Visualizing the invisible
Intraoperative Multi-Modal Imaging

Intraoperative Multi-Modal Imaging fusing navigated 3D ultrasound, 3D angiography and MRI / CT in real time.

The invention and development of intraoperative imaging based on ultrasound has revolutionized neurosurgery by providing a perspective of the human brain beyond the scope of our eyes. The SonoWand Invite combines high quality intraoperative 3D ultrasound with optimized neuronavigation. It’s the all-in-one solution for image-guided surgery.

Intraoperative imaging is vital in coping with the fundamental neurosurgical needs. Image guidance should strengthen the neurosurgeons confidence by means of its accuracy and clarity throughout the entire surgical procedure. SonoWand Invite has been designed to perform highly precise neuronavigation regardless of brain shift and anatomical manipulation during surgery.

+ Multi Modal 3D Imaging
+ 3D Direct Ultrasound
+ 3D Power Doppler Angiography
+ Real Time Neuronavigation

= The All-in-one solution
SonoWand Invite™

SonoWand Invite™ allows the surgeon to identify and distinguish lesions from normal brain tissue and surrounding landmarks in real time, 3 dimensional view. Intraoperative imaging eliminates the challenge of brain shift and provides medical professionals with the confidence to safely guide surgical instruments to the region of interest. Updated 3D ultrasound volumes can be created at any time during surgery. It takes less than 30 seconds to perform an ultrasound scan to acquire a new 3D volume, and it is available for navigation in less than a minute. This feature allows detailed control of the progress of the surgery.

With clear and precise images provided by the SonoWand Invite you are able to;

1. Distinguish lesions from surrounding landmarks and anatomical structures.
2. Safely guide surgical instruments to the region of interest regardless of any brain shift.
3. Control the result of resection and vascular repair.

Perform radical resection with minimal morbidity.
**SonoWand Invite™ in the OR**

The SonoWand Invite provides the neurosurgeon with real-time images during surgery, allowing him/her to perform a better and more precise treatment. The system enables the surgeon to navigate precisely in the brain, not only based on MR or CT images taken prior to surgery, but also 3D ultrasound images scanned during the operation. By using the SonoWand Invite the surgeon is given the advantage of having the most recent and accurate information available when making decisions.

SonoWand Invite is particularly useful during removal of malignant brain tumors such as low-grade astrocytomas, anaplastic astrocytomas, glioblastomas and metastasis. SonoWand Invite is also well suited for treating a broad range of other brain lesions including cavernous hemangiomas (cavernomas), cysts, abscesses and skull base meningiomas. Clinical research has documented high clinical value in vascular brain surgery including arteriovenous malformations (AVM) and aneurysms.

**Tumor Resection**

Resection control of malignant brain tumors represents a main clinical application of the SonoWand Invite. With informative intraoperative images the chances of gross total resection (GTR) increases, while minimizing the chance of loss of neurological function. Brain shift can easily be detected and the surgical strategy updated.

**Skull Base Surgery**

In addition to identifying brain shift, the 3D Direct™ angio mode enables detection and localization of vital blood vessels in the area of interest.

**Vascular Surgery**

Ultrasound angio can be used to identify nidus, feeders and draining veins of the AVM. Accurate information both initially, during and at the end of the procedure increases the resection control. SonoWand Invite fuses navigated MR and ultrasound angio which means that most feeders can be localized and clipped early in the procedure. At the touch of a button, Ultrasound Doppler Color Flow enables the surgeon to see the direction of the blood flow.

**Minimally Invasive Surgery**

Various ultrasound probes are available using the SonoWand Invite. The Mini Craniotomy Probe enables intraoperative imaging in procedures with restricted access to the dura, e.g. small craniotomies, posterior fossa and medulla.

**Trauma Surgery**

The system offers visualization and guidance even without preoperative images. With immediate access to the dura, the 3D Direct™ functionality of the SonoWand Invite enables unique image acquisition and navigation in the OR.

**Pediatric Surgery**

In cases where there are some concerns about using anesthesia for small children in order to perform an MR scan, the SonoWand Invite offers an alternative with direct 3D ultrasound imaging through the fontanel.

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Images courtesy of Neurosurgical Department, St.Olav University Hospital
Features and Functionalities of the SonoWand Invite™

Main Unit
SonoWand Invite consists of one single rack unit. It is easy to move around and requires little space in the OR. The 24 inch touch-screen monitor and the optical tracking system are both connected to long multi-joint arms to accommodate maximum flexibility.

Automatic Co-registration
Import all available preoperative images to aid your image guided surgery. Simply choose your reference image, and verify the registrations in the easy to use interface. You can also choose manual registration for full control.

3D Power Doppler Angiography
The Power Doppler Angiography is a powerful ultrasound modality, visualizing blood flow in vessels down to sub-millimeter size. With SonoWand Invite you can even acquire 3D images of the blood flow using this modality in the same fast and simple way as the tissue imaging. Keep track of vessels to speed up your procedure and operate with confidence near important blood vessels. Use it to visualize aneurysms and AVMs during vascular surgery.

Advanced Ultrasound Controls
Our ultrasound is tuned to give you the best intraoperative images of the brain possible. Still, for the advanced user there might be improvements to gain by adjusting parameters for the individual case. The new “Advanced” panel provides the user full control to optimize the ultrasound even further.

NaviWand™
No need to cover the monitor with a sterile drape compromising image clarity. No semi-sterile stylus and no more explaining to a circulating nurse what you want. Simply use the Intraoperative Navigator to control all features on the monitor. Point to the button you want to operate, and click with the footswitch. Fast and simple. With NaviWand there is no need for additional equipment.

3D Direct™
You have a patient, but no navigation-quality preoperative images? No problem. With the 3D Direct functionality you can acquire intraoperative 3D ultrasound images to use for navigation as soon as you have made the craniotomy. The functionality is seamlessly integrated. Just start the system, press the “Start Navigation” button and the system is ready for the ultrasound acquisition.

True Multi-Modal Flexibility
Choose from the predefined navigation scenes or compose your own image view from available pre- and intraoperative images. Utilize all the imaging power of the SonoWand Invite to compose the optimal view for each particular case. Choose one or more preoperative images, adjust colors, transparency and thresholds. Add intraoperative tissue and angio images to obtain accuracy and clarity. Mix colors and transparency to obtain exactly the scene you want, true multi-modal flexibility.

Images courtesy of Neurosurgical Department, St.Olav University Hospital
The All-in-one Solution

SonoWand Invite is the all-in-one solution for intraoperative imaging, angiography and navigation. Features and functionalities of the SonoWand Invite combined with solid clinical judgement creates confidence and predictability throughout the entire neurosurgical procedure.

State of the Art Ultrasound

Seamlessly integrated in the SonoWand Invite is an ultrasound scanner specially adapted to provide the best possible images of the structures in the brain and spine. It is what distinguishes the SonoWand Invite from regular navigation systems, and is the component that provides the intraoperative imaging functionality.

A truly unique functionality is the 3D Angio, in seconds providing navigatable angio images intraoperatively.

Navigation Computer

The core of the SonoWand Invite is in the Navigation Computer. Within this component, standard navigation features and intraoperative 3D ultrasound are seamlessly combined to provide the user with an on-demand updated navigation scene.

Optical Tracking System

The industry-standard Optical Tracking System will track navigation tools and probes with an extreme level of accuracy to provide the user with continued accurate navigation throughout the operation.

Most SonoWand Invite trackers use 4 reflective spheres. This is beneficial in two ways:
- A smoother navigation experience, less interruption by hidden reflective spheres.
- A higher level of accuracy due to the redundant sphere.

Ultrasound Probes

Several Ultrasound Probes are available to provide the best possible image quality in every case. Each of the ultrasound probes is individually tuned for optimal performance in their designated area of operation.

Navigation Tools

Included with the SonoWand Invite are all necessary tools to acquire and navigate in pre- and intraoperative images.

A separate set of tools for the unsterile patient registration process is also provided.

Tool Adapters*

Sonowand Invite supports a number of trackable instruments and smart accessories allowing you to use your preferred surgical instrument as a pointer. Two different adapters are available, and may be used to add navigation to your surgical tools. These adapters are suitable for most rigid surgical tools e.g. ultrasound aspirators, endoscopes, etc.

* Pending FDA clearance.
SonoWand Invite – One Step Ahead

Intraoperative visualization technology has undergone comprehensive improvement and development in recent years, making SonoWand Invite an excellent clinical alternative.

1. **Easy to Understand – Easy to Use**

Neurosurgeons today are highly familiar with the use of MR images. At the same time 3D ultrasound is fast becoming a recognized tool for neurosurgical planning and guidance. SonoWand Invite is created for maximum ease of use, with an intuitive interface and efficient workflow. 3D visualization improves perception and enhances the understanding of complex anatomical structures such as irregular lesions and intertwined vessels. Neurosurgeons that start using intraoperative 3D ultrasound generally learn very quickly and are anxious to explore its numerous possibilities.

2. **Usable Throughout the Operation**

SonoWand Invite ensures image clarity and updated information during the entire surgery and is a very powerful tool for resection control.

It provides imaging to track every stage of the resection in an efficient and easy manner. Whenever the surgery causes the shape and position of the tissue to change, simply acquire a new 3D image and keep navigating with the same high accuracy that only an intraoperative imaging system like the SonoWand Invite can provide. It will take you less than a minute each time.

3. **Perfect for Minimally Invasive Surgery**

The SonoWand Invite handles a wide selection of probes, all with exceptional image quality.

Large craniotomies are not required for probe contact. The Mini Craniotomy probe is specially designed for procedures with restrained access through smaller craniotomies and for deep-seated minimally invasive procedures (e.g. in the medulla or posterior fossa). Imaging is easily performed through the same surgical access used for tumor resection.

4. **Exceptional Image Quality**

SonoWand Invite will help you detect brain shift with a navigational accuracy of 1 +/- 0.3 mm and help you maximize resection possibilities.

Tumor lesions can now be depicted by ultrasound during the initial phases of a procedure. The quality of these images is fully comparable to today’s preoperative MR images.

The clear and precise images from SonoWand Invite show exactly where you are, at all times.

Images courtesy of Neurosurgical Department, St.Olav University Hospital
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