Computer Assisted Spine Surgery

Navigation

Computer assisted surgery (CAS) is leading-edge medical technology, and its use in spine procedures is rapidly expanding. Today, spine surgeons may use CAS technology to help implant pedicle screws during spinal fusions to treat spinal instability caused by degenerative disc disease, deformity, spinal stenosis, sponylolisthesis, fractures, tumor and infection. CAS provides surgeons the ability to operate with **enhanced visualization** and **more accuracy** than ever before.

What is computer assisted spine surgery?

During computer assisted spine surgery, specialized software creates a virtual, 3-D computer model of the patient's spine, essentially a digital roadmap for the surgeon to follow. In the operating room, the surgeon matches the patient's actual spine to the computer's virtual model displayed on the monitor. Much like a GPS in an automobile, the surgeon is then able to track in real time the position of surgical instruments and spine implants in relation to the patient's true anatomy. For this reason, CAS may also be referred to as surgical navigation.

How does surgical navigation work?

Stryker's surgical spine navigation system consists of a **computer with navigation software**, an **infrared navigation camera** and a variety of **Smart Instruments** (embedded with light emitting diodes (LEDs)). Prior to surgery, the patient undergoes a CT scan, and these images are downloaded into the navigation computer. The software uses these images to build the virtual, 3-D model of the spine. In a process called registration, the surgeon uses the Smart Instruments to match pre-defined points on the 3-D computer model to the patient's true anatomy. This correlates the position of the patient in real-time with the computer model. Rather than sending the patient for a pre-operative CT, some surgeons may utilize a 3-D intra-operative imaging device to obtain the images and automatically register the patient's anatomy. Once the registration process is complete, the navigation camera tracks the movement and position of Smart Instruments in the surgical field and real-time images of the instruments are displayed on the 3-D model. In spinal fusions, the surgeon may also use the navigation software and its 3-D model of the patient's spine to plan the position, length and diameter of pedicle screws and then navigate instruments to ensure the screws are implanted as planned.

Potential benefits of computer assisted spine surgery

CAS **enables minimally invasive procedures** by offering enhanced visualization of the anatomy especially when smaller incisions are used.[1] The surgeon can view surgical instruments in relation to critical anatomy, such as the spinal cord, nerves and arteries. Real-time feedback on the position of instrumentation provides the surgeon the ability to correct potential implant misalignment in the OR. The ability to **work more precisely** may reduce the risk of spinal injury during surgery. The use of the equipment to pre-plan the operation, such as determining the size and location of pedicle screws, **saves valuable time and uncertainty** in the OR. CAS may also **reduce the amount of radiation exposure** in the OR by lessening the number of X-ray images needed througout the procedure.[2]

1. Tjardes T, Shafizadeh S, Rixen D, Paffrath T, Bouillon B, Steinhausen ES, Baethis H. Image-guided spine surgery: state of the art and future directions. Eur Spine J. 2010 Jan;19(1):25-45.
2. Gebhard FT, Kraus MD, Schneider E, Liener UC, Kinzl L, Arand M. Does computer-assisted spine surgery reduce intra-operative radiation doses? Spine. 2006 Aug 1;31(17):2024-7; discussion 2028.