GNG 2101 Deliverable J

Deliverable J: User Manual
For Lightweight Posterior Walker

Submitted by

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Scope of Document

This document has two primary purposes: it provides a brief technical summary of our lightweight posterior walker project, and it outlines key features and best practices for users of this walker.

Symbols Used in this Document

Useful Info When you see this symbol, the information next to it will allow you to make the best decisions when using this walker.

Caution When you see this symbol, please pay attention! It contains important information that will help you make safe decisions when using this walker.

Introduction

The goal of this design project was to create a useful and safe mobility product that would allow someone with limited mobility and strength to transport the product easily in and out of a car. While it was designed with a specific client in mind, it could be easily adapted to fit a different person by adjusting the legs and width.

The result was a lightweight posterior walker that could be collapsed and latched with one hand. At the request of the client, it also contained key safety features such as braking and wheel slow-down to provide a safe experience while using the walker in day-to-day life.

This design is unlike other walkers on the market in the following ways:

1. It combines features such as braking, folding, slow-down wheels and weighs less than 9lbs.
2. It folds compactly to less than 5” diameter, allowing it to fit in tight spaces.
3. It costs less than $120 to make.

The walker shown in this document was designed for a person with a height of 158 cm and a weight of 55 kg.

Halted Progress

Due to the exceptional circumstances surrounding the COVID-19 outbreak in March 2020 (ie the closure of uOttawa design spaces), the construction of the walker had to be halted before the writing of this document. At this time, we are unsure if a follow-up will be published when construction is finished.

Construction Information

The walker has a very simplistic design and it basically has no complex mechanisms. The most important feature of this walker is the joint system which holds all the parts together and gives the walker good internal movement. The construction to the walker was straightforward. Once we had cut and drilled the aluminium parts into them, all that was left was to put the whole thing together.

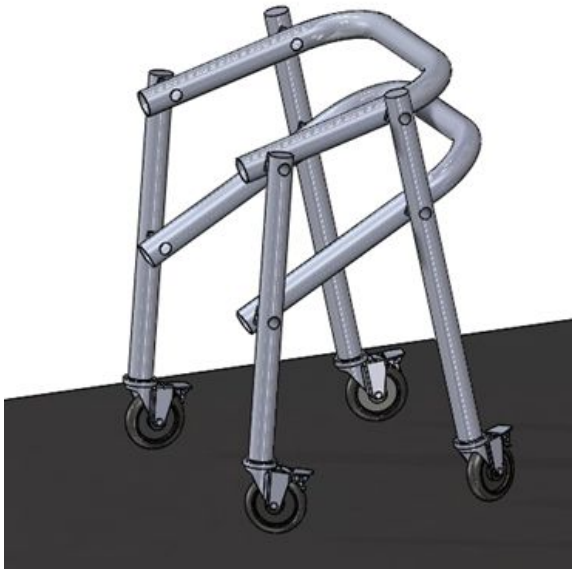

Figure 1 : 3D Model of Walker

Joint System

The joints consist of a bolt that goes straight through the two pieces of PVC with two pieces of brass bushing in between the pipes and a nut on the other side. Using the brass bushing prevents corrosion and it also prevents the two components combined from rubbing against each other. Using this system proved to be very effective.

Figure 2 : Joint System Of Walker

3D printing

There are two 3d printed parts in the walker which are the latch and the brake handles.

The latch was used to keep the walker in a closed position when not in use. It is a very simple mechanism as it just clips the bottom handle to the top handle

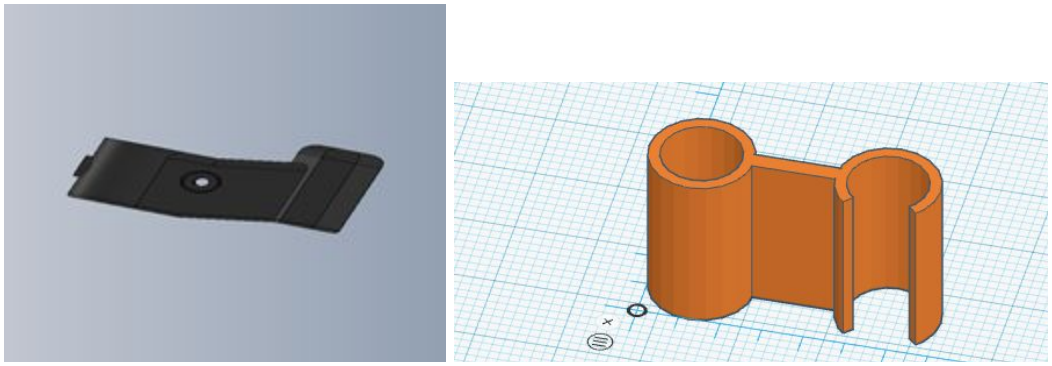

Figure 3 : 3D model of brake handle and Latch

Figure 4 : The walker in a closed position

Handles

We had a problem attaching the handles to the back bars because we couldn't get a curved aluminium piece for this, we were also not able to weld the pieces together. We had a simple fix to this which was attaching the two parts to a metal plate with screws.

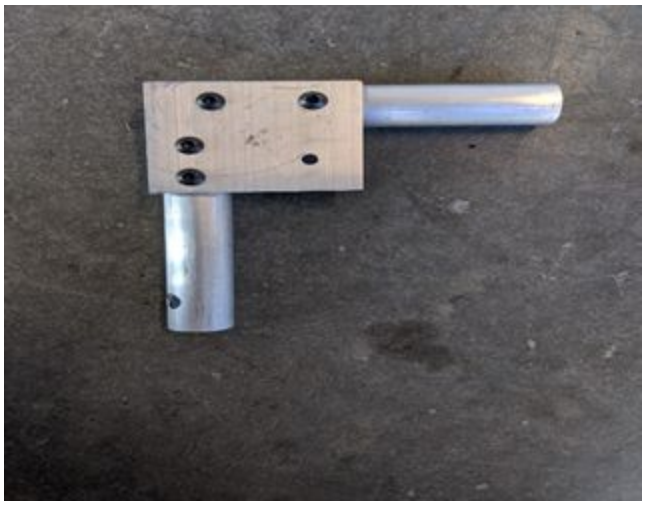

Figure 5 : Handle and Back Support

User Information

Features

The features of this walker can be found in the table below

Feature	Usability
Brass plated contact joints	Allows the foldability of the walker to be very smooth and sturdy. Will allow the user to have more control over the walker.
Aluminum frame	Allows the walker to be relatively light. This makes it easy to carry the walker around when not in use. It is also very strong and can withstand many conditions.
Foam Padding	Allows the user to have a comfortable grip on the walker, as well as protect themselves from cold or hot aluminium.
3D printed locking clips	Allows the walker to be clicked in a closed position. This makes it easier for it to be stored and not unfold when it is being carried around.
Front brake enablers	Allows the user to stop the walker when using it.
Aluminium plated corners	Having aluminium plated corners allows the walker to be very strong and resist twististing. The plates are replaceable as well.
4 wheels (2-360 2-fixed)	Having two 360 rotatable wheels in the front allows the user to make sharp turns in their environment. Having two straight fixed wheels in the back prevents the entire walker from rolling sideways.
Adjustability knobs	The wheel heights can each be adjusted to match the users weight. This will allow for the best comfortability.
Posterior walker itself	Compared to other walkers, the posterior walker raps around the individual keeping them from hunching over. This will allow for the user to straighten their back and work on their posture.

Health and Safety

Caution This section contains important health and safety precautions that must be followed before the use and storage of this device. Please follow these precautions for simple and efficient use of this device. Not following these precautions may cause unforeseeable events to health and safety.

Before Operation:

Make sure the walker is clean of any materials such as dirt or hair. These materials may affect the foldability and the overall functionality of the device. It is recommended to perform routine cleanings and maintenance to the joints of the device.

Be sure to verify that the device doesn't have any defects such as cracks, major dents and loose components. Any unverified components may cause a threat to health as the walker would be unreliable and unsafe. If a defect is observed, do not use the device and contact support at support@Team14GNG2101.ca

During Operation:

Do not apply more than the recommended weight limit on this device. The walker has only been observed and tested under exceptional and expected conditions. Any conditions that are beyond tested limits are not guaranteed to last.

Please do not submerge the walker into water, some of the joints and ball bearings in the wheels will rust. Do not use the walker in extreme cold or extreme heat, the plastics may melt and the metal may crack.

Storing the device:

Do not store the device in a very moist location, doing so may cause some components to rust and malfunction. Do not store the device in a very hot location, some plastics may melt or deform. Do not store in a very cold location, may cause metals to crack and become brittle.

Possible hazards when using the device:

Beware when collapsing the walker, your hands may get caught in between the aluminium. This may cause injuries or pain. When handling the walker in cold weather, it is recommended to use hand protection. Use caution when handling the walker in cold temperatures as cold aluminum can be uncomfortable to hold.

Troubleshooting

Below is a table of most common issues and possible solutions so come issues that may arise:

Issues that may occur	Reasons for issue	Possible solution for the issue
Stiffening/seizing, grinding, unpleasant sounds coming from brake handles.	• Grime or other materials may have entered the brake handle mechanism. • Loosening of the brake handle wire screws. • The break handles are dry and need lubrication.	1. Make sure the brake handles are relatively clean and clear from dirt, hair, etc. 2. Tighten any wire screws that leave the brake handles. 3. Lubricate the moving parts of the handles with grease lubrication materials. .
Folding of the walker is becoming stiff, seizing, or grinding.	• Brass sleeve bearing may be dirty. (containing hair, dirt, dust) • The joints may have gotten tight over time and are in need of lubrication.	1. Make sure the joints are clean from any dirt, hair, etc. 2. Lubricate the brass joints with grease or other lubrication materials.
Wheels have become stiff, seizing or not rolling.	• The joints may have gotten tight over time and are in need of lubrication. • Grime or other materials may have entered the wheel joints.	1. Make sure the wheel joints are clean from any dirt, hair, etc. 2. Lubricate the wheel joints grease or other lubrication materials. 3. Verify the wire going from the wheel to the handle brakes are screwed in enough.
Wheels have become stiff, seized while spinning.	• The joints may have gotten tight over time and are in need of lubrication. • Grime or other materials may have entered the ball bearings.	1. Make sure the ball bearings are clean from any dirt, hair, etc. 2. Lubricate the wheel joints grease or other lubrication materials. Note: Do not use water based compounds for any cleaning of the wheel ball bearings.

Useful Info Note that not all issues can be resolved, and it is recommended to contact us at support@Team14GNG2101.ca (Email not actually functional) for further assistance or to report an issue.

Conclusion

If our group were to do anything differently were we to restart the construction of the walker, we would have tried to find cheaper components for the joints. The brass bushings that we bought were over $1 each and we needed 2 per joint. This came out to just over $20 for the brass bushings, which is extremely expensive for only one component of the walker, considering the small budget we were given. Another thing we could improve for future work is the sturdiness of the walker. Although it was reasonably sturdy as is, we could have made it more so by playing around with the angles at which we positioned the four legs. Despite these two minor improvements we could have made to our prototype, our team started this project fairly early and kept to our timeline which gave us plenty of time along the way to fix all of the errors and weak links we had with our walker. We therefore didn't have a lot to fix come our final prototype and wouldn't change much about our project.

Ideas for future work that our team had was to use the same standard structure of our walker and make a lightweight foldable anterior model for clients that would prefer an anterior version that is at the same time lightweight and easily foldable. We could also make posterior and anterior walkers with the option of a lightweight seat and/or basket for clients who would like these added features. Another future plan we had for our walker was to create the structure with carbon fiber instead of aluminum for clients who are willing to pay more for the model. Our team originally had the idea to use carbon fiber instead of aluminum but did not have the budget for it.

Appendix

BOM

Material	Cost of 1	Total Cost
Screw	0.34 x 20	6.80
Nuts	0.19 x 20	3.80
PVC		19.04
PVC edge connectors	0.33 x 4	1.32
PVC connectors	1.17 x 3	3.51
Brass bushing	1.47 x 16	23.52

Aluminum tube		30.59
Handles and braking systems	~10 x 2	20.00
Wheels	~ 10 x 4	40.00
Total		**148.58**