THE RECHARGE SKATE—A TOOL FOR EXPRESSING IN-SEASON REPEAT SPRINT ABILITY

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The recharge skate is an in-season hockey conditioning drill designed by the authors. The purpose of this on-ice drill is to maintain hockey-specific energy system fitness throughout the competitive season. It is consistent with the training principle of specificity in that it resembles the competitive demands of the sport with respect to environment, movement mechanics, and work-to-rest ratios. The target population is male elite hockey players; however, intensity and volume can be modified to make it appropriate for other competitive levels.

A regulation professional hockey game is comprised of three, 20-min stop time periods with 15-min intermissions between periods. A typical 60-min game extends to approximately three hours of actual time. At the professional level, skaters (forwards and defense) are usually on the ice, competing, for 15 – 24 min of the 60-min game. At this level, shifts last between 45 – 60 s, followed by 3 – 5 min of passive rest off the ice sitting on the team bench. Typically, 5 – 7 high-activity bursts, each 2 – 3.5 s in duration, occur during each shift (1).

Hockey performance at the professional level relies heavily on the alactic and aerobic pathways. Skaters repeatedly engage in a race to the puck and an ensuing battle for puck position. In the lens of strength and conditioning, a game tests an athlete's repeat sprint ability (RSA). This article will discuss how in-season RSA is addressed within the context of professional hockey at the East Coast Hockey League level.

Within the context of a hockey game, a shift involves intermittent work. Typically, 2 – 3.5 s maximal-intensity efforts are alternated with low-intensity efforts (1). The capacity of an ice hockey player to repeatedly produce high levels of power over the course of a game will give them a competitive advantage over their opponents. To this end, improvement of repeatable skating speed should be a focus of conditioning programs (12). RSA is defined as an athlete's ability to recover and maintain maximal effort during subsequent sprints (13). Repeatable skating speed is a function of: 1) absolute speed (anaerobic power) and 2) ability to recover from maximal efforts (aerobic capacity). Aerobic capacity can be measured by VO_2peak and VO_2max. Previous research has concluded that there is an inverse relationship between aerobic capacity and fatigue from an on-ice repeat sprint test (12). Athletes with higher VO_2peak and VO_2max typically have a higher RSA than their less aerobically conditioned peers (2,12). This can be attributed to the fact that elevated aerobic conditioning levels allows phosphocreatine stores to be replenished at a faster rate (5). Furthermore, superior aerobic conditioning limits the influence of the lactate pathway on metabolism (5). Additionally, high aerobic fitness has been linked to improved lactate clearance during recovery between sprints, as well as sustained power output in subsequent sprints (10).

EXPRESSING REPEAT SPRINT ABILITY

The goal of in-season training sessions is to allow athletes to express their fitness in competition. The development of the components of fitness necessary for success in competition (anaerobic power and aerobic capacity) should occur during the off-season and pre-season.

In the competitive arena, RSA hinges on an athlete's ability to recover from a maximal alactic effort to be able to perform subsequent sprints with uniform high intensity. RSA development is governed by the application of the specificity principle, which states that training sessions need to resemble the work-to-rest ratio and movement mechanics of the sport. Additionally, peak power and velocity need to be maintained throughout each alactic repetition (13).

Given the time constraints of a conditioning period within the framework of an organized practice, an effective drill should address both technical and conditioning needs of the athlete (6). Technically, high-speed forward linear skating is a valuable trait for ice hockey players because games can be won or lost in less than a second (14). Players who start fast often get to the puck or to their position on the ice first, gaining an advantage for their team. Consequently, players need to develop the acceleration and explosiveness from a complete stop (11).

From a metabolic standpoint, the goal of RSA training is to minimize the role of the lactic pathway during competition due to the metabolic stress it creates, namely: 1) lactate and 2) pH disruption via creating an acidic environment (7). Conversely, the alactic and aerobic pathways can be viewed as "clean" energy. The high-power demands of puck races and battles are fueled by the alactic system. During the ensuing recovery, the aerobic system is responsible for returning the body to homeostasis (4). In season, workouts that pair the alactic and anaerobic systems are critical for maintaining hockey-specific metabolic fitness.

THE RECHARGE SKATE

When developing training stimuli to improve RSA, it is necessary to have a high power, alactic movement immediately precede a low-intensity, aerobic movement. The recharge skate is an on-ice example of this template designed to address RSA (Figure 1). Each round of the recharge skate begins with a 5 – 8 s maximum-effort sprint from a standing start; from the goal line to the face off dot just outside the near blue line for the five-second sprint or to the far blue line for the eight-second sprint. Once the end of this five-second period is reached, the athlete will skate at a very low intensity for 52 – 55 s before starting another round. Athletes will loop around points I and II, returning to the goal line and beginning the next round immediately after coming to a complete stop. A full recharge skate workout should be comprised of approximately 10 – 12 rounds. The brief maximum-effort sprint satisfies the alactic requirement, while the extended recovery stresses the aerobic pathway.

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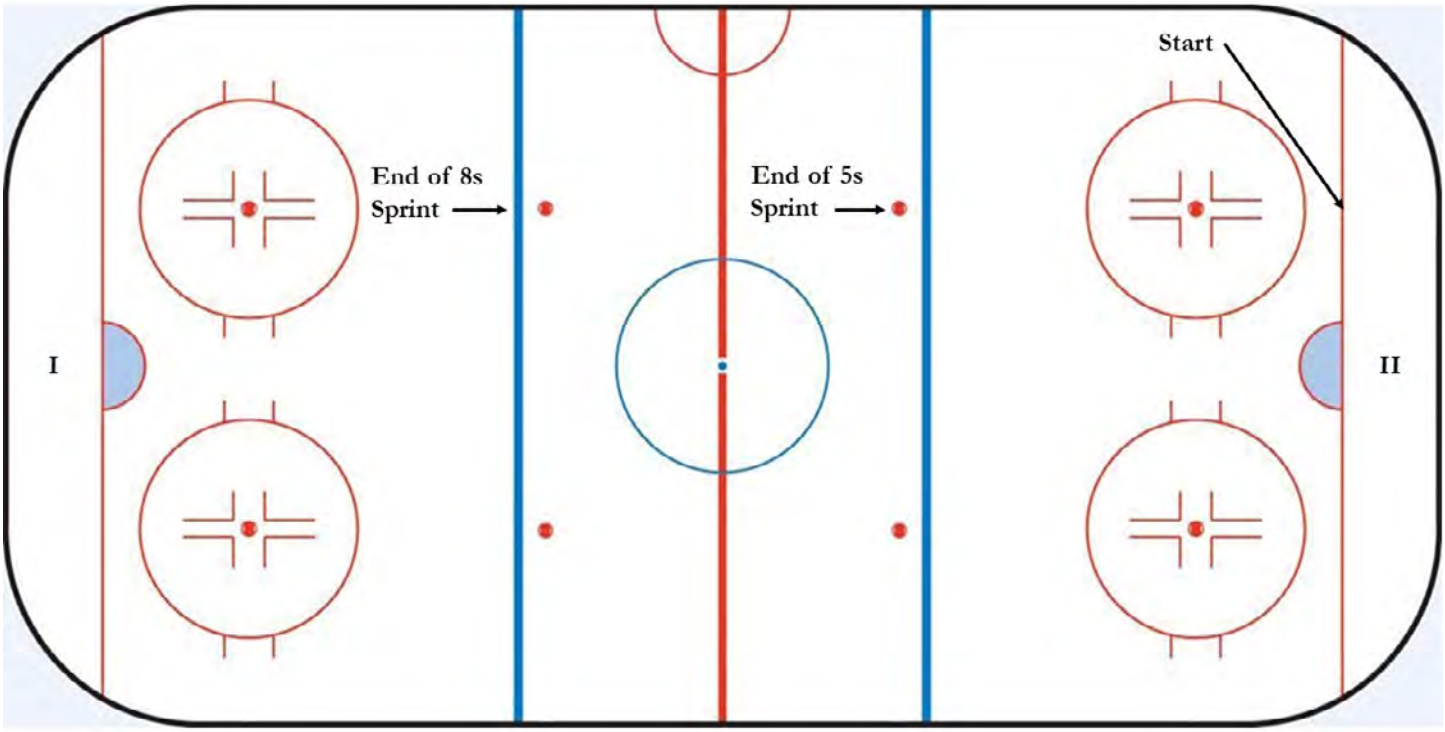

FIGURE 1. EXAMPLE OF A RECHARGE SKATE ON ICE

Instant acceleration is critical for hockey success. Successful players have mastered the ability to accelerate rapidly and explosively from a complete stop. This begins by using a technique aptly described by Stamm as toe starts (11). Often athletes neglect this technique in game situations due to lack of practice (11). The recharge skate provides an excellent forum for developing toe starts. When players start each round of this drill, they should take the first few accelerating steps on their toes before transitioning to a sprinting forward stride (11).

In the East Coast Hockey League, games typically fall on weekends or weekdays later in the week. This rather predictable schedule is ideal for infusing significant training stimuli into the in-season macrocycle. Athletes should have 48 hr of recovery between the completion of the recharge skate and the first game of the week. This rationale is consistent with the high-low approach to training where a high-intensity day is followed by a low-intensity day. The high-low approach alternates high- and low-intensity days to maximize athlete readiness for competition (3). Table 1 shows how the timing, volume and intensity of a recharge skate can be modified based on the competitive demands of the training week.

TABLE 1. SAMPLE RECHARGE SKATE PROGRAMMING

WEEKLY GAME SCHEDULE	SCHEDULED DAY	PARAMETERS
Thursday and Saturday	Tuesday	12 x 8 s sprint, 52 s low-intensity skate
Friday, Saturday, and Sunday	Wednesday	10 x 5 s sprint, 55 s low-intensity skate

With respect to monitoring the intensity of this drill, heart rate should stay in the aerobic range between 100 – 180 beats per minute (5). Note that the protective equipment necessary for competitive hockey may preclude manually monitoring recovery heart rate via radial or carotid pulse. Athletes would have to set their stick down and remove their gloves following each repetition. If heart rate monitoring equipment is unavailable, athletes can use nasal only breathing for the duration of this drill to ensure minimal influence of the lactate pathway (5). The point where an athlete switches from nasal to oral breathing has been correlated with the transition from low-intensity aerobic activity to high-intensity levels (8). To employ this technique, instruct the athletes to complete all repetitions of the recharge skate with their mouths closed.

CONCLUSION

The recharge skate is a drill strength and conditioning coaches can employ to develop on-ice speed and power due to the coupling of the near maximal intensity, alactic, 5 – 8 s sprint with a generous 52 – 55 s low-intensity aerobic recovery period. Ideally, it will be the last period of a practice (6). The primary goal of the recharge skate is to stress the alactic and aerobic pathways. The secondary goal is to address work capacity. Practicing explosive starts for gaining the competitive edge is a tertiary goal (9).

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REFERENCES

1. Brocherie, F, Girard, O, and Millet, GP. Updated analysis of changes in locomotor activities across periods in an international ice hockey game. *Biology of Sport* 35(3): 261, 2018.

2. Doyle, B, Browne, D, and Horan, D. The relationship of aerobic endurance and linear speed on repeat sprint ability performance in female international footballers. *International Journal of Human Movement and Sports Sciences* 8: 147-153, 2020.

3. Francis, C, and Patterson, P. *The Charlie Francis Training System*. Ottawa, CA: TBLI Publications; 42-43, 1992.

4. Glaister, M. Multiple sprint work. *Sports Medicine* 35: 757-777, 2005.

5. Hickey, B. Bridging the gap: Understanding energy system development in hockey. NSCA Hockey Strength and Conditioning Clinic and Live Stream, 2019.

6. Hickey, B, and Ward, B. The men's lacrosse 1-4-1 double mumbo: Teaching and training. Published ahead of print. *Journal of Physical Education and Sports Management*, 2021.

7. House, S, Johnston, S, and Jornet. K. *Training for the Uphill Athlete: A Manual for Mountain Runners and Ski Mountaineers*. Ventura, CA: Patagonia Books; 41-50, 2019.

8. LaComb, CO, Tandy, RD, Lee, SP, Young, JC, and Navalta, JW. Oral versus nasal breathing during moderate to high intensity submaximal aerobic exercise. *International Journal of Kinesiology and Sports Science* 5(1): 8-16, 2017.

9. McConnell, D. High performance periodization: Integration of on and off ice training for optimal development. NSCA Hockey Strength and Conditioning Clinic, 2017.

10. Oyono-Enguelle, S, Heitz, A, Marbach, J, Ott, C, Gartner, M, Pape, A, et al. Blood lactate during constant-load exercise at aerobic and anaerobic thresholds. *European Journal of Applied Physiology and Occupational Physiology* 60(5): 321-330, 1990.

11. Stamm, L. *Laura Stamm's Power Skating 4th Edition*. Champaign, IL: Human Kinetics; 141-170, 2010.

12. Stanula, A, Roczniok, R, Maszczyk, A, Pietraszewski, P, and Zając, A. The role of aerobic capacity in high-intensity intermittent efforts in ice-hockey. *Biology of Sport* 31(3): 193, 2014.

13. Turner, A, and Stewart, P. Repeat sprint ability. *Strength and Conditioning Journal* 35(1): 37-41, 2013.

14. Wilson, K, Jackson, J, Snydmiller, G, and Bell, G. Development and reliability of a 7×15m repeated on-ice sprint test for female ice hockey players. *International Journal of Exercise Science* 14(6): 666-676, 2021.

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