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# How to maximize performance during Paralympics by analyzing the Human-wheelchair-athletic track interactions ?

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**INTRODUCTION:**
**Sciences2024 is a collaborative French research project between sport federations and academic researchers aimed at improving athletics and para-athletics performance for the Paris Olympic and Paralympic Games. Thus, for instance, maximizing the velocity of the wheelchairs during competitions requires to increase the grip between gloves and handrims during the propulsion phase as well as to understand the friction dissipation between the wheelchair tire and the athletic track during the rolling phase.**
**METHODS:**
**A lab-field approach was carried out. From experiments with French national athletes in real conditions, an analysis of the kinematics was performed and force sensors, strapped on the athlete glove, provided additional data on the glove/handrim interface.**
**The propulsion phase kinematics was experimentally simulated in LTDS by means of the LORRY tribometer that allows one to control both the contact and release times of the glove/handrim interface. The rolling/sliding phase between the wheelchair tire and various tracks was experimentally investigated thanks to the LUG tribometer. It allows us to realize contacts between a rubber barrel sample, representative of the tire, versus various tracks, from smooth transparent glass discs to real athletic tracks. The contact kinematics was controlled with each solid velocity ranging from 50 m/s to 1 m/s and the contact forces were measured up to 10 N. The composition of rubber samples (both handrim and tire) provided by Hutchinson was varied in terms of fillers, keeping the elastomer matrix constant.**
**RESULTS:**
**Our first results on the model glass/rubber contact in rolling/sliding conditions helped us to identify the relative influence of adhesive and viscoelastic contributions of the rubbers. When investigating more realistic scenarii with rolling-sliding conditions on athletic tracks, friction depended on the sliding-rolling ratio (SRR): at low SRR, a levelling of friction was observed and at higher SRR, the friction level did not correlate directly with the rubber bulk properties. These results highlighted the influence of track viscoelasticity and roughness, confirming field experimental results focusing on the coefficient of rolling resistance.**
**The contribution of adhesion was marked during the propulsion phase and this will be confronted to field results.**
**CONCLUSION:**
**The methodology proposed here was based on the analysis of the interactions of the wheelchair with either the Human athlete or the track, during rolling-sliding and propulsion phases. Confronting measurements on field to lab experiments, we were able to discuss the role of the roughness, adhesion and viscoelasticity, defining a promising way to enhance athletic performance.**

**Topic:** **Sport Technology**

**Presentation** **Poster**