Lateral Trunk Flexion Impacts Walking Economy in Individuals with Knee Osteoarthritis and Low Back Pain

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Summary

Knee osteoarthritis (KOA) and lower back pain (LBP) are prevalent conditions that affect gait mechanics and mobility. This study examined the relationship between peak trunk lateral flexion (TLF) and walking economy (WE) in individuals with KOA and LBP. In the involved limb, WE exhibited a strong positive correlation with TLF during the swing phase and a moderate positive correlation in the first half of stance phase. Conversely, in the uninvolved limb, a moderate negative correlation was observed in the latter half of stance. These findings suggest that frontal plane trunk kinematics are significantly associated with WE. Interventions aimed at improving trunk kinematics, particularly those that shift frontal plane trunk motion toward the contralateral limb, may enhance gait efficiency. Such improvements could facilitate greater physical activity in individuals with KOA and LBP, potentially mitigating disease progression and enhancing overall function.

Introduction

KOA and LBP are extremely prevalent in aging populations and may negatively impact mobility and gait efficiency [1]. Individuals with KOA often adopt compensatory movement patterns, including altered trunk mechanics, to reduce pain and maintain stability. TLF is particularly relevant, as excessive movement may decrease walking efficiency, a key determinant of functional mobility and energy expenditure [2]. The purpose of this study was to investigate the association between TLF during gait and WE in individuals with KOA and LBP, with the goal of identifying factors that may inform targeted interventions to improve gait efficiency and promote greater physical activity.

Methods

Thirty participants with symptomatic KOA and LBP (12F/18M; 63±9 years; 96±29 kg; 171±18 cm) completed a six-minute walk test on a split-belt treadmill. Frontal plane trunk kinematics and WE were recorded throughout the test. Trunk kinematics were averaged across the walk with between 25-35 gait cycles per participant (heel strike to ipsilateral heel strike). The gait cycle was normalized to 101 data points. Data points 0-30 were used for first half of stance, 31-61 were used for second half of stance and the remainder were used for swing. WE was calculated as total oxygen uptake normalized to body mass and divided by total distance (mL/kg/m). Participants identified the limb with more severe KOA, designated as the "involved" limb. A Pearsons Correlation was used to assess correlations between peak TLF during early stance, late stance, and swing with WE in both the involved and uninvolved limbs.

Results and Discussion

In the involved limb, there was a strong correlation between peak TLF and WE during swing (r=.542, p=.002) and a moderate correlation during early stance (r=.455, p=.011). In the uninvolved limb, there was a moderate negative correlation in the second half of stance (r=-.452, p=.012).

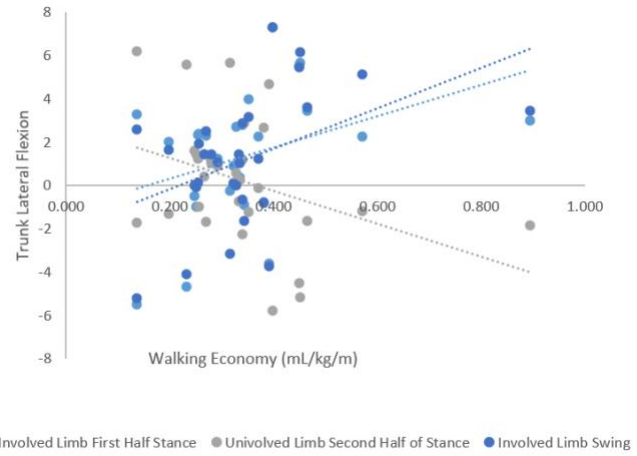

Figure 1: Pearsons's correlation of TLF and WE in involved and uninvolved limbs. A positive value for TLF indicates a frontal plane shift to the ipsilateral side, a negative value for TLF indicates frontal plane shift to the contralateral side.

Conclusions

In people with KOA and LBP, interventions which aim to improve walking efficiency and thus mobility, should not ignore physiotherapy techniques which target TLF. Currently most physiotherapy exercise target the lower body which may not address TLF [3]. More research is needed to explore the effects of targeted physiotherapy exercise to improve back stability.

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References

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