch.** The speed of the first contraction is important to initiate the pre stretch and carry over into the second contraction, the faster it is the more it contributes.
- 2) **Duration of pause between contractions.** The pause between contractions is directly related to power out put, the longer the pause the less power generated, the shorter the pause the greater the power generated.
- 3) **The speed of the second contraction (being the main action of the striking/throwing limb).** The faster the speed of the second contraction, the greater the power out put. The slower the speed, the greater the loss of elastic energy.

If velocity (speed of the throwing/striking limb) is increased and strength and technique are either maintained or improved then power increases.

STRENGTH. In particular specific strength to the core area, (looking at examples 1A, 1B and 1C, alot of power can be generated from the trunk). Specific strength of the throwing/striking limbs, in particular the strength of the muscles that are put under a pre stretch as these muscles are placed under incredible stresses and lack of strength and conditioning of these muscles could result in injury. Opposing muscle groups need to be strengthened as well as joint stabilizers. Leg strength is also important as the legs often set up the upper body motion.

If strength (specific strength) is increased and speed and technique are either maintained or improved then power increases.

ANGULAR MOTION. (Rotation around an axis) You'll find that in alot of throwing and striking sports there will be rotation around an axis to generate velocity, the axis usually being the trunk, shoulder joint, hip joint or the bodies centerline.

LENGTH OF THROWING/STRIKING LIMB. Although this is a genetic factor, a longer throwing/striking limb can generate more velocity.

TECHNIQUE. In particular technique that best suits an individual according to their own body mechanics.

FLEXABILITY Good flexibility usually means better technique, less chance of injury and in some cases can mean greater range of motion to generate velocity.

APPLYING ABOVE EXAMPLES TO BOXING AND KICKBOXING

When applying these variations of the SSC to punching and kicking we are specifically looking at power punching and power kicking as opposed to using these striking techniques to tag (score points), to keep distance and to set up other techniques.

As kickboxing and boxing are open chain sports, there can be problems when using some of these variations of the SSC literally. The problem being that the first contraction can telegraph your intentions to your opponent, which could be a real problem if your opponent is a good counter fighter. This problem can be over come by using various footwork, body movement and the use of other punches and kicks to conceal the first contraction.

SOME EXAMPLES OF THE SSC IN BOXING & KICKBOXING.

- 1) From an orthodox fighting stance we'll lead with a jab, the jab has in turn rotated our body which has set up a SSC for the right cross (eg. 1A).



2) From our fighting stance we'll lead with a jab which has in turn rotated the trunk and set up a SSC for a leg kick (eg. 1A).



3) From our fighting stance we'll lead with a jab and then recoil our left arm, which has set up a SSC for another jab (eg. 3).



4) From our fighting stance we'll lead with our body which in turn will set up a SSC for our right cross (eg. 2), the rotation of our body from our right cross has set up another SSC for a left body rip (eg. 1A).



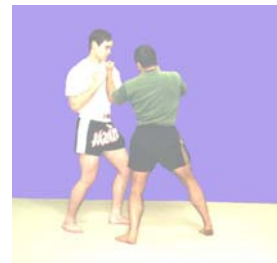
5) From our fighting stance we'll lead with our body which in turn will set up a SSC for our right cross (eg. 2), the rotation of our body from our right cross has set up another SSC for a left hook (eg. 1A).



6) From our fighting stance we'll lead with our body which in turn will set up a SSC for our right cross (eg. 2), the rotation of our body from our right cross has set up another SSC for an inside thigh kick (eg. 1A).



7) From our fighting stance we'll lead with our body which in turn will set up a SSC for our right cross (eg. 2), the rotation of our body from our right cross has set up another SSC for a left upper cut. Our SSC for our upper cut is a combination of (eg. 1A) and (eg. 1C done in reverse, flexion through to extension).

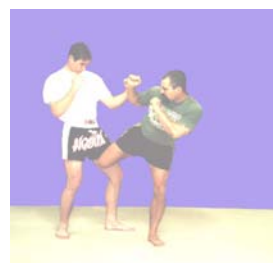
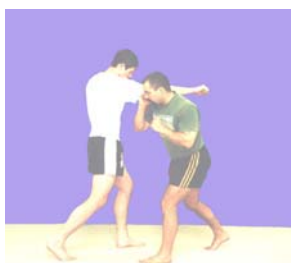
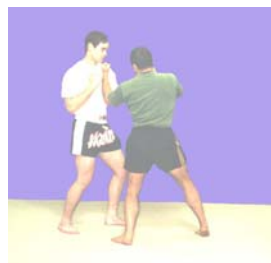
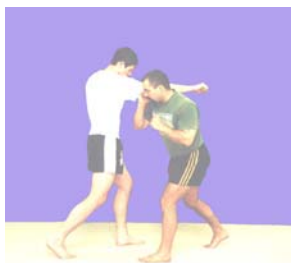
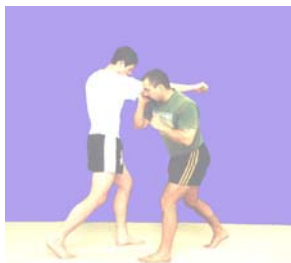
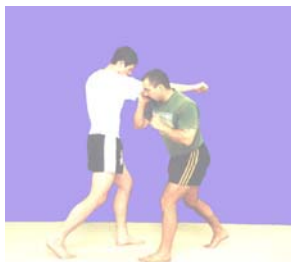


8) From our fighting stance we'll lead with our body which in turn will set up a SSC for our right cross (eg. 2), the rotation of our body from our right cross has set up another SSC for a left upper cut. Our left upper cut has in turn set up a SSC for a chopping leg kick (eg. 1C).



Examples 4 – 8 have the same body rotation (eg. 1A) as slipping a jab to the inside or as in the following photos slipping a cross to the outside.





9) From our fighting stance our opponent throws a jab and we slip to the outside, our body rotation when slipping the jab sets up a SSC for a right rip (eg.1A).



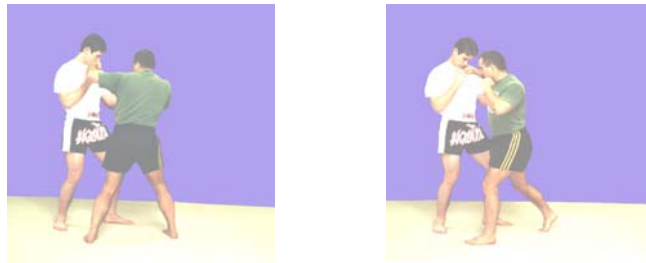
10) From our fighting stance our opponent throws a jab and we slip to the outside, our body rotation when slipping the jab sets up a SSC for a right hook (eg. 1A).



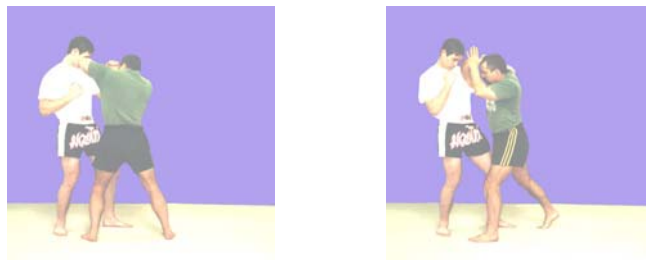
11) From our fighting stance our opponent throws a jab and we slip to the outside, our body rotation when slipping the jab sets up a SSC for a right upper cut. Our SSC for our uppercut is a combination of (eg. 1A) and (eg. 1C done in reverse, flexion through to extension).



12) When throwing a left hook our body rotation sets up a SSC for a right hook or vice versa (eg. 1A).



13) When throwing a left through elbow our body rotation sets up a SSC for a right through elbow or vice versa (eg. 1A).



14) When throwing a front kick, if we flex our trunk we set up a SSC that will allow us to extend our trunk and drive our hips forward (eg. 1C done in reverse)



15) When throwing a front knee, if we flex our trunk we set up a SSC that will allow us to extend our trunk and drive our hips forward (eg. 1C done in reverse).



REFERENCES

King.I. (1999) Understanding plyometrics.(book & 3 video set) QLD. King sports publishing.

