



Passive Back-Support Exoskeletons Have Limited Benefits During Floor Tiling

Passive Back Support Exoskeletons Do Not Effectively Reduce Physical Demands During Simulated Floor Tiling

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Overview

Back-support exoskeletons (BSEs) are designed to reduce the physical demands placed on the lower back during physically demanding tasks. However, BSE effectiveness for tasks involving extreme non-neutral postures—such as floor tiling—has largely been unexplored. To evaluate BSE effectiveness for floor tiling, researchers evaluated two commercially available passive BSEs, the HeroWear Apex (which uses elastic material to generate support) and Laevo Flex (which uses gas springs), using a convenience sample of 18 novice participants (nine males and nine females). Each participant completed floor tiling simulations in 12 experimental conditions: three levels of interventions (no device, HeroWear Apex, and Laevo Flex) × two tile sizes (large and small) × two task types (tiling and grouting). Participants first received training to familiarize themselves with the tiling and grouting processes, as well as with the BSEs being tested. The researchers then recorded muscle activity, task performance, and user perceptions across different conditions.

Key Findings

- BSEs did not effectively reduce trunk muscle activity during floor tiling and grouting.
- The HeroWear Apex increased activity in the trunk extensor muscles (iliocostalis lumborum and longissimus thoracis) by 13–44%, compared to no device.
- The Laevo Flex had minimal effects, with muscle activity levels comparable to the no BSE condition, and not providing any significant reduction in physical demands.
- Neither of the BSEs substantially reduced ratings of perceived exertion or discomfort.
- More participants preferred the Laevo Flex exoskeleton, reporting that the HeroWear Apex caused more frustration during tasks and required additional time for adjustments.
- The study's results emphasize the importance of evaluating BSEs in realistic simulations rather than isolated task segments.

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Read the abstract:

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