Abstract

Patients suffering from hydrocephalus, a medical condition in which there is an abnormal accumulation of cerebrospinal fluid in the brain, are often treated with a shunt to regulate the cerebrospinal fluid pressure. Each patient requires a different pressure setting on the shunt. In larger patients, LP shunts naturally migrate deeper into the tissue, making adjustment difficult. We created an improved adjustment tool that allows for adjustments on shunts that have migrated deeper into subcutaneous tissue.

Design Requirements

- Maximum weight - 2 lbs
- Minimum magnetic field strength at 2” – 100 Gauss
- Overall Dimensions - 5” x 5” x 3”
- Time required to perform adjustment - 45 sec
- Safety locking mechanism requiring an equal torque as the current cranial version – 1.0 N-m
- FDA regulations – Magnets and material used must be FDA approved
- Accuracy – Adjustment tool must make the correct adjustment to the shunt 80% of the time

Design Features

In our design we wanted to maintain as much similarity to the original device in look and usage method to ease the transition for physicians from the current device to our new design. We have maintained all tactile feedback between each discrete setting, and the safety lock to prevent jumping between the lowest and highest settings. We also maintained the same setting indication label. Our product is four times larger than the original tool, but its magnetic dipole moment is five times stronger. We have achieved all design requirements in creating a safe, strong, and effective tool.

Benchmarking

Using a gauss probe we were able to measure the magnetic field strength at various distances of the current StrataVarius adjustment tool along with the strength of the field at the surface of the shunt required to make an accurate adjustment. We also measured the necessary torque required to turn the tool through each setting and the resistance between the highest and lowest settings.

Future Recommendations

- Look into testing more complex magnetic assemblies
- Meet and discuss our design with physicians who will be using the device.

Acknowledgments:

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References:

www.fda.gov
http://www.lifenph.com/prog-shunts.asp