Effects of a wheelchair stabilization and safety system on spatiotemporal and kinetic parameters during motorized treadmill propulsion

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INTRODUCTION
• There is growing interest to realize wheelchair propulsion biomechanical assessment on motorized treadmills1.
• To ensure users' safety, wheelchair is often secured on both sides with two elastic bands that constrain lateral deviation without affecting anteroposterior movement2 (Fig. 1 - TS).
• It is unknown if such devices affect the wheelchair dynamics and, consequently, the propulsion biomechanics.

METHODS
• 7 experienced wheelchair users (T12-B, T6-D, T5-A, T4-A, C7-B, cerebral palsy, muscular distrophy) propelled their own wheelchair at 1 m/s in three conditions in a random order (Fig. 1):
  • Overground (OG)
  • Treadmill Free (TF).
  • Treadmill Secured (TS)
• OG setup used the same rubber flooring as TF and TS.
• Cadence, push/recovery time, total/tangential forces and power were measured for every participants on 10 consecutive pushes in steady-state propulsion.
• Parameters were compared between setups using an ANOVA for repeated measures, followed by Student t-tests for repeated measures with Bonferroni correction, with $\alpha = 0.05$.

RESULTS
• Significant differences (*) were found in spatiotemporal parameters (Fig. 2), but not in kinetic parameters (Fig. 3).
• Cadence was significantly higher on TF than OG.
• Recovery time was significantly lower on TF than OG.
• Although not significantly different, forces and power were higher on TF than OG and TS.

CONCLUSIONS
• Higher cadence on treadmill than OG is consistent with literature2.
• Propelling on treadmill with the wheelchair attached with elastic bands (TS) seems to be more representative of overground propulsion (OG) than propelling with the wheelchair free (TF).
• This suggests that other factors (fear, steering, etc.), aside from the elastic bands, may also alter propulsion biomechanics.

REFERENCES