The Posterior Kinetic Chain

How it will help us crush our snowboarding goals while helping us bring ourselves, our students to the next level

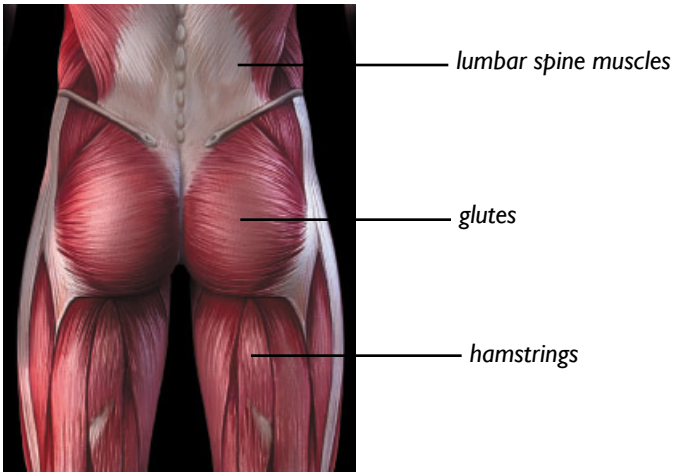
Biomechanics of the Posterior Kinetic Chain

The Posterior Kinetic Chain (PKC) is made up of the glutes, hamstrings, lumbar spine (lower back) muscles and calves. It's important to engage all of these muscles while manipulating your snowboard, because they link together to create tension and efficient movements on your board. These muscles work like a chain link fence or a charm bracelet. When a link of the chain breaks, the fence or bracelet no longer work properly. Therefore, when one muscle in the PKC is disengaged, the desired outcome turns out to be less than ideal. This article will cover the biomechanics of the PKC, weaknesses and deficiencies due to inefficient activation of the PKC, effective cues for movement analysis, and potential fixes to attain efficient movement patterns.

The Posterior Kinetic Chain Relating to Hip Flexion and Extension

The PKC, is biomechanically essential for ideal hip flexion and extension in snowboarding and applies to all snowsport athletes who aspire to make biomechanically efficient movements to manipulate their snow tools while on the mountain. When ideally activated, the PKC allows trainers, instructors and students to engage their larger muscle groups surrounding their hips to perform biomechanically efficient movements, reduce injury and understand what is happening when the entire PKC is not activated, or when there is a break in the chain.

The glutes are the most powerful muscles in the posterior chain. When the glutes are not effectively activated for hip flexion and extension, the hip flexors and hamstrings become overused and easily exhausted. Flexibility is hindered and extra stress is also placed upon the lower back. This overcompensation of the hip flexors, hamstrings and lower back stresses these muscles, which causes lower crossed syndrome.



This is a diagram of the PKC muscles that pertain to this article. The glutes, hamstrings, lunbar spine muscles and calves (not pictured are all essential to snowbaording and most effective when engaged together.

Deficiencies Surrounding the Hip Joint Due to Weakness in the Posterior Kinetic Chain

It is possible to snowboard at all levels without a properly engaged chain. However, movements become less efficient, and the muscles that support and surround the PKC must compensate to create the necessary movements to complete a task/skill. These compensating muscular movements create a deficiency known as lower crossed syndrome.

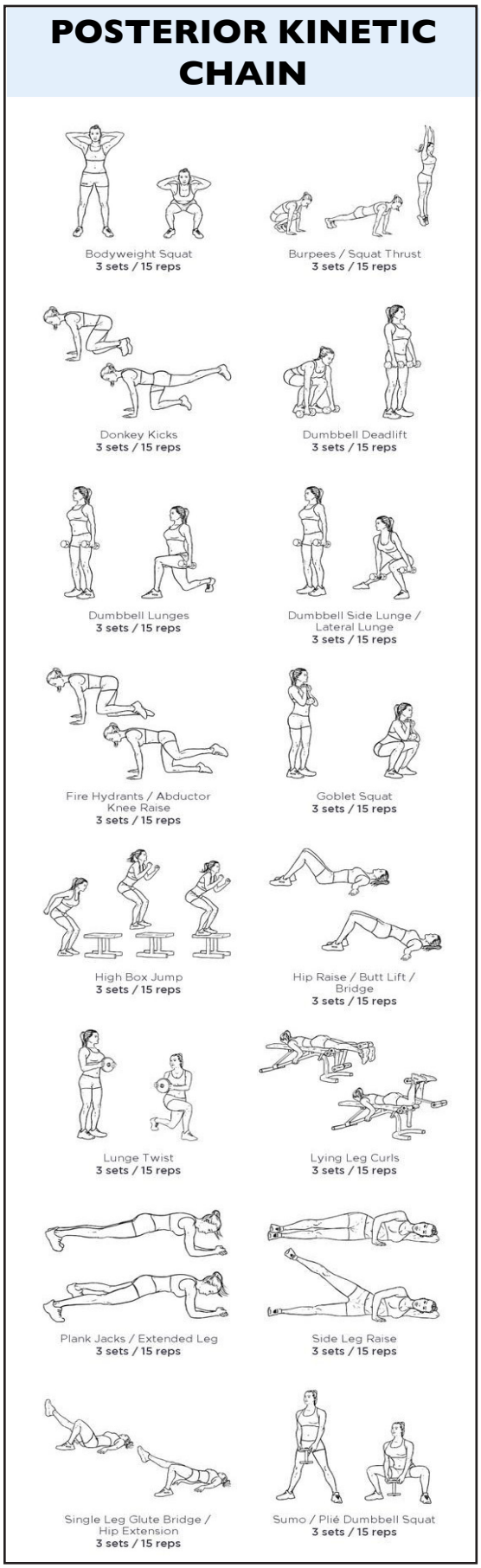
Lower crossed syndrome occurs when a person's hip flexors are overactive, which inhibits the glutes and places extra stress on the hip flexors, hamstrings and lower spine muscles. A person with lower crossed syndrome exhibits a more pronounced curvature of the lower spine and leads to an anteriorly tilted pelvis. Snowboarding with an anteriorly tilted pelvis is biomechanically inefficient and enforces a non-activation of the gluteal muscles, which puts the rider at a biomechanical disadvantage when preparing for the next turn.

Proper hip flexion and PKC activation through glute activation is imperative for the protection of the spine and lower back. These deficiencies due to weakness in the glutes can be corrected. Corrective exercises, including strengthening and conscious activation of the glutes lead to efficient movement patterns.

Corrective Exercises

It is possible to correct the muscular deficiencies created through PKC weakness in the glutes. Corrective exercises are best done off snow with focus on strengthening the glutes, hamstrings, abdominals and lower back muscles. Some exercises that strengthen these muscles are on the exercise plan chart to your right. These diagrams and brief descriptions are a good start in the right direction for snowboarders who want to strengthen their PKC.

Once these exercises are mastered, a person can feel the activation of their glutes and the other major muscles in their PKC (as well as other stabilizing muscles). This newly acquired ability to activate the glutes on command can be carried over to snowboarding.



Cues for Movement Analysis for PKC Weakness in Snowboarding

In snowboarding, if a rider has a weak PKC, it is visible at all levels.

A **first timer** may be bent over at the waist (moving their hips towards their heel edge) while side slipping on their heels, or sticking their butt out (downhill) when on their toe edge.*

A **beginner** may have difficulty turning. The indicator for a weak PKC may be extreme flexion at the hips while turning, which places their center of mass to be out of alignment and makes it difficult to complete turns successfully.*

*First time and beginner snowboarders do not always have weakness in their PKC just because they flex extensively at their hips. Sometimes this flexing is due to lack of comfort and confidence.

The indicators of a weak PKC for an **intermediate** rider are extensive absorption at the waist and a visual of flexing at the hips while turning (not limited to this list). An intermediate rider will be able to partially compensate for the weakness in the glutes by using supporting muscles. However, these weaknesses would still be visible as they begin to ride easy bumps and perform turns on steeper terrain through, but not limited to, absorption at the waist, compensation with upper body movements and uneven turn size and shape.

A weak PKC is both more and less apparent as riders reach the upper skill levels. These **advanced** riders are somewhat able to compensate for weaknesses in their glutes, and perform as desired. PKC weakness can still be seen through absorption in the hips and difficulty in turns where they are most flexed at edge change. According to the AASI Snowboard Technical Manual, "This is most evident when students have difficulty retracting the feet for a grab, [or] at the end of the control phase of a turn….[a weak PKC can result in a shift of the] CM over the heel edge, which can result in counter-balancing with the upper body."(62). Another sign of weakness in the PKC is injury, especially to the hamstrings, hip flexors and lower back due to extra stress placed on these muscles.

The exercises on the previous page can help all riders strengthen their PKC and lead to biomechanically improved movements on their boards at all levels.

This rider has a weak posterior kinetic chain,. Her center of mass is nearly parallel to her board, which causes excessive flexing of the hips and absorption there instead of primarily through the knees and ankles.

This rider has a strong posterior kinetic chain. Her keens, ankles, hips and spine are all properly absorbing the terrain beneather her, which allows her to be ready to make her next move.

Benefits of a Strong Posterior Kinetic Chain

A strong PKC allows us to make riding feel and seem effortless with biomechanically effective and efficient movements. We get tired less quickly while freeriding because we can make quicker recovery movements in our own riding. Our demonstrations for our students are more clear because they show efficient movement patterns.

How Your Poster Kinetic Chain Ultimately Affects Your Riding

A strong posterior kinetic chain is essential for biomechanically efficient movements in snowboarding. When the PKC is intact, and the glutes, hamstrings and lower back muscles are all properly engaged, ideal alignment can be attained, and efficient movements can be made that protect us from injury, allow closer to ideal movement outcomes and set us up for future success. It is important to be able to identify breaks in the PKC through movement analysis, prescribe exercises to fix them and apply the fixes to our movements on snow through complete PKC muscle activation. Get outside and ride to see and feel how Posterior Kinetic Chain activation applies to you and your students.

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