

Wrist Guardian

Guard Yourself From Future Problems



RDES41732

Faculty of Craft and Design - Industrial Design

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Wrist Guardian

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Introduction

Background

I took an interest in hand pain when I started working at my internship at Valley Lab Furnishings. While working in the workshop one of the floor workers could not keep on carrying with his hands because he said that his wrists could not hold onto any weight due to the repeated lifting he was doing; he started lifting with his forearms so that he could get the rest of his tasks completed. When I talked to my family about this, my father told me he had carpal tunnel syndrome due to the jobs he's had. My father worked in the Trimlight for 4 years and he was carrying glass frames for doors. Once he moved over to the ford factory line his hands got worse until he sought medical help. These events made me more curious about why this pain happens and what methods are used to prevent or lessen this pain.

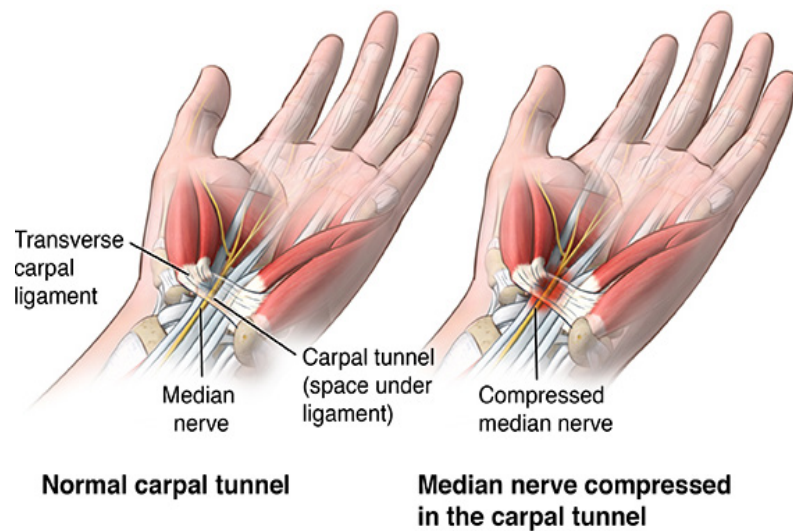


Figure [4] Man Carrying Boxes

The Issue

Hand injuries make up 20% of the injuries that labour workers get when working (*Workplace Injuries And Illnesses And Employer Costs For Workers' Compensation,2016*). Labour jobs are jobs where physical work is required such as lifting materials, repeated movements and more. Some job examples are construction workers, factory line workers, grocery store employees, landscaping and other physically demanding jobs. These pains can lead to serious health problems such as arthritis, carpal tunnel, and other symptoms (*Preventing Repetitive Motion Injuries In The Warehouse,2022*).

Definitions



Carpal Tunnel Syndrome is caused by the repetitive use of the wrist flexors (the muscles in front of our wrists) to grip and hold on to objects. The median nerve, which runs under the wrist flexors, can become compressed if the wrist is in a flexed position repetitively (*Carpal tunnel syndrome: The role of occupational factors, 2011*).

Figure [5] Carpal Tunnel Visuals

Brief

To design a PPE (Personal Protective Equipment) glove for labour workers that will support the wrist and still provide flexibility. This glove will protect the hand and prevent/lessen injuries before they become serious such as carpal tunnel.

Research

Market Research



Figure [4]



Figure [5]



Figure [6]



Figure [7]

Products like workwear gloves are made to protect the hand from any impact and provide grip. Other products such as gym gloves, provide some wrist support but mainly provide palm padding and prevent calluses. Medical and skating braces completely place the wrist in a fixed position.

Interview 1

Jessica Johnson (Doctor):

Q: What are the common injuries workers get?

A: "Back injuries are most common amongst labour workers but I also see many cases of carpal tunnel specifically in the wrists due to the type of work. Also, people who work on computers suffer from this problem"

Q: Are there any products used to prevent/ lessen the effects of these injuries?

A: "There are a few methods used for lessening the pain of carpal tunnel; such as wrist braces which are used when the person is sleeping, and carpal tunnel surgery in which a surgeon makes an incision in the palm of your hand over the carpal tunnel ligament and cuts through the ligament to relieve pressure on the median nerve."

Q: Are there any methods used to prevent/ lessen the effects of these Injuries?

A: For the back yes there are stretches which help reduce the chance of back injuries but with the wrists, stretches can not stop the effects of carpal tunnel wrist splints and surgery appear to be the only way.

Interview 2

Sofia Garces-Vasquez (Personal Trainer):

Q: Do you use any equipment to carry weights/ any heavy loads?

A: I use wrist wraps when performing heavy compound exercises because I feel that my grip gives out before my muscles do. For some exercises, I feel as if my wrist is overextending which makes me uncomfortable at times. The wraps help me perform better.

Q: Are there stretches that you tell your clients to do?

A: I don't do wrist stretches with my clients but whenever I feel any wrist pain I do wrist rotations and then I put my arm straight and pull on my fingers to stretch out my hands, I feel that stretch in my forearms as well.

Q: Do you have any clients that have joint issues? If so, what equipment do they use?

A: I have a client who has carpal tunnel in one of her hands because she is a dog groomer and is constantly lifting dogs with one arm to cut the bottom of their hair. She has a wrist brace, one time she came in without her brace and was unable to do certain exercises due to the pain she suffered.

Interview 3

Amber Kosubovich (Physiotherapist)

Q: Are there different types of braces such as braces that are used for people before injuries and after they've had an injury?

A: Yes there are, it depends on the Injury and how we must treat the injury. Some braces just compress the wrist and hand giving a little support but remaining flexible and other braces keep the hand completely fixed; they can begin from the wrist to half of the forearm.

Q: What materials are used in the braces?

A: Depending on the seriousness of the injury a person may have obtained there are a few. All the braces we use are kitted flexible fabrics that allow air to flow keeping the arm(s) fresh and breathable. If the arm has to be kept fixed the braces will include metal splints.

Q: Are there other things you look after when examining hand pain, like grip loss?

A: Yes there are, we measure the grip strength of a person and the amount of strength they produce is going to vary due to a few details such as a person's age, whether they are male or female, previous injuries, and if they are physically active. We also check if they have had any shoulder injuries and tendon injuries since these can also be factors that can contribute to further injuries.

Interview 3 Continued

Q: Do any patients come to you before they get an injury or after?

A: We only get patients after they start feeling constant or extreme bodily pains. They are usually younger people who just do not know how to lift or are rushed by work, so they ignore their lifting form to get work done. Other times it is just repetitive work that damages their bodies.

Q: What are some things that people use?

A: They use the braces that we use that provide support by applying pressure to the wrist like other braces such as the knee, ankle, and elbow braces. Some people even started wearing gym gloves because of the padding on the palms and fingers which lessens the effects of arthritis in the fingers.

Interview 4

Andrés Araque (Warehouse Employee)

Q: Have you ever worked in a warehouse?

A: Yes, I currently work in a warehouse lifting particle boards and some other heavy materials to be used in the workshop.

Q: Have you ever gotten injured at work?

Yes, I currently have carpal tunnel in both my hands due to the physical nature of my job. To prevent/lessen the pain at work I usually wear wrist braces but before that happened I would wrap my hands with electrical tape to support my hands.

Q: Does the pain affect your daily life?

Unfortunately, yes. When I play video games I can't play for too long because the pain in my forearms becomes unbearable. The pain I usually experience is not really in my wrist but rather in my forearms which is normal for a person who has Carpal Tunnel syndrome.

Interview 5

Carlos Somocurcio (Ford Factory Employee)

Q: When did the pain in your hands start and how?

A: After working for 3 months in Trimlight my hands started to hurt, I was in production, filling up orders. I was carrying glass inserts for doors as big as 22"x64". I worked there for 3 years. I did not wear any hand protection for all those years, no work gloves or wrist braces.

Q: Have you ignored the pain? When do you say this is enough and seek help?

A: I did not ignore the pain but rather I would apply creams on my hands to stop the pain temporarily. After 4 years of working on the Ford assembly line, I decided to get help. I got physiotherapy for my hands and I changed jobs at Ford as well to a forklift driver.

Q: Have you done anything at work/home to stop or lessen the pain?

A: I wore medical wrist braces both at work and while I slept, for 4 months. The result of this work has left some of my fingers numb and without any feeling in them. In the morning my hands would be completely numb when I first started wearing the braces but once I started wearing the braces it stopped except for my fingers. I was even told by my doctor that I should have carpal tunnel.

Interview 6

Connor Dobbin (Former Landscaper)

Q: How long have you been working in landscaping and did you face any pain while working there?

A: I have been working for 2 years, and I noticed that I did start to experience wrist pain, I would continue feeling this pain even when I got home. I also started feeling back pain and I started stretching more to feel better.

Q: What work would you do that would make you feel this pain?

A: I would feel this pain specifically after I was carrying heavy materials like bags of dirt, bricks, cement bags and other things. Even when I was using tools like digging tools, that would make my hands hurt more.

Q: Did you seek any help? how does the pain affect your daily life?

A: I have recently sought help since this pain is affecting my daily life. Since I am on the computer a lot of the time I have gotten special wrist support for when I am typing or for when I am gaming. I also play volleyball and it has affected that too, now I can't play for too long since my hands hurt a whole lot more. I now stretch my wrists and put my hands in ice water to release some of that pain.

Survey Insights

Q: Have you ever experienced any form of wrist or hand pain while at work?

Most people who answered this question worked in labour jobs and have experienced some sort of bodily pain that being shoulder pain, hand pain, knee pain, back pain, and other pains.

Q: Why did it hurt? was it muscular pain? tendon pain? or joint pain?

All the people who answered this question said that they started feeling these pains from work and the type of work they were doing such as lifting heavy loads many times.

Q: Are there any exercises or products you use to lessen this pain?

People have said that they do a lot of stretching to alleviate the pain in their bodies and wear braces to prevent further injuries.

Q: Does this pain affect your daily life?

People have said that this pain does affect their daily lives when they are playing sports, working out, playing video games, or even typing has been affected by the pain they feel.

Q: Have you ever felt as if your grip/wrists felt weak or unable to hold objects?

Some people have said that their grip has been affected by their injuries and have had to do specific exercises and stretches so that it doesn't hurt so much.

Key Insights

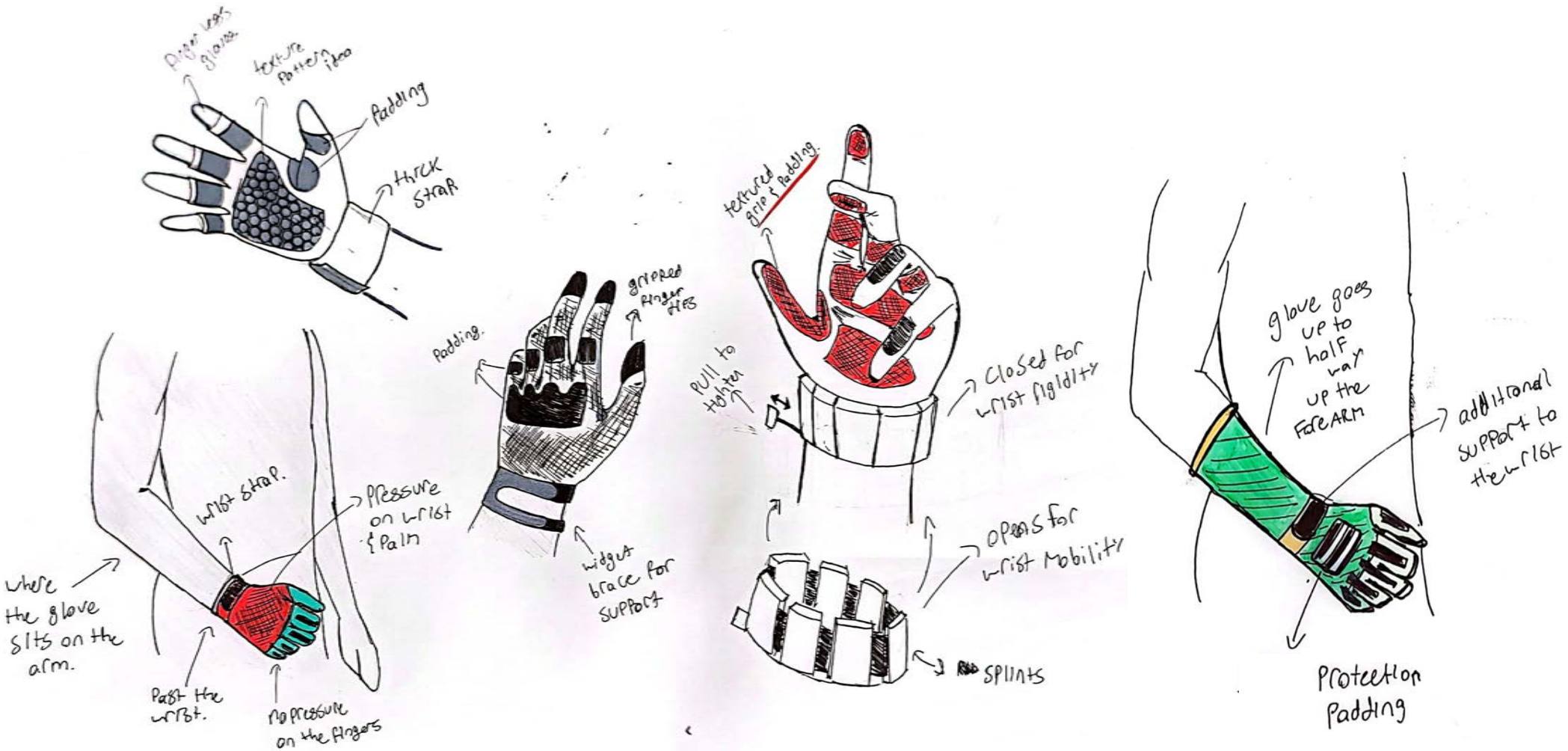
Some key findings that I found through my research are that labour workers suffer many symptoms due to the nature of their work. Unfortunately, most of the workers ignore the pain. Ignoring the pain can cause serious problems later in their lives and make it harder to treat these issues.

Some symptoms include arthritis, carpal tunnel, back injuries, ganglion cysts, and other issues. People who suffer from some of these conditions need to wear wrist splints/braces when they sleep when they are performing any form of lifting and any physical activity. Other people may have to get carpal tunnel surgery in which an incision is made in the wrist over the carpal tunnel ligament and cuts through the ligament to relieve pressure on the median nerve, the healing process takes to 3-4 months before they can get back to their regular lives, but a risk is that a person could lose feelings in their hands.

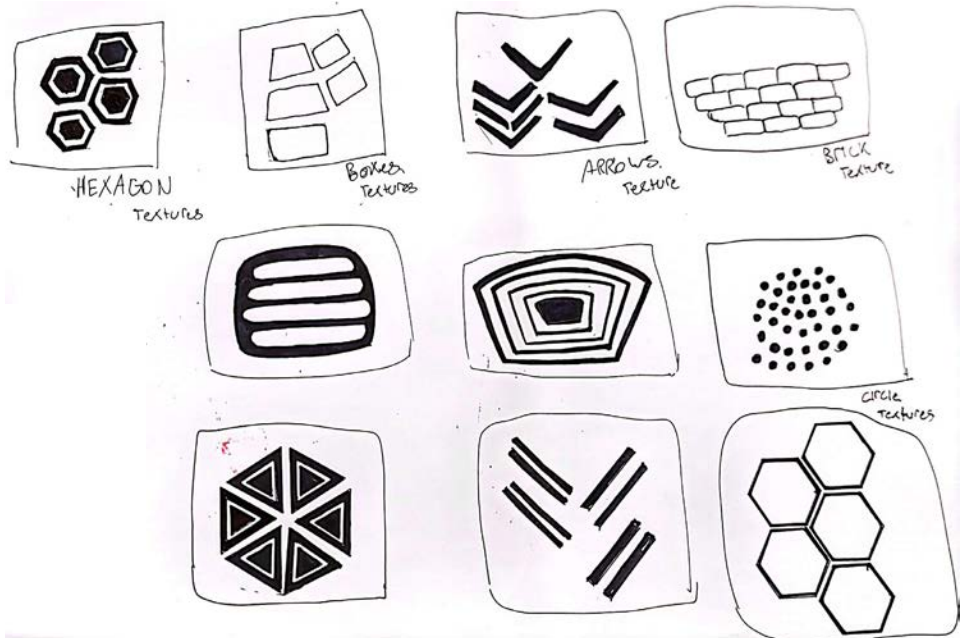
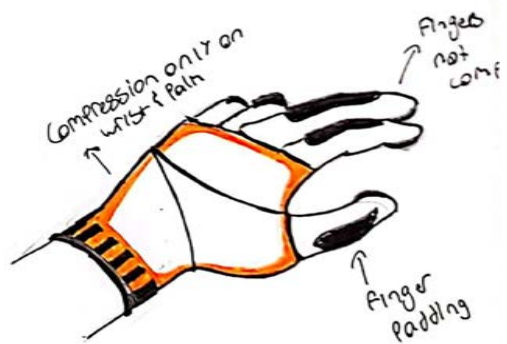
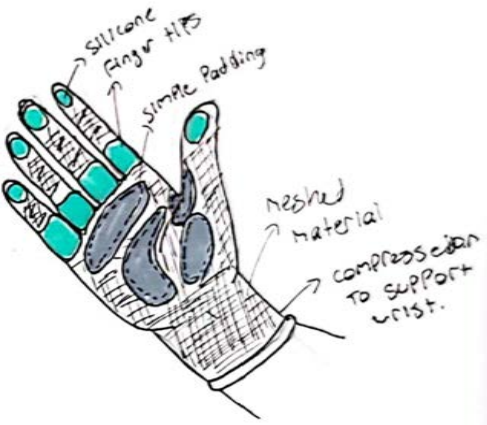
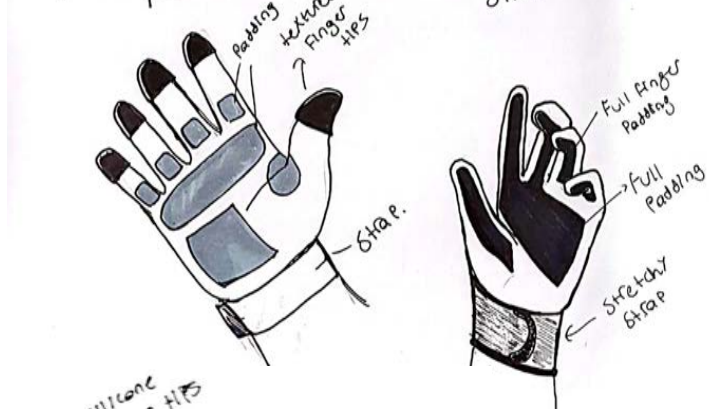
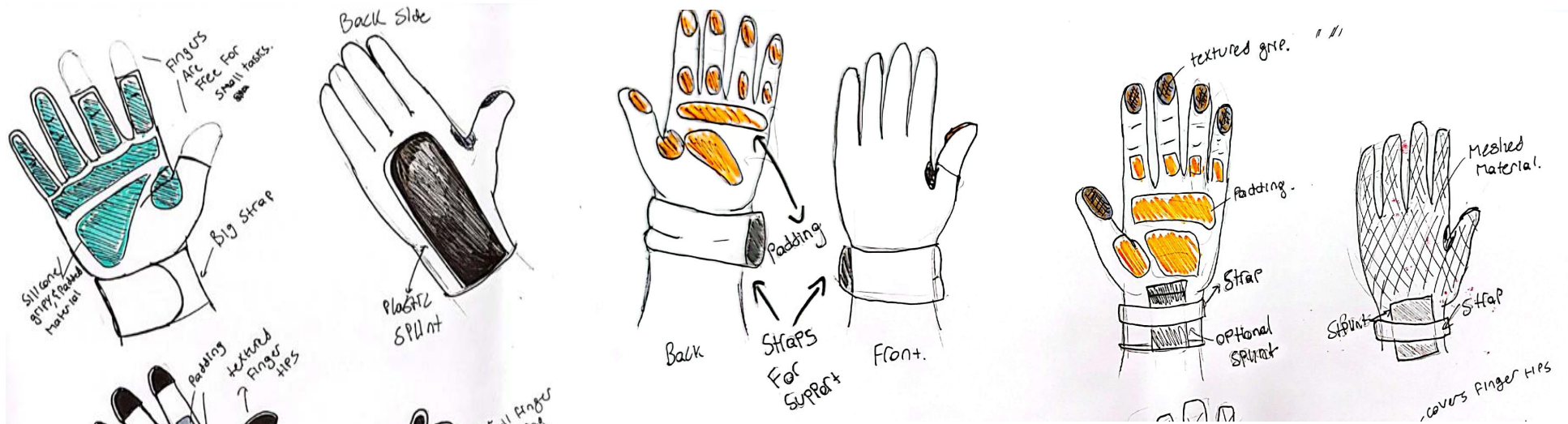
I began to look into many forms in which the wrist and hands can be both supported and protected. Exploring many products such as gym gloves, wrist straps, workers' gloves, skating wrist braces, and medical wrist braces. Designing a lifting garment that is flexible enough to support the wrist and provide a better grip for workers, will help prevent serious injuries.

Sketches

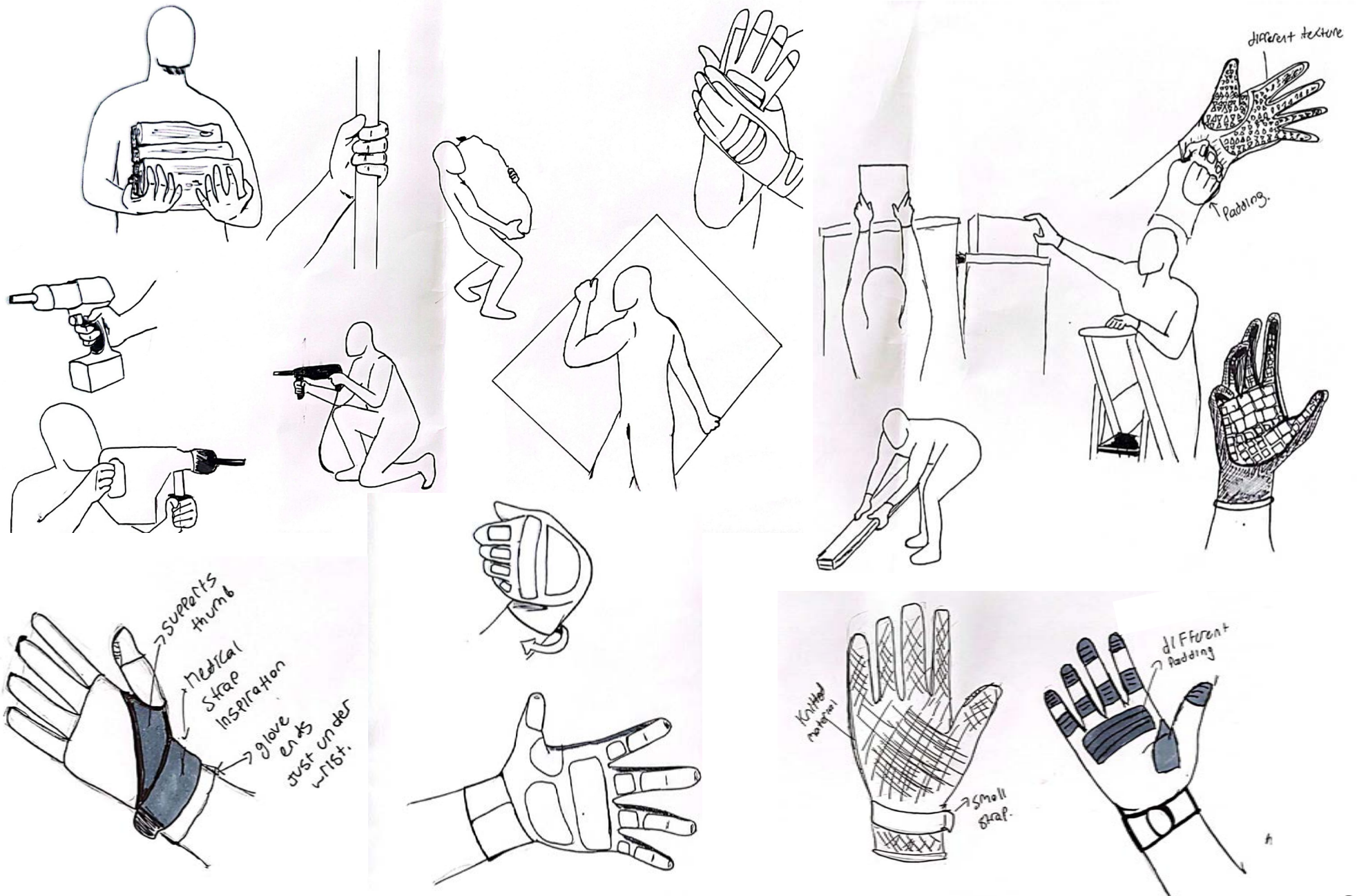
Sketches



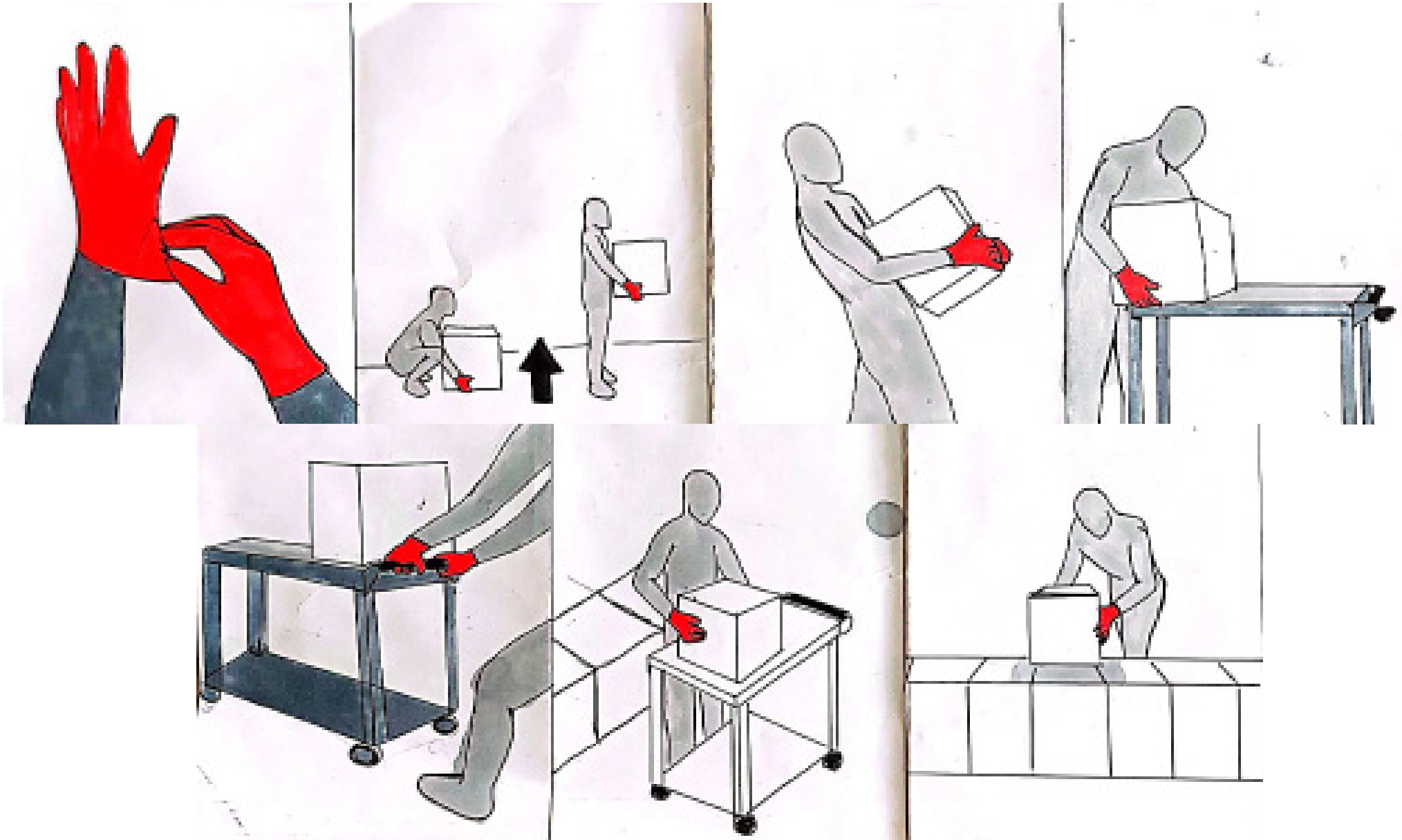
Sketches



Sketches



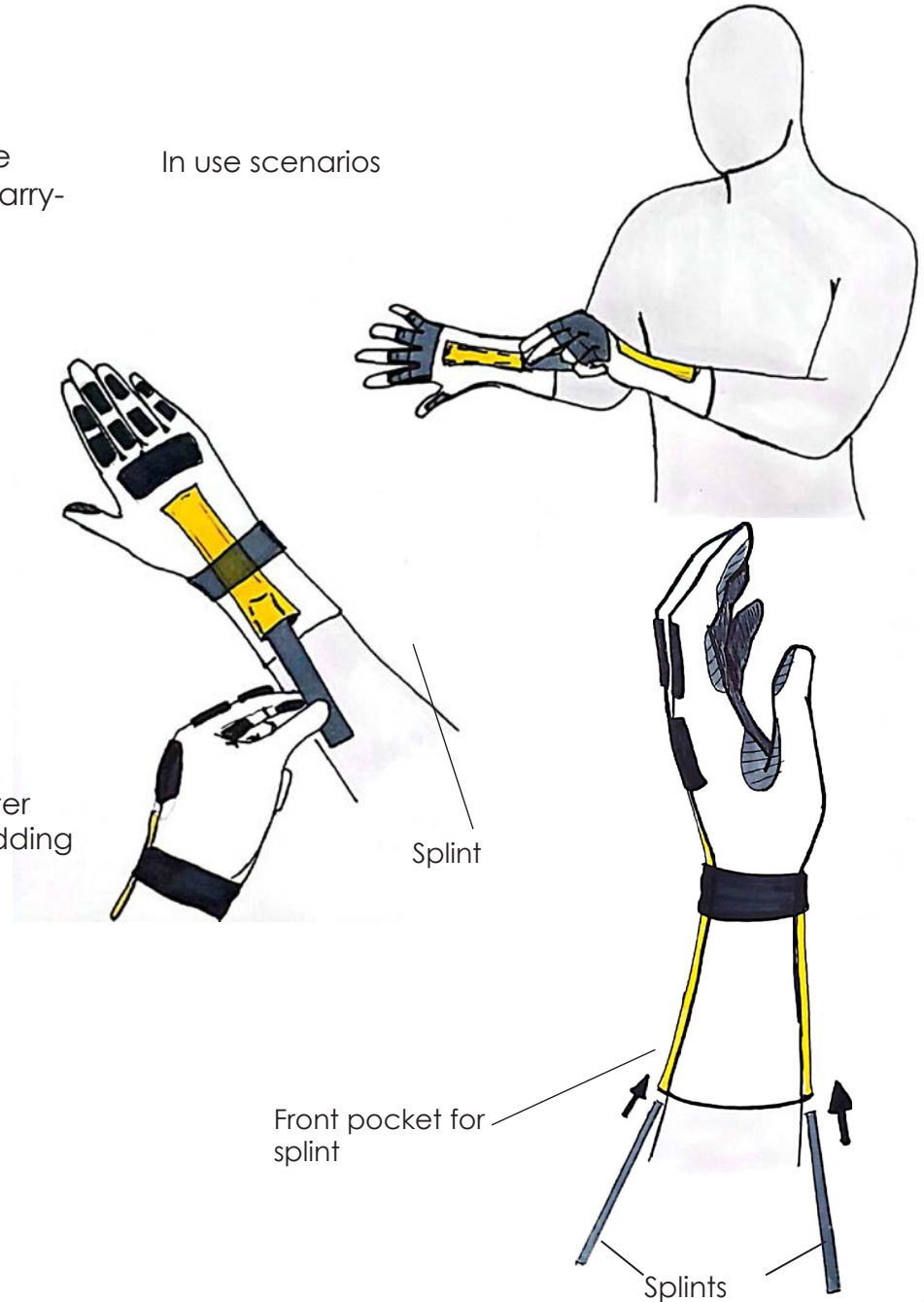
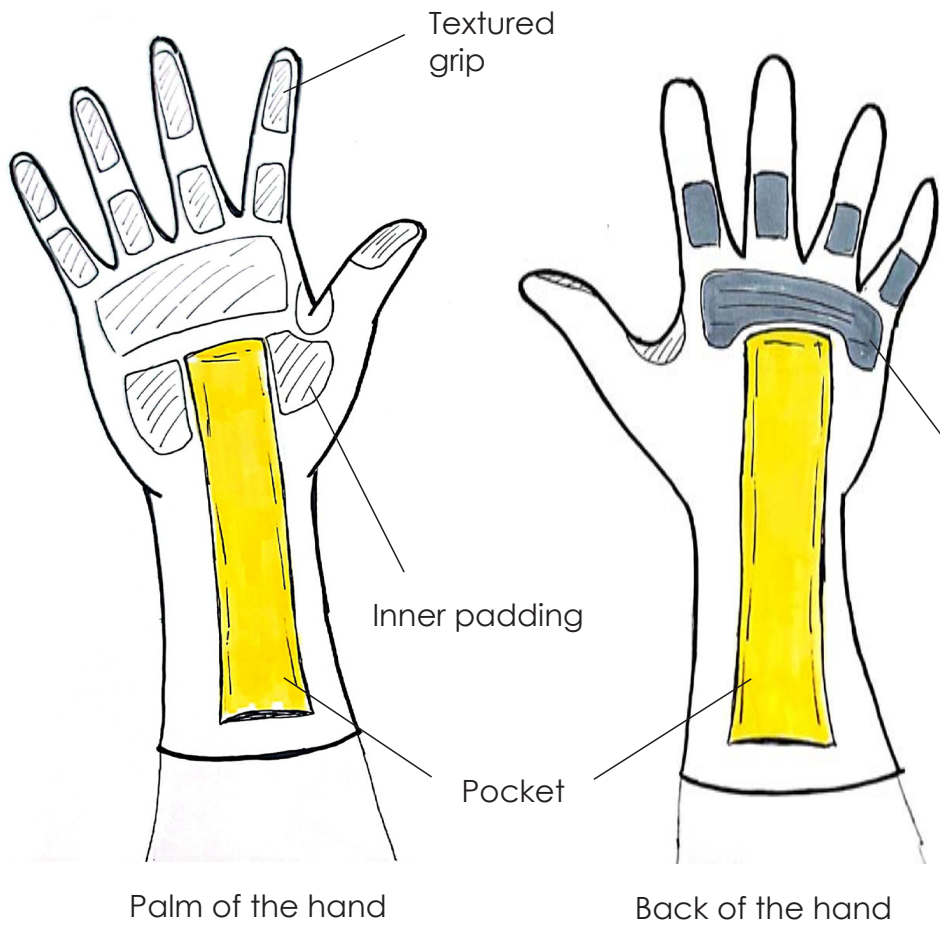
Story Board



Validation

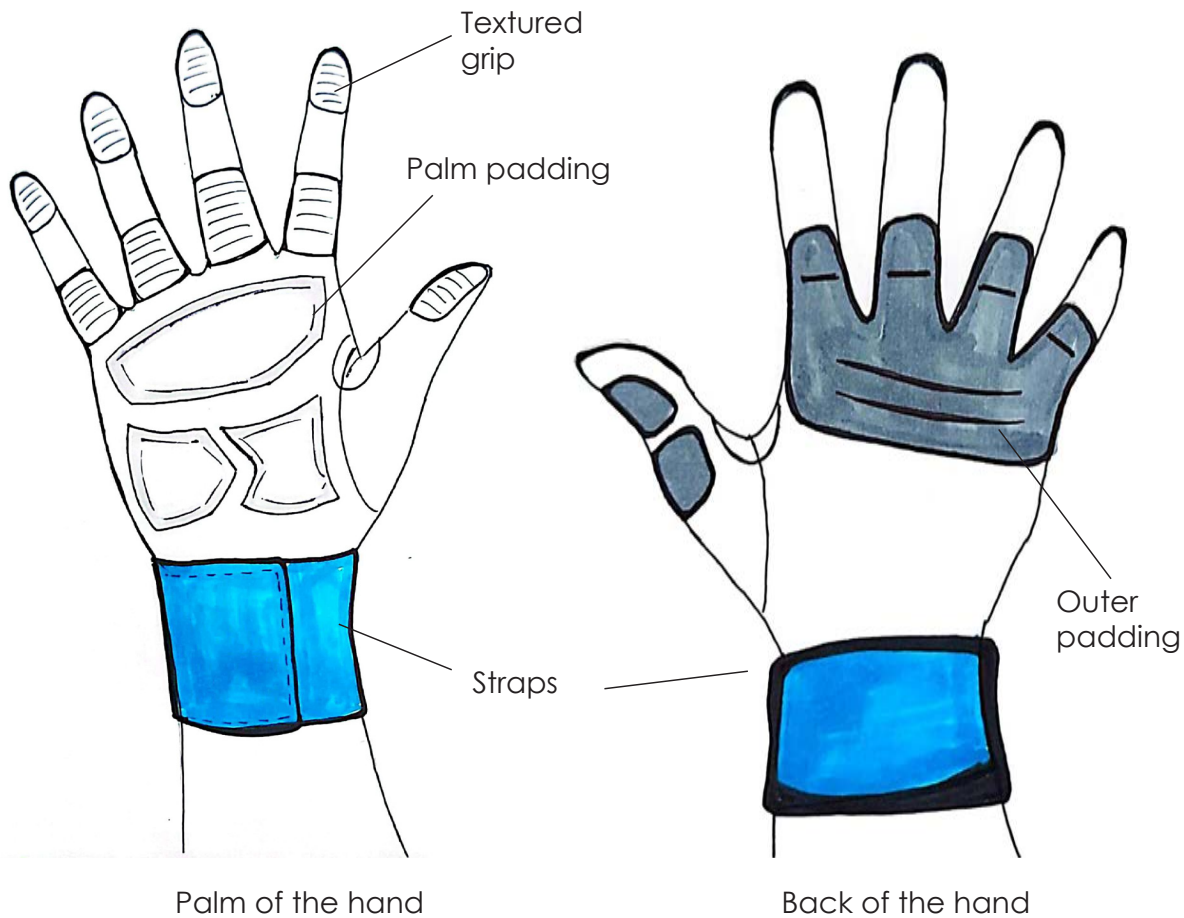
Concept 1

For this concept, I added pockets for optional splints so that the user can slide them in and have that rigid support for when carrying a heavy load.

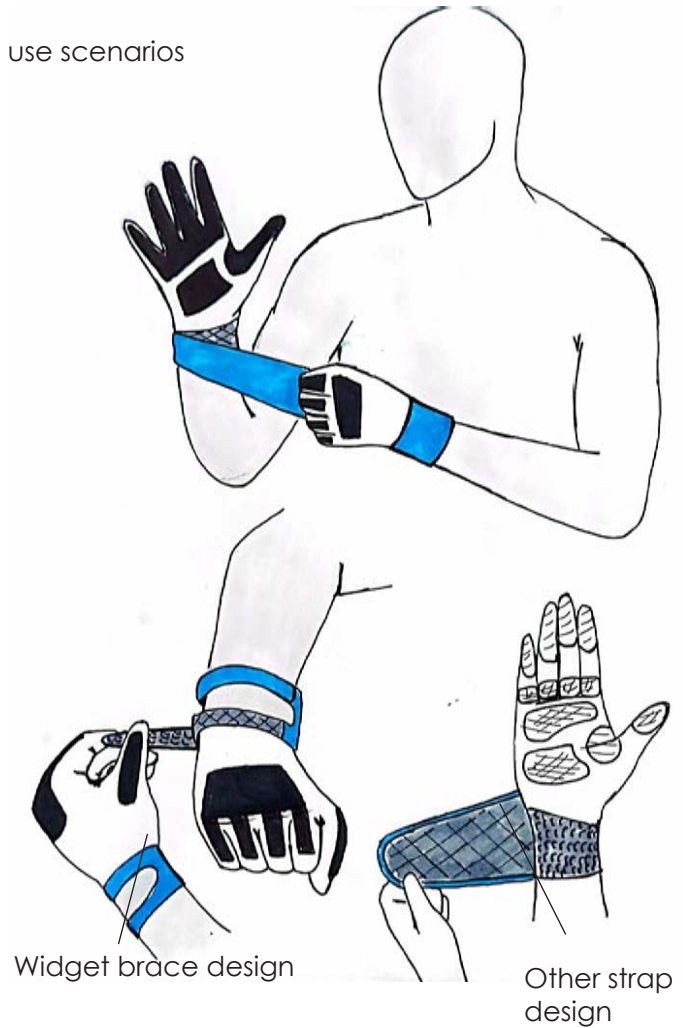


Concept 2

For this concept it has a strap that will provide some support to the wrist but will still allow the user to move their wrist around for whatever position they need.

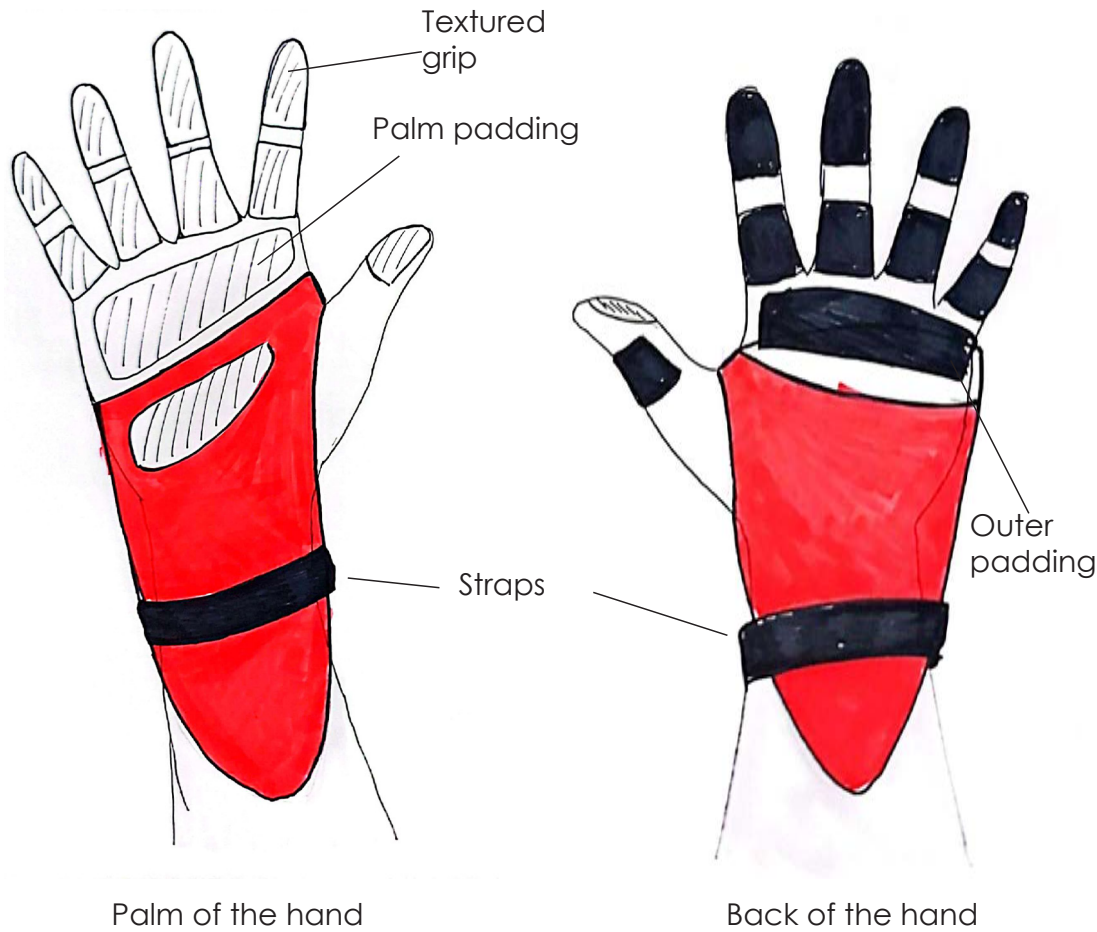


In use scenarios

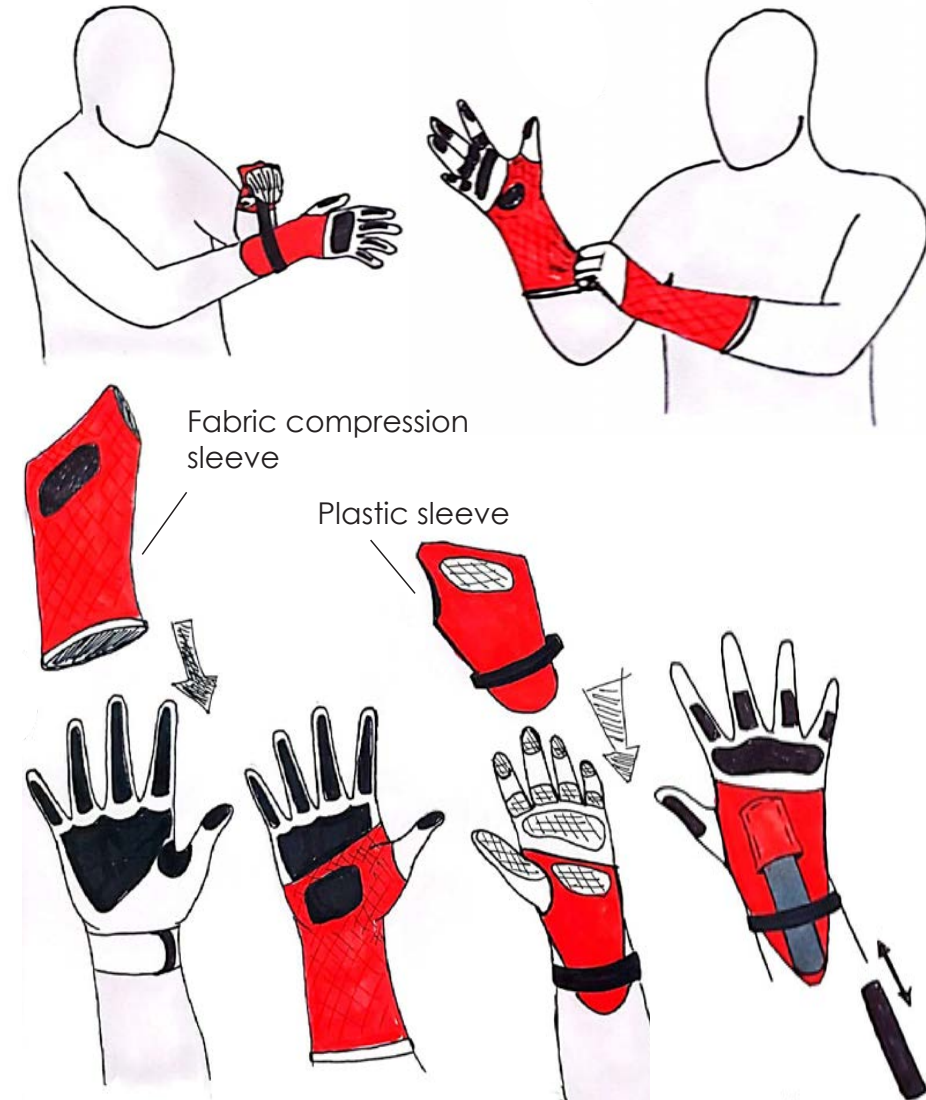


Concept 3

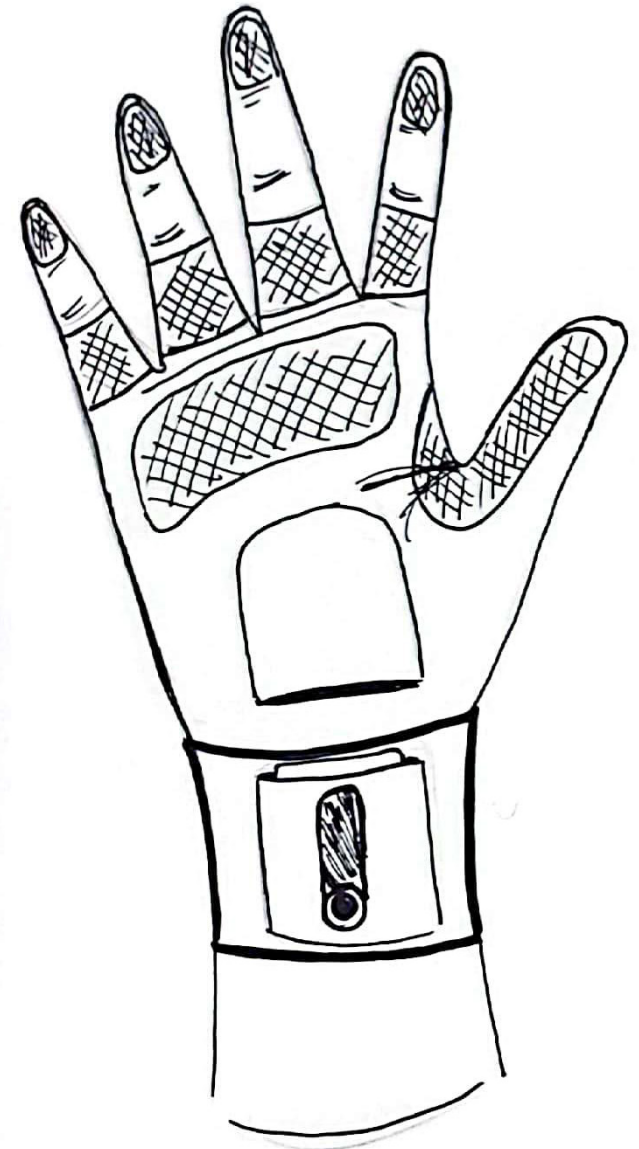
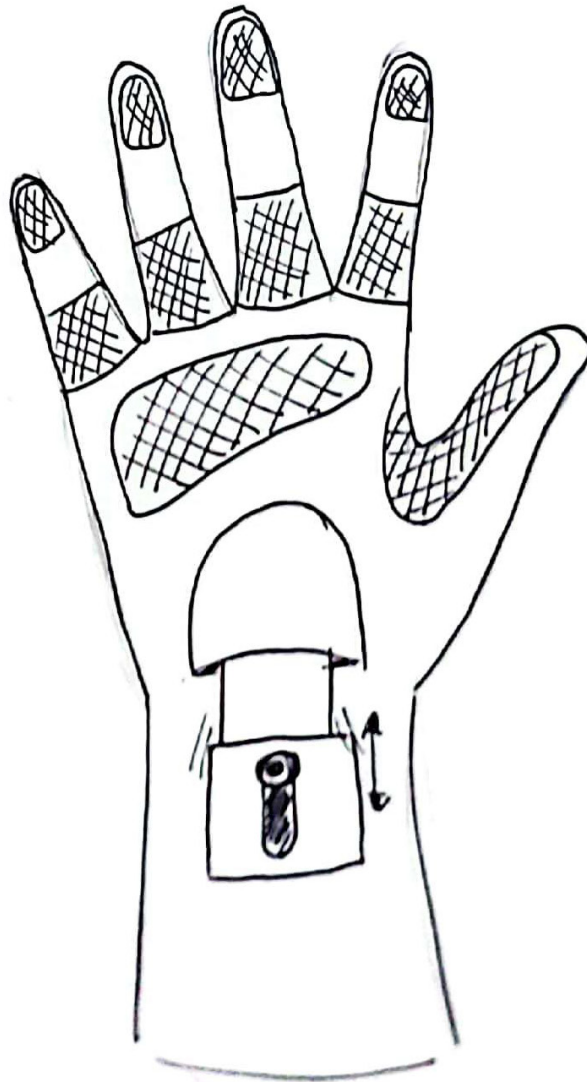
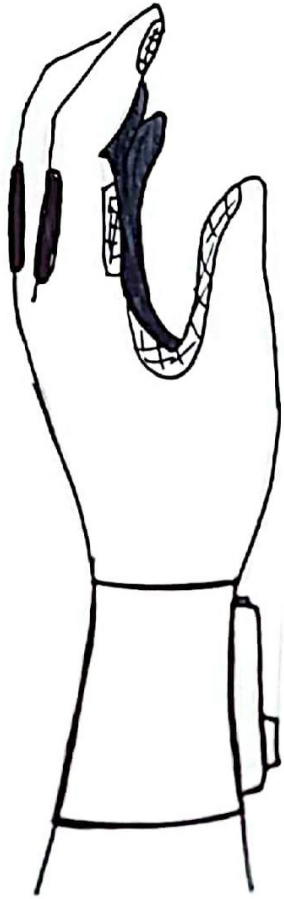
For this concept has more than one component. it has the glove which already has a strap for minimal support but it also comes with a sleeve that will provide further support for heavier loads.

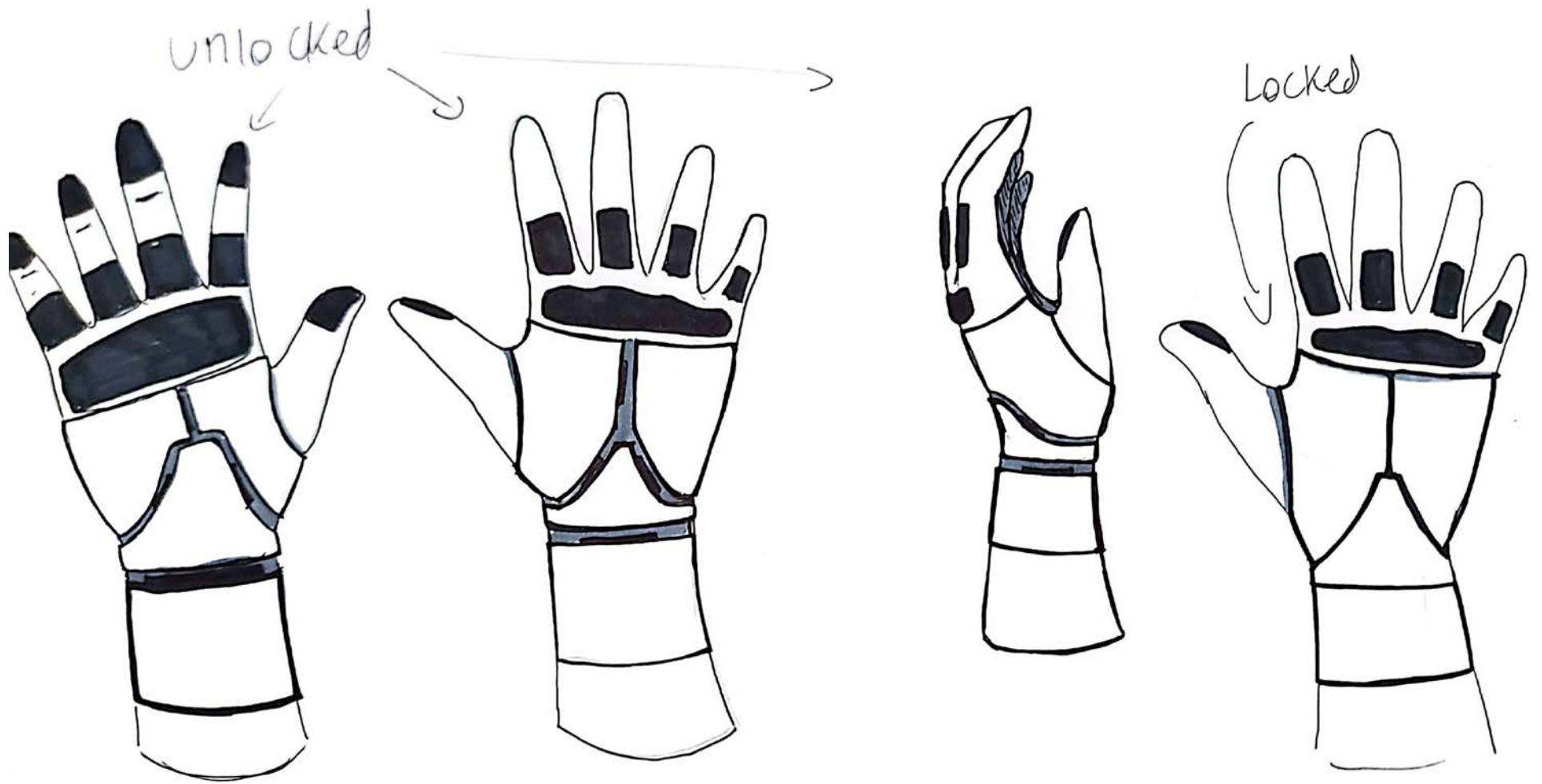


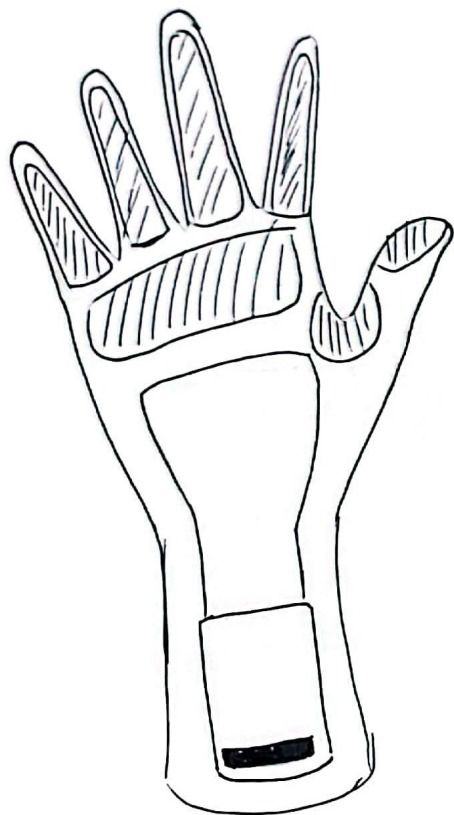
In use scenarios



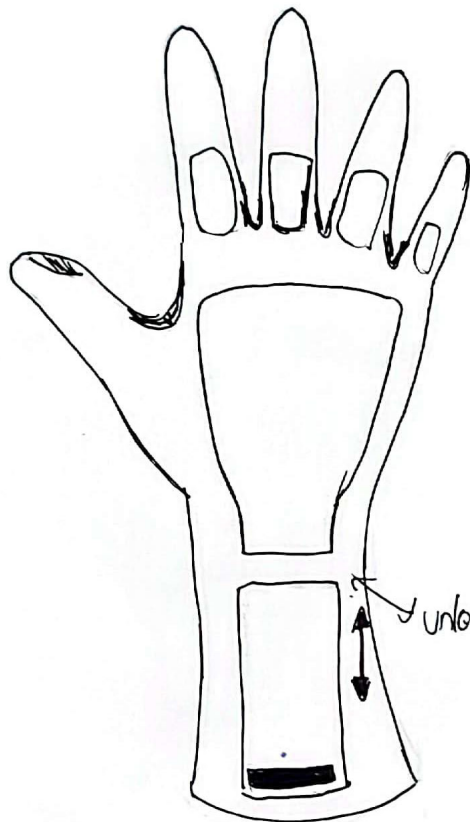
Sketches







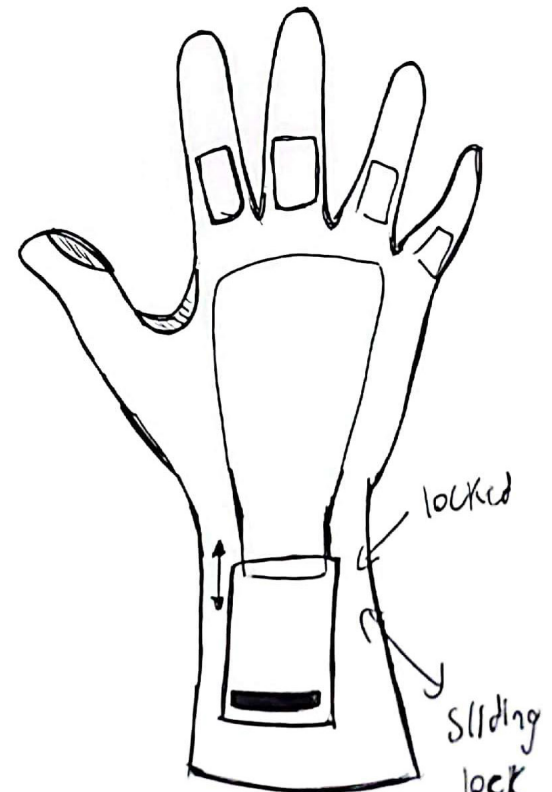
Palm of hand



Back of hand



Side view



locked view.

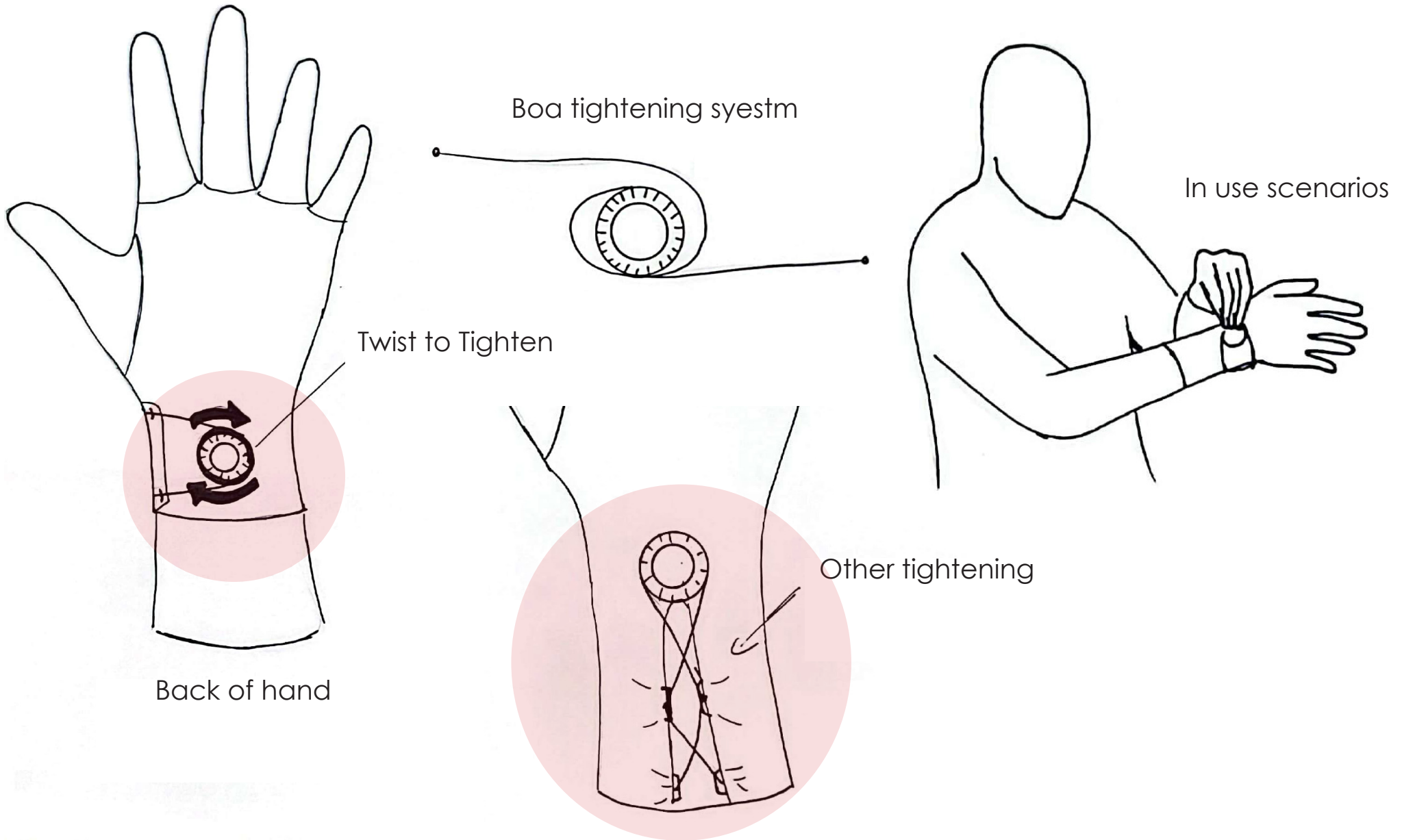
Boa Closure System

The BOA closure system is a system to pull on or out your safety shoes or boots. Classic laces are replaced by stainless steel wires, connected to a turning knob. This knob is used to tighten, loosen and snapping your laces into place(The History of the BOA).



Figure [10]

Final Concept



Model making

Concept Model #1



Concept Model #2



Concept Model #3



Concept Model #4



Story board



The process of moving a table from one place to another

Concept Model Insights

- Having the Tightening dial on the back of the hand will allow the user to not be interrupted when doing any sorts of labour and the run the risk of loosening the brace.
- Increasing the length of the glove will provide further support for the user
- The spinning dial concept was the preferred method of tighteing the glove due to the user only using 1 hand rather than both their hands.
- Using different thicknesses for the overall padding system will make the glove more comfortable
- A coreset type design may be the best way to tighten the glove for the support aspect of the glove.

Materials



Sports Nylon
Allows air flow for the hand

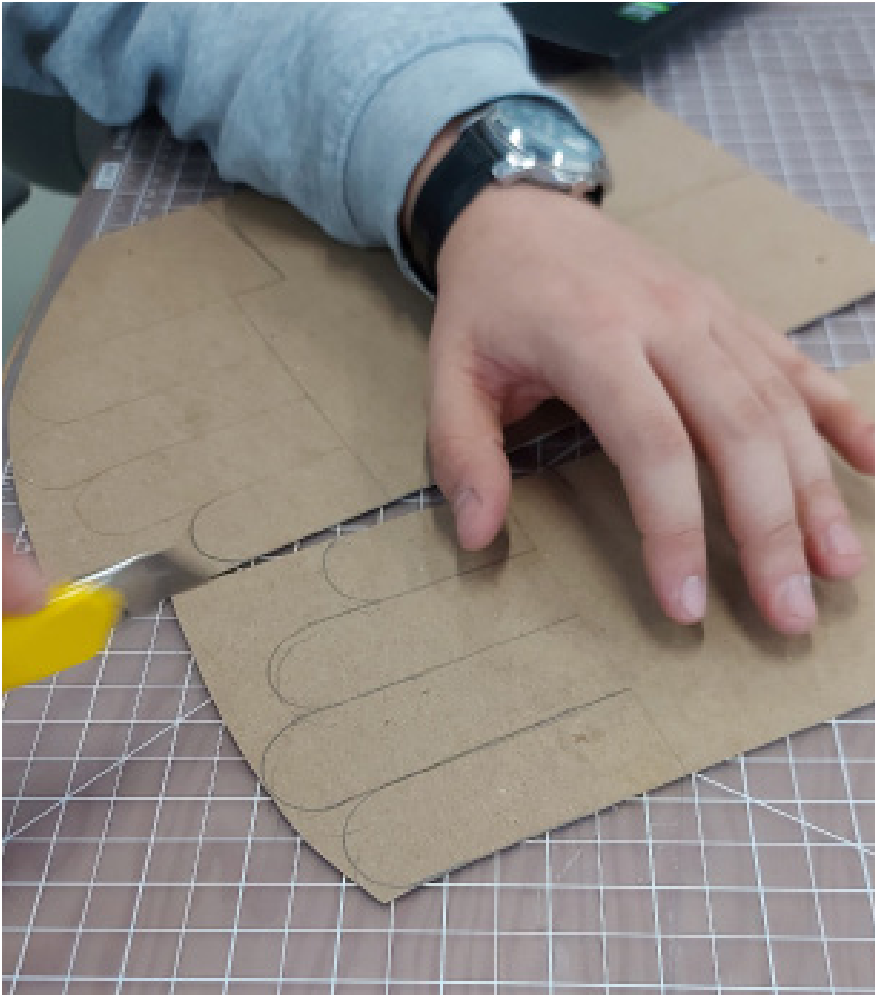
Polyester
Main body of the glove

Knuckle Padding
Thermoplastic rubber

Brace Layer
Vinyl Fabric

Process

Pattern making

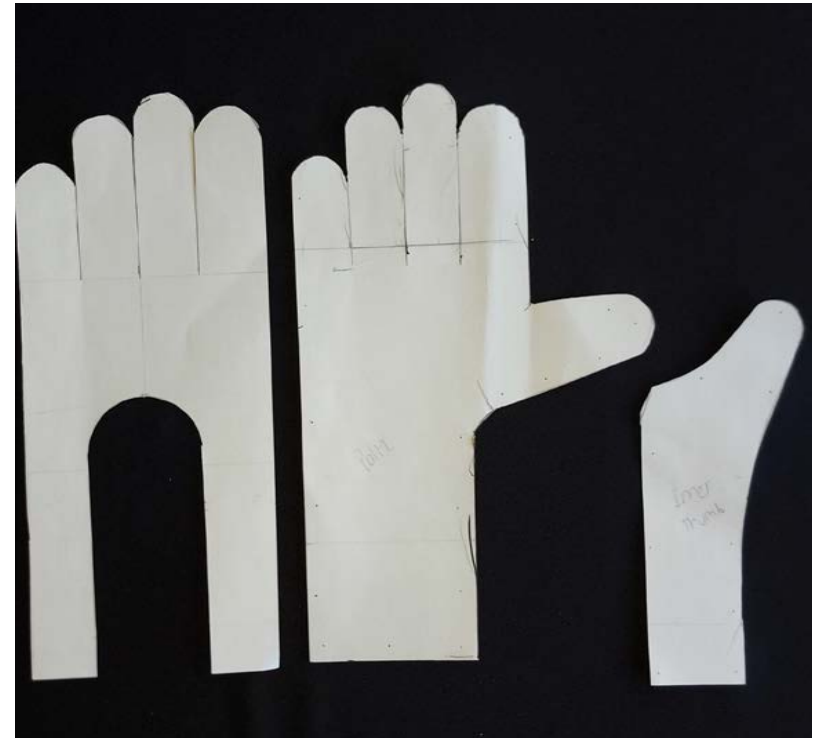


This part was a little complex as I needed to make patterns for the first time in my life and I had no clue how to make patterns for gloves. It took many attempts until I found the correct size for a large hand and it took many attempts and prototypes to get the sizing of the pattern correct.

Pattern Process



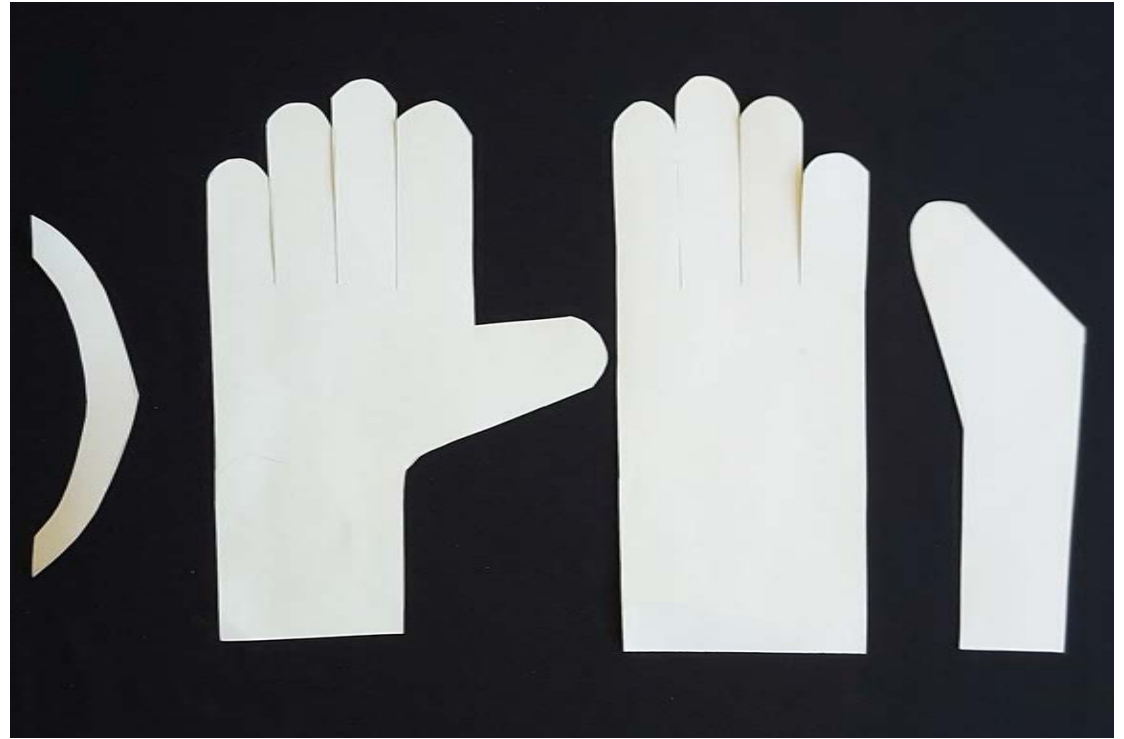
First Pattern



Second Pattern



Third Pattern



Final Pattern

Sewing



The process of learning how to sew was a daunting one. It took many prototypes to learn how to sew and make sure it was done correctly. After talking to some of the textile department students and professors they all said that sewing gloves are the most complicated garments to construct as they have many small curves and tight corners as well. It took many attempts to come close to something that looks good, but I learned how to sew very well throughout the process

Glove prototypes



This model showed me that I had to fix my pattern and needed to work on my sewing skills.



This model showed me that I had to fix my pattern and began the tightening system exploration. I also needed to work on my sew skills.



Further Practice on the sewing machine is needed but the glove held together better and all seams were completely closed.



Final pattern was a success and it was time to move onto better fabric.



This model was testing the final pattern on stretchy material and it was a success. Need to make sure that the sewing is done on the right side.

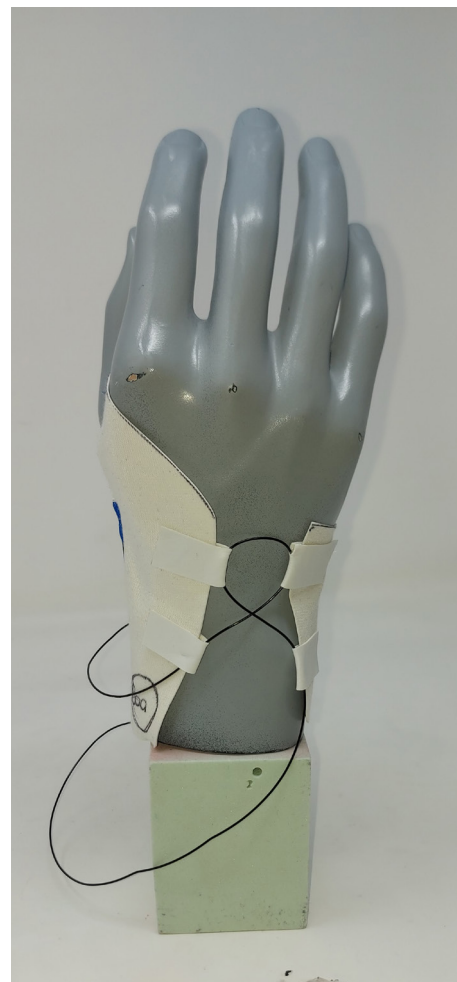


Model was to test out brace mechanism. It did not work
but the sewing was done properly.



Final Prototype, was the proper length and fit more snug

Brace Prototypes



First tested with tape then with Vinyl fabric to see if tighten
the wrist.

Glove making



Drawing out patterns on polyester



Cutting out patterns with a rotary cutter

Sewing



Sewing base of glove together



Sewing the final seam to complete glove

Final Design



Final Model



Final Scenario



Heavy boxes in needing to be moved



Putting glove on



Press to activate system



Tighten until you feel the support



Lifting boxes



Support

Next Steps

To further this project, I would like to explore further specific aspects of the glove which would improve the use of the product, I mainly focused on the construction of the glove, sewing it all together. First, further developing the bracing system would have been much more helpful and given it a form of its own and addressed where the pressure is being applied. I would've liked to investigate more the grip, such as the design of the grip and the materials that could have been included within the glove. Having more tests with actual people would have been excellent and would have influenced the final design.

Adding a render of the glove would have also helped present the glove and helped address aspects such as presenting a clean model and showing a model that could help viewers see what it would look like if the glove was fabricated for mass production.

Self-Reflection

Through this whole project, I learned a lot about how we can damage our joints by overworking them and how we need to take care of our body's physical health as it can affect our lives in the future. Also, I learned that labour workers' bodies are worn down more due to their jobs. I learned that interviewing people from different backgrounds can have a different viewpoints on the same issue and how they adapt to continue doing the things they enjoy. Observing many scenarios of people lifting different objects, there are different techniques for lifting especially when it comes to the size of the load and the weight of the object.

I learned that we need to address problems in our bodies before any damage to the body becomes extreme. I was shown that being able to have support and flexibility is crucial for the work environment, being able to carry loads differently workers need to be able to have their hands flexible enough to adapt to what they are interacting with.

I learned and grew respect for the process of sewing, it is a complicated and challenging task to undertake and execute. Sewing gloves has humbled me in asking for help when I need it and has also made me appreciate all the work that goes into making clothes and other garments.

Acknowledgments

Faculty of Craft and Design

Thank you to my Advisors Doreen Stegmuller, and Scot Laughton, for your guidance and expertise throughout this project. You kept me focused and kept me on track

Thank you to Mickey Wang, our studio technologist, who helped me get the parts I needed and provided help through my whole project. Also thanks for all the hard work you do and the late night snacks.

A special thank you to all my friends and classmates, who made long days and nights, less stressful and provide help when I needed it. Thank you for making every moment exciting, unforgettable, and fun. I can never thank you enough.

Thank you to my parents who have always supported me through this journey and provided new ideas and were always there for me. Thank you for always believing in me.

Appendix

Figure [1] PROPER LIFTING TECHNIQUE: 8 COMMANDMENTS TO AVOID INJURY WHEN LIFTING [UPDATED 2022]. (2022, June 19).

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Figure [2] Carpal Tunnel Release. (n.d.). <https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/carpal-tunnel-release>.

Figure [3] Slip-On Gloves. (2022, October 11). <https://www.marks.com/en/helly-hansen-workwear-slip-on-gloves-color-black-80235.html#80235%5Bcolor%5D=BLACK>.

Figure [4] MKO Elite 6” Wrist Brace. (2022). <https://shoptrinity.ca/products/mko-elite-6-wrist-brace>.

Figure [5] DEFY Padded Weight Lifting Gloves. (n.d.). <https://www.askmall.cf/ProductDetail.aspx?iid=215606946&pr=55.88>.

Figure [6] Wrist Guard Protective Gear Wrist Brace Wrist Support for Skating Skateboard Skiing Snowboard Motocross Multi Sport Protectio. (n.d.). <https://www.walmart.ca/en/ip/Wrist-Guard-Protective-Gear-Wrist-Brace-Wrist-Support-for-Skating-Skateboard-Skiing-Snowboard-Motocross-Multi-Sport-Protection/0UNMTT3JOOEY>.

Figure [7] Hard-working Boa® fit system, built for life. (n.d.). <https://www.hsimagazine.com/>. <https://www.hsimagazine.com/press-release/hard-working-boa-fit-system-built-for-life/>

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