Assistive Transfer Device

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Abstract

In many medical situations, patients may be requested to sit on an exam table, however individuals who are post-operative or elderly may find this difficult give only the 10" built into the table. Current lifting methods are inconvenient or uncomfortable for both patients and medical personnel, so a new device to assist patients in accessing an exam table has been designed and constructed. The design consists of a vertical lift platform that is powered by an electric motor and scissor cross links. The platform has a low profile to increase accessibility and has a rotating and locking top plate to assist patients. The device design was subjected to finite element analysis and the prototype was dynamically tested to ensure safety of the device.

Assistive Lifting Methods

Patients often have difficulty getting up onto a standard exam table. Therefore, methods of assisting these patients have been developed:

Manual Labor

Nurses will often manually help patients onto the exam table. This involves grabbing the patients around the waist and lifting them onto the exam table.

http://www.corpmed.com/images/patient-transfer.jpg

Disadvantages:
- Uncomfortable for patient
- Requires heavy lifting for nurse
- Success is dependent on nurse's strength

Hoyer Lift

Named for one of the first companies to distribute it, the Hoyer lift uses hydraulics (or an electric motor) and a slings to lift a patients to the exam table[2].

http://hubpages.com/hub/hoyerlifts

Disadvantages:
- Difficult to get patients into sling
- Used primarily for wheelchair bound patients

Device Specifications

The objective of this project is to make an assistive transfer device to lift an individual to a comfortable height for sitting on a standard exam table.

- Able to lift 300 lbs (Safety factor of 2)
- Lift 10 in. (height of exam table step)
- Rotate Patient
- Portable (Device < 50 lbs or on wheels)
- Easy Storage (under bed, behind door, against wall etc.)
- Stable during ascent and descent (patient comfort)

Final Design

The final design is composed of three specific components that were analyzed and designed separately and put together into a combined design. The three separate systems included: lifting mechanisms, platform geometry, and patient safety and ergonomics.

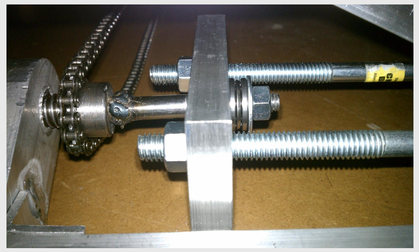

Figure 1 – Image of thrust bearing system

Lifting Mechanism

- Motor turns a drive shaft that raises the platform
- Force is transferred to other side through a gear and pulley system
- Thrust bearings to reduce friction in the system

Platform Geometry

- Raised sides to house links
- Circular turn table
- Support bars spaced to provide most support where needed as seen in Figure 2

Patient Safety & Ergonomics

- Collapsible support railing for patients
- Locking turntable
- Support bars spaced to provide most support where needed as seen in Figure 2

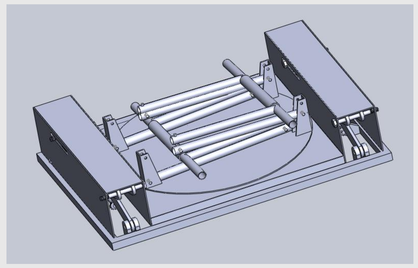

Figure 2 – SolidWorks drawing of folded assembly

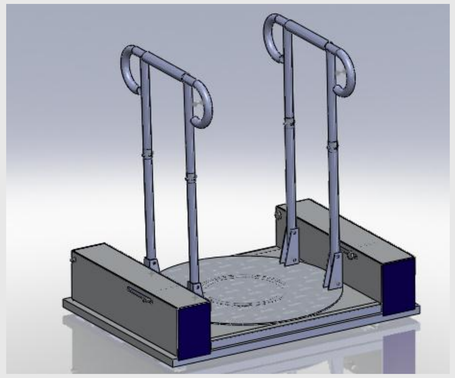

Figure 3 – SolidWorks drawing with ergonomic handles

Previous Semester's Design

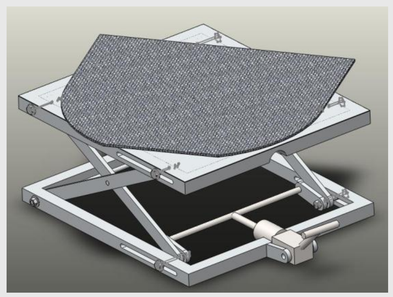

Figure 4 – SolidWorks drawing of the Spring'10 design

Areas for Improvement:
- Increase stability
- Increase mechanical advantage
- Decrease step height

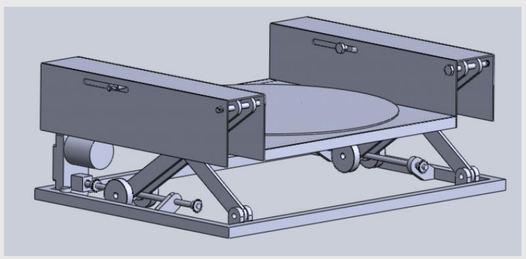

Figure 5 – SolidWorks drawing of the Fall '10 design

Areas for Improvement:
- Improve patient safety during operation
- Improve ergonomics
- Increase efficiency of lifting mechanism

IRB Research Proposal

A study will be conducted to determine the most comfortable stepping height and average stance width for elderly people. Research indicates that the maximum knee flexion in elderly people (ages 75-93) allows for a 8" step, but does not account for difficulty or comfort[1]. Approval through the Minimal Risk Health Sciences Institutional Review Board pending.

- Target population: Individuals older than 65 yrs
- Parameters for device
  - Maximum step height
  - Stance Width
- Survey for study subjects
  - Test different step heights
  - Measure stance widths
  - Rate on comfort/difficulty
- Results of study will be integrated into future device designs

http://www.imageenvision.com/cliparts/person-pg25

Future Work

- Prototype Testing
  - Conduct static and fatigue testing
  - Perform "Drop" Test
- Design for manufacturing
  - Eliminate awkward welding and assembly areas
  - Create a simple bottom-up assembly
- Improvements that can be made to the design itself:
  - Addition of wheels
  - Improve overall ergonomics
  - Refine turntable locking mechanism
  - Limit user's ability to tamper with driving mechanism

Acknowledgements

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References

[1] Bergland A, Sylliaas H, Jarnlo GB, Wyller TB. Health, balance and walking as correlates of climbing stairs. J of Aging and Physical Activity 2008;16:42-52.
[2] Simonton, Kevin, and Dana Wilcox. "Frequently Asked Questions About Portable Total Body Patient/Resident Lifts" *Department of Labor and Industries: Nursing Home Initiative.*<http://www.wa.gov/lni/hip/liftfaq.html>.