

Innovations 2025





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AO ITC Innovations Magazine 2025 – Editorial

We are delighted to present the 2025 AO ITC Innovations Magazine, showcasing the latest pioneering solutions developed across the AO Innovation Translation Center (AO ITC) to improve patient care and outcomes in the musculoskeletal field. Our global network of over 400 expert surgeons continues to guide and support numerous development projects, ensuring that new solutions align with real-world surgical needs. We are grateful for the tireless dedication of our members to advance surgical care.

2025 was very productive for the **AO Technical Commission**, (AO TC) with the approval of important new solutions in Trauma and Spine. Here, we feature the VOLT™ Wrist Treatment System, the VOLT™ Proximal Humerus System, and the Cannulated Headless Screw (Fully Threaded) System, developed in collaboration with our valued and longstanding partner DePuy Synthes. We also present three clinical cases from our expert surgeons, featuring plating with VOLT™ technology. Such examples of clinical usage form an essential part of the AO TC's quality monitoring process for new solutions once they reach the clinical setting.

Newly approved solutions in Spine include the TriALTIS™ Spine and Revision Systems, and the Viper Prime™ TLIF Retractor. The approval of the CMORE® CervicoThoracic system marks the culmination of the AO TC's first off-ramp project with icotec AG and promises better treatment for patients with spinal tumors. Remarkably, this new solution was developed from concept to market launch in only six years. Another exciting development is the announcement of a new partnership between the AO and TeDan Surgical Innovations, Inc. to co-develop next-generation solutions for surgical access systems in the cervical spine.

In CMF, surgeons from the Temporomandibular Joint Task Force have published a new review on TMJ replacement, offering valuable guidance and perspectives in a challenging surgical area.

Our news items encompass the inspiring work done by our expert surgeons as global ambassadors for innovation, our latest Meet the Expert sessions, recent Expert Symposia and the Innovation Prize 2026.

AO Innovation Funding continues to support inventors with funding and expertise, bringing innovative solutions in trauma and orthopedics from concept phase to market. Here we report on successful projects encompassing transformative surgical products such as the Distal Radius Intramedullary Nail (DRIM-Nail) and Biphasic Plate, advanced approaches to surgical education via short surgical videos, and new tools to enhance the uptake of AO-generated clinical research.

Several key papers were published by **Clinical Evidence**, reinforcing the value of new solutions developed by the AO ITC. A new study published in Spine Deformity shows promising outcomes for the modern Luque trolley technique in early-onset scoliosis management. We also feature an update on the FROST (Fracture-Related Outcome Study for operatively treated Tibia shaft fractures) Registry, which is the largest registry of its kind worldwide. With over 1,000 patients enrolled, primary results will be published in mid-2026. The pioneering Fracture Monitor project is also highlighted, with the recent publication of the clinical study protocol in BMJ Open.

The AO TC's partnership with the **AO Research Institute** has yielded important preclinical data supporting the efficacy of new surgical developments. A biomechanical study investigating the performance of the Advanced Reaming System highlights the potential of the novel reaming system to reduce surgical effort and enhance performance and efficiency during intramedullary reaming. The spotlight is also on SpineFusion, a project to translate AO's technology for fracture healing monitoring (AO Fracture Monitor) into a novel approach to address spinal fusion. Biomechanical and preclinical studies have proven the monitoring system to provide a reliable and objective measure of spinal fusion progression, an advance that could be transformative for spine patient care.

In 2025, the **AO Spine Knowledge Forums** generated more high-quality evidence around major spinal pathologies than ever before, with over 80 manuscripts and close to 100 abstracts submitted for publication. The mission of the AO Spine Knowledge Forums is to translate clinical research into practical tools and treatment recommendations for spine surgeons worldwide. True to this aim, achievements included publication of the AO Spine Primary Infection Classification System and clinical practice recommendations released via the Global Spine Journal for the management of disorders including degenerative spondylolisthesis and acute traumatic spinal cord injury.

Special Focus Issues in the Global Spine Journal reported on topics ranging from personalization in spinal oncology to adult spine deformity (ASD). Furthermore, results were published from two landmark studies: Scolio-RISK, a large multicenter adult deformity clinical study which significantly advances the understanding of neurologic complications in complex ASD surgery, and a further large multicenter clinical study, comparing surgical and non-surgical approaches in thoracolumbar burst fractures.

Read on to discover advanced surgical technologies, new offerings for surgeon education, and cutting-edge clinical evidence that can elevate your daily clinical practice.



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VOLT™ Proximal Humerus Plating System

Approved by the AO Technical Commission in 2024, the VOLT™ Proximal Humerus Plating System addresses complex fractures of the proximal humerus. The newly designed plate holes feature locking with Variable Angle Optimized Locking Technology (VOLT™) which allows improved screw positioning (Fig 1) and improved flexibility in plate placement.

Enhanced design features of the plates include elongated combi holes, which aid in plate positioning and accept both locking and cortex screws, and limited-contact undercuts on

the plate shaft. The redesigned suture holes around the proximal end allow the rotator cuff muscles to be more easily secured to the plate after implant insertion (Fig 2).

With an expanded implant selection, the VOLT™ Proximal Humerus Plating System offers a range of plate lengths to address a wider range of patients and fracture situations. The system includes 3.5 mm VOLT™ locking screws which feature an atraumatic tip (Fig 3) designed to reduce the risk of soft-tissue irritation compared to locking compression plates.

Instrumentation has been improved with new, streamlined guide blocks addressing both deltopectoral and deltoid split approaches. A new length probe facilitates three different techniques for precise measuring.

System overview: plates and screws

VOLT™ Proximal Humerus Plates are available in short (3 and 5 hole) and long (5, 6, 7, 8, 9, 10, 11, 12, and 13 hole) versions (Fig 4). All plate lengths are available in stainless steel and titanium and are compatible with VOLT™ 3.5 mm locking screws, 3.5 mm cortex screws and 4.0 mm cancellous screws. All implants feature 3.5 mm VOLT™ locking and combi-holes.



Fig 1 The VOLT™ Proximal Humerus Plate (short) with new VOLT™ Locking Technology



Fig 2 Redesigned suture holes



Fig 3 New VOLT™ 3.5 mm locking screws with atraumatic tip



Fig 4 VOLT™ Proximal Humerus Plates are available in short (3 and 5 hole) and long (5-13 hole) versions.

System overview: instruments

The VOLT™ Proximal Humerus instruments include guide blocks, a length probe, a triple trocar, an outer sleeve for guided screw insertion, and 3- and 12-hole sizing templates. The streamlined guide block design is available in both a standard and short size (Fig 5), addressing both deltopectoral and deltoid split surgical approaches. The length probe offers versatility and precision with three measuring techniques: guide block (nominal angle), threaded drill guide (nominal angle), and locking drill guide (free hand, variable angle), depending on anatomic requirements.

Features and benefits

The design features of the new VOLT™ Proximal Humerus Plating System offer many benefits to both patients and surgeons:

- Precision locking with VOLT™ Variable Angle Optimized Locking Technology allows improved calcar screw positioning, more adjustability in plate placement (which is especially critical in smaller patients), and increased overall construct stability.
- The new length probe facilitates easier measurement of proximal screws and reduces the risk of screw penetration when bone quality is poor.
- The risk of interference with the axillary nerve is reduced when using the short guide block with the deltoid split approach.

- The new system is compatible with the VOLT™ Small Fragment platform of instruments with identical color-coding and a platform design approach. The ease of use facilitates training and adoption by surgeons and ORP, making instrument identification intuitive and reducing surgical delay.

Indications (US)

- The VOLT Proximal Humerus Plating 3.5 System is indicated for internal fixation of proximal humerus fractures in adults and adolescents (12–21 years) where growth plates have fused.
- VOLT Proximal Humerus Plates are indicated for fractures of the proximal end segment of the humerus.
- VOLT Proximal Humerus Plates, Long are indicated for fractures of the proximal end segment and/or diaphyseal segment of the humerus.

Indications (EU)

- VOLT Proximal Humerus Plates are indicated for internal fixation of fractures of the proximal end segment of the humerus.
- VOLT Proximal Humerus Plates, Long are indicated for internal fixation of fractures of the proximal end segment and/or diaphyseal segment of the humerus.

Contraindications

- No contraindication specific to these devices.



Fig 5a–b Streamlined guide blocks (a) standard and (b) short size

Clinical case, VOLT™ Proximal Humerus Plating System: proximal humerus fracture

Case kindly provided by Harry Hoyen MD, Metro Health Medical Center, Department of Orthopaedic Surgery, Cleveland, Ohio, US.

A 24-year-old woman presented to the emergency room following a motor vehicle accident. X-rays on the day of admission (**Fig 1a-c**) showed a fracture to the proximal humerus. There was some varus displacement of the humerus with involvement of the surgical neck and greater tuberosity.

The patient was treated with open reduction and internal fixation (ORIF). First, the fracture was reduced (**Fig 2a-b**). There was an attempt at closed reduction with continued displacement. Then an open reduction through a deltopectoral approach was performed. After direct reduction, a 1.6 mm K-wire was placed along the anterolateral humeral surface. The provisional plate placement and reduction are depicted in **Fig 3**.

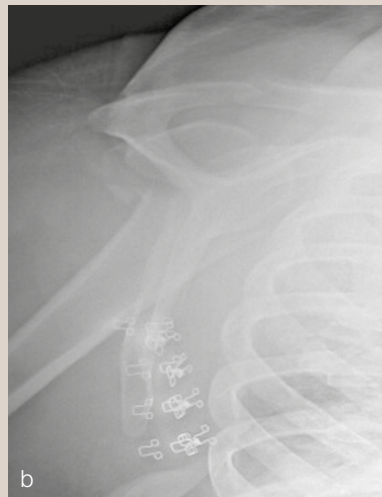


Fig 1a-c X-rays on the day of admission showing the fracture to the proximal humerus (**a**) anterior-posterior; (**b**) lateral; and (**c**) axial projections.

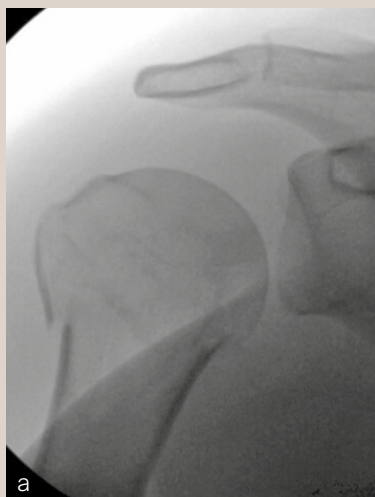


Fig 2a-b Intraoperative closed reduction of the fracture (**a**) lateral view and (**b**) anterior-posterior view.



Fig 3 Temporary K-wire placement with provisional plate alignment.

Definitive fixation was performed with a 3-hole VOLT™ Proximal Humerus plate (Fig 4). The plate was placed just beneath the rotator cuff insertion to directly support the greater tuberosity component. The proximal screws were angulated toward the superior head to maximize length. The calcar screws were placed in a slightly splayed trajectory. One of the angular stable variable angled screws in the central portion was angulated in a posterior and more central position. This permitted maximal screw spread within the humeral head.

The patient was managed with sling immobilization for 2-3 weeks postoperatively. Early motion was permissible as the fracture was stable after fixation.

Three months after surgery, the patient had good elevation in the scapular plane to 130°. External rotation was measured at 30°, with more limited internal rotation (to the belt line). X-ray imaging (Fig 5) showed maintenance of fracture alignment and no change in screw position. The axial view (Fig 5c) highlights the subchondral position of the variable angular screws in the humeral head. The patient was progressing nicely with functional tasks and adding weight in her therapy program.

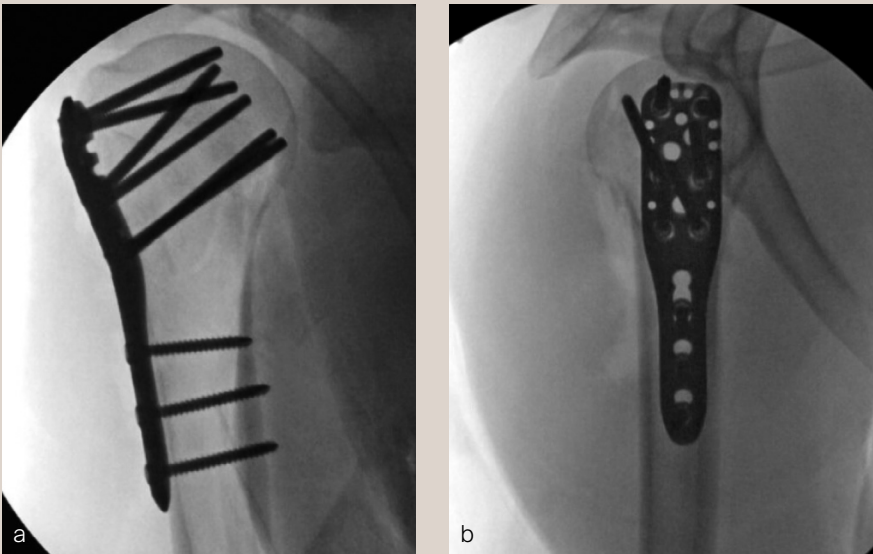


Fig 4a-b X-rays showing the VOLT™ Proximal Humerus plate in situ (a) antero-posterior view and (b) lateral view.

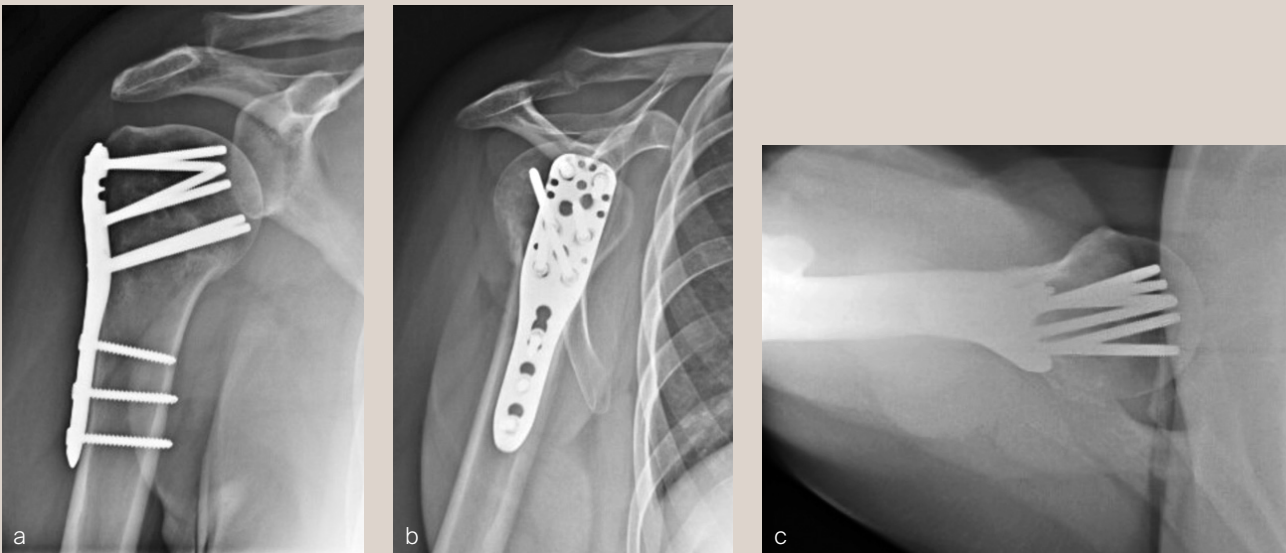


Fig 5a-c X-rays at 3 months postoperative showing timely fracture healing in the (a) anteroposterior; (b) lateral; and (c) axial views.

VOLT™ Wrist Treatment System

VOLT™ Two-Column Distal Radius Plate

The VOLT™ (Variable Angle Optimized Locking Technology) Wrist Treatment System is a comprehensive plating solution designed to address the entire spectrum of wrist fractures. Comprising standard volar and dorsal fixation for basic fractures, specialized plating options for more complex fractures, dedicated implants for elective procedures, and wrist-specialized instrumentation, the plating system allows fixation of very distal wrist fractures without invading articular space or causing postoperative soft-tissue concerns.

VOLT™ technology allows for the design of low-profile plates without compromising stability or locking strength. The enhanced design of the new system facilitates the entire surgical procedure, aiding fracture reduction, plate placement, and screw insertion. All instruments within the VOLT™ Wrist Treatment System have been re-designed to provide surgeons the same user experience across all VOLT systems, and ultimately to allow the streamlining of inventory.

The VOLT™ Two-Column Distal Radius Plate - standard (Fig 1) and rim (Fig 2) versions - build on the heritage of the well researched LCP and VA-LCP predecessors, with enhanced design features that allow Variable Angle Optimized Locking Technology (VOLT™) to be combined with a pre-contoured plate refined through extensive anatomic research. The plate addresses the clinical need for fixation of small and very distal bone fragments, while keeping the plate profile distanced from the path of the flexor pollicis longus (FPL) tendon.

Design features of VOLT™ Two-Column Distal Radius Plate

The VOLT™ Two-Column Distal Radius Plate is low profile and features rounded edges in the proximity of the flexor pollicis longus (FPL) tendon. Markings are incorporated in the shaft region to help with plate adjustment (Fig 2), and in the distal plate to indicate nominal screw direction. The plate fits a wide range of radius anatomies and offers more distal placement on the ulnar side and better targeting of the radial styloid than its predecessors.

The VOLT™ screw holes are threaded and accept either 2.4 mm or 2.7 mm cortex or locking screws in any hole. VOLT™ screw holes have a 30° cone of angulation with locking screws (Fig 3). The radial screw holes are more steeply angled to direct the screw towards the styloid tip, allowing the capture of distal bone fragments (Fig 2). The additional VOLT™ Two-Column Distal Radius Rim plate version (Fig 2) features low profile ulnar and radial extensions to help control distal fragments while avoiding the region of the FPL tendon.

The system includes radiolucent guide blocks that feature safe screw angles directing implants and instruments away from the wrist joint for sequential drilling and screw insertion. Built-in 1.6 mm K-wire holes indicate the approximate trajectory of the adjacent distal ulnar and radial screws to assist with plate placement using reference K-wires (Fig 2).

The system is fully compatible with the VOLT™ Mini Fragment Plating System, and its modular design allows the system to be either self-contained or used as an add-on to the existing system.



Fig 1 The VOLT™ Two-Column Distal Radius Plate.



Fig 2 Features of the VOLT™ Two-Column Distal Radius Plate (Rim version shown).



Fig 3 VOLT™ screw holes have a 30° cone of angulation with locking screws.

Two-Column Plate screw angle overview

The VOLT™ Two-Column Distal Radius Plate and Two-Column Distal Radius Rim Plate provide various locking screw options in the plate head:

- Radial screws for the radial column
- Ulnar screws for the intermediate column

Screw placement can be planned according to the screw angle overview (Fig 4). Both the Two-Column Distal Radius Plate and the Two-Column Distal Radius Rim Plate feature identical screw angles. Reference for the angles given is relative to the plate shaft with screw angulation of 0°.

Indications

The VOLT™ Wrist Treatment System includes distal radius, forearm, and fragment-specific plates, which are indicated for

fixation of fractures, fusions, nonunions and malunions, or osteotomies of the radius, ulna, and hand.

The VOLT™ Wrist Treatment System is not for spinal use.

Contraindications

The VOLT™ Wrist Treatment System has the following contraindications:

- Infection.
- Patient conditions including blood supply limitations, obesity and insufficient quantity or quality of bone.
- Patients with mental or neurologic conditions who are unwilling or incapable of following postoperative care instructions.
- Foreign body sensitivity. If material sensitivity is suspected, testing is required prior to implanting the device.

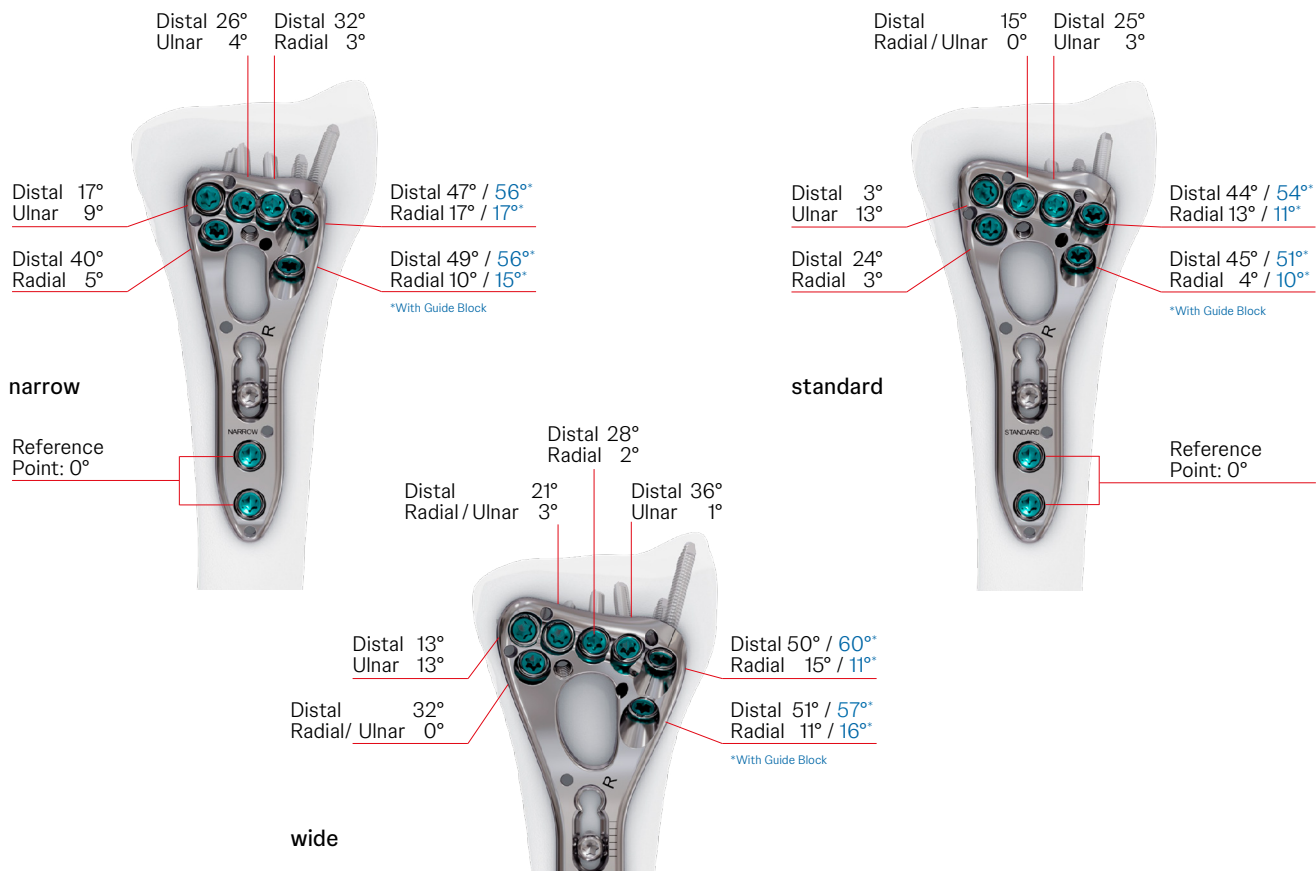


Fig 4 Screw angle overview for the Two-Column Distal Radius Plate and Two-Column Distal Radius Rim Plate.

Clinical case, VOLT™ Wrist Treatment System, Two-Column Distal Radius Plate: complex wrist fracture
Case kindly provided by Amy Speeckaert, Department of Orthopaedic Surgery, Ohio State University

A 60-year-old woman fell on ice from standing height and sustained an injury to the right wrist. Upon admission to the hospital, x-rays revealed a comminuted, intraarticular distal radius fracture with significant dorsal translation and angulation (Fig 1).

The patient's previous medical history included:

- Type 2 diabetes treated with oral medication
- Obesity

The distal radius fracture was treated with open reduction and internal fixation through a volar Henry Approach, using a VOLT™ Two-Column Distal Radius plate. At the 6-week follow-up, x-rays demonstrated a healed fracture (Fig 2). The patient's pain had resolved and she was regaining range of motion with occupational therapy.



Fig 1a-b On the day of hospital admission, these x-rays show the distal radius fracture: (a) anteroposterior and (b) lateral views.



Fig 2a-b At the 6-week follow up, these x-rays show healing of the distal radius following fracture fixation: (a) anteroposterior and (b) lateral views.

VOLT™ Volar and Dorsal Distal Radius Plates

Approved by the AO Technical Commission in September 2025, the VOLT™ Volar and Dorsal Distal Radius Plates were developed by members of the Hand Expert Group as a complementary extension to the [VOLT™ Wrist Treatment System](#), in collaboration with J&J Medtech.

Encompassing low-profile dorsal and volar plates and a variety of wrist spanning plates ([Fig 1](#)), the new implants broaden the existing platform of VOLT™ Two-Column Distal Radius Plates, allowing treatment of a wide spectrum of fractures. The plating system is fully compatible with the [VOLT™ Mini Fragment Plating System](#). The modular design allows the system to be either self-contained or used as an extension to the VOLT™ Mini Fragment Plating System.

a

b

c

Fig 1a-c VOLT™ Wrist Treatment System: (a) the extra-long VOLT™ Two-Column Plate, (b) the VOLT™ Dorsal Plate, and (c) the Wrist Spanning Plate.

Extra-long VOLT™ Two-Column Plate

The extra-long VOLT™ Two-Column Plate (Fig 2) is tapered with a narrowed proximal end and is available in various head widths and shaft lengths (Fig 3). The VOLT™ screw holes are threaded and accept either 2.4 mm or 2.7 mm screws in any hole. An overview of the VOLT screw portfolio is shown in Fig 4. 1.6 mm Kirschner wire (K-wire) holes enable preliminary fixation with 1.25 mm and 1.6 mm K-wires.

The head design is identical to that of the VOLT™ Two-Column Plate, providing compatibility with the VOLT™ Two-Column Plate Guide Block. All plates can be bent out-of-plane (flexion-extension). The 14-hole plate can be bent out-of-plane and in-plane at bending notches. The plates feature undercuts (Fig 2) designed to reduce plate-to-bone contact.



Fig 2a–b Extra-long VOLT™ Two-Column Plate: (a) standard and (b) rim versions.

VOLT™ Dorsal Plate

Designed for use in the radial and intermediate column, the VOLT™ Dorsal Plate (Fig 1b) is anatomically pre-contoured, reducing the need for bending in the OR. The plate is low-profile (1.7 mm) with rounded edges and polished surfaces.

The plate features 1.6 mm K-wire holes that enable preliminary plate fixation with both 1.25 mm and 1.6 mm K-wires. Undercuts and bending notches assist in contouring the plate while preserving locking holes. VOLT™ variable angle screw holes allow for up to 15° of off-axis angulation and accept 2.4 mm and 2.7 mm locking and cortex screws.

VOLT™ Wrist Spanning Plate

The VOLT™ Wrist Spanning Plate (Fig 1c) is designed for the

temporary fixation of highly comminuted distal radius fractures and allows load to be reduced across the wrist joint. The narrow plate profile features a tapered and rounded tip to facilitate insertion and to minimise soft-tissue disruption. VOLT™ Variable Angle Screw Holes allow 15° of off-axis angulation and accept 2.4 mm and 2.7 mm locking and cortex screws. 1.6 mm K-wire holes enable preliminary plate fixation with 1.25 mm and 1.6 mm K-wires.

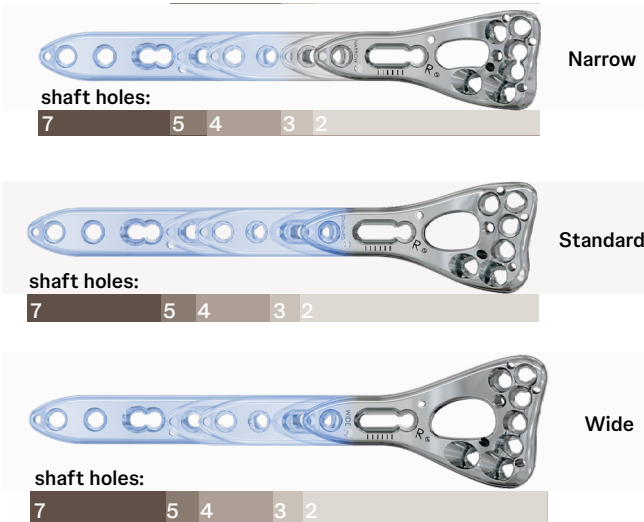
The VOLT™ Wrist Spanning Plate is available in different versions:

- Standard 170 mm (with/without middle holes)
- Extra-long 210 mm for metaphyseal comminution

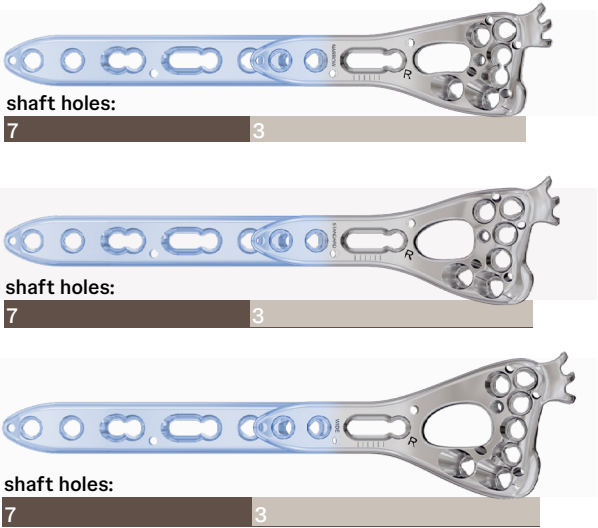
Elongated screw holes allow 7 mm of adjustment for accurate plate placement and distraction adjustment. A dedicated handle assists with insertion of the plate.

Volar Distal Radius Plates

Two-Column Plates



Two-Column Rim Plates



Overview: plate options

Fig 3 Portfolio of VOLT™ Volar Distal Radius Plates, showing available plate lengths and widths.

Screws for use with the VOLT™ Volar and Dorsal Distal Radius Plates

Screws for use with the VOLT™ Volar and Dorsal Distal Radius Plates come in length increments of 1 mm up to 20 mm, and in length increments of 2 mm up to a length of 30 mm. Locking buttress pegs and cannulated locking screws may be used according to surgeon preference or fixation requirement. An overview of screw options is shown in Fig 4.

Indications

The VOLT™ Wrist Treatment System includes distal radius, forearm, and fragment-specific plates, which are indicated for fixation of fractures, fusions, nonunions and malunions, or osteotomies of the radius, ulna, and hand.

The VOLT™ Wrist Treatment System is not for spinal use.

Contraindications

The VOLT™ Wrist Treatment System has the following contraindications:

- Infection.
- Patient conditions including blood supply limitations, obesity and insufficient quantity or quality of bone.
- Patients with mental or neurologic conditions who are unwilling or incapable of following postoperative care instructions.
- Foreign body sensitivity. If material sensitivity is suspected, testing is required prior to implanting the device.

Screw Options

	VOLT™ 2.0mm ●		VOLT™ 2.4mm ●	
Screw Size and Type	2.0 Cortex 	2.0 Locking 	2.4 Cortex 	2.4 Locking 
Screw Length	6-20 (1mm increments) 22-26 (2mm increments)		6-20 (1mm increments) 22-30 (2mm increments)	
Driver Size / Type	T6 	T6 	T8 	T8 

	VOLT™ 2.7mm ●			
Screw Size and Type	2.7 Cortex 	2.7 Locking 	2.7 Locking Buttress Peg 	2.7 Cannulated Locking 
Screw Length	6-20 (1mm increments) 22-30 (2mm increments)		10-26 (2mm increments)	10-30 (2mm increments)
Driver Size / Type	T8 	T8 	T8 	T8 

Fig 4 Portfolio of screw options for the VOLT™ Volar and Dorsal Distal Radius Plates.

Cannulated Headless Screw (Fully Threaded) System

Developed by members of the Hand Expert Group and Foot and Ankle Expert Group and approved by the AO Technical Commission in September 2025, the Cannulated Headless Screw (Fully Threaded) System (Fig 1) is indicated for use in bone reconstruction, osteotomy, arthrodesis, joint fusion, fracture repair, and fracture fixation of bones appropriate for the size of the device (Fig 4). The initial product launch in 2025 will focus on hand and wrist procedures. The new system was developed as a line extension to the Cannulated Compression Headless Screw (CCHS) System, approved in 2019 with indications for the foot and ankle. The use of cannulated screws follows the principles of interfragmentary screw fixation and aims to optimize screw position.

The new screw design incorporates a patented self-tapping, self-drilling screw tip that allows for precise placement. The screw cannulation feature allows placement over a guidewire to facilitate better accuracy before drilling or screw insertion (Fig 2).

Containing a comprehensive range of implants, the system is engineered to meet the needs of patients with diverse anatomy. The initial product launch in 2025 will focus on hand and wrist procedures (screw diameters 2.0–4.5 mm).



Fig 1 The Cannulated Headless Screw System - Fully Threaded

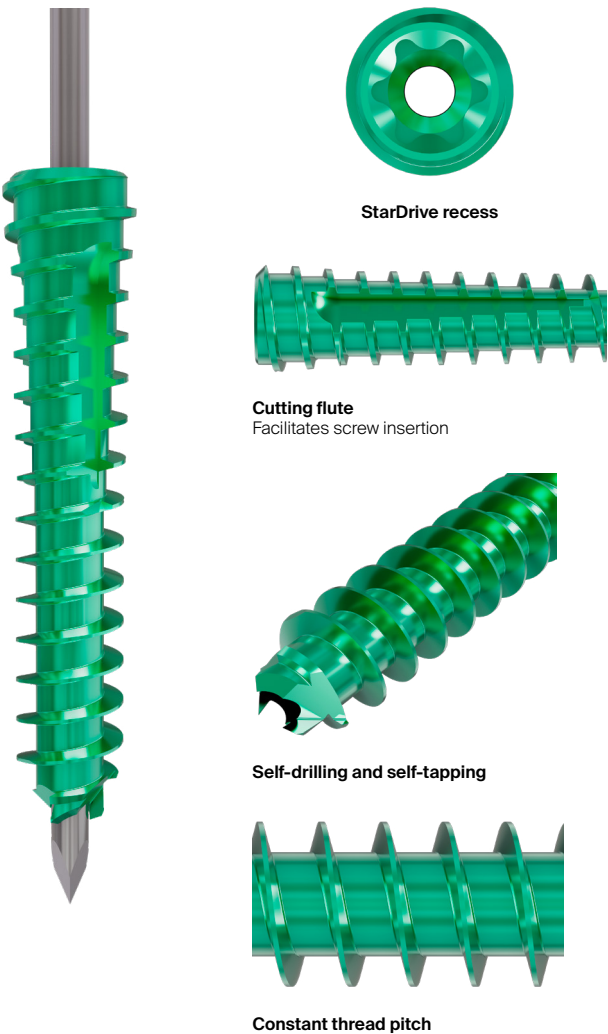


Fig 2 Design features of the Cannulated Headless Screw - Fully Threaded

System overview

The Cannulated Headless Screw (Fully Threaded) features a constant thread pitch and is fully threaded with a non-compressive screw design. With self-drilling and self-tapping elements (Fig 2), the cutting tip design is identical to that of the CCHS. Screws are available in a range of diameters (2.0, 2.5, 3.0, 3.5, 4.0, and 4.5 mm) and in lengths from 10 mm–110 mm (Fig 3). Screws are manufactured in titanium alloy (Ti-6Al-4V ELI) and are cannulated for use with a guide wire.

For ease of handling, the screws are color-coded to the instrumentation in a schema identical to that of the CCHS (Fig 3). The new system is available in sterile and non-sterile implant and instrument packaging options and is provided in modular sets. A significant advantage for hospital inventory management is the similar geometry of the new screws and the CCHS, offering compatibility with the CCHS screw racks, graphic cases, and instrumentation.

Implant size and instrumentation overview

	2.0 	2.5 	3.0 	3.5 	4.0 	4.5 
Guide wire (Ø mm/L mm)	Ø 0.8 / L100	Ø 1.1 / L150		Ø 1.4 / L 150		Ø 1.6 / L 220
Guide wire tip type	Single trocar or double trocar	Single trocar, double trocar		Single trocar, double trocar		Single trocar
Cann drill bit (Ø/L)	Ø 1.6 / L 100	Ø 2.0 / L 150		Ø 2.7 / L 150		Ø 3.0 / L 220
Cann countersink	✓	✓		✓		✓
Drill guide (Ø)	Ø 0.8 / Ø 1.6	Ø 1.1 / Ø 2.0		Ø 1.4 / Ø 2.7		Ø 1.6 / Ø 3.0
Tissue protector/wire sleeve (Ø)	N/A					✓
Direct measuring device (L)	L 100	L 150				L 220
IM sizing template (L)	L 70					
Cann screwdriver shaft (stardrive)*	T6	T8		T15		
Cann handle	Small handle with jeweler cap (Standard AO coupling)			Large ratcheting handle (Standard AO coupling)		
Implant lengths (L increments)	10-50 mm (2 mm)	10-60 mm (2 mm)	10-60 mm (2 mm)	14-60 mm (2 mm) 65-75 mm (5 mm)	14-60 mm (2 mm) 65-75 mm (5 mm)	16-50 mm (2 mm) 55-110 mm (5 mm)

All Screws, Guide Wires, Drill Bits and Countersink are also available sterile packaged.

* Solid Screwdrivers are also available.

Fig 3 Range of implants and instruments included in the Cannulated Headless Screw (Fully Threaded) System.

Features and benefits of the new Cannulated Headless Screw (Fully Threaded) System

- **Unique angled cutting tip:** increased sharpness at the screw tip may reduce surgeon effort to achieve screw insertion, allowing better final screw alignment.
- **Stiffer guidewire (CoCr):** may reduce guidewire deflection during screw insertion, allowing the surgeon to better judge screw depth and trajectory, and ultimately place the screw more accurately.
- **Comprehensive options:** the extensive range of screw diameters and lengths in the new Cannulated Headless Screw (Fully Threaded) System addresses the complexity and unforeseen challenges in surgical procedures arising from varying patient anatomy.
- **Broadened portfolio:** previously, only cannulated compression headless screws were offered. This line extension introduces fully threaded, constant pitch headless screws that are non-compressive.

Indications in EU and US

The Cannulated Headless Screw (Fully Threaded) System is indicated for use in bone reconstruction, osteotomy, arthrodesis, joint fusion, fracture repair, and fracture fixation of bones appropriate for the size of the device. Screws are intended for single use only.

Contraindications

The implant should not be used in a patient who has current, or who has a history of:

- Local or systemic acute or chronic inflammation;
- Active infection or inflammation;
- Suspected or documented metal allergy or intolerance



Fig 4 The new Cannulated Headless Screw (Fully Threaded) System offers comprehensive options for surgical procedures in the wrist and hand.

Clinical case, VOLT™ Mini Fragment and Small Fragment Plating Systems: complex ankle fracture

Case kindly provided by Andrew Sands, MD, New York Downtown Orthopaedic Associates, US

A 22-year-old woman presented to the emergency department having sustained a trimalleolar fracture with syndesmosis disruption. The fracture occurred when she slipped on a patch of ice and twisted her ankle while getting out of a taxi (Fig 1).

The patient underwent open reduction and internal fixation (ORIF) surgery once the soft-tissue swelling had reduced sufficiently (Fig 2).

The surgery was uneventful and performed on an ambulatory basis. At the 2-week postoperative follow-up, the splint was removed and the wounds assessed. The patient was then placed into a controlled ankle motion (CAM) boot and was advised to maintain non-weight bearing and start to gently increase range of motion in her ankle and hindfoot.

At the 6-week postoperative follow-up, the patient reported no pain and was advised to start progressive weight bearing with formal physiotherapy, and progressed from the CAM boot to a cushioned heel, rocker bottom shoe. X-rays taken at this time (Fig 3) showed good position of hardware and the fracture with signs of early healing.

At subsequent follow-up visits, the patient was doing well with full weight bearing and normal gait. The treatment plan is to remove the syndesmosis screws at 6 months postoperative or when convenient for the patient. As the screws are 4.0 mm, they are less likely to break. However, should screw breakage occur, the evidence [1] shows there is no disadvantage if they are removed from medial and lateral aspects of the ankle, or if the screw fragments are left in place.

Reference

Schepers, T. [To retain or remove the syndesmotic screw: a review of literature.](#) *Arch Orthop Trauma Surg* (2011) 131:879–883.



Fig 1a–c Preoperative x-rays show trimalleolar fracture with syndesmosis disruption to the left ankle (a) anterior view; (b) mortise view; (c) lateral view.

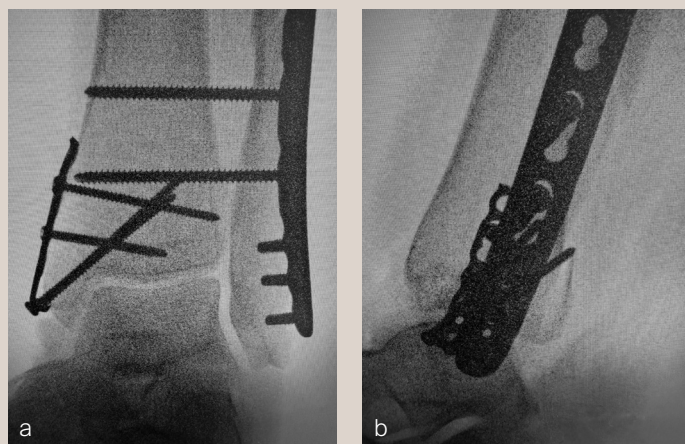


Fig 2a–b Intraoperative image intensifier views show (a) anterior and (b) lateral views of the fracture fixation with the hook plate medially and the metaphyseal plate laterally. The syndesmosis was addressed with 4.0 mm screws.



Fig 3a–b X-rays at 6-week follow-up show (a) anterior and (b) lateral view of the left ankle. The hardware and fractures are well positioned.

Clinical case, TRUMATCH™ Graft Cage – Long Bone: nonunion/malunion of the distal humerus

Case kindly provided by Brent Norris MD, Orthopedic and Trauma Service of Oklahoma, US

A 35-year-old male was admitted to the hospital in July 2022 with instability of the left elbow. He had a previous ORIF of the left distal humerus in January 2022 and no relevant medical history. He was positive for tobacco use (vaping).

Patient examination revealed a healed incision on the left upper extremity, with varus alignment of the elbow and an elbow range of motion of 90–120°. X-rays revealed a nonunion/malunion of the distal humerus and implant failure (Fig 1).

Following metabolic, endocrine, and infectious lab work to determine the cause of the failure of fracture healing, the

patient was found to have a Vitamin D deficiency. The patient was advised to start Vitamin D supplementation and to stop smoking.

By August 2022, the patient tested negative for nicotine. Revision surgery was planned in September 2022 with the aims of removing the existing hardware, taking deep cultures for possible chronic infection, and repairing the nonunion/malunion.

In the first stage, the distal humerus was debrided and devitalized bone was resected, leaving an 8 cm defect into which a cement spacer was placed. New plates were inserted to stabilize the fracture (Fig 2 and Fig 3). Cultures taken in the OR were negative.

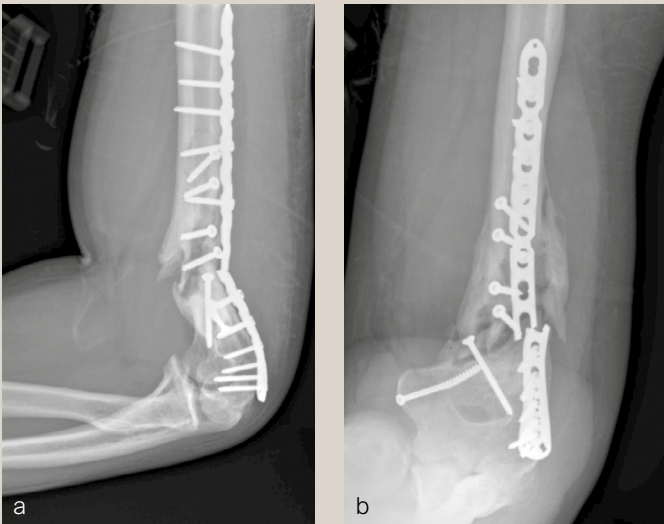


Fig 1 Lateral (a) and anterior (b) x-rays of the distal humerus showing nonunion/malunion and implant failure.

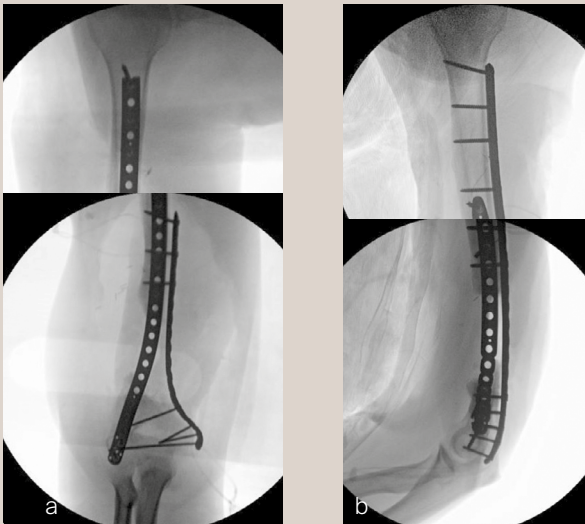


Fig 2 Posterior (a) and lateral (b) x-rays of the distal humerus following debridement and resection of devitalized bone, and fixation with new hardware.

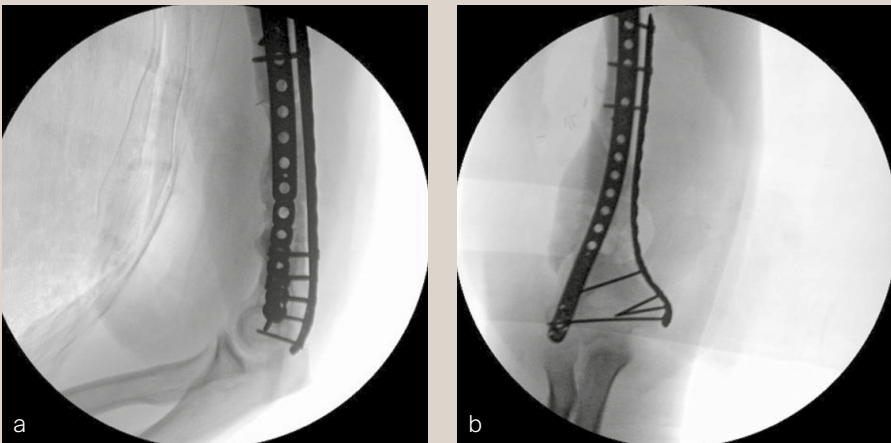


Fig 3 Lateral (a) and posterior (b) x-rays of the distal humerus, showing the 8 cm bone defect filled with a cement spacer.

In October 2022, planning began for the second stage of surgery. A graft cage was planned (Fig 4) to allow the formation of new bone in the 8 cm defect.

The second stage of surgery took place in October 2022. The cage was inserted (Fig 5 and Fig 7) and filled with ~20 cc autograft obtained by RIA of the femur, 30 cc allograft and 3 cc BMAC.

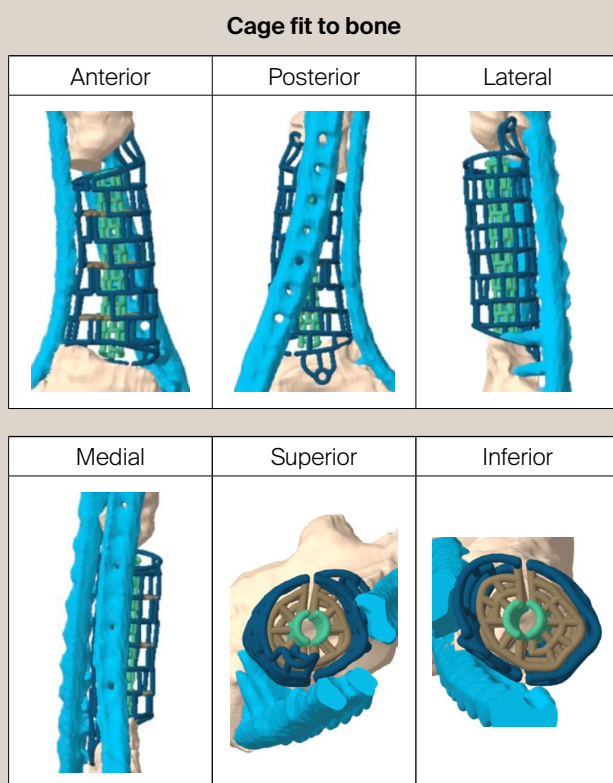


Fig 4 Planning of the humeral graft cage. The graft cage (outer mesh, dark blue; interstitial shelves, brown; and inner mesh, green) is seen in situ within the bone defect alongside the planned hardware (light blue).

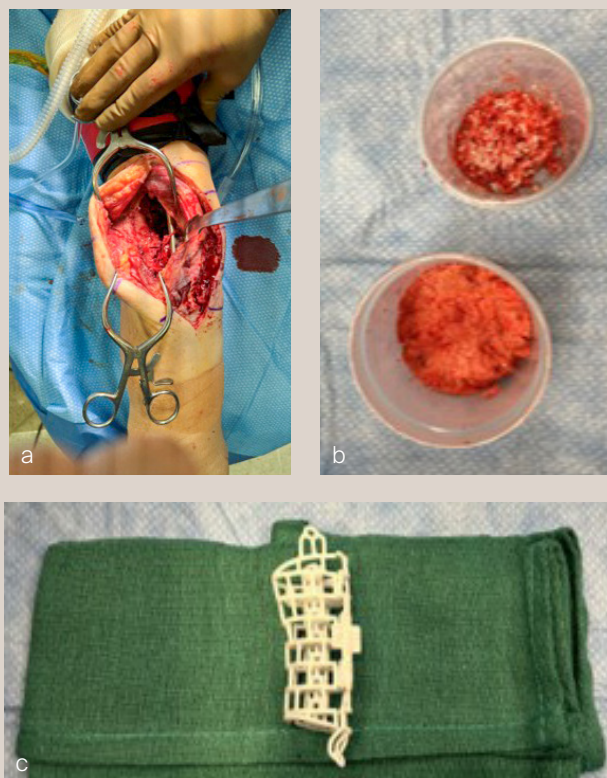


Fig 5 Intraoperative images showing (a) the bone defect following debridement and removal of fragments; (b) autograft and BMAC ready for filling the graft cage and (c) the customized graft cage ready for insertion into the bone defect.

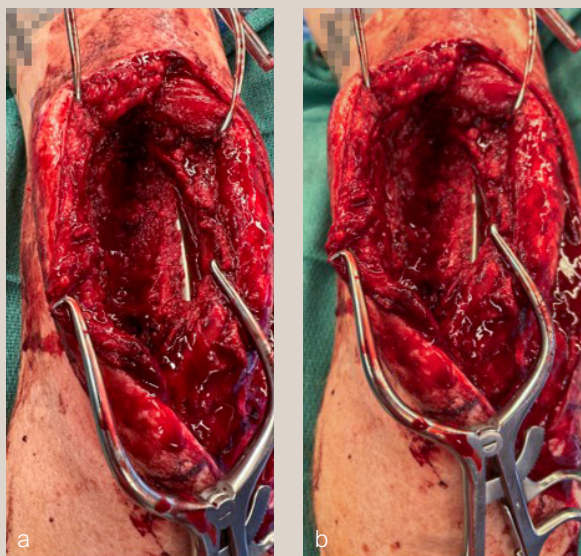


Fig 6 Intraoperative images showing the bone defect, prior to insertion of the graft cage.

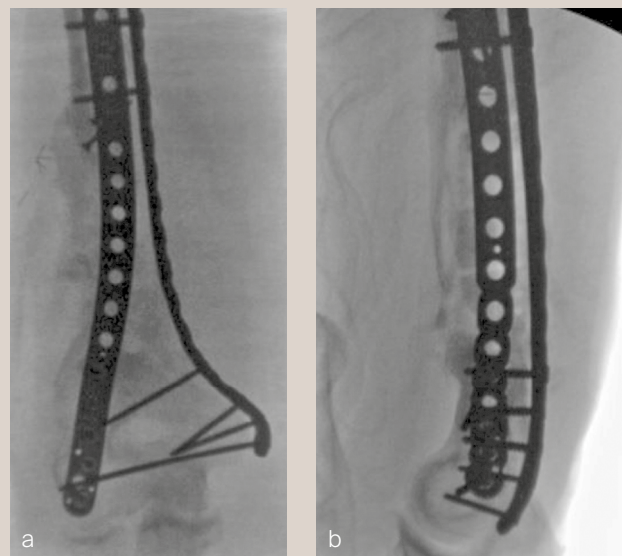


Fig 7 Intraoperative x-rays of the (a) posterior and (b) lateral aspects of the distal humerus, showing plates on the medial and lateral aspects of the humerus and the filled graft cage in situ.

Healing progressed well over the following 9 months (Fig 8-12). The patient's pain was well controlled in the early postoperative phase, and he was weaned off the prescribed narcotics after four

weeks. He remained smoke free for the first four weeks and then admitted to re-starting vaping. His elbow ROM improved significantly to 20-125° and good supination/pronation.



Fig 8 Anterior (a) and lateral (b) x-rays of the distal humerus at 3 weeks postop. The graft material is retained in the graft cage and there is no sign of graft resorption.

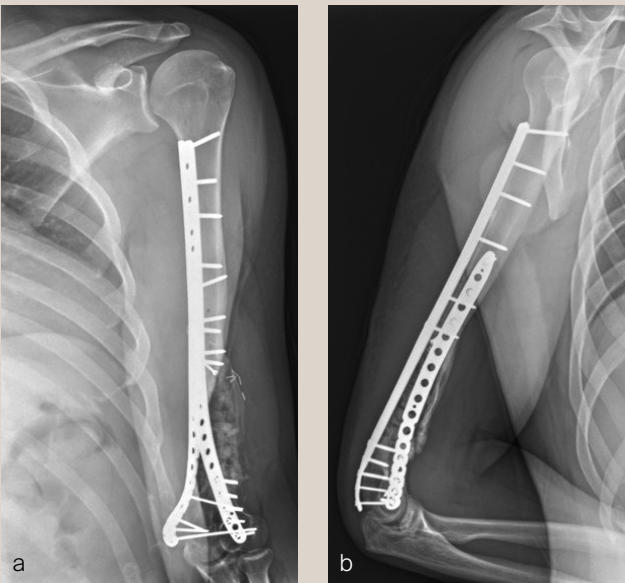


Fig 9 Anterior (a) and posterolateral (b) x-rays of the distal humerus at 7-8 weeks postoperative. Graft consolidation appears to be occurring between the ledges of the graft cage, with some formation of bridging callus along the edges.

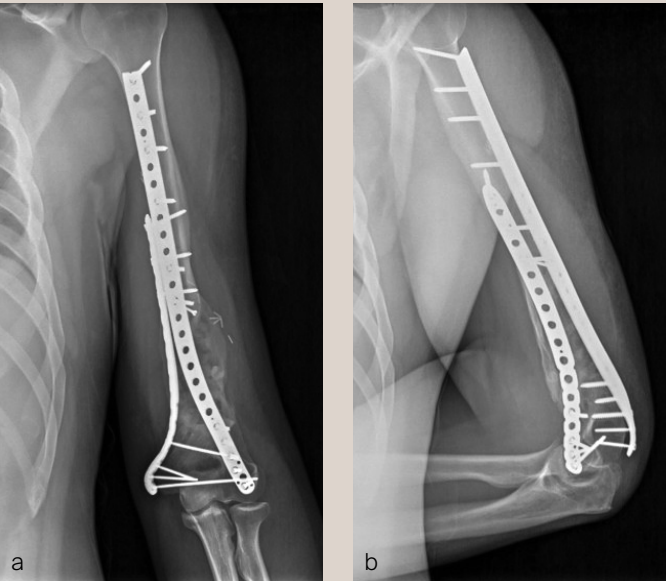


Fig 10 Anterior (a) and posterolateral (b) x-rays of the distal humerus at 4 months postoperative. Further bridging callus is noted with further consolidation of the RIA particulate. The linear corticalization of the graft can be best seen anteriorly on the lateral view.

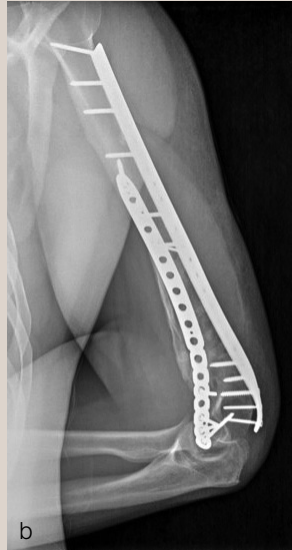


Fig 11 Anterior-posterior (**a**) and lateral (**b**) x-rays of the distal humerus at 8 months postoperative. There is evidence of further consolidation with formation of some dense bone, especially anteriorly and laterally.



Fig 12 Anterior (**a**) and posterolateral (**b**) x-rays of the distal humerus at 8-9 months postoperative. Thickening of the neocortex can be seen on both x-rays, (**a**) on the radial side and (**b**) on the anterior side, confirming maturation of the bone graft and application of Wolff's law.

AO's novel Next TomoFix plate for knee preservation showcased in Chengdu, China

Thanks to its global network of skilled surgeons, the [AO Innovation Translation Center](#) is uniquely positioned as the leading innovator in the surgical treatment of trauma and musculoskeletal disorders. This world-wide affiliation of expertise was recently leveraged to great effect when Michael Schütz, member of the AO Technical Commission's Next TomoFix Task Force (NTTF) showcased an innovative solution for knee preservation to a large audience of trauma and orthopedic surgeons at the Asian Knee Preservation Expert Conference in Chengdu, China (May 23–24, 2025).

Keen to include cutting-edge surgical solutions in their program, conference Chairs Ye Huang (NTTF member) and Kang-Il Kim (NTTF Chairperson) invited Schütz to present the next generation TomoFix project, an in-development plating solution for osteotomies around the knee. Increasingly – and notably in the Asian population—knee osteotomy is used in preference to joint replacement to preserve the existing anatomy and relieve symptoms by correcting the knee's alignment.



Michael Schütz (NTTF member, center) with Kang-Il Kim (NTTF Chair, fourth from right) and fellow conference participants in Chengdu



Michael Schütz presenting the Next TomoFix solution in Chengdu, China (left) and conference Chair Ye Huang (right).

Building on the success of the existing [TOMOFIX™ Osteotomy System](#), the Next TomoFix plates aim to address the specific anatomical needs of the Asian population while offering improved stability and options for minimally invasive surgery. Development of this novel system is being guided by the [Next TomoFix Task Force](#), comprising six expert surgeons from China, Japan, Korea, and Australia. The AO's global network of expert surgeons provides a direct entry point to regions such as Asia and ensures that industry partners can address the specific clinical needs of local patient populations.

The presentation of the new plate prototype allowed Schütz, an expert AO surgeon, to raise awareness of a forthcoming AO innovation which will undoubtedly add value for both patients and surgeons throughout Asia. Furthermore, it highlights the enduring value of the AO global network in delivering improved patient care and outcomes through innovative surgical solutions.

Schütz elaborated: "The new TomoFix is a significant advancement in its design to fit patients of the Asian region. The expertise and engagement of the Asian Expert Team was outstanding, and I am sure that the new TomoFix will be subsequently welcomed in other regions."



Participants of the Asian Knee Preservation Expert Conference in Chengdu, China (May 23–24, 2025).

Fracture-related infection: the pioneering FROST Registry is well underway

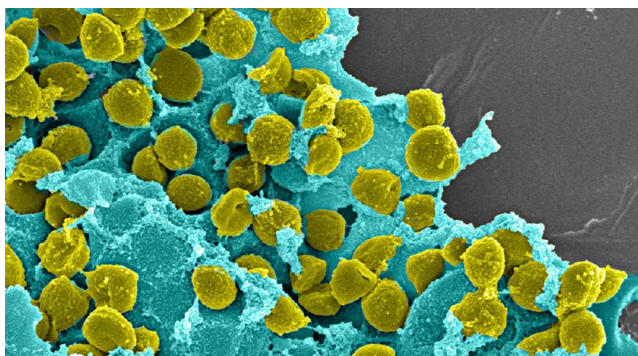
The pioneering FROST (Fracture-Related Outcome Study for operatively treated Tibia shaft fractures) registry, launched in 2018 by the AO Technical Commission's [Anti-Infection Global Expert Committee](#) (AIGEC), is well underway.

Developed as part of the AIGEC's mission to improve the prevention and treatment of fracture-related infection, the FROST registry is a global, multicenter study which looks at epidemiology and treatment concepts for tibia shaft fractures. The knowledge and evidence generated by the registry offer a unique opportunity to document treatment and outcome data around tibia shaft fractures and to build a database in a systematic way. The creation of such a database allows for extensive data mining to generate hypotheses for further studies and to gather information to assist the clinical decision-making process, for example by identifying risk factors and their relationship with the outcome and complications.

Many centers worldwide expressed their interest and motivation to include patients. However, for organizational and budget reasons, it was not feasible to include all sites. To date, over 1000 patients have been enrolled in the study at 17 hospitals and clinics across 8 countries spanning Europe, North America, South Africa, and Asia. As of February 2026, enrolment for the study has been successfully completed. Data analyses are currently in progress, and forthcoming results and subsequent publications will be available in the coming months.

FROST was developed by global experts in FRI including Michiel Verhofstad (NL), Michael Raschke (DE), Willem Metsemakers (BE), Bill Obremsky (US) and Andrej Trampuz (DE) in collaboration with AO Clinical Evidence, and is the largest ongoing, international fracture-related outcomes registry worldwide to date. Outcome data, due to be published in late 2026, will be pivotal in informing the global effort to address fracture-related infection (FRI).

As one of the most complex problems in modern orthopedic trauma surgery, FRI can— even after exemplary surgical care— severely impact patient recovery following fracture treatment. Improved clinical knowledge, underpinned by comprehensive data from the FROST registry, promises to reduce the cost of FRI treatment, lead to more effective treatment strategies, and promote better patient



A *Staphylococcus aureus* biofilm; commonly present in fracture-related infection.

outcomes. Furthermore, the FROST data will be fundamental to developing more robust clinical FRI studies in future.

Chaired by Michiel Verhofstad, the Expert Committee driving this registry is composed of global key opinion leaders in the field of musculoskeletal infection, including orthopedic and trauma surgeons, microbiologists, infectious disease specialists, and basic scientists. The work of AIGEC is firmly grounded in both interdisciplinary and cross-organizational collaboration. Bringing different specialists from diverse fields together creates powerful synergies and new opportunities to solve the longstanding problem of FRI.

“As the largest study of its kind, establishing the FROST registry was hugely complex,” says Michiel Verhofstad, AIGEC Chair, “but it was possible thanks to the outstanding collaboration between surgeons, scientists, infectious disease specialists, and clinical experts from AO. We are all eager to see the study come to fruition and we are convinced this work will ultimately improve outcomes for the patients with FRI that we see daily in our clinical practice.”

The AO is honored to play a leading role in international efforts to prevent FRI and to support the AIGEC in driving forward this vital work and improving patient care.



Members and guests of the Anti-Infection Global Expert Committee pictured in 2022. From left: Lois Wallach (AO), Robert Jan Kroeze, Bill Obremsky, Martin Pouw, Andrej Trampuz, Fintan Moriaty (AO), Charalampos Zalavras, Niels Vanvelk (AO), Willem Metsemakers, Steffen Rosslenbroich, Michiel Verhofstad, Aleksandra Vidakovic (AO).

TriALTIS™ Spine System

The TriALTIS™ Spine System (Fig 1) is a next generation posterior thoracolumbar spine implant system with a clinical focus on open surgery for degenerative, tumor, trauma, and deformity pathologies in adults. Combining a new portfolio of implants with digital enabling technology, the TriALTIS™ Spine System aims to address unmet clinical needs and help surgeons achieve more consistent outcomes in treating complex spine conditions. Novel implants include polyaxial screws, favored angle screws, set screws, rods, and instruments.

Leveraging design features of the EXPEDIUM™ 5.5 Spine, VIPER™ Spine, and MATRIX™ Spine Systems, the TriALTIS™ Spine System delivers a consistent user experience and improved implant performance in terms of set screw clamping force, set screw loosening torque, resistance to pullout, and gripping capacity. Other innovations include improved instrument design to indicate actuation points, consolidated instrument sets, and a modular case and tray design.

The TriALTIS™ system affords efficient integration with cement augmentation, power, navigation, and robotic-assisted solutions, while decreasing costs to healthcare systems and addressing the needs of more patients. The TriALTIS™ Spine System is the foundational element of a wider comprehensive system (coming soon) that will allow for a consistent surgeon user experience across all indicated pathologies.

Clinical needs addressed

- The TriALTIS™ Spine System is designed to meet the demands of varying patient populations
- The streamlined system offers improved procedural efficiency with 5.5/6.0 mm diameter rod compatibility
- The system offers improved mechanical performance which may lead to reduced postoperative mechanical failure
- The system offers efficient integration with power and navigation systems

TriALTIS Implant Portfolio

Poly screws

Poly screws are available in diameters ranging from 4.5–7.0 mm (Fig 2). Solid cortical fix screws are available in lengths from 20–60 mm, and cannulated fenestrated cortical fix screws are available in lengths from 30–60 mm.

Rods

The TriALTIS™ Spine System offers an increased availability of rod options and materials for various clinical applications and anatomies. Rods are available in both Ti and CoCr, in diameters of 5.5 mm and 6.0 mm. The 6.0 mm rod option has improved fatigue performance compared to 5.5 mm rods of the same material and may be advantageous in deformity correction. The TriALTIS™ system is compatible with Symphony™ OCT and Altalyne™ rods.

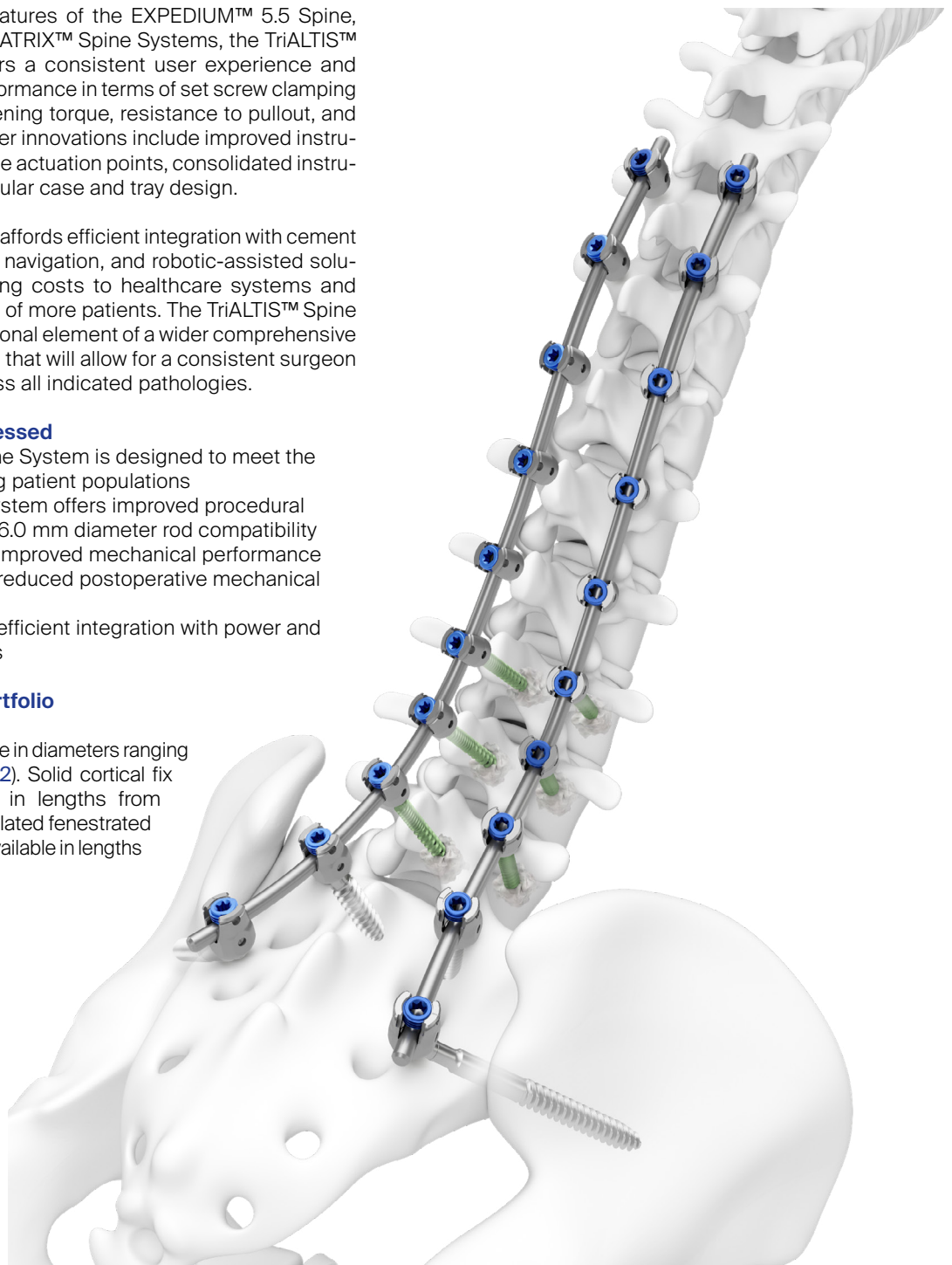


Fig 1 The TriALTIS™ Spine System

TriALTIS™ pedicle screws

Design features (Fig 3) include:

- 5.5/6.0 mm diameter rod compatibility
- **Cortical fix thread form:** this feature is standard on all TriALTIS polyaxial screws and available in solid and fenestrated screws.
- **Fenestrations for cement augmentation:** the injection of bone cement through the screw allows additional fixation in patients with advanced stage tumors involving the thoracic and lumbar spine.
- **Polyaxial drag:** the screw head features an interference fit between the shank sphere/flex ball and the drag ring. This friction fit allows the polyaxial heads to maintain their user-designated position in-situ [1].
- **Quick catch tip:** allows for immediate bone engagement. This design feature consists of a bullet-shaped screw tip that allows the screw threads to extend all the way to the distal end, meaning that the effective diameter of the start of the threads is larger. TriALTIS™ screws offer improved starting efficiency when compared to the EXPEDIUM™ 5.5 Spine System [2].

The unique design features of the TriALTIS™ cortical fix screw (Fig 3) allow the most challenging clinical cases to be addressed:

- The cortical fix thread form doubles the number of contact points within the pedicle and increases the resistance to axial pullout forces, ultimately enhancing fixation within the pedicle.
- The dual lead thread integrates with the cancellous bone in the vertebral body and advances twice as far with each rotation (as compared to single lead screws).

- Additional proximal threads engage more of the posterior wall of the pedicle.
- The constant dual thread lead gives a smooth transition between the dual lead and quad lead thread forms, allowing for ease of insertion and compatibility with TriALTIS™ system taps.
- The optimized self-tapping and self-centering tip allows for insertion with or without tapping.

Mechanical testing shows that TriALTIS™ cortical fix thread form screws have 24% increased pullout strength compared to EXPEDIUM dual lead thread form screws [3].

In terms of overall construct stability, TriALTIS™ screws demonstrated statistically higher gripping capacity [4, 5] and statistically higher performance in cantilever beam testing [6, 7] when compared to EXPEDIUM VERSE screws.

TriALTIS™ set screws

Design features include:

- Star drive recess offering improved driver strength with the TriALTIS™ Spine System's T27 driver.
- The set screw thread features a square cross-sectional geometry and a coarse thread pitch, offering a significant improvement over standard threads and reducing the propensity for cross-threading of the implants during insertion. The distance between threads is 1.4 mm for TriALTIS™ set screws compared to 1.0 mm for Expedium 5.5 screws [8].



Fig 2 Poly screws from the TriALTIS™ Spine System

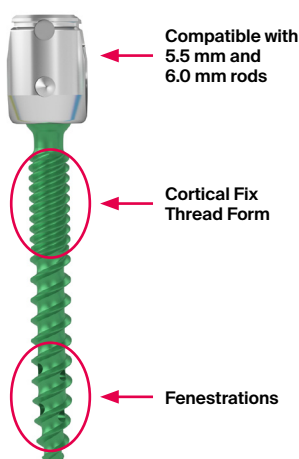


Fig 3 Features of the pedicle screw from the TriALTIS™ Spine System

Mechanical testing shows that compared to the EXPEDIUM 5.5 Spine System, the TriALTIS™ set screw offers a 20% improvement in set screw loosening torque and a 16% increase in set screw clamping force [9].

Instruments

The consolidated instrument sets within the TriALTIS™ Spine System include different types of reducers, including the sequential reducer, rocker reducer and acute reducer. The sequential reducer is shown in Fig 4.

Integration with enabling technology

Throughout the TriALTIS™ system, instruments are designed with standardized features to allow for consistent interaction with enabling technology. Instrumentation for navigation integration includes drill bits, taps, and screwdrivers:

- Navigated taps range from 3.5 mm–12.0 mm diameter
- Navigated drill bits come in 2.4 mm, 3.2 mm, and 4.0 mm diameter

Instrumentation also includes drill sleeves that enable one-handed adjustment of the navigation array.



Fig 4 The sequential reducer from the TriALTIS™ Spine System

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1. **DePuy Synthes.** Screw Polyaxial Drag. September 25, 2023. Windchill Document No. 501360165 Rev A.
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8. **DePuy Synthes.** Implant Cross Threading Memo. September 05, 2023. Windchill Document No. 501337048 Rev A.
9. **DePuy Synthes.** TriALTIS System Torque and Clamping Comparison to Predicates. September 05, 2023. Windchill Document No. 501335337, Rev A.

Clinical cases, TriALTIS™ Spine System

Cases kindly provided by Firoz Miyanji, MD, University of British Columbia, Canada

Case 1

A 17-year-old girl presented to the spine clinic with significant low back pain. X-ray imaging (Figs 1–3) showed evidence of spondylolisthesis.

Upon clinical examination of spinal alignment, the patient was found to have a pelvic incidence of 78°, a lumbar lordosis of 54°, and a pelvic tilt of 51°.

Posterior spinal instrumentation and fusion (PSIF) was undertaken with an interbody fusion at L5–S1. L5 laminectomy and sacral dome osteotomy followed by pedicle screw instrumentation using TriALTIS™ implants helped reduce the lumbosacral kyphosis and translation of L5–S1 and promote fusion across this level (Fig 4a–b).

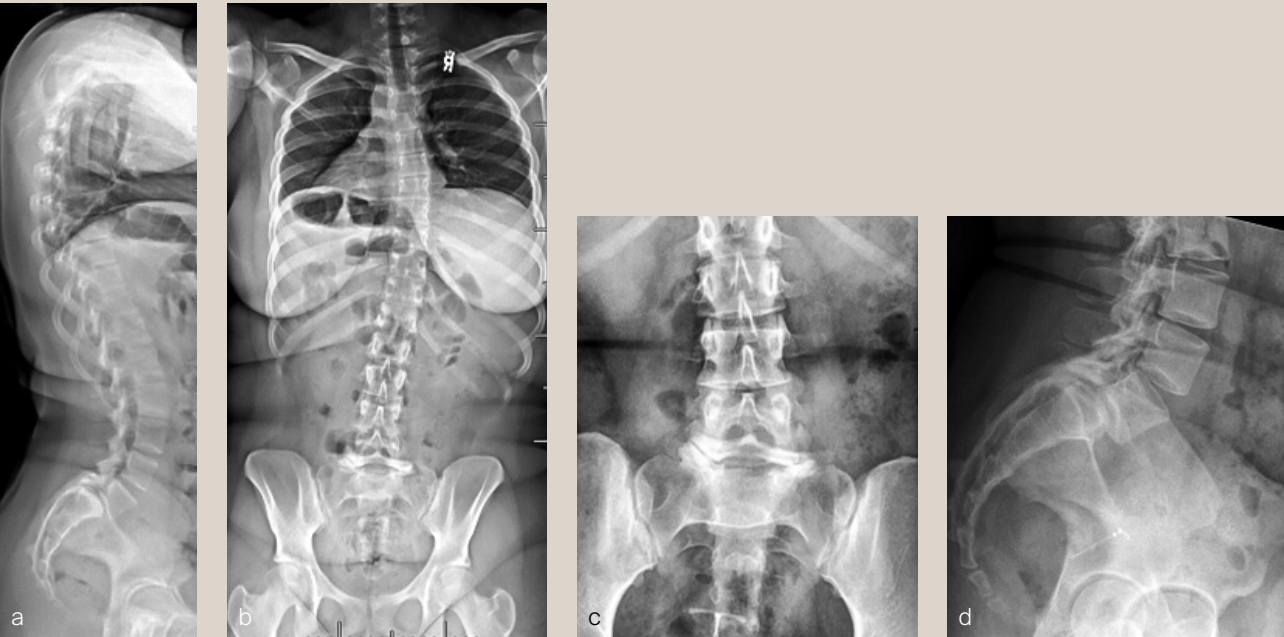


Fig 1a–d Preoperative x-rays showing full-length lateral (a) and posteroanterior (PA) (b) views of the spine; spot PA (c) and lateral (d) views of the lumbosacral spine. X-rays demonstrate a Meyerding grade 2/3 L5–S1 spondylolisthesis with significant disc space narrowing.

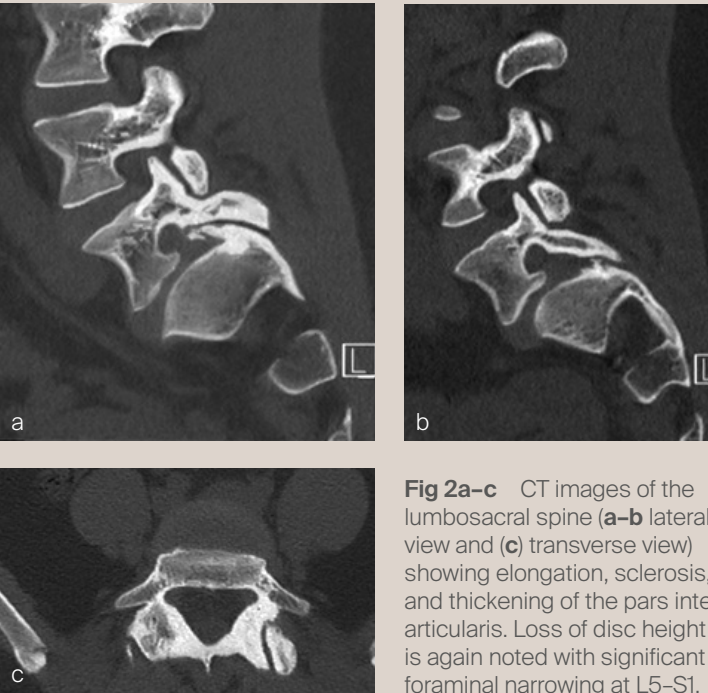


Fig 2a–c CT images of the lumbosacral spine (a–b lateral view and (c) transverse view) showing elongation, sclerosis, and thickening of the pars interarticularis. Loss of disc height is again noted with significant foraminal narrowing at L5–S1.



Fig 3 Midsagittal MRI image of the lumbosacral spine showing significant degeneration of the L5-S1 disc and continued evidence of L5-S1 spondylolisthesis (not fully reduced).



Fig 4a-b Postoperative images showing TriALTIS™ pedicle screws and rods at L5-S1 with reduction of the lumbosacral kyphosis and translation of L5 on S1.

Case 2

A 19-year-old man with colon cancer was admitted to the spine clinic with pain and progressive kyphosis (**Fig 5a**). Preoperative CT imaging (**Fig 5b**) showed a residual mass abutting the superior mesenteric artery.

Surgery was undertaken with TriALTIS™ posterior spinal instrumentation system from T5–L1 to correct and support the

kyphotic deformity (**Fig 6**). The upper and lower instrumented vertebrae were selected to allow symmetry of fixation above and below the apex of the kyphotic curve. Care was taken not to overcorrect the hyperkyphosis given the abdominal mass abutting the superior mesenteric artery. During surgery, multiple sequential reducers were used to achieve cantilever reduction of the deformity (**Fig 7**).

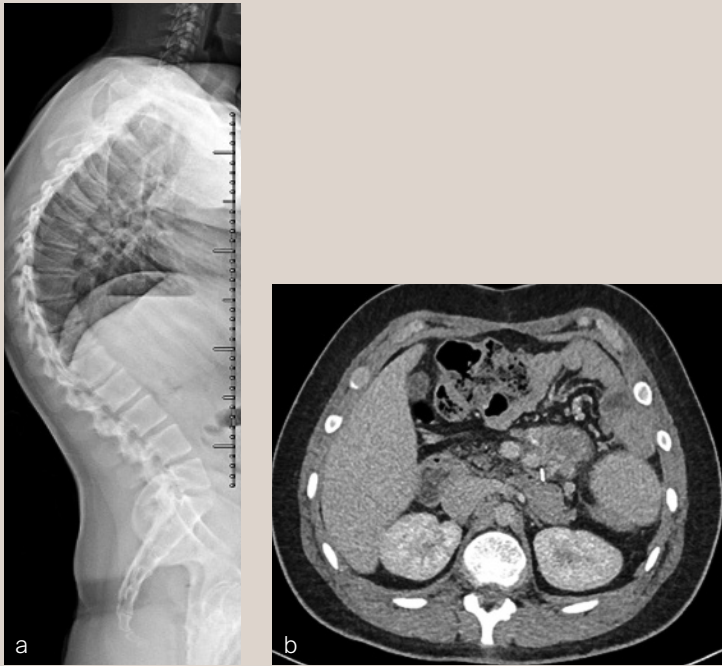


Fig 5a–b Preoperative x-ray showing kyphosis in the thoracic spine (**a**) and preoperative CT imaging showing a residual mass abutting the superior mesenteric artery (**b**).



Fig 6a–b Preoperative (**a**) and postoperative (**b**) x-rays showing correction of the kyphotic deformity and symmetry of fixation.



Fig 7 Multiple sequential reducers were used in the surgical procedure to allow cantilever reduction of the kyphotic deformity.

TriALTIS™ Revision System

The TriALTIS™ Revision System (Fig 1) is a new module of rod connectors and surgical instruments, designed as a complementary extension to the original TriALTIS™ posterior thoracolumbar spine implant system. The new components

broaden the TriALTIS™ platform's array of implant and instrument options, enabling tailored solutions for complex thoracolumbar spine revision cases across diverse patient populations.



Fig 1 The new TriALTIS™ Revision System

Connectors

The new connectors (Fig 2) are designed to accommodate different rod configurations including parallel (side-by-side), axial (end-to-end), and lateral. Several different rod capture mechanisms are available, including top loading, side loading, and closed. The system also offers articulating and multiple centerline offset connectors, providing intraoperative flexibility. The connectors feature an integrated set screw, allowing the surgeon to connect to a rod or a connector holder instrument.

The TriALTIS™ connectors are compatible with other systems as follows:

- 5.5 mm rods: Expedium 5.5 mm hooks and connectors
- 5.5 and 6.0 mm rods: Expedium 5.5–6.35 mm variable connectors
- Matrix Transconnector
- Symphony

Connector instruments offered within the new system allow efficient insertion and manipulation and also provide counter torque capability for efficient connector handling. Fig 2 shows the unilateral inserter and the connector holder.

The complete TriALTIS™ Spine System (Fig 3) is a streamlined product that offers 5.5 and 6.0 mm diameter rod compatibility, improved procedural efficiency, and decreased surgical time. In addition to compatibility with power tools and navigation systems, the enhanced mechanical performance of the system may lead to reduced postoperative mechanical failure.

Revision Screws

The TriALTIS™ Spine System includes a specialty revision screw offering, with screw diameters ranging from 7.5–12.0 mm. Using larger diameter screws in revision surgery may decrease the likelihood of postoperative complications such as screw pullout [1] in patients requiring revision surgery to the lumbar spine.

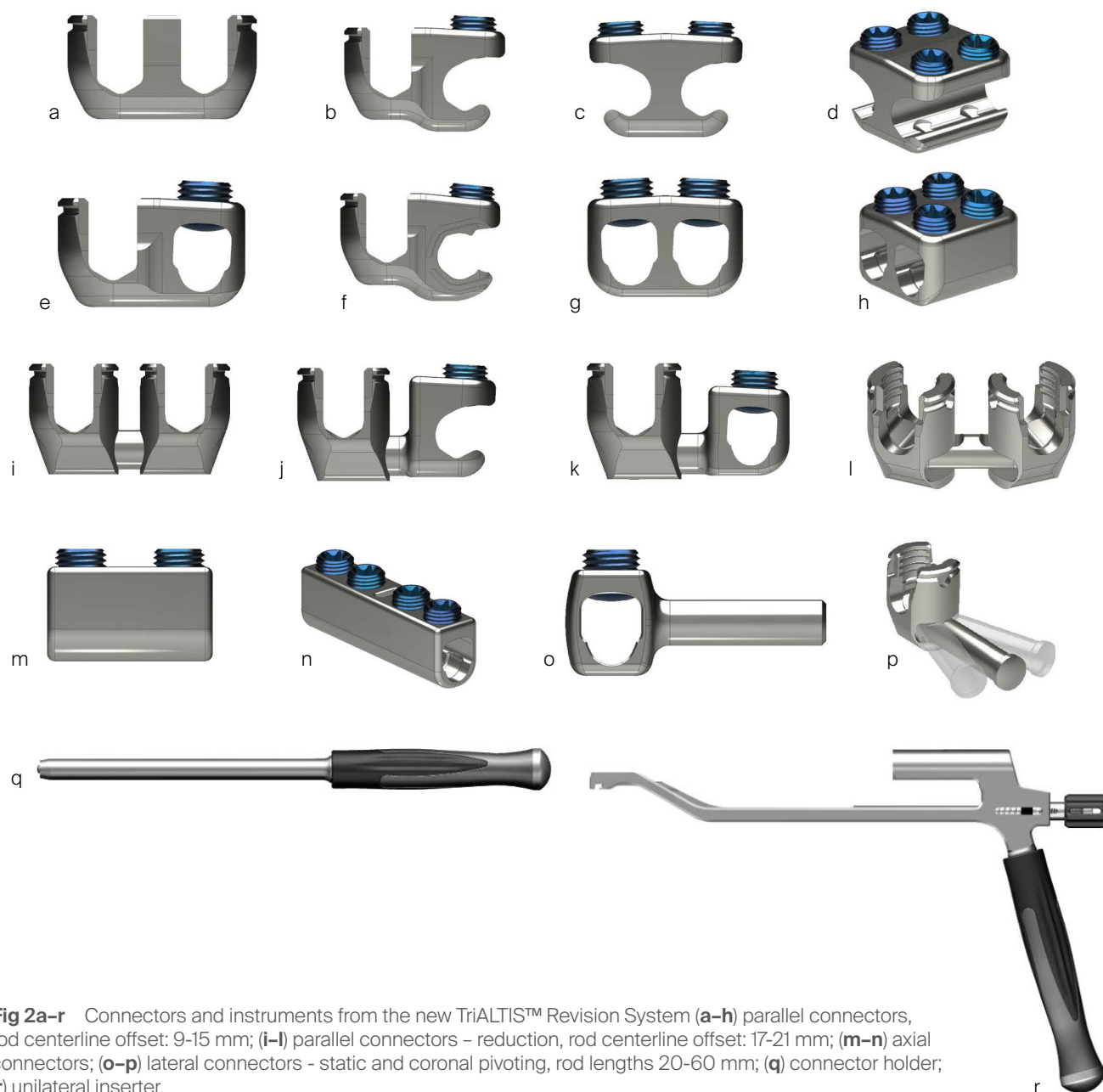


Fig 2a-r Connectors and instruments from the new TriALTIS™ Revision System (a-h) parallel connectors, rod centerline offset: 9-15 mm; (i-l) parallel connectors – reduction, rod centerline offset: 17-21 mm; (m-n) axial connectors; (o-p) lateral connectors - static and coronal pivoting, rod lengths 20-60 mm; (q) connector holder; (r) unilateral inserter.

Design features

The large diameter favored angle revision screws (**Fig 4**) are compatible with both 5.5 mm and 6.0 mm rods and have 46° of motion in the favored angle design. The screws feature a quick catch tip for immediate engagement with bone and ease of insertion into the pedicle [2]. The thread design allows a 6 mm screw advancement with one complete screwdriver turn.

The specialty revision screw shank offering includes:

- Solid Cortical Fix (available in lengths of 30–60 mm)
- Cannulated Fenestrated Cortical Fix (available in lengths of 30–60 mm)
- Solid Dual Lead (65–110 mm)
- Solid Partial Thread (65–110 mm)
- Cannulated Partial Thread (65–110 mm)

Instrumentation

The TriALTIS™ System Revision Screw portfolio is offered in combination with dedicated instrumentation.

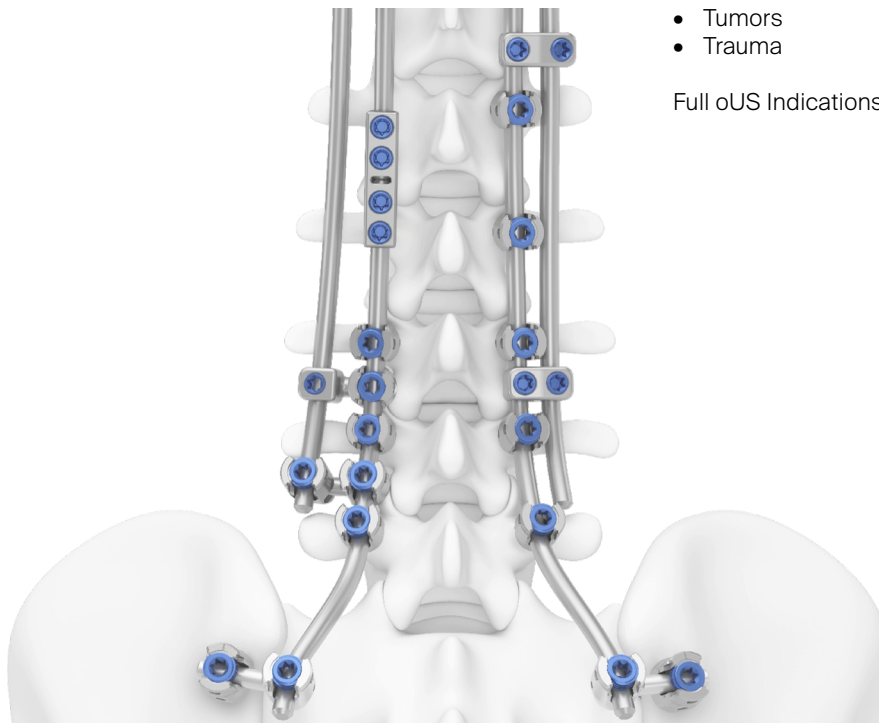


Fig 3 The new TriALTIS™ Revision System

The revision screw offering shares standard features with all TriALTIS™ screws, enabling consistent instrumentation across the platform:

- TOP NOTCH™ feature
- Tapered head design
- Rocker connection
- T27 drive feature

Indications (US)

The TriALTIS™ Spine System is intended to provide immobilization and stabilization of spinal segments in skeletally mature patients as an adjunct to fusion in the treatment of acute and chronic instabilities or deformities of the thoracic, lumbar and sacral spine.

Full US Indications in IFU – 0902-90-407

Indications (EU)

The TriALTIS™ Spine System is indicated for the following in skeletally mature patients:

- Degenerative spine disease
- Deformities/Instabilities
- Tumors
- Trauma

Full oUS Indications in IFU – 0902-90-432



Fig 4 The TriALTIS™ System Revision Screw

References

1. **Varghese V, Venkatesh K, Gurunathan SK.** Comparison of pullout strength of pedicle screws following revision using larger diameter screws. (2019) *Medical Engineering & Physics*, 74: 180–185.
2. **DePuy Synthes.** TriALTIS™ Evidence Generation Engineering Analysis: Quick Catch and Tapered Self-Tapping Tip Design. May 9, 2023. Windchill Document No. 501380612 Rev. A

VIPER PRIME™ TLIF Retractor

The new VIPER PRIME™ TLIF Retractor (Fig 1) facilitates the surgical approach to the lumbar spine during minimally invasive transforaminal lumbar interbody fusion (TLIF), providing a clear pathway to the disc space through the patient's lumbar musculature and intervertebral foramen opening.

This innovative retractor achieves pedicle screw-based distraction and tissue retraction in a single system, enabling access and exposure of the surgical site while requiring minimal hardware. Integrated light channels and optional medial retraction provide improved visualization of the targeted disc space. The retractor frame features a tower clamp design and a medial blade holder with pivoting capabilities allowing distal exposure without a larger incision.

The VIPER PRIME™ TLIF Retractor is a key component of the UNLEASH™ MIS TLIF Procedural Suite (Fig 2) and offers several procedural advantages. It enables parallel distraction through screw-based retraction, offers three options for lighting via medial blades and tower clamps, and offers multiple widths and lengths of medial blades to allow for 22° of toeing capability. Furthermore, the VIPER PRIME™ locking post and screw constructs allow for polyaxial screw locking to form a rigid system, and the tower clamps provide 360° of freedom for versatility and modular retractor assembly.

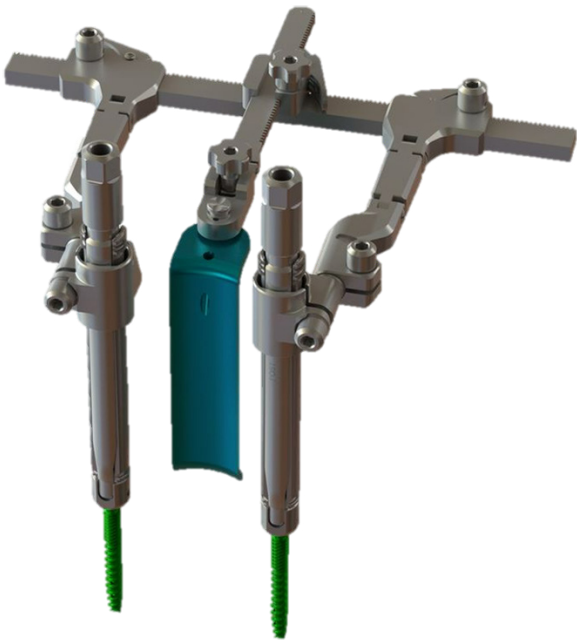


Fig 1 The VIPER PRIME™ TLIF Retractor

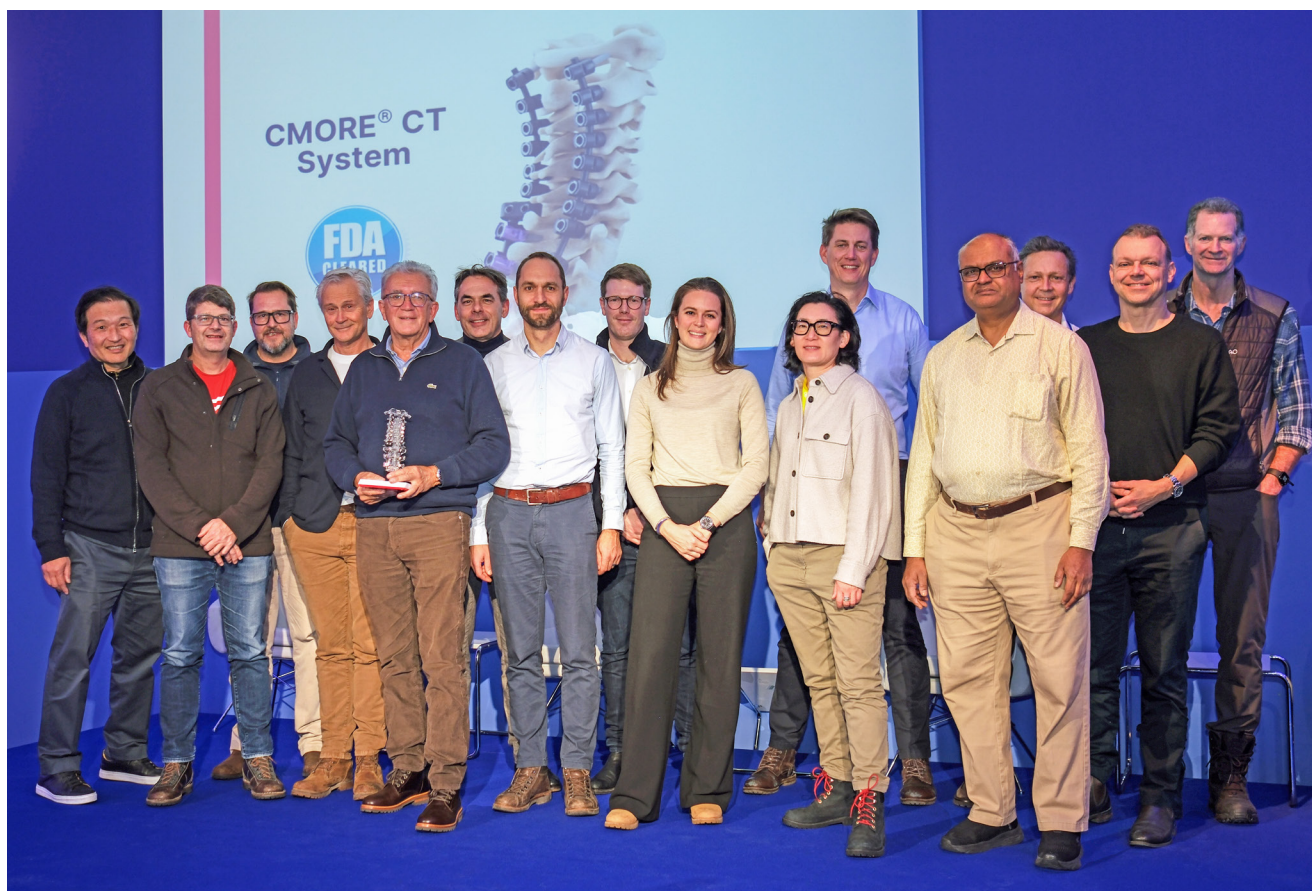


Fig 2 The VIPER PRIME™ TLIF Retractor is a key component of the UNLEASH™ MIS TLIF Procedural Suite

AO approval for icotec's CMORE® Cervicothoracic System

The AO Foundation and [icotec AG](#) are proud to announce a major milestone in their collaborative effort to advance spine surgical care: the CMORE® Cervicothoracic System was approved by members of the AO Technical Commission (Spine) on December 5, 2025, and is scheduled for release to the US market under 510(k) clearance in Quarter 1, 2026.

The CMORE® CT System is made from BlackArmor® engineered Carbon/PEEK and features radiolucency, offering significant advantages to patients with tumors in the cervicothoracic spine. The material's low imaging artefact profile enhances diagnostic clarity and facilitates postoperative monitoring. Its compatibility with postoperative radiotherapy allows more precise treatment planning, optimizing dosage delivery, and expanding the range of treatment modalities available, while allowing earlier detection of tumor recurrence.



Members of the AO-icotec Task Force who collaborated closely to develop the CMORE® Cervicothoracic System. From left: Kota Watanabe, Jean-Paul Wolinsky, Lorin Benneker, Maarten Spruit, Christian Mazel, Kurt Zoller (icotec), Ramon Hüppi (icotec), Nils Diethelm (AO), Laura Hüskens (icotec), Yu-Mi Rieng, Christoph Eigenmann (icotec), Naresh Kumar, Roger Stadler (icotec), Claas Albers (AO) Rick Bransford.

Dr. Maarten Spruit, Chair of the AO Technical Commission Spine, emphasized the importance of the new solution: “The AO Technical Commission is delighted to have worked closely with our icotec colleagues in a special Task Force chaired by Prof. Christian Mazel, to bring this much-needed innovation to patients. Until now, no cervicothoracic spine implant system has adequately addressed the unique needs of patients who require spine stabilization and ongoing tumor treatment in the cervical and upper thoracic spine”. Prof. Mazel added: “The collaboration between the AO Task Force and icotec has been outstanding. We are confident that this new development will markedly improve patient care and outcomes in this challenging clinical area”.

The CMORE® CT System is grounded in icotec’s radiolucent BlackArmor® material, offering potential as a platform for broader orthopedic applications. Following the system’s launch, spine surgeons from the AO Technical Commission and the

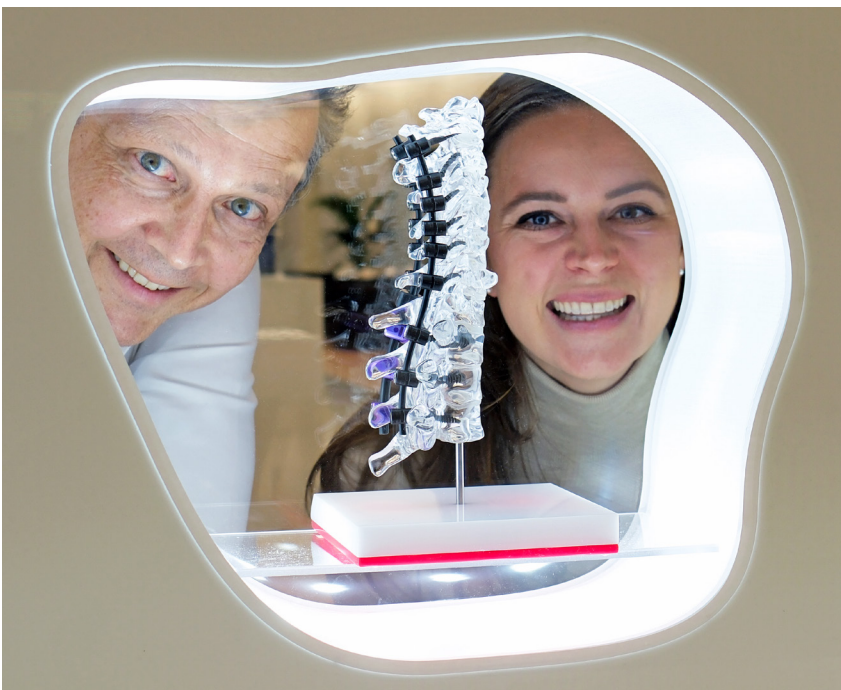
global AO network will continue to monitor the CMORE® CT System and to work closely with icotec, applying icotec’s cutting-edge capabilities in Carbon/PEEK composites and material properties to new spine surgical solutions.

Roger Stadler, CEO of icotec, emphasized the value of this collaboration: “Our joint projects with the AO Innovation Translation Center, in particular the AO Technical Commission, enable us to combine our world-class engineering capabilities in Carbon/PEEK composites with the expertise of globally renowned spine surgeons. This allows us to offer patients better treatment options and ultimately, a better quality of life.”

icotec AG is a family-owned SME in Altstätten, Switzerland established in 1999. icotec designs and manufactures non-metallic spinal implants made from BlackArmor® (Carbon/PEEK) material. icotec has become the world leader in spine tumor care and is setting new standards for tumor treatment.



Development work underway for the CMORE® Cervicothoracic System. Left, Task Force Chairperson Christian Mazel; right, Laura Hüsken (icotec).



Roger Stadler (left) and Laura Hüsken (right) with the new CMORE® Cervicothoracic System.

CMORE® Cervicothoracic System

Approved by members of the AO Technical Commission in December 2025, the CMORE® Cervicothoracic System (Fig 1) is a novel spine instrumentation system that is made from BlackArmor® engineered Carbon/PEEK. Intended for use in patients with spinal tumors, de-novo spinal infections, and additional indications, the system offers a radiolucent alternative to conventional metallic implants. The clinical advantages of BlackArmor® for patients and surgical teams include more precise targeting of radiation treatment, superior local tumor control, earlier detection of tumor recurrence and compatibility with advanced radiation modalities.

The product portfolio includes:

- Screws in a range of diameters and lengths
- BlackArmor® engineered Carbon/PEEK rods in various lengths and curvatures
- Titanium straight rods
- Axial and parallel connectors



Fig 1 The CMORE® CT System provides access to radiolucent implants for patients with cervicothoracic tumors.

CMORE® Pedicle Screw

The CMORE® Screw features a BlackArmor® tulip, a titanium nut screw, and tantalum markers, allowing the implant a degree of imaging visibility (Fig 2 and Fig 4). The screws are available in 4.0 mm, 4.5 mm, and 5.0 mm diameters. The shank screw is available in a diameter of 4.0 mm.

CMORE® Rods and Connectors

The CMORE® CT System offers a comprehensive selection of BlackArmor® Carbon/PEEK rods (4.0 mm diameter, maximum length 200 mm), available in straight, curved, and S-configurations

(Fig 3). Straight titanium rods supplement the system with a maximum length of 300 mm.

The connectors allow the secure joining of rods from the CMORE® CT and VADER® Pedicle Systems (Fig 3). Design features include titanium screws and a titanium ring that allows flexibility for rod insertion.

The CMORE® Parallel- and Axial Connector can accommodate 4.0 mm Carbon/PEEK or 4.0 mm titanium rods and link them to 6.0 mm Carbon/PEEK or 6.0 mm titanium rods.

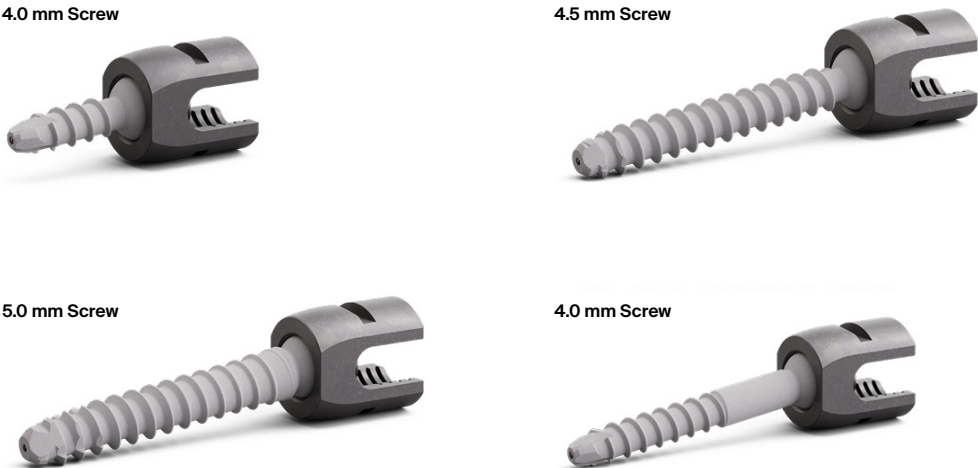


Fig 2 Pedicle screws from the CMORE® CT System. The comprehensive variety of screw diameters allows surgeons to tailor fixation to diverse patient anatomy, enhancing safety and construct stability in the challenging cervicothoracic region.

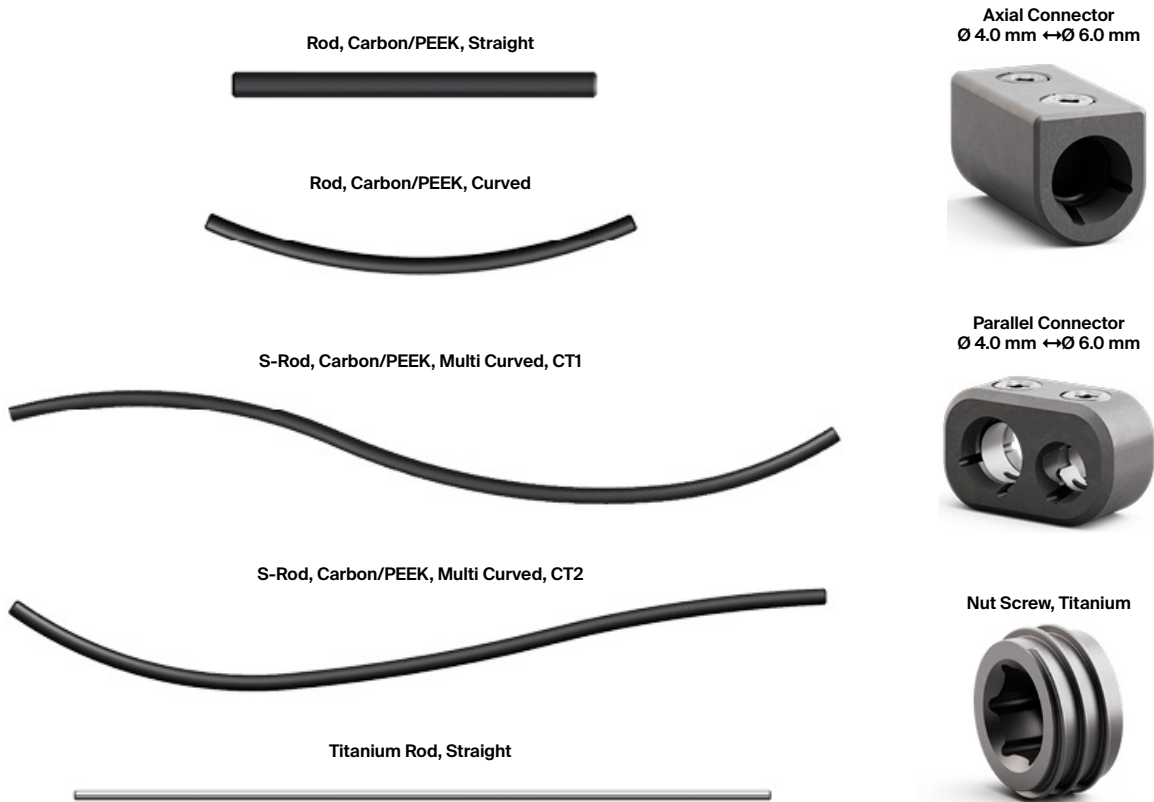


Fig 3 Rods and Connectors from the CMORE® CT System

Radiolucency and clinical benefits of BlackArmor® Carbon/PEEK implants

The radiolucency of BlackArmor® engineered Carbon/PEEK (Fig 4) offers numerous clinical benefits for spinal tumor patients:

More precise radiation treatment

- BlackArmor® implants offer significant reduction in metal artifacts compared to titanium, improving postoperative imaging accuracy [1].

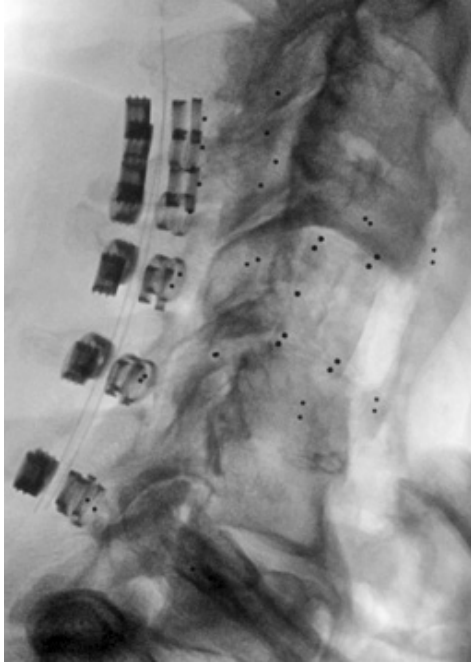


Fig 4 Standard lateral x-ray showing the appearance of the CMORE® Cervicothoracic System. Only the metal components within the screw head and the tantalum markers are visible on x-ray, highlighting the radiolucency of the BlackArmor® components.

- Increased accuracy in targeting and delineation of organs at risk (OAR), optimal radiation plan quality, and unimpeded dose delivery [1].

Improved local tumor control

- BlackArmor® implants allow the delivery of a higher radiation dose without scattering (cold spots), reducing infield or marginal recurrence [2].

Earlier recurrence detection

- In a matched cohort study (99 CFR-PEEK vs. 49 titanium cases), tumor recurrence was detected one scan earlier with Carbon/PEEK (mean 94 days vs. 189 days; $p = 0.013$) [3].

Advanced radiation modalities

- BlackArmor® implants enable accurate proton and stereotactic photon planning with minimal dose uncertainty. The target coverage and OAR sparing is equivalent to that of a non-instrumented spine [4].

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1. **de Almeida R, Ghia A, Amini B et al.** Quantification of MRI Artifacts in Carbon Fiber Reinforced Polyetheretherketone Thoracolumbar Pedicle Screw Constructs prior to Spinal Stereotactic Radiosurgery. *Practical Radiation Oncology*. (2024); 14(2): 103–111.
2. **de Almeida R, Call-Orellana F, Zuluaga-Garcia J et al.** Local Control After Adjuvant Radiosurgery for Spinal Metastasis Treated With Decompression and Posterior Segmental Stabilization: A Comparison Between Carbon Fiber/ Polyetheretherketone-Based and Metallic Implants. *Advances in Radiation Oncology*. (2025); 10(7): 101806.
3. **Ward J, Damante M, Wilson S et al.** Impact of instrumentation material on local recurrence: a case-matched series using carbon fiber-PEEK vs. titanium. *Journal of Neuro-Oncology*. (2025); 171: 155–162
4. **Henzen D, Schmidhalter D, Guyer G et al.** Feasibility of postoperative spine stereotactic body radiation therapy in proximity of carbon and titanium hybrid implants using a robotic radiotherapy device. *Radiation Oncology*. (2022); 17, 94.

Read more about the AO-icotec collaboration on [page 35](#)

AO announces new partnership with TeDan Surgical Innovations, Inc.

The AO and TeDan Surgical Innovations, Inc. (TSI) proudly announce a new partnership to co-develop next-generation solutions for surgical access systems in the cervical spine.

Headquartered in Sugar Land, Texas, US, TSI specializes in advanced access technologies for spine procedures and has over 75 years of combined market experience in bringing new devices to surgical practice. This collaboration integrates TSI's innovative technology platform with expertise from the AO Technical Commission's world-leading cervical spine surgeons. By aligning product development with real-world surgical needs, the partnership aims to enhance procedural safety and efficiency, and ultimately to improve patient outcomes.

"This collaboration represents a crucial step forward in our mission to further improve techniques in cervical spine surgery," Dr. Maarten Spruit, Chairperson of the AO Technical Commission Spine explained. "We aim to develop solutions that optimize anterior and posterior cervical spine exposure, limit tissue damage and streamline the entire surgical workflow. There is always room for improvement."

Dr. Chung Chek Wong, Chairperson of the AO's Cervical Spine Expert Group, added: "I see a significant need for better cervical spine solutions in my daily practice in Malaysia. I look forward to working with TSI to develop the next generation of products and to bring that innovative technology to my patients."

TSI President, Danny Fishman, highlighted the significant and lasting value of this partnership for upcoming projects: "This partnership builds on TSI's long-standing commitment to advancing surgical access for spine surgeons. Working directly with the AO's Cervical Expert Spine Group brings an exceptional clinical perspective that enables us to align our product development with evolving surgical practice. We are excited for what this collaboration will bring to the field."

TeDan Surgical Innovations (TSI) is a global leader in the design and manufacture of advanced surgical access systems for spine, neuro, and orthopedic procedures. Known for its innovation and quality, TSI is recognized by leading industry professionals, teaching institutions, and thought leaders worldwide. With over 75 years of combined market experience, the company has consistently driven initiatives that foster clinical success and business growth.



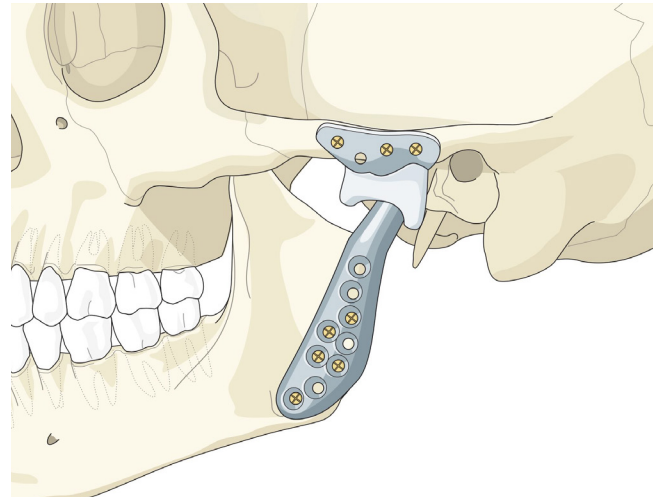
Key members of the AO-TSI project team. From left: Christian Mazel, Maarten Spruit, Kalashi Jones (TSI), Rick Bransford, Chung Chek Wong, Jessica Hanson (TSI), Vanessa Schenk (AO). Via Zoom: Kazuya Kitamura and Juan José Zamorano.

New Narrative Review on Temporomandibular Joint (TMJ) Prostheses from AO Technical Commission CMF

The AO Technical Commission's expert CMF surgeons have recently published a narrative review on the use of temporomandibular joint (TMJ) prostheses in the *Journal of Craniofacial Surgery* [1]. Total mandibular joint replacement is a clinical strategy to treat severe temporomandibular joint disease. After approval by the FDA in the 1990s, the use of TMJ prostheses has become a regular surgical intervention in some TMJ disorders. However, procedures to implant the prosthesis and replace the TMJ are complex, and controversy remains regarding indications and timing of the technique.

The recent review, produced by expert surgeon members of the AO Technical Commission's TMJ Task Force, addresses the indications, characteristics, and variables in TMJ replacement in clinical conditions related to condylar destruction (rheumatoid arthritis and degenerative disease, idiopathic condylar resorption, TMJ osteoarthritis, and juvenile idiopathic arthritis) or condylar overgrowth in the case of benign tumors (osteoma, osteochondroma, ameloblastoma, odontogenic keratocyst, synovial chondromatosis, and chondroid tenosynovial giant cell tumor).

Themes explored in the review include the most common complications of total TMJ replacement, patient age at the time of surgery, and the advantages and disadvantages of implanting alloplastic custom-made joints. Furthermore, the review evaluates post-surgical functional and quality of life outcomes for patients.



Temporomandibular joint (TMJ) prosthesis

Reference

1. **Smolka W, Kumar R, Zimmerer R, Peacock Z, and Olate S.** [TMJ Prostheses for Condylar Resorption and Benign Tumors Affecting the Condyle.](#) *The Journal of Craniofacial Surgery.* (2025) Oct; 36 (7).



The TMJ Task Force. From left: Zachary S. Peacock, Bettina Bolliger (AO), Rüdiger Zimmerer, Ricky Kumar, Sergio Olate, Wenko Smolka

The AO Technical Commission Innovation Prize 2026

The AO Technical Commission is delighted to announce the Hand Expert Group (HAEG) as worthy winners of the 2026 Innovation Prize. Members of the HAEG have been honored for their innovative approach in developing the VOLT™ Wrist Treatment System, a novel plating solution designed to address the entire spectrum of wrist fractures.

The new system addresses important clinical challenges, allowing fixation of very distal wrist fractures without invasion of the articular space or causing postoperative soft-tissue concerns. Thanks to expert guidance from HAEG members, the platform includes advanced design features that facilitate the entire surgical procedure, from fracture reduction to plate placement and screw insertion. The incorporation of VOLT™ technology allows plates to be low-profile without compromising stability or locking strength.

The VOLT™ Wrist Treatment System embodies both the HAEG's commitment to innovation and their meticulous attention to detail and promises better outcomes for patients undergoing wrist surgery. The AO Technical Commission commends the HAEG's outstanding contribution to advancing trauma care and congratulates each member on this important achievement.

Members of the HAEG are:

- Sudhir Warriar (IN)—Chairperson
- Thomas Fischer (US)
- Stephen Tham (AU)
- Alex Lluch (ES)
- Martin Langer (DE)



Ceremony for the AO TC Innovation Prize 2026. From left: Michael Raschke (Chairperson, AO TC Executive Board), Nils Diethelm (AO) Sudhir Warriar (Chairperson, HAEG), Thomas Fischer (member, HAEG), André Galm (DPS).



The Hand Expert Group. From left: Martin Langer, Thomas Fischer, Alejandro Lluch, Sudhir Warriar, Stephen Tham, Nils Diethelm (AO).

Meet the Experts 2025

The AO Technical Commission (AO TC) ran several “Meet the Experts” sessions at the Davos Courses in December 2025, offering course participants the opportunity to view live stage shows showcasing the latest and most innovative AO TC approved solutions for musculoskeletal surgery. Expert surgeons closely involved in the development of the new implants and techniques led interactive practical sessions demonstrating surgical techniques and the benefits of the new products for both patients and surgeons.

Some “Meet the Experts” sessions were held in the award winning mobile operating room, “The Shard”, at the AO Davos Courses. An overview of the different technologies presented is given below. Full-length video recordings can be accessed by clicking on the [link](#).

VOLT™ Wrist Treatment System

Expert surgeons Alex Lluch, Martin Langer, and Sudhir Warrier presented new components of the VOLT™ Wrist Treatment System, including the rationale for the new system and a discussion of the advantages of VOLT™ over VA LCP two-column distal radius plates.

Novel design elements of the new plates were highlighted including the distal radius two column rim plate, which features a hook design to hold volar lip fragments, the volar ulnar corner plate, the volar radial column plate, and the wrist spanning plate. The presenters outlined further innovative components of the new system including enhanced reduction instruments, guide blocks, screw holes to guide K-wire trajectories, and double drill guides. A clinical case from Amy Speeckaert was presented, showcasing the successful use of the distal radius two column rim plate on a 60-year-old woman who slipped on ice.

The surgical demonstration covered insertion of the distal radius two column rim plate and a discussion of the suitability of different plate designs for varying fracture morphologies. The presenters shared surgical hints and tips and showed how the plate avoids tendon involvement. Later, insertion of the volar ulnar corner plate and volar radial column plate was demonstrated, together with an explanation of the less common indications for using these two plates in combination.



Fig 1a–b (a) Expert surgeons Alex Lluch (left) and Martin Langer (right) in “The Shard”, demonstrating the novel VOLT™ Wrist Treatment System; (b) Participants of the Davos Courses 2025 watching the “Meet the Experts” session in “The Shard”.

Finally, the presenters showed insertion of the wrist spanning plate via a less invasive approach and highlighted the advantages of using these plates for treating comminuted fractures.

TriALTIS™ Core & Revision Spine Systems

Expert spine surgeons Rick Bransford and JP Wolinsky presented the unmet clinical needs addressed by the TriALTIS™ Core & Revision Spine Systems, including improved procedural efficiency and enhanced mechanical performance. The presentation outlined the scope of the new pedicle screws, rods, and connectors, highlighting the benefits of novel design features and showing promising biomechanical test results. The presenters also outlined the smooth interaction of the new implants and instruments with enabling technology, including power tools and navigation. The workflow for cement augmentation was also explained.

The surgical demonstration showed instrumentation of L3 – pelvis on a spine model, including pedicle screw insertion, and the fixation of rods and connectors.



Fig 2a–b (a) Expert surgeons Jean-Paul Wolinsky (left) and Richard Bransford (right) in the Innovation Hub, demonstrating the novel TriALTIS™ Core & Revision Spine Systems; (b) Participants of the Davos Courses 2025 watching the “Meet the Experts” session in the “Innovation Hub”.

AO Technical Commission Experts Symposia 2025



Participants of the 5th AO TC Spine Experts Symposium, Dallas

The Experts Symposia of the AO Technical Commission (AO TC) are well-established events which aim to improve patient treatment by fostering exchange between the AO TC's surgeons and industrial partners. The symposia provide a confidential setting in which participants critically review the clinical performance of implants, instruments, and techniques, identify potential device improvements, and discuss refinements to surgical procedures. The Experts Symposia are fundamental to the product development cycle and allow the AO TC to fulfill its quality assurance mandate when newly developed devices are released to surgeons. The information gathered at Expert Symposia is invaluable, both for defining unmet clinical needs and supporting the initiation of new development projects with industrial partners. Three symposia were held in 2025, all in North America.

5th AO TC Spine Experts Symposium, Dallas

The 5th AO Technical Commission (TC) Spine Experts Symposium brought together 32 participants, primarily from North America, for almost two days of focused scientific exchange in Dallas, Texas, on March 21–22, 2025.

Chaired by Rick Bransford and Jean Ouellet, the symposium explored the complexities and innovations in managing spinal deformities across a wide range of patient populations. The program featured 31 case presentations, sparking dynamic discussions on topics including:

- Adult thoracolumbar deformities
- Posttraumatic deformities
- Adolescent idiopathic scoliosis
- Early onset scoliosis
- Oncologic aspects of spinal deformities

Each session concluded with the identification of clinical needs and potential areas for innovation. The interactive format and

diverse case discussions fostered a highly engaging environment for knowledge sharing and expert dialogue. Building on the success of this event, the 6th AO TC Spine Experts Symposium is planned for spring 2027 in Europe.

8th AO TC Trauma Experts Symposium (North America), US

The 8th AO TC Trauma Experts Symposium (North America), took place in San Diego on September 5–6, 2025, chaired by expert surgeon Mark Lee.

Leading experts and emerging surgeons come together in interactive, solution-oriented forums to share real clinical cases, identify unmet clinical needs, and discuss better solutions for trauma surgery.

In San Diego, sessions focused on challenges and opportunities in several anatomical regions:

- Clavicle and scapula fractures
- Proximal humeral fractures
- Humeral shaft fractures
- Complex elbow injuries
- Complex wrist fractures

Grounded in real clinical problems, these sessions have a genuine impact and ultimately drive the development of better solutions for patient care. The openness, expertise, and engagement of participants directly shape the future priorities and innovation direction of the AO Technical Commission.

The 1st AO TC Trauma Experts Symposium (North & Latin America) will take place in 2027 in San José, Costa Rica, chaired by Mark Lee and Paulo Barbosa.



3rd AO TC CMF Experts Symposium, Washington DC, US

Leading experts and emerging talents in CMF surgery convened in Washington DC on September 21-22, 2025, for the 3rd AO TC CMF Experts Symposium, expertly chaired by Nils-Claudius Gellrich and Michael Grant.

Through highly interactive sessions, participants presented thought-provoking clinical cases and identified important clinical needs in the following areas:

- CAD/CAM 3D-printed subperiosteal implants
- Immediate implant-supported dental rehabilitation
- Total mandibular joint replacement (TMJR)

All moderators, speakers, and participants showed their dedication to improving CMF surgery through their inspiring contributions.

The AO Technical Commission (AO TC) is proud to support this unique expert forum in which science, clinical practice, and innovation intersect to drive the development of better solutions for CMF patients worldwide.

Participants at the 8th AO TC Trauma Experts Symposium, San Diego, US



Participants at the 3rd AO TC CMF Experts Symposium, Washington DC, US

Transforming research into practice



The AO Knowledge Translation Committee, supported by AO innovation funding, is aiming to accelerate the uptake of AO-generated knowledge.

Researchers have found that, on average, it takes 15–17 years for new scientific findings in the medical realm to be adopted into clinical practice. Intending to close this unacceptably large gap, the concept of knowledge translation focuses on accelerating this process. Thanks to its strong footing in research, education, community, and the regions, the AO is in a unique position to get at the forefront of knowledge translation. [The AO Spine Knowledge Translation Steering Committee](#) has been designing an AO-tailored Knowledge Translation Framework aiming to accelerate the uptake of AO-generated knowledge and thus speed up the improvement of patient outcomes.

Within the 36-month project supported by [AO Innovation Funding](#), the Knowledge Translation Steering Committee has recently identified two AO Spine pilot projects for which the AO-tailored Knowledge Translation Framework will be implemented. If proven effective, the framework will be phased in cross-divisionally and become an essential part of clinical research project development.

The committee has already succeeded in bringing the different infrastructures at the AO—AO Spine education, research, and community development—together to emphasize the uptake and dissemination of research. “Our initial aim was to have the Education and Research Commissions fully collaborate on this, and then with proof of concept bring in the Community Development commission,” said Charles Fisher, Chairperson of the Knowledge Translation Steering Committee. “Knowledge translation is so much more than educating clinicians about the newest research. It involves an ongoing interaction between community development, education, and research—and it’s different in every region; so the regions themselves also play an integral role.”

Regional differences are an important factor in integrating research evidence into clinical practice, but by far not the only one, Fisher explained. “The biggest challenge comes with the

different practice settings. There are differences not only between regions, but also between whether clinicians practice alone or in a group, whether they get their information online or read journals, how far along in their career they are, whether they go to meetings, and so on. Additionally, a new technique might require new equipment or additional resources. All these issues make it difficult to translate knowledge in the surgical world.”



“Knowledge translation is so much more than educating clinicians about the newest research. It involves community development, education, and research—and it’s different in every region.”

Charles Fisher, Chairperson AO Spine Knowledge Translation Steering Committee

Currently, the committee is working on understanding how clinicians in different settings learn and what it takes for them to adapt new findings for their practice. “Obviously, if it currently takes 15 years, what we’re doing right now isn’t working,” said Fisher.

The two pilot projects for implementing the AO-tailored Knowledge Translation Framework had to fulfill several criteria. First and foremost, their findings had to be easy to integrate into clinicians’ practice—not resource-heavy, generalizable, and of good quality. With the pilots—[EPOSO](#) and [TLA3/A4](#)—selected, the committee recently convened in London to refine tailored knowledge translation plans, including strategies to measure their translational efforts.

“I am hoping that our work will eventually contribute to reducing the knowledge gap by five to ten years,” said Fisher. “But I also want to get some answers to why it actually takes so long.”

The Biphasic Plate clinical study is well underway



The Biphasic Plate represents a significant advancement in orthopedic trauma surgery, offering a novel solution for treating fractures. It is currently used to manage distal femur fractures. Developed through a collaboration between the AO Research Institute Davos (ARI) in Switzerland and the Queensland University of Technology (QUT) in Australia, and with Development Incubator resources from the AO Innovation Translation Center (AO ITC), this innovative device addresses the limitations of traditional fracture fixation methods.

The Biphasic Plate is designed to provide optimal mechanical stability while allowing a controlled degree of motion at the fracture site. This unique feature enhances the healing environment by promoting callus formation, essential for robust and fast bone healing.

A clinical study of the Biphasic Plate with 4iMedical AG as its manufacturer is well underway in Europe, and the 100th Biphasic Plate was applied at the end of 2024 at Kantonsspital Graubünden in Chur, Switzerland—the same hospital that performed the first in-human application. Christoph Sommer, who implanted the first Biphasic Plate, is confident that it will, once serially produced, cover a currently unmet clinical need. Sommer is the Chief Trauma Surgeon at Kantonsspital Graubünden, chairperson of the [AO Technical Commission's](#) Lower Extremity Global Expert Committee, and has been an AO faculty member for over 30 years.



"The big advantage of the plate is its longevity. When implanting a Biphasic Plate to treat distal femur fractures, there is—unlike in standard plating—usually no need for a medial second plate."

Christoph Sommer

"The big advantage of the plate is its longevity. When implanting a Biphasic Plate to treat distal femur fractures, there is—unlike in standard plating—usually no need for a medial second plate. Not having to touch the medial tissue preserves the blood supply of these medial fragments and, therefore, promotes better bone healing, which is a clear advantage in elderly patients who go into full weight-bearing at an early stage. Double plating creates a more stable construct, but on the other hand—by too rigid fixation—ends up with more nonunions, which will eventually lead to more plate failures as patients live longer."

Although the failure rate is not zero in the Biphasic Plate's clinical study so far, Sommer believes in its superiority. "The longevity of the Biphasic Plate is clearly an improvement compared to today's plates, but you will never get a 100% success rate."

Sommer believes the Biphasic Plate to be an ideal solution for distal femur fractures, especially in elderly patients and in a periprosthetic context. "There is clearly a market for this plate, and my colleagues have shown huge interest in it whenever we presented it at congresses and symposia."



"The biphasic plate concept combines improved healing times with a more liberal rehabilitation protocol and has the potential to corroborate the AO's leadership in fracture management innovation."

Michael Schuetz

Michael Schuetz, Director of the Jamieson Trauma Institute in Brisbane, Australia, and Chairperson of the AO Technology Transfer Board, is equally optimistic about the concept: "The Biphasic Plate concept combines improved healing times with a more liberal rehabilitation protocol and has the potential to corroborate the AO's leadership in fracture management innovation. It is another great AO innovation that demonstrates how fundamental understanding of optimal healing conditions can be translated into clinical application and improvement."

The Biphasic Plate was CE-approved as a class IIB medical device in April 2021, and the team at the AO ITC is currently working on getting FDA approval to conduct cases in the United States. The European study will, including a full year of follow-ups, be concluded in 2026. "Once the clinical study is completed and analyzed, we will focus all our efforts on finding an industrial partner," said Ladina Hofmann-Fliri, Project Manager Technology Transfer at the AO ITC.

Educational videos to resonate across generations



The AO Foundation has been using video for surgical education since the 1970s, evolving from early 30-minute demonstrations to today's diverse formats.

Starting in 2023, and with the support of [AO Innovation Funding \(Strategy Fund\)](#), an eleven-month proof of concept project, led by AO Trauma Faculty Member Tobias Fritz in collaboration with the AO Education Institute (AO EI) and RIMASYS, has looked into the expansion of formats and applications of surgical videos for educational purposes. By producing multichannel cinema quality video content, the team created source material for various learning contexts.

"Today's surgical education must bridge generational divides," noted Matthias Schmidt, Head of Education Design at the AO Education Institute. "Younger learners expect experiences similar to social media, while we must maintain educational rigor."

As part of this project, Monica Ghidinelli, Manager of Education Research at the AO EI, and Tobias Fritz conducted a study to evaluate the effectiveness of "reels"—short videos lasting around 60 seconds—in surgical education, focusing on orthopedic and trauma surgeons.

"To remain relevant, surgical education must evolve alongside consumption habits. Our research shows that formats familiar from digital platforms drive engagement, but we balance this with educational depth. The challenge isn't creating shorter content—it's delivering comprehensive knowledge in formats that resonate across generations," said Schmidt.

Two reels were produced: "Steps to Gain Access to the Sciatic Nerve" and "Dissect the Piriformis Muscle to Gain Access to the Posterior Wall." An evaluation questionnaire was answered by 178 surgeons from 55 countries. 96% of the participants found the educational reels clear and effective, with learning objective achievement rated above 4.2/5. The participating surgeons reported using these videos primarily to refresh procedural knowledge (75.7%) and review anatomical structures (56.8%).

The pilot project confirmed that while format preferences vary by generation, educational value remains paramount. "Surgical education can easily be transferred using short video formats," said Tobias Fritz. "Furthermore, insights from the engagement rate of such educational content will enhance the future education experience for the AO."

New horizons for the DRIM-Nail

The [AO Innovation Translation Center](#) (AO ITC) is delighted to provide an update regarding the evolution of the [Distal Radius Intramedullary Nail \(DRIM-Nail\)](#), an implant development project in the early stages of clinical application. Following recent investment activities by DISRAD AG in the wider availability of the DRIM-Nail, a clinical case series has been (re-)launched in selected clinics in Switzerland, Germany, and Austria to enable data collection around device performance and patient outcomes.

Approved by the AO in June 2022, the DRIM-Nail is an innovative treatment option for patients with extraarticular distal radius fractures. The design, development, and certification of this new intramedullary nailing implant originally grew from a multi-partner collaboration between DISRAD AG, a start-up founded at Balgrist University Hospital by the Balgrist Beteiligungs AG, the University of Zurich, the AO Technical Commission's Hand Expert Group, the [AO's Innovation Funding](#), and 4Imedical.

Since obtaining its CE mark—a regulatory milestone that remains in effect—the DRIM-Nail has been used in the treatment of

approximately 50 distal radius fractures to date. In partnership with expert surgeons at the aforementioned clinics, further data collection is currently underway with a focus on two key areas: patient outcomes following treatment with the new implant, and the procedural experience for surgeons. Insights from clinical usage are expected to provide the framework for a future clinical study. Additionally, the DRIM-Nail is anticipated to gain FDA approval in the near future, allowing expansion to the US market.

Key insights from the case series were presented at the AO ITC's Innovation Hub during the 2025 AO Davos Courses. This event built on last year's [Meet the Expert](#) session (Davos, December 2024), which was an interactive stage show featuring a practical demonstration of the surgical technique to insert the DRIM-Nail and an overview of the clinical benefits of the new device. The presenters included renowned surgeons Andreas Schweizer, Martin Langer and Alejandro Lluch, who were instrumental in the development of the new implant. The session was well received, both in Davos and internationally.

Consistent with the AO TC's ethos of harnessing innovation to improve patient care and outcomes, the new DRIM-Nail provides all the benefits of minimally invasive intramedullary fracture stabilization, including minimal trauma to the bone fragments and protection of the adjacent soft tissue. This aims to achieve faster recovery, better and faster functional and cosmetic outcomes, and a lower economic burden compared to current treatment options.

Martin Langer said: "The DRIM-Nail system is the most gentle implant system available - and the surgical time was also shorter than with plate osteosynthesis. This new solution marks a genuine step forward for patient care and outcomes. We look forward to seeing the findings from the clinical case series, and hope that the DRIM-Nail will soon be more widely available for patients and surgeons worldwide."



Fig 1 The Distal Radius Intramedullary Nail (DRIM-Nail)



Fig 2 Exemplar case using the DRIM-Nail: (a) Lateral preoperative radiograph after closed reduction showing a dorsal dislocation of 25° compared to the physiological palmar tilt and a dorsal comminution; (b) AP preoperative radiograph following closed reduction; (c) AP and (d) lateral radiographs after 3 months with the distal radius fracture healed in anatomical position. (Case kindly provided by Ladislav Nagy, MD, Balgrist University Hospital, Zurich, Switzerland).

Clinical Evidence: Highlights from 2025

The [Clinical Evidence](#) unit supports innovation translation at the AO ITC, conducting clinical research grounded in sound scientific methodology. This knowledge creation forms an integral part of a streamlined pathway to transform ideas and novel solutions into published clinical data. Here we feature two recent projects in detail, and highlight other recently published and ongoing studies.

AO Fracture Monitor clinical trial protocol published in BMJ Open

Benedikt Braun, Michael Raschke, Konrad Schütze, Tim Pohlemann, Alexander Joeris, Manuela Ernst

The AO's pioneering Fracture Monitor project is moving ahead with the recent publication of the [clinical study protocol in the respected journal BMJ Open](#) [1]. The clinical study marks a significant step in the validation of the implantable telemetric sensor system designed to continuously monitor fracture healing.

The AO Fracture Monitor, developed through [AO Innovation Funding](#), represents an innovative approach in tailoring rehabilitation to the specific needs of individual patients. By enabling real-time data collection on bone healing, the device aims to optimize post-surgical care and improve patient outcomes.

The ongoing multicenter clinical trial, launched in autumn 2023, is currently underway at four leading German hospitals: BG Klinik Tübingen, Universitätsklinikum des Saarlandes, Universitätsklinikum Ulm, and Universitätsklinikum Münster. To date, 17 patients have been enrolled in this first-in-human, interventional, prospective study, which evaluates the safety of the Fracture Monitor T1 in patients with femoral fracture over a six-month period. 15 of the 17 enrolled patients have already completed their 6-month follow-up. As well as delivering safety and performance data, project stakeholders anticipate that

outcome data will advance the surgical understanding of fracture treatment, fracture aftercare, and rehabilitation, and how these factors relate to fracture healing.

Manuela Ernst, Senior Project Leader Technology Development at ARI, emphasized the importance of this phase:

"This study was rigorously designed and is a critical step toward market availability. The data that we collect will support regulatory approval of the Fracture Monitor under European medical device regulations, meaning that more patients in Europe can benefit from the device."

The success of the AO Fracture Monitor project reflects a robust interdisciplinary collaboration. AO scientists and engineers spearheaded the device's development, supported by AO Innovation Funding. Renowned AO surgeons have provided critical clinical expertise and feedback throughout both the development phase and the current initial human implantation phase, while the Clinical Evidence team continues to play a key role in driving the clinical study.

This combination of engineering expertise, surgical skill, and clinical insight underscores the AO Foundation's commitment to advancing trauma and orthopaedic innovation and improving patient care through evidence-based solutions.

Alexander Joeris, Head of the AO's [Medical and Scientific Affairs](#) team, highlighted the unique nature of the study: "This is a landmark study for AO Clinical Evidence – it's the first pre-market clinical study with an investigational device that our team has designed and implemented." Ramona Ritzmann, Head of the AO's [Clinical Operations](#) team, added: "We are proud to support the Fracture Monitor project so that more patients can benefit from this important advancement in fracture care."

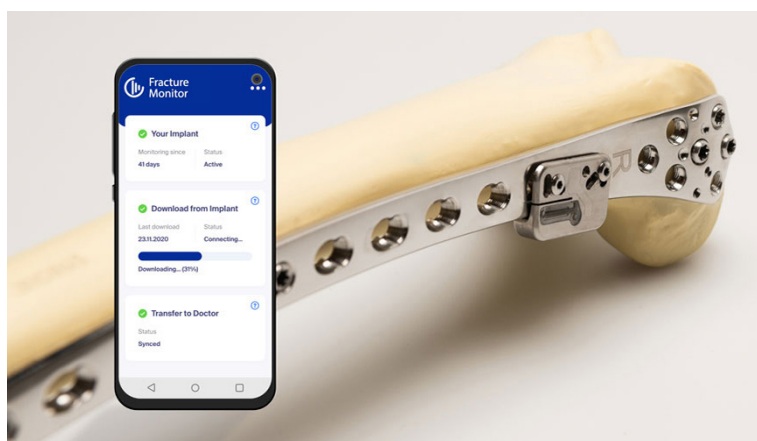


Fig 1 The novel AO Fracture Monitor System for remote monitoring of implant load

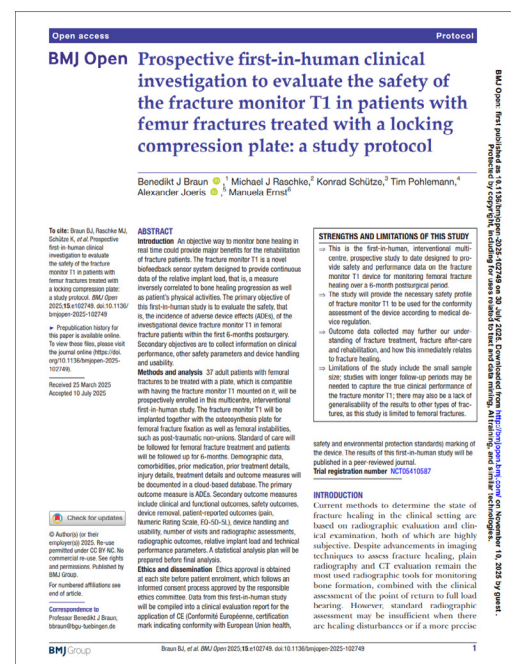


Fig 2 The clinical study protocol was recently published in BMJ Open.

Modern Luque trolley technique shows superior outcomes in early-onset scoliosis management

Romain Dayer, Michael Grevitt, Lee Breakwell, WaiWeng Yoon, Maio Chen, Tiara Ratz, Tina Szocik, Yaner Y. Zhu, Pediatric Spine Study Group (PSSG), Jean Ouellet

A prospective, multicenter cohort study recently published in *Spine Deformity* [2] has demonstrated that the modern Luque trolley (MLT) technique significantly reduces reoperation rates in children with early-onset scoliosis (EOS) and is associated with a low implant failure rate, compared to traditional growth-friendly surgical methods.

Study overview

Led by Jean Ouellet and an international team of spine specialists, the study enrolled 18 EOS patients treated with MLT, a growth guidance construct, and compared them to 43 matched historical controls drawn from the PSSG (Pediatric Spine Study Group) who underwent treatment with dual growing rods (DGR), rib-based growing rods (RBGR), or magnetically controlled growing rods (MCGR). The primary endpoint was the number of spinal reoperations within three years post-surgery.

Key Findings

- Only 1 of 18 MLT patients (5.6%) required reoperation within 3 years of surgery, compared to 30 of 43 controls (69.8%). Conditional Poisson regression yielded a rate ratio of 0.02 (95% CI: 0–0.12, $p < 0.001$).
- The median time to first reoperation was 5.4 years for MLT vs. 4.3 years for MCGR and 0.5 years for DGR and RBGR.
- Total spinal growth (T1–S1) was comparable between groups, although thoracic growth (T1–T12) was slightly lower in the MLT group.

- The MLT group achieved the same curve correction as the controls at 3 years. Initial curve correction was greater in MLT patients, but they experienced more postoperative loss of curve correction.
- No difference was observed in standing heights and quality of life (EOSQ-24) scores.
- MLT patients had no spontaneous spinal fusion and only one patient experienced implant loosening. Adverse events were fewer and less severe than in control groups.

Clinical implications

The MLT technique, which captures the apex of the deformity with gliding anchors via a minimally invasive approach, markedly reduces the need for repeated surgeries in children with EOS. It addresses key limitations of earlier Luque trolley designs and modern growing rod systems, particularly the high rates of implant failure and spontaneous spinal fusion seen in other growth sparing techniques.

Limitations

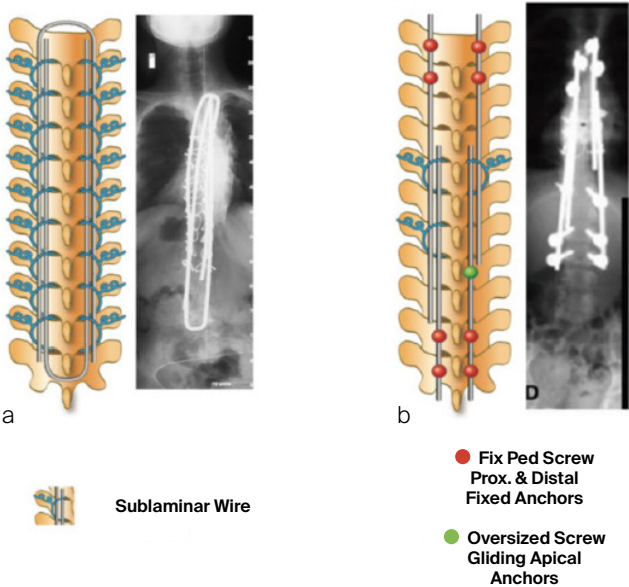
A historical cohort was used as the study’s control group, and some matching criteria (eg, curve flexibility) were unavailable. The follow-up period was limited to three years, and sample size constraints affected statistical power for secondary outcomes like quality of life.

Conclusion

The MLT technique is a promising solution for EOS management, with markedly lower reoperation rates, comparable spinal growth, and favorable safety outcomes. Longer-term studies are needed to confirm sustained benefits and refine patient selection criteria.

Further to the 3-year study results described above, 5-year results will be published later in 2026.

Classic Luque Trolley



Modern Luque Trolley

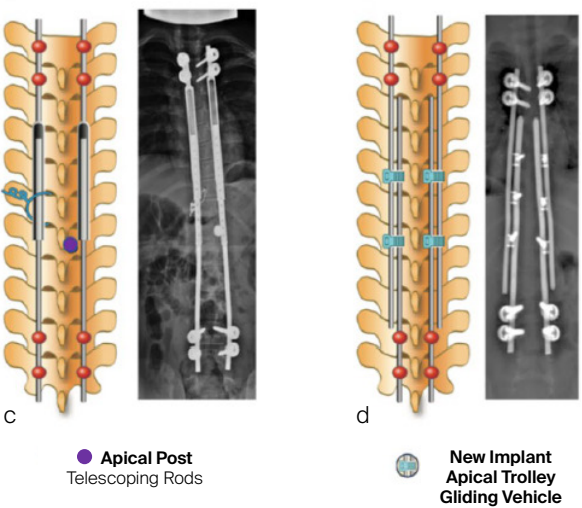


Fig 3 Types of constructs adopting the Luque trolley concept of self-growth guidance. The classic Luque trolley technique with sublamina wires (**a**) or a combination of sublamina wire, fixed pedicle screw proximal and distal fixed anchors, and screw gliding apical anchors (**b**). The modern Luque trolley technique progressed from telescoping rods (**c**) to the novel implant used in the current study consisting of fixed distal and proximal anchors and the apical trolley gliding vehicles (**d**).

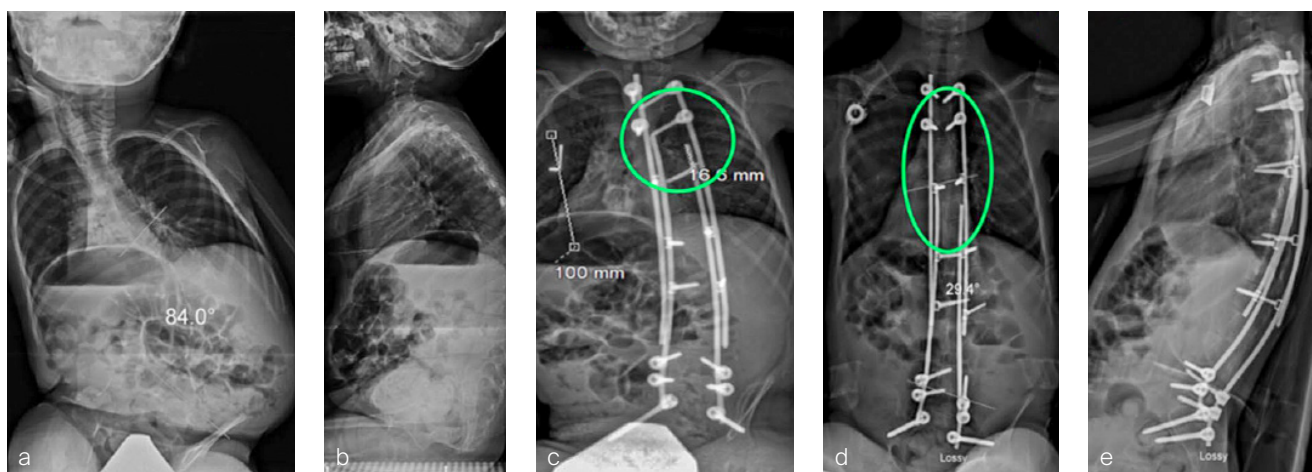


Fig 4a–e Clinical example of the modern Luque trolley technique. **(a–b)** The modern Luque trolley technique was performed on a 6-year-old with preoperative low tone severe scoliosis of 84°. **(c)** Immediately postoperative, the deformity was corrected to 28°. **(d)** At 5 years follow-up, the trolley gliding vehicles had a self-guided growth of 5.5 cm (growth within the green circles from **(c–d)**). The patient did not require any revision surgery.

Also from Clinical Evidence:

A 2026 paper published by [Audisio et al. in Injury](#) [3] focuses on image database validation with the aim of AI-assisted diagnosis. Sponsored by AO Innovation Funding, the pilot study aims to validate the “ground truth” accuracy and consistency of proximal femur fracture classification using a large radiographic image database. The project, a collaboration between expert groups from the University of Turin and the AO Foundation, supports the reliability of reference annotations for future artificial intelligence (AI) model development and paves the way for safer integration of decision support tools into orthopedic trauma workflows.

Martin Jaeger and expert colleagues from the AO TC’s Shoulder Task Force have recently published a study protocol for an [observational case series on the clinical performance of the new VA-LCP Clavicle 2.7 Plating System](#) in *Frontiers in Surgery* [4]. The AO Technical Commission-funded study protocol aims to gather early and mid- to long-term evidence on the clinical performance, safety, and usability of the 2.7 mm VA-LCP Clavicle Plates and 2.7 mm VA-LCP Clavicle Hook Plates, specifically to describe safety, clinical performance, functional outcomes, patient-reported outcomes (PROs), usability, and surgeons’ experience with the implants. This post-approval product monitoring is an important step for quality control in the AO Technical Commission’s Milestones Process for the development of new solutions.

Coming soon:

Epidemiological and primary results from the FROST Registry (Fracture-Related Outcome Study for operatively treated Tibia

shaft fractures) will be published in mid 2026. This registry is the largest of its kind and is guided by expert surgeons from the AO TC’s Anti-Infection Global Expert Committee. Read more about the FROST Registry on [page 24](#).

Primary results from two AO TC registries are expected to be released in 2026. Three papers will be submitted in early 2026 for the PedFemFx Registry—a prospective multicenter observational registry for femoral shaft fractures in children up to 16 years of age, guided by expert surgeons Peter Schmittenbecher (Karlsruhe, Germany) and Unni Narayanan (Toronto, Canada).

Furthermore, manuscript preparation is underway with leading CMF experts Paris Georgios Liokatis and Carl-Peter Cornelius (both of Munich, Germany) for the MatrixWAVE Registry, an international, multicenter study established to collect clinical data on the MatrixWAVE™ Mandibulo-Maxillary Fixation System.

A clinical study for the [Biphase Plate](#) is well underway in Europe and primary results, including a whole year of follow-up data, are expected to be published in late 2026 or early 2027. The Biphase Plate is an innovative device for the treatment of distal femur fractures and represents a significant advancement in orthopedic trauma surgery. It received CE-MDR certification in March 2025, and the AO ITC team is currently preparing a 510(k) submission to enable potential future use of the implant in the United States. The study is strongly supported by an engaged group of investigators led by Christoph Sommer (Chur, Switzerland), whose dedicated efforts in evaluating and documenting the clinical cases continue to enrich the overall understanding of the device’s performance.

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Clinical Research Symposium takes center stage at EORS Conference, June 2025

The [AO Innovation Translation Center](#) (AO ITC) drives knowledge creation to improve patient care and outcomes. Staff within [Clinical Evidence](#) and [Knowledge Forums](#) currently support 80+ ongoing clinical studies with over 10,000 enrolled patients, and have delivered more than 750 peer-reviewed publications since 2001.

To address the most urgent questions in orthopedic and trauma surgery, AO ITC staff work closely with expert surgeons, sharing their expertise in medical affairs, statistics, medical writing, data management, quality management, and regulatory affairs. This high-level collaboration allows innovation to be brought into hospitals and clinics faster.

The recent [EORS](#) conference, held in the beautiful alpine town of Davos in June 2025, saw Ted Miclau (Chair of the [AO Clinical Science Advisory Commission](#)) joining forces with [AO ITC Clinical Evidence](#) staff Ramona Ritzmann, Alexander

Joeris, Katrin Simioni, Tracy Zhu, Janneke Loomans, and Olesja Hazenbiller to showcase best practice in clinical research. Topics included the importance of clinical data collection; the challenges and pitfalls inherent to international clinical studies; and methods to boost the implementation of research findings in the clinical setting. Ultimately, this high-impact clinical research allows patients to receive clinical care of the highest quality and fulfills the enduring AO mission to improve patient care and outcomes.

Ted Miclau, Chair of the AO Clinical Science Advisory Commission, said: "Clinical research is the backbone of bringing technological and clinical innovations to patient care. With its well-rounded, world-class research team and extensive surgeon network, the AO is highly positioned to conduct critical studies to change clinical practice. This symposium reviewed key facets of the conduct of international clinical trials, from study design to knowledge translation."



From left: Katrin Simioni, Ramona Ritzmann, Ted Miclau, Janneke Loomans, Olesja Hazenbiller, and Tracy Zhu.

AO Spine Knowledge Forums

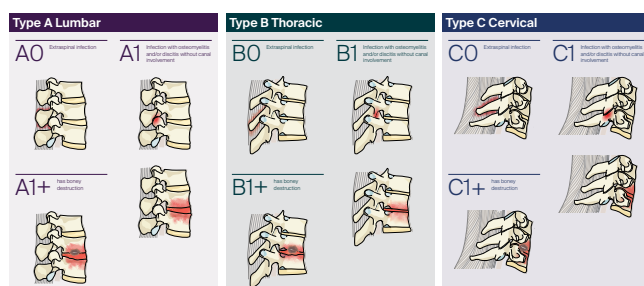
In 2026, the AO celebrates [15 years of its Knowledge Forums](#)—global expert groups launched in 2011 at the AO's headquarters in Davos. Today, the [AO Spine Knowledge Forums](#) bring together more than 280 leading spine clinicians and researchers from around the world to focus on major spinal pathologies. The aim is to create high-quality evidence and translate it into practical tools and recommendations for spine surgeons worldwide, ensuring better patient care and outcomes.



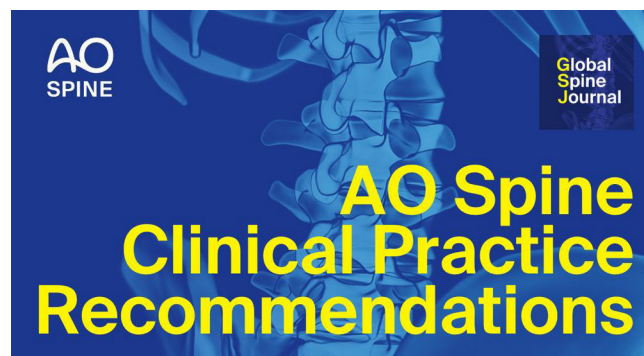
The AO Spine Knowledge Forums were highly productive in 2025 and generated numerous high-quality publications from global key opinion leaders. The AO Spine Knowledge Forum Trauma and Infection published the [AO Spine Primary Infection Classification System](#), a new toolkit to improve diagnosis and decision-making in cases of primary spinal infection. The new system is designed to standardize decision-making and improve communication worldwide.



AO Spine Primary Infection Classification System



Throughout the year, [expert recommendations](#) from the AO Spine Knowledge Forums were published in the Global Spine Journal. Topics include Management of Osteoporosis in Adult Spine Deformity [1], Surgical Management of Degenerative Spondylolisthesis [2], and Surgical Management of Acute Traumatic Spinal Cord Injury [3].



In January, the AO Spine Knowledge Forum Tumor published a special Focus Issue in the Global Spine Journal highlighting [personalization in spinal oncology](#). The issue features a detailed exploration of the current state of precision medicine in spinal oncology and examines the impact of growing diagnostic and treatment personalization on clinical decision making in the care of patients with primary and metastatic spinal tumors.



The AO Spine Knowledge Forum Deformity recently concluded a landmark study, [Evaluation of Neurologic Complications Associated with Surgical Correction of Adult Spinal Deformity \(Scoli-RISK\)](#). The latest publication [4] summarizes all results from a large multicenter adult deformity clinical study and significantly advances the understanding of motor neurologic outcomes in complex adult spinal deformity (ASD) surgery, establishing the gold standard for the rate of neurologic complications.



In a further notable achievement, the AO Spine Knowledge Forum Deformity released a new Focus Issue in July dedicated to [Adult Spine Deformity](#) (ASD), one of spine surgery's most complex and controversial areas. In the issue, leading spine surgeons analyse current trends in ASD surgery, evaluate risk-benefit balances, and identify gaps in knowledge that demand further exploration.



The AO Spine Knowledge Forum Trauma and Infection recently published data from a [large multicenter thoracolumbar fracture clinical study](#) entitled Surgical versus Non-Surgical Treatment of Thoracolumbar Burst Fractures in Neurologically Intact Patients: A Prospective International Multicentre Cohort Study [5]. The results provide crucial insights into outcomes, cost-effectiveness, and regional trends—equipping surgeons worldwide with the evidence needed for informed decision-making and treatment planning.



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Advanced Reaming System for intramedullary nailing – experimental cadaveric analysis

Reaming is a critical step during intramedullary nailing, enhancing implant fit and promoting healing. However, conventional reaming systems can elevate intramedullary pressure and temperature, potentially leading to such complications as fat embolism and/or thermal damage. Recently, the Advanced Reaming System was introduced to address these issues, incorporating a [Flexible Monobloc Reamer](#) with both front- and side-cutting features and streamlined distal end for high performance and efficiency ([Fig 1](#)).

Building on this innovation, an experimental study was performed to evaluate the performance of the novel reaming system versus the conventional Synream system, with focus on intramedullary pressure, temperature, thrust force, and integral effort/energy during sequential reaming stages.

For this purpose, eight pairs of porcine cadaveric humeri – assigned to two study groups and instrumented with pressure sensors and thermocouples – underwent standardized reaming procedures in a testing machine setup.

The results demonstrate significantly lower intramedullary pressure, temperature, thrust force, and integral effort/energy indicated for the Advanced Reaming System versus the conventional reaming system, $P \leq 0.018$ ([Fig 2](#)).

These findings highlight the potential of the novel reaming system to reduce surgical effort and enhance performance and efficiency during intramedullary reaming.



Fig 1 Flexible Monobloc Reamer with elastic shaft and deeply fluted reamer head incorporating both front- and side-cutting features to reduce intramedullary pressure, increase flow of bone chips and marrow, and facilitate high performance and efficiency.

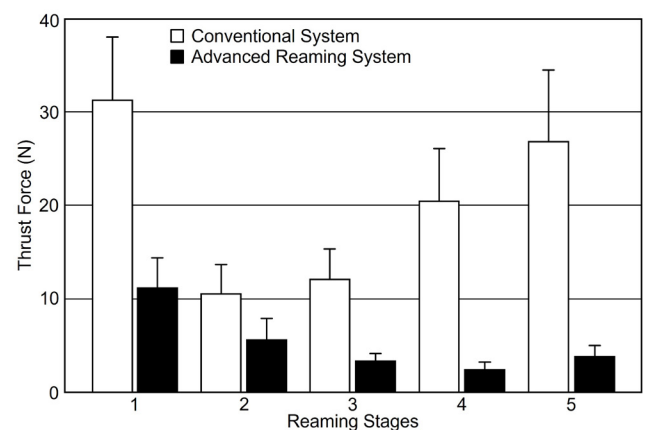


Fig 2 Thrust force during five sequential reaming stages of both tested reaming systems presented in terms of mean value and standard error.

SmartFusion: objective monitoring of spinal fusion via AO's sensor technology can enhance spinal care

Spinal fusion is a procedure that permanently joins two or more vertebrae to eliminate movement between them, reduce pain, and stabilize the spine. Today, spinal fusion monitoring relies mainly on CT imaging and patient-reported outcomes. While widely used, CT scans expose patients to radiation during follow up visits, only provide snapshots of the process, and depend on subjective interpretation.

What if the success of a spinal fusion could be monitored continuously, remotely, and without any radiation? What if spine surgeons could detect complications before they became critical – based on objective sensor data rather than relying on subjective image interpretation?

This vision is pursued in the AO Research Institute Davos (ARI), the AO Innovation Translation Center (ITC), and their partners through SmartFusion – a project to translate the AO's sensor technology for fracture healing monitoring (AO Fracture Monitor) into a novel approach for spinal fusion.

From fractures to fusion: the spark of an idea

The [AO Fracture Monitor](#) was first developed as a system that used an implantable sensor to track fracture healing in long bones. By continuously measuring the implant load of orthopedic plates during daily patient activities, the system was designed to allow remote assessment of fracture healing progression at any time – based on quantifiable data. The AO Fracture Monitor is currently part of a clinical safety study with the goal of being certified as a medical device following a successful clinical trial.

As the development advanced, a natural question arose: could this technology be applied to another challenging area of orthopedics – spinal fusion?

The possibility of offering objective, real-time, and remote feedback on spinal fusion progression without any radiation would open the door to a transformative opportunity.

Testing the concept

Utilizing the principle of the AO Fracture Monitor, spinal fusion progression was assessed in ARI by measuring the load on implanted pedicle rod-screw systems. One major milestone was reached in a preclinical study, when an adapted version of the AO Fracture Monitor was successfully implanted in sheep – attached to posterior spinal instrumentation following posterolateral fusion surgery. Despite the complex in vivo loading scenarios, it was demonstrated that the continuously measured implant load decreased with ongoing fusion [1, 2].

The investigation was expanded to lumbar interbody and multilevel fusion procedures ([Fig 1](#)). Biomechanical studies were conducted in collaboration with the AO Technical Commission Spine to collect valuable data on both the potential and the limitations of the system [3, 4]. Particular emphasis was placed on the development of concepts to allow adaptation of the AO Fracture Monitor for spinal applications.

Both preclinical and biomechanical studies supported the hypothesis that continuous implant load monitoring provides a reliable and objective measure of spinal fusion progression.

Building the next generation

With feasibility proven and a clear vision for the next concept, the project reached a turning point. Under the lead of Manuela Ernst (Senior Project Leader, ARI) and with support from the AO ITC, a roadmap was defined to bring the system closer to clinical reality.

A new prototype, designed for spinal applications, is now under development. This next-generation system will meet the unique requirements of spine surgery, including optimized sensor size and sensitivity. Moreover, the new design will result in a platform technology, adaptable not only for spinal applications but also for use with other orthopedic implants and fixation systems.

To accelerate development, AO partnered with Sensirion AG (Stäfa, Switzerland) and secured an Innosuisse project grant in 2025. This collaboration is set to drive innovation from the lab to the operating room. In parallel, the project also explores the business model for such a system to help define the long-term future of the sensor technology.

A glimpse into the future

The vision of SmartFusion is ambitious. With a solid founda-

tion of scientific proof and strong industry collaboration underway, SmartFusion has the potential to transform the monitoring of spinal fusion – shifting it from subjective snapshots to continuous, objective insights. Even though there is still work to be done, the project already exemplifies the AO's spirit of innovation, translating visionary ideas into technologies that can advance patient care through collaboration between surgeons, scientists, engineers, and industrial partners.

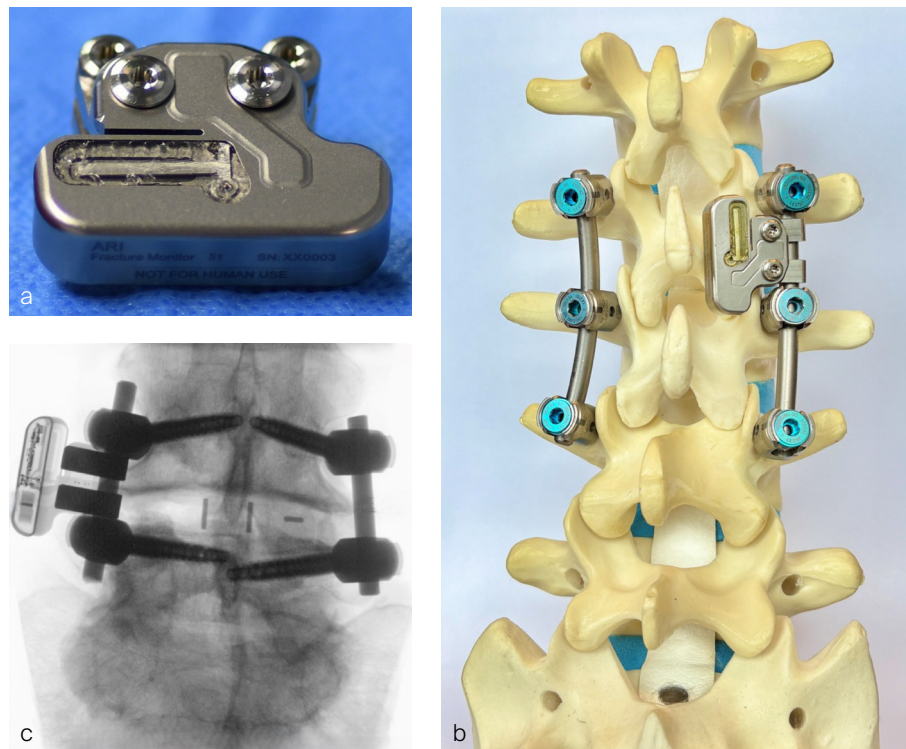


Fig 1 Fusion monitor sensor (a) attached via clamps to rods of an instrumented spine model (b). X-ray image (c) showing the sensor attached to instrumentation in an anatomical specimen, and utilized to monitor implant load after transforaminal lumbar interbody fusion in a biomechanical study [3].

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