Design of a Neurosurgical Drilling Device

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Drilling of the temporal bone for the purposes of neurosurgery is currently a lengthy and costly process. In order to reduce the time and cost of surgical procedures, the Department of Neurosurgery contacted the Department of Mechanical Engineering to create a machine to automate the temporal bone removal process. The scope of the project has involved meeting with neurosurgeons and observing neurological procedures to determine normal operating conditions in the operating room and to define the requirements of the system. These requirements include portability between operating rooms, stability and accuracy during the drilling process, biocompatibility to meet FDA and OSHA requirements, and that the machine must sit away from the bedside and work at a standard operating height. An existing three-axis gantry machine was purchased and modified to prove the concept that the drilling can be done offset 24" from the machine. Testing has indicated that the modified gantry machine meets the accuracy requirements of drilling the temporal bone. This poster displays how the gantry machine is to be housed to meet portability, stability, biocompatibility, and the operating height requirements of this project. The housing unit is designed using modular parts so it can be modified to test out various parameters. A lever mechanism that lowers caster wheels is placed in the base of the machine to provide portability and stability. A Fault-Tree Analysis was performed to identify the key components of the system, which will lead to critical failure. Results of preliminary calculations and experimental results of parameters such as weight, moment of inertia, and stability are shown to verify that the system will not fail under normal operating conditions. Suggestions on how the system can be further improved are also discussed.

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