



DO ALTERED KINEMATICS & KINETICS IN GAIT INCREASE PREVALENCE OF LOW BACK PAIN IN LOWER LIMB AMPUTEES COMPARED TO ABLE-BODIED PEOPLE: A SYSTEMATIC REVIEW

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Purpose

An estimated eighty percent of the adult population experiences low back pain (LBP) at least once during their life¹. LBP is a common cause of decreased function, lost workdays, disability in the general population, and one of the leading reasons patients seek physical therapy services. There is a considerably higher prevalence of LBP among persons with lower limb amputation (LLA) versus the general population². This systematic review was designed to investigate the cause of the higher prevalence of LBP in lower limb amputees (LLA) compared to able bodied people. Specifically, the systematic review investigates if altered kinematics in gait increase the prevalence of LBP in LLA compared to able bodied people.

Methods

In April 2016 we searched Southwest Baptist University's library database using keywords: low back pain, amputation or amputee, and able bodied people and found 15,598 articles. Limitations were added to bring the number of articles to 237: date 2006-2016, peer reviewed articles, academic journals, and English language. These articles were screened by title and 225 records were excluded due to relevance. The final 12 articles were assessed for inclusion of kinetics or kinematics in gait as the cause of LBP in amputees. This left 4 cross-sectional studies to be included for data extraction and analysis.

Results

Using the modified Downs and Black assessment tool, one study was graded as good quality and three were graded as fair quality. Between the 4 studies evaluated, each had different hypotheses as for the cause of LBP in LLA. A majority of the studies found notable alterations during gait in LLA with LBP compared to able bodied individuals or LLA without LBP. Gait alterations included differences in transverse, sagittal, or frontal plane motion, muscle activation, and forces applied through the lower extremities.

Summary of Findings

All 4 studies were analyzed using the modified Downs and Black quality assessment tool.

Year & Lead Author	Down and Black	Participants	Ages	Measurement Tool(s)	Results
2013 Esposito ¹	14 (fair)	28 participants (7 TFA without LBP, 9 TFA with LBP, and 12 able-bodied)	22-39 yrs	26-camera motion capture system with 57 markers	Transverse plane continuous relative phase (CRP) was consistent in all groups. Both TFA groups had altered sagittal and frontal CRP compared to the able-bodied group.
2010 Morgenroth ²	21 (good)	23 participants (8 TFA without LBP, 9 TFA with LBP, and 6 able-bodied)	Control Average: 32.3 TFA without pain average: 49 TFA with pain average: 52	Ten-camera VICON motion analysis system with 38 markers	TFA with LBP had greater transverse plane rotation in the lumbar spine during walking compared to the TFA without LBP. No significant differences in sagittal or frontal plane lumbar spine between groups.
2016 Shojaei ³	14 (fair)	40 participants (20 with LLA and 20 without LLA)	Control Average: 28.1 LLA Average: 29.2	23-camera motion capture system with tracking markers positioned in the mid-sagittal plane over the S1, T10, and C7 spinous processes, sternal notch, and xiphoid; and bilaterally over the acromion, ASIS, and PSIS	The LLA population experiences greater spinal loading with each step. This increased loading leads to co-activation and fatigue failure which results in LBP.
2013 Zahraee ⁴	14 (fair)	40 participants (20 with LBP, 20 healthy)	25-55 yrs	Ground Reaction Forces with a Kistler force plate, the Asymmetry Index measure, and the Shapiro-Wilk test	No difference in the forces applied to the legs or in the asymmetry indices between the 2 groups. Asymmetry is not the cause of LBP.

Key: Low Back Pain (LBP), Lower Limb Amputee (LLA), Transfemoral Amputee (TFA), Anterior Superior Iliac Spine (ASIS), Posterior Superior Iliac Spine (PSIS)

Conclusion

Based on the quality and quantity of evidence evaluated in this review, we could not form a definitive conclusion to the cause of LBP in LLA. In addition, the studies failed to consider types of prostheses in their inclusion and exclusion criteria which could cause differences within the LLA group. Transverse plane motion was shown to be significantly different between LLA with LBP and both able-bodied individuals and LLA without LBP⁸. Another contributor to a higher prevalence in LBP in LLA includes increased spinal loads leading to coactivation and fatigue failure⁶ of trunk musculature. Future research is needed to assess asymmetries between LLA with LBP and able-bodied individuals with LBP. In addition, research is needed to examine the differences in the prevalence and cause of LBP between transtibial and transfemoral amputees.

Clinical Relevance

While we cannot identify specific asymmetries as the cause of LBP in LLA, we can surmise that altered kinematics and kinetics may contribute to the higher prevalence of LBP in LLA based on the research. Clinicians must be aware of an increased risk of LBP in LLA and work to eliminate as many asymmetries as possible and increase core strength to counteract any residual asymmetries and abnormal spinal loads present.

References

References available upon request.

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