Assistive Transfer Device

Gerhard van Baalen Marc Egeland Scott Sokn Luisa Meyer

Client: Diana Eastridge, RN, CNP [1] and Lisa Kaikuanna, RN[2]
Advisor: Professor Willis Tompkins, PhD[3]

[1,2] UW School of Medicine and Public Health– Vascular Surgery
[3]Department of Biomedical Engineering – University of Wisconsin - Madison

Problem Statement

The goal of the project is to develop an assistive transfer device for use in a hospital or clinical setting. The device must:

- Safely transfer patients from wheelchair to exam table
- Patients can hold on to device while being moved
- Reduce physical exertion by patient and medical personnel

Motivation:

- Many patients are weak or Injured and cannot lift themselves onto the exam table
- Current lifting method is manual labor
  - -Large effort from assistant
  - -Uncomfortable for patient and assistant
  - -Dependent on assistant strength


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

Specifications:

- Patients can generally manage a 3-4 in. step
- Current step is 10 in.
- Nurses can lift the patient out of the wheelchair, but have difficulty rotating and lifting onto the exam table

Device Requirements:

- Small base
- Easily stored,
- Lift a max of 300 lbs (Safety Factor of 2)
- Less than 4” in height
- Simple to operate
- Easy to sterilize
- Reduce patient anxiety during transfer

Background

Hoyer Lift

- Hydraulic mechanism
- Woven Nylon or Cotton Sling
- Adjustable with wheels for portability


http://dehanmedequip.com/images/electric%20hoyer%20lift.jpg

Ambulation Assistive Device

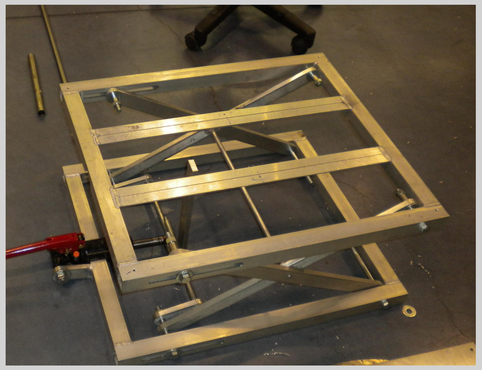
- Automated hydraulic system
- Nylon safety harness and straps
- Wheels for easy transport


http://litegait.com/md.html

Final Design

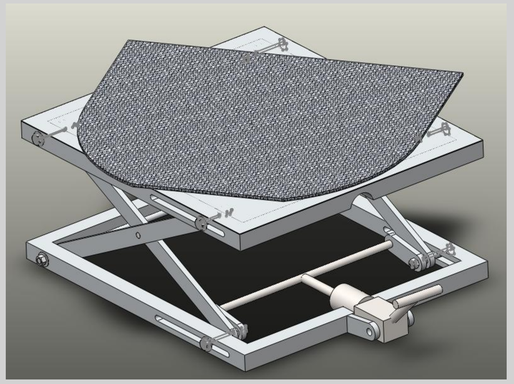
Structure

- Aluminum frame
- Scissor link lifting mechanism
- Hydraulic cylinder with manual pump
- Rotating top platform limited to 90° turn
- Handle and wheels for portability
- Release vale to lower platform



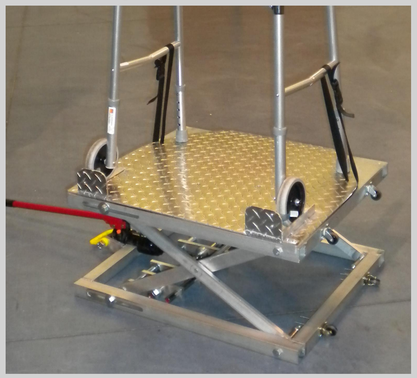
Procedure

- Place device next to end of exam table
- Help patient with walker onto top platform
- Lock walker in place
- Lift 1 in. vertically
- Rotate patient 90° so that back is towards table
- Pump hydraulic to raise patient to optimum height
- Lower table with release value



Device Specifications

- Hydraulic Cylinder exerts 5,250 lbs force to lift 300 lb vertically
- Can lift to a maximum of 15 in. with a beginning height of 3.5 in.
- Total weight 60 lbs.



Testing

Durability Test

- Static strength tested successfully up to 450lbs

Portability Test

- To lift onto caster only takes 35 lbs.
- Stable on wheels and easy to push around

Functionality Test

- The device lifted increasing weights to prove functionality, either passing or failing.
- The device successfully lifted with no weight on top and 120 lbs. But failed when lifting 150 lbs. The bottom frame bent significantly.
- When collapsed, forces are to large for aluminum to withstand. When raised, easily able to lift weight

Discussion

- If bent frame is re-enforced, device may lift considerably more weight.
- Joints need to be tighter to prevent racking.
- There is room for development within the transfer of force between hydraulic cylinder and the scissor links.
- If proved functional for repeated use through future testing, the device will have met the client requirements.
- Device Cost $450—original budget of $400.

Limitations

- Can only help patients able to stand with the assistance of a walker or nurse
- Step up is 3.5 in.
- Friction in the joints require oiling
- Heavier weight may reduce portability and positioning
- Device must be raised off the ground in order to be rotated

Future Work

Hydraulic cylinder

- Increase Mechanical advantage of hydraulic positioning
- Use two, smaller, synchronized hydraulic cylinders
- Fit entire hydraulic assembly underneath the lift

Automation

- Hydraulic cylinder
- Rotation of top platform

General enhancement

- Reduce overall weight and size
- Reduce friction for a smoother ride
- Increase strength, especially the areas by the hydraulic.

References

[1]Abate M, Di Iorio A, Di Renzo D, Paganelli R, Saggini R, Abate G (September 2007). Frailty in the elderly: the physical dimension. *Eura Medicophys 43 (3): 407–15.*
[2] http://www.phc-online.com/Hoyer_Lift_Supply_s/44.htm
[3] http://litegait.com/md.html

Acknowledgements

Prof. Willis Tompkins—Department of Biomedical Engineering
Lisa Kaikuanna, RN— School of Medicine and Public Health
Diana Eastridge, RN, CNP—School of Medicine and Public Health
Prof. Frank Fronczak—Department of Mechanical Engineering
Dr. Jay Samuel —Department of Mechanical Engineering
Karim Abrouq –Engineering Student