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The effects of heavy upper-body strength training on ice sledge hockey sprint abilities in world class players

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ABSTRACT

The current study investigated the effects of 6 weeks of heavy upper-body strength training on maximal strength and sprint abilities in eight world class ice sledge hockey players. Before and after the strength training intervention, all subjects performed a 30-m maximal sprint on ice (where time for each 10 m section was measured) and 1 repetition maximal (1RM) strength test in the bench pull (BP), pull-down (PD), pull over (PO) and front pull (FP) exercises. Three weekly sessions with 3 × 6–8RM for these strength exercises were added during the intervention period. From pre- to post-test, 1RM in the strength exercises improved by 4–8%, whereas 30-m sprint time, all 10-m section times and the calculated power output in the 10-m acceleration phase all improved by 2–3% (all $P < .05$). The pre- to post-test changes in 30-m sprint time and the initial 10-m time correlated significantly with the changes in 1RM for BP ($r = 0.59$ and 0.55) and PD ($r = 0.60$ and 0.68) (all $P < .05$). In conclusion, the results of this study strongly suggest that heavy upper-body strength training improves upper-body strength and ice sledge hockey sprint abilities, and that the magnitude of improvements in strength correlates with the improvements in sprint abilities.

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1. Introduction

Ice sledge hockey is the Paralympic version of regular ice hockey and targets athletes with a physical disability in the lower-body. The players sit in an aluminum sledge with their feet, ankles, knees, and hips fixed during the match and employ two modified hockey sticks for puck handling and player movement. Thus, the players rely entirely on their upper-body to propel themselves rapidly across the ice surface. The rapid poling movements during ice sledge hockey make the athletes' sprint abilities important, which subsequently create a large requirement for upper-body maximal strength and power. As ice sledge hockey is a popular Paralympic team sport it is also a unique locomotion where the isolated and repetitive poling movements provide a model for examining upper-body sprint abilities and the effects of improved strength characteristics.

In a previous study we showed significant correlations between upper-body strength and sprint abilities in ice sledge hockey players (Skovereng, Ettema, Welde, & Sandbakk, 2013). Here, the correlation was strongest for the most movement-specific strength exercise when compared to more general strength measures. Associations between upper-body strength and various types of performances are further supported by studies on elite kayakers (Liow & Hopkins, 2003; Uali et al., 2012), wheelchair racers (Turbanski & Schmidtbleicher, 2010), surfers (Sheppard et al., 2012) and luge athletes (Crossland, Hartman, Kilgore, Hartman, & Kaus, 2011; Platzer, Raschner, & Patterson, 2009). A few of these studies also showed simultaneous improvements of maximal strength and sprint abilities with heavy upper-body strength training (Liow & Hopkins, 2003; Turbanski & Schmidtbleicher, 2010), whereas such training in cross-country skiers improved upper-body strength, skiing economy and endurance performance (Hoff, Gran, & Helgerud, 2002; Losnegard et al., 2011; Osteras, Helgerud, & Hoff, 2002; Ronnestad, Kojedal, Losnegard, Kvamme, & Raastad, 2012). Whether these strength training effects apply for elite athletes who are specialized in an isolated upper-body movement needs to be further elucidated. Furthermore, the relationships between strength gains in general versus specific exercises and improvements in upper-body sprint abilities has not yet been investigated.

In this context ice sledge hockey players that are already highly trained in their upper-body would provide relevant subjects for analyzing how increased emphasis on heavy strength training would influence upper-body strength and the different phases of a sprint. Therefore, the purpose of the present study was to investigate the effects of 6 weeks of heavy upper-body strength training on maximal upper-body strength and sprint abilities in world class ice sledge hockey players. Our main hypotheses were that heavy strength training would improve ice sledge hockey sprint abilities, and that the magnitude of improvements in the most movement-specific strength exercises would correlate with the improvements in sprint abilities.

2. Methods

2.1. Subjects

Eight elite ice sledge hockey players from the Norwegian national team volunteered to participate in this study. All subjects were highly committed to training, and six of them had won medals in international championships in this sport. The subjects had either one or two legs amputated or spinal cord injuries (Th11–12). However, none of the examined athletes had injuries or disabilities that influenced their performance in the sprint or strength exercises. The anthropometric, physiological and training characteristics of all subjects are depicted in Table 1. Before providing their written consent to participate, all of the subjects were fully informed about the nature of the study. It was stated explicitly that subjects could withdraw from the study at any point without giving a reason for doing so.

2.2. The experimental approach

After preliminary tests and a 6-week habituation period, 6 weeks of heavy strength training was executed. Before and after the intervention, 30-m sprint poling on ice (where time for the different