



KEY POINT SUMMARY

OBJECTIVES

To assess the spine loads occurring over the entire lumbar spine when operating ceiling-based and floor-based patient handling devices under typical of patient handling conditions.

DESIGN IMPLICATIONS

Mechanical patient lift systems can reduce risk of lower back pain in caregivers

Ceiling-based lifts are preferable to floor-based patient lift systems.

If floor-based systems are used floor surface and device wheel conditions should be carefully considered.

Lumbar Spine Forces during Manoeuvring of Ceiling-Based and Floor-Based Patient Transfer Devices

Marras, W.S., Knapik, G.G., Ferguson, S.
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Key Concepts/Context

Patient handling is an important concern in healthcare facilities linked to patient falls, as well as staff injury. It continues to represent a high risk for low back pain among caregivers. Research shows that manual transfer of patients can impose unacceptable loads on the spine (even when the task is shared by two caregivers). Due to this, patient lift devices have gained popularity and are frequently used. However the merits and demerits between the different systems continues to be explored. What is also lacking is rigorous, biomechanical analyses, that investigate spine loads and lower back pain (LBP) risk associated with different transfer devices. This study addresses this need for research by comparing floor-based and ceiling-based lifts.

Methods

10 subjects (5 male, 5 female), with no previous patient handling experience, were recruited on a volunteer basis for the study. A series of typical patient pushing and pulling tasks using two common patient handling devices (ceiling based lift system and floor-based lift system) were evaluated as subjects performed a series of patient handling manoeuvres that varied according to: 1) floor conditions; 2) wheel size (for floor based system); 3) patient weight; 4) the degree of control required by the patient handling manoeuvre. A subject-specific, biologically assisted (electromyographic (EMG)-assisted) biomechanical model was employed to assess spine forces over the entire lumbar spine as subjects performed these tasks.



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Findings

1. Compared to manually lifting a patient, mechanical patient lift-assist devices can significantly reduce compressive spine loads experienced by the caregiver during a patient handling task.
2. When the ceiling-based lift system was used to handle patients, no conditions yielded A/P shear forces of sufficient magnitude to cause disc damage. A/P refers to anterior-posterior shear loads which are greatly increased by pushing and pulling activities. However, when the floor-based patient lift system was used, certain conditions of use could be expected to initiate disc damage regardless of patient weight. These included manipulating the floor-based patient handling device in a confined area, such as a bathroom; any turning of the patient-handling device (sharp or gradual); operating the system on carpet; and when the patient lift system had small wheels.
3. Patient weight had no effect on the spine load of caregivers using ceiling-based lifts, whereas A/P spine shear forces became much greater when attempting to turn floor-based lift systems.

Overall, authors conclude that ceiling-based lifts are preferable to floor-based patient lift systems. If floor-based systems must be used, the floor surface and device wheel conditions must be considered in order to reduce LBP risk exposure.

Limitations

Authors suggest that the findings should be considered in perspective with the conditions of the experiment and that the findings could be different if different patient handling devices, or different flooring conditions, had been studied.

Additionally, the study only looked at inexperienced undergraduate students as subjects. Repeating the study with experienced caregivers could provide additional insights.