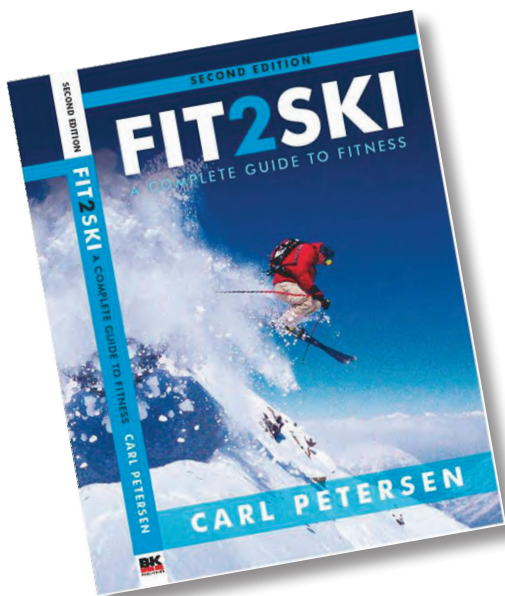


THE ABC'S OF ACL PROTECTION

EXCERPT ADAPTED FROM CARL PETERSEN'S
NEW BOOK **FIT 2 SKI**

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Injuries to the knee are a regular occurrence for skiing professionals and anterior cruciate ligament (ACL) tears are common. They can be the cause of a prolonged absence from on hill teaching activities. Today you are more likely to tear your ACL than you were to fracture your leg in the early seventies. It is estimated that alpine skiers at the National or World Cup level have a risk of 1 in 4 or a 25% chance to tear the ACL each year they compete.



The ACL serves a 'crucial' function in preventing the tibia from sliding forward on the femur and in controlling rotation in the knee, thus preventing it from buckling when twisted or rotated. Skiers who tear the ACL and have surgery must undergo a long rehabilitation process taking anywhere from 6-9-12 months. Unfortunately surgical intervention does not always ensure skiers will return to previous levels of performance, therefore protecting against injuries to the ACL should be part of every skiers training program.

Studies suggest that one in five female alpine racers (22%) reported an ACL disruption, and females were 3.1 times more likely to sustain an ACL injury in comparison to their male counterparts. There are many theories as to why females are more at risk for an ACL injury over male athletes, but most likely there are multi-factorial causes. Anatomical, hormonal, biomechanical and movement differences do exist that we must be aware of. While little can be done about many of these differences some studies suggest that the biomechanical and movement differences can be altered. Therefore ACL injury protection/prevention programs should address not only these at risk females but all young athletes.

Finding a way to prevent ACL injury is an important goal of all professionals working with skiing athletes. No one can strengthen their ACL, they can, however, strengthen and improve the stability of the muscle groups around the core, hip, knee and ankle. I would suggest that by improving overall athleticism, balance control, core strength, coordination and deceleration strength we may be able to protect against injury by reducing the number of vulnerable positions skiers find themselves in.

When designing your dryland and ski training program, it is wise to incorporate the concepts outlined below. These concepts have been adapted from the ACL protection components of dryland training programs used by Olympic Skiers since the mid eighties. Following the ABCs will improve training potential by improving skills in agility, balance, coordination, core control and deceleration strength.

ALIGNMENT

If your knees have poor alignment and cave inward when landing from a jump or when doing a cutting maneuver in field sports you may be at increased risk of an ACL injury. Excessive knee valgus (knees coming together) alignment can contribute to ACL injury in both

males and females. Both of these factors result in the femur, or upper leg bone, rotating inward and the knees assuming a valgus 'knock knee' position. This inward-rotated, valgus position places abnormal stress on the ACL and other soft tissue structures of the knee. During all exercises and movements emphasize a low CG athletic stance with correct knee alignment (knees always tracking over the toes). When doing lunges or split squats, keep the line of gravity through the pubic bone of the pelvis to avoid shear forces on the pelvic joints.

BALANCE & BALANCED LEG STRENGTH

Many skiers have an over development of the quadriceps compared to the hamstrings. The hamstring muscles are an ACL agonist (removing stress on the ACL when contracting). If the hamstrings are either weak or lack the flexibility to smoothly decelerate, they may not be able to protect the ACL from injury during a strong quadriceps contraction. Work on developing a good balance of strength and stability between the hamstrings and

quadriceps. Functional neuromuscular training will increase hamstring strength and correct imbalances in hamstrings to quadriceps strength ratios and side-to-side (dominant versus non-dominant leg) hamstrings strength for both females and males.

Skiers need to work as well on dynamic balance and stability to effectively prepare the knees for an injury free season.



ABOVE AND BELOW – SQUATS RETRACT
Do wall squats while squeezing a ball between your knees and working mid back with a stretch band. Gradually go down deeper as your strength improves.



ABOVE & BELOW – HAMSTRING BRIDGE
Lying on your back place feet on a stability ball and bridge hips up.





ABOVE & BELOW – HAMSTRING BRIDGE

As strength improves try pulling the ball towards your buttocks or rolling it from side to side.



ABOVE & BELOW – DYN HIP HIKE

Start by holding a stability ball at above head height against the wall in a split squat position. Squeeze the ball lightly and pull down to chest height. At the same time flex the hip so your knee comes up and across at waist height.



ACL PROTECTION

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CONNECT YOUR CORE

Skiing and training for skiing requires the body to move in and rotate around three different planes of motion at the same time. Unfortunately most machine based exercises often involve or isolate a single joint and only allow movement in one plane of motion. Try designing a core training routine that can be easily followed that works both the upper and lower core muscle systems at the same time. The upper and lower core muscles are connected by muscles that attach in groups of functional slings from the hips through the pelvis and torso to the shoulder girdle.

Exercises with balls and stretch bands that challenge balance can augment the stability of these functional slings within a closed kinetic chain. Closed-kinetic chain activities may help improve dynamic stability by muscle co-contraction which will help improve function and protect against ACL injury.

DECELERATION STRENGTH

Skiing is an activity that requires controlling the forces of gravity on frozen water. Many turns require deceleration or eccentric (lengthening) control of the muscle for 2-4 seconds. Deceleration control occurs during edging and carving, landing from jumps, absorbing terrain changes and overcoming gravity



ABOVE & BELOW – SPLIT SQUATS

Do split squats with a stability ball at your side and stretch cords to connect the upper and lower core.



The typical male athlete lands with forces two and a half times their body weight after a maximum jump while females land with forces up to five times their body weight. These larger forces are the result of poor shock absorption from landing too upright, with the knee in a more extended position and allowing the knee to move side to side and rotationally during landing potentially leading to injury. Proper alignment control is once again an issue as the valgus (knock kneed) position places stress on

the ACL and combined with the large forces generated during jumping is a potential formula for disaster.

Deceleration alignment problems can be corrected with appropriate strengthening and jump training. Learning to land softly and in correct alignment (no valgus stress) may help protect your knees. Strength training should target trunk and gluteal muscles. Jump training must emphasize knee over second-toe position.



LEFT – SPLIT SQUATS ROTATION

As strength and stability improves add upper body rotation to mimic the forces in a ski turn.

General ACL Injury Protection Rules:

- Never train hard if you are stiff from the previous effort.
 - Instead do longer warm-up.
 - More recovery work.
- Increases in training should be matched with increases in rest and recovery.
- Use appropriate training surfaces when running or doing agility drills.
- Female skiers should take extra care to strengthen and stretch their hamstring muscles as well as their quadriceps.
- Check training and competition areas are clear of hazards.
- Increase in training loads should be preceded by increased strengthening.
- Introduce new activities very gradually with respect to increases in volume, intensity and density.
- Always allow time in training for proper warm-up and cool down.
- Ski easier at the end of the day, when you are typically fatigued and avoid:
 - Difficult trails.
 - Big air.
 - Big moguls.
 - Loss of control on ice.

Carl Petersen is a Partner and Director of High Performance at City Sports & Physiotherapy Clinics in Vancouver. Info on his new book *Fit 2 Ski* at www.fit2ski.com and DVD series *Fit to Play™* & *Perform* at www.citysportsphysio.com or e-mail carl@citysportsphysio.com



The above is a chapter from **Fit2Ski**, a book by **Carl Petersen**, BPE, BSc(PT), a physiotherapist & fitness coach based in Vancouver, Canada. For many years, he was the Director of Sports Science & Medicine for Alpine Canada. He has travelled as the physiotherapist and fitness coach for the Canadian Olympic Ski Team for 14 years.

For more info, go to www.fit2ski.com.
Other useful resources available at www.citysportsphysio.com

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