SPRINT ACCELERATION MECHANICS

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INTRODUCTION: Sprint acceleration is a key feature in many sports performance. It is a direct determinant of performance and the focus of specific training in track and field events such as the 100- or 200-m, but is also paramount in other sports such as soccer or rugby. In the latter, the acceleration capability is a major physical determinant of performance, especially in decisive offensive and defensive actions. In addition, although the exact moment of occurrence is still debated, sprinting and the acceleration phase in particular are the most frequent tasks involved in hamstring strain injuries. Therefore, a better understanding of the mechanical determinants of sprint acceleration performance could help sport practitioners better design training programs, and likely better manage the complex muscle injury prevention / rehabilitation process.
However, due to the very fast motion of the human body induced by maximal acceleration (running speeds of more than 10 $m.s^{-1}$ are reached within a few seconds), and the necessary field (i.e. specific) measurements, valid scientific methods that provide direct, accurate and specific mechanical data over the course of an entire sprint (start + acceleration phases) are scarce.

SHORT SUMMARY: The session consisted of performing kinetics and kinematics measurements of a sprint start and acceleration phase (starting-blocks and 40-m acceleration to top speed) on a track, and then directly analyze data from two perspectives. First (S Willwacher), push-off force measurements combined with high speed video analysis allowed a deep and detailed understanding of the sprint start and first steps technique and performance through kinetic and kinematic variables. Furthermore, performance related parameters were extracted immediately from the captured force signals, and individual values were compared to a large reference database. Then (JB Morin), a new simple field method based on speed-time measurements using a radar device allowed the determination of horizontal net force and power output during the acceleration, and the study of external power-force-velocity profile of the subjects. Two athletes were compared during the session in order to better discuss the interest of the methods presented in monitoring and coaching sprint technique and performance. Applications concern athletics, but also all sports that include sprint acceleration as a performance component.

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