The Effects of Task Demands on Lifting Strategies During an Occupation-Style Lifting Task

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Summary

The effects of low back pain (LBP) on lifting kinematics are well-explored. However, the potential influences of psychosocial factors, such as kinesiophobia, and perceived task demands remain under-explored. The purpose of this project is to explore the lifting strategies individuals employ when lifting loads of varied mass in both known and unknown conditions. Preliminary results (n = 16) suggest limited effects of both mass and knowledge on the pose adopted at load acceptance (PLA). This research may be especially relevant for occupational settings in which employees handle loads of varied mass throughout their workdays.

Introduction

LBP is among the largest contributors to disability worldwide [1]. Its incidence and impact have grown in recent years and are expected to continue rising [2]. LBP can elicit changes in postural control and coordinative variability during ergonomic tasks [e.g., 3]. Changes to load mass and load knowledge have further been shown to affect lifting strategies [4]. At present it is unknown how the effects of perceived demand can influence the preparation of a sagittal lifting movement. Further, it is unknown how psychological factors such as kinesiophobia interact with this preparation. The purpose of the current work is to explore the range of strategies that individuals take while lifting loads of varied mass in both known and unknown conditions. It is expected that individuals will adopt a lifting strategy with reduced spine flexion when knowing task demands (i.e., mass) are high, and when task demands are unknown.

Methods

This is a cross-sectional study with a repeated measures design. The current convenience sample stands at n=16 (9M), mean age 22.1 ± 3.5y, height 1.76 ± 0.69m, mass 74.7 ± 14.9kg. Participants complete a series of online intake measures to assess pain history, kinesiophobia, and fear avoidance. After having a chance to familiarize with the loads to be lifted, participants begin the protocol. Participants are instructed to lift boxes of varied mass (light, medium, heavy) from the floor onto a table (hip height) in both known and unknown conditions. Load masses are scaled by sex, based on long-standing manual materials handling (MMH) guidelines [5]. Lift kinematics are recorded using eight Miqus Video cameras (Qualisys AB, Göteborg, Sweden), with pose estimation completed using Theia3D (Theia Markerless, Kingston, Canada) and Visual3D (HAS-Motion, Kingston, Canada). To reduce the dimensionality of the dataset the PLA has been identified using the minimum mean hand position, while full body kinematics have been further reduced using principal component analysis (PCA). PC scores have been compared statistically using two-way ANOVA, conducted to identify main effects of load mass and knowledge on PLA.

Results and Discussion

After retaining 16 PCs (≥ 99% explained variance), no significant main or interaction effects emerged from the two-way ANOVA, despite notable diversity in PLA (Figure 1). It is speculated that relationships may continue to emerge as the participant pool grows and further diversifies. The present research will be relevant for employees who engage in MMH, and especially those who deal with varying load demands.

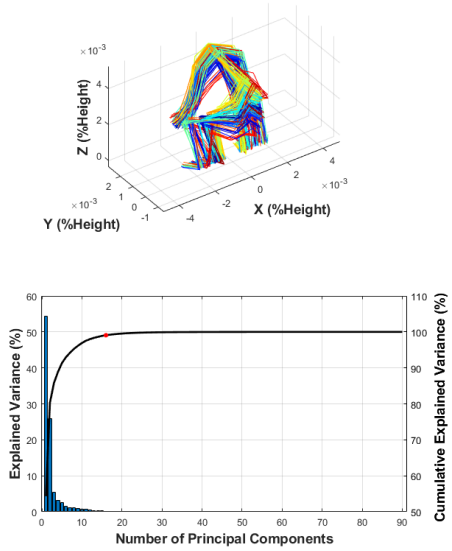

Figure 1: Ensemble of PLA data from all lifts (top); scree plot depicting cumulative explained variance of PCs (bottom).

Conclusions

Preliminary results depict notable variation in PLA during sagittal lifting maneuvers. Specific load and knowledge will be further explored with additional sampling across a diverse sample of participants with varying kinesiophobia and fear avoidance tendencies.

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