Brain Morphing:

The Future of DBS.

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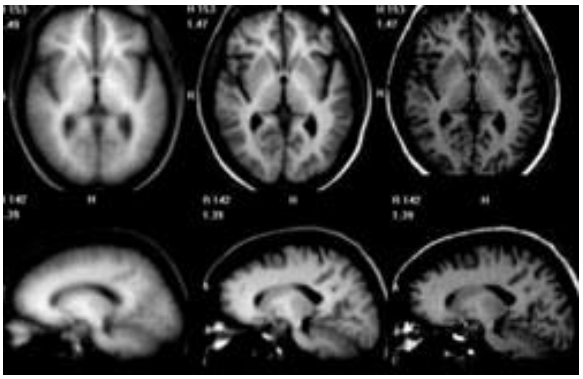
November 30, 2005

Deep brain stimulation was approved for practice in 1998 as an alternative means to treat symptoms of various neuromusclular disorders, such as Parkinson's disease, dystonia, and tremors. For treatment two electrodes are placed deep within the brain to intercept specific nuclei where the misfires occur. The procedure has proven to be very effective in controlling the convulsions associated with such disorders. Because the implants used are localized, the side effects are minor and the efficacy is much greater than that of parallel drug therapies which are the mainstream for treatments. However, the operation is highly invasive which incorporates numerous risks that are involved with procedures of this magnitude. Also, because the nuclei in question are not visible on MRI scans or to the naked eye, surgeons must search for the specific areas, implant test probes, and await feedback only to then implant the final electrodes. If the problem area is not found in the first pass, more must be made until the correct area is found, sometimes up to three or four times. This only compounds the problems, due to the sensitive nature of the brain and the time it takes for each trial.

Brain morphing is a program developed by Peter Konrad and Benoit Dawant of Vanderbilt University which effectively could change the way the DBS procedure is contemplated. In the program a complex algorithm is implement which allows the MRIs to be treated as non-rigid objects. The program executes by rotating, translating, zooming, and deforming independent brain structures to create a detailed atlas of the post-op MRI which becomes a suitable roadmap for surgeons to use as a starting point for electrode placement. In this image:



the scan in the center is a test scan compiled of 20 MRIs and morphed to match the patient's scan on the right, showing enough detail to enable location of specific related areas of the brain.

MRI scans of previous operations are compared, through this program, with a patient who wishes to receive the procedure. Once the morph is complete, the surgeons can use the program's output to find an area where most of the previous implants have been localized, allowing them to take a very good first guess as to where the electrodes should be placed. In a test of six implants, four out of the six where successful on the first test, and the 8-12 hour procedure for which the patient must remain awake and alert, was cut into merely 5 hours.

This carries significant implications, not only the effectiveness and reduced risk of the surgery, but also hospital costs and patient stress associated with the length of the procedure. Before the morphing technology, the price of the operation came to about $25,000-30,000 per electrode, which is staggering.

For the future, researchers hope to make maps for all neuromuscular disorders, depending on how the nuclei appear to be placed in relation to the disorder in question. As for now, more operations are being performed and feedback is being steadily incorporated into the operation as to keep improving the effectiveness of the program to keep this lengthy and risky procedure shorter and more accurate.

Sources:

- **Deep Brain Stimulation**
  http://rarediseases.about.com/cs/movementdisorders/a/020902.htm
- **Medtronic**
  http://wwwp.medtronic.com/Newsroom/NewsReleaseDetails.do?itemId=1096566053412&lang=en_US
- **Vanderbilt University Research Journal**
  http://exploration.vanderbilt.edu/news/news_dbs.htm