



# PERSONAL TRAINING FOR THE RECREATIONAL DOWNHILL SKIER

CHAT WILLIAMS, MS, CSCS,\*D, CSPS, NSCA-CPT,\*D, FNCSA

Each winter, individuals start hitting the slopes with friends and family to enjoy the physical demands, fitness challenges, and stress relief of skiing. Incorporating a strength and conditioning program can improve total body strength, reduce injuries, and improve several motor skills for recreational downhill skiers. Understanding the movements involved in skiing and the potential injuries is important when considering the type of strength and conditioning program and which exercises to include.

## MOVEMENT PATTERNS

There are four major movements involved in downhill skiing: the initiation phase, turning phase, completion phase, and transition phase (2). During the initiation phase, the outside leg will support the body. In the turning phase, the shoulders will become level with the snow and the outside leg will remain straight while the inside leg will bend, bringing the hips closer to the snow. Next is the completion phase, where the hips rise up to decrease the angle of the skis. And finally, the transition phase is where the feet move under the hips and prepare for the next turn (2).

In the neutral position, the major muscles used are the quadriceps of the upper leg and the anterior tibialis, gastrocnemius, and peroneals of the lower leg; additionally, the rectus abdominis and gluteals are critical in maintaining an erect position (1). The upper body requires deltoids and the flexor muscles of the lower arms to maintain position of the ski poles (1). The quadriceps maintain balance throughout the entirety of the four movement patterns. The turn phase requires the hips to extend. During the completion movement, the tibialis anterior muscles help pull the body forward with dorsiflexion. The rectus abdominis has the highest electromyography (EMG) activity during the turning phase, and the hamstrings and glutes are activated in the eccentric portion of the transition and turning phases (2).

## SKIING INJURIES

While skiing, contact and non-contact injuries can take place with a small percentage coming from running into another skier or an obstruction. Injuries with downhill skiing commonly occur at the knee and shoulder joints (2). For example, shoulder injuries account for up to 4 – 11% of all injuries and 22 – 41% of all upper

body injuries (2). These injuries include rotator cuff contusions, anterior glenohumeral dislocations, acromioclavicular separations, and clavicle fractures. Accidental falls contribute to many of these injuries, usually with a direct fall onto an outstretched arm (2).

Knee injuries can occur during knee extension, or full dynamic flexion with the addition of one or a combination of anterior draw of the tibia, and internal/external rotation (2). A study at the Jackson Hole Ski Resort reported that from 1982 to 1993, about 30% of all reported injuries were knee sprains (4). Non-contact injuries can take place with different techniques used in skiing, which include a slip-catch, snow plow, and back-weighted landing. The most common of these techniques is called a “slip-catch,” which is when the skier makes a turn and the outside leg leaves the ground while the extended leg makes a turn across the body. Another technique commonly seen is the “snow plow,” which occurs when knee and hip flexion are very deep and then turn quickly under the body, causing rapid internal rotation. During the back-weighted landing, the back of the ski hits the ground causing anterior draw of the tibia and an internal or external twist of the body (2).

## STRENGTH AND CONDITIONING

Downhill skiing requires total body strength, power, and motor skill development. This can be achieved by using dynamic and static exercises (3). A downhill skiing program should simulate skiing actions by including exercises that are slow and controlled, and movements that are rapid and explosive (3). Squats, leg presses, bench presses, deadlifts, and dumbbell rows are all examples of foundational strength exercises that can be included into a training program. Box jumps, lateral box jumps, squat jumps, and hurdle jumps are just a few of the exercises that can be included to improve power. Balance exercises can be added to challenge neurological adaptations by incorporating unstable surfaces and performing movements unilaterally (2).

The following are some examples of power, strength, and balance exercises that can be incorporated to help improve performance in downhill skiing. Additionally, Tables 1 and 2 provide an example strength and power program that can be used as a guideline (5,6).

### SQUAT JUMP (FIGURES 1 – 2)

The client should start with feet shoulder-width apart preparing to squat. They should lower the body to a half squat (loading the hips) and jump explosively while performing triple extension with the ankles, knee, and hips. The client should land in the same position with “soft” knees and ankles while under control. It is helpful to maintain posture by keeping the core tight.



FIGURE 1. SQUAT JUMP – START



FIGURE 2. SQUAT JUMP – EXECUTION

### BOX JUMP VARIATIONS (FIGURES 3 – 9)

The client should start with feet shoulder-width apart preparing to squat. Lower the body to a half squat (loading the hips) and jump explosively while performing triple extension with the ankles, knees, and hips. The client should land on top of the box with the feet facing forward and the knees slightly bent. The landing should be soft with minimal noise made by the feet. It is also important for the knees to remain aligned over the feet through the movement (do not let the knees collapse inwards). Progressions can be incorporated by adding unilateral landings and hops onto the box. Starting with jumping from two feet and landing with one on the box, then hopping and landing with one foot. Landing techniques stated above should be applied to both of these movements as well. Lateral box jumps can be added by having the client stand next to the box with the shoulders perpendicular to the box. The jump will be performed in the same manner but from the side.



FIGURE 3. BOX JUMP – START



FIGURE 4. BOX JUMP – FINISH



FIGURE 5. LOW-LEVEL BOX JUMP 2 TO 1 – START



FIGURE 6. LOW-LEVEL BOX JUMP 2 TO 1 – FINISH

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FIGURE 7. LOW-LEVEL BOX JUMP 1 TO 1 – START



FIGURE 8. LATERAL BOX JUMP – START



FIGURE 9. LATERAL BOX JUMP – FINISH

## SKATERS (FIGURES 10 – 11)

The client should start by standing with feet together and push off laterally to one side. Immediately after landing, the client should explosively push off with the outside foot and land on the other foot. This should be repeated by going back and forth from one foot to the other.



FIGURE 10. SKATERS – START



FIGURE 11. SKATERS – FINISH

## DIAGONAL SKATERS (FIGURES 12 – 14)

The client should start by standing on one foot (Figure 12) and push off laterally to one side aiming for the dot diagonally placed on the floor. Immediately after landing (Figure 13), the client should explosively push off with the outside foot and return to other foot while progressing to the next dot in the sequence (Figure 14).



FIGURE 12. DIAGONAL SKATERS – START



FIGURE 13. DIAGONAL SKATERS – LANDING



FIGURE 14. DIAGONAL SKATERS – RETURN

#### SUPINE MEDICINE BALL CHEST PASS (FIGURES 15 – 16)

The client should lie on their back as a partner holds a medicine ball while standing on a box above them (Figure 15). The partner should drop the ball to the client around chest level (Figure 16). The client should catch the ball and explosively return it upwards with a chest pass.



FIGURE 15. SUPINE MEDICINE BALL CHEST PASS – START



FIGURE 16. SUPINE MEDICINE BALL CHEST PASS – CATCH

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## HURDLE SQUARE (FIGURES 17 - 18)

The client should start in the middle of the hurdle square and complete jumps to the outside of each hurdle, then return back to the center each time. This should be done as quickly as possible and include decelerating, reloading, and explosive movements while under control. The client should jump laterally left, right, forward, and backward. There is no specific pattern and can be performed in a clockwise or counter-clockwise sequence.



FIGURE 17. HURDLE SQUARE - JUMP



FIGURE 18. HURDLE SQUARE - LANDING

## LATERAL HURDLE JUMP (FIGURE 19)

The client should start by standing beside a hurdle and then laterally jump over it. After landing, immediately load and unload the lower body by laterally jumping back over the hurdle. This can be measured by total repetitions or for time (quickness and power). For example, three sets of 20 reps, or the total amount of reps performed in 10 - 30 s.



FIGURE 19. LATERAL HURDLE JUMP

## SQUAT ON BALANCE TRAINER (FIGURES 20 - 22)

The client should start with feet shoulder-width apart while standing on a balance trainer. While under control, lower the body to a position that mimics sitting in a chair (Figure 20). Keep the core tight and maintain a neutral spine. Knee flexion should be approximately 90 degrees, meaning the thighs should be parallel to the floor, or as close to parallel as possible without sacrificing form. Drive through the feet and return. A more challenging variation includes adding a diagonal chop. To do this, a medicine ball can be taken from the shoulder to the opposite knee (creating a chopping motion) when ascending and descending during the squat.



FIGURE 20. SQUAT ON BALANCE TRAINER



**FIGURE 21. SQUAT ON BALANCE TRAINER WITH DIAGONAL CHOP – START**



**FIGURE 22. SQUAT ON BALANCE TRAINER WITH DIAGONAL CHOP – FINISH**

#### **SINGLE-LEG DEADLIFT (FIGURES 23 – 24)**

The client should start by standing on one leg with the knee bent about 5 – 10 degrees (Figure 23). Then, the client should lean forward flexing at the hip. In a controlled manner, the dumbbells or medicine ball should be lowered to the ground while maintaining a tight core and a neutral spine (Figure 24). The depth of the deadlift will be determined by the strength and flexibility of the hamstrings and glutes. The client should engage the glutes to return back to the starting position.



**FIGURE 23. SINGLE-LEG DEADLIFT – START**



**FIGURE 24. SINGLE-LEG DEADLIFT – FINISH**

#### **SINGLE-LEG SQUAT (FIGURE 25)**

The client should start by standing and balancing on one leg (a suspension trainer can be used for balance). Once balanced, lower the body until the thigh is parallel to the floor (Figure 25). Then, the client should drive through the heel of the foot and extend at the knee to return to the starting position. The depth of the squat depends on strength and can be increased once there is more strength and stability in the leg.



**FIGURE 25. SINGLE-LEG SQUAT**

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## LUNGE ON BALANCE TRAINER (SAGITTAL, FRONTAL, AND TRANSVERSE) (FIGURES 26 – 28)

The client should start with feet shoulder-width apart and step forward onto the balance trainer while flexing at the knee and hip. After taking the step, lunge forward; the thigh of the lead leg should be parallel to the floor and the knee should be at about 90 degrees. The rear leg should be approximately 2 – 4 in. above the ground. During the lunge phase of the movement, the client should perform shoulder flexion to raise the medicine ball directly over the head. When returning to the starting point, perform shoulder extension to bring the medicine ball back down to about thigh level.



FIGURE 26. LUNGE ON BALANCE TRAINER – SAGITTAL PLANE



FIGURE 27. LUNGE ON BALANCE TRAINER – FRONTAL PLANE



FIGURE 28. LUNGE ON BALANCE TRAINER – TRANSVERSE PLANE

## FRONTAL/TOE TOUCH

The client should start with feet shoulder-width apart and step to the side onto the balance trainer (laterally) or in the frontal plane. The toes should be kept straight ahead with the lead leg. The client should maintain an upright position and tight core throughout the movement. While lunging, reach across the body with both dumbbells towards the toes to create more of a challenge for the hips and glutes.

## TRANSVERSE/TOE TOUCH

The client should start with feet shoulder-width apart and initiate the movement by opening up the hips to create rotation in the core region. The lead leg should finish approximately at 135 degrees on the balance trainer while the toes of the trail leg might turn in slightly. This will depend on knee mobility, flexibility of the hips and the core, and the overall strength of the lower body. While opening up the hips, the client should reach towards the lead foot with dumbbells to create more of a challenge for the hips and glutes. The ability to decelerate the movement (lead leg) in the transverse plane and return to the starting position will also create challenges.

## REFERENCES

1. Atkins, J, and Hagerman, G. Sports performance: Alpine skiing. *National Strength and Conditioning Association Journal* 5(6): 6-8, 1983.
2. Hydren, J, Volek, J, Maresh, C, Comstock, B, and Kraemer, W. Review of strength and conditioning for alpine skiing. *Strength and Conditioning Journal* 35(1): 10-28, 2013.
3. Plisk, S. Skiing: Physiological training for competitive alpine skiing. *National Strength and Conditioning Association Journal* 10(1): 30-33, 1988.
4. Warme, WJ, Feagin, JA Jr, King, P, Lambert, KL, and Cunningham, RR. Ski injury statistics, 1982 to 1993, Jackson Hole Ski Resort. *American Journal of Sports Medicine* 23(5): 597-600, 1995.
5. Williams, C. Complex set variations: Strength and power. *Personal Training Quarterly* 1(3): 20-25, 2014.
6. Williams, C. Speed and agility training outdoors. *Personal Training Quarterly* 1(2): 28-33, 2014.

## ABOUT THE AUTHOR

Chat Williams is the Supervisor for the Norman Regional Health Club. He has served as a member of the National Strength and Conditioning Association (NSCA) Board of Directors, NSCA State Director Committee Chair, Midwest Regional Coordinator, and State Director of Oklahoma (including being named the 2004 State Director of the Year). He also served on the NSCA Personal Trainers Special Interest Group (SIG) Executive Council. He is the author of multiple training DVDs. Williams also runs his own company, Oklahoma Strength and Conditioning Productions, which offers personal training services, sports performance for youth, metabolic testing, and educational conferences and seminars for strength and conditioning professionals.

TABLE 1. STRENGTH AND POWER PROGRAM EXAMPLE

TYPE	EXERCISE	SETS X REPS
<b>LBPWR</b>	Box jumps	3 x 5
<b>LBS</b>	45-degree leg presses	3 x 8
<b>UBS</b>	Bench presses	3 x 8
<b>PWR</b>	Supine chest passes	3 x 5
<b>LBS</b>	Single-leg squats	3 x 6 (each)
<b>PWR/QUI</b>	Hurdle lateral jumps	3 x 20
<b>LBS</b>	Lunges on balance trainer	3 x 6 (each plane)
<b>UBS</b>	Pull-ups	3 x 8 - 10
<b>Core</b>	Stability ball ab exercises	3 x 15

TABLE 2. STRENGTH AND POWER PROGRAM EXAMPLE - MORE VOLUME

TYPE	EXERCISE	SETS X REPS
<b>LBPWR</b>	Lateral box jumps	4 x 5
<b>LBS</b>	Squats	4 x 8
<b>UBS</b>	Dumbbell presses	4 x 8
<b>UBS</b>	Dumbbell rows	4 x 8
<b>LBS</b>	Squats on balance trainer	4 x 8
<b>LBS</b>	Single-leg deadlifts	3 x 8 (each)
<b>PWR</b>	Diagonal skaters	4 x 8
<b>UBS</b>	Push-ups	3 x 10
<b>PWR/QUI</b>	Hurdle square	4 x 2

Key:

LBS - Lower body strength

LBPWR - Lower body power

UBS - Upper body strength

PWR - Power

QUI - Quickness