ICE HOCKEY STRENGTH AND CONDITIONING CONSIDERATIONS—SLED RESISTED SPRINT TRAINING AS A DYNAMIC CORRESPONDENCE EXERCISE FOR IMPROVING ON-ICE ACCELERATION

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Ice hockey is a physically demanding sport requiring multiple fitness components. This includes strength, acceleration, speed, power, anaerobic and aerobic endurance, agility, and balance (8). Additionally, ice hockey requires highly skilled capabilities while encountering intensive physical contact. Explosive strength and power for on-ice acceleration are specific fitness components that can be the difference maker in beating an opponent to the puck, chasing an opponent for defensive strategy, or out accelerating an opponent for a break away, with an opportunity of scoring a goal.

An athlete's time and energy is precious, so training programs should be effective and efficient. It is important to incorporate exercises transferring to on-ice speed rather than spending time on methods that will not transfer to the game (7). Incorporating dynamic correspondence exercises, rather than less transferable exercises, is an important consideration when designing a hockey-specific strength and conditioning program. Dynamic correspondence exercises enhance sport performance as they resemble the sport movement's amplitude, direction, force production, movement dynamics, and type of muscular contraction (6). This article examines using the sled as a dynamic correspondence exercise for increasing on-ice acceleration.

PHYSICAL DEMANDS OF ICE HOCKEY

Ice hockey mechanics occur with a forward lean, piston-like leg action, and long ground-contact time (7). Ice hockey players must perform repeated accelerations, from a stopped position, gliding, or changing direction, as opposed to simply achieving top end speed and holding it as commonly seen with sprinters or some field athletes. In comparison to running mechanics of sprinters or athletes on the field, ice hockey relates more to the acceleration sprinting phase than the top-speed upright running phase (7). Neeld suggests that performing short-distance sprints of 15 yards or less is an effective dynamic transference exercise for on-ice speed (7). With the biomechanical considerations of a hockey player, a sled can be used successfully as a tool to improve the acceleration sprinting phase. Further, using the sled for resisted sprinting can be used to increase horizontal strength and horizontal performance (7).

USING A SLED TO ENHANCE SKATING

Prescribing an appropriate load for resisted sled sprinting, as it relates to the ice-skating characteristics of a hockey player of the acceleration phase, will likely enhance transfer of training to the ice (4). A general recommendation is 20 – 30% body weight (BW) external load for increasing acceleration, whereas lighter loads of 10 – 20% BW are recommended for increasing maximal velocity (9). Other recent research indicates sled loads up to 40% BW, or even greater, may be ideal for improving acceleration (4). Because heavier loads are related to increased acceleration and increasing horizontal performance, heavier loads appear more applicable for the hockey player looking to increase on-ice acceleration. As sled loads increase, trunk angle forward lean increases, which may increase net horizontal force production (3).

However, simply assigning loads relative to body mass may not be the most appropriate approach. Furthermore, using loads based on BW alone does not account for mitigating factors, such as how strong the athlete is, the athlete's training status, or surface area (affecting friction). A slightly heavier load, for example, may be required to increase acceleration of trained athletes as compared to untrained athletes (3). With this in mind, load prescription is not one-size fits all. For example, in an untrained or novice athlete, using a load of 30% BW may change the mechanics, eliciting an undesired effect. In my own personal observations, I have seen athletes prescribed a load so heavy for their individual strength abilities that they can hardly move the sled and when they do, they can only perform it while walking. In contrast, in a trained athlete with an ample background in strength training, a load greater than 30% BW may be required to produce the desired effect (3). For example, an athlete with a higher maximum squat and deadlift typically requires a greater resistance than an athlete who is a novice to strength training. I recommend using enough load to induce a training stimulus, but not so high that it significantly changes the biomechanics of sprint technique (3). During dryland training, a strength and conditioning coach could simply watch an athlete's mechanics and effort, or perform a timed 15-yard resisted sled sprint and a non-resisted sprint on a track. In contrast, if it feels like the resisted sprint is not different between a regular sprint in terms of the athlete's effort, and the resisted sprint and the 15-yard times are the same, the load is likely too light.

It is suggested that load for sled resisted acceleration should also consider if the athlete is in the strength/power phase, as well as the individual force output and goals (2). You may want to consider using a relatively heavier load in the early pre-season for improving strength, progressing to lighter loads for peak power closer to the season. Considering Newton's second law (force = mass * acceleration or force / mass = acceleration), an athlete's relative strength is crucial in improving acceleration and speed (4).

In consideration of using a harness at the waist or shoulder for the sled pull, Cahill et al. suggests attaching the harness at the waist instead of the shoulders because it can lead to greater horizontal impulses (2). Bentley et al. exhibited greater net horizontal impulses of 22.5% for waist attachment versus 17.5% for shoulder attachment (2). The greater net horizontal impulses with a waist attachment is attributed to foot placement relative to the center of mass, as well as greater forward lean (2). Bentley et al. suggest that using a waist attachment point is more suitable for the acceleration phase of sprinting because it leads to greater horizontal impulses and fewer kinematic alternations compared to the shoulder attachment (2).

Although additional research is needed to examine the kinematic effects of sled pushing, sled pushing with the arms does appear to increase forward lean and alter foot placement, suggesting greater net horizontal impulses (3). The tradeoff using the sled push is the lack of arm use. Including the use of arms during the sled pull could likely enhance the athlete's drive phase of acceleration and velocity (3). Additionally, activation of certain muscle groups and sprint mechanics may differ between the sled pull and push, considering the anterior position during the sled push versus the posterior position during the sled pull (3).

PROGRAM DESIGN USING SLEDS

When an ice hockey player is getting close to the season, it is recommended that sled resisted sprint training be used during a six-week period, 2 – 3 times per week, during the peak strength and power phase (5). Sled resisted acceleration training could be done as repeats on its own or used in conjunction for other exercises for metabolic conditioning. Strength and conditioning coaches can also use both methods if incorporating sled sprint training twice per week: once per week on its own as repeated sprints and once per week as metabolic conditioning. A number of training strategies have shown the sled resisted sprint to be effective for improving acceleration, both on their own or in a combination with a strength or power exercise (4). For example, a 10-yard sled resisted sprint as a combination following box back squats or hang cleans, or on their own as a series of 6 – 10 15-yard sled resisted sprints with approximately two minutes rest between each repetition.

In our training, we use resisted sprint training with other exercises as a combined training methodology. Complex training classically involves a strength exercise followed by a plyometric exercise. Ice hockey relies heavily on anaerobic glycolysis as an energy system, in which lactate is the end product (8). With this in mind, complex training can also be used as metabolic conditioning to mirror ice hockey demands (8). To improve acceleration in hockey players, combined training can be performed by using a sled resisted sprint, instead of a plyometric exercise, following a strength exercise.

The following provides an example program progression for complex training and metabolic conditioning. Note that the specific exercises, repetitions, rest time, and distance vary depending on the training goals. Equally important is that they are programmed, along with specific sled sprint training, based on individual training age, experience, and motor skills abilities, as well as training status considering attributes such as the athlete's strength and load capabilities (9). Persoanlly, I will typically build the athlete up to using the sled resisted sprint as metabolic conditioning for the pre-season peak power and conditioning phase. I have also incorporated specific exercises related to position, include sequences to mimic typical play to rest time, and included a skill component.

During dryland training, it is recommended to test often (every 10 – 14 days) to ensure that the athletes are making improvements. Testing is typically done off ice for a 10-yard sled resisted sprint, as well as a 10-yard non-resisted sprint using the same surface area (e.g., track surface). If possible, a repeatable ice sprint can also be done to ensure the training is transferring to the field of play.

Example Program Design Progression – Part 1:

a. Box back squats x 5 repetitions at 75 – 80+% 1RM (Athlete begins with 75%, increasing load each set with the last 2 – 3 sets at peak load. Focus: explosive movement during the concentric phase)

b. Sled resisted sprint 10 – 15 yards

Example Program Design Progression – Part 2:

a. Box back squats x 4 repetitions at 80 – 85% 1RM

b. Skater lateral hops with medicine ball x 10 repetitions total (5 each side)

c. Sled sprint 10 – 15 yards

Example Program Design Progression – Part 3:

a. Hang cleans x 4 repetitons at 80% 1RM

b. Box back squats x 4 repetitions at 80 – 85% 1RM

c. Skater lateral hops with medicine ball x 10 repetitions total (5 each side)

d. Sled sprint 10 – 15 yards

Notes:
Sets: 4 – 5
Repetitions: Suggested repetition scheme for strength and power (1).
Rest: Minimal between exercises, ~10 – 15 s with enough time for the athlete to walk to the next station. 2 – 3 min rest between sets, the suggested rest time for resisted acceleration sprints (3).

CONCLUSION

Sled resisted sprints, used appropriately, can be an effective dynamic correspondence exercise for developing on-ice acceleration. Incorporating complex or a combined style of training is an efficient training method, especially when time is limited and the ice hockey player needs to focus on skill development or other specific hockey elements. From personal experience, I also find that when we come to this phase of the program, athletes get very excited and are motivated to give it their all, with a high intensity output.

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ABOUT THE AUTHOR

Tammy Kovaluk has over a decade of experience as a strength and conditioning coach. She has worked with both teams and individuals in most sports with a special interest in dynamic correspondence and metabolic conditioning for hockey and American football. Kovaluk was the strength, speed, and assistant wide receiver coach for Belmont High School football. She works with a variety of hockey athletes from youth to the National Hockey League (NHL) prospects, and is the current strength and conditioning consultant for Beyond the Edge International Search and Rescue. She has also worked as a clinical corrective exercise specialist alongside Dr. Rob Hasegawa, Team Canada Chiropractor. Kovaluk holds a Master of Science degree in Kinesiology and Sport Conditioning through AT Still University, where she was awarded a certificate for academic excellence. She is also a Certified Strength and Conditioning Specialist® (CSCS®) through the National Strength and Conditioning Association (NSCA), Certified Speed and Agility Specialist (CSAS) through the International Youth Conditioning Association (IYCA), and is certified as a Level 2 Function Movement Screen™ (FMS™).

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