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On-Ice Force-Velocity Modeling Technical Considerations

Authors : Dan Geneau, Mary Claire Geneau, Seth Lenetsky, Ming -Chang Tsai, Marc Klimstra

Abstract : Introduction— Horizontal force-velocity profiling (HFVP) involves modeling an athletes linear sprint kinematics to estimate valuable maximum force and velocity metrics. This approach to performance modeling has been used in field-based team sports and has recently been introduced to ice-hockey as a forward skating performance assessment. While preliminary data has been collected on ice, distance constraints of the on-ice test restrict the ability of the athletes to reach their maximal velocity which result in limits of the model to effectively estimate athlete performance. This is especially true of more elite athletes. This report explores whether athletes on-ice are able to reach a velocity plateau similar to what has been seen in overground trials. Fourteen male Major Junior ice-hockey players (BW= 83.87 +/- 7.30 kg, height = 188 ± 3.4cm cm, age = 18 ± 1.2 years n = 14) were recruited. For on-ice sprints, participants completed a standardized warm-up consisting of skating and dynamic stretching and a progression of three skating efforts from 50% to 95%. Following the warm-up, participants completed three on ice 45m sprints, with three minutes of rest in between each trial. For overground sprints, participants completed a similar dynamic warm-up to that of on-ice trials. Following the warm-up participants completed three 40m overground sprint trials. For each trial (on-ice and overground), radar was used to collect instantaneous velocity (Stalker ATS II, Texas, USA) aimed at the participant's waist. Sprint velocities were modelled using custom Python (version 3.2) script using a mono-exponential function, similar to previous work. To determine if on-ice tirals were achieving a maximum velocity (plateau), minimum acceleration values of the modeled data at the end of the sprint were compared (using paired t-test) between on-ice and overground trials. Significant differences ($P<0.001$) between overground and on-ice minimum accelerations were observed. It was found that on-ice trials consistently reported higher final acceleration values, indicating a maximum maintained velocity (plateau) had not been reached. Based on these preliminary findings, it is suggested that reliable HFVP metrics cannot yet be collected from all ice-hockey populations using current methods. Elite male populations were not able to achieve a velocity plateau similar to what has been seen in overground trials, indicating the absence of a maximum velocity measure. With current velocity and acceleration modeling techniques, including a dependency of a velocity plateau, these results indicate the potential for error in on-ice HFVP measures. Therefore, these findings suggest that a greater on-ice sprint distance may be required or the need for other velocity modeling techniques, where maximal velocity is not required for a complete profile.

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