

PROJECT FOUR: MILESTONE 2 – COVER PAGE

Team Number:

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|---------|
| Tues-31 |
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Please list full names and MacID's of all *present* Team Members.

| Full Name: | MacID: |
|---------------------|----------|
| Avanish Ahluwalia | ahluwa6 |
| Ziad Ahmad | ahmadz18 |
| Luigi Quattrociochi | quattrl |
| Michael Ferlisi | ferlisim |

MILESTONE 2.1 – CLIENT NOTES

Team Number: Tues-31

You should have already completed this task individually prior to Design Studio/Lab B for Week 8.

1. Compile your team's notes from the client Q&A visit.

Notes from March 10th which could be potentially applicable to initial problem statement

- Is approximately 5 feet and 1 inch tall
- While using charcoals and paints, she cannot rest arm on the canvas or else it will smudge
- Grips pens and brushes sometimes with a “closed grip”, it is easier when she utilizes the palms of her hands rather than her fingers
- Cloth compression sleeves for wrist and forearm shown during live session, material consistency of “really thick tights”
- Materials that irritate her: No gluten based, rough edges (such as Velcro). Prefers cotton and silk-based materials
- Moves to all sides of canvas, usually rotates painting to stay working from seated position
- Paints on floor sometimes because she feels nauseous while standing up for some time, and this makes her feel more stable
- Smaller brushes cause cramps. Pain near shoulder after holding brushes for long time.
- Wears vest, sleeves, and gauntlet everyday to paint
- Frequently changes position to avoid pain and stiffness of arm
- Performs different exercises (stretching and meditation) between activities based on pain
- Fine with Velcro if no rough or sharp edges in contact with skin
- Cold (possibly caused by change in weather) increases pain, whereas warmth is preferred for less pain. However, extreme temperatures are not comfortable at all.
- Usually moves around canvas to paint. Also rotates the canvas when needed.
- Prefers to push an object rather than pulling
- Can wear belt or similar structure if it does not negatively impact posture and causes no constrictions
- She prefers to use her palm to grip objects rather than fingertips to reduce load on specific points and avoid ‘spikes’ in pain.
- When wrist is aligned (parallel to forearm), it is easier to paint for her and it avoids more pain.

MILESTONE 2.2 – RESEARCH ASSIGNMENT

Team Number: Tues-31

You should have already completed this task individually prior to Design Studio/Lab B for week 8.

1. Copy-and-paste each team member's research assignment on the following pages (1 assignment per page)
 - Be sure to indicate each team member's Name and MacID

See individual worksheet for assignment specification.

We are asking that you submit your work on both the team and individual worksheets. It does seem redundant, but there are valid reasons for this:

1. Each team member needs to submit their research assignment with the **Milestone Two Individual Worksheets** document so that it can be *graded*
2. Compiling your individual work into this **Milestone Two Team Worksheets** document allows you to readily access your team member's work
 - a. This will be especially helpful when completing the rest of the milestone

Team Number: Tues-31

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|---|----------------|
| Name: Luigi Quattrociochi | MacID: quattrl |
| <i>What are effective treatments for chronic lymphedema, and why are they effective?</i> | |
| <p>To support our client, we must consider her conditions and their effects, which poses a question: what are some effective treatments for chronic lymphedema, and why are they effective? To answer that, we should first understand what lymphedema is. Lymphedema refers to localized tissue swelling, typically in the arms or legs, and caused by a buildup of lymphatic fluid in a damaged lymphatic system [1]. The lymphatic system carries lymph fluid through the body, which serves to collect bodily waste products. Lymphatic fluid is circulated through the lymph vessels and flushed through the lymph nodes. When the lymph vessels are blocked and can't sufficiently drain the lymph fluid, it pools in the body and causes swelling [2]. Lymphedema is common in cancer patients because lymph nodes can be damaged or removed during surgery or treatment [2].</p> <p>Lymphedema can yield symptoms such as discomfort, infection, swelling in the extremities, restricted range of motion, and hardening/thickening of the skin [2]. There is currently no cure for lymphedema; the main objective is to limit discomfort caused by symptoms and prevent further complications [1]. Despite there being no cure, we can focus on treating it by reducing the swelling and pain. Some treatments include light exercises involving movement to prevent excessive pooling of lymph fluid, wrapping of the extremities or wearing compression garments to encourage lymph fluid to return to the trunk of the body, or massaging to promote drainage of lymph fluid [2].</p> <p>Although some doctors believe that lifting heavy weights worsens lymphedema, a study has shown that light physical activity can be beneficial to breast cancer survivors with stable lymphedema. Lymphedema flare-ups were less common in those who lifted light weights than those who didn't exercise at all. Results of this study recommend developing an exercise plan for those with lymphedema. Prescribed activities include flexibility and stretching exercises, strength training, and aerobic exercise, though the exact schedule and amount will vary from patient to patient. It is also pertinent to be careful, slow, and progressive in the buildup of activity to ensure that the risk is decreased rather than increased [3]. The activation of limb muscles incurred by these exercises serves to pump lymph fluid away from the limb and reduce swelling.</p> <p>Lymphatic drainage massages can help to flush trapped fluid and improve circulation in the lymphatic system. Typically massages are administered by professionals, but they can also be performed at home by oneself. During the massage, lymph fluid is drained by very gently stimulating the skin on the arms and legs. Areas of the skin where there are lymph nodes also massaged [4].</p> <p>Compression garments are another way to treat lymphedema by reducing swelling by pushing out the fluid. These garments usually are specifically prescribed by a doctor and used in combination with bandages. They cover the swollen limb and apply enough compression to give firm support but are not too tight to cause numbness or discomfort [5].</p> | |

The common factor among these three treatment methods is the displacement of lymphatic fluid from the affected limbs, mitigating the swelling and associated discomfort.

List of sources:

- [1] A. A. Grada and T. J. Phillips, "Lymphedema: Diagnostic workup and management," *Journal of the American Academy of Dermatology*, vol. 77, no. 6, pp. 995–1006, Dec. 2017, doi: 10.1016/j.jaad.2017.03.021.
- [2] "Lymphedema - Symptoms and causes," *Mayo Clinic*. <https://www.mayoclinic.org/diseases-conditions/lymphedema/symptoms-causes/syc-20374682> (accessed Mar. 15, 2021).
- [3] "Lymphedema & Exercise," *Breastcancer.org*, Aug. 05, 2020. <https://www.breastcancer.org/treatment/lymphedema/exercise> (accessed Mar. 15, 2021).
- [4] "Lymphatic drainage massage: How-to guide and benefits," Feb. 22, 2019. <https://www.medicalnewstoday.com/articles/324518> (accessed Mar. 15, 2021).
- [5] "Compression treatment for lymphoedema | Coping with cancer | Cancer Research UK." <https://www.cancerresearchuk.org/about-cancer/coping/physically/lymphoedema-and-cancer/treating/compression> (accessed Mar. 15, 2021).

Team Number: Tues-31

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| Name: Avanish Ahluwalia | MacID: ahluwa6 |
| <p><i>What is your question?</i></p> <p>What are the limitations for individuals with fibromyalgia? What are the types of treatments provided to mitigate pain and other symptoms of fibromyalgia?</p> | |
| <p><i>What is your answer?</i></p> <p>Due to fibromyalgia, Alanna cannot hold art tools for more extended periods due to increasing pain in her dominant arm. To find a suitable and efficient solution, we would also look at the devices and methods used to improve the physical status of an individual with fibromyalgia.</p> <p>Fibromyalgia is a medical condition known for widespread pain and increased pain due to pressure in the body's musculoskeletal system. This condition is caused by many reasons such as genetics, PTSD, increase in pain due to an infection or other diseases, physical exertion, and depression. Its symptoms are fatigue, sleep, memory issues and emotional distress [1]. The effect of widespread pain is described as a constant ache in specific muscular regions. It is also known to cause fatigue because it becomes challenging to perform daily tasks in an average amount of time. Due to fatigue, the individual has difficulty sleeping because of the aggravating pain in their muscles. The pain also causes other sleep disorders [1]. It has been observed that the condition is diagnosed more in women than men. Scientists believe that the severity and higher chance is linked to the reproductive hormones of women [2].</p> <p>There is no instant or complete cure for fibromyalgia. It is advisable not to overexert your muscles and bear more weight than they can for longer periods. However, engineers and healthcare professionals develop many medical devices, medicines, and physical treatments to alleviate pain and allow the individual to perform basic tasks/activities. There has been the production of numerous painkillers such as aspirin, ibuprofen, and naproxen sodium to reduce pain caused by fibromyalgia. Companies have also produced antidepressants to avoid depression and fatigue [3]. In addition to painkillers and antidepressants, some different exercises and therapies help the patient reduce pain intensity in a specific region. Yoga is an excellent exercise to move a group of muscles and remain focused to decrease fatigue and avoid depression. It is performed by the client almost every day and does improve her physical movement. Yoga could include deep breathing drills, meditation and stretching [3]. Another exercise is acupuncture, which is used to treat chronic pain, change the blood flow in the body and alter the levels of neurotransmitters in the brain [4]. There are therapies such as Cognitive behaviour therapy (CBT), a therapy focused on improving mental health. This therapy involves patients working on identifying dysfunctional</p> | |

thought patterns and developing techniques to manage negative thoughts [3]. This treatment is a helpful way to reduce pain and provide a positive mindset.

Along with medicine and therapies, there are medical devices or instruments used by individuals with fibromyalgia. Epsom salts are commonly used to remove pain from the arms and legs [4]. Heat pads and blankets are used to relax the muscles after exhaustion. Magnesium lotion has many health benefits for those with fibromyalgia; its anti-inflammatory properties can be beneficial. Yeti hand warmers are used for comfort and provide heat to the exhausted region of muscles [4].

List of Sources:

[1] “Fibromyalgia - Symptoms and causes - Mayo Clinic.” <https://www.mayoclinic.org/diseases-conditions/fibromyalgia/symptoms-causes/syc-20354780> (accessed Mar. 14, 2021).

[2] “The Role of Gender in Fibromyalgia | Everyday Health.” <https://www.everydayhealth.com/fibromyalgia/101/the-role-of-gender.aspx> (accessed Mar. 15, 2021).

[3] “Fibromyalgia Treatments: 13 Ways to Alleviate Pain.” <https://www.healthline.com/health/fibromyalgia-treatments-for-pain#alternatives> (accessed Mar. 15, 2021).

[4] “20 Products People With Fibromyalgia Swear By | The Mighty.” <https://themighty.com/2017/08/fibromyalgia-pain-relief-products/> (accessed Mar. 15, 2021).

Team Number: Tues-31

| | |
|--|-----------------|
| Name: Ziad Ahmad | MacID: ahmadz18 |
| <p><i>What is your question?</i></p> <p><i>How does fibromyalgia affect the body and what are ways to help reduce its effect when the client is feeling pain or being affected? (How can this relate to the client?)</i></p> | |
| <p><i>What is your answer?</i></p> <p>Fibromyalgia is a condition that affects joints and muscles. It mostly disturbs the soft tissues around joints, which results in soreness all around them, which is the joints. It is one of the most common conditions that affect people’s everyday lives. As it causes people to feel pain in muscles and joints, it creates fatigue all over people’s bodies [1]. There is not a 100% factual reason why this condition affects people in certain ways, but many cases have been studied and most scientists think that illnesses may occur from how the brain and spinal cords process signals such as pain from the nerves all around the body. This possibly connects to why many people experience unpredictable pain in their bodies. Fibromyalgia can also happen from previous painful diseases or infections, rarely exercising, psychological stress and physical trauma [2]. There is no medical cure to make it completely vanish, but there are lots of methods that can be used to reduce the chances of feeling powerful pain throughout the body. There are obviously pain relievers to use to reduce discomfort throughout the body and improve the quality of sleep, but doing exercise is similarly effective, or having an enjoyable hobby also helps reduce pain, but people are sometimes limited from performing sorts of movements, which</p> | |

impacts them negatively as they feel discomfort. Joints and muscles are the main issues, so relieving stress and pressure mentally and especially physically assists people by making their lives easier to control with minimal discomfort [3]. Therefore, for people to enjoy their hobbies such as painting for example, we would need the client to hold paint brushes using less effort as lots of pressure is required to hold them steady, which ends up causing more agony for the client. In addition to this, because Other symptoms of fibromyalgia are headaches, numbness all around the body, sensitivity to cold, heat, light, or sound. One of the solutions is to take lots of breaks in short periods of time before feeling tired or switch between sitting and moving as it would make the body less prone to feeling muscle or joint soreness [3]. Relating this to the client, I would need to implement a way to reduce pressure on her body, such as her arms when she paints. The client has difficulty using small brushes, and the reasoning behind it is because of having no control and constant pain from the muscles and joints as she applies plenty of pressure in one spot. This can be reduced by implementing an easier way for the client to use paint brushes, such as creating brush holders or making bigger paint brushes with small heads. This should reduce pressure because it becomes distributed around the hand with minimal effect. Therefore, if the affect on muscles and joints is reduced, this leads to less unpredictable pain. This occurs because even though the nervous system will still have the same effects, it creates insignificant pain as muscles and joints move as they are reduced.

List of sources:

- [1] “Fibromyalgia: Symptoms, causes, and treatment.” <https://www.medicalnewstoday.com/articles/147083> (accessed Mar. 08, 2021).

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- [2] “Fibromyalgia: Symptoms, Causes, Diagnosis, Treatment.”
<https://www.webmd.com/fibromyalgia/guide/what-is-fibromyalgia> (accessed Mar. 08, 2021).
- [3] “Fibromyalgia Treatments: 13 Ways to Alleviate Pain.”
<https://www.healthline.com/health/fibromyalgia-treatments-for-pain#treat-pain>
(accessed Mar. 08, 2021).

Team Number: Tues-31

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| Name: Michael Ferlisi | MacID: ferlisim |
| <p><i>How do other patients with chronic lymphedema find relaxation from their medical condition?</i></p> | |
| <p>“Lymphedema is a chronic, debilitating condition in which excess fluid called lymph collects in tissues and causes swelling (edema) in them” [1]. Symptoms involved with lymphedema include swelling of the limbs, infections, the feeling of heaviness, aching, reduced range of motion, along with hardening/thickening of the skin. Cancer treatment survivors are all susceptible to developing lymphedema especially people who have undergone previous breast cancer treatment [2].</p> <p>It is known that Alanna suffers with chronic pain from lymphedema, and she uses items such as compression sleeves to relax the pain, but this sparks the question, “other than artists, how do other people who suffer from chronic lymphedema numb the pain”? A story about Susan O’Brien, a former breast cancer patient who likewise, suffers from chronic lymphedema, shares her perspective of the medical condition. She stated that “when [she] get[‘s] sick with a cold, the lymphedema flares up” [3] creating another complication that must be regarded when thinking of solutions to assist Alanna. She also provided information claiming that “her lymphedema is also triggered by over exertion, lifting heavy objects and too much sun” [3] where she will then need to take a break to reduce the inflammation and pain caused by her condition. This article provides significant detail and demonstrates that Susan shares very similar symptoms to that of Alanna concluding that the affects will be very similar from person to person but will never be identical. Using this knowledge, the way Susan find’s comfort could be applied to Alanna, in hopes that it will provide the same comfort.</p> <p>Susan O’Brien’s story demonstrates that both her and Alanna consistently wrap their arms with bandages and find this to be one of the easiest and most effective ways to alleviate the pain. The reasoning is provided as “wrapping the swollen part of [ones] body with bandages (compression), helps move the lymph fluid in the direction of the heart and away from [ones] swollen area” [4]. This information directs a solution that the device that will be provided for Alanna must adapt to the fact that she will be wearing a bandage around her arm. It also provides for possible solutions that provide compression within the design itself. Whether that be an area where she can place her arm into, or a connecting feature that provides links between her arm and the device. Viewing O’Brien’s conditions, the wrapping of the arm is the only concern that may alter the design as most remedies do not include external items that would obstruct the device.</p> <p>Minimizing the changes to Allana’s life supplies a crucial role and becomes extremely important when helping her try to find comfort and enjoyment in her hobbies as she once did. Upon the following research, certain ideas can be scattered to create a device that check off the most important objectives while not altering Alanna’s original remedies provided her lymphedema.</p> | |
| <p><i>List of sources:</i></p> | |

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- [1] M. D. Melissa Conrad Stöppler, “What Is Lymphedema? Treatment, Therapy, Causes, Symptoms, Pictures,” *MedicineNet*, 12-Dec-2019. [Online]. Available: <https://www.medicinenet.com/lymphedema/article.htm>. [Accessed: 08-Mar-2021].
- [2] D. Furnace, *Lymphatic Education & Research Network*, 2020. [Online]. Available: <https://lymphaticnetwork.org/living-with-lymphedema/lymphedema-and-lymphatic-diseases-affect-millions-and-concern-us-all#:~:text=More%20people%20suffer%20from%20these,are%20susceptible%20to%20developing%20lymphedema>. [Accessed: 13-Mar-2021].
- [3] “Living with Lymphedema: Susan O'Brien's Story,” *The James - OSUCCC*, 02-Jun-2016. [Online]. Available: <https://cancer.osu.edu/blog/living-with-lymphedema-susan-obriens-story>. [Accessed: 08-Mar-2021].
- [4] S. Phan, S. Crowhurst, and P. Hammond, *How to Self-Bandage Your Hand(s) and Arm(s) to Reduce Lymphedema*, 2019. [Online]. Available: [https://www.uhn.ca/PatientsFamilies/Health Information/Health Topics/Documents/Self-bandage hands arms to reduce lymphedema.pdf](https://www.uhn.ca/PatientsFamilies/Health%20Information/Health%20Topics/Documents/Self-bandage%20hands%20arms%20to%20reduce%20lymphedema.pdf). [Accessed: 13-Mar-2021].

*If you are in a team of 5, please copy and paste the above on a new page.

MILESTONE 2.3 – REFINED PROBLEM STATEMENT

Team Number: Tues-31

1. Write your initial problem statement below. This is what you have submitted for Milestone 1.2.

Problem Statement (Milestone 1.2)

To aid Alanna in her artistic endeavors while feeling as comfortable as possible for prolonged periods of time given her lymphedema and fibromyalgia by supporting her forearm and wrist.

2. Outline the Who, Where, Why, and What elements of your problem statement. Then write the refined problem statement below. Refer to the provided Refined Problem Statement rubric provided.

- Who? – Alanna, the client
- Where? – at her home in her art studio
- Why? – make her feel more comfortable while painting
 - (given her medical conditions)
- What? – comfort and support her forearm and wrist (function)
 - Lightweight (objective)
 - Easy to use (objective)
 - Comfortable (objective)
 - Durable (objective)

Refined Problem Statement:

Design a solution to provide comfort and physical support to Alanna's forearm and wrist, while she is painting at home in her art studio for prolonged periods of time. Given her lymphedema and fibromyalgia, the solution design should be lightweight, comfortable, and easy to use while supporting her forearm and wrist.

MILESTONE 2.4 – FUNCTIONAL ANALYSIS

Team Number:

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| Tues-31 |
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1. Identify your team's choice of design tool to perform Functional Analysis and the rationale behind choosing it. For examples of design tools, see "Review of Design Process" lecture – Wednesday, Feb 24th.











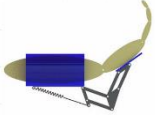
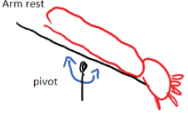



Choice: Morphological Chart

Rational:

The rationale behind choosing a morphological chart (aka a morph chart) as our functional analysis tool has some benefits. Firstly, a morph chart once filled in provides many different ideas, which can give a lot of inspiration for the concept exploration phase and reduce the amount of time spend coming up with concepts drastically. Additionally, it makes the team think more creatively about solutions to solve the problem, as they are meant to come up with means that are practical as well as "outside the box".

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2. Include a copy of your team’s functional analysis below.

| Primary function: Should comfort the forearm and wrist Secondary functions: <ul style="list-style-type: none"> • Should bear the weight of and support the forearm • Should increase effective wrist range of motion without pain | | | | |
|--|---|---|---|--|
| Function | Means | | | |
| Comfort the forearm and wrist  | Cushion-like material to rest on (ex. sponge, memory foam ...)  | Arm and wrist brace  | Glove and long sleeve  | Soft cast / tight wrap  |
| Bear the weight of and support the forearm  | A platform for the arm to rest on  | Pneumatic pump or tube  | Hanging suspension cable  | Weighted pulley system  |
| Increase effective wrist range of motion without pain  | Spring-loaded wrist rest  | Angled arm pivot system  | Swivel base platform  | Set of linkages /joints connected to the ground  |

MILESTONE 2.5 – CONCEPT EXPLORATION

Team Number: Tues-31

Complete this worksheet during Design Studio/Lab B for Week 8.

1. Include multiple photos of your concept exploration, if needed
 - Include necessary annotations to help in the communication of your ideas
 - Include your Team Number, Name and MacID on each concept
2. Insert your photo(s) as a Picture (Insert > Picture > This Device)
3. **Do not include more than two concept photos per page**

Make sure to include photos of each team member's concept exploration

We are asking that you submit your work on both the team and individual worksheets. It does seem redundant, but there are valid reasons for this:

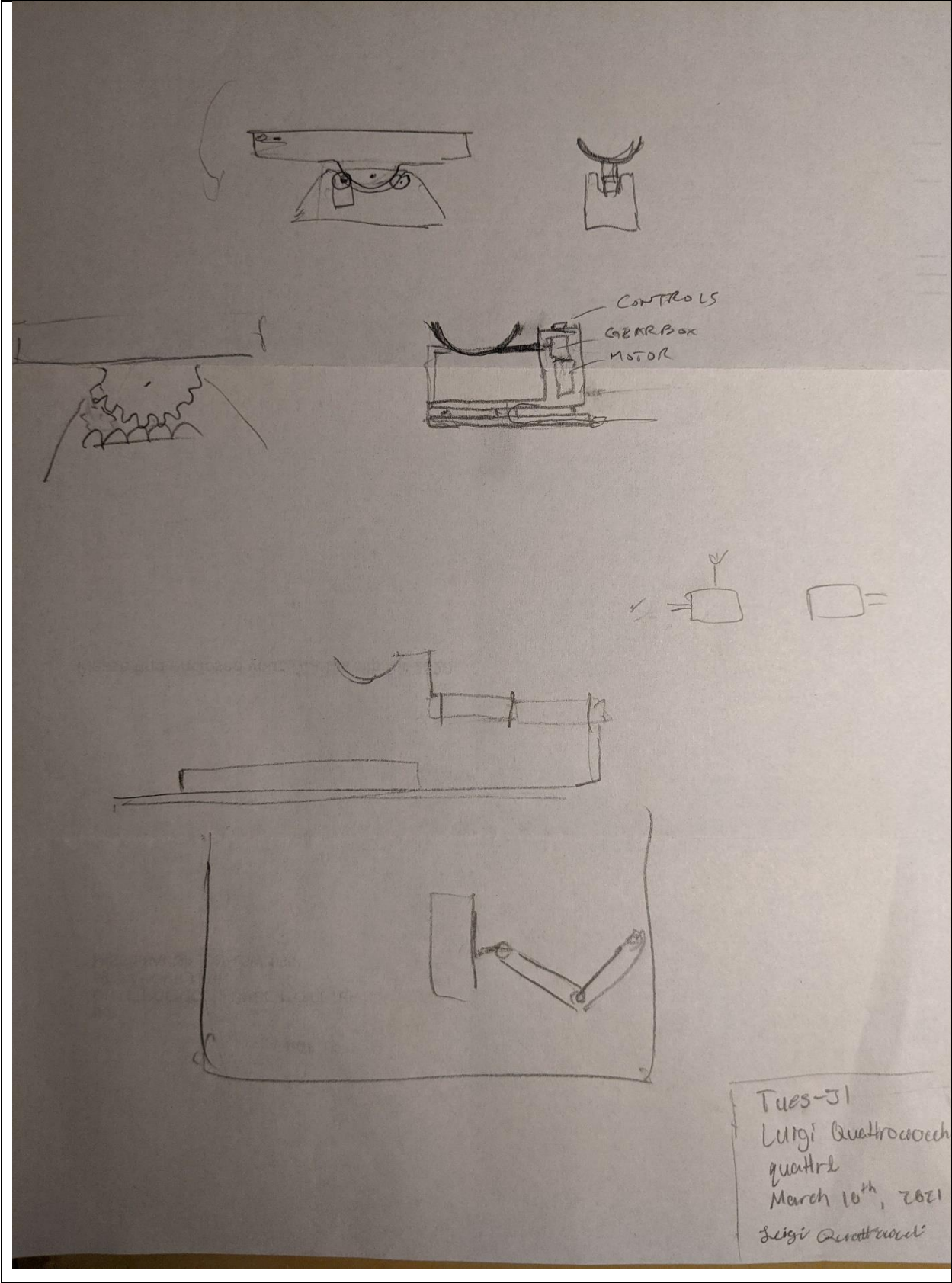
- Each team member needs to submit pictures of their concept with the **Milestone Two Individual Worksheets** document so that it can be **graded**
- Compiling your individual work into this **Milestone Two Team Worksheets** document allows you to readily access your team member's work
 - This will be especially helpful when completing the next milestone

Team Number: Tues-31

Concept 1

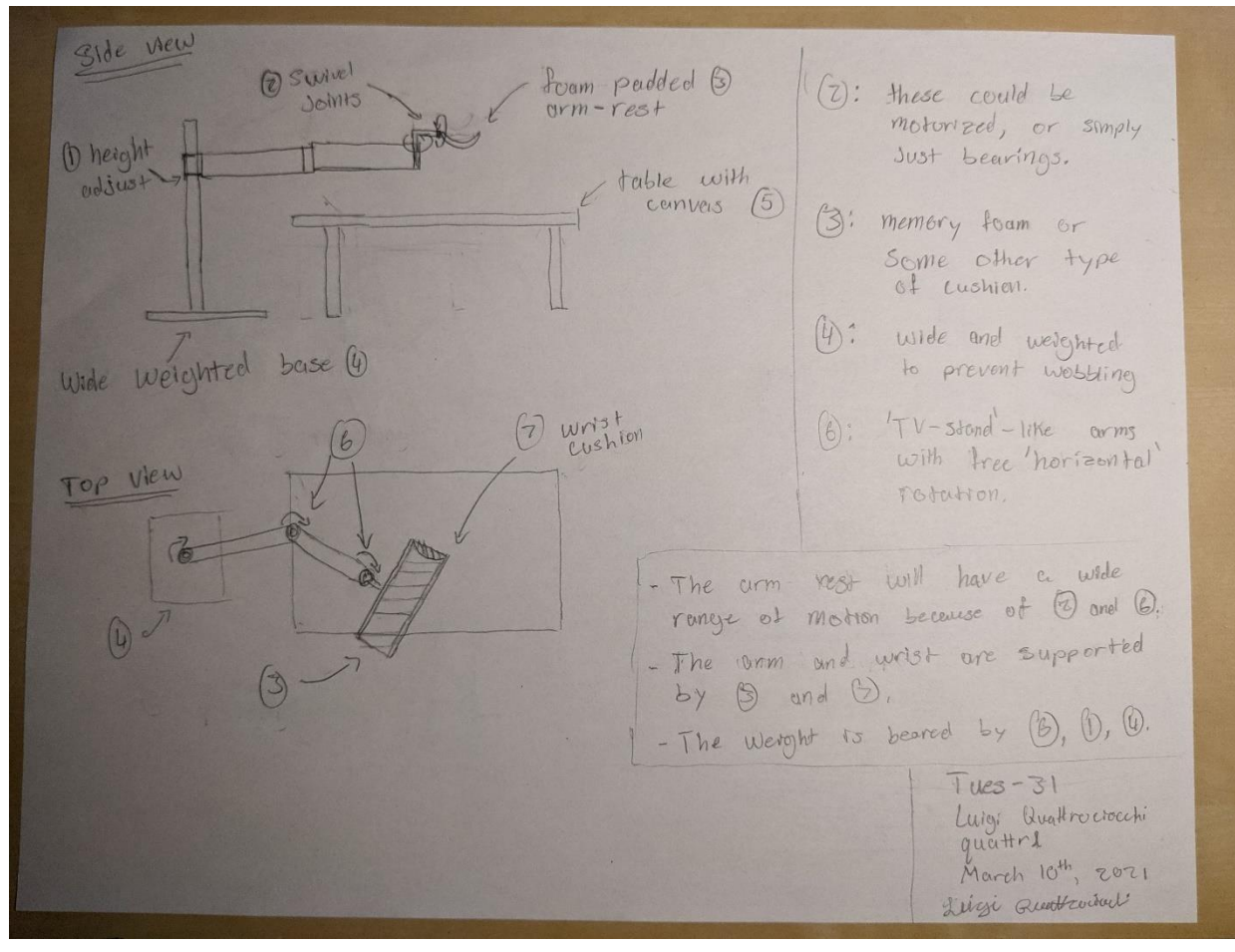
| | |
|--|----------------|
| Name: Luigi Quattrociochi | MacID: quattrl |
| <i>Concept exploration</i> | |
|  | |
| <p>Tues-31 Luigi Quattrociochi quattrl March 10th, 2011 Luigi Quattrociochi</p> | |

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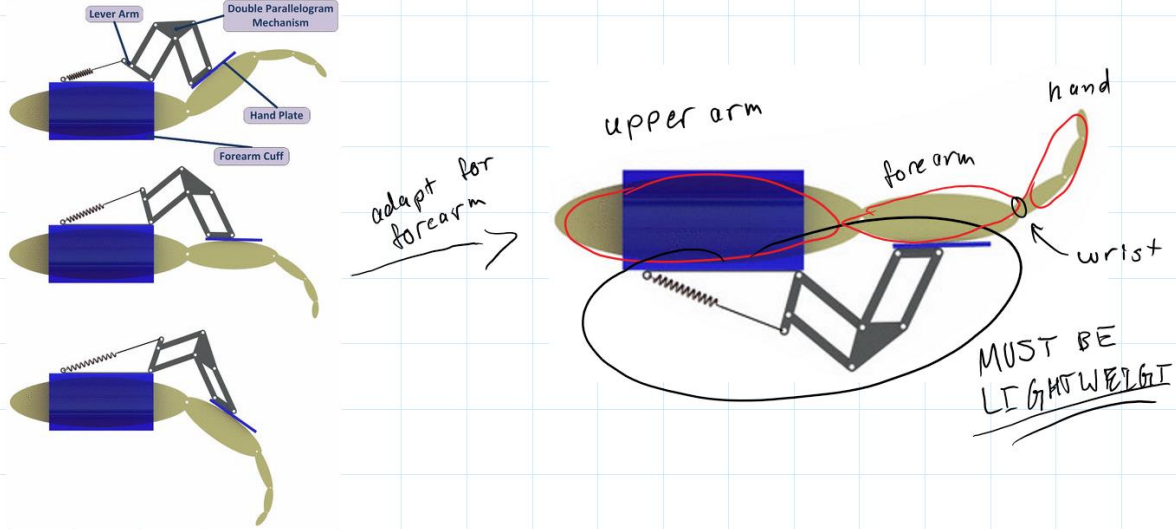


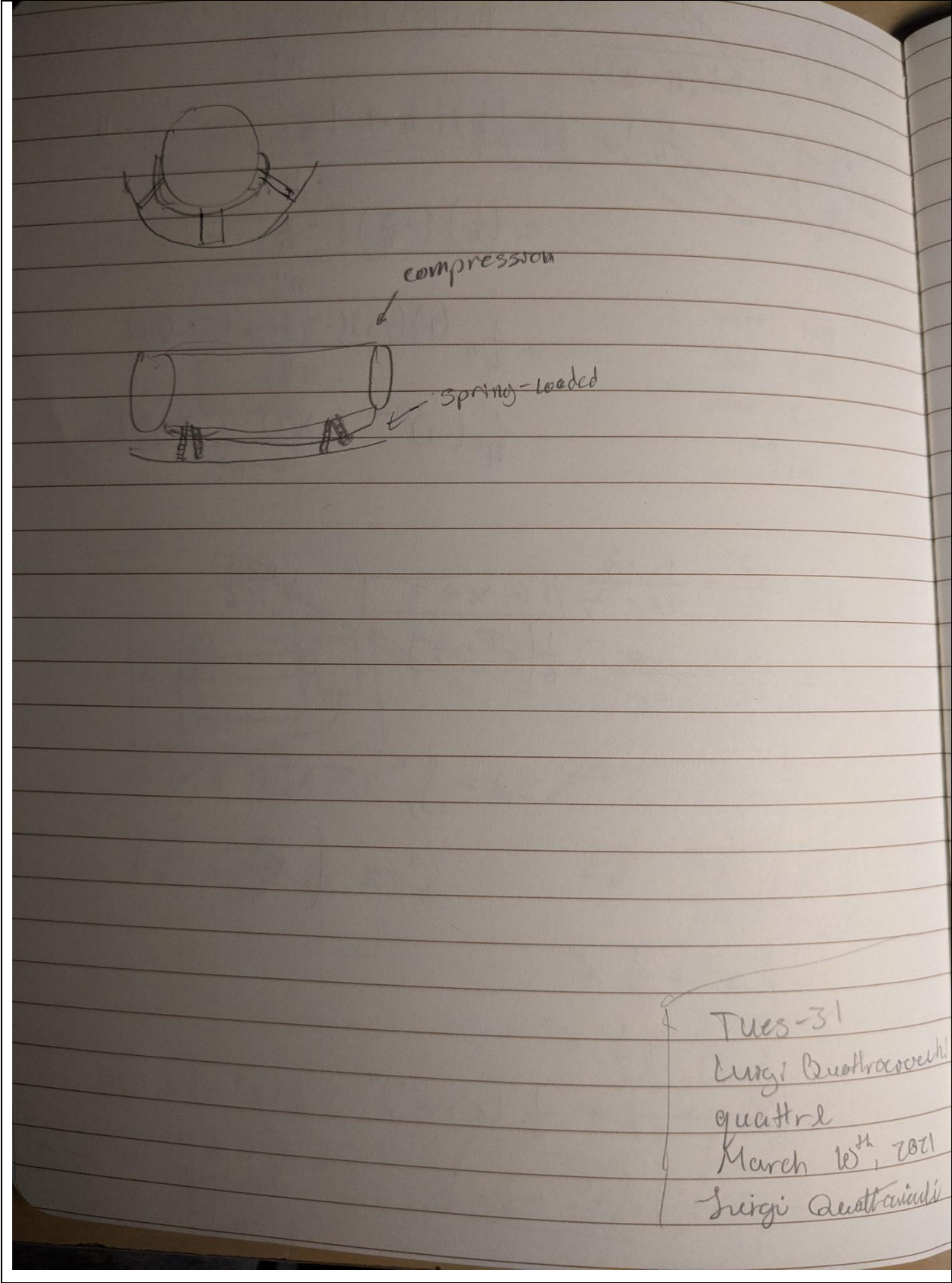
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Concept Sketch



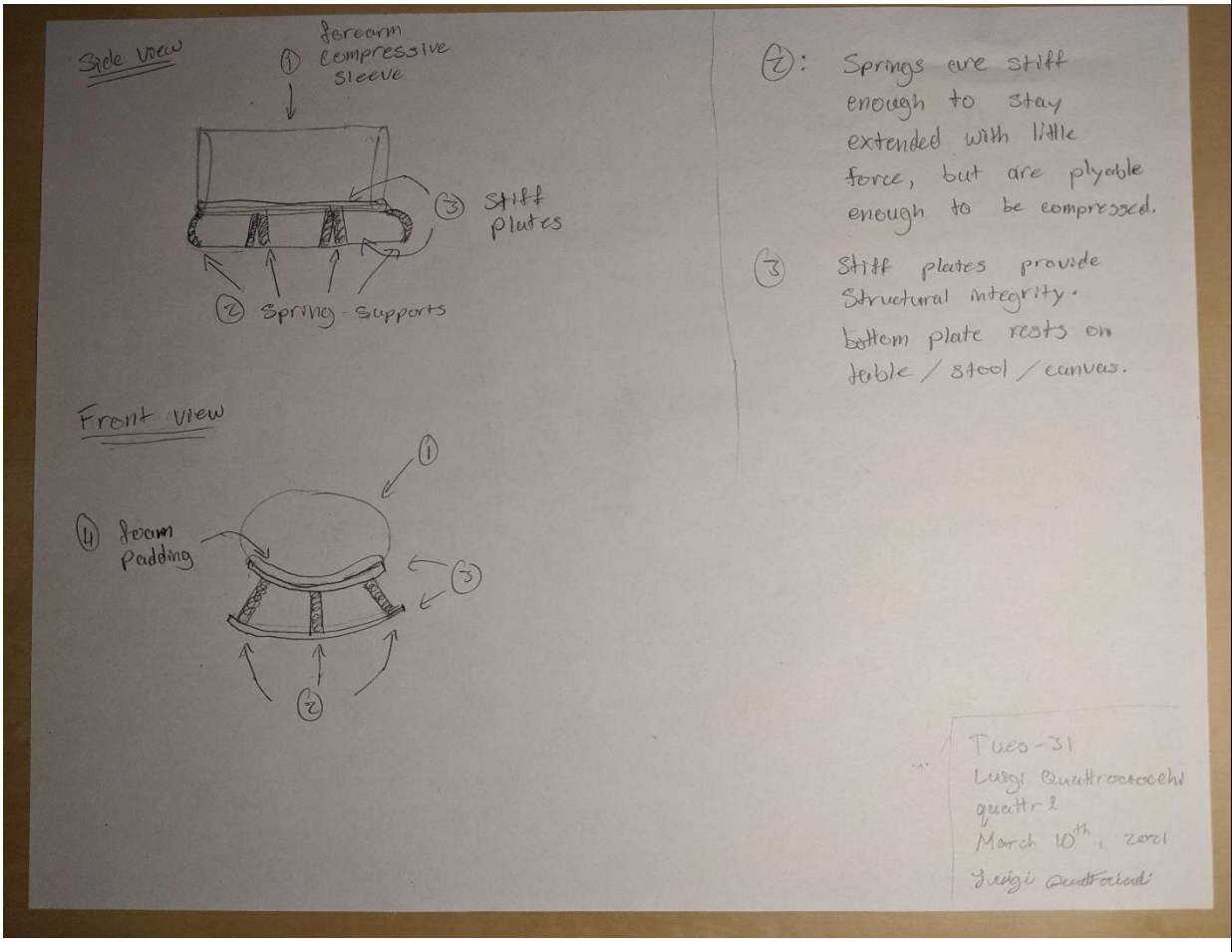
Concept 2

| | |
|--|----------------|
| Name: Luigi Quattrociochi | MacID: quattrl |
| <p><i>Concept exploration</i></p> <p>From https://www.researchgate.net/figure/The-SPO-F-wrist-mechanism-side-view-which-is-a-spring-loaded-double-parallelogram_fig5_305268048</p>  <p>adapt for forearm →</p> <p>upper arm</p> <p>forearm</p> <p>hand</p> <p>wrist</p> <p><u>MUST BE LIGHTWEIGHT</u></p> | |



Tues-31
Luigi Quattrocchi
quattr
March 15th, 2021
Luigi Quattrocchi

Concept Sketch



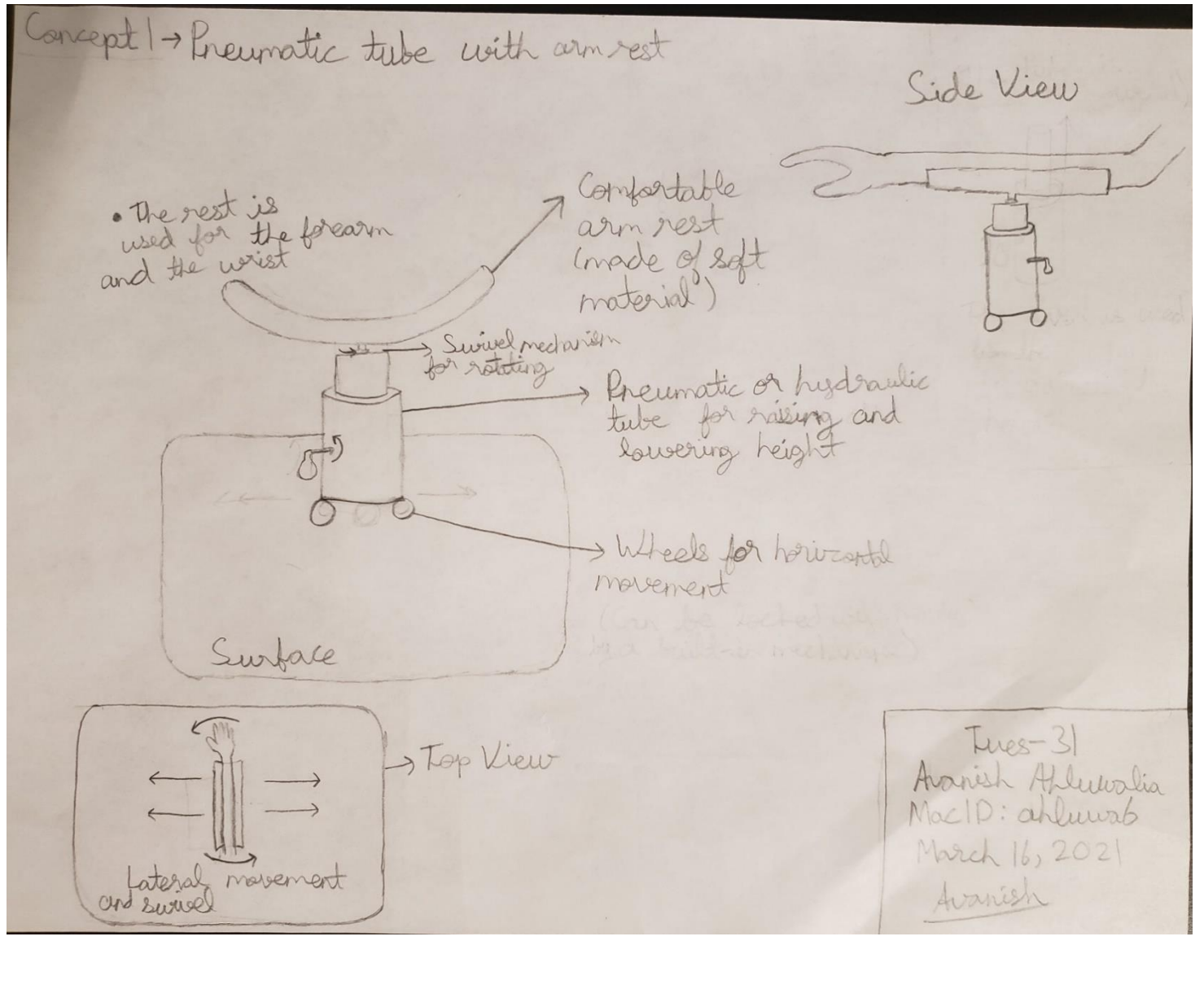
Team Number: Tues-31

Concept 1

Name: Avanish Ahluwalia

MacID: ahluwa6

Concept 1

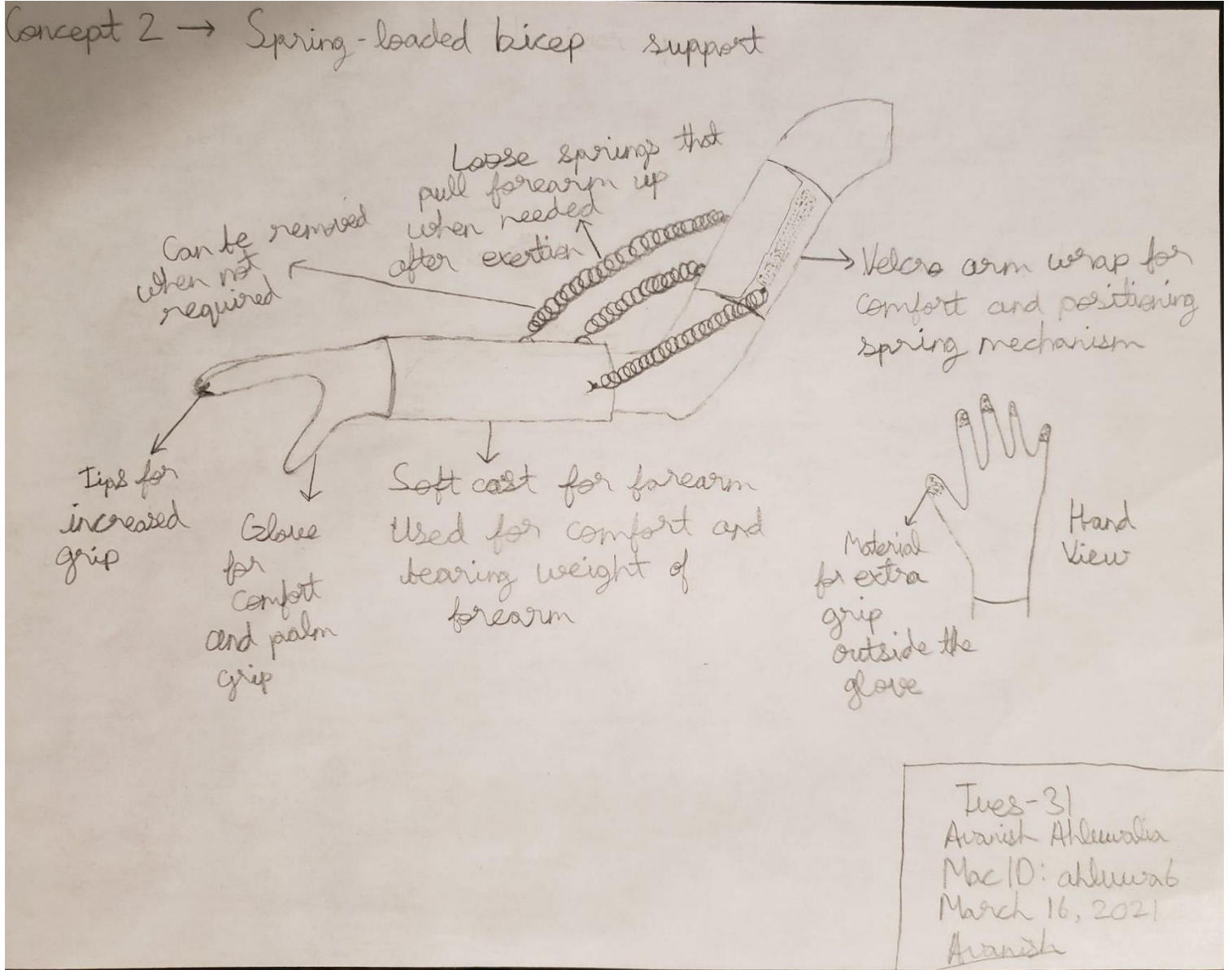


Concept 2

Name: Avanish Ahluwalia

MacID: ahluwa6

Concept 2

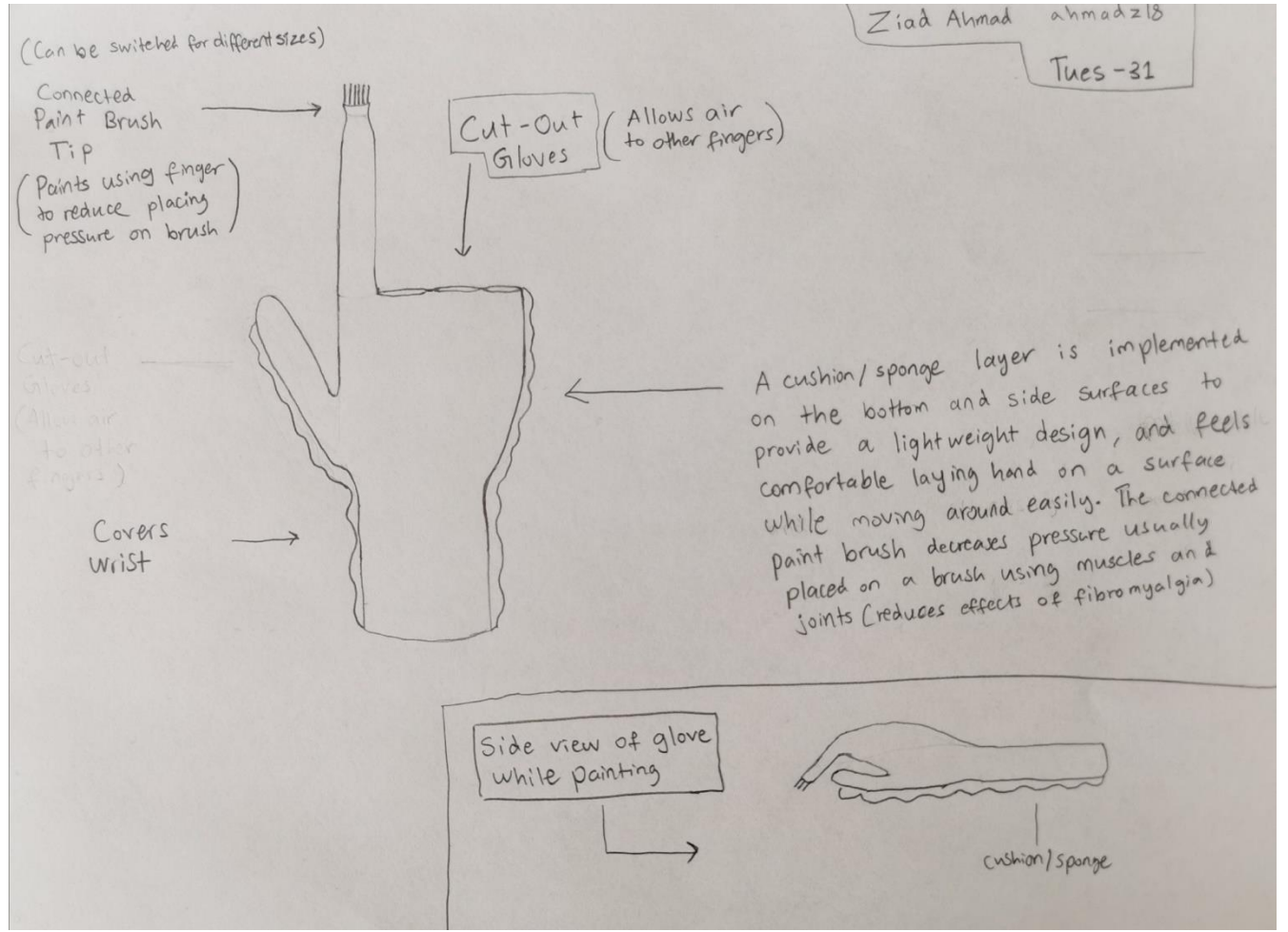


Team Number: Tues-31

Concept 1

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| Name: Ziad Ahmad | MacID: ahmadz18 |
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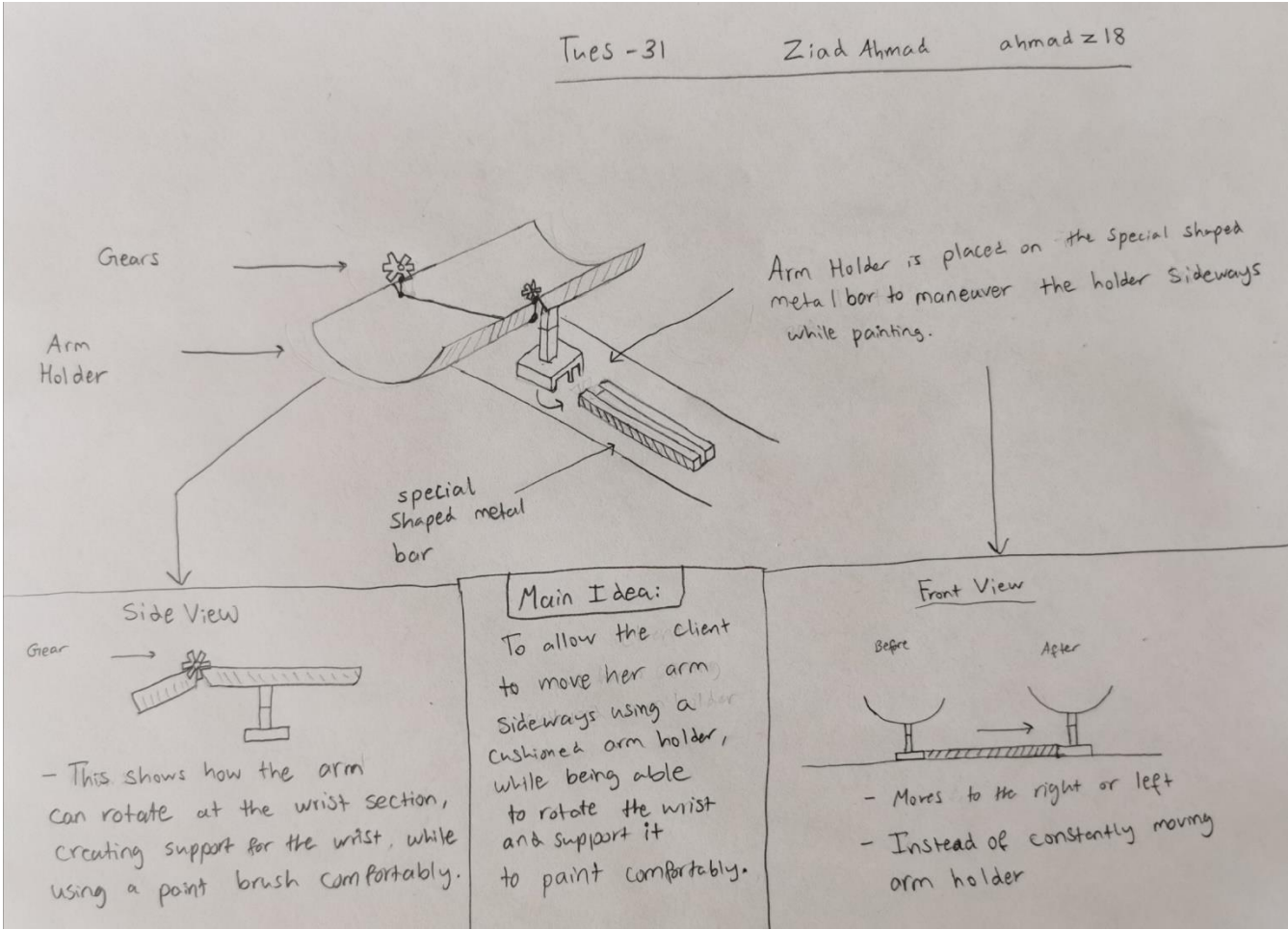
Insert screenshot(s) of your concept below.



Concept 2

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| Name: Ziad Ahmad | MacID: ahmadz18 |
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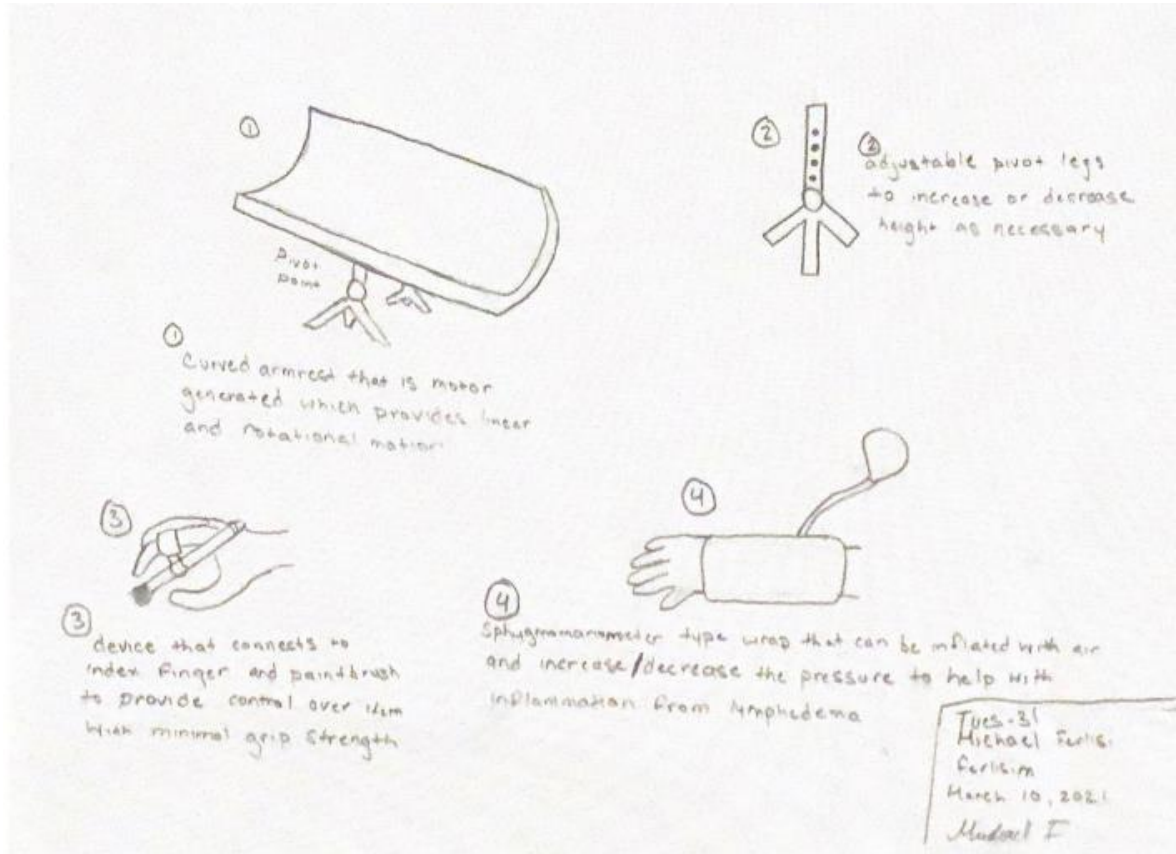
Insert screenshot(s) of your concept below.



Concept 1

| | |
|-----------------------|-----------------|
| Name: Michael Ferlisi | MacID: ferlisim |
|-----------------------|-----------------|

Insert screenshot(s) of your concept below.



Concept 2

| | |
|-----------------------|-----------------|
| Name: Michael Ferlisi | MaCID: ferlisim |
|-----------------------|-----------------|

Insert screenshot(s) of your concept below.

