LNJ Packs

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Problem Statement

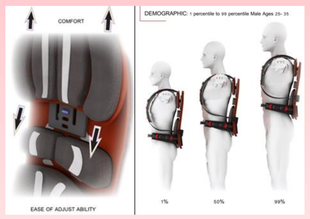
The problem we are dealing with is the lack of lumbar support in backpacks for people who use backpacks on a daily basis which creates asymmetric backs and problems such as scoliosis and chronic back pain. The problem occurs to people all over the world, especially in students and workers. This problem starts to occur as early as kindergarten when children start to use backpacks and has been around since the invention of backpacks.

Justification

Over 80% of consumers that use backpacks on a daily basis have experienced back pain in their life. The constant force and load of a backpack cause a gradual change on a person's spine. This change leads to chronic back pain and limited range of motion for daily activities.

Similar Solutions

Lumbar support for chairs



Attack Points

- A backpack to prevent back pain
- Widely accessible too the public (Cheap)
- Clean and sleek design (Not Bulky)

Experts + Credentials

Consulted with Ms. Reyes (Santa Monica High School Biology Teacher)
kreyes@smmusd.org

Final Prototype

Figure 6) Backpack during one of our tests

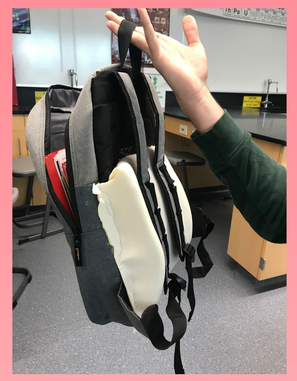
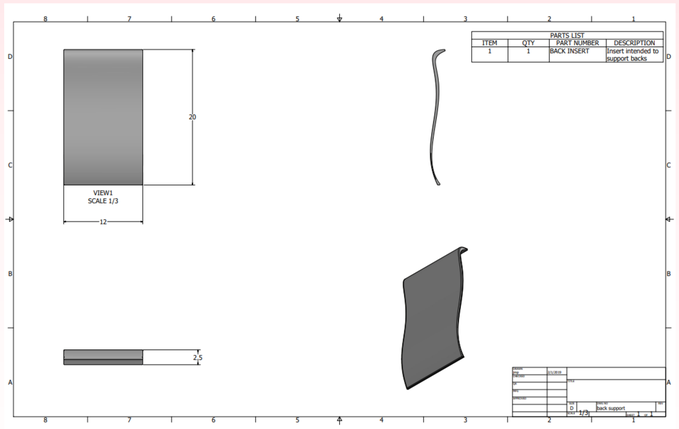


Figure 5) Final product

Prototype/Build Documentation

Day 1: Took a look at various back supports and lumbar supporting chairs and try to distinguish what makes them “back supporting”
We found that majority of these lumbar supports have a “hump” located where there is an indent in the spine, so we decided to create something to fill the gap but on a backpack. (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3766244/)
Day 2: After the creation of our brainstorm along side the CAD file, we decided what materials we needed, and purchased them.
Day 3: Tested the InstaMorph ($16.99) moldable plastic. Tested by melting a small sample of plastic and made a smaller scale mold of the back support and let it dry. Determined malleability, durability and dry time.
Day 4: Using multiple Bunsen burners and the majority of the plastic, a mold was created to support backs. The mold was initially intended to be formed on a chair, but later improvised and used a team members back.
Day 5: The mold hardened and was well made, however, there were still many sharp edges and curves that we had to remove, so the band-saw was used to remove these excess parts.
Day 6: Attached the plastic to our backpack (9$), and covered it with foam(8.99$) and fabric (2$). Later attached it to the backpack, and made sure it would not detach.

Final Technical Drawings

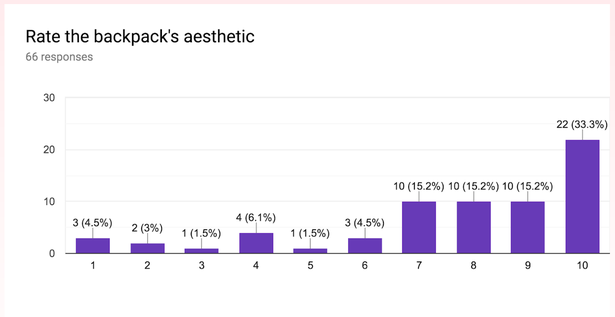


(Figure 1) CAD File of back curvature insert

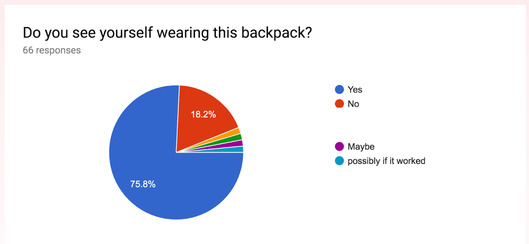
Testing Procedures

Created multiple tests that it had to go through to be a valid backpack
Created a survey that asked various questions about the backpack, and asked if someone was likely to purchase and wear one
We then planned out to ask students to wear the backpack (using random sampling to avoid confounding variables)
We also intend on testing its durability (ex. Withstanding various drops, or other tests that other backpacks go through to be sold to the public)

Testing Results/Stakeholder feedback



(Figure 2) Survey Results of backpack aesthetic



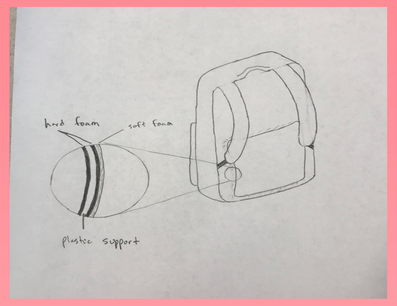
(Figure 3) Survey Results of peoples initial thoughts of backpack

Modifications/Next Steps

In the future we plan on taking our product to the next level. We plan on:

- Adding a chest strap to provider further support in the back.
- Use a 3D printer or a mass manufacturing mold to create the support.
- Use sewing machines to better attach the lumbar support to the backpack

Conclusion



(Figure 4) Final annotated drawing of the LNJ Pack

Overall, our year long project created a product that was considered useful by the stakeholders and passed all our tests. We are confident that our product is successful.