

What is EXTEND?



The EXTEND™ program from Elekta is a complete system for extending the utilization of Leksell Gamma Knife® Perfexion™. The unique design of Perfexion™ enables the accurate and efficient treatment of the most difficult targets in the head, an ability that continues to set it apart from all other radiosurgery solutions.

With the addition of the EXTEND™ program it is now possible to treat new indications that were previously untreatable with Gamma Knife® surgery. Examples include lesions too large or so critically located that not even Gamma Knife conformity is sufficient. For these cases, fractionation becomes a new alternative for the physician.

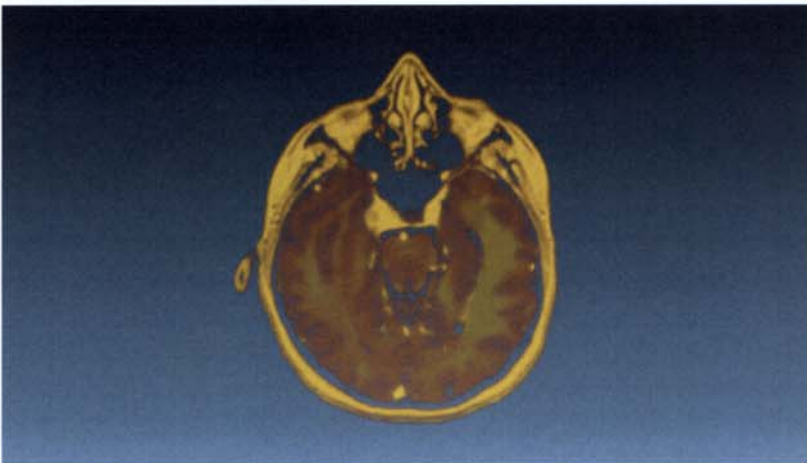
In short, EXTEND™ provides cross-functional advantages – in both stereotactic radiosurgery and stereotactic radiation therapy – to offer a new tool for both neurosurgeons and radiation oncologists.

EXTEND™ animation script

This document provides an overview of the workflow for EXTEND™ and the equipment used and can support when viewing the EXTEND™ animation.

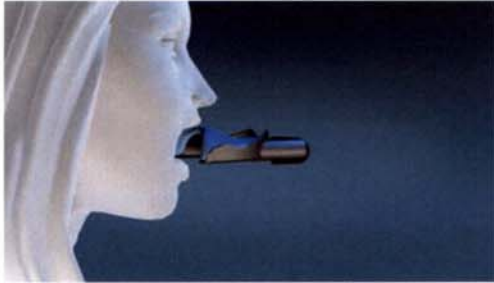
MRI

- MRI is performed without the EXTEND™ frame, obtaining non-stereotactic images. The frame is MR compatible, i.e. it can be used in MR, with good image quality. However, the frame will not fit in a head coil due to its size. Stereotactic images for planning are obtained by co-registering the MRI study to a stereotactic CT set, as described later.



Dental imprint

A dental imprint is done for the patient. This is done once. Different size mouthpieces are available. Dental impression material is put on the mouthpiece and it is then pressed to the upper palate for 5 minutes to harden. When the mould is done the dental impression material is like rubber and the mould covers the upper palate and teeth. A connection on the underside of the mouthpiece allows for attachment of vacuum tubing. When the vacuum is applied, a small channel through the mouthpiece and dental material evacuates a volume at the palate. The evacuation results in a very good seal between the patient and fixation.

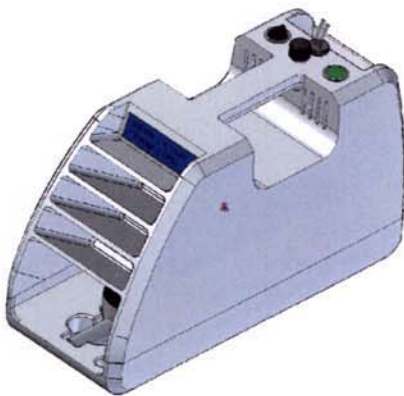


The mouthpiece and front piece are then assembled.

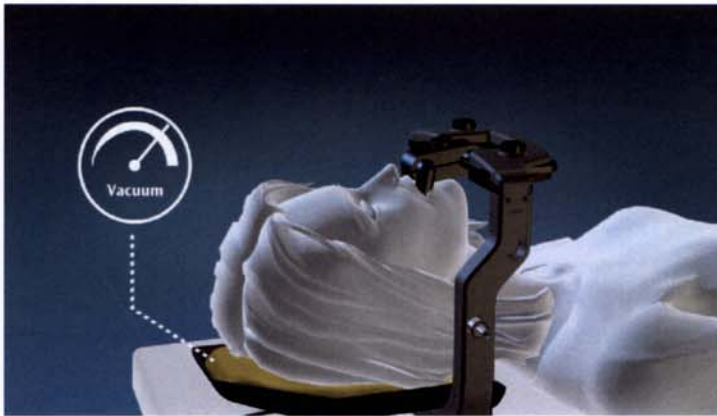
Patient set up

The following is done at Leksell Gamma Knife® Perfexion™ and it is done once for a patient. The reason to use Perfexion™ for set up is that a fixation for the frame is needed and it is also convenient to check that the patient finds a comfortable position with enough room for shoulders etc.

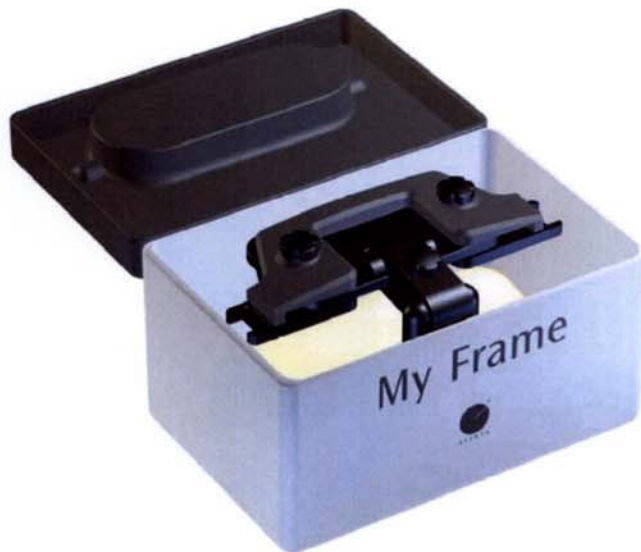
- The EXTEND™ Frame is attached to Perfexion™ frame fixation.
- The patient is positioned on the mattress and vacuum pillow and the mouthpiece is inserted (including front piece). Different sizes of vacuum pillow are available.
- Vacuum is applied to the mouthpiece and the vacuum is verified. Vacuum is achieved using the Patient Control Unit, a unit including;
 - Vacuum pump
 - Vacuum surveillance, notifying if vacuum is lost during CT or treatment.
 - Patient alert button, enabling the patient to alert the staff during CT and treatment.
 - Measuring probe used for reposition check as described later.



- The front piece is adjusted to allow a tension free docking and is then locked to the EXTEND™ frame.
- The three screws on the front piece, fixating the mouthpiece relative to the frame, are tightened.
- The vacuum pillow is evacuated, using the same vacuum tube as used for the mouthpiece.



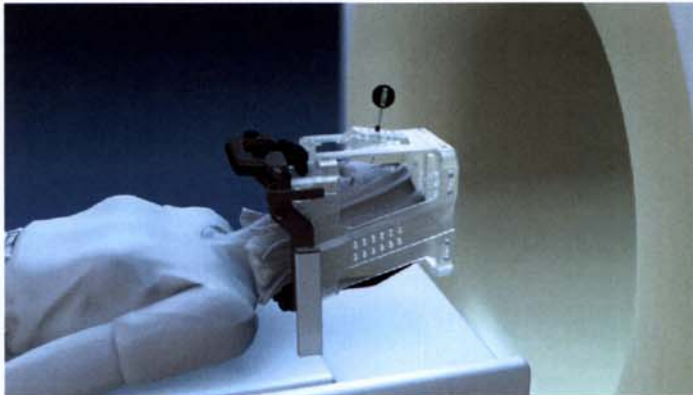
The patient is undocked and the patient unique parts, Front piece with locked mouthpiece and evacuated pillow, are stored in a box marked with patient ID.



Position reference and CT

The following is done at the CT and it is done once for a patient.

- The EXTEND™ Frame is attached to the CT table.
- Patient is docked using the patient unique parts.
- Vacuum surveillance is started on the Patient Control Unit. This surveillance will raise an alarm if vacuum is lost during CT imaging. The frame and front piece are very rigid structures that assure an effective immobilization of the patient. Patient movement would only result in loss of vacuum. The vacuum surveillance will alert, assuring that the patient position always is fully controlled.
- Alignment between Front piece and EXTEND™ frame is checked and the front piece is locked to EXTEND™ frame.
- The EXTEND™ frame system will re-position the patient with a high degree of accuracy. As a quality assurance system, the reposition check tool is used to verify patient position before every treatment session. The reposition check tool is attached to the frame and distances to the patient skull are measured, using the measuring probe in the Patient Control Unit. The measurements are recorded on a printed protocol. This first set of measurements performed at the CT will be used as reference for later measurements. The reference will show the position of the patient during CT, the stereotactic set of images used for treatment planning.

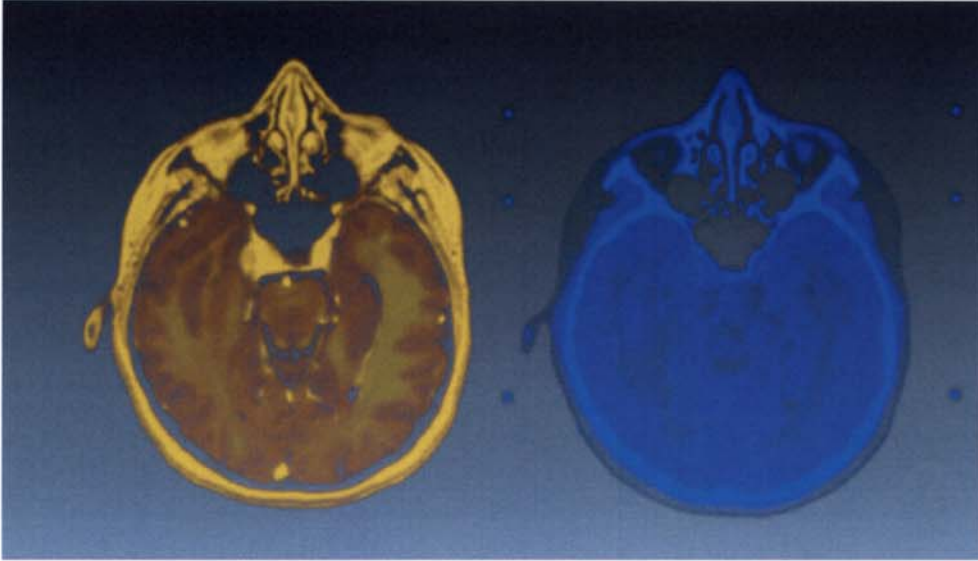


CT is performed with CT box, to obtain stereotactic images

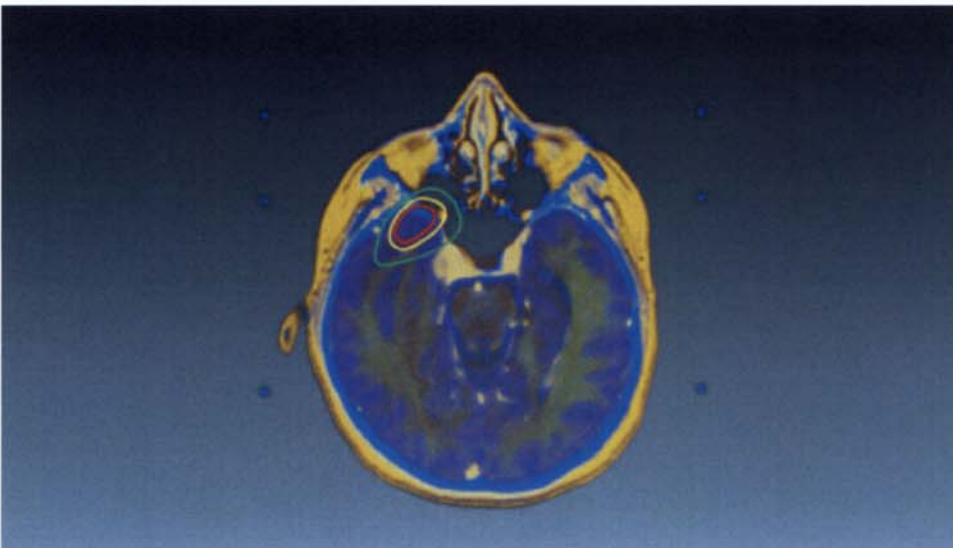


Treatment Planning

Co-registration is used to obtain stereotactic MRI



Treatment planning is performed as for a G-frame based treatment



Number of fractions is prescribed and the treatment plan exported

Position verification and treatment

The following is done at Leksell Gamma Knife® Perfexion™ and is repeated for all fractions.

- Treatment plan is loaded at Perfexion™ (first fraction).
- Reposition check reference values, recorded on protocol in CT room, are entered.
- Patient Control Unit is placed in a fixation at the side of the Patient Positioning System of Perfexion™ and connected via a connector in the cover.
- Patient is docked using the patient unique parts.
- Vacuum surveillance is started on the Patient Control Unit. This surveillance will pause an ongoing treatment if vacuum is lost.
- Reposition check is performed by measuring distances to patient skull using Reposition Check Tool and probe. This is done to verify correct patient re-positioning. Measurement values are recorded and handled by the control system of Perfexion™. The values are compared to the reference values and if the re-positioning was successful this means that the patient is positioned as during CT imaging, the stereotactic set of images used for planning.



Reposition check result is confirmed



Treatment starts