The influence of bodyweight on lower limb kinematics during walking on the AlterG treadmill

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Summary

The aim of this study is to assess the influence of bodyweight (BW) in healthy adults on the key gait kinematics variables during walking on the AlterG treadmill. 17 healthy adults walked on an AlterG treadmill at 3 km/h and 4 km/h at four BW conditions (100, 75, 50, 25%) while wearing Xsens sensors and lower body kinematics were calculated using the Xsens motion cloud software. Reducing BW in healthy adults via the BW support system on the AlterG treadmill had a significant effect on hip and knee range of motion (ROM), hip, knee and ankle maximum angles, and hip and ankle minimum angles during walking at 3km/h. Clinicians should consider the effect of reducing BW on walking kinematics when using the AlterG treadmill for rehabilitation.

Introduction

AlterG treadmills are used for rehabilitation in clinical populations as they can provide up to 80% BW support [1], however, there are conflicting findings on the effect of BW support on walking [2]. Therefore, the aim of this study is to assess the influence of BW in healthy adults on the key gait kinematics variables during walking on the AlterG treadmill.

Methods

17 healthy adults (8 males and 9 females, age: 31.6 ± 7.0 yr, mass: 78.9 ± 13.9 kg, stature: 1.720 ± 0.096 m) gave informed consent to participate in this study which was approved by the university ethics committee. The participants completed a 5-minute warm-up at 3km/h and 100% of their BW on the treadmill (AlterG VIA, Fremont, CA). They then walked for 2 minutes at two walking speeds (3 and 4 km/h) at four BW conditions (100, 75, 50, 25%), in a randomized order 3 times with 3 minutes rest between sets. Lower body kinematics were measured using Xsens sensors (MVN Awinda lower body, Movella, the Netherlands) and analyzed using MVN Reports (Motion Cloud, Xsens) to obtain sagittal plane gait kinematics for each trial. The average gait kinematics for each participant were calculated for each testing condition. Only the 3 km/h data is presented in this abstract. Repeated measures one-way ANOVA's or Freidman test were performed to assess the effect of BW on key gait kinematics for parametric data or non-parametric data (hip angle maximum) respectively, and if a significant main effect was found a post-hoc analysis with a Bonferroni adjustment was carried out.

Results and Discussion

Reducing BW in healthy adults via the BW support system on the AlterG treadmill had a significant effect on hip and knee ROM, hip, knee and ankle maximum angles, and hip and ankle minimum angles during walking at 3 km/h (Table 1). Our findings that hip and knee ROM reduces with reducing BW agree with previous research [3]. The changes in angle kinematics (more plantarflexed ankle with reduced BW) support previous research that a high level of reduced BW the foot strike pattern changes from a heel strike to a forefoot strike during walking [4].

Conclusions

For healthy adults reducing their BW via the BW support system on the AlterG treadmill significantly changed some key gait lower body kinematics. Clinicians should consider these findings when using the AlterG treadmill for rehabilitation.

Acknowledgments

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References

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Table 1: Kinematic gait metrics for left leg at the four different BW conditions at 3 km/h

Variable	Units	Mean (SD)								
		BW = 100%		BW = 75%		BW = 50%		BW = 25%		*P*
Hip range of motion	°	42.6	4.7	40.4	4.8	37.5	5.0	29.6	4.5	< 0.001
Hip angle minimum	°	-13.3	3.5	-13.1	4.0	-11.8	5.0	-7.6	5.8	< 0.001
Hip angle maximum	°	29.4	5.5	27.3	5.7	25.7	6.5	22.0	6.0	0.004
Knee range of motion	°	66.3	4.1	65.6	4.1	64.4	4.6	60.9	5.5	< 0.001
Knee angle minimum	°	0.6	2.7	-0.4	2.8	-0.3	3.2	0.2	3.9	0.371
Knee angle maximum	°	66.9	3.7	65.2	3.7	64.1	4.0	61.1	4.6	< 0.001
Ankle range of motion	°	31.7	4.8	31.1	6.3	32.3	8.2	33.3	9.4	0.349
Ankle angle minimum	°	-12.0	3.6	-11.9	5.2	-13.8	7.6	-17.7	9.4	0.004
Ankle angle maximum	°	19.8	2.3	19.1	2.4	18.5	2.7	15.6	3.2	< 0.001