

New Trauma Products from AO Development

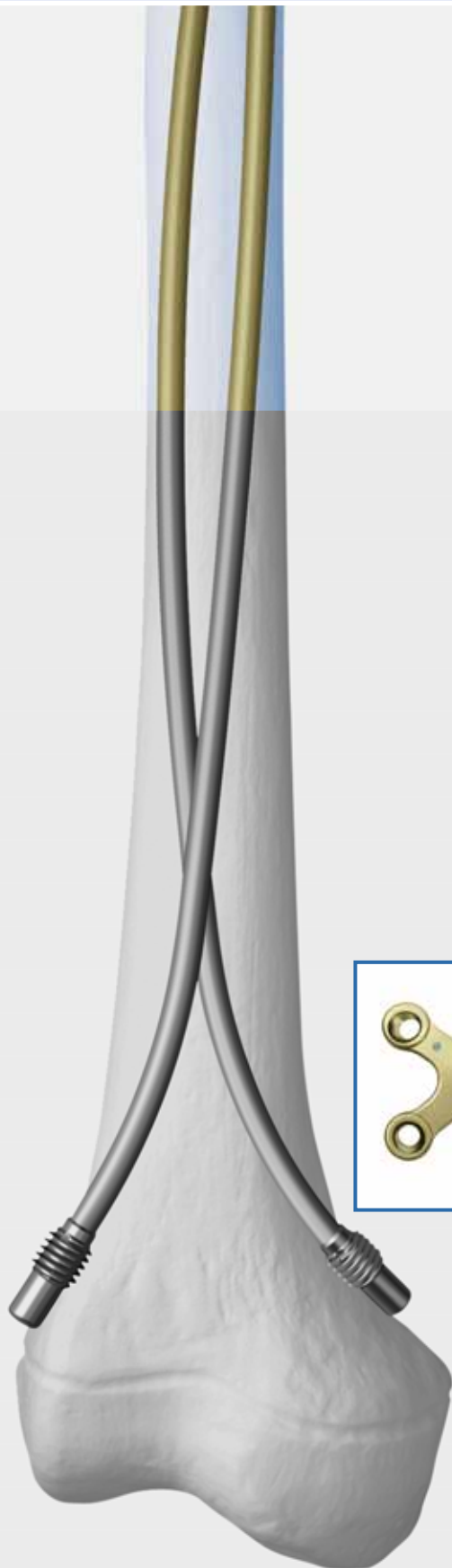


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DUE TO VARYING COUNTRIES' LEGAL AND REGULATORY APPROVAL REQUIREMENTS PLEASE CONSULT THE APPROPRIATE LOCAL PRODUCT LABELING FOR APPROVED INTENDED USE OF THE PRODUCTS DESCRIBED IN THIS BROCHURE. ALL DEVICES IN THIS BROCHURE ARE AOTK APPROVED. FOR LOGISTICAL REASONS, THESE DEVICES MAY NOT BE AVAILABLE IN ALL COUNTRIES WORLDWIDE AT THE DATE OF PUBLICATION.



Dear reader,

Due to your positive feedback, we have decided to produce three issues of the TK News each year instead of two. Furthermore, we have adapted the concept slightly. From now on, each issue will focus on one of the AO's three main specialties, trauma, spine, and craniomaxillofacial, reflecting on the increasing specialization of surgeons worldwide. Therefore, the editorship will also be shared with Paul Pavlov, chairman of the AOSpine TK and Edward Ellis III, chairman of the AOTK (CMF). This issue will focus on new trauma techniques and information around these, plus a few selected items from spine and CMF which are either major innovations for these specialties, as for example the SynFix in spine or could also be interesting for a trauma surgeon.

Another major change occurred in the recent past, the signing of a new contract between the AO Foundation and its leading industrial partner, Synthes, Inc. This contract strengthens the AO's position as a leading independent academic and scientific organization and continues the very successful collaboration with Synthes, Inc. for the benefit of our patients. The TK-System will remain the undisputed institution, which provides unbiased medical guidance and control for the development of new implants, methods and techniques. Its impact will increase since it provides a stable and reliable framework for the future relationship between AO and all its industrial partners.

In the lead article, Hans Zwipp, the long-standing chairman of the Foot & Ankle Expert Group (FAEG) will give you a comprehensive overview on the latest developments in foot surgery. Hans Zwipp will step down as chairman after having been a successful leader of the FAEG for 12 years. I would like to thank and congratulate him for his contribution and achievements.

A clever new device is the End Cap for the Titanium Elastic Nails (TEN) and Stainless Steel Elastic Nails (STEN). This End Cap stops the movement of the nail in the entry-point, especially in the backing out direction. This development also shows the close cooperation between AO Development and Research to prove the safety and effectiveness of an AO approved technique.

The column Portrait features Martin Langer, MD, a surgeon who also could have become a graphics artist for anatomical illustrations at "Netter Atlas". But instead he is providing his inspiration to new developments in hand surgery.

I would like to encourage you to share your talents with us and approach the AO if you have an idea for the improvement of patient treatment as he did.

Once again, I would like to stress that none of the product descriptions in this publication is a substitute for the AO's surgical techniques or the AO teaching tools.

Yours faithfully,

Norbert P Haas

Hans Zwipp

THE FOOT & ANKLE EXPERT GROUP (FAEG): A 12 YEARS REPORT

As one as the youngest specialty groups, the FAEG was established in May 1994 as Foot & Ankle Study Group (FASG). Stephan M Perren, chairman of the AO Technical Commission at this time, initiated the founding of this specialty group which should interact with the small Fragment Coordination Group like the Hand Study Group developing this way new ideas.

“Feel free to take up new areas” offered Stephan M Perren to me as brandnew chairman and to the founding members [1] at the initial meeting in Interlaken, May 27, 1994.

What were the initial goals and what has been achieved in a dozen years?

1. The first and most demanding goal was to establish a comprehensive foot classification according to the AO Principles, following the ABC-Classification of Maurice E Müller.
2. New AO foot scores such as preoperative activity and postoperative follow-up scores should be defined.
3. Clinically unsolved problems had to be focused, such as posttraumatic avascular necrosis of the talus and navicular, treatment of charcot feet, replacement of bone and cartilage as well as the development of reliable cementless ankle joint replacement.
4. New techniques should be realized such as biological fixation with a minimal invasive K-wire network in high-energy fractures, to minimize the use of hardware.
5. New implants for the C2/C3-pilon fractures (pilon plate) and complex calcaneal fractures (calcaneus plate) should be developed with the industrial partners Mathys Medical Ltd., Bettlach, Stratec Medical Ltd., Oberdorf and Synthes (USA), Brandywine.

Today, close to the 40th Meeting (Dresden, July 8th, 2006) of the Foot & Ankle Expert Group (FAEG) [2], a lot has been achieved, but by far not all of the initial goals. The main task of creating a new AO Classification for injuries of the foot was achieved after 7 years in a final 5-day-clausure in the lonesome Sertig valley in July 2001, the results are published in Injury 2004 [3]. An intra- and interobserver reliability study of this classification as well as an AO-Foot-Classification software is still under development with AOCID. Goal two concerning AO scoring systems has not yet been reached, but is still in a funding process with AOFAS (American Orthopaedic Foot & Ankle Society). The initial goals three to five have been mainly achieved by developing anatomically shaped interlocking plates (Fig 1) for the pilon, talus [4], calcaneus, navicular, [4] and cuboid [4]. These plates allow stable fixation even in multifragmentary fracture patterns, osteoporotic bone compromising less the critical bone blood supply. High primary fracture stabilization by using the interlocking calcaneal plate (Fig 2) instead of the conventional one, could reduce the rate of cancellous bone transplantation from 53% to 3.8% [Zwipp H, et al 2004] [5]. The interlocking calcaneal plate is meanwhile produced in four sizes right and left in a stainless steel, titanium and recently also in a titanium-molybden version. The pilon plate (Fig 1e; Fig 3) for fixing C2/C3-fractures is in clinical use since 2001 and available in a scalloped and a biomechanical more stable unscalloped plate shape (stainless steel or titanium). A longer third version for extended meta-/diaphyseal pilon fractures will be a project for the near future.

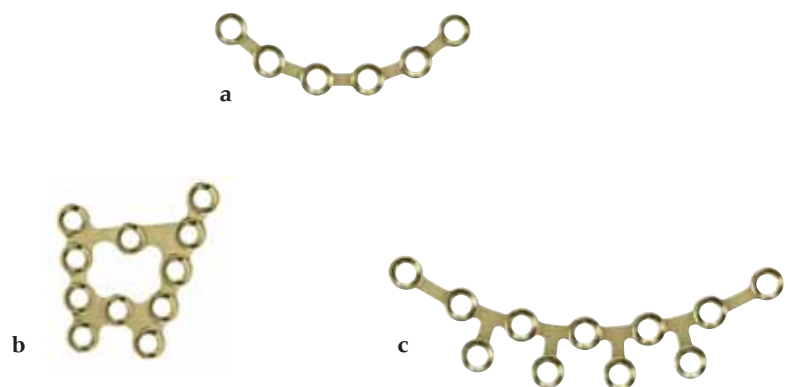


Fig 1a–e Interlocking plates.
a Talus plate.

b Cuboid plate.
c Navicular plate.

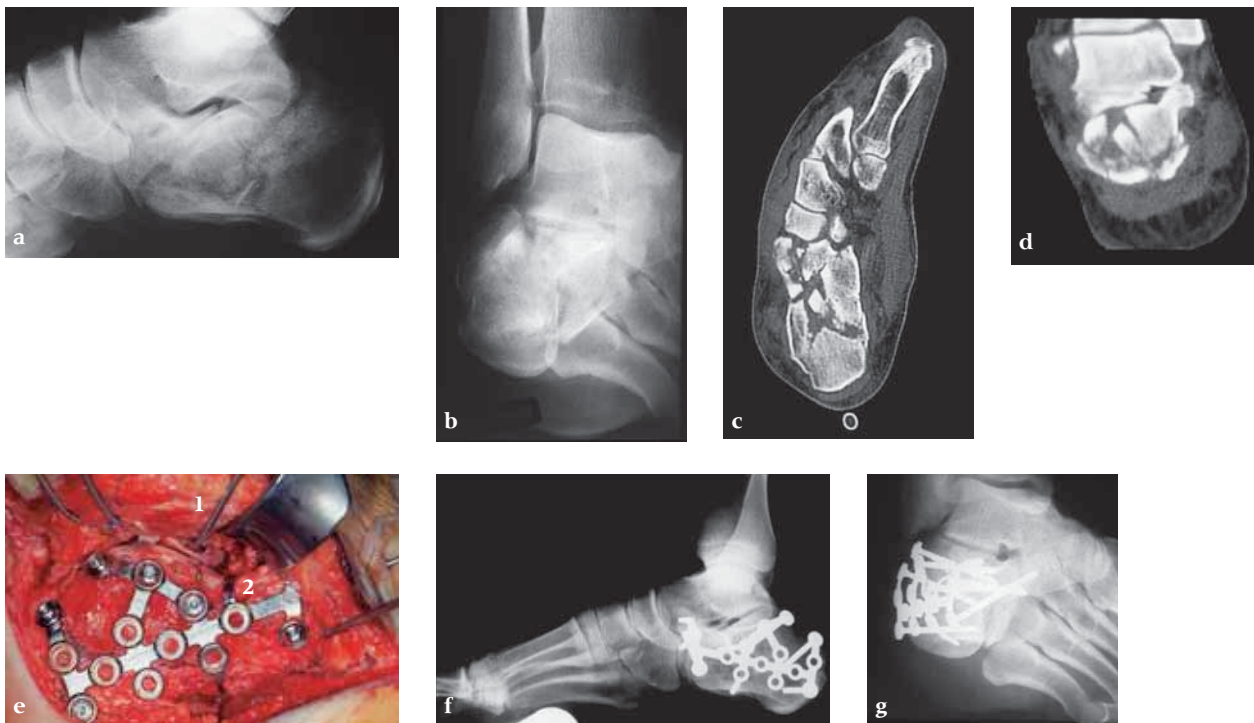
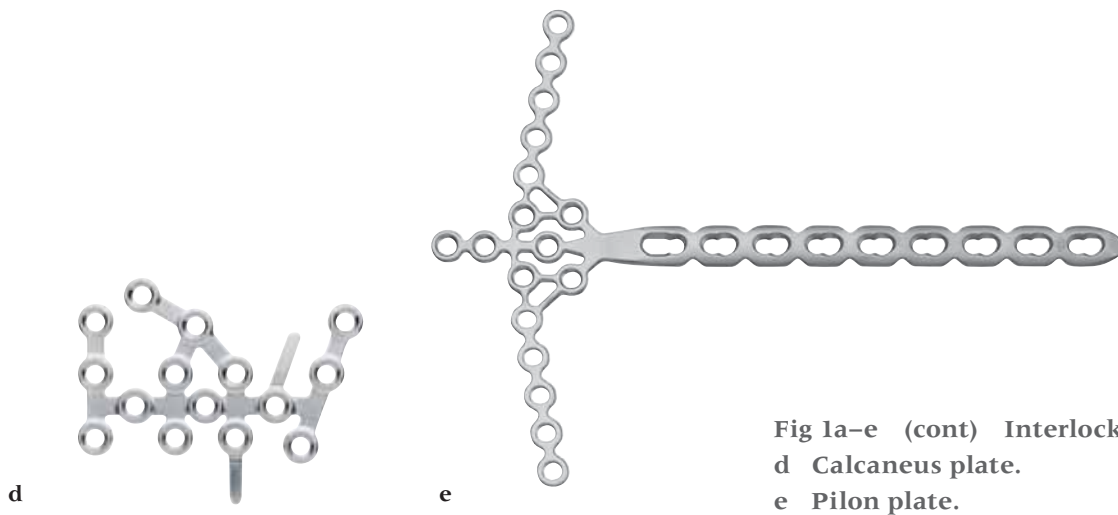


Fig 2a-g First clinical use (January 4, 2000, Dresden) of the new interlocking calcaneal plate in a B2 fracture of the calcaneus.

a-b The lateral view and the Brodén's view show the deep impaction of the posterior facet.

c-d The axial and coronal cut of the CT scan show the severe damage to the calcaneo-cuboidal and subtalar joint classified according to the new AO-Classification as 81.2 B2 [ie, (1.3.3)].
81.2 = calcaneus, B2 = intraarticular fracture of two joints involved, d = posterior facet, h = cuboidal facet, 1.3.3 = bony lesion, multifragmentary, severely distocated.

e-g Intraoperative situation after anatomical reduction and fixation with the interlocking plate.
1 = one of the four 2.0 mm K-wires, which are inserted in the talus and cuboid keeping the full thickness flap upwards for optimal exposure.
2 = tab bowed close to the bone in the calcaneal neck area to keep the ante.



Fig 3a–h First clinical use of the new pilon plate (2001, Dresden). 39-year-old man fell 3 meters. Open C2.2 fracture treated immediately with debridement, fibula fixation, tibio-tarsal transfixation and vacuseal-dressing. 7 days later secondary A. dorsalis pedis flap after joint reconstruction and pilon plate fixation.

a–c Injury x-rays of open injury.

d–e Primary treatment with external fixator.

f–g Postoperative x-rays.

h–i X-rays after 4 years.

j–l Functional pictures after 4 years.

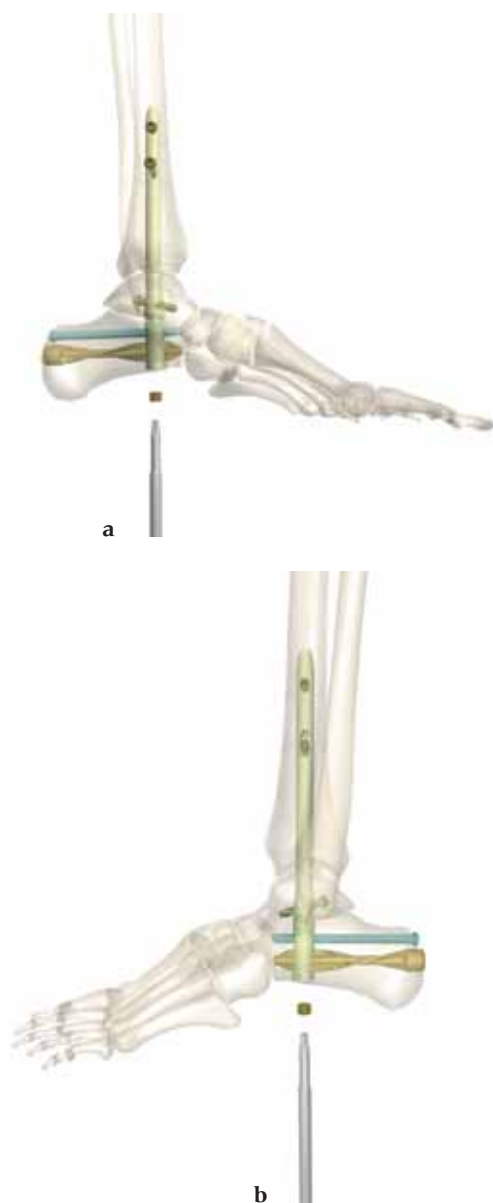


Fig 4a–b Hindfoot Expert Nail.

In combination with the Modular Foot Set including special Hohmann retractors (blunt and sharp “EVA’s”), forceps, K-wire cutters, and different bone spreaders, etc an astonishing palette of very special and useful implants, instruments and devices for the foot and ankle surgery is offered.

Reconstructive surgery: Charcot hindfoot problems have been addressed by developing an Hindfoot Expert Nail (Fig 4) which is going through handling tests.

The interlocking X-plate, initially produced for the proximal crescentic osteotomy of the first ray or modified Lapidus procedures in hallux valgus surgery, is available in three sizes and is also used for different other indications such as Dwyer- and Evans-osteotomies, metatarsal nonunions, Lisfranc-and talo-navicular-fusions as well as for 3-D calcaneal osteotomies in complex foot reconstructions. The intramedullary interlocking hallux valgus plate for distal osteotomies is, after several successful cadaver studies, close to TK-approval like the locking two-hole plate for the Akin osteotomies (see page 7).

Teaching: Since establishing a biannual International Foot & Ankle Course in Davos since December 1998, worldwide courses have been initiated in Asia (Singapore 2000), South America (Lima 2002), AO-Oceania (Sydney 2004) with a total number of 528 participants in 2004.

Outlook: By integrating the OFTF (Orthopaedic Foot Task Force) which was initiated in 2004 into the FAEG in the near future, the repertoire of reconstructive procedures such as perimalleolar osteotomies, salvage procedures in collapsed charcot feet etc will be extended. Problems of necessary bone and/or cartilage replacement, ligament and tendon substitutions in means of tissue engineering are still not solved but are nevertheless just as demanding and challenging as the need of reliable longstanding artificial joint replacements in the foot and ankle region.

1. **Cronier P**, Angers, France; **Jorda E**, Palma de Mallorca, Spain; **Klaue K**, Bern, Switzerland; **Sangeorzean BJ**, Seattle, USA; **Ingold AK** (Mathys); **Blaser B** (Stratec), NN (SUSA).
2. Since 1999 the Foot & Ankle Study Group (FASG) was named FAEG by decision of the TK.
3. **Zwipp H, Baumgart F, Cronier P, et al** (2004) Integral classification of injuries (ICI) to the bones, joints, and ligaments—application to injuries of the foot. *Injury*; 35 Suppl 2:SB3–9.
4. Currently under clinical evaluation.
5. **Zwipp H, Rammelt S, Barthel S** (2004) Calcaneal fractures—open reduction and internal fixation (ORIF). *Injury*; 35 Suppl 2:SB46–54.

Hans Zwipp

NEW FOOT PRODUCTS

**Locking X-Plate**

Post traumatic arthritis, rheumatoid arthritis, and neurological disorders can cause severe deformities such as cavus foot, equinovarus, talipes, and planovalgus. Treatment of these deformities by an osteotomy or a fusion of one or several joints bears the risk of screw breakage due to high shear forces. Other disadvantages are long healing and rehabilitation time. Metatarsophalangeal arthroplasty may leave a large defect if it fails.

The Locking X-Plate 2.7 was developed to treat these deformities of the foot by a rigid fixation construct with high primary stability. It is a stand alone implant in osteotomies and serves as a neutralization plate in arthrodesis of foot joints in combination with one or two compression screws. Primary indications are first metatarso cuneiform fusions, proximal first metatarsal osteotomies (crescentic, open wedge, Mann, Ludloff, and proximal Chevron) and first metatarso phalangeal fusions.

The Locking X-Plate 2.7 is a geometric, low profile and easy to bend implant. This enables further usage for calcaneal osteotomies (Evans and Dwyer), metatarso nonunion fractures, supramalleolar osteotomies, and diabetic foot reconstruction.

Screw angulation prevents collision of the screws. The two dorsal screws are more angulated. The osteotomy can be crossed with a locking head screw when fixing a proximal metatarsal osteotomy providing high stability according to the locked internal fixator principle.

The X-Plate is fully compatible with the Compact Foot Set 2.7.



62-year-old female, one year after modified Lapidus operation with screws in the right foot. Now new treatment with an X-Plate (medium size) in the left foot.

a Intraoperative x-rays.

b–c Intraoperative picture.

d Postoperative x-ray, compared to screw osteosynthesis in the right foot, full weight bearing was possible after 6 weeks instead of 12.



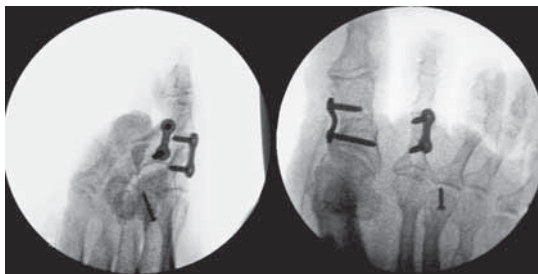
Locking Two-Hole Plate

The Locking Two-Hole Plate 2.4/2.7 is indicated for treatment of Akin osteotomy and phalangeal closing wedge osteotomy. It is an addition to the Locking X-Plate 2.7 when a proximal first metatarsal procedure is performed and a counter correction to realign the proximal phalanx is needed.

Bending of the plate can be achieved with bending pins to adapt to the specific needs (correction or anatomy) or to slightly manipulate the screw direction.

Compared to the staple technique, the usage of the Locking Two-Hole Plate is advantageous because implantation/explantation is easier and less violent, the different screw lengths provide more versatility, there is no temperature effect and less equipment is required. The risk of nonunion and local necroses is diminished.

The Locking Two-Hole Plate is fully compatible with the Compact Foot Set 2.7.



Correction of malunioned Akin osteotomy D1 and shortening of the middle phalanx D2 of a flexible hammer toe using a Locking Two-Hole Plate for each correction.



LC-DCP Adaption Plate for metatarsal osteotomy

The LC-DCP Adaption Plate 2.4 with four holes is an addition to the existing implants and instruments of the Modular Foot Set 2.4.

The LC-DCP Adaption Plate 2.4 is indicated for treatment of fractures and osteotomies on the 2.–4. metatarsal bone. The need for compression and the possibility of movement of the plate is very important for these procedures, therefore the DC-hole is more advantageous compared to the LCP. The standard DCU hole allows for 14–80° of angulation and enables compression on both directions.

Furthermore, the plate has a scalloped contour providing a better view to the bone.

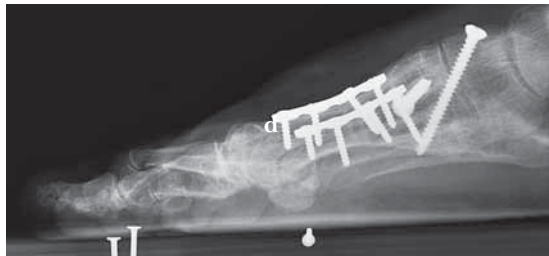


Plate in situ after corrective osteotomy and arthrodeses.

Case provided by Kaj Klaue, Switzerland.



Locking Calcaneal Plate extra small and extra large

The Locking Calcaneal Plates are designed to address complex fractures and osteotomies of the calcaneus, including, but not limited to extra-articular, intra-articular, joint depression, and tongue type fractures. The plates are applied to the lateral side.

The plate has 15 threaded holes, which accept 2.7 mm and 3.5 mm cortex screws as well as 3.5 mm locking head screws. The numerous holes enable versatility and options to address multiple fragments and fracture patterns. Left and right versions are available in stainless steel as well as titanium molybdenum.

It provides an angular stable construct and a buttress to the articular surface of the calcaneus.

The distal end of the plate has two bendable tabs to give support for the anterior process and plantar fragments.

The Calcaneal Plate is now also available in extra small and extra large versions, extending the range of plates in the set from 64 mm to 81 mm. Bending templates for all sizes match each existing plate.

Jesse Jupiter

NEW HAND PRODUCTS



LCP Extraarticular Volar Plate 2.4, for distal radius

The LCP Extraarticular Volar Plate 2.4, for distal radius provides surgeons with a choice of a simpler fixation using extraarticular volar placement. It is indicated for fixation of complex intra- and extraarticular fractures and osteotomies of the distal radius and other small bones.

The plates are anatomically preshaped to fit on the volar side of the distal radius proximal to the articular surface. There are plates with either a 5-hole or 6-hole head, left and right. Shaft lengths can be chosen between either 3 or 5 holes.

The LCP Extraarticular Volar Plate 2.4, for the distal radius has a slightly different shape than the existing LCP Volar Plate for distal radius. It is wider and thicker (2.0 mm instead of 1.6 mm) which makes it stronger in bending.

The plate is available in stainless steel and titanium.



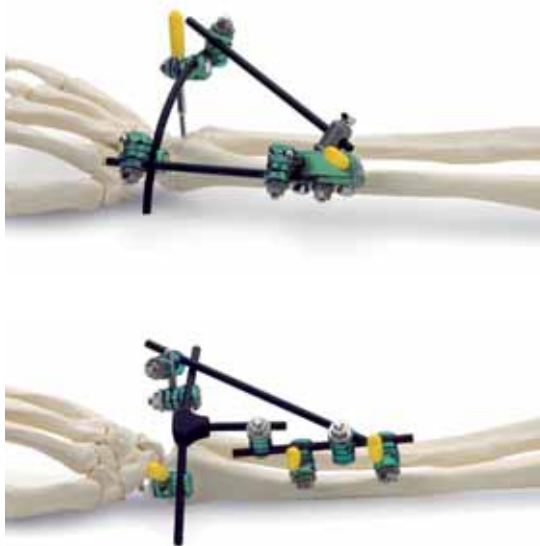
63-year-old female with skiing accident. Full motion and function was regained after 4 weeks.

a–b Preoperative x-rays.

c–d X-rays 6 months postoperatively.

Dankward Höntzsch, Jesse Jupiter

NEW EXTERNAL FIXATOR PRODUCTS



Nonspanning Distal Radius Fixator

Treatment of fractures of the distal radius has been proven to be advantageous if spanning of the wrist joint is avoided. This allows for greater motion throughout the treatment resulting in improved range of motion, grip strength, and dexterity.

The nonspanning Distal Radius Fixator provides such a nonbridging external fixator, creating a low-profile frame for increased patient comfort and the ability to perform daily activities.

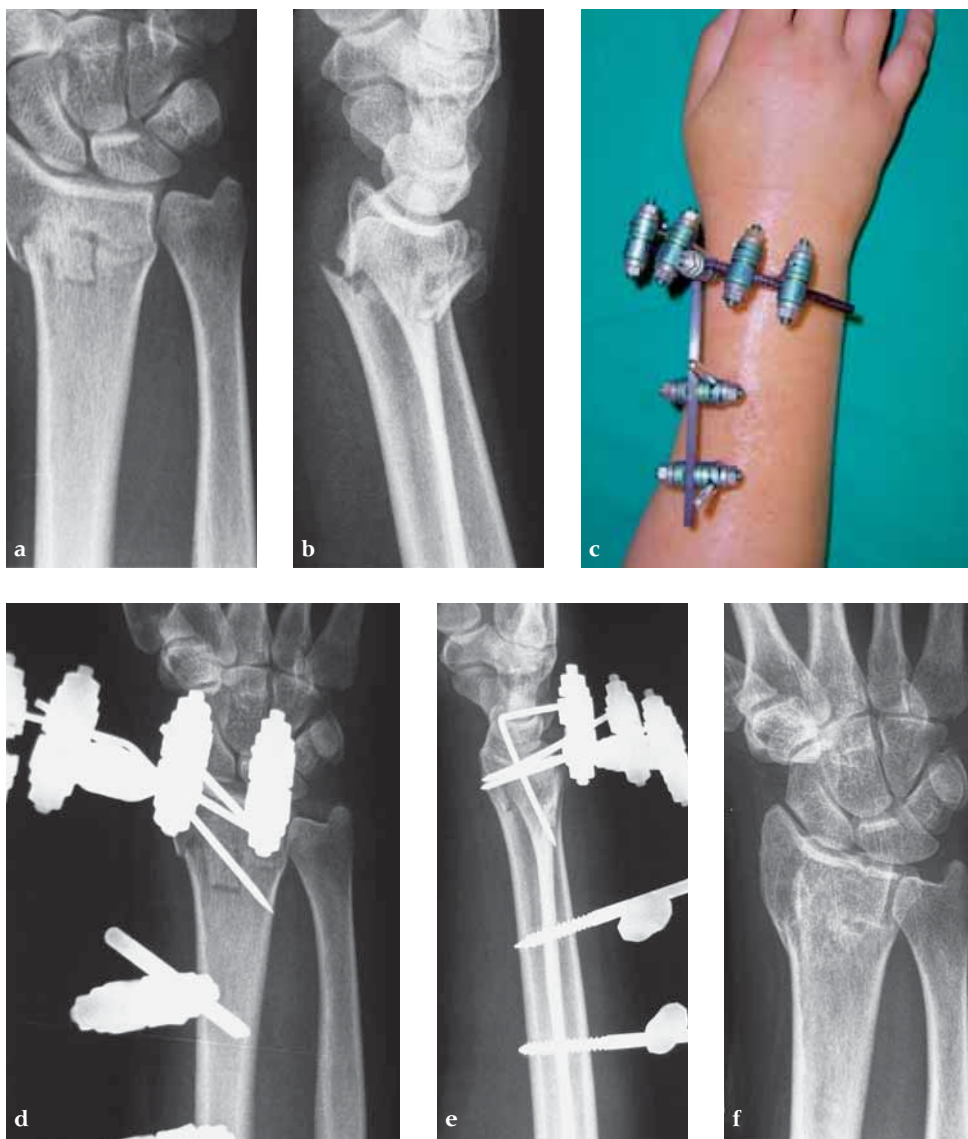
The nonspanning Distal Radius Fixator consists of a small adjustable clamp, nonspanning, MR safe. It locks on to two 4.0 mm Schanz Screws spaced 20 mm apart. The 4.0 mm carbon fiber rod slides into a through hole in the clamp with a set screw tightening point to establish the desired length. A ball joint in the clamp then provides for ulnar/radial as well as volar/dorsal deviation of the rod.

To create lower profile frames, the nonspanning Distal Radius Fixator includes three shorter length Schanz screws—65 mm lengths in both 4.0/2.5 mm size (with a trocar tip) and the 4.0/3.0 mm size (with a self-drilling tip), and an 80 mm length in the 4.0/2.5 mm size (with a trocar tip).

The 4.0 mm curved carbon fiber rods match the axial curvature of the wrist. They are available in 60°, 90°, 120°, or 180° arcs to be used for fixation of the distal fragment.

The 4.0 mm angled T-bar carbon fiber rods create the same angle as the curved rods, with the addition of a rod extending perpendicularly. The material allows a frame to be constructed with a rod centred on the dorsal aspect of the wrist without sacrificing the C-arm image in the dorsal/palmar view. The angled T-bar fiber rods will be available in 80 mm (length) × 50 mm (width), 80 × 120 mm, 110 × 50 mm, and 110 × 120 mm. Both the curved and angled T-bar fiber rods can be used as part of a delta frame construct.

Additional instruments such as drill sleeves, drill guides, and trocars are included in the set.



56-year-old female, accident at home.

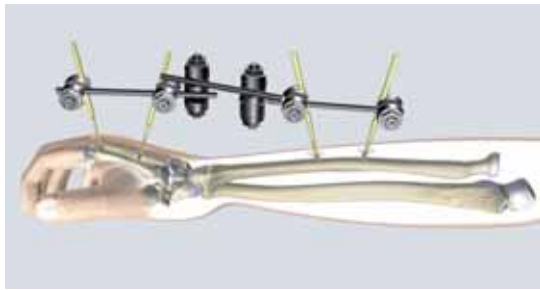
a-b Preoperative x-rays.

c Postoperative image with nonspanning distal radius fixator.

d-e Postoperative x-rays after one day.

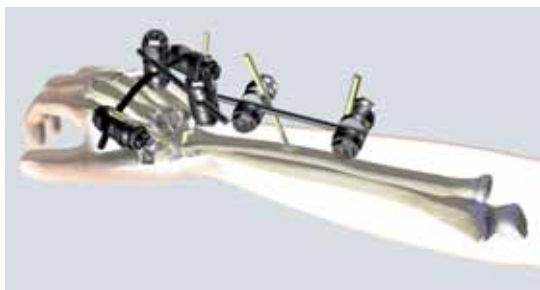
f Follow-up x-ray after one year.

Case provided by Georg Gradl, Germany.



Radiolucent Small External Fixator

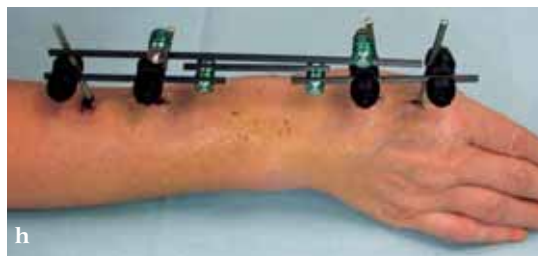
The Radiolucent Small External Fixator is indicated for unstable fractures of the distal radius (intra- and extraarticular, as well as fractures with open and closed soft-tissue defect), injuries, fractures, dislocations, and burns in the wrist and forearm, fractures in connection with extensive soft-tissue injuries, bone loss and vessel and/or nerve involvement, fracture dislocations of the wrist, and in open pediatric fractures with bone loss.



The multi-functional clamp is flexible, holds different diameters, allows free pin placement, is easy to handle and radiolucent. The clamp accepts 4.0 mm rods and pins from 2.0 to 4.0 mm. It is made out of a carbon-fiber reinforced polymer which reduces weight without compromising stability. It is suitable for use in the MRI.

The two nuts allow for an independent fixation of the implant/rod which improves the fine-tuning of the reduction.

The set includes additional instruments as a disposable 4.0 mm drill sleeve, wrench (11 mm), and 4.0 mm T-handle, 4.0 mm connecting rods (80 and 100 mm lengths) and 4.0/3.0 mm self-drilling Schanz Screws (80 mm length).



54-year-old female with 23-C3 fracture after fall. External fixator due to severe soft-tissue trauma. Palmar plate 1 week later.

- a-b Injury x-rays.
- c Preoperative CT scan, AP.
- d Preoperative CT scan, axial.
- e Intraoperative x-ray.
- f-g Postoperative x-rays after 1 week.
- h Postoperative picture.

Medium and Large External Fixators—Pin Clamps, Outrigger Posts, and Curved Carbon Fiber Rods

The Medium and Large External Fixator family now offer a wider variety of possible constructs to create the appropriate frame configuration suitable to the fracture and soft-tissue situation. The line extension features new Pin Clamps, Outrigger Posts, and Curved Carbon Fiber Rods.

This enables the creation of bilateral frames where the rods are spaced further apart, allowing more stable constructs. The wider attachment points on the clamps allow sufficient space around the soft tissues. The number of tightening points to control the position of the rod is reduced from two to only one when using the Outrigger Posts and Pin Clamps. This reduction can be secured more quickly and easily. The frame construct can be double-stacked or made into a delta frame while using only one Pin Clamp in each fragment.

4- and 6-Position Pin Clamps are now available in both medium (8 mm) and large (11 mm) size. All four Pin Clamps use the same sub-components as the vise plate assemblies from the corresponding Multi-Pin Clamps. In place of the Rod Attachments, the threaded holes of the Pin Clamps are left empty to be filled with Outrigger Posts. The Pin Clamps connect two or more Schanz screws in one fragment of the bone and provide attachment sites for up to two Outrigger Posts.

The Outrigger Posts are available in a straight, 30° bend and 90° bend in large and medium size. The design allows for any orientation of the Outrigger Post in a complete 360° arc. The Outrigger Posts and the Pin Clamps are MR Safe and compatible with the existing External Fixation lines.

The 8 mm and 11 mm diameter Curved Carbon Fiber Rods come with a 45°, 90°, 135°, and 180° bend. They may be used in pelvic fractures and whenever extra clearance is needed due to swelling or damage of the soft tissues.



Norbert Südkamp

NEW ELBOW PRODUCTS

Olecranon Plate

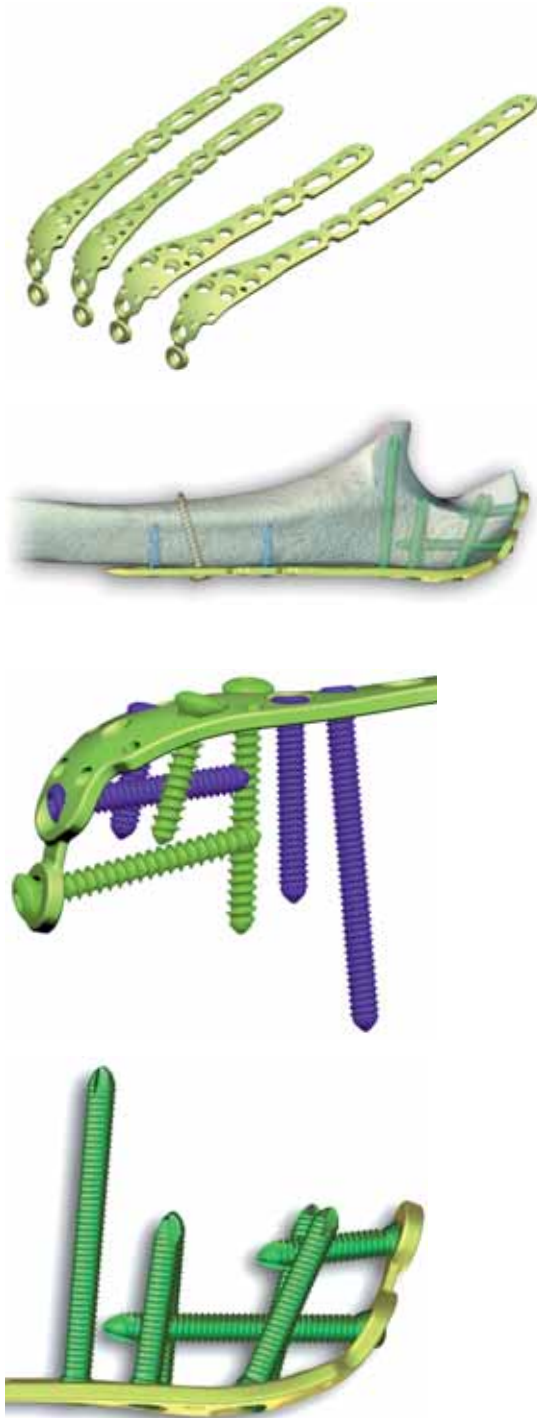
Treatment of olecranon fractures often requires complex and time consuming operations with the risk that an insufficient fixation leads to secondary loss of reduction, especially in osteoporotic fractures. This would be inevitable followed by functional deficits, pain and arthrosis.

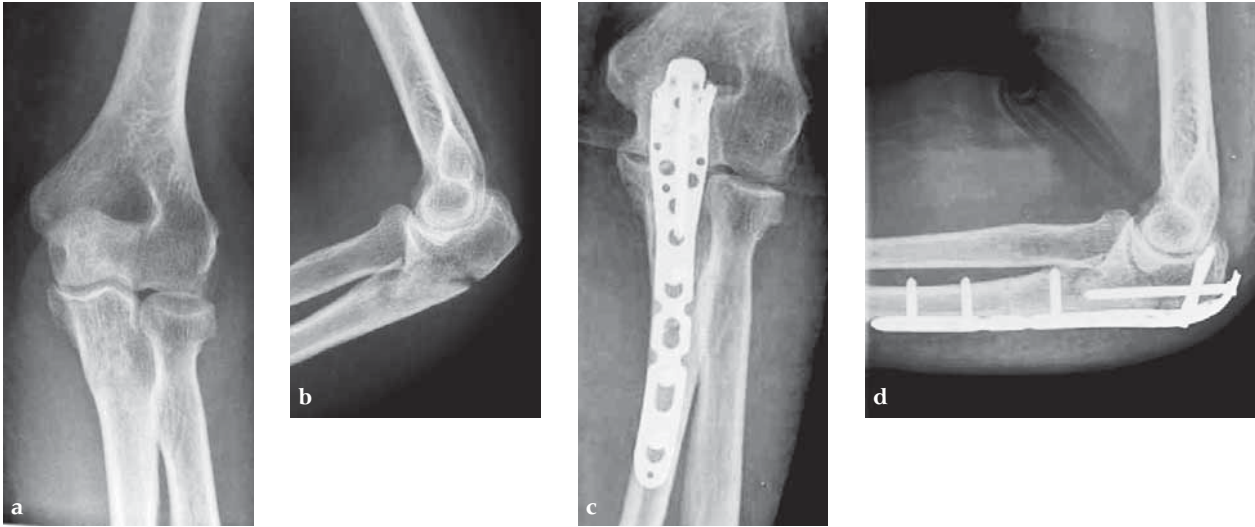
The Olecranon Plate is part of the new elbow system, it has a precontoured anatomical fit and provides a high stability. Indications for this new plate are complex extra- and intraarticular olecranon fractures, especially with distal extension beyond the coronoid process, fractures of the proximal ulna, nonunions of the proximal ulna, and osteotomies.

The proximal part of the plate is slightly thinner than the shaft. Eight round locking holes allow for a choice of locking head screw placement. These screws have predetermined angulations that were adapted to the anatomy of the olecranon and the proximal ulna. The proximal tab can be removed with standard cutting instruments if not needed. The shaft portion of the plate has a long sliding hole to enable optimal positioning of the plate. The plate holes in the shaft portion are typically combination holes, allowing the application of both conventional and locking head screws. Since the bend of the proximal ulna can vary significantly, the longer plates especially require contouring of the plate in the horizontal plane. Recesses in the shaft (as in reconstruction plates) allow for this adaptation in the horizontal plane (maximal 4° per individual recess of the plate).

The Olecranon Plate is available in a right and left version. It comes in six lengths with 2-, 4-, 6-, 8-, 10-, or 12-LCP combination holes in the shaft for 3.5 mm locking head screws. Alternately, 3.5 mm cortex screws or 4.0 mm cancellous bone screws can be used. The plate is available in stainless steel and titanium.

Specific aiming devices can be fixed to the plate by a snap-on mechanism. The other instrumentation is fully compatible with the LCP system 3.5.





65-year-old female treated with an Olecranon plate.

a-b Preoperative x-rays.

c-d Postoperative x-rays.

Theddy Slongo

NEW PEDIATRIC PRODUCTS



End Cap for elastic nails

The End Cap is a new implant developed to enhance safety of the Titanium Elastic Nails (TEN) and Stainless Steel Elastic Nails (STEN) with indications where loss of axial stability/shortening is a potential problem/complication. This problem can be seen especially in completely unstable fractures, such as long oblique and spiral fractures, including fractures with a third fragment. One of the reasons for this problem is the backing-out of the nails at the entry point, especially when the correct biomechanical properties are missing. The End Cap simply stops the movement of the nail in the entry-point, especially in the backing out direction. As the longitudinal forces on the nail have a counter force in the End Cap the stability of the bone/implant interface in the fracture zone is enhanced too. The initial intention of using the elasticity of the nail to act as a spring in the fracture zone is regained as the nail is no longer “slipping away”.

The End Cap itself does not need any additional preparation, except when soft tissue does not allow it to be pushed down on the bone surface directly. The End Cap is easily applied directly over the end of the TEN or STEN after its cutting and final insertion. By screwing in the End Cap the insertion hole of the TEN/STEN this hole slightly enlarged and the End Cap is fastened in the bone by its thread.

The effectiveness of the End Caps has been proven in mechanical tests enhancing the push-out resistance of the Titanium Elastic Nails through the insertion hole by five times and more. An additional advantage was observed during removal. By removing the End Cap the insertion hole of the nails is “opened” automatically to a slightly bigger diameter and the nails are then easily grabbed and taken out.

The End Cap should be used for all unstable fracture patterns, where the use of the TEN/STEN is indicated. The End Cap is not intended to enlarge the indications for the ESIN technique, but to enhance the safety of its use. There is no contraindication against the use of the End Cap except in situations where the enlargement of the insertion hole might not be acceptable (very small entrance points).

In summary, the indications are unstable fractures of the femur or tibia in older children. The End Caps are designed for nails with a diameter between 3–4 mm.



Fig 1 a-f 6-year-old girl, ski injury.

- a-b** X-rays show a long spiral fracture of the proximal third of the right femur (32-D/5.1). Because of the age good indication for ESIN, but some danger of instability is possible.
- c-d** Postoperative x-rays. A closed reduction and fixation with 3.0 mm TEN was carried out with correct child-oriented alignment. For stability reasons two End Caps became uses. No signs of a shortening can be seen.
- e-f** AP and lateral view 6 weeks after surgery shows good callus formation and still a perfect alignment. Full weight bearing was then allowed.

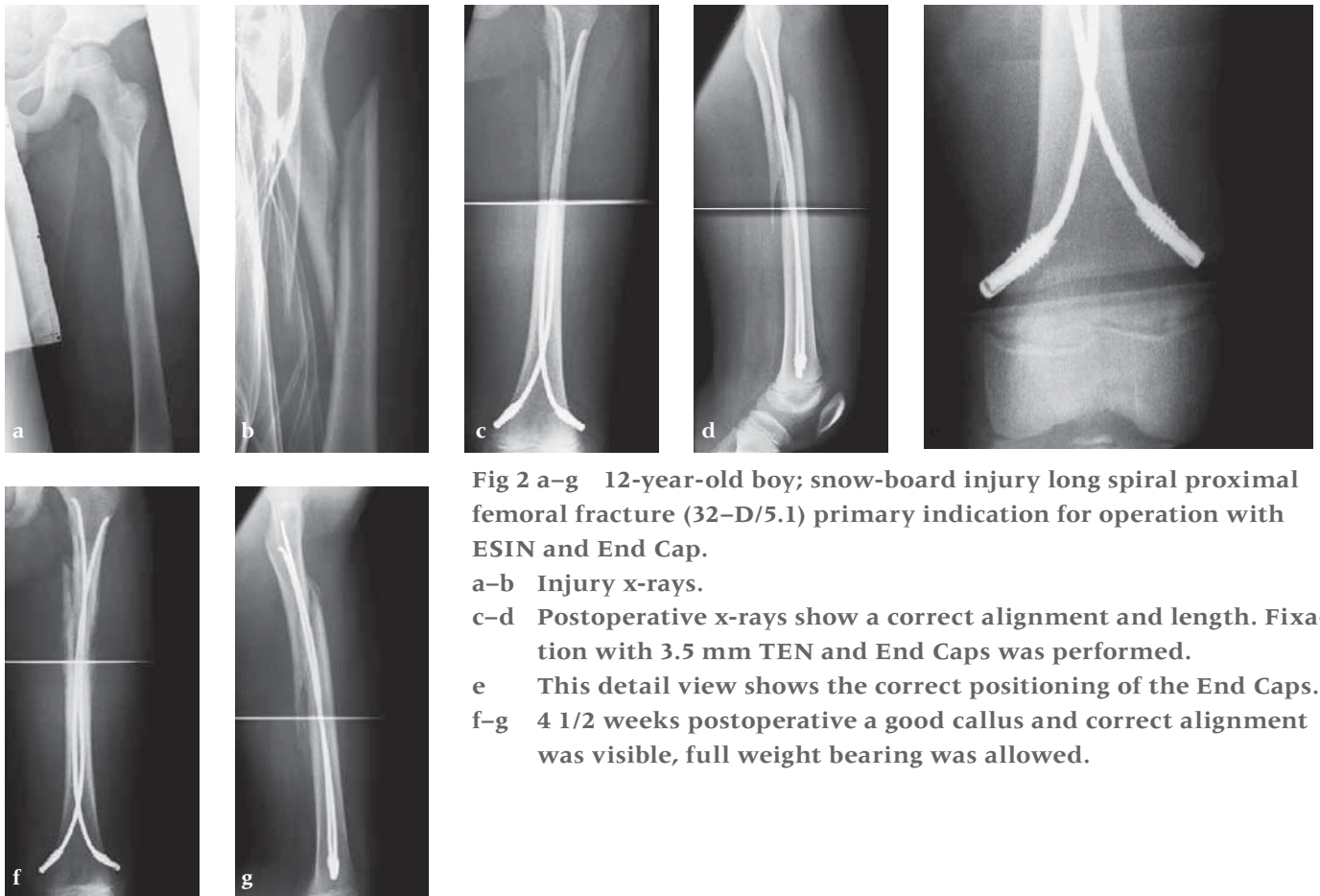


Fig 2 a-g 12-year-old boy; snow-board injury long spiral proximal femoral fracture (32-D/5.1) primary indication for operation with ESIN and End Cap.

- a-b** Injury x-rays.
- c-d** Postoperative x-rays show a correct alignment and length. Fixation with 3.5 mm TEN and End Caps was performed.
- e** This detail view shows the correct positioning of the End Caps.
- f-g** 4 1/2 weeks postoperative a good callus and correct alignment was visible, full weight bearing was allowed.

Philip Kregor

NEW LONG BONE PRODUCTS



7.3 mm Cannulated Locking Screw: additional lengths

7.3 mm Cannulated Locking Screws are used mainly in conjunction with the Locking Condylar Plate System. Shorter screw lengths of 20–45 mm, in 5 mm increments, are now available in stainless steel, extending the existing range of up to 90 mm. The screws are self-drilling, self-tapping.



4.0 mm Locking Screw: additional lengths

Additional lengths of the 4.0 mm Locking Screws are now available from 20–60 mm in 4 mm increments. Together with the existing lengths from 18–58 mm in 4 mm increments, the 4.0 mm Locking Screws now range from 18–60 mm in 2 mm increments overall. The screws are self-tapping and have the T25 StarDrive Recess which offers a better resistance to stripping.



Star/HexDrive screwdriver

The Star/HexDrive screwdriver combines the T25 StarDrive and 3.5 mm hexagonal screwdrivers into one instrument. The tip of the new screwdriver engages with T25 StarDrive and 3.5 mm hexagonal recess screw heads. This is advantageous for screw removal, especially if the type of drive mechanism of the screw head is unknown.

The Star/HexDrive screwdriver can insert or remove any LCP large fragment screw or titanium intramedullary nail locking screw or bolt. The shafts are self-retaining, quick coupling and available in 165 mm and 280 mm lengths.

Flexible Reamer System (SynReam)

The Flexible Reamer System (SynReam) for intramedullary nailing has replaced the Universal Reaming System in the recent past. SynReams' smaller shaft and core diameter reduces intramedullary pressure and improves the clearance of chips due to increased flute space during the reaming procedure. The shaft, which is made out of an elastic material (Nitinol), provides good flexibility to ream both femur and tibia.

The 5.0 mm flexible shaft is now available in a longer version (620 mm). This increased shaft length allows for greater soft-tissue clearance in obese patients. Also the 3.6 mm cleaning brush has been extended up to 830 mm length.



Dankward Höntzsch

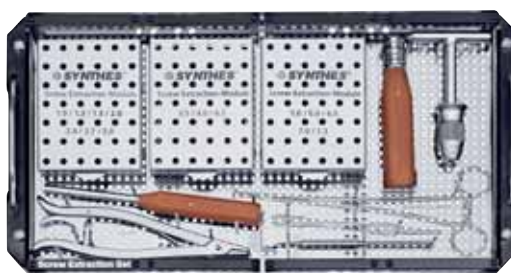
NEW MIO PRODUCTS



Screw Extraction Set

The Screw Extraction Set includes already existing and new instruments to enable screw removal in a minimally invasive procedure, especially in difficult situations.

Screws with a stripped hex can be removed with a left-threaded, conical hexagon socket set.



Carbide Drill

If necessary, a destroyed hex can be drilled with a slightly larger special drill in such a way that a left-threaded chuck finds good hold or the head becomes separated from the shaft. Left-over screw shafts can (but don't have to) be removed with a hollow drill and a left-threaded sleeve.

The Carbide Drill is a special drill to bore up screw heads and/or hex. The special alloy and design enable very efficient drilling of metal. These drills come from the metalworking industry. Compared to the usual carbide drills, they are more aggressive and efficient.

The drill is available in 4 and 6 mm diameter. The length of the drill is fixed. If the length of the drill is not sufficient, the Drill Elongator provides additional extension.

Pliers for Screw Removal, narrow

Furthermore, the set includes several specially designed instruments for screw removal, eg, Pliers for Screw Removal which features a very thin tip but still has a very strong grip. It has sharp edges at the tip to awl the bone if the screw is not pointing out.

In the near future, a drill suction device will be available for the Extraction Set to remove the shavings.





Slim Screw Extraction Forceps

During explantation the screw might be stripped out of the cortex or become trapped in the soft tissues.

The Slim Screw Extraction Forceps enable the removal of a screw with or without rotation of the screwdriver. The screw is grasped behind the screw head. The forceps arms are slim and stable. They are bent in a way that the closed forceps arms lay parallel and tight to the screwdriver shaft.

The forceps can also be used together with a screwdriver to support insertion by creating an angular stable connection between screwdriver and screw. This is relevant in low laying, funnel-like operation areas such as in pelvic surgery or a screw inserted by a minimal-invasive stitch incision.

The Slim Screw Extraction Forceps is available in two sizes for small and large screws/short and long screwdrivers.



Hohmann Retractor Holder

The Hohmann Retractor Holder holds two Hohmann Hooks which are positioned opposite to each other at the bone, in a spreaded position. Distance and tension can be adjusted by clicking together individual parts. By attaching the lengthener, the instrument can be enlarged up to 15 cm.

The Hohmann Retractor Holder is mainly used for the femur to hold the minimal-invasive approach intraoperatively at the proximal end of a percutaneously inserted plate, eg, LISS. The Hohmann Retractor Holder is made out of a light and radiolucent material. The angled retractors provide a good view of the operating field.





Soft Tissue Spreader

The Soft Tissue Spreader is comparable to a spreadable speculum in ENT medicine.

The Soft Tissue Spreader enables to create a uniform, funnel-like opening for a local minimal-invasive approach, eg, for insertion or removal of a screw. By carefully moving back and forth, two to three screws in one plate can be handled.

The spreading can be reduced, ie, the tension can be released, by pushing the release button. Fine-tuning is possible in both directions, opening and closing of the instrument.

The new locking mechanism allows for a secure intraoperative single-hand use. The Retractor Blades can be used with the LCP drill sleeves.



Soft Tissue Retractor Blade

The Soft Tissue Retractor Blade enables tunneling/retracting of the soft tissue before insertion of a plate in a minimal-invasive procedure. The Blades are available in large and small sizes suited to the instruments of the Small- and Large Fragment Sets. The slightly bent tip can be extracted to different lengths and then locked at the desired length. The tip has a sharp and rounded side, to slide on the periosteum as needed. The tip features a hole, for using a wire or suture to insert the plate in the push- and/or pull-procedure.



MIO Cable Cutter

The MIO Cable Cutter cuts cable and wires in a minimal-invasive way. The device can be leaned to the cable or wire and pushed down to the bone or plate to cut the cable or wire without damaging the soft tissues. The thin and long tip allows a small incision.



It is a forerunner for the upcoming ingenious new passer for wires or cables for cerclages. It will feature a wire/cable passer, twister and the cutter presented here.

Bob McGuire, Chris Cain, Frank Kandziora

MOST IMPORTANT PRODUCT DEVELOPMENTS IN SPINE



Vectra

Diseased or fractured discs in the cervical spine are usually treated with anterior plate-screw fixation. Within the field of anterior cervical plating, different treatment philosophies have led to different requirements for implants over the past decade. During the 1980s and 1990s surgeons almost exclusively used constrained plate systems. These rigid plate-screw-constructs do not allow for any motion of the vertebral bodies. In the 1990s a debate arose about whether micromovements facilitate the healing process. This sparked the development of semi-constrained systems that allow the screws to toggle (pivot at the screw head) and not be locked rigidly to the plate. Although today there is no single, established philosophy for anterior cervical plate-screw fixation, semi-constrained systems have increasingly become the norm.

Vectra is a flexible and easy-to-use plating system for the semi-constrained fixation of the anterior cervical spine. Vectra allows surgeons to combine fixed-angle and variable-angle screws as required, and therefore gives more freedom to build a safe construct that is appropriate to the individual situation. Variable-angle screws allow the plate-screw-construct to move minimally so that it can compensate for post-operational subsidence. Meanwhile the construct maintains stability and keeps the screws contained in the plate. Fixed-angle screws, on the other hand, restrict motion.

Vectra is a low profile implant with a narrow footprint and is easy to use. The self-drilling screws can be inserted free-hand, without prior drilling or tapping. The instrumentation allows for very small incisions, and is intuitive, quick and easy to work with.



Postoperative x-rays of a case treated with Vectra in which this 60-year-old female underwent discectomy and interbody grafting for C5-6, 6-7 stenosis with radiculopathy.

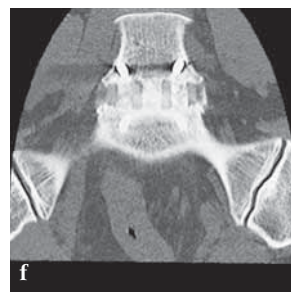
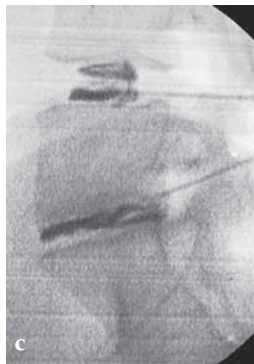
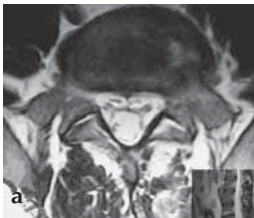


SynFix

SynFix is intended for use in the lumbar spine to facilitate fusion of the adjacent vertebrae. It's shape is based on the SynCage-LR with the addition of an integrated anterior fixation plate that re-establishes an anterior tension band following resection of the anterior longitudinal ligament. This fixation also provides additional stability in all directions of load and facilitates the use of this implant as a stand-alone device for the treatment of degenerative discs disease. The capacity to use this implant as a stand alone device enables the preservation of the vital posterior muscular structures to reduce the surgical morbidity associated with lumbar fusion surgery. First clinical experience in over 100 procedures in the past 18 months has shown that the construct is stable. Operation time and hospital stay was reduced significantly.

SynFix features a wedge shape, anatomical contour of the endplate interface, open structure for bone ingrowth. In order to achieve a stable fixation in flexion, extension and rotation, a titanium plate is integrated into the PEEK cage. Four locking head screws positioned in diverging angles provide purchase into the stronger peripheral bone near the anterior rim as the mechanical strong aspect of the vertebral bodies. The locking head screws provide considerable additional stability to the construct, similar to the widely used LCP principle in trauma. Biomechanical tests have demonstrated that the resultant stability is not significantly different from that of 360° fixation in flexion, extension and lateral bending, and is superior in torsion. These screws are self-tapping which improves the thread purchase.

SynFix-LR can be chosen in heights of 13.5, 15, 17 and 19 mm, with lordotic angles of either 8° or 12° and two different footprints of 32 × 26 mm or 38 × 30 mm. Specific instruments included in the SynFix-LR set serve to determine the correct implant size, to fill it with autologous bone, to insert the cage into the intervertebral space and finally to place the screws in the correct angles.



A 37-year-old female (65 kg and 170 cm tall) who suffered from back (L5/S1) and leg pain without neural compression for 2.5 years. She had a full range of conservative treatment and rehabilitation without benefit and reports a significant improvement in symptoms and function following surgery. She has returned to work with minimal restrictions in ongoing activities.

a–d Preoperative pictures.

e–h Postoperative pictures.

Rainer Schmelzeisen

MOST IMPORTANT PRODUCT DEVELOPMENTS IN CRANIOMAXILLOFACIAL



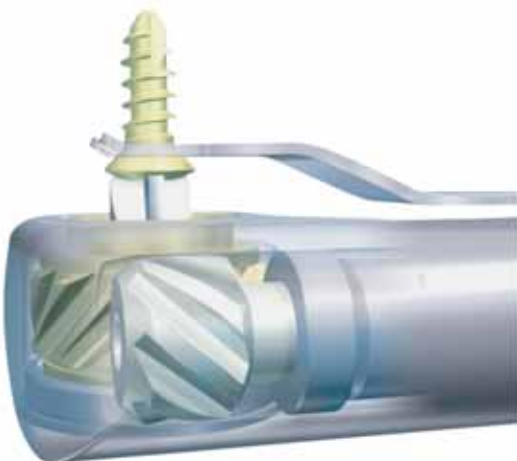
Rectangular Drill/Screwdriver

The Rectangular Drill/Screwdriver has been developed for predrilling and screw insertion on mandible and midfacial fractures with minimal invasive approaches. Its flat head (6.5 mm) and low overall height allows for intraoral fracture treatments especially when endoscopically supported. Among various possible applications are plate fixation on subcondylar fractures and bilateral sagittal split osteotomies (BSSO).

The Rectangular Drill/Screwdriver is offered with a Minimodule including screwdriver shafts (StarDrive, cruciform) and drill bits. It has inserts for screw sizes of 1.5 mm/2.0 mm and 2.4 mm. All parts can be picked up and exchanged quickly, which makes the device easy to clean. For better visibility and less irritation of soft tissue the screwholder can be turned at an angle behind the head.

By removing the screwholder insert or the complete screwholder and connection of a conventional drive unit at the handle the device can also be used for rectangular pre-drilling.

The device is equipped with an intra coupling according to ISO 3964/EN 23 964 (maximal output: 5.000rpm). The gear ratio is 1:2.



Enno Bösche, Boris M Pfeiffer, Florian Gebhard, Christian Krettek

NEWS FROM AO CLINICAL INVESTIGATION & DOCUMENTATION (AOCID)

Computer-assisted high tibial osteotomy (NAVI Study tomofix and BrainLAB Vector-Vision Osteotomy 1.0)

Osteoarthritis (OA) of the knee is the second most common diagnosis made in the elderly by their general practitioner, and the most common cause of disability in old age. The medial compartment of the knee is most frequently affected where varus deformity is present. This leads to increasing load pressures acting on the medial articular surface. Thus, an increase in the deformity by 10° implies a threefold increase in loading stresses.

Ideal correction of the leg axis is difficult to achieve and postoperative malalignment is observed following HTO. Unreliable preoperative planning is seen as one reason for the postoperative malalignment. Computer-assisted navigation systems may improve precision and accuracy of the leg-axis correction, offering simulation tools and being able to predict the postoperative alignment.

BrainLAB's VectorVision Osteotomy 1.0 allows both open and closed wedge procedures. During the registration step, the program records all anatomical landmarks important to calculate the leg geometry. Next, the initial preoperative leg alignment is determined and stored and information about the Mikulicz line, and the medial proximal tibia angle (MPTA) is given.

Following that, the start and end point of the cutting plane is defined. The program provides the surgeon with the sawing depth to reach the rotation point, ie, the point where the cutting process stops inside the bone.

The next step helps the surgeon find a correction plan combining a positive alignment of both mechanical angle and the hip-ankle-line and also the influence on the leg length. Using either a CB adapter or K-wires, the navigation determines the cutting plane. Once the resection is finished, the alignment is fixed regarding rotation, angle, length and varus/valgus alignment before fixing the osteotomy with Tomofix.

A multi-center cohort study to define the effective deviation from the planned leg axis is currently being conducted by AOCID. In this study, patients with medial gonarthrosis or genu varum congenitum undergoing a medial open-wedge osteotomy are operated guided by BrainLAB's VectorVision Osteotomy 1.0 using Tomofix. The control group is selected from a currently ongoing RCT which was developed parallel to this study to give the needed additional information.

A total of 60 patients are operated on using computer-assisted navigation. At a follow up after 6 weeks, the leg axis, complications, range of motion, and pain relief are measured. The intent of this study is to compare the outcome of the HTO measured in deviation between planned and actual correction angle between the navigated and the nonnavigated group.

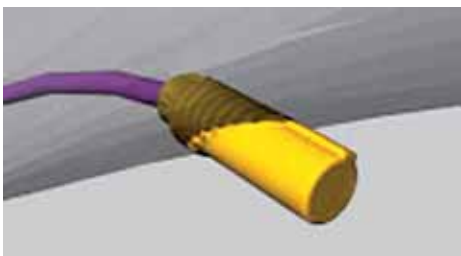
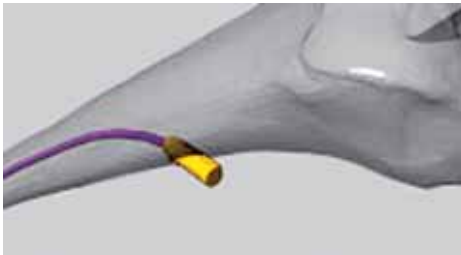
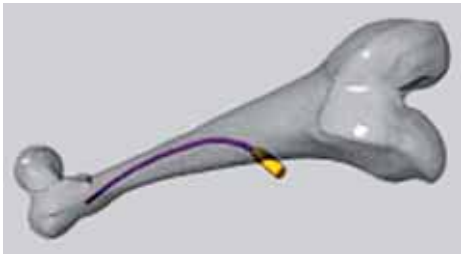


Thomas Kaup, Romano Matthys

NEWS FROM THE AO DEVELOPMENT INSTITUTE (ADI)



Mechanical laboratory simulation of backing out.



3D check of the first prototype.

AO Development Institute's (ADI) organizational structure comprises a Concept Development Group, a CT Database Working Group, a Prototype Workshop, and a Development Service Group.

The Development Service Group of the ADI supports the Expert Groups of the TK-System by translation of their ideas into prototypes. 1/6 of ADI's resources are dedicated for this service. When a prototype is finally accepted by the medical members and fulfils the group's requirements, ADI transfers the project to the specific Synthes development group. Within Synthes the final development of the product takes place. Below you can find an example of a typical Development Service project, which has now reached serial production status within Synthes Inc.

Project: End Cap for TEN/STEN

When using the TEN system for the stabilization of infant, diaphysal fractures in older and heavier children, the following effects, as shown in the picture of a mechanical laboratory simulation, should be avoided:

- Risk of backing out with subsequent soft tissue irritation
- Risk of sliding in

Idea

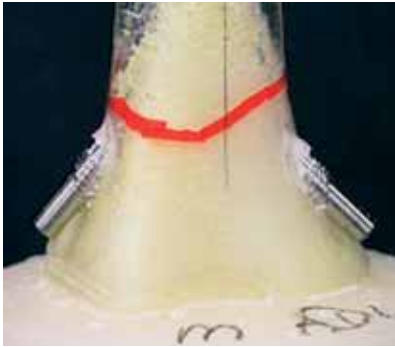
End Cap for TEN to ensure secure fixation relative to the bone.

Prototype

12.2002: presentation of first Synthes-Stratec prototypes and definition of clinical problem.

10.2003: invitation of ADI to be involved in the project.

To clarify the requirements, the clinical inputs have been discussed within the Development Service Group. The clinical inputs have been prioritized and further translated in to technical descriptions. In the following development phase we separated the needs in to features. This features have been combined in different arrangements and were checked within a 3-D construction program in terms of, placement, geometry, fit, eg, and have been discussed in the Pediatric Expert Group.



Placement of two distal End Caps in the artificial bone.



Set up of the artificial bone with a proximal fracture.

After construction and finalizing of the drawings the first prototypes have been discussed for production in the prototype team of ADI's Workshop. In parallel an alternative solution was worked out by Synthes. The produced End Caps and the alternative of Synthes have then been used for further mechanical testing in cooperation with the Research Service Group of the ARI and Synthes. The test was designed to clarify the following points: difference between using the two designed End Caps and not using an End Cap. The results were checked for distal and proximal migration of the Nail, displacement of the fractured bone model and eventual backing out of the End Cap. The End Caps were tested also in three different insertion angles in relation to the bone, 40°, 45°, and 50°. The test was performed in artificial bone models. After mechanical testing and additional handling tests the Expert Group agreed to pursue ADI's solution because the design incorporated the following features: bidirectional drill tip which allows easy insertion in angles from 40° to 50° and no soft tissue irritation due to the oblique threat design.

Serial product

03.2004: after final testing, hand over of the first ADI prototype to Synthes Inc. for final product development.

For the final serial product refer to information on page 16/17.

Karsten Schwieger, Theddy Slongo, Erich Schneider

NEWS FROM THE AO RESEARCH INSTITUTE (ARI)

Performance of the End Cap System

Biomechanical study of elastic stable intramedullary nailing (ESIN) in pediatric fractures.

Objective

Elastic Stable Intramedullary Nailing (ESIN) is a common method for treatment of pediatric femoral shaft fractures. Backing out of the nails at the insertion sites is a potential problem in unstable fractures of older children. To overcome this problem End Caps may be placed over the nail ends and screwed into the bone (see also page 16). This in vitro study investigated two aspects: (a) The effect of the End Cap insertion angle upon the End Cap push-out force and (b) the potential advantage of using End Caps with regard to backing out of the nails.

Materials/methods

(a) Oblique midshaft defects of 1.5 cm lengths were created in artificial pediatric femurs to simulate completely unstable fractures. Fixation was performed with 3 mm Titanium Elastic Nails (TEN) and End Caps inserted at angles of 45°, 55°, and 65° to the long axis of the femur ($n = 5$ for each group). Specimens were shortened about 2 cm above the defect, embedded in a fixture to avoid proximal nail migration and placed on a materials testing machine for axial loading at a crosshead speed of 5 mm/min (Fig 1). Push-out force F and displacement were recorded.

(b) An identical defect model was created in four small adult cadaveric femurs and treated with 3.5 or 4 mm TEN. Applying the same experimental methods, all femurs were first tested without and subsequently with End Caps inserted at 45°. Maximum force was recorded until nail backing out occurred.

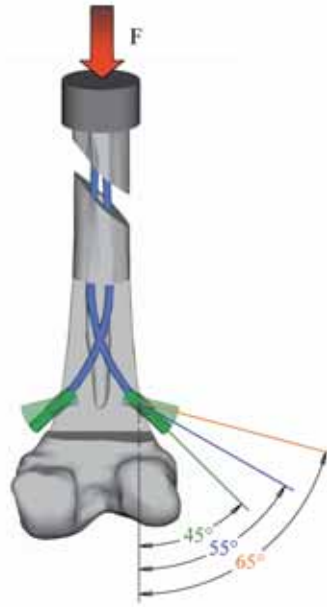


Fig 1 Schematic drawing of the test setup to investigate the effect of the End Cap insertion angle upon push-out force.

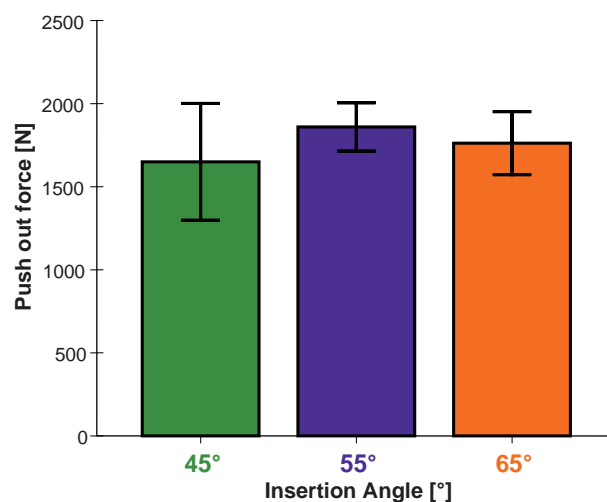


Fig 2 Push-out force depending on End Cap insertion angle in an artificial bone model.

Results

(a) The End Cap insertion angle did not influence End Cap push-out force in the artificial bone model ($P = 0.613$) (Fig 2).

(b) The force necessary to provoke backing out of the nails was up to 6 times higher when using End Caps compared to the condition without End Cap. This difference was statistically significant ($P = 0.007$) (Fig 3).

Conclusion

It may be concluded from the artificial bone tests that the End Cap insertion angle can be varied within 10° without significant loss of push-out resistance. However, nail insertion may be more difficult at higher insertion angles and may require stronger prebending of the nails. The results of the cadaveric tests suggest that the risk of backing out of the nails can very effectively be reduced by means of End Caps. The additional effort to place them may allow the ESIN technique to be used safely in unstable pediatric femoral shaft fractures. For further information on the End Caps see page 16/17.

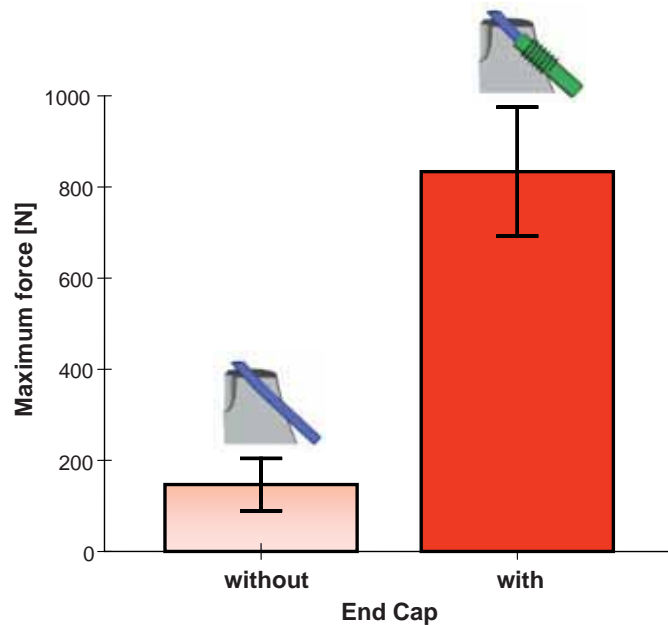


Fig 3 Maximum force of the push-out tests performed without and with End Caps in cadaveric femurs.

Norbert P Haas

TK PRIZE 2005

The TK Recognition Award was awarded by at the opening ceremony of the 83rd Davos Course in December 2005 to four trauma surgeons from AO's established four regions. Christoph Sommer, Switzerland, was honored for his contribution to the Locking Compression Plate (LCP), Anselmo Reyes, Mexico, for the Modular Distal Aiming Device (MoDAD), Theerachai Apivatthakakul, Thailand, for minimally invasive osteosynthesis (MIO), and Tim Weber, USA, for the Reamer-Irrigator-Aspirator (RIA). The prizes were awarded by Norbert P Haas, president of TK system (in the picture from left to right).



Nicola Rusca

NEWS FROM AO INTERNATIONAL (AOI)

New navigational interface for PFNA DVD

In collaboration with Christiaan van der Werken and Rogier Simmermacher, a new navigational interface for the PFNA DVD has been developed. The user now has the possibility to choose between two different versions—a course version and a full version (Fig 1). The course version (Fig 2) is divided into different parts designed for use during a practical exercise. The full version is longer than the course version (Fig 3), and can be used not only for courses but also for clinical work. For example in the full version the

chapter “surgical approach” uses clinical footage and 3-D animation to demonstrate a specific technique (Fig 4).

The new expert tibial nail video will have a similar navigation interface.

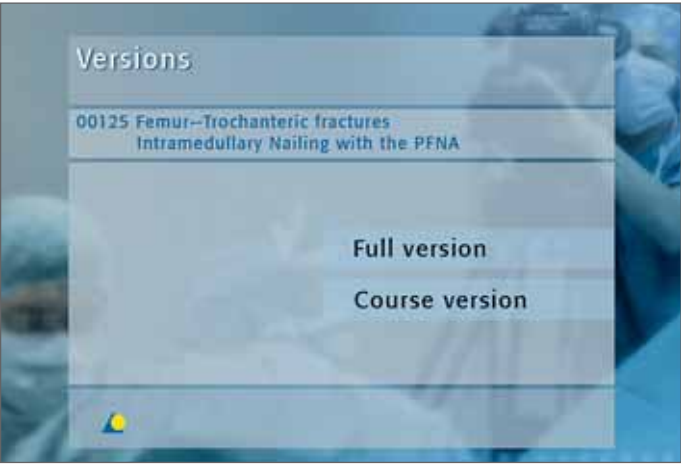


Fig 1 Course version.

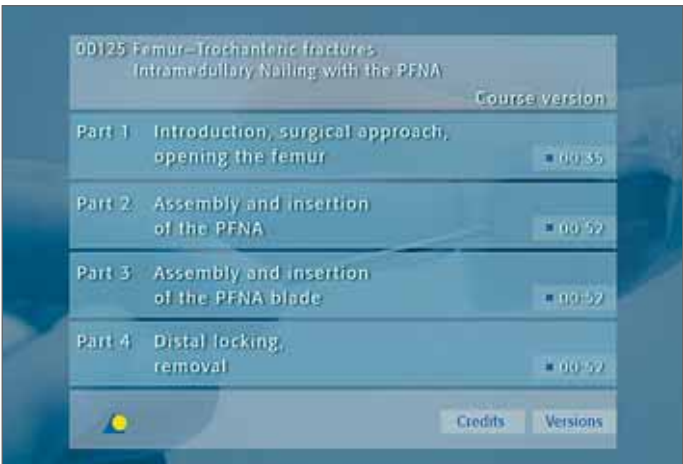


Fig 2 Course version.

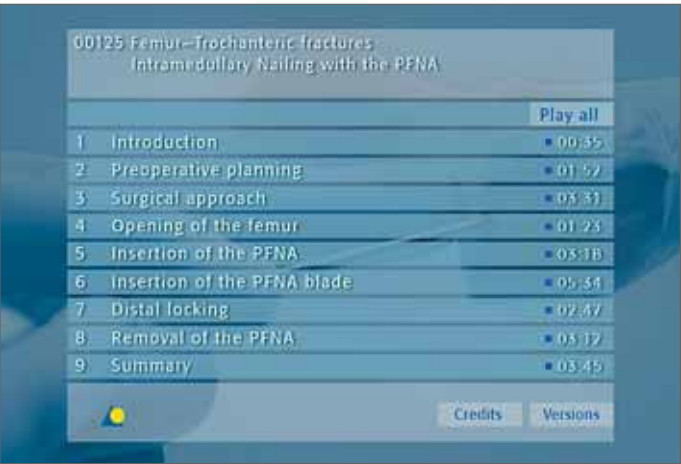


Fig 3 Full version.

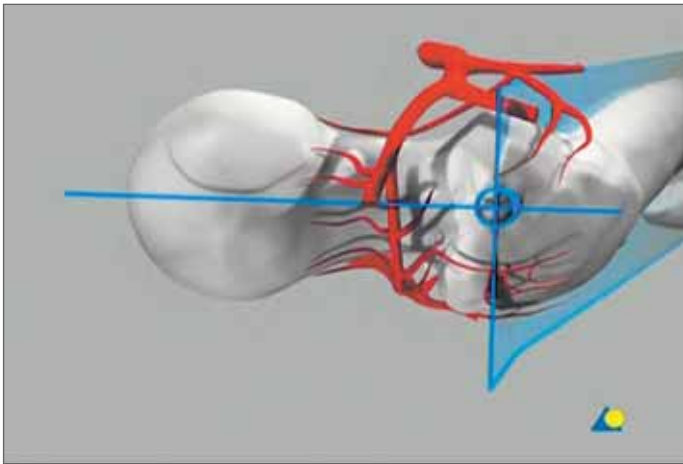


Fig 4 Entry point for PFNA.

Clinical links

DVD technology offers benefits such as improved navigation, a clarified structure and a unified visual language. Switching to DVD also creates the possibility of “clinical links”, ie, “live” footage of real surgical interventions. The DVD main menu will show which workshop subject (artificial bone) is complemented by a clinical video (Fig 5). In the example below the “surgical approach” of the clinical video is selected (Fig 6).

Easier viewing of AO Videos over the Internet

To begin with, the most popular videos are available in DVD format (mainly in English), and can also be viewed over the Internet in three different streaming formats. The user can select their preferred player (Fig 7).

For more information please visit the site:
www.aofoundation.org/aovideo

If you have any comments or questions regarding AO Teaching Videos, please contact:
nicola.rusca@aofoundation.org



Fig 5 Navigation interface of the ESIN DVD which combines artificial bone footage with clinical video.

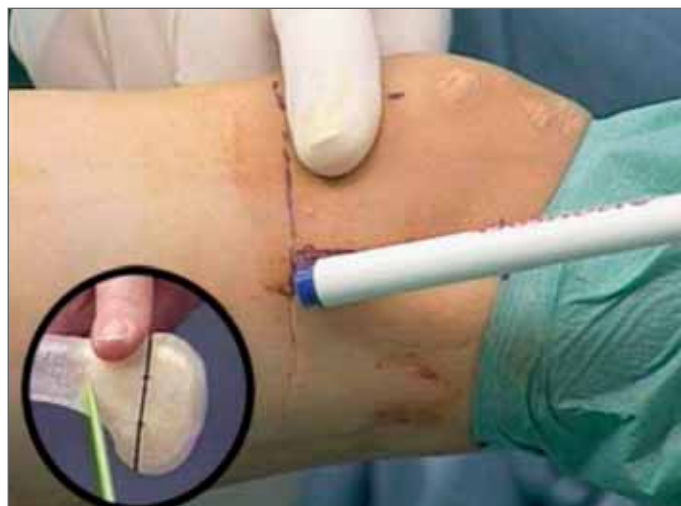


Fig 6 Surgical approach in the clinical section.

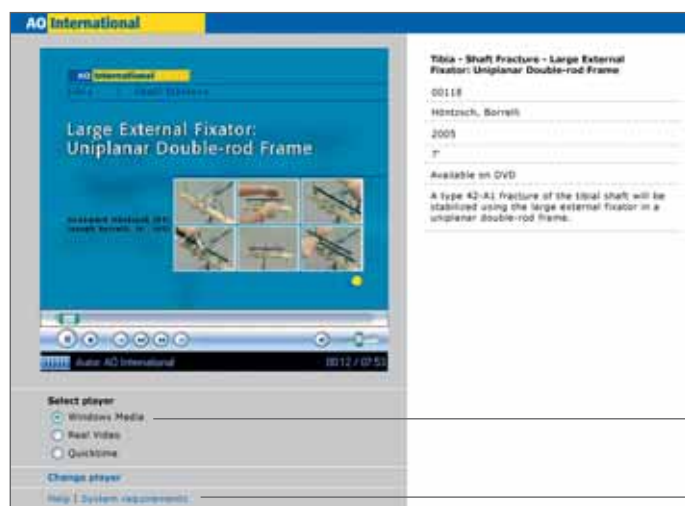


Fig 7 AO Videos over the Internet.

Important information giving a short description of the video.

Preferred media player selection.

Useful information to help solve technical problems (eg, firewall).

Michael Raschke

PORTRAIT OF MARTIN LANGER, MD



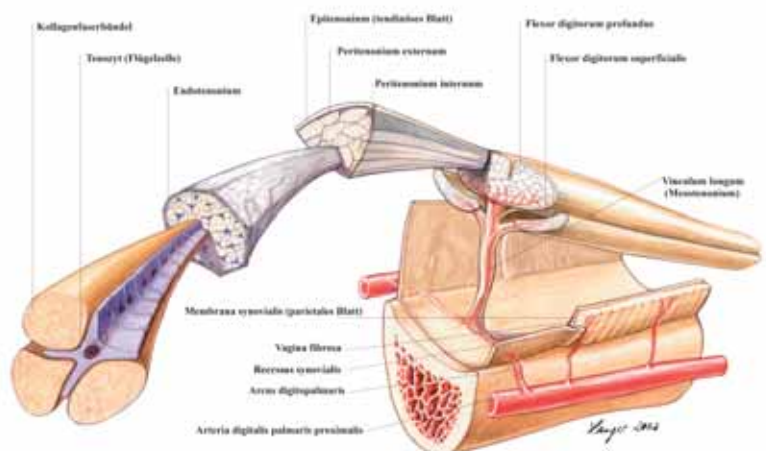
Martin Langer almost didn't become a doctor but a graphics artist for anatomical illustrations at "Netter Atlas". A head hunter claimed that his drawings came as close as possible to the medical situations shown in the Netter Atlases. Even as a schoolboy he earned his pocket money doing technical drawings. But he felt that this work would not be sufficiently challenging in the long term and so he decided to become a surgeon.

Dr Martin Langer, born 27.10.1963 in Paderborn, Germany, has been a Senior Consultant in the Hospital and Polyclinic for Traumatology, Hand and Reconstruction Surgery for many years. During his training he worked from 1995–1998 at the University of Erlangen–Nürnberg and from 2000–2001 at the Inselspital in Bern. Today, he is head of the team for hand and microsurgery at the University Hospital in Münster and is a master of the whole spectrum of trauma surgery. He is an equable, quiet and very popular physician. If he has something to say, his comments are always well justified and display a high level of ability, not only in the field of hand surgery.

Martin Langer lives "on the wing" and is a walking encyclopedia, especially in the fields of medical history and anatomy. He can draw even the smallest structure quickly and distinctly, whereby the structural details and function are accurately named and often supplemented by a short anecdote. His performance in the operating room is virtuosic, as are the perfect sketches he makes afterwards that serve as documentation. All these sketches are of textbook quality.

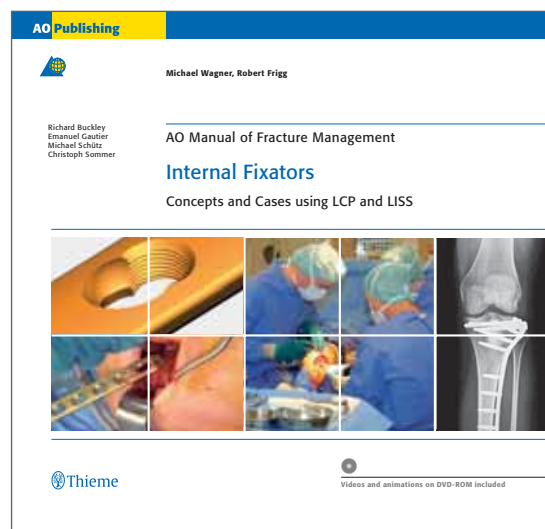
His scientific interest is focused on the biology of tendon healing, new suture techniques, treatment of pediatric deformities, injuries to the hand, and the development of new instruments and osteosynthesis techniques. His proposals for new treatment techniques have met with a very positive response in the AO Hand Expert Group. Martin Langer is currently the medical project leader for the development of a new plate for intraoperative correction of malrotation, a plate for mallet fractures, and Collinear Small Reduction Forceps. The AO can look forward to fruitful collaboration with him in future, as his latest idea for an RSL Fusion Plate shows.

Martin Langer is married and has two children. He loves Ella Fitzgerald and Prokofjew—especially during lengthy replantation procedures. He is always keen to acquire various anatomical atlases and medical history treasures from eBay, and when the long-awaited delivery arrives he withdraws with his latest pickings. In the little free time that he has, he still doesn't give up on anatomy; he undertakes comparison studies of flora and fauna and hoards his loot—to the displeasure of the family—at home in the freezer.



Miriam Uhlmann

NEWS FROM AO PUBLISHING (AOPUB)



We are happy to announce our latest publication—the AO Manual of Fracture Management Internal Fixators Concepts and Cases using LCP and LISS

This publication is primarily intended for orthopedic trauma surgeons, general surgeons, and residents, to learn how to apply the internal fixator technique.

The book is the world's first compendium of principles using LISS and LCP as internal fixators.

- More than 110 cases from world-leading surgeons with intraoperative photos and illustrations.
- Interactive DVD-ROM offering additional animations and videos.

Number of pages: 888

Number of illustrations: 800

Number of photos: 2280

This book can be ordered from end of June 2006 directly on www.aopublishing.org.

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