Digital Human Modeling Evaluation for Lifting Obese Patients

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Abstract: Nurses undergo many stressful tasks when handling patients. Studies show that tasks such as transferring a patient from a chair to a bed or repositioning a patient in a bed can be very strenuous for nurses to perform, especially when the patient they are lifting is obese. In this study, Jack 7.0 (a digital human modeling software) was used to evaluate the effectiveness of the Australian lifting technique for lifting obese patients. A full-factorial experimental design was used to study the impact of patient's body mass index (BMI), the gender and percentile of the nurse performing the lift, on their lower back compression force. Five patients were selected with BMIs ranging from 30.0 to 50.0. Two nurses were evaluated for each situation and were grouped by gender and percentile (5th, 50th, and 95th). At a 5% significance level, the Analysis of Variance (ANOVA) showed that all the main effects, as well as the nurse percentile and nurse gender interaction effect, were significant. The results also showed that a maximum compression force on the lower back of 14134 N occurred for a 95th percentile male nurse when lifting a 50-BMI patient. On the other hand, a minimum compression force of 771 N occurred when a 5th percentile female nurse was lifting 30-BMI patient. Finally, when plotting the compression force over time, it was observed that the maximum compression force for different combinations of nurse percentile and patient BMI occurred (on average) after 13 seconds from the start of the lifting procedure. Future research will evaluate other lifting techniques, such as Orthodox lift, Barrow lift, Through-arm lift, and Under-arm lift, and will also consider additional dependent variables, such as fatigue recovery.