Referent/in
Preiser, Thede (Gleichen DE)
DSHS Köln - M.Sc. Human Technology in Sports and Medicine

Titel
TRUNK BIOMECHANICS OF TRANSTIBIAL AMPUTEES IN LEVEL AND SLOPED GAIT USING RIGID, HYDRAULIC AND MICROPROCESSOR CONTROLLED ANKLES

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Zusammenfassung
Study with the aim to investigate how different prosthetic feet influence trunk angles during gait in transtibial amputees (TTA). Six TTA, six controls, three feet analysed during -5°, 0° and +5° gait. Feet show small differences for trunk angles, but with probably no influence on lower back pain.

Hintergrund
Compensational gait mechanisms, as an increased mediolateral trunk lean, are associated with the development of lower back pain, which is common among individuals with TTA Most common is the trunk lean towards the prosthetic side as well as an increased pelvis obliquity during the stance phase, which are connected to cause lower back pain (Gaffney et al., 2016; Michaud et al. 2000; Molina Rueda et al., 2013). Previous studies have shown, that lower limb biomechanics or the centre of mass trajectory can be influenced significantly by different prosthetic ankle-foot devices (Bai et al. 2017; De Asha et al. 2013 a/b; De Asha et al. 2014; Askew et al. 2019). But the diffent influences on the trunk kinematics stay unclear. Therefore, the aim of this study was to investigate if different prosthetic ankle-foot devices influence differently trunk biomechanics during gait in TTA.

Material Methode; Durchführung/ Prozess
Six unilateral transtibial amputees and six healthy controls (CON) participated in this study. All participants completed 6 valid on a hydraulically adjustable ramp system in downhill (-5°), level (0°) and uphill (+5°) inclination. Tested device have been an energy storing and return (ESAR) foot without any ankle constriction (RIG) as well as an ESAR foot adjusted with a microprocessor-controlled ankle joint in the modes microprocessor “off” (HYD) and

microprocessor “on” (MPC). Kinematic data was collected via a Qualisys Oqus system. Analysed parameter were a trunk to lab angle (Trunk), a pelvis to lab angle (Pelvic Obliquity) and a pelvis to thorax angle (Thorax). SPM one-way ANAOVA for repeated measures and paired t-test were run for statistical analyzation.

Ergebnisse

Amputees show significant differences compared to the controls in all three parameters. In the sagittal plane, the trunk angle was significantly increased for all three feet during terminal stance at the +5° incline compared to controls. In the frontal plane, the trunk ankle during loading response was significant increased for RIG and HYD, but not for MPC. Same significant differences were found for the loading response in the pelvic obliquity. The thorax ankle has shown significant differences between the conditions CON and RIG during terminal stance.

Diskussion/ Schlussfolgerung; Fazit für die Praxis

The measured results for the transtibial amputee trunk kinematics were in general congruent with the found results in the literature. Increased forward lean as well an increased lateral lean towards the prosthetic side during prosthetic stance show the changes connected to a transtibial amputation, which may result in an increased risk of developing lower back pain (Hendershot and Wolf 2014, Yoder et al. 2015, Gaffney et al. 2016). In this study, these changes were most prominent during the inclined walking. When comparing each foot condition, HYD and MPC show less significant differences compared to the controls, than RIG. Additionally, the differences can even be minimalized when walking with an MPC foot. This study gives an insight into the different influences of prosthetic feet on the trunk. Results should be proven in further research, but have the potential to make recommendation for patient care.

Literaturreferenzen

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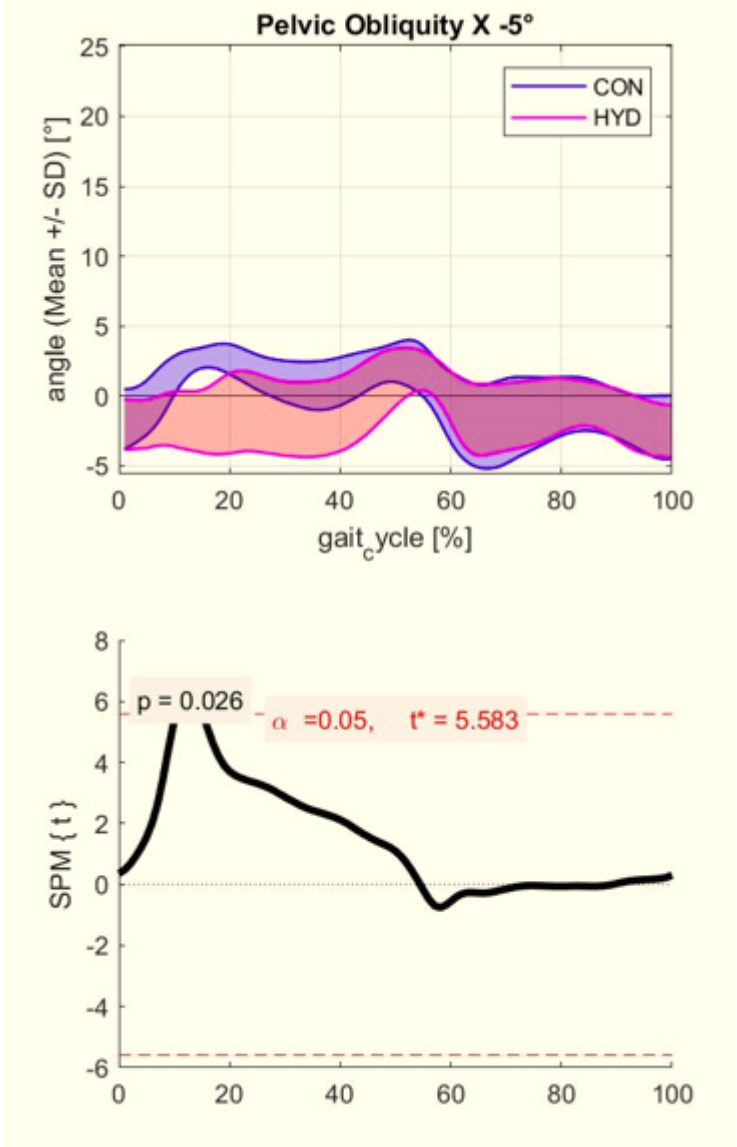
Image: pelvic ob -5 con hyd_263.png



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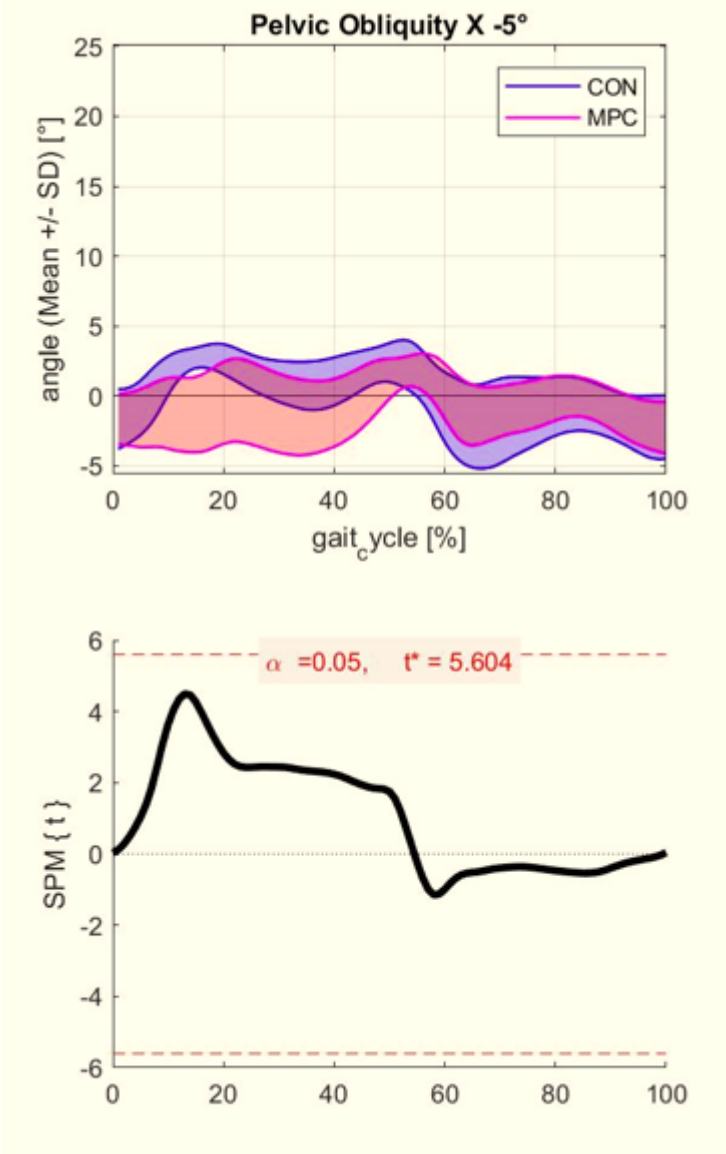

Image: pelvic ob -5 con rig_265.png