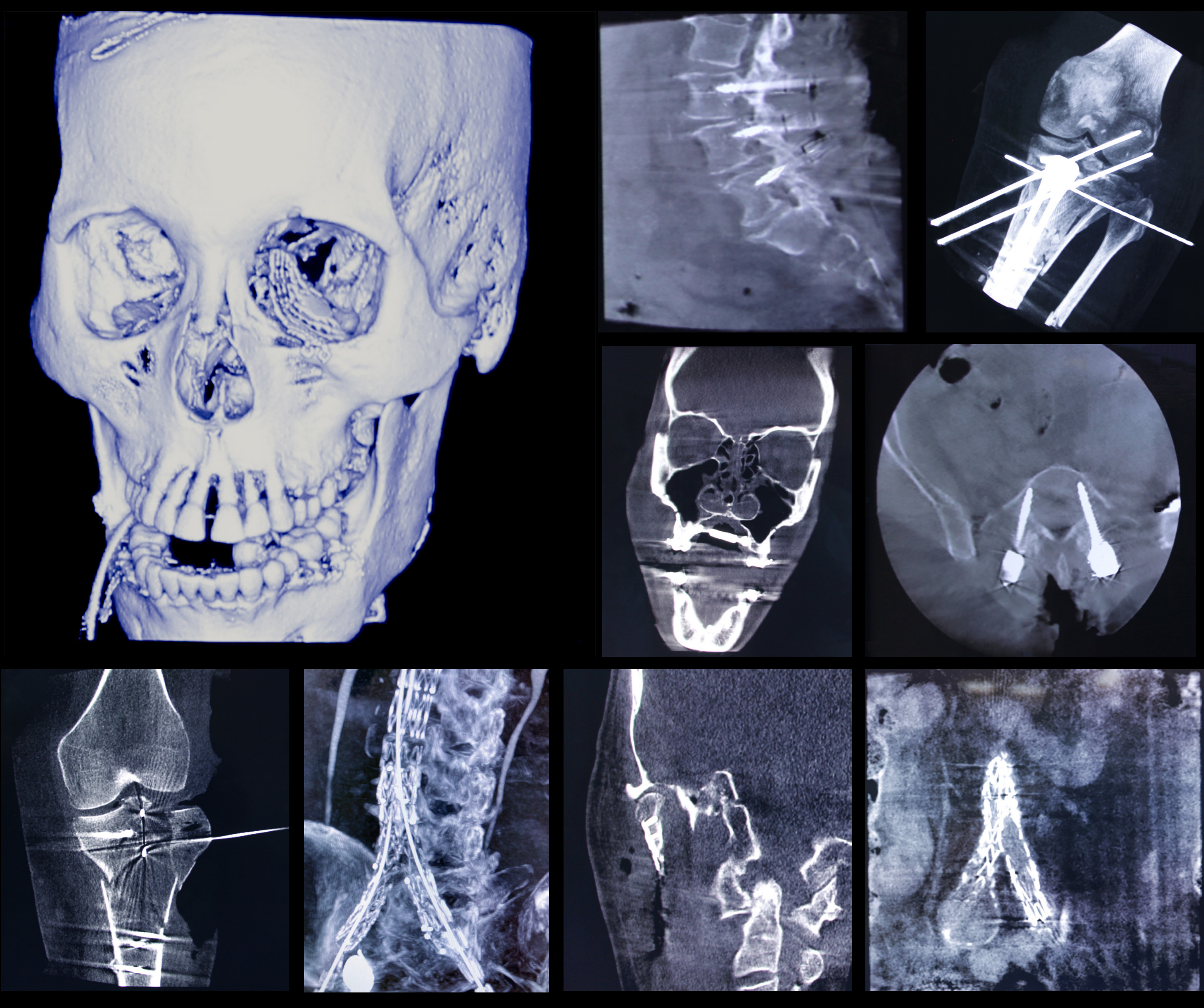
GE HealthCare

OEC Magazine

#04

Innovation in Surgical Imaging with OEC C-arms



OEC Magazine

Many thanks to our contributors:

Dr. Ernest E. Braxton Jr., Vail, Colorado, USA | Dr. Nils Petter Fossland, Trondheim, Norway | Dr. Mats Säll, Trondheim, Norway | Dr. Rémi Gauthé, Rouen, France | Dr. Vianney Gilard, Rouen, France | Dr. Steffen König, Strausberg, Germany | Pr. Sobocinski, Lille, France

Chief Editor: Coralie Nulac

Editorial Team:

Ellen van Oostenbrugge | Daniel Walters | Maria Fernanda Rodriguez | Lifeng Wang | Anders Forsell | Erik Hemmingsson | Ville Kauhanen | Knut Markeng | Antoine Karbowy | Christophe Chambord | Haissam Haidar Ahmad | Benedict Kuepker | Amandine Ribout | Christoph Obermeier | Marine Alcaraz | Anand Kumar

Design: Marine Alcaraz

Local Contact Information:

GE HealthCare
283 rue de la Miniere
78533 Buc Cedex, France

For any feedback or question(s) you can contact: coralie.nulac@ge.com

04 _

Minimally Invasive Outpatient Spine Surgery with OEC 3D

Dr. Ernest E. Braxton Jr.
Vail-Summit Orthopaedics and Neurosurgery in Vail, Colorado, USA

12 _

Intraoperative mobile cone beam CT scanner for maxillofacial surgery

Dr. Nils Petter Fossland, Dr. Mats Säll
St. Olavs University Hospital, Trondheim, Norway

24 _

A new standard in Spine Surgery

Dr. Rémi Gauthé,
Dr. Vianney Gilard,
Clinique St. Hilaire, Rouen, France

38 _

Trauma Surgery: 2D/3D imaging with OEC 3D, an isocentric C-arm

Dr. König, Märkisch-Oderland Hospital, Strausberg, Germany

Minimally Invasive Outpatient Spine Surgery with OEC 3D

Interview with Dr. Ernest E. Braxton Jr.
Neurosurgeon at Vail-Summit Orthopaedics & Neurosurgery in Vail, Colorado, United States.

Vail-Summit Orthopaedics and Neurosurgery is a 13-physician group practice specializing in musculoskeletal care, sports medicine, joint reconstruction, spine surgery, as well as physiatry and rehabilitation.

Focused on minimally invasive spine surgery, Dr. Braxton has more than 13 years of experience. Before joining Vail-Summit, he was the Chief of Neurosurgery for the Air Force in San Antonio, Texas. Dr. Braxton has extensive experience in the military serving in tertiary medical centers like San Antonio Military Medical Center, Wilford Hall Medical Center, and on military deployements in Korea, Germany, and Afghanistan. Dr Braxton shares his experience performing minimally invasive outpatient spine procedures and how he has fully incorporated the OEC 3D into his practice in Vail, Colorado, U.S.A.

Why minimally invasive outpatient spine surgery?

I started my career doing about 60% cranial work, skull-based work, tumors, cerebrovascular and about 40% of spine, mostly complex spine and in trauma situations. Then, I made a little pivot towards minimally invasive spine with an emphasis on outpatient surgery. There are a lot of similarities between the population that I see here in Vail and in the military. They are for the most part, very healthy, active, and motivated patients, looking for a quick recovery. It seemed to make more sense to perform minimally invasive operations where there is less tissue disruption and do the procedure in a way that it could be outpatient. The COVID pandemic really highlighted that and was an accelerant to helping us do more outpatient surgeries because we needed the hospital beds to reserve them for higher acuity patients. Yet, patients with elective degenerative problems really wanted to get their procedures done, and in an outpatient setting where they can recover at home.

Why did you choose the OEC 3D for your practice?

We did an exhaustive search trialing and looking at other C-arms. At the end of the day, one of my concerns was what is the long-term durability of the product? What if the technology shifts or moves, will this C-arm still be competitive? Will this still meet my surgical needs for my patients?

The fact that the OEC 3D is open source, it means that you can apply many different types of implants and technologies. This gives me, as a surgeon, a lot more options when discussing alternatives with a patient.*

What type of procedures are you using the OEC 3D C-arm for?

The OEC 3D has really been a game changer in my practice. We use the OEC 3D for artificial disc replacement

> *"OEC 3D really takes the place of a traditional C-arm because it does everything that a traditional C-arm does, plus it can render 3D reconstructed images for more precise localization."*

surgery, both in the cervical and lumbar spine, spine arthrodesis or spine fusion operations, for lumbar discectomy and laminectomy, as well as neuromodulation cases where implanting spinal cord stimulators.

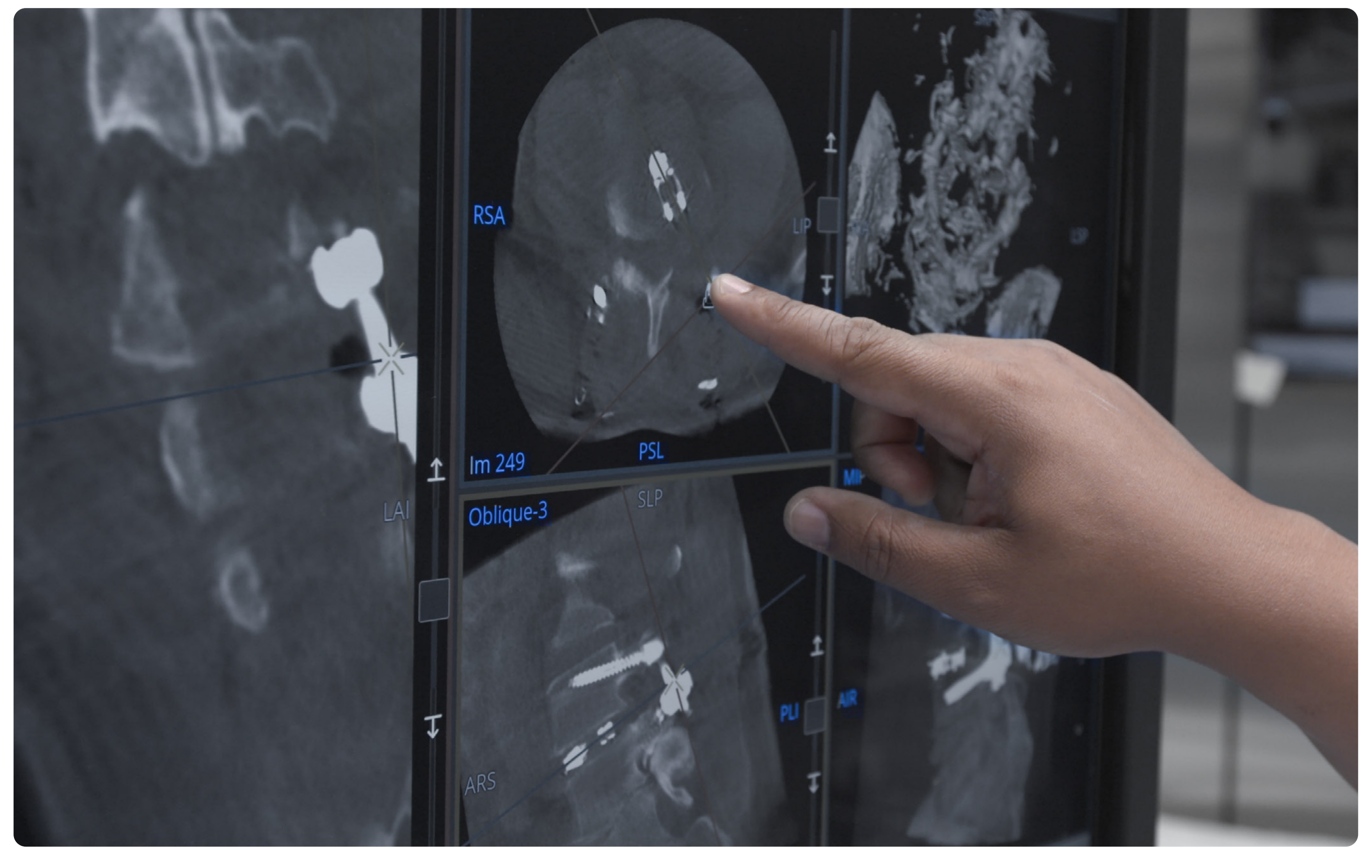
One of the more challenging cases we do is localizing in the thoracic spine. We don't have the same landmarks as in the cervical spine or lumbar spine, and when I'm doing thoracic procedures, I find the OEC 3D a must have device. In fact, we make it a note that the OEC 3D needs to be in the room, or we don't do the case. Having the large field of view and being able to get a 3D reconstruction when you're in the thoracic spine is critical.

The OEC 3D has a small footprint and less radiation exposure: We're not leaving the room to do a spin or a 3D reconstruction, and when it is not necessary to do a 3D reconstruction, we use the OEC 3D as a conventional C-arm, with a large field of view.

How does the OEC 3D improve your workflow?

I thought the OEC 3D was a conventional C-arm. I didn't realize that it had the ability to obtain 3D reconstructed images of the spine for surgery. The OEC 3D offers different methods of imaging specific anatomy, and it has features that I wasn't used to having but found to be invaluable, like the Live View camera and the green laser aimer.

> *"Image quality has really been amazing, both in the image quality itself and the large field of view."*



Review of spine images on OEC 3D Volume Viewer.

Dr. Braxton preparing for a 3D acquisition using OEC 3D assistant for collision check.

Specifically during neuromodulation case or spinal cord similar case, where the precise localization of your leads is critical to the outcome of the surgery.

With other traditional C-arms, what we had to do was to take a shot and then move the detector along as we were driving the lead along the spinal cord.

What has changed our workflow in multiple ways is the 3D acquisition time. When I was using other devices, often we would skip the post-op spin because of radiation exposure to the patient and added surgical time. Now, with the OEC 3D system, we do pre and post-spins for every case because the imaging is superb, the timing is quick, then the question is, why wouldn't you get a second spin?

When placing an artificial disk, unlike a conventional fusion operation, it's important to know exactly where you are, to be precisely in the midline and make sure that the prosthetic fits the patient perfectly. With the OEC 3D, having the capability to get a 3D spin, we're able to get better matches of the prosthetic and the patient anatomy, and know before leaving the operating room that the prosthetic is well placed.

The OEC 3D augmented what we already can do, because at the end of the day, we really need to know in real time where we're at anatomically.

Navigation provides us a picture of the spine, in my case, 20 minutes or an hour ago; then, when I need to refresh that, getting a new spin or refreshing that image can be done in less than 3 minutes.

> *"Having the OEC 3D has given me more confidence to do complex procedures in the ASC (Ambulatory Surgery Center)."*

OEC 3D enables us to check the precise location of the instrumentation prior to closing, and because of the efficiency, the OEC 3D has allowed us to do more cases.

Why choose the OEC 3D over other C-arms?

One of the first things I noticed when comparing the OEC 3D to other 3D C-arms is the smaller footprint, the speed of image acquisition, and decreased radiation exposure, both to the patient and to the surgical team.

My favorite feature is the motorized position memory recall. When I line up a view to a pedicle or a specific part of the anatomy, I'll ask the technologist to save that shot, save that position, and then I'll go to another position. Later, the technologist can automatically go back to the last position quickly and easily. That is one of the biggest frustrations that we had before having the OEC 3D, finding that last view that we had 10 minutes ago.

> *"One of the first things I noticed when comparing the OEC 3D to other 3D C-arms is the smaller footprint, the speed of image acquisition, and radiation exposure management tools."*

Initially, I was concerned about not being able to physically move the C-arm around the patient and about the learning curve that would take for the technologist, myself, and our surgical team to use the device.

But I found there's a lot of advantages to having a motorized C-arm, being able to memorize certain positions and coming back to those quickly, has really made my operations efficient.

What advice would you give to other surgeons that are purchasing a 3D C-arm?

If there are surgeons who have reservations about considering the OEC 3D C-arm, especially in an ASC, I would highly encourage them to do a trial of the device to see if it meets their needs for image quality. I think they'll find that it's a fiscally responsible decision, and it is a lighter footprint, smaller device to use in sometimes crammed operating rooms in surgery centers.

I can't really think of a procedure where I would not want to have the OEC 3D. We have really fully incorporated the OEC 3D into our practice.

Dr. Ernest E. Braxton Jr. is a board-certified neurosurgeon who focuses on treating brain tumors, neurotrauma, and performing complex minimally invasive spine surgeries in the ambulatory surgery center. He is particularly enthusiastic about minimally invasive spine surgery due to the rapid recovery of patients.

*OEC Open is the OEC 3D C-arm interface designed to transfer 3D reconstructed volume data set to navigation or robotic systems.

Dr. Ernest Braxton is a paid consultant for GE HealthCare and was compensated for his participation in this testimonial. The statements by Dr. Braxton described here are based on his own opinions and results that were achieved in his unique setting. Since there is no "typical" hospital and many variables exist, i.e. ambulatory surgery center size, case mix, etc. There can be no guarantee that other customers will achieve the same results. JB25192XX

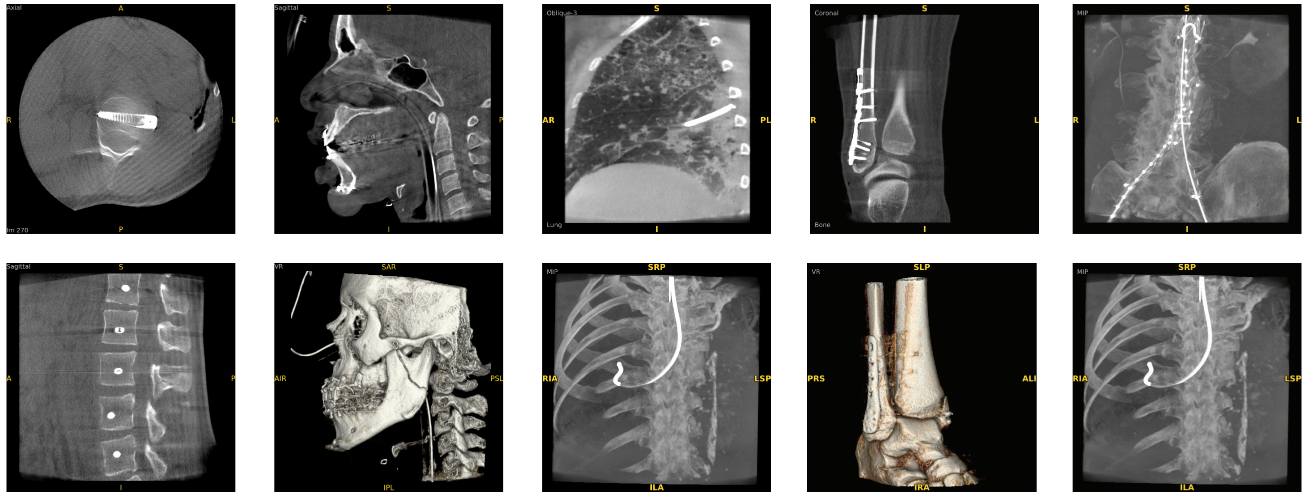
OEC 3D

Imaging capabilities every procedure room deserves

Streamline patient imaging with the versatility of a single mobile C-arm. With cone beam CT and fluoroscopy capabilities, OEC 3D delivers precise 3D and 2D images efficiently to every procedure.

Everyday utilization in one efficient mobile C-arm – the OEC 3D

Spine • Orthopedic • Trauma • Pulmonary • Maxillofacial • Interventional Radiology



GE HealthCare

gehealthcare.com/surgery

Intraoperative mobile cone beam CT scanner for maxillofacial surgery

Dr. Nils Petter Fossland, head of the department of maxillofacial surgery, and Dr. Mats Säll maxillofacial radiologist, at St. Olavs University Hospital, department of maxillofacial surgery, Trondheim, Norway.

The department of oral and maxillofacial surgery of St. Olavs University Hospital was established in 1962. It includes an outpatient clinic and six operating suites shared with the ear-nose-throat (ENT) department.

Expanding minimally invasive surgery for maxillofacial procedures in Norway for the past five years, Dr. Fossland, head of the department of oral and maxillofacial surgery and Dr. Säll, maxillofacial radiologist, decided to invest in a cone beam CT (CBCT) C-arm for their surgical suite. They selected OEC 3D which provides precise intraoperative CT-like volumetric images with the level of precision required for their complex maxillofacial procedures. The 3D intraoperative imaging with OEC 3D allows them to confirm a high-quality procedure before the patient's discharge from the operating room (OR). As a result, the team decided to eliminate postoperative CT-scans.

After one year of practice with this new patient care pathway, created using intraoperative OEC 3D CT-like images, Dr. Fossland and Dr. Säll tell us what benefits they have found for their routine activity.

In the 'Operating Room of the Future' maxillofacial surgical suite, OEC 3D stands next to the patient operating table. While fluoroscopic imaging is not used in maxillofacial surgery, Dr. Fossland and Dr. Säll selected the OEC 3D C-arm to be used primarily as a mobile intraoperative CBCT imaging system. They explain why this choice allows them to avoid the postoperative CT, and how the patient benefits from a review of the surgery in the OR before discharge.

Dr. Fossland, can you explain the activities and surgical procedures of your department?

The oral and maxillofacial department has 6 surgeons trained and specialized in oral and maxillofacial surgery working in two dedicated ORs. Personally, I am trained both in ENT and maxillofacial surgery. However, today in Norway most maxillofacial specialists are both medical doctors and dentists who completed their training in oral and maxillofacial surgery.

Our field of expertise covers: dentoalveolar surgery (cyst and tumor treatment), dental implants, trauma surgery of the facial skeleton, orthognathic surgery (correction of bite disorders and facial asymmetries), plastic and reconstructive surgery of head, neck, and face, and open surgery of the jaw joint.

As a university hospital we have developed our expertise in these areas and have become the reference center of the region Central Norway for facial injuries, reconstructive and orthognathic surgery. We work in collaboration with orthodontists from Central Norway region, but we also receive referrals from other parts of the country for an assessment regarding surgery.

We have developed quite strong expertise in major reconstructive surgery of the head, neck, and face after traumatic injuries and cancer surgery. We have a good collaboration with both the ENT and Plastic Surgery departments here at St. Olavs University Hospital, allowing us to provide the patient with the most comprehensive care pathway possible.

Whenever possible, we want to provide a minimally invasive surgery approach. We offer endoscopic treatment of salivary gland disorders such as the removal of stones or the relief of the obstructions in the strictures of salivary gland and ducts. This is a minimally invasive operation where we enter the normal opening of the salivary gland duct with small camera and its working channel. In addition, we propose arthroscopy to diagnose and treat disorders of the temporomandibular joint (temporomandibular disorders – TMD), where this is indicated.

Over the last twelve months, our team performed about 1,100 surgical procedures. A significant part of the major surgeries is performed with OEC 3D to access intraoperative image control in the OR. Of these, there are about 75 to 100 facial fracture reduction surgeries, 50 orthodontic surgeries, 50 orbital surgeries, as well as in a smaller volume reconstructive surgery of orbital tumors and reconstructions of the temporomandibular joint (TMJ) with TMJ prosthesis.'

Dr. Fossland, can you share an example of a complex procedure where OEC 3D provides clinical benefits?

'In orbital surgery it is very helpful to have intraoperative CT-like images because we perform very small incisions, and even while using intraoperative navigation, it can be difficult to estimate the precision of the implant placement toward the apex of the orbit.

Since we can acquire and review volumetric images during the surgery, we no longer have to wait for the postoperative examination of the patient, which is based on pain felt when moving the eye after surgery and performing a postoperative CT scan to see if the implant is one millimeter too high or not exactly where we wanted to place it with the risk of touching an eye muscle. The patient will then need to go back to surgery. Revision surgery has a cost and takes up time and resources. Now that we can access 3D images during the procedure in the OR, with a precise image quality to check the orbital implant placement, we avoid complications of revision surgery.

Dr. Fossland reviewing intraoperative CBCT on the OEC 3D workstation display.

“I did several orbital surgery procedures with OEC 3D and I am very happy, OEC 3D is perfect for that.”

We estimated that about 10% of the orbital reconstruction and orthognathic procedures required revision upon review of the postoperative CBCT scan. This is how we could justify the return on investment of purchasing OEC 3D to my administration, by reducing that number of revision surgeries, over a 10-year period.

‘I believe we are quite an advanced maxillofacial department in Scandinavia. We have in our department our own preoperative CBCT scanner for diagnostics, which we acquired 6 years ago, replacing our old CBCT from 2010. We use 3D printers to create templates to plan the complex surgeries. And now we are the first maxillofacial department in Scandinavia routinely using an intraoperative mobile CBCT imaging system for a clinical application. I have heard of some colleagues in Sweden who have acquired other types of 3D C-arms, but they are not using it in their routine because it is too complicated, instead, preferring to limit its use to research in specific cases. This is why we choose OEC 3D from GE HealthCare. Our university department has a strong history of looking towards technology at the service of clinical needs.

Dr. Säll, can you explain your role and what are the main drivers that led you to choose OEC 3D for the maxillofacial surgery OR?

‘I started my career as an intensive-care nurse as which I worked for 17 years, after which I became a dentist, working as such for 7 years, and finally I specialized in maxillofacial radiology. I have been working as a maxillofacial radiologist for 8 years now. I interpret the images and write notes for the surgeons. This is how our hospital is organized: radiologists are medically trained and specialized in different clinical domains.

Our ‘Operating Room of the Future’ project is to equip a larger operating room that we share with ENT surgeons. We are building it to satisfy the needs of different types of surgery. With this in mind, about two years ago we started to investigate the performance of 3D C-arms. We entered in communications with the different manufacturers, and we tried their C-arms.

In maxillofacial surgery, we never use C-arms for 2D fluoroscopic imaging as orthopedic surgeons do. Rather we need 3D volumetric imaging. The use of a C-arm is new to our team. I’ve trained twelve nurses in the maxillofacial OR on OEC 3D at once, and they find it very easy to use. It is significant as none of these nurses had ever been using a C-arm before! Ease of use was an important criterion. OEC 3D workflow is highly suited to the 3D acquisition and 3D image review in the OR environment.

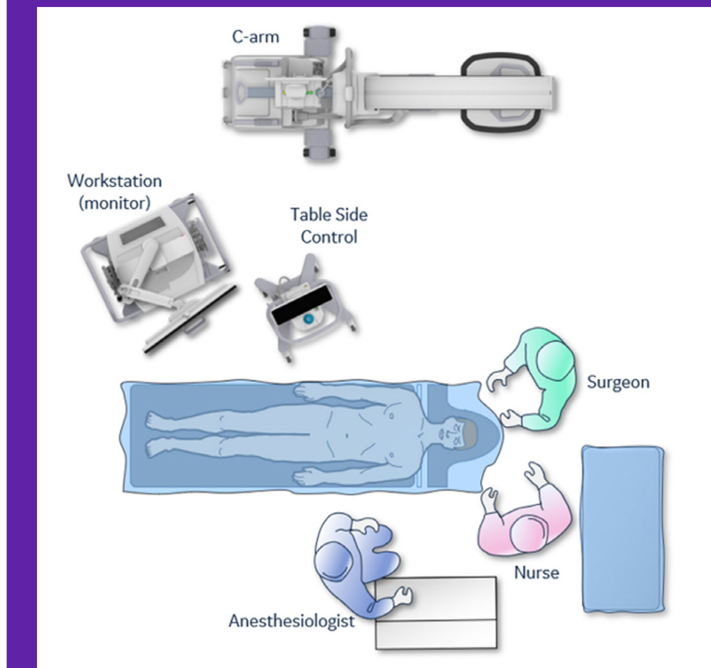
Personally, I love to review the multiplanar reconstruction (MPR) images using the oblique views. Then we send the 3D data to our PACS for further reviews. The last 3D acquisition of the procedure is used instead of the postoperative CT. This dataset is managed in our PACS along with the rest of the patient data records, as is the case for MRI or CT scan diagnostic data. The radiology department has a huge workload, so radiologists are in favor of us using this intraoperative imaging in the place of the postoperative scanner. And as I am the radiologist of the department, it is ok for the radiology department.

Of course, a main criterion in our selection was the image quality of the volumetric images since surgeons perform minimally invasive surgical techniques and work through very small incisions, using small screws and small plates. The 3D images of OEC 3D are very good.

“Indeed, in our activity, we use OEC 3D more as a mobile intraoperative scanner.”

Sometimes we perform a 3D acquisition during the procedure, and we always perform a 3D scan at the end of the procedure to verify the position of the implants before discharging the patient.

OR Layout during Maxillofacial surgery



OR Layout during intraoperative CBCT control

’Operating Room of the Future’ set up during surgery and during intraoperative CBCT imaging.

In order not to degrade the image quality of our intraoperative CT-like images obtained with OEC 3D, we are in the process of replacing all our patient tables with carbon-fiber tables over the next two years.’

Dr. Fossland, Dr. Säll what is your vision of the future for your operating room?

Dr. Säll: *‘We are working on optimizing our ‘Operating Room of the Future’ to set up the Brainlab ENT navigation system for cochlear implant placement procedures. Today this activity represents about 20 procedures per year. We expect this volume to grow once we have completed the installation. The volumetric images acquired with OEC 3D bring a good indication of the exact positioning of the tip of the electrode inside the 3 chambers of the cochlea. It is more beneficial for the patient to complete this imaging in the OR while asleep, rather than using the postoperative CBCT scanner while sitting awake, resulting in motion artifacts on the image. Thus, using OEC 3D as a mobile intraoperative scanner for the quality control of the procedure provides more information than we can get using the postoperative CBCT.*

When we started the cochlear implant placement procedure with OEC 3D, I reviewed the images with another radiologist. He compared the volumetric images of the same bones of the internal ear obtained using OEC 3D with the ones obtained using the postoperative CT scanner. We concluded that OEC 3D provided images with outstanding image quality of this anatomy. As a result, there is a consensus in our team that we can start the cochlear implant placement activity with OEC 3D.

In ENT we are also interested in acquiring 3D images of the sinus to update the navigation volume intraoperatively. There are many ways to use OEC 3D in maxillofacial and ENT surgery for the benefit of the patient. We are just starting the journey!’

Dr. Fossland: *From the clinical point of view, we are considering broadening the use of intraoperative volumetric images for the surgical treatment of sleep apnea. In this case it makes sense to verify the alignment of the jaw before discharging the patient. OEC 3D will also be used by the ENT surgeons to confirm the intracochlear placement of cochlear implants. We have a broad range of procedures that could benefit of intraoperative volumetric CT-like images that we need to investigate.*

> *"In our experience, the image quality of the intraoperative volumetric images of OEC 3D is better than the image quality we get with the postoperative CBCT."*

During the postoperative CBCT acquisition, the patient stands up and the image is degraded by motion artifacts even if the acquisition duration is only 15 seconds. We have a better contrast adjustment on OEC 3D that gives a better view of the soft tissues. OEC 3D is used for final imaging, and then upon the review of the volumetric images, the surgeon can close and discharge the patient. We estimate that the patient dose with OEC 3D is one-sixth of that if the patient underwent a standard postoperative CT scan of the skull. This is a further advantage of performing intraoperative CBCT imaging with OEC 3D.

With OEC 3D, we can see some tumor contours, and in the future, it would be interesting to be able to differentiate soft tissues enough to perform measurements. For example, this would be very valuable for one of the most complex anatomies to analyze, namely the temporomandibular joint, made up of a complex structure of nerves, muscles, fibrocartilage, and a disk. A step forward in image quality would allow us to distinguish all these tissues during the operation. Today we can only access this information through a preoperative or postoperative MRI.

I really like the image resolution. I think it is better than on our postoperative CBCT that is already 5 years old. I am very impressed by how easy it is to run a 3D acquisition, the nurses do it by themselves. The nurses learned extremely fast how to perform the 3D acquisition. I just stand back and say 'do it'. Then I review the 3D volume images on the workstation by myself.

Dr. Nils Petter Fossland
After completing his internship in Kristiansund Sykehus in 2004, Dr. Fossland practiced as a consultant in ENT and head and neck surgeon in Aleris Norge hospital in Trondheim. He completed his curriculum through a observational fellowship in microvascular reconstruction Head and Neck Surgery at Chris O'Brian Lifehouse in Sidney, Australia.
Since 2015, Dr. Nils Petter Fossland practices as chief surgeon of the department for oral and maxillofacial surgery at St. Olavs University Hospital in Trondheim, Trøndelag, Norway with a double specialty in ENT and oral and maxillofacial surgery.

Reconstruction of a traumatic orbital floor with Titanium mesh implant

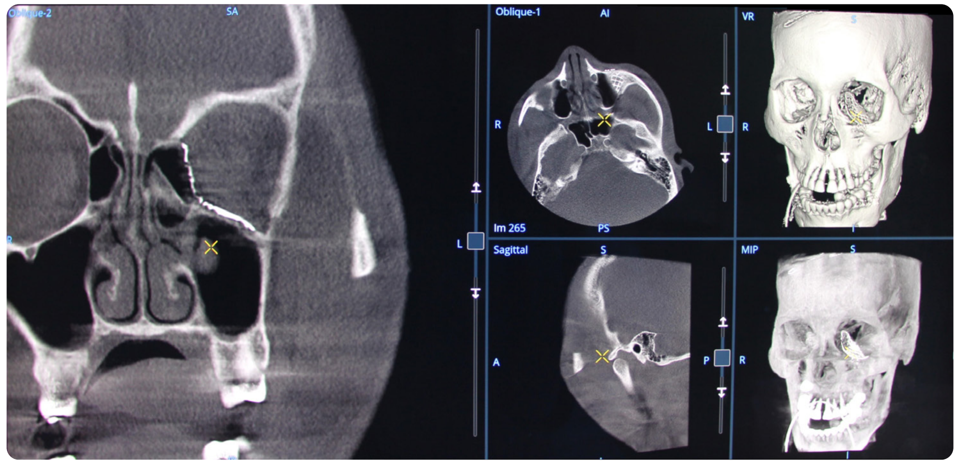
Courtesy of Dr. Nils Petter Fossland and Dr. Mats Säll, St Olavs University Hospital, Trondheim, Norway

Minimally invasive surgical repair of the complex anatomy and physiology of the orbital globe is an elaborated procedure that requires a precise placement of mesh to the order of a millimeter.

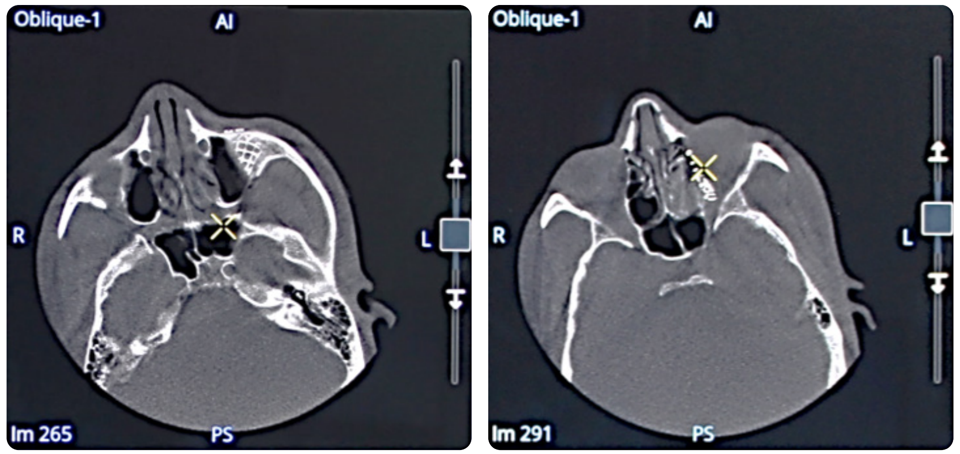
Patient History

The patient presented a traumatic fracture of the left orbital floor and was eligible for minimally invasive surgical reconstruction of the orbital floor by the placement of a titanium mesh implant. The procedure was performed under general anesthesia. No fluoroscopic imaging was performed during the procedure. OEC 3D was used for 3D confirmation at the end of the procedure. The intraoperative CBCT imaging allows surgeons to review the implant placement before discharging the patient, reducing the risk of potential revision surgery, and removing the need for postoperative CT imaging.

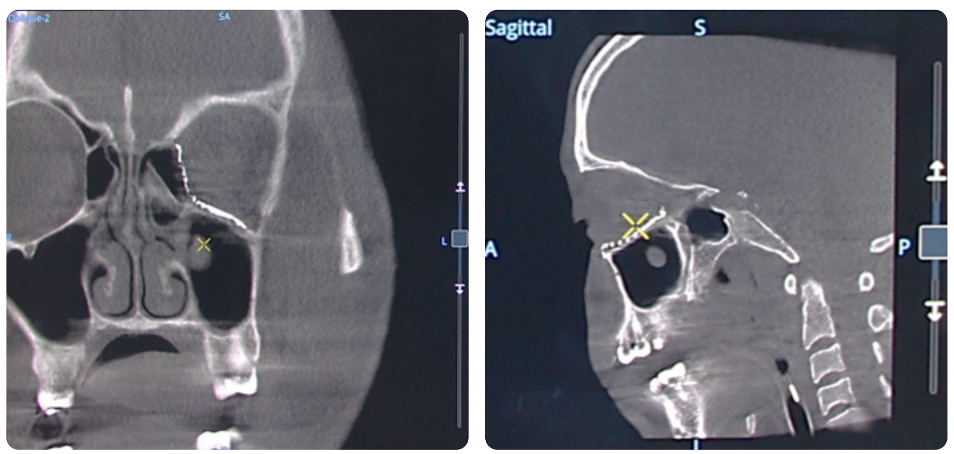
Dr. Mats Säll reviewing the final CBCT images of the procedure on the OEC 3D workstation using the 3D volume viewer.



Orbital wall reconstruction with a mesh implant: volumetric images multi oblique views, Volume Rendering (VR) and Maximum Intensity Projection (MIP).



Volumetric images of the mesh in multi oblique view in axial direction.



Volumetric image of the mesh in multi oblique view in coronal and sagittal directions.

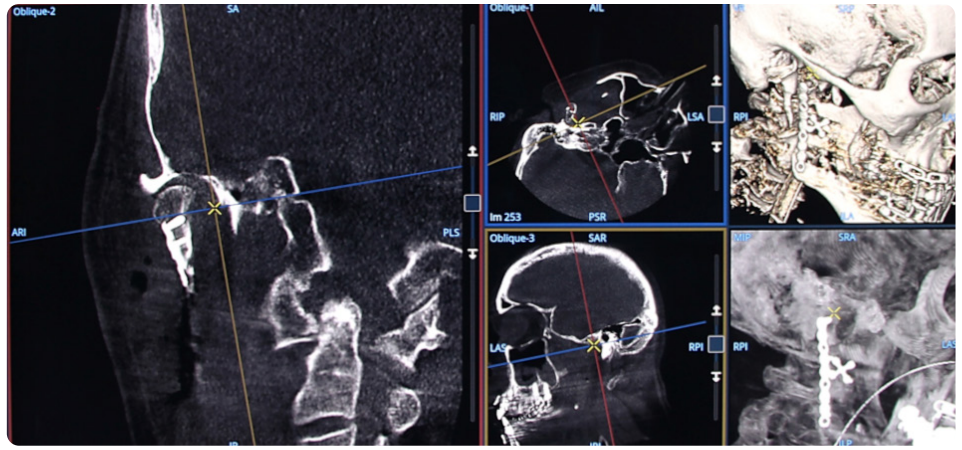
Volumetric image of the mesh in Volume Rendering format.

Right temporomandibular joint (TMJ) repair with alloplastic implant

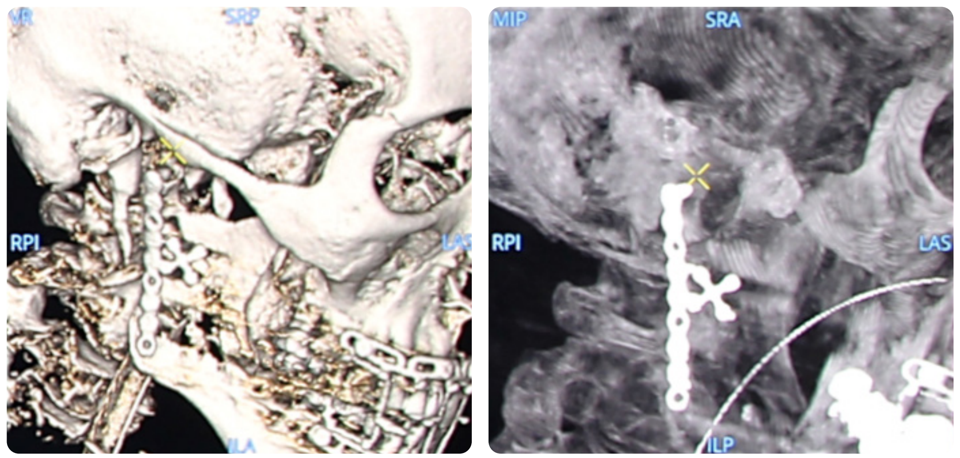
Courtesy of Dr. Nils Petter Fossland and Dr. Mats Säll, St Olavs University Hospital, Trondheim, Norway

The temporomandibular joint is a complex anatomy formed by an assembly of nerves, muscles, fibrocartilage, and a disk.

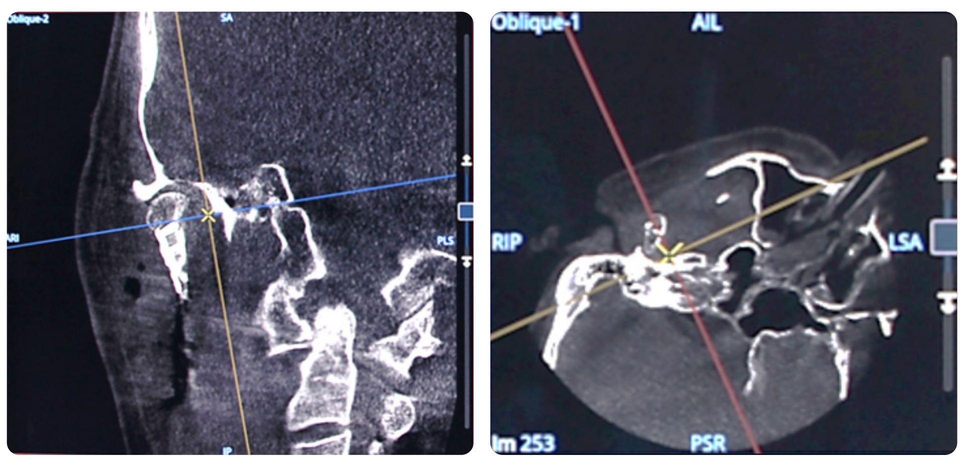
Dr. Mats Säll reviewing the final CBCT images of the procedure on the OEC 3D workstation using the 3D volume viewer.



TMJ reconstruction with alloplastic implant: volumetric images in multi oblique views, Volume Rendering (VR) and Maximum Intensity Projection (MIP).



VR (left) and MIP (right) images showing the type of implants.

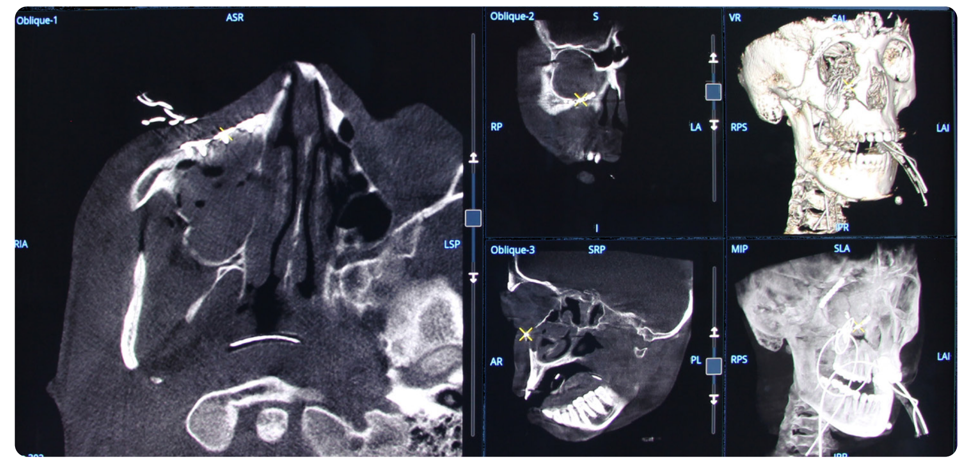


Volumetric image of the implants in the TMJ in multi oblique view in coronal and axial directions.

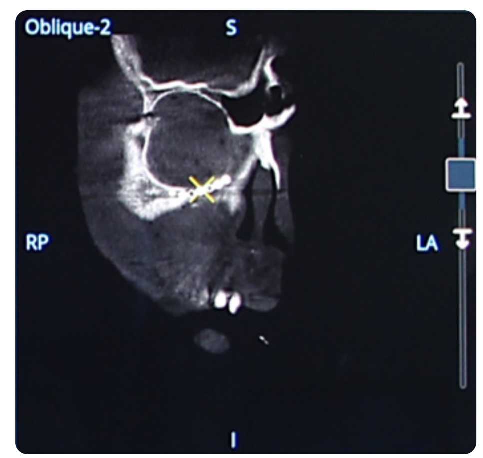
Right orbit fracture reduction with plate and screw fixation

Courtesy of Dr. Nils Petter Fossland and Dr. Mats Säll, St Olavs University Hospital, Trondheim, Norway

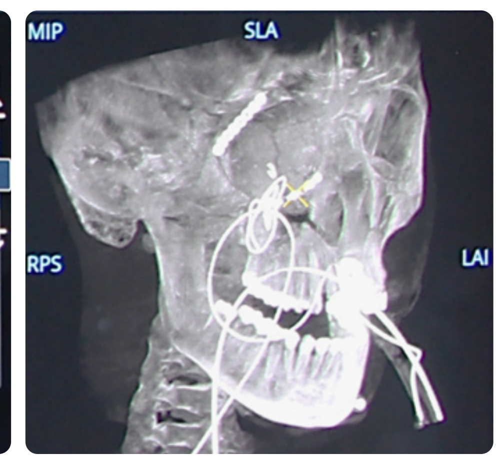
In this case, tiny plates and screws have been placed for the reconstruction of the orbit anatomy with minimally invasive access. Final intraoperative CBCT has been performed to verify implantation.



Orbit reconstruction with plates and screws: volumetric images in multi oblique views, Volume Rendering (VR) and Maximum Intensity Projection (MIP).



Volumetric image of the lower plate in multi oblique view in coronal direction.



MIP image showing the two plates in the upper and lower part of the right orbit.

A new standard in Spine Surgery

OEC 3D paired with neuronavigation

Interview with Dr. Rémi Gauthé and Dr. Vianney Gilard, spine surgeons, Centre Normandie Rachis, Clinique Saint-Hilaire, Rouen, France.

Clinique Saint-Hilaire is a medical and surgical institution in which the technical facilities are managed by multidisciplinary teams structured into three key divisions: medical and surgical division, cardiovascular division and cancer division.

In 2021, the medical and surgical division was strengthened by the incorporation of the Centre Normandie Rachis spine surgery practice. This practice comprises five surgeons who provide comprehensive management of spinal disorders affecting adults and children.

As part of the incorporation of Centre Normandie Rachis, an operating room was created to include a 3D imaging C-arm paired with neuronavigation. After testing different equipment, the center opted for the OEC 3D C-arm with integrated Brainlab Kick® navigation (Brainlab, Munich - Germany).
Here, Drs. Gauthé and Gilard share their experience with 3D imaging and integrated neuronavigation after one year of use.

Dr. Rémi Gauthé is an orthopedic and trauma surgeon who specializes in spine surgery. After obtaining his medical degree from Université Paris-Descartes, he completed his clinical training in orthopedic surgery and traumatology at Rouen University Hospital–Charles Nicolle.

After working for four years as a resident, then for a year and a half as a hospital practitioner at Rouen University Hospital, he joined Centre Normandie Rachis at Clinique Saint-Hilaire in November 2021. Dr. Gauthé is a member of SOFCOT (Société Française de Chirurgie Orthopédique et de Traumatologie – French Society for Orthopedic Surgery & Traumatology) and SFCR (Société Française de Chirurgie Rachidienne – French Society for Spine Surgery). He is also a member of the French College of Orthopedic Surgeons, which manages the training of interns. Dr. Gauthé belongs to the Spine Research Community (SRC), which brings together 35 private physicians working together on a collaborative medical and clinical research project on the benefits associated with spine surgery.

Could you describe how Centre Normandie Rachis is set up at Clinique Saint-Hilaire?

Dr. Gilard: *Clinique Saint-Hilaire is a private family-run clinic owned by the Martin family. It is an independent institution committed to quality of care and quality of work life. This is clearly seen in the clinic's management, operations and focus on people. The clinic's moderate size enables it to operate more efficiently. Staff members know each other and work together as a team. The clinic has about 100 practitioners. There are 220 beds, half of which are dedicated to surgery. In addition, there is an oncology department, intensive care unit, post-acute care unit, cardiac rehabilitation unit and an outpatient unit. The clinic therefore provides a large proportion of regional care in medicine and surgery.*

Centre Normandie Rachis is a nominal partnership that brings together five spine surgeons from a variety of backgrounds and that delivers comprehensive care for all spinal disorders affecting adults and children. Our group includes one pediatric orthopedic surgeon, two adult orthopedic surgeons who specialize in spine surgery and two neurosurgeons.

I want to stress that we are particularly well equipped and set up at the clinic. Since my arrival, I have been able to use OEC 3D C-arm, an operating microscope, a Cavitron® aspirator, which is used to resect tumors in neurosurgical procedures, and other modern equipment. We are equipped in much the same way as a teaching hospital, which benefits both the staff and patients.

Dr. Gauthé: *Since I arrived at the clinic in November 2021, with my colleagues we have been developing the surgical management of spinal disorders in adults and musculoskeletal conditions in children and adolescents. We created a practice that previously did not exist. The clinic's management made the decision to build a modern operating room dedicated to spine surgery. As a result, the clinic now has equipment specifically intended for use in this facility, such as imaging and navigation systems and the operating table. We submitted a list of the equipment required for our practice, and the clinic then issued a call for tenders, after which we carried out tests and selected our equipment. It is in this context that we chose OEC 3D for the 2D and 3D imaging necessary for our procedures.*

We continue to work on building our facility in terms of operating room equipment, as well as the development of our patient consultation, namely communication with referring physicians who send us treatments. I have also started to take on a number of responsibilities regarding radiation safety and the operating room. The practitioners are involved in different areas at the clinic, such as quality, the users' committee, the infection committee and accreditation.

Within your practice, what are your requirements in terms of 2D and 3D imaging?

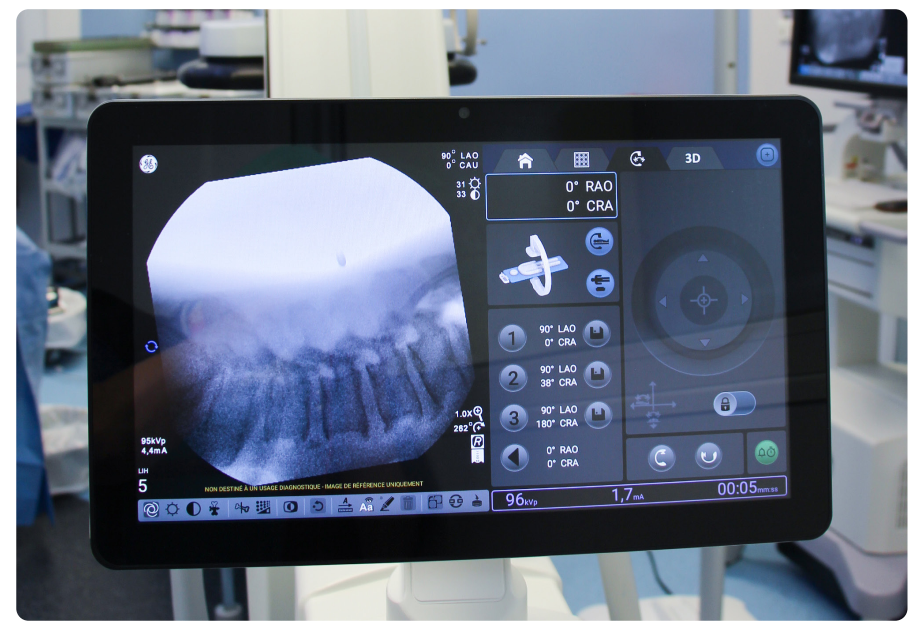
Dr. Gauthé: *Generally, all our procedures require either 2D or 3D imaging in the operating room. We perform very few surgical procedures without 2D fluoroscopic imaging because we routinely check the spinal level at which we are operating. Navigation and 3D imaging are not required for all procedures. Our practice is growing and is in its startup phase. We currently treat around four to five patients per day, over four days a week.*

Most of the procedures involve lumbar spine fusions and lumbar and cervical disc herniations, which account for about a third of the total volume.

With regard to the use of imaging, 3D guidance is routinely used in procedures involving the insertion of lumbar implants. This means that we do not always use navigation, but we do use volumetric imaging to check the placement of implants.

We use navigation alongside 3D acquisition for lumbar spine surgery when we anticipate difficulties: for example, when we know that there is extensive scoliosis, short pedicles or anatomy that is significantly altered due to extensive osteoarthritis. Therefore, when we expect difficulty from the outset in inserting the screws, we use the navigation system. Navigation is not routinely used. In cervical spine surgery, we never use navigation; instead, we use 2D imaging control in antero posterior and lateral views. Exceptionally, we may use 3D imaging. In this case, it is very easy with OEC 3D to switch from 2D imaging to 3D imaging. That is why the C-arm remains permanently available for use in our operating room.

> *"I think that 2D/3D imaging will become widely used even if only for 3D guidance."*
>
> Dr. Vianney Gilard



2D fluroroscopic image of lumbar spine in lateral view to check the spinal level.

Dr. Gilard and Dr. Gauthé preparing OEC 3D for the 3D acquisition.

Lastly, pedicle screw implantation represents the majority of our activity. This is a procedure in which 3D imaging guidance is the only way of ensuring that the implants are positioned correctly, that the screw is not in contact with a nerve and that it is definitely in the right place. This is what we look at when we perform an intraoperative 3D imaging with OEC 3D.

In the future, I think that imaging will always be necessary, if only to check the spinal level.

Dr. Gilard: *Intraoperative 3D imaging has become our new standard. Today, it is unimaginable to insert an implant without 3D guidance, especially when we are fortunate enough to have the OEC 3D C-arm at our disposal. Practically speaking, 2D imaging has its limitations, even from a purely medical perspective. This means that if a patient is relatively heavyset, you might not be able to see some implants using 2D imaging. There are also some anatomical areas that cannot be accessed with 2D imaging. However, 3D volumetric imaging provides a comprehensive solution to this problem, making it possible to analyze multiplanar views of large-volume reconstructions and enabling us to view the anatomy behind implants. This is also useful when treating nerve root compression, i.e., removing bone or osteoarthritis that is compressing a nerve root. This is not the most common occurrence, but we can check the quality of our decompression: we view the section of bone we made using forceps, and we can make an estimate to determine whether it is sufficiently clear of the nerves. We learned how to assess nerve compression using a preoperative scan and can now do this using volumetric imaging obtained intraoperatively with OEC 3D.*

Another issue to consider is radiation safety. With 2D imaging, lead aprons provide protection, but most of the time, we remain in the room during the imaging process, albeit at a distance. By contrast, 3D imaging with OEC 3D coupled with navigation makes it possible to produce a series of volumetric images with relatively low irradiation, while we remain out of the room. The rest of the procedure then involves little or no radiation, which offers long-term radiation safety to us and other staff members.

In parallel with this, there is a place for navigation, and there will always be a need for direct view imaging, especially endoscopic spine surgery, which is becoming more common. Today endoscopic spine surgery requires 2D imaging to triangulate the position of the endoscope in the treatment of disc herniation. In the future, endoscopy might be navigated with 3D imaging.

Can you explain to us the benefits of OEC 3D integration with Brainlab navigation for your procedures?

Dr. Gauthé: *In our surgical technique we use the bare minimum of navigated tools, i.e we work primarily with the navigated locator stylet. We position the screws according to the free-hand technique, then we check their position using OEC 3D intraoperative volumetric imaging.*

As with all other screw placement techniques, we work by touch and by controlling the force that we place on the instrument. For me, it is important to control the manual sensation applied to the instruments, to be able to adapt to the feel of the technique instead of relying on automated instruments.

Therefore, we prefer to use the navigation system to identify an entry point and establish the direction of the screws, then to check our technique using OEC 3D imaging.

Navigation is an undeniable aid, especially in the case of complicated screw implantation procedures. Navigation ensures a more precise and safer technique, making it possible to insert screws on the first attempt when the anatomical points of reference are accurate.

Generally, we use navigation if the preoperative imaging suggests that implantation may be difficult, for example, when there are vertebrae that are slightly twisted, short pedicles or significant alteration of the surface where a lot of bone has formed and the

Dr. Vianney Gilard is a neurosurgeon. Originally from Normandy, he studied medicine and completed his clinical training in neurosurgery at Rouen University Hospital–Charles Nicolle. During his clinical training, he specialized in pediatric neurosurgery and spine surgery and completed two placements: one at Necker–Enfants Malades University Hospital in Paris and the other during his postdoctoral fellowship at Great Ormond Street Hospital for Children NHS Foundation Trust in London. He spent three years working as a resident at Rouen University Hospital in spine surgery and general cranial and pediatric neurosurgery. He then worked as a lecturer and hospital practitioner at Rouen University Hospital for two years. Dr. Gilard joined Clinique Saint-Hilaire in September 2022.
Dr. Gilard is a member of the SFCR, SFNC (Société Française de Neurochirurgie – French Society of Neurosurgery) and the Spine Research Committee (SRC), through which he carries out fundamental and clinical research projects with his associates. Currently, he is focusing on spinal treatments in adult patients and retains an associate position at Rouen University Hospital in pediatric neurosurgery.

Dr. Rémi Gauthé reviewing the final control images of the procedure on the OEC 3D workstation using the 3D volume viewer.

> *"A decisive factor in the selection of OEC 3D was the volumetric image reconstruction method. I like having the ability to easily take oblique slice images in the screw axis, the vertebral axis, exactly as I used to do with a CT scanner in multiplanar reconstruction (MPR) mode."*
>
> Dr. Vianney Gilard

anatomical landmarks are hard to identify.

Dr. Gilard: *Navigation should be viewed as an aid to identify anatomical landmarks and to facilitate our practices, rather than as a replacement for them. By inserting the screw in a single step, without damaging any anatomical structures, we maintain the stability of the implant. This ensures efficiency and patient safety.*

Furthermore, we considered radiation safety thoroughly since our specialty involves a high level of exposure. Our patients undergo surgery once, perhaps twice, in their lifetimes and are exposed to some X-rays. For us, we see as many as ten patients per week over a 35-year career. There is a real need to reduce our exposure to X-rays. When we use a navigation system, the staff and surgeons leave the room during the 3D acquisition, thereby significantly reducing their exposure.

For some procedures lasting up to three hours, this prevents us having to wear lead aprons, which has significant practical benefit. When we use navigation in the procedure, we take front and lateral views, we leave the room during 3D acquisition and we do not have to wear a lead apron during the procedure.

Dr. Gauthé: *The integration of the Brainlab navigation system with the OEC 3D C-arm is an additional benefit. The communication between the camera and the C-arm makes it possible to signal and suspend the trackers if the navigation trackers are not correctly located by the camera. If the navigation system were not integrated with the C-arm, we might proceed to the acquisition, realizing once the acquisition was complete that the navigation trackers were not in view of the camera, meaning that we would have to perform the 3D acquisition again. The communication between the navigation system and the imaging system is a kind of safety measure ensuring that we don't perform a 3D acquisition that cannot be navigated. The integration allows the automatic transfer of the 3D images to the navigation computer. The calibration between the C-arm and the navigation system enables to avoid using an additional tracker on the patient in the 3D volume image. This simplifies the centering of the anatomy of interest in the 3D volume image and enables surgery to be performed with a clearer surgical field.*

After using OEC 3D for about one year, which features do you like and use the most?

Dr. Gilard: *I find OEC 3D quite user-friendly and intuitive. The OEC Touch control panel menus are simple, and it is easy to select/unselect the various fluoroscopy modes in 2D imaging.*

If the patient is thinner, I activate the low dose mode; otherwise, I usually work in standard mode. I only use pulsed mode, which is slightly more irradiating than low dose mode, with larger patients who are more radiopaque. I regularly use the collimation feature, which enables to reduce the radiation field to the anatomy of interest and improves image quality.

The 3D acquisition menu can be accessed at the same menu level as that of 2D imaging. It is easy to switch between 2D acquisition and 3D acquisition. This is simple to do because you can follow the different steps guided by the OEC 3D Setup Assistant.

In addition, the Volume Viewer on the Workstation is easy to use; it is intuitive and touch operated.

Dr. Gauthé: *In my practice, for 2D imaging, I usually set the C-arm to low dose mode and pulsed mode at 8 pulses per second. I deactivate low dose mode to see better if the patient is larger. But that is quite rare. I use the preset imaging profiles 'Spine' or 'C-Spine' depending on the procedure. For a cervical spine procedure, I configure the C-arm using the 'C-Spine' imaging profile and I am satisfied with that. For a thoracolumbar spine procedure, I configure the C-arm using the 'Spine' imaging profile. I find the image quality perfectly appropriate for carrying out my procedures.*

I like the anticollision system located on the detector. It is extremely effective. When performing a simple procedure with 2D imaging, the C-arm is placed under sterile drapes. If the C-arm touches the patient during its rotation, we are not aware of it. The C-arm signals this, and then it stops. We could describe this as a soft stop. Even if it touches the patient's arm, it will not roll over it. It stops before that point. It does take up space, but that proves useful, too.

For 3D imaging, there are three acquisition modes: Standard (SD) mode, High Definition (HD) mode and HD+ mode. I usually configure the C-arm using the HD mode. When the system was installed, we activated the metal artifact reduction (MAR) feature, as well as the noise filter. Recently we have activated the eNR. We do not change these settings because we routinely work with metal implants and these filters enable us to obtain our desired level of image quality.

With the other 3D C-arms that we tested, reading the images was much too complicated.

Dr. Gilard: *In the past, I often used a different 3D C-arm, which was very bulky and lacked versatility.*

In our practice, we need a versatile 2D and 3D imaging tool. We also wanted the freedom to choose the navigation tool that we coupled it with.

As part of our selection process, we also considered the human support aspect. We did not choose a tool and an imaging system, we chose a team with whom we felt supported and assisted. We could have the best tool on earth, but if there were no customer service, engineers or a good working relationship, it would fail. We think that it works well and that's why we're happy to be here with you.

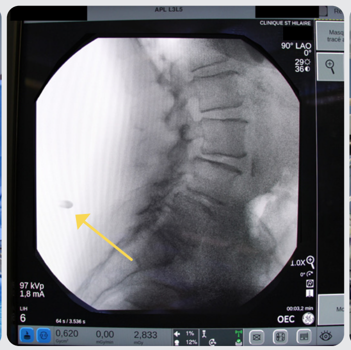
Dr. Vianney Gilard is a paid consultant for GE HealthCare and was compensated for his participation in this testimonial.
The statements by GE HealthCare customers described here are based on their own opinions and on results that were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist, i.e. hospital size, case mix, etc., there can be no guarantee that other customers will achieve the same results. JB25770XX

OEC 3D workflow if using navigation

Brainlab Drapelink navigation tracker for OEC 3D is fixed on the detector, and Brainlab system is connected to OEC 3D via the integrated navigation port of OEC 3D workstation. A single 2D image is acquired in lateral view over the patient lower back anatomy to identify the incision level necessary to fix the patient pin tracker on the ilium bone. This image is done with the spine imaging profile and standard continuous fluoroscopy. Once the incision is performed, surgeon prepares the navigation patient's tracker. After draping the equipement, surgeon proceeds to 3D imaging data acquisition.

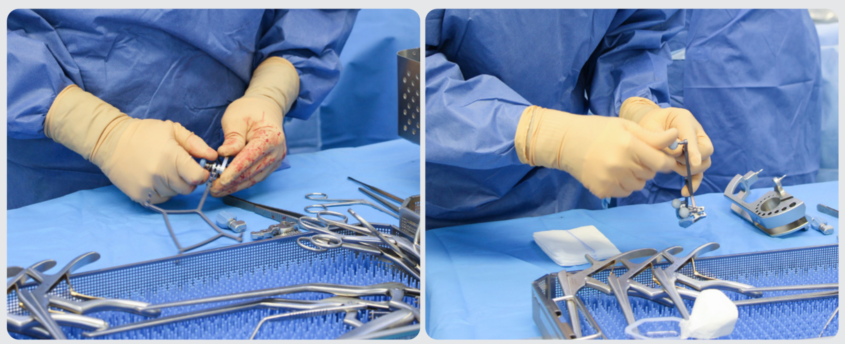
Brainlab navigation preparation: Patient Tracker

Drapelink for OEC 3D fixed on detector handle.

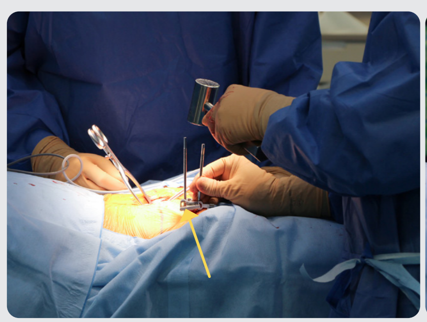


Incision level on 2D spine profile.

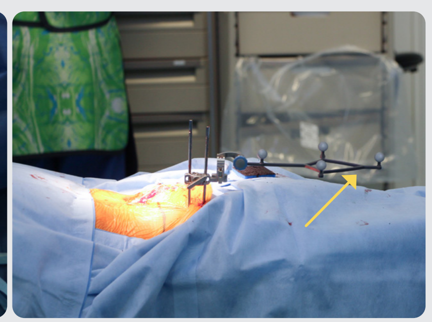
Patient incision for patient tracker placement.



Preparation of patient tracker with its reflective marker spheres.



Fixation of patient tracker pin on the iliac crest.



Attachment of the reference array on patient pin tracker.

OEC 3D preparation: draping

Detector head draping

Patient draping with patient tracker visible

Brainlab camera is positioned in order to view both OEC 3D navigation tracker and patient tracker

OEC 3D - 3D Setup Assistant

STEP 1: 3D set up

Set up of patient orientation, imaging acquisition mode, dose level and 3D volumetric images reconstruction option.
Activation of the connectivity with the integrated Brainlab navigation system.

STEP 2: centering

Anatomy centering in the 3D volume – AP and Lateral view.

OEC 3D - 3D Setup Assistant

STEP 3: collision check

Collision check over 200° rotation starting point at + 130°. All over the 200° rotation, OEC 3D and Brainlab navigation system communicate checking the trackers are visible. During the 3D collision check doctor verifies that the Brainlab navigation systems sees the navigation trackers.

Collision check complete.

OEC 3D - 3D Setup Assistant

STEP 4: imaging

Brainlab camera tracks the C-arm position and the patient position for each image of projection acquired.
OEC 3D displays projection images acquired at each degree.
OEC 3D completes acquisition of projection images for volumetric image reconstruction up to 200° rotation.

OEC 3D rotation and exposure stops automatically when the percentage of completion shows 100%.

3D volumetric images are automatically reconstructed, displayed on OEC 3D workstation, and sent to Brainlab navigation system.
Doctor is ready to start navigated surgery.

Lumbar spine fusion

Surgeon working with pointer to identify entry point and direction of the screws to be placed in pedicle.

Pedicle screws are placed with free-hand technique.

OEC 3D: Featuring CBCT imaging

OEC Elite CFD

OEC One CFD

OEC MiniView MAX

Trauma Surgery: 2D/3D imaging with OEC 3D, an isocentric C-arm

Interview with Dr. Steffen König, head of Clinic of Trauma and Reconstructive Surgery, Märkisch-Oderland Hospital, Strausberg, Germany.

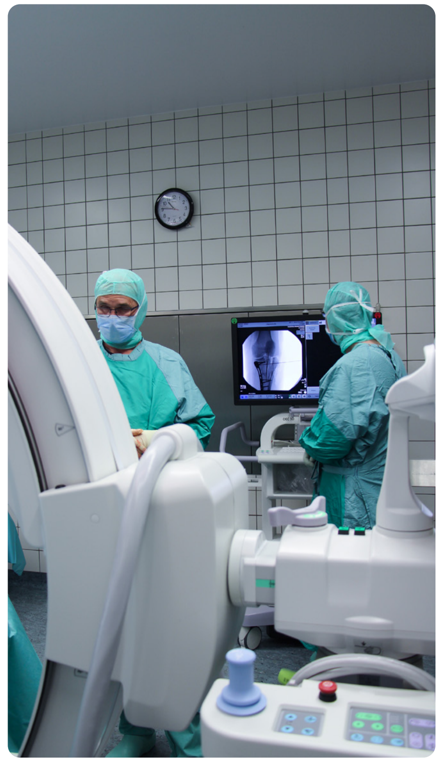
Located 30 km east of Berlin and 30 km west of the Polish border, Strausberg is the largest town in the district of Märkisch-Oderland. In 2000, in order to meet population's demands for healthcare, the Märkisch-Oderland Hospital merged clinics in Strausberg and Wriezen, creating a modern hospital network.

In 2008, in addition to the Clinic of Trauma and Reconstructive Surgery, the hospital of Strausberg created the Clinic of Trauma and Reconstructive Surgery under the leadership of Dr. König. The clinic has since continued to develop its expertise by focusing on the specialized care of patients who suffered of acute accidents.

One specialty of the clinic is the treatment of spinal injuries with minimally invasive surgery techniques, the department recently acquired an OEC 3D C-arm for high precision intraoperative 3D imaging.

Dr. König shares with us what was important when selecting a new 3D C-arm and how his hospital integrated the OEC 3D C-arm during orthopedic traumatology procedures.

Dr. König and Dr. Peuthert operating a patient knee.



Dr. Peuthert checking 2D image on OEC 3D workstation.

Dr. König checking patient draping before running 3D acquisition.

Dr. König can you explain to us the activity of the Clinic of Trauma and Reconstructive Surgery at Märkisch-Oderland Strausberg Hospital?

The district of Märkisch-Oderland has approximately 200,000 inhabitants. Healthcare for this population is covered by four hospitals. Three of these four hospitals are in our group: the hospitals in the cities of Wriezen, Seelow, and Strausberg.

The Märkisch-Oderland Strausberg Hospital covers various clinical activities including orthopedic surgery, directed by one of my colleagues, as well as traumatology and reconstructive surgery which I lead.

The primary spectrum of our activity is emergency surgery of age-related trauma due to the demographic evolution of our district. Thus, we treat a very large number of fractures of the upper leg, proximal to the hip joints, as well as emergency surgery of big joints such knee and spine.

Our clinic is approved for the process of consultation of accident, but not for treatment of severely injured patients. These patients are addressed to the emergency hospital in Berlin.

The staff includes our senior surgeon, Dr. Peuthert, two specialists, three assistants and myself, head of the clinic. We can manage patients through the community health center.

One of our operating room is actually an emergency room. It is currently managed by a senior physician, a deputy, and an assistant physician. The clinic has 30 beds, including beds that we can use in intensive care and intermediate care.

As a trauma specialist, what is your experience with surgical and 3D imaging, and how did you choose OEC 3D?

I started working with 3D C-arms in 2004 when I was senior physician in emergency surgery at the Northwest Hospital of Frankfurt am Main and later in the Hospital of Lahr/Ettenheim where I gained experience and saw the benefits in 3D imaging and also used navigation systems with the first generation of products we used from Siemens.

When I joined Märkisch-Oderland Strausberg Hospital, we saw the need to acquire a 3D C-arm without navigation given the type of procedures we carry out in our department.

Initially, in 2008, we opted for the Ziehm 3D C-arm which we used for several years with good 2D imaging, but some limitations in the 3D image quality.

In 2022, we started tendering again for a new 3D C-arm, and after testing C-arms available on the market, I was pleasantly surprised by the image quality of OEC 3D.

Through my experience in trauma surgery, I tested several types of C-arm designed for 3D imaging. I have found that C-arms rotating more than 180 degrees provides superior 3D image quality.

During the renewal process, as we have relatively small operating rooms, I wanted to verify that the new 3D C-arm could fit in the room for different trauma procedures we do. We found that the size of OEC 3D is just the right. Initially we had some positioning challenges with upper leg fractures close to the hip joint because there is relatively little space. We also had to rethink a few things in terms of setup, but after the initial phase we now have an easy workflow in 2D and 3D imaging. The volumetric 3D images are produced relatively quickly in the intraoperative workflow.

With OEC 3D I believe we get the right balance of excellence in 2D and 3D imaging with a reasonable C-arm footprint even for our small operating room.

"Overall we can say the OEC 3D C-arm is easy to operate in 2D and 3D imaging and it provides us very good image quality for our procedures. These are the reasons why we decided to choose it for our daily practice."

Can you tell us which procedures you need 2D/3D imaging for, and what are the advantages?

In general, there is no such thing as emergency surgery without 2D/3D imaging. We use 3D imaging in about 5 percent of the surgical procedures we perform. For our other procedures we only use 2D imaging. This is mainly due to our concern for radioprotection. We use 3D imaging only when needed.

Considering the relatively small operating room we have; we cannot have one C-arm for 3D and another C-arm for 2D imaging. In addition, bringing the device in and out requires a certain amount of logistical effort that the OR staff wouldn't appreciate. We use OEC 3D for everything: 2D and 3D imaging.

In our clinic we do about 20 tibial plateau fractures per year and another 20 tibial head fractures per year with 3D imaging. Tibia fracture reduction is one of the most complex procedures in traumatology. The volumetric images give us information on the anatomy behind the knee, that is difficult to perceive with 2D projection images.

So, my main indications for the use of OEC 3D for 3D imaging includes the surgery of the fracture of the tibial plateau at the level of the knee and ankle particularly when implying bone fusion. We also use 3D imaging for procedures of pelvic repair in geriatric patients. It is a procedure we performed with pelvic screws and cementoplasty. I check in the volumetric images, that the implants are in a good position. In spine surgery, particularly with kyphoplasty, sometimes I am not one hundred percent certain with 2D imaging, of the locations where the cement has flown out. I use 3D imaging in order to check that the cement doesn't go toward the spinal nerve and toward the spinal cord canal. It is fairly easy to correct after checking the 3D images. I also use 3D imaging in very complex fractures of the radius. Surgery of the elbow tends to be technically difficult, and 3D imaging provides more information to get a better idea on how to proceed.

The advantage for me to do intraoperative 3D imaging is simply to verify that I have reduced the fracture in an anatomically correct manner and that the screws are not too long. These are decisive advantages for me.

In the past, after doing the post operative CT scan of pelvic screw placement, we actually did have to correct the surgery. Obviously, I would not have to do that anymore, because we can do 3D imaging during the surgery. That's the better solution. I consider that doing intraoperative 3D imaging contributes towards minimizing the cost of the surgery. Revision surgery planned after a CT scan is requested because the patient feels pain costs money. When patients are in the hospital for a certain time it becomes uneconomical.

The goal of OEC 3D, with 3D imaging, is to be able to identify problems immediately and intraoperatively to avoid repeating interventions.

Starting 3D collision check on OEC 3D.

3D acquisition on going at 91% completion, projection images displayed on OEC 3D Touch View and Workstation.

Did OEC 3D require a special setup in the operating room or different set up for each procedure?

By experience I know that you should never start to operate and then look later at how to take X-ray images. Instead, we need to anticipate how to position the C-arm to get the working space needed during the surgery, sometimes you need to compromise in order to get the information you have to get.

For example in 2D imaging, I like to use the retrograde intramedullary nail fixation technique for humerus fracture reduction with freehand tightening. Patient lies in lateral decubitus, and in order to take profile views of his humerus we need to position the X-ray tube and the detector of the C-arm in the rainbow configuration, over the table. However, for this procedure we also need oblique views. We figured out how to position the patient far at the head end of the table and far away from the side of the table in order to do profile and oblique views in a comfortable way. With this setting we just sweep back and forth and move the C-arm along the table to get more anatomical coverage.

For 3D imaging, we didn't encounter major difficulties. For procedures on the lower extremities we had to work more on the patient set up. We are used to positioning the contralateral leg outward and that's a bit tight when working toward the knee. In that case, we prefer to stretch the leg out lengthwise, and we accept the loss of image quality we might get from the attenuation of the X-ray beam from the contralateral leg. But as said, we figure it out before starting the surgery and it is not an issue.

How do you use OEC 3D imaging protocols and acquisition modes during surgery?

When doing 2D imaging, we select the imaging protocol depending on the anatomy. We work on orthopedic or spine imaging profiles. We set up

Dr. König reviewing MPR images on OEC 3D workstation

OEC 3D to low dose mode as it boots up and rarely change the settings as the system adapts automatically in real time. We like the image quality we get with this set up in 2D.

When doing kyphoplasty, we also like to use the C-arm angulation memorization function. Once we identified the hip oblique views, we store the angulation values and recall them. That's valuable for the staff and the learning curve has been relatively quick.

We generally only run one 3D scan per patient for radiation exposure reasons. After reduction of the fracture and securing the osteosynthesis material in place, we run a 3D scan before we do the final osteosynthesis. Sometimes, if the screw lengths have to be verified, we perform another 3D scan. It is also the case if the patient suffers from discitis and we are trying to repair and shape the vertebrae, a second 3D scan can allow us to check whether the bones are in the correct position. The 3D scan is generally performed before the final implant is inserted during the procedure or at the end of the procedure.

We run 3D acquisition in High Definition (HD) mode, and we activate the Metal Artefact Reduction (MAR) function if needed.

"The positioning of the C-arm is fairly easy without dose as we like to use the 2 laser aimers to adjust the C-arm detector over the anatomy of interest."

When we run the 3D acquisition scan, the anesthetist stays in the corner of the room so that he can see the patient, and I usually stay at a safe distance of four meters from the C-arm. I do this because when I run the 3D scan, I always look at the images of projection that are acquired in real time because this loop of images provides me with additional information.

For image review, I like to manipulate the 3D images on the 3D volume viewer of the workstation myself. I know what I am looking for and I can review the information directly using the multi oblique view function without asking anyone.

The large size of 3D volume 19 cm x 19 cm x 19 cm is an advantage for our procedures. In particular it is interesting when we are placing pelvic screws. The 3D volume we had before with our previous C-arm was definitely not sufficient. I am really interested to get volumetric images of the sacrum, to check how the wires are positioned, how the screws could be placed later on during the procedure.

OEC 3D user interface and 3D workflow were new to me and to our team but the learning curve was quite fast as the design is intuitive. Our OR staff are running the 3D collision check, under supervision of surgeons and guided by the 3D Setup Assistant.

The OEC 3D C-arm is rather compact for a 3D C-arm, and its carbon fiber C-arm is a good size for our work. It is the type of design we will need more and more in the future, with an image quality that looks more like that of an intraoperative CT scanner.

OEC 3D C-arm is easy to operate and it is very good quality. These are the reasons why we decided to choose it for our daily practice.

Dr. Steffen König is an orthopedic surgeon specialized in emergency surgery. After completing his medical studies at Humboldt University in Berlin, he specialized as an orthopedic surgeon at Wriezen Hospital. In parallel he spent one year in Frankfurt/Oder to start his specialty in emergency surgery and has been doing emergency surgery exclusively since 1999.
Dr. König worked as a senior physician at Märkisch-Oderland Hospital in Wriezen, at Northwest Hospital in Frankfurt am Main, and at Lahr/Ettenheim Hospital in Baden before joining Märkisch-Oderland Hospital in Strausberg, where he has been Chief Physician and head of the Clinic of Trauma and Reconstructive Surgery since 2008.
Dr. König also completed a Master of Business Administration (MBA) in healthcare management in Dresden. He is Vice President of the Brandenburg State Medical Association and, in line with the position of Medical Director of the hospital, he is also second Chair of the association Marburger Bund Berlin Brandenburg.
He actively contributes to orthopedic and trauma education of his peers as a member of committees and attending conferences of the German Medical Association in the field of the Deutsche Akademie der Ärzte (German Academy of Physicians). Dr König also sits on the administrative committee of the medical pension.

OEC C-arms

GE HealthCare

Make your Surgical Imaging easy with OEC C-arms

Orthopedics, Urology, Pain Management, Spine, Vascular, Cardiac

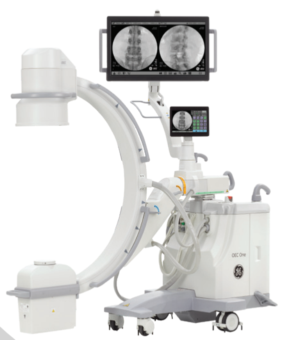
Extremities surgery

OEC MiniView MAX *

General Surgery

OEC One CFD *

OEC One **



Advanced Surgery

OEC Elite CFD *

OEC 3D *

OEC Elite **

Innovation.

Performance.

Intuitiveness.

Reliability.

** CMOS flat panel detector*
*** Image Intensifier*

JB02721UK

The OEC family of mobile C-arms has been used by surgeons for more than 40 years enabling clinical and operational excellence.

More than 35,000 systems installed worldwide remain hard at work close to 15 years after their first procedure.

GE HealthCare

GE HealthCare is a leading global medical technology, pharmaceutical diagnostics, and digital solutions innovator, dedicated to providing integrated solutions, services and data analyeading global medical technologytics to make clinicians more effective, therapies more precise, and patients healthier and happier.

Serving patients and providers for more than 100 years, GE HealthCare is advancing connected and compassionate care, while simplifying the patient's journey across the care pathway.

Make your Surgical Imaging easy: GE HealthCare is dedicated to improving lives during the moments that matter most by providing the imaging guidance platform for diagnostic, interventional and surgical procedures.

Innovation: Leveraging one of the latest imaging technologies such as CMOS flat detectors, advanced features and software enabling stunning image quality while following the ALARA dose principles for patient and staff.

Performance: Providing C-arms with simplified workflows, great anatomical coverage and ergonomic design enabling accurate and smooth positioning.

Intuitiveness: Simplifying user experience while optimizing surgery time.

Reliability: Being a trusted and long-term collaborator building a strong and sustainable relationship.

www.gehealthcare.com/surgical_imaging