

PEAK VELOCITY OF NORDIC SKI DOUBLE POLE TECHNIQUE: STAND-UP VS. ADAPTIVE SIT-SKIING.

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INTRODUCTION: One of the event styles in cross-country skiing is the classic technique in which the skis move in groomed tracks. Double poling is a technique used under the classic skiing style, and is defined as when the upper body provides most of the propulsion via bilateral pole pushes. Double poling during classic cross-country skiing has become more popular in the past twenty years. It has also been shown to have strong correlations with increased race speed (Smith, Fewster, & Braudt, 1996).

Maximal velocity considers an overall velocity of the movements, but does not specify at which point during the poling phase that peak velocity occurs. By breaking a movement down into its components one may be able to critique technique more specifically. This study examined the point at which peak linear velocity occurred during the double poling cycle time in Nordic stand-up and sit-down skiing.

METHODS: Four female and two male collegiate athletes participated in stand-up and sit-skiing, and one experienced male sit-skier participated as a subject to reference for the analysis portion of this study. All subjects arrived at an outdoor cross-country ski venue with skis, boots, and poles. Ethical approval (#HS09-242) was received prior to conduction of the study, and signed an informed consent and PAR-Q questionnaire were completed prior to participating. A Canon Digital Video Camcorder NTSC Optura 20 (Canon Inc., Japan) was placed perpendicular to the ski line approximately 4.5 meters away. A 1/1000 shutter speed was used, with a 60 Hz camera. Each subject had markers placed on their ski binding to allow digitization of movement. They were asked to mimic a race start using the double pole technique. The video captured a recording of at least one complete cycle of double poling. One cycle is defined from pole plant to pole plant. The Peak Motus System version 8.5 (Vicon Motion Systems Inc., Centennial, CO) was used to analyze the data. One poling cycle lasted approximately one second. Using MATLAB each subject's trial was standardized to one second. This allowed the researchers to calculate the percentage of poling cycle (%PC) for comparisons.

RESULTS & DISCUSSION: Paired T-Test indicated that the point at which peak velocity occurs in Nordic sit-skiing (mean \pm SD: 0.350 ± 0.066 %PC) and stand-up skiing is (0.231 ± 0.031 %PC) ($p = 0.017$). A One-sample T-Test comparing the experienced male sit-skier (0.350 %PC) to the subjects found no difference ($p = 0.995$). Results of the study indicate that there is a difference in the point at which peak velocity occurs between Nordic sit-skiing and stand-up skiing. Furthermore, it may be possible to use experienced stand-up skiers as subjects in sit-skiing research. A larger subject base in the future may allow more extensive conclusions to be made.

REFERENCES:

Smith, G. A., Fewster, J. B., & Braudt, S. M. (1996). Double poling kinematics and performance in cross-country skiing. *Journal of Applied Biomechanics*, 12, 88 – 103.