

Pilates for Alpine Skiing

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Abstract

Skiing is a sport that demands muscular strength and stability in three planes of movement. Due to the large amount of time spent in forward flexion (mostly loaded) muscular imbalances in professional and frequent skiers are quite common. This can lead to pain and/or injury. Also, skiers who lack core strength are easily identifiable on the slopes by their flailing arms and frequent falls. Developing a stable core and functional movement patterns can greatly reduce the occurrence of injury and create a stronger, more fluid and balanced skier. This together with the goal of avoiding overuse injuries are why Pilates is an optimal training program for skiers.

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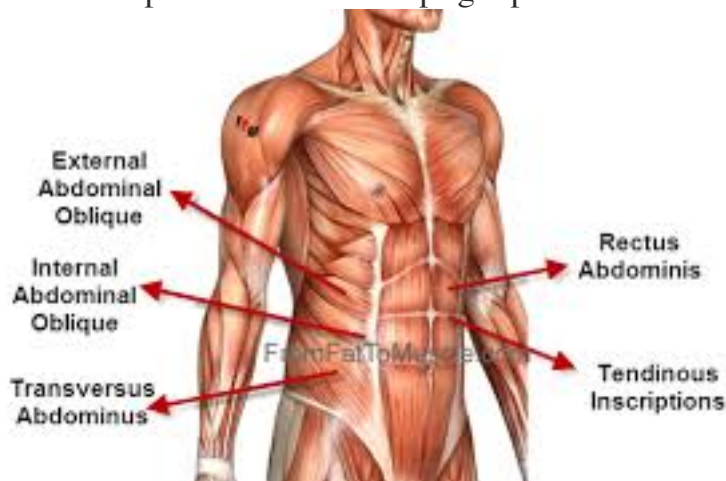
Introduction

The purpose of this paper is to present a solid and well researched Pilates training program for alpine skiers. Skiing is a sport that demands strength, flexibility, stability, balance and coordination in three planes of movement. All of which can be greatly enhanced by a Pilates training program. Strength training for skiers relates to the amount of work that the skier can do at any point. Strength endurance focuses on the length of time for which the skier can do the work. Because of the immense forces inherent in skiing, strength training plays a big role in conditioning. Fit skiers perform at their highest levels for longer periods, thus ingraining functional movement patterns will aid in placing less strain on their joints and connective tissue. As a skier's body gets stronger they will be able to ski longer and harder with better technique¹. Essentially alpine skiing involves all of the muscles of the body. However, the five main groups have been identified as the core, the foot and ankle group, the lower leg, the knee flexors and extensors, and the gluteals.

The 5 Main Muscle Groups used in Alpine Skiing

The Core

In Alpine skiing the main muscles of the core that are recruited for stability are the transverse abdominal muscle, the multifidus, the internal and external obliques and to some extent, the rectus abdominus. And although the works sighted here do not mention the muscles of the pelvic floor I will theorize that they are important enough to be listed as well. These muscle groups work as a unit to stabilize the pelvis and spine and maintain upright posture while moving down the slope.



The Foot and Ankle Group

The Knee Flexors and Extensors

Flexion and extension, or bending and straightening of the leg controls pressure and helps absorb the ground-impact forces of alpine skiing. The hamstrings, take on the important task of bending your knees. When your hamstrings perform properly, they protect your anterior cruciate ligament, a highly sensitive knee ligament that has a tendency to snap under pressure. The quadriceps straighten the legs, stabilize your knee joint and prevent excess knee rotation, explains Robert E. Leach, coauthor of "Alpine Skiing."



The Gluteals

These muscles act as stabilizers and assist in flexion and extension. The gluteus medius, which attaches to the top of the outer thigh, abducts, or moves your leg away from the center of your body. Your gluteal muscles also assist in external leg rotation, which helps perform the rotary movements that steer your skis.



Case Study

The case study for this paper is a 43-year-old male, lifetime skier named Chris. He has worked as a ski mountaineering guide for the last 20 years. His skier level is advanced. He is in great physical condition but presents with tightness in the hips, quadriceps, hamstrings, IT bands, lower leg and ankle. These restrictions are at times painful but do not limit activity. In postural assessment Chris has an anterior tilt to the pelvis and slightly rounded shoulders. The goal is to create a Pilates program that focuses on core abdominal strength to create more stability allowing the hip flexor group in particular to work less. There should also be a focus on the back extensor group, as his life style activities require a large amount of forward flexion (carrying heavy backpacks uphill). This will hopefully bring his posture into plume and perhaps relieve some of the discomfort due to over tightened muscles. It is appropriate to begin with the fundamentals with Chris. Due to the fact that he is extremely athletic and active and in an effort to maintain mental engagement with Pilates intermediate exercises were introduced early on.

Recommended Repertoire Sessions 1-10

Block/Equipment	Exercise	Purpose/Desired Outcome
Warm up/Mat	Pelvic Curl	Warm up the spine, warm up abdominals create conscious awareness of the body
Warm up/Mat	Supine Spine Twist	Warm up the abdominal obliques
Warm up/Mat	Chest Lift	Warm up the abdominals
Warm up/Mat	Chest Lift with Rotation	Warm up the abdominals/obliques
Warm up/Mat(mix in)	Leg Changes	Warm up the Abdominals
Foot Work/ Reformer	Parallel Heels	Work the hamstrings and quadriceps both concentrically and eccentrically, hip extensor strength, knee extensor strength, warm up, good for dorsiflexion
	Parallel Toes	Work the hamstring and quadriceps both concentrically and eccentrically, hip extensor strength, ankle plantar flexor strength

	V-position Toes	Work the hamstrings and quadriceps both concentrically and eccentrically, hip extensor strength, knee extensor strength, ankle plantar flexor strength, warm up
	Open V Heels	Work the hamstrings both concentrically and eccentrically, Hip extensor strength, knee extensor strength, dorsi flexion, while engaging the adductors
	Open V Toes	Work the hamstrings and quadriceps both concentrically and eccentrically, Hip extensor strength, knee extensor strength, ankle plantar flexor strength
	Calf Raises	Ankle plantar flexor strength, stretch the gastrocnemius
	Prances	Ankle plantar flexor strength
	Prehensile (mix in)	Foot stretch
	Single Leg Heel	Hip and knee extensor strength, bring awareness to any imbalances
	Single Leg Toe	Hip and knee extensor strength, bring awareness to any imbalances
Abdominal Work/Reformer	Hundred Prep	Abdominal strength
	Hundred (mix in)	abdominal strength, pelvic stabilization, connecting with the lattisimus dorsi
	Coordination (mix in)	abdominal strength ,pelvic stabilization ,connecting with the lattisimus dorsi
Hip Work/ Reformer	Supine Leg Series	Hip adductor strength, Knee extensor control, Pelvic lumbar stabilization
	Frog	Hip adductor strength, hip extensor control, pelvic lumbar stabilization
	Circles Down	same as above
	Circles Up Openings	Hip adductor stretch, hip adductor strength, pelvic lumbar stabilization
Stretches/Reformer OR	Standing Lunge	Hip flexor stretch, hamstring stretch

Stretches/ Ladder Barrel	Gluteals Hamstrings Adductors Hip Flexors	gluteal stretch hamstring stretch adductor stretch hip flexor stretch
Arm Work/Pedi Pole	Arms Standing Series Extension Adduction Circles Up Circles Down Triceps	Shoulder extensor strength, scapulae stabilization Shoulder adductor strength, scapulae stabilization Shoulder extensor strength, shoulder adductor strength, shoulder joint mobility same as above elbow extensor strength
Leg Work/ Mat	Gluteals Kneeling (Box) Series Hip Extension Bent Knee Hip Abduction Bent Knee Hip Extension Straight Leg	Hip extensor strength, pelvic lumbar stabilization Hip abductor strength, pelvic lumbar stabilization Hip extensor strength, pelvic lumbar stabilization
Lateral Flexion/Rotation/Mat	Side Lifts	Lateral flexor strength, trunk stabilization
Back Extension Mat/Cadillac/Reformer	Back Extension Prone 1 Breaststroke prep	Back extensor strength

Recommended Repertoire Sessions 11-20

Block/Equipment	Exercise	Purpose/ Desired Outcome
Warm up/Mat	Pelvic Curl	Warm up the spine, Warm up abdominals, Create conscious awareness of the body
Warm up/Mat	Supine Spine Twist	Warm up the abdominal obliques

Warm up/Mat/w/ exercise ball	Chest lift	Warm up the abdominals
Warm up/Mat/w/ exercise ball	Chest lift with Rotation	Warm up the abdominals/obliques
Warm up/Mat(mix in)	Leg Changes	Warm up the abdominals
Warm Up/ Mat	Hundred prep	Warm up the abdominals
Foot Work/ Cadillac	Parallel Heels	Hip extensor strength and stretch, knee extensor strength, pelvic lumbar stabilization
	Parallel Toes	Hip extensor strength and stretch, knee extensor strength, pelvic lumbar stabilization, foot alignment and stabilization
	V Position Toes	Hip extensor strength, knee extensor strength, pelvic lumbar stabilization, hip adductor control
	Open V Heels	Hip extensor strength and stretch, knee extensor strength, pelvic lumbar stabilization, adductor control
	Open V Toes	Hip extensor strength and stretch, knee extensor strength, pelvic lumbar stabilization, foot alignment and stabilization
	Calf Raises	Foot plantar flexor strength, control of foot stabilizers, establish correct foot alignment
	Prances	Foot plantar flexor strength, control of foot stabilizers, establish correct foot alignment
	Single Leg Heel	Hip extensor strength and stretch, knee extensor strength, pelvic lumbar stabilization
	Single Leg Toe	Hip extensor strength and stretch, knee extensor strength, pelvic lumbar stabilization, foot alignment and stabilization
Abdominals/ Cadillac	Roll Up w/ Roll Up Bar	Abdominal control, trunk stabilization
	Mini Roll-Ups	Abdominal strength, pelvic lumbar stabilization
	Mini Roll-Ups Oblique	Abdominal strength with oblique emphasis, maintain a

		neutral pelvis
Hip Work/ Cadillac	Frog	Adductor strength, hip extensor strength
	Circles Down/Up	Hip extensor strength, hip adductor control, hip disassociation
	Walking	Hip extensor control, hip disassociation, pelvic lumbar stabilization
	Bicycle	Hip extensor strength, hip adductor control, hip disassociation
Spinal Articulation/Reformer	Bottom Lift	Abdominal control, spinal stretch and mobility, hamstring and calf control
	Tower prep	Spinal articulation, hamstring stretch, hamstring control
Stretches/Pole	Shoulder Stretch Pole Series	
	Shoulder Stretch	Shoulder stretch, scapulae stabilization
	Overhead Stretch	Chest stretch, shoulder stretch
	Side Stretch Spine Twist	Oblique stretch, trunk control Oblique control, trunk control
Full Body Integration/Reformer	Elephant	Trunk stabilization, shoulder stabilization, hamstring stretch, shoulder stretch
	Up Stretch 1	Trunk stabilization, shoulder stabilization, hamstring stretch, shoulder stretch
	Scooter	Trunk stabilization, shoulder stabilization, hip extensor control/strength (depending on resistance), knee extensor control/ strength (depending on resistance)
Arm Work/ Reformer	Arms Kneeling Series	
	Chest Expansion	Shoulder/Elbow extensor strength/ trunk stabilization
	Up/Down Circles	Shoulder flexor/abductor strength/ trunk stabilization
	Triceps	Elbow extensor strength/ trunk stabilization
	Biceps	Elbow flexor strength/ trunk stabilization/ shoulder flexor stretch

Leg Work	Gluteals Kneeling Series Hip Extension Bent Knee	Hip extensor strength, pelvic lumbar stabilization
	Hip Abduction Bent Knee	Hip abductor strength, pelvic lumbar stabilization
	Hip Extension Straight Leg	Hip extensor strength, pelvic lumbar stabilization
and/or Single Leg Skating		Hip abductor Strength, knee extensor strength, pelvic lumbar stabilization
Lateral Flexion/ Rotation/Ladder Barrel	Side over prep	Trunk lateral flexor stretch, trunk lateral flexor strength
Later Flexion/ Rotation Step-Barrel	Side lift	Abdominal oblique strength and stretch
	Side over with extended arms	Abdominal oblique strength and stretch
Back Extension/Reformer	Breaststroke Prep	Back extensor strength, elbow extensor control
and/or		
Back Extension/ Ladder Barrel	Basic Back Extension	trunk stabilization, back extensor strength

Recommended Repertoire Sessions 21-30

Warm up/mat	Pelvic curl	Warm up the spine warm up abdominals Create conscious awareness of the body
	Roll up	Warm up abdominals and spine
	Spine twist supine	Warm up the abdominal obliques
	Double leg stretch Single leg stretch	Warm up the abdominal Warm up the abdominals and obliques
	Cris cross	Warm up the abdominals and

		obliques
Foot Work/Cadillac	Add Hip Opener to the fundamental series	Hip external rotator control, adductor control and stretch, hip extensor control and stretch
Abdominals/Reformer	100's	Abdominal strength, trunk stabilization
	Coordination	Abdominal strength, trunk stabilization
	Short box series	
	Round back	abdominals, pelvic lumbar stabilization
	Flat back	Abdominal strength, trunk stabilization, back extensor focus
	Tilt	Abdominal oblique control and stretch
	Twist	Abdominal strength with oblique emphasis
	Roundabout	Abdominal strength with oblique emphasis
Hip Work/Cadillac	Climb-a-tree	Abdominal strength, Back extensor control, Hamstring stretch
	Supine single leg series	
	Frog	Hip extensor control, knee extensor control, pelvic lumbar stabilization
	Circles down/up	Adductor control, Hip extensor control, Pelvic lumbar stabilization
	Hip extension	Hip extensor strength, pelvic lumbar stabilization
or Reformer	Bicycles	Hip extensor control, Pelvic lumbar stabilization, Coordination
	Hip work supine adding extended frog/reverse	Hip adductor stretch, Hip adductor strength, pelvic lumbar stabilization

Spinal Articulation/Reformer	Bottom lift w/ extensions	Spinal articulation, hip extensor control, hip flexor stretch
	Short spine	Spinal articulation, hamstring stretch
Stretches/ Reformer	Kneeling lunge/ full lunge	Hip flexor stretch, hamstring stretch
	Side Split	Hip adductor stretch, hip adductor strength
Full Body Integration/Reformer	Up Stretch 2 Knee stretch series Round back	Trunk stabilization, Shoulder stabilization, Hip extensor control/ strength, knee extensor control/ strength (depending on resistance)
	Flat back	Trunk stabilization, Shoulder stabilization, Hip extensor control/strength, knee extensor control/strength (depending on resistance)
Arm Work/Cadillac	Arms Standing Series Chest expansion	Shoulder extensor strength, Elbow extensor strength, Trunk stabilization
	Hug-A-Tree	Shoulder horizontal adductor strength, trunk stabilization
	Up/Down Circles	Scapular stabilization, increase range of motion in shoulder joint, trunk stabilization
	Punches	Elbow extensor strength, shoulder horizontal adductor strength, trunk stabilization
	Biceps	Elbow flexor strength, trunk stabilization, shoulder flexor stretch

Full Body Integration/ Cadillac	<p>Thigh Stretch with the roll up bar</p> <p>Sitting Forward (push Through Series)</p> <p>Side reach (push Through Series)</p> <p>Kneeling cat stretch (push through series)</p>	<p>Abdominal control, Hamstring stretch, Spinal mobility</p> <p>Abdominal control, Obliques stretch, Shoulder adductor stretch</p> <p>Abdominal control, quadricep stretch, quadricep strength</p>
Leg Work/Reformer	<p>Jumping Series Parallel position</p> <p>V-position</p> <p>Single leg parallel</p> <p>Leg changes</p>	<p>Hip extensor control, knee extensor control, foot plantar Flexor strength, Pelvic lumbar stabilization</p> <p>Hip adductor control, Hip extensor control, Knee extensor strength, Foot plantar flexor strength, Pelvic lumbar stabilization</p> <p>Hip extensor control, knee extensor control, foot plantar Flexor strength, Pelvic lumbar stabilization</p> <p>Hip extensor control, knee extensor control, foot plantar Flexor strength, Pelvic lumbar stabilization</p>
Lateral flexion/rotation/ladder barrel and/or	Side overs	Trunk stabilization, lateral flexor stretch, lateral flexor strength
Reformer	Side over on the box (short	Abdominal strength,

	box)	Trunk stabilization
Back Extension/Reformer	Pulling straps 1	Back extensor strength, Shoulder extensor strength
	Pulling straps 2	Back extensor strength, Shoulder adductor strength

Note on the repertoire:

As stated in the introduction Chris comes from a life time of athleticism. It was apparent early on that some intermediate and advance exercises should be introduced early on. In addition to the above repertoire use of the Wunda Chair in particular was very useful and challenging. The Footwork series on the Wunda Chair was great for facilitating more back extension. Torso Press Sit, Pike and Side Pike on the Wunda Chair are a great challenge and perfect for ski strength training. Using the Ladder Barrell for the shoulder stretches is also indicated to combat the forward roll of the shoulders.

Conclusion

The foot work is of particular importance in strengthening and stretching the muscles of the lower leg and ankles for skiing. As mentioned above skiers spend a good deal of time in dorsi flexion. Prehensile in particular is a great exercise to aid a skier to be in dorsi flexion while keeping the toes on the bottom of the boot. Many skiers will lift the toes in order to achieve flexion. The skier will be able to exhibit more accurate control over the ski with the toes down. These exercises are also paramount for strengthening the lateral muscle(s) of the lower leg, in particular peroneus longaeus, which must be engaged both eccentrically and concentrically when edging the skis.

Skiers with a weak core are easily identified on the slopes by their flailing arms and frequent falls. The importance of the abdominal exercises including lateral flexion and rotation and back extension cannot be overstated.

Mobility of the spine is essential to ski well and when the skier falls to protect the spine, as a mobile spine will sustain a fall with less damage than a rigid one. Bottom lift on the reformer is a great choice, as it requires recruitment of the hamstrings which when used properly will also protect the ligaments of the knees. Rolling like a ball and Open leg rocker are also important for the skier. When the skier falls forward down slope the strength developed in these exercises will help protect the spine.

A skier must constantly adduct the legs in order to keep the skis straight and in control when turning. Hip Work on the reformer is a good choice for strengthening and stretching this muscle group. Moving on to the Supine Leg Series and Single Leg Supine Series on the Cadillac will address muscular imbalances in this muscle group. This is a good approach to improving a skier's weaker side turn.

Stretches clearly should target, but not be limited to, the quadriceps, hamstrings adductors and IT bands to protect the knees as well as the muscles of the back. Stretches for the upper body should also be included (pole series, Ladder Barrel shoulder stretch series, push through series on the Cadillac, etc) to improve posture, which will improve overall balance.

Full Body Integration is also a wonderful block for the skier to focus on. Elephant, Up stretch 1,2,3, are an effective way to train the body to recover from near falls by bringing the legs back under the torso from the abdominals while maintaining scapular stabilization. Scooter is of particular importance because like in skiing the legs are on different surfaces. This encourages the skier to maintain a neutral pelvis and move from the core when the legs are uneven. The legs are rarely even in Alpine skiing.

The Leg work should target the gluteals, as strong hip muscles will protect the knees by keeping the leg in line with the hips. The jumping series can be especially helpful in strength building for jump turns, mogul skiing and jumping and landing in general.

Essentially every block will be included in each workout for a well-rounded repertoire. As stated in the introduction Alpine Skiing uses all of the muscle groups of the body. So even though the arms are not identified as one of the main muscle groups used in Alpine Skiing it is extremely important to develop strength and proper muscle recruitment in this group so that the skier can use their poles

correctly. Without proper stabilization of the scapulae the muscles of the neck will take over when pole planting causing undue stress to the neck. This can be avoided with proper recruitment.

Lateral flexion and Back Extension will also be very important for general strength and balance and to further trunk stabilization. Every time a skier makes a parallel turn lateral flexion is a part of the movement. Back extension will help balance the large amount of time that the skier spends in forward flexion.

At the writing of this paper Chris is on session 15. He is enjoying the process. While still experiencing tightness in the hips he is encouraged by the muscle movement patterns that he is learning. We will continue to focus on ways to improve hip strength and mobility within a complete block system workout.

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