GNG2101

Design Project User and Product Manual

Tic Protection Glove: Glovers

Submitted by:

Group A6

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1 Introduction

The goal of our project is to develop a glove that can prevent various injuries related to Tourette syndrome by acting as a shock as well as prepare a business and economic plan for our product after the needs of our client have been satisfied. We assume that our product is durable enough to last our client for about a year before needing replacement or suffering from damage. We assume from injuries such as burns, cuts, and dislocations while suffering from rapid uncontrollable movements. We assume that our client's disability would not prevent them from equipping the glove without professional assistance. In this document, we will go over how to use, maintain, and clean our gloves. We will also document the many developmental stages of this project.

2 Overview

Tourette Syndrome (TS) is a condition of the nervous system. TS causes people to have motor or vocal tics. Tics are sudden involuntary twitches, movements, or sounds. For example, a person might keep blinking over and over or in the case of our client, they experience physical tics where they hit their hand on different things that can cause serious injury. The problem our team had to solve was finding a way to reduce the damage impacted on our client's hand with a protective glove. The glove needed to be impact, cut and heat resisted and be breathable for all-day use.

Many patients suffering from Tourette's syndrome have no reliable way to prevent injuries during their tics. Many products on the market currently have major flaws that prevent them from being reliable solutions. Features such as durability, comfort, and esthetics were some of our key priorities. The key feature of our glove is to prevent dislocation of the knuckles as well as prevent burns and cuts of the hand. The glove will be made from Kevlar material and have polyurethane paddings on all knuckles that suffer dislocations. These knuckles included all the first knuckles and the second knuckles of the index, middle and ring finger. Furthermore, the glove will have its fingertips exposed to allow for freedom of movement and to allow our client to wear the glove all day while still able to fulfill their job as an artist.

Figure 1: Glovers Final Design

3 Using the System

To use the Glovers protective glove, simply put on the glove with the padding on the back of the hand and adjust as necessary. Be sure that the glove is on the proper hand and in the proper position, as improper use will reduce the glove's ability to protect the user from harm. To wash the glove between uses, you may put the glove in the washing machine on a DELICATE setting. Air Dry. Do NOT bleach. Do NOT tumble dry. Do NOT iron. Do NOT dry clean.

The following sub-sections provide detailed, step-by-step instructions on how to use the various functions or features of the Glovers protective glove.

3.1 Knuckle Padding

The padding in the glove is made of layered polyurethane foam. This dense foam but light provides protection to the hand against impacts on hard surfaces by absorbing the kinetic energy and dispersing it across the hand. Its density is 3 lbs./cu. ft., a temperature range of –20 – 180 F, a stretch limit of 1.40 and a thickness of 1 inch on the 2nd knuckles and 2 inches on the 1st knuckles.

Be careful not to apply direct high heat to the padding as this may damage the foam and lessen its ability to absorb impacts. If the foam becomes damaged in any way, seek a replacement as soon as possible. Be sure to always have the foam positioned directly over the knuckles for maximum protection.

3.2 Protective Fabric

The glove is made from Kevlar fabric which is cut- and heat-resistant. The blend of materials in this type of fabric gives it superior resistance to cutting and ripping, and the insulating material protects the user from hot objects. The glove offers a EN388 level cut resistance, is food safe and comes in a charcoal grey colour.

If the fabric of the glove becomes damaged in any way, seek a replacement glove as soon as possible. Always be sure that the glove is fully on the hand for maximum protection.

4 Care & Support

4.1 Special Considerations

If the product is damaged, please discontinue use until repaired. If you experience any discomfort while wearing this item, remove it immediately and consult your physician before resuming use. Check with your physician before use if you have circulatory problems.

4.2 Maintenance.

Before usage, inspect the glove for any defects or imperfections.

WASHING INSTRUCTIONS:

Machine wash on DELICATE with mild detergent. Air dry. Do NOT bleach. Do NOT tumble dry. Do NOT iron. Do NOT dry clean.

4.3 Support

Development team can be contacted through maker labs at:
makerlab@uOttawa.ca
+1 613-562-5800

5 Product Documentation

5.1 Glovers Product

Many considerations went into the development of this design, mainly the materials used. A Kevlar material for the glove was used along with a polyurethane foam padding. In the first prototype, a memory foam was used as the padding, this didn't not preform the way the glove was intended and was ultimately not sufficient in preventing injury. The memory foam was swapped with the much more durable and denser, polyurethane. The material of the first prototype was initially a polyester and cotton blend with a latex coated palm. This offered cut resistance but was not sufficient in heat resistance and was not form fitting. This section overviews the materials chosen, instructions and testing.

5.1.1 BOM (Bill of Materials)

1x Polyurethane padding Link

- 1 large double layer for 1st knuckles of all fingers
- 3 small single layer for 2nd knuckle on index, middle and ring finger

1x Kevlar glove Link

5.1.2 Equipment list

- High quality scissors
- Tape measure
- Sewing needle
- Sewing thread

5.1.3 Instructions

In order to construct this product, the following needs to be completed. Firstly, obtain all materials needed. Once you have all the materials, the polyurethane padding can be cut into pieces that will fit the 1st knuckles, as well as the 2nd knuckles. For the first knuckles two layers are needed, so cut the material into 5x9 cm rectangle. The top layer of the padding can be rounded/fillet for a sleeker fit of the glove. For the second knuckles, cut the foam in to approximately 2.5x4 cm pieces. Three of these are needed for the index, middle and ring finger, size varies slightly finger to finger.

After the foam is cut out, the left-handed glove can be cut into pieces approximately the same size as their corresponding foam piece. Once all 4 pieces of material are cut, the sewing can begin. Ideally, this would be done but a professional seamstress to make sure all stitching is clean

and done properly. This will make the glove look better and preform for a longer amount of time. What was done for this prototype was purely by hand. A needle and thread were used to sew the pieces of fabric onto the glove, with the protective foam in between. This ensures the foam stays in place and preforms as designed.

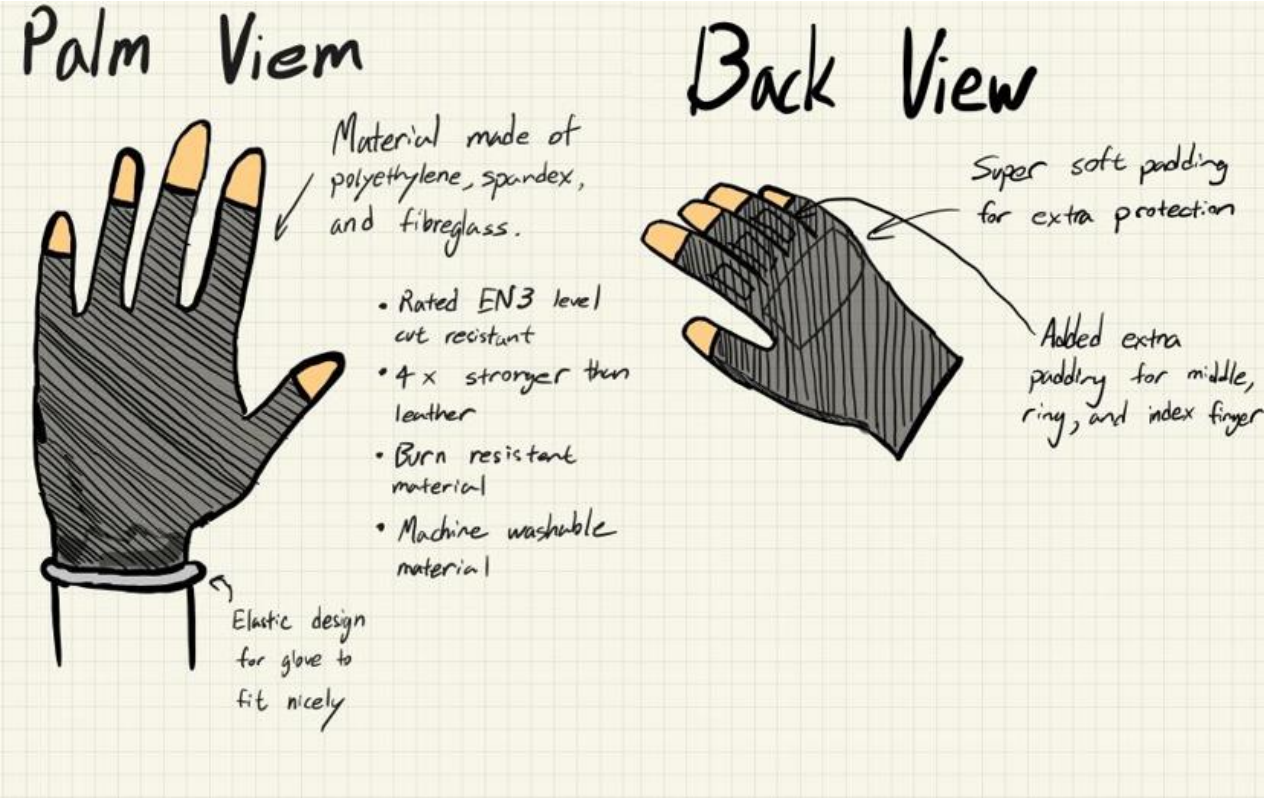

Figure 2: Design of Glove

5.2 Testing & Validation

The testing of the glove was mainly done without any calculations or analysis, the glove to be worn by the client all day so they would not encounter anything that our testing hasn't included. The testing done to confirm the properties of the glove are as follows:

- Try on test – Wearing the glove for extended period of time to ensure the glove is comfortable and everyday activities can be performed with the glove on. The client also approved the fitting of the glove.
- Blunt force test – Hitting different surfaces with varying force, the client approved the level of padding provided in the glove.

- Cut resistance test – For cut resistance, we knew that the glove was rated EN388 for cut resistance. But we also tested using a carrot as a finger and took note of any abrasions.
- Heat resistance test – A glass dish was placed into an oven at varying temperatures for 10 minutes. This allowed the dish to get to the temperature for as accurate readings as we can get. The glove was resistant to temperatures up to 150°C.
- Wash test – The glove was placed in the washing machine to ensure that it can maintain proper hygiene. The glove held up in the washing machine with no issues and was allowed to airdry.

Table 1: Testing Results

Test Type	Testing Result
Try on test (comfort + breathability)	Passed
Blunt force test	Passed
Cut resistance test	Passed
Heat resistance test	75%
Wash test (durability)	Passed

6 Conclusions and Recommendations for Future Work

The lessons that can be taken away from this project relate to many different parts of design. The first lesson taken away from this project is that testing a the most important part of the process. The testing of the materials is very important when considering various options, and because this product is intended to be apart of the client everyday life. The real-life testing that we did gave our members a huge glimpse and made us understand the importance of this step.

In addition, the project gave us huge insight on product and project management. Due to our project being less technical than most, we really had to trust the design process and make decisions based on client feedback and analysis. Working with new people, on something we all aren't familiar with raised challenges at times. Learning how to communicate in various ways and settings is something that can be taken to any avenue of design.

As for future work, any groups that work on this project should seek a professional seamstress as soon as possible for improved quality and durability. We struggled finding someone to professionally sew our product due to time constraints but having more time our group would have chosen to hire a professional seamstress to sew the glove for us. We would also conduct more extensive testing to work out any small kinks we may have missed. Finally, we would have liked to make a left-handed glove for our client on top of the right one that was prioritized.

7 Bibliography

"What is Tourette syndrome?," *Centers for Disease Control and Prevention*, 20-Apr-2021. [Online]. Available: https://www.cdc.gov/ncbddd/tourette/facts.html#:~:text=Tourette%20Syndrome%20(TS)%20is%20a,keep%20blinking%20over%20and%20over. [Accessed: 06-Dec-2021].

"Nocry cut resistant gloves - ambidextrous, food grade, high performance level 5 protection. Size Medium, free ebook included!," *Amazon.ca: Sports & Outdoors*. [Online]. Available: https://www.amazon.ca/gp/product/B00MXUHHGK/ref=ppx_yo_dt_b_asin_title_o00_s00?ie=UTF8&th=1. [Accessed: 06-Dec-2021].

"Grainger-Canada: Industrial Supply, safety equipment and ..." [Online]. Available: https://www.grainger.ca/en. [Accessed: 06-Dec-2021].

APPENDICES

8 APPENDIX I: Design Files

During the development process, deliverables were made and updated in order to track the progress of our product.

Table 2: Supporting Documents

Document Name	Document Location and/or URL	Issuance Date
DeliverableC-GA6	MakerRepo	Sep. 30, 2021
DeliverableD-GA6	MakerRepo	Oct. 7, 2021
DeliverableF-GA6	MakerRepo	Nov. 4, 2021
DeliverableG-A6	MakerRepo	Nov. 18, 2021
DeliverableJ-A6	MakerRepo	Dec. 1, 2021
DeliverableI-GA6	MakerRepo	Dec. 5, 2021