P3-H-50

Immediate effects of wearing a passive exoskeleton on spatiotemporal gait parameters.

Lelard T[1,2], Mathurel K[2], Delanaud S[3], Douay MC[3], Dierick F[4,5], Telliez F[2,3]

[1]UR 3300, Adaptations Physiologiques à l'Exercice et Réadaptation à l'Effort, Université de Picardie, France
[2]Institut d'Ingénierie de la Santé d'Amiens, Université de Picardie, France
[3]Laboratoire Péritox (UMR I-1), Université de Picardie, France
[4]Laboratoire d'Analyse du Mouvement et de la Posture, CNRFR-Rehazenter, Luxembourg, Luxembourg
[5]CeREF Technique, Mons, Belgique

INTRODUCTION

In the last decade, there has been a significant interest in the use of passive exoskeleton to reduce the risk of work-related musculoskeletal disorders (MSDs).

However, there is a lack of field-based evidence on the effects of using an exoskeleton on motor control during daily activities. Studies suggested that wearing a passive exoskeleton could compromise gait performance and stability, increasing the risk of falling (Park, 2022). Given the limitations reported by the literature, we wondered about the disturbances (imbalances, instabilities) that could be generated by wearing of exoskeleton, especially during locomotion

The aim of this pilot study was to examine whether wearing a passive upper or lower limb exoskeleton affects spatiotemporal gait parameters.

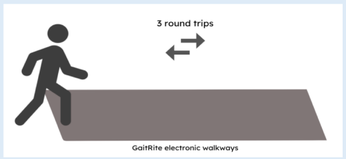
MATERIALS AND METHODS

Participants

25 healthy adults

Women / Men : 13 / 12
Mean age : 22.2 [SD 1.6] years
Average height : 1.74 [SD 0.11] m
Average weight : 67.5 [SD 13.9] kg

Experimental design



Each participant performed walking at a natural pace randomly under 4 conditions :

1) without an exoskeleton (No),
2) with an upper limb exoskeleton (Exo_{up}),
3) with a non-activated lower limb exoskeleton (Exo_{Lo-}),
4) with an activated lower limb exoskeleton (Exo_{Lo+}).

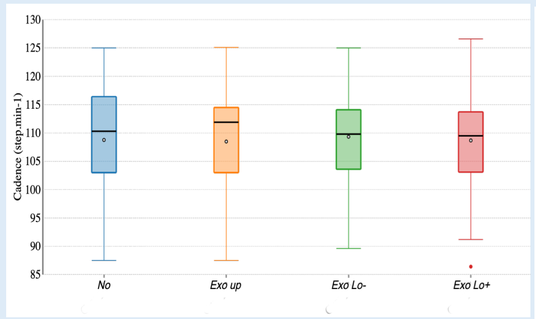
Spatio-temporal parameters

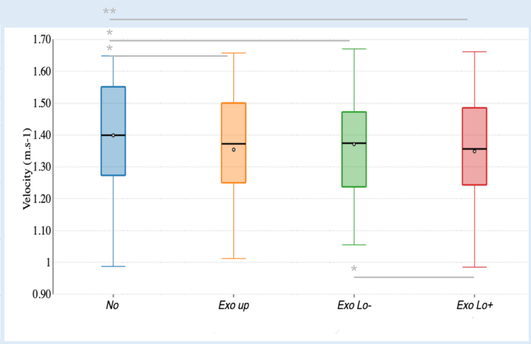
Step lenght (m)
Cadence (step.min-1)
Velocity (m.s-1)
Double stance phase period (% cycle)

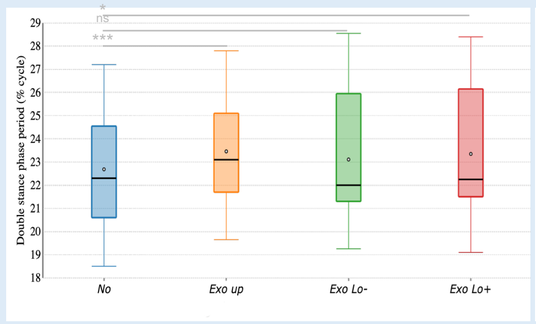
Statistics

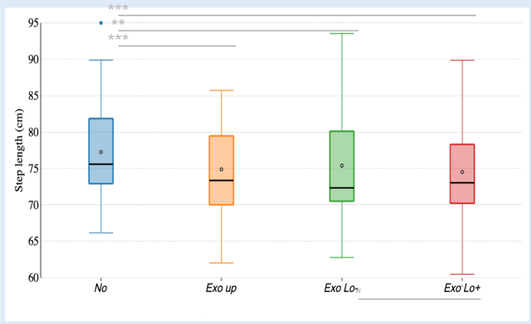
Friedmann test and Wilcoxon signed rank test

RESULTS









Significant differences

↘ Gait velocity (-0,03-0,05 m/s; p = 0.01)
↘ Step lenght (-2-3cm; p = 0.0003)
↗ Double stance period (p = 0.008)

Non significant differences

Cadence(p = 0.44)

ns : non significant ; * : p < 0,05 ; ** : p < 0,01 ; *** : p < 0,001

DISCUSSION

Our results are comparable to those obtained by Baltrusch (2019) and Park (2022). Indeed, tasks that required a large range of motion of trunk or hip flexion, including walking, can be impeded by a trunk exoskeleton (Baltrusch, 2018).

Immediate effects of wearing a passive exoskeleton are :

- decreased spontaneous gait speed
- reduced step length
- increased double stance phase period.

Cadence was kept similar in each condition, and let us think that participants keep the same rhythmic organization of gait.

Surprisingly, the changes in gait pattern are similar independently on the type of exoskeleton (Exo_{Lo} or Ex_{oup}) and on the assistance (ExoLo+ vs ExoLo-).

CONCLUSION

Further studies should be carried out, particularly on the effects of prolonged wearing of an exoskeleton on walking.

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