INTRODUCTION

- For those that rely on wheelchairs, completing proper transfers are essential for independence with daily activities.
- Full-time wheelchair users perform an average of 14 to 40 transfers per day.
- During these transfers, the user applies excessive loads on their arms, which produces large joint reaction forces that can often lead to upper extremity pain and injuries.
- 3D depth sensors can possibly solve this issue by providing a way to detect improper wheelchair transfers.

In this study, we will compare the upper body motions captured during wheelchair transfers by two different low-cost, 3D depth sensors: Intel RealSense and Microsoft Kinect v2.

The purpose is to determine whether these two depth sensors can distinguish between proper and improper wheelchair transfer techniques by analyzing multiple biomechanical variables such as joint angles and body segment displacements.

OBJECTIVES

- Compare the upper body motions detected by two different motion depth cameras, the Microsoft Kinect v2 and the RealSense.
- Analyze biomechanical variables and determine how they are affected by different improper transfer techniques.
- Evaluate the quality of the wheelchair sitting pivot transfer.
- Determine the most efficient and cost-effective model that allows for wheelchair users to prevent limb injuries.

RESULTS

- The overall outcomes show that both the Kinect and RealSense can detect differences in the biomechanical variables.
- Kinect is more sensitive to hand and wrist angles ($p$-value < 0.05).
- RealSense is more sensitive to differences in trunk angles ($p$-value < 0.05).
- RealSense is unable to detect any joint angles in the hand and wrist, possible due to its sensitivity

CONCLUSIONS

- The results suggest that both the Kinect and RealSense have abilities to distinguish between the quality of the transfer, but through different biomechanical variables.
- The technology can be applied to educate therapists and wheelchair users on the best evidence-based transfer practices that will prevent injuries to the upper extremities.
- It has great potential to reduce healthcare costs associated with transfers and overuse injuries.

REFERENCES

- American Physical Therapy Association (2015). Special thanks to the Human Engineering Research Laboratories for allowing me to work in their labs.

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Analysis of Two Motion Depth Cameras for Capturing Upper Body Motions during Wheelchair Transfers

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