Case story
H-3000-1261-03

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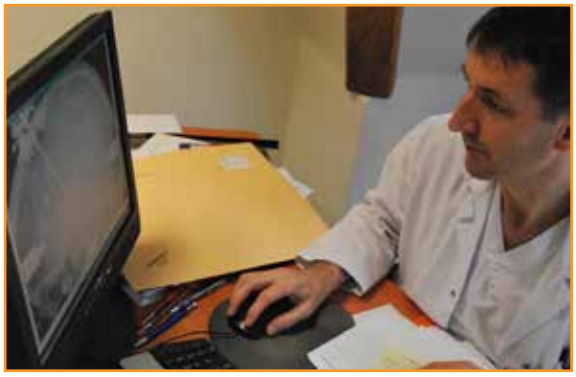
Pioneers of stereotactic neurosurgery perform DBS implantation procedures with *neuromate*® Frameless Gen II stereotactic robot

Professor Devaux and his colleagues at the Sainte-Anne Hospital, Paris, use the Renishaw mayfield neuromate* robot for stereotactic procedures including Deep Brain Stimulation (DBS)

Professor Bertrand Devaux, consultant neurosurgeon at Sainte-Anne Hospital, Paris, favourably compares the *neuromate robotic method against manual stereotactic surgery. "The robot is used every day for procedures such as DBS, biopsies and stereoelectroencephalography (SEEG); we would not consider doing these manually, without *neuromate**. In my opinion it is the easiest, fastest and most precise way to perform stereotactic procedures. It is an essential part of any fully integrated neurosurgical operating theatre of the future."**



Professor Devaux planning a DBS procedure

After years of experience performing DBS electrode implantation with stereotactic frames, Professor Devaux now performs DBS procedures with the added benefits of reduced operating time and increased accuracy, brought by the use of the *neuromate** robot. Professor Devaux explains, "Six years ago, when we purchased the robot, I knew it would make a considerable difference and was happy to incorporate it into my practice - very quickly it became an integral part of my procedure. Stereotactic procedures can be hampered by inaccurate positioning for many reasons, of which human error is only one.

The robot reduces the degree of error by precisely positioning the surgical tools to pre-programmed co-ordinates, with a high degree of accuracy and reproducibility."

Whilst the neurosurgeon retains complete control he/she is then able to accurately manoeuvre the articulated robotic arm, which serves as a 'solid base' for mounting and manipulating surgical tools. The patients head together with the frame is supported on the robot's static base.

*neuromate** robot with drill attachment and frame, used for reference and to rigidly support the skull

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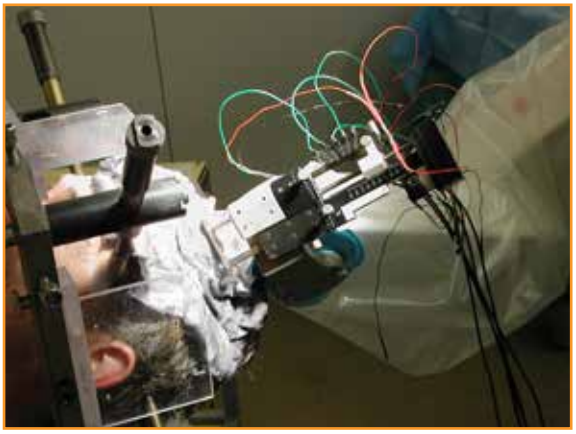
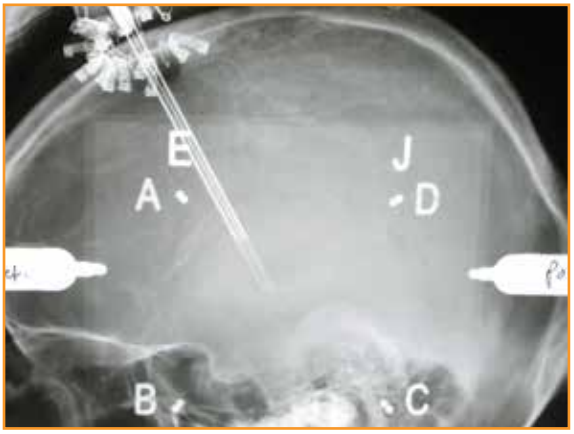


Insertion of micro-electrodes using *neuromate** as a tool holder



Recording electrodes in place visualised on screening X-ray

The DBS procedure with the *neuromate** robot

Pre-surgical preparation under general anaesthesia involves fitting a frame to act as a reference system, followed by taking a combination of MRI scans, CT scans and pre-operative X-rays. This data is used to carefully plan the trajectories, avoiding sulci and blood vessels and taking the safest path to the target.

The *neuromate** robot is then used to position the drill with which the surgeon creates the burr hole. The robot helps to ensure that the burr hole is very accurately positioned and orientated, centred on the trajectory axis.

Recording electrodes are implanted next, with the robot positioned so that the tip of the electrode enters the burr hole along the planned trajectory. The trajectory is not limited in the same way as with a conventional stereotactic frame, since the robotic tool can be orientated in any direction through the burr hole. This can be an issue with semi-rigid tools like DBS electrodes, that can deviate from the planned trajectory path.

Micro-electrode recording procedure with *neuromate**

The five recording electrodes are first implanted on the contralateral side to where the disease was first diagnosed. They are placed in a '+' pattern, with the centre electrode following the planned trajectory, and the other four 2 mm away from the centre point. The outer sheath of each implant has a macro-electrode contact at its tip and within this is a sliding inner lead with a micro-electrode contact at the end.

NOTE: The *neuromate** stereotactic robot system is CE marked and cleared for sale in the USA.

For worldwide contact details, please visit our main web site at www.renishaw.com/contact

Once in position at the target location, the patient is woken from the general anaesthetic and the procedure continues under local anaesthetic. Each of the five inner micro-electrodes is tested at different positions, with the robot and macro-electrode in a fixed position. This is facilitated by moving the inner electrode along the trajectory with a third-party micro-drive mounted on the tool holder of the robot.

The electrophysiological readings allow the surgeon to find the optimum location to stimulate, whilst minimising side effects.

*neuromate** precision - saving time and reducing the number of X-rays

With the optimum position established, the recording electrodes are withdrawn and the final electrode, with four contacts along its length, is implanted by the surgeon such that the two central contacts (contacts 1 and 2) are on either side of the target. This is where the robot's ability to re-position with a high repeatability saves time and ensures accuracy.

On several occasions during the procedure, Professor Devaux checks the position of the electrodes, using X-ray screening. In a similar manual procedure it is likely that a far greater number of X-rays would be required.

The use of *neuromate** for the treatment of pain, biopsies and SEEG

In addition to DBS, Sainte-Anne's also use *neuromate** with different tools to perform stereotactic biopsies and implantation of electrodes for SEEG monitoring, which are used for treatment of epilepsy. Thus there is a daily demand for the use of the robot in various neurosurgical procedures.

* In the USA the *neuromate*® is known as the *neuromate*® Frameless Gen II stereotactic robot.

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