Erogonomics backpack for human

Invention for s.c soft brain 21-2

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Problem

The most loaded area wearing a typical backpack
> Trapezius(윗 승모근) & Lumbar spine(요추)

- Trapezius(윗 승모근)
  -Typical backpack applies compression(in about -45degree) and shear on the trapezius.
  -> increase the blood flow of the trapezius -> leukocyte and prostaglandins flow into the trapezius-> swelling and pain occur.

- Lumbar spine(요추)
  -Objects in typical backpack locate from the bottommost of the bag, And this makes the CM of bag get far away from the axis of the spine
  >1. Backward torque by the bag get bigger proportion to the length of moment arm, make person easy to fall back.
  >2. (The longer the moment arm is, the bigger shear applied on the Trapezius too)
  >3. Vertical load cause the lumbar disc compression.

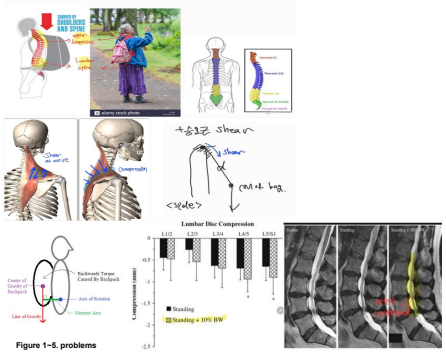


Figure 1~5. problems

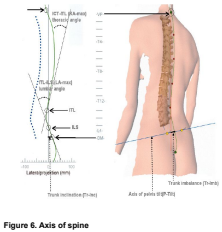
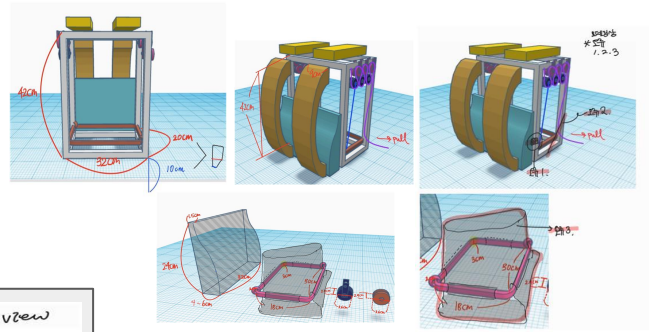


Figure 6. Axis of spine

3D model (Tinkercad) & Dimension



Solution- Our Erogonomics backpack

- 3.Shoulder pad
  -1)Make the bag+strap and the shoulder locate horizontally
  > Least the compression and shear force applied to the trapezius. (=project the force)
  -2)Shoulder pad locates closer with the spine's axis
  > Moment of load get shorter -> lessen the lumbar disc compression

- 1.Shorten the strap
  -Lessen the backward torque by the backpack which applied to the chest.

- 7. Detachable lumber spine pusher
  -Apply the force which is opposite to the load force.
  >So the net force lessens.

>Main ideas

- 4+5+6+8(composite pulley & inner bag)
  -How to use
  put objects in the inner bag(5)>pull the rope connected to the puller(4)> bar(6) and inner bag(5) goes up> put inner bag(5) in high or appropriate place/height then fix it(8)
  -1)CM of backpack get closer(moment arm shorten) to the axis of spine. Also CM of backpack+human goes upper
  >So the backward torque applied get smaller
  -2)Shear force get smaller which is applied to the trapezius.

- 2(Outer bag)
  -The shape which gets skinnier going to the bottom makes the same advantage when the bag is full (but have to be aware when object's mass is not similar with others)

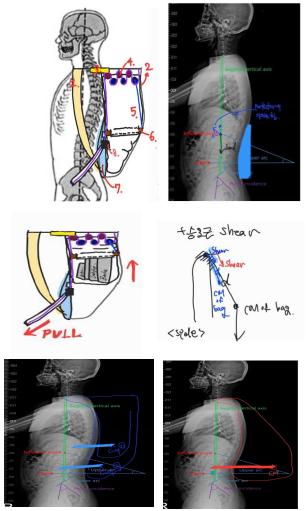


Figure 8.Solution.

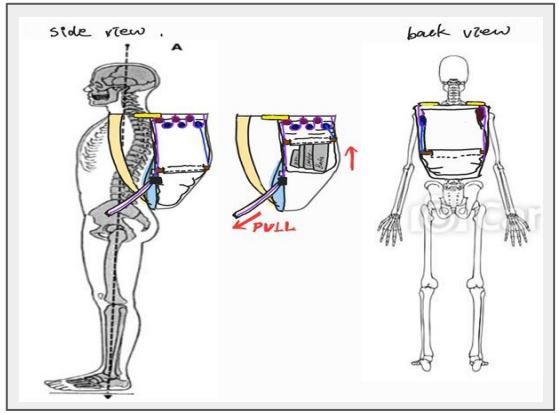


Figure 7. Full product of our erogonomics backpack.

Materials

We decided to choose typical materials for:
-Strap: polyester
-Outer bag: pvc
-Puller: Aluminium
-Inner bag: polyester
-Lumbar pusher: Nylon, memory foam
-Strap fixer: polymer

We decided to choose cheap and stiff materials for:
-Shoulder pad: polyester(Tire rubber)
-Bar: Duralumin

Our thoughts

-It would be useful and healthy for hikers.
-It would be useful in the situation when we have to move objects without their position changes.
-But it would be heavy because of the various kinds of inner products.
-It would be expensive