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Using the Pavesled to Develop the Skating Musculature

David J. Pollitt, CSCS
Optimal Performance Strength and Conditioning Consulting, Riverside, California

summary

This article explores a new dryland training device to help train the skating-specific musculature in ice hockey. Coaches who wish to add more sport-specific training with a cost-effective product may find this article useful.

Skating is a highly technical skill, which requires a great deal of strength, balance, agility, and power for a skater to move effectively across the ice. During dryland training, hockey players often find it difficult to train skating-specific actions in a technically precise manner that transfers to the ice. One of the keys to ice hockey training is that it must be ground-based and involve body weight and triple-extension movements of the hip, knee, and ankle (4). Several training devices have been created that attempt to duplicate the exact vectors and forces used in the skating stride so there will be a positive carryover to the ice. Recently a device (Pavesled, Independence, MO) was developed consisting of a weighted sled that slides across pavement while being towed by an athlete skating on in-line skates. The idea behind this concept is to duplicate the on-ice skating stride during off-ice training anywhere dry, flat pavement is found. When used in conjunction with a periodized strength and conditioning program, this device may offer an additional training tool for skating athletes to develop sport-specific musculature.

About the Device

The sled consists of a metal platform (16 × 24 in) with 4 hard-bristle brushes attached to the bottom, which, when weighted, provide resistance to the skating stride as the sled is towed (Figures 1–3). A waist belt, which is the primary attachment to the sled, is designed to allow the skater to rotate, turn, or pivot without getting tangled in the towline. An ankle strap attachment and other hand-held attachments (not shown) can also be used with the sled. To avoid injuries, a flat, dry, smooth paved surface is the best place to use the sled. Protective gear, such as a helmet and gloves, should always be worn when using the weighted sled to help prevent possible injuries.

Rationale for Towing the Sled

There are a number of reasons that players and coaches may wish to use the sled as part of their dryland training, including the following:

- This form of sled can be used anywhere that smooth pavement is available. Indoor ice has become less available with the popularity of hockey and figure skating, and rink managers can be reluctant to rent a rink to people who wish to use it for unfamiliar exercises, such as sled dragging on the ice.
- North American players tend to emphasize game competition at the expense of training and skill development (1). Players often use practices and games as their in-season conditioning and rely on the contribution of minimal off-ice conditioning (9). Using a dryland sled allows players to develop fundamental skating and agility skills in the off-season before they move to the ice. In the relatively safe environment of open pavement, coaches can provide more time for the detection and correction of problems with the skating technique and can include video analysis to improve technical proficiency.
- This training tool is cost-effective compared with the rising price of ice

time. With a minimal investment, coaches and athletes can spend a great deal of time outdoors during the off-season perfecting the skating stride and building power.

- Exercising outdoors provides athletes a chance to get some fresh air (as compared to the poor air quality often found in indoor rinks because of the exhaust from the ice machine).
- With standard sled dragging, the sled can only be pulled in one direction without having to stop and adjust the hands or belt. This sled has a waist belt harness that allows the athlete to turn and pivot during the dragging process, so the transferred skills are more sport-specific. By wearing normal hockey gear (i.e., stick, gloves, helmet, and pads, if necessary) the workouts can closely simulate an on-ice workout.
- Because this sled has coarse bristles on the bottom for resistance, it can be used on the ice to load the skating action during a training session or practice. Coaches should be advised that using the sled on the ice works best at the end of a practice because of the increased resistance of the cut-up ice.

Understanding Skating Efficiency

The correct biomechanics of the hockey stride involve a number of joint angles and combinations of movements performed in sequence to provide the most powerful stride. The leg push begins near the center of gravity with a knee angle of between 90 and 110 degrees; as the skate contacts the ice, the push is to the side and back (5). The maximum power range at the knee is between 130 to 155 degrees (5). Emphasis must be placed on using a deep knee bend and low hip position, which change the center of gravity for quick movements and allow more quadriceps involvement in the skating stride.

Aside from a deeper knee bend, faster skaters use a wider stride (36–54 in. at

Figure 1. Forward skating with the Pavesled.

Figure 2. Backward skating with the Pavesled.

Figure 3. Ankle dragging with the Pavesled.

full speed) compared to slower skaters, and their skates are angled between 45 and 60 degrees outward (5), resulting in a better push phase and the ability to recruit all the lower-body muscles and joint angles through a larger range of motion sequence for optimal power. When the leg finally pushes out to the side and backwards, that leg should quickly return to the midpoint of the body for a full recovery before the next stride is initiated.

Developing the hip and leg musculature is very important for improving skating efficiency. Two-footed strength exercises simply cannot replicate the force production required by on-ice activities, nor can they promote any degree of balance, proprioception, or athletic development (6). It is important to develop skate-specific exercises that allow an athlete to develop strength and power in the exact mechanical vectors that are used in the sport (7). Sled training follows this form of training protocol, with movements from 1 leg to the other and in the same mechanics of triple extension of the ankle, knee, and hip used in the skating motion.

The Biomechanics of Using the Sled

The worth of any training device lies in the ability of the athlete using the training tool to carry over the training effect to a sport application. With this sled, 2 important areas must be considered when evaluating its effectiveness. First, the correct technique must be used and duplicated throughout all drills to allow efficient transfer to the ice. Second, the device must help develop the skating musculature.

The acquisition of the most effective skating technique should be one of the major goals during the early years of hockey training (3). As stated earlier, players often have limited opportunities to develop correct skating techniques because of the low availability of ice times, prohibitive cost, and reliance on game-type scrimmages. Players often turn to in-line skating as a means to develop skating technique and fitness. The trouble with in-line skating is that the glide phase is too long, because of the low-friction wheels. The joint order of the in-line stride can be compromised because of the glide factor, which should not be transferred on the ice. When towing a sled on in-line skates, the resistance of the sled slows the glide of the in-line skates, and the movement and recruitment patterns become very similar to that of on-ice skating. Using a low weight on the sled and working with a coach or other players for feedback may allow more time for critical technique work that can ultimately have a tremendous benefit for the athlete.

When using the sled to develop the skating musculature, the reduced glide provided by the resistance has another effect on the athlete. Inexperienced players often overutilize the glide phase of skating and develop poor habits instead of dropping down into a deep knee bend and pushing forcefully. When dragging the sled, the athlete is required to develop a stronger push phase and then recover the leg quickly to keep the loaded sled moving. The exercise is a closed-chain multi-joint exercise that allows the posterior muscle chain to be worked in a functional skating motion (8). By periodizing the loading of the sled, players can gradually develop their skating musculature and can transfer that power to the ice.

Skating Techniques Used With the Weighted Sled

It is important to use correct skating technique when using the sled so that bad habits are not transferred to the ice. Athletes should start off using a light weight (5 to 10 lb) on the sled and should have their technique reviewed and corrected by a certified coach before any additional loads are used. The cut-off point for all sled loads occurs when the technique of the athlete declines to less than 90% of optimal for that athlete. Coaches should emphasize technique points, such as a deep knee bend (90 to 110 degrees), recovery of the unweighted leg to the midpoint of the body, appropriate forward lean of the torso near 45 degrees, and triple extension of the ankle, knee, and hip throughout a full range of motion for the athlete.

The following are the 3 basic exercises that can be used with the sled to develop the skating stride. Many more exercises can be used with various attachments and handles. It should be restated that the construction of the waist and ankle belts allows the sled to turn when the athlete changes direction, so it is possible for the athlete to shift from forwards to backwards and back again without stopping to adjust the harness.

Forward Skating

The player puts on the waist or upper body shoulder belt, hooks the belt to the cable attached to the sled, and drags the weighted sled forward with correct technique (Figure 1).

Backward Skating

The athlete puts the waist belt or shoulder strap on so that the harness is in front and he or she is facing the sled, attaches the harness to the cable, and pulls the sled, going backward, using powerful C-cuts (a technique in backward skating) to each side (Figure 2).

Ankle Skating

The player puts the straps on each ankle, attaches the cable to the harness on each strap, and drags the sled either forward or backward with a strong push and quick recovery from each leg. At first this may prove very difficult, but as the strength in the hip flexors and posterior chain develop, the athlete will find this a very challenging but rewarding exercise (Figure 3).

Incorporating the Sled Into a Training Program

When using any training apparatus it is important to emphasize safety. Players should wear, at the minimum, a helmet

Table 1
Sample Off-season Sled Workout Plan

Workout 1 (Conditioning) Monday
Forward skating (5 × 15-second bursts)
Backwards skating (5 × 15-second bursts)
Forward ankle skating (5 × 15-second bursts)
Forward/back, back/forward pivot turns (3 × 10-second bursts each way)
Cross-over turns left and right (around pylons or a set course) (2 × 10-second bursts each way)
Note: Use a weight that will not impair technique by more than 90% of optimum. Rest periods should be kept to 45 seconds to keep with the 1:3 work/rest ratios. These sessions are usually combined with an interval workout on foot or with in-line skates for further conditioning.
Workout 2 (Acceleration) Saturday
Forward skating (10 × 5-second bursts)
Backwards skating (8 × 5-second bursts)
Cross-over turns around pylons to forward sprinting (4 × 7-second sprints each way)
Forwards skating (match sprinting) (10 × 40 meters)
Note: Use a weight that will not impair technique by more than 90% of optimum. Rest periods should be kept to 25 seconds for 5-second sprints, and 35 seconds for 7-second sprints to keep with the 1:5 work/rest ratio. These sessions are usually combined with plyometrics, kettlebell lifting, or sprints on foot or with in-line skates to complete the workout.

and gloves for protection. A large, open, paved area that is free of traffic and people should be used for all training sessions. To prevent any negative effects from transferring to the ice, coaches must make sure that the sled is not overloaded and that poor techniques are not used. Setting up training sessions with groups of 2 or 3 players taking turns on 1 sled provides the coach with a good opportunity to supervise and correct any technical errors as they arise.

When developing a training plan for sled-dragging workouts, interval training, which is similar to game conditions, is recommended. Research has shown that limiting skating drills to less than 20 seconds helps to preserve skating technique (2). When athletes get tired, they tend to straighten their legs, push through the hips more without much quadriceps involvement, and fail to lean forward in the upper body. While a typical hockey shift lasts for 45 seconds, not all of that time is spent skating at maximal velocity; therefore, the training times should range from 5- to 15-second sprints that simulate game conditions. Rest periods between sprints should range from a 1:3 work to rest ratio (which is typical of a hockey shift) to a 1:5 ratio (to allow for more recovery), depending on the goal of the session. Two primary types of training sessions are outlined in Table 1.

Conclusion

Hockey players need to incorporate a number of different training modalities to create a complete yearly training plan. Training that is sport specific should be used as much as possible to allow for the greatest transfer of skills to game situations. Towing a weighted sled may be an efficient and cost-effective method of developing technique and strength enhancement in the skating stride. Because this product is new, more research on how best to use it should be performed. Other sports, such as speed skating, figure skating, in-line skating, and Nordic skiing may also benefit from this type of training, as the technical demands in the skating action of these sports are similar to those of hockey. ♦

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Pollitt

David J. Pollitt is the owner of Optimal Performance Strength & Conditioning Consulting and works with a number of hockey players and teams throughout North America.