

TK System

New Trauma Products

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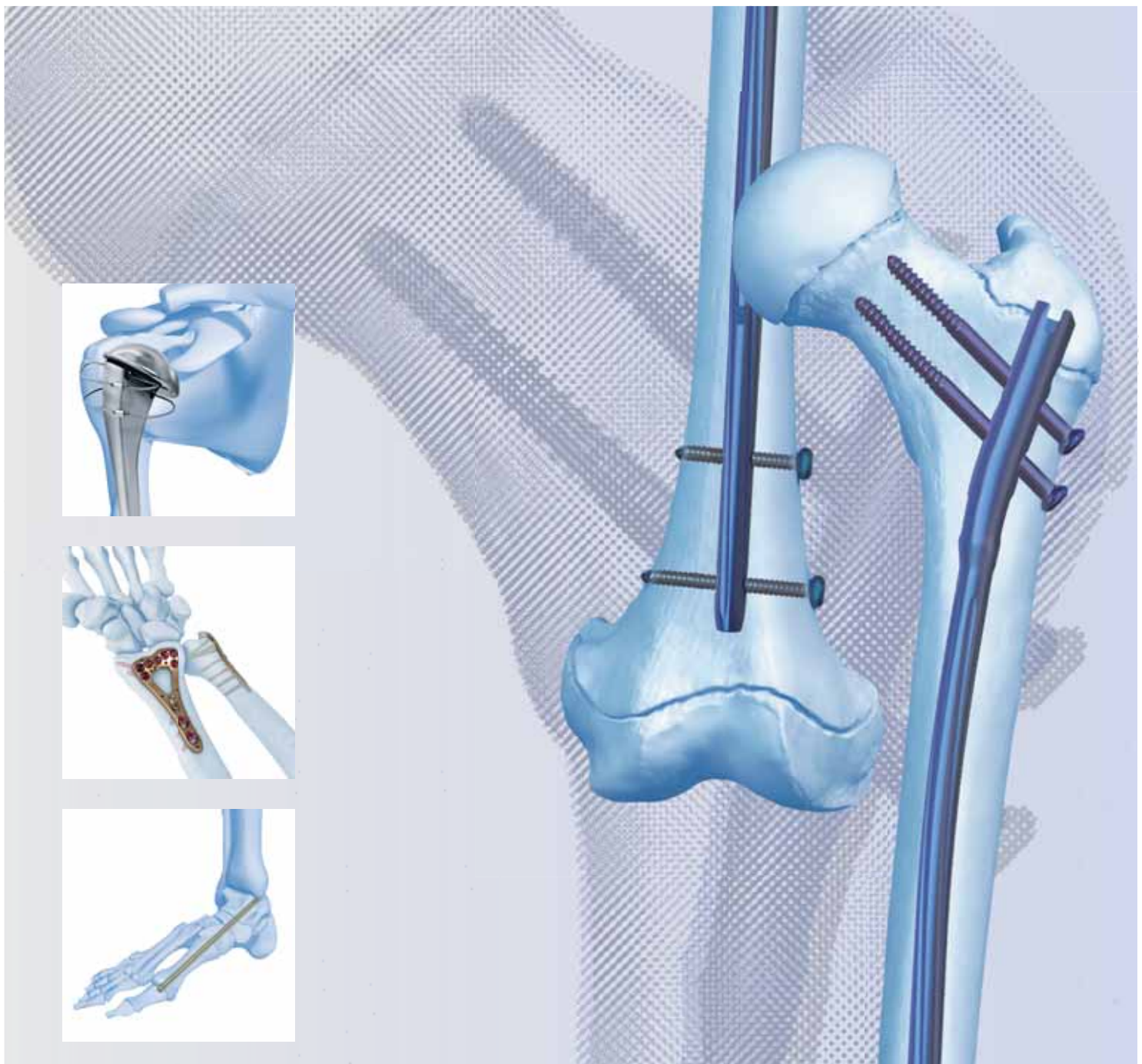


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DUE TO LEGAL AND REGULATORY APPROVAL REQUIREMENTS OF VARIOUS COUNTRIES
PLEASE CONSULT THE APPROPRIATE LOCAL PRODUCT LABELING FOR APPROVED
INTENDED USE OF THE PRODUCTS DESCRIBED IN THIS BROCHURE.
ALL DEVICES IN THIS BROCHURE ARE AOTK APPROVED. FOR LOGISTICAL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



Dear reader

On December 31, 2008 the long-standing chairman of the TK System, Norbert Haas, resigned due to his new role as President-Elect of the AO Foundation. I succeeded him as chairman of the TK Executive Board and the AOTK (Trauma) which implies also the function as editor-in-chief of the TK News Trauma. It is always easy to build on well-prepared basis and at this time I want to thank Norbert Haas for his outstanding achievements, evolving the TK to the prospering system which now provides a large, worldwide group of creative and enthusiastic surgeons the basis for realizing new ideas for improved patient care. I myself had the privilege to experience the inspiring atmosphere by being involved in the TK System since 1989, including 8 years as Chairman of the Pelvic Expert Group.

It is one of my first, but very sad tasks to commemorate our first Chairman of the TK and one of the leading AO founders, Prof Maurice E Müller who passed away recently at the age of 91. Known as an outstanding surgeon and technical genius, he inaugurated the institution of the Technical Commission and by constant support facilitated the process toward the existing strength and high standards in physician driven implant development. We all have to make sure that his spirit and patient-oriented engagement will always guide our further engagements.

The TK System currently has 134 medical members from around the globe, welcoming the first four members from the Middle East recently. The processes to develop new devices under the clinical guidance of the surgeons are well established but we will enhance our efforts to design innovative studies and continue to improve clinical evaluation to obtain highly-ranked publications. An increased level of evidence is required partially due to regulatory changes but more important to maintain the AO Foundation's high clinical standards and to ensure that our innovations not only reach the patient, but create measurable advantages in patient care. Another focus will be put on the identification of potential new development areas according to our changing clinical needs. Whereas technology integration and navigation will remain a priority, new focus areas will either revisit established instruments and techniques for improvement (powertools, reduction aids, positioning, etc), but also will combine expertise for new clinical demands like periprosthetic fractures, prosthesis in fracture care, augmentation, and reduction tools.

In the lead article of this issue, Norbert Südkamp and Ralph Hertel from the Upper Extremity Expert Group will give you a comprehensive overview of the humerus prosthesis EPOCA®. Other new devices I would like to highlight are the headless compression screws of which we will soon have sizes from 1.5–6.5 mm, the 30° variable angle screw technology which was first incorporated into the distal radius plates but will disseminate into most other locking plates, the adolescent femoral nail with a lateral entry point, TomoFix medial high tibia, and the midfoot fusion bolt. Since quite a number of removal tools are featured, we added an article with pitfalls and pearls of removal.

The column portrait features Matthew Graves, USA, a bright young surgeon who challenges us with his ideas, research, and enthusiasm. I encourage you to follow his example and share your talents with us. You may approach the AO anytime if you have an idea for 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. You can obtain more detailed information on these products from the AO or your local Synthes representative.

If you have any comments or questions on the articles or the new products, please do not hesitate to contact me.

Yours faithfully,

Tim Pohlemann

Norbert P Südkamp, Martin Jaeger, Ralph Hertel

EPOCA®—A VERSATILE PROSTHESIS SYSTEM SERVING AS AN ANATOMICAL SUBSTITUTE OF THE SHOULDER JOINT IN TRAUMATIC AND DEGENERATIVE CONDITIONS



The EPOCA® shoulder arthroplasty system is a versatile prosthetic system serving as an anatomical substitute of the shoulder joint in traumatic and degenerative indications. The system is able to restore glenohumeral kinematics and facilitates anatomical reconstruction of the proximal humerus.

The system consists of a finless stem of different sizes in a cemented or a press-fit version. The stem is coupled with the head via a unique double eccentric disc. This eccentric disc allows for an independent adjustment of the medial and posterior offset in respect to the shaft. The head sizes grow linearly with a fixed ratio between the head height and radius. The EPOCA® shoulder arthroplasty system also comprises of a resurfacing option and a polyethylen glenoid system, which is compatible with all other components. The glenoid system allows a hybrid fixation with shell screws or cementless application with a metal back glenoid. For rotator cuff insufficiencies there is a reco glenoid providing a stable fulcrum despite cuff dysfunction (Fig 1).

In general, the stemmed implants could be used in all conditions, but with the advent of resurfacing implants, the main indication for stemmed implants is in the treatment of irreparable fractures of the proximal humerus and in posttraumatic conditions with advanced joint destruction. The treatment of proximal humeral fractures is still challenging and it is not possible to reliably reconstruct all fractures. Especially severely destroyed humeral head fractures, ie, head splitting fractures, cannot be reduced and stabilized adequately. A second unsolved and widespread problem are the 4-part fractures in the anatomical neck with a very small, often less than 15 mm thin, osteoporotic head fragment. Even with modern angular stable fixation systems plus additional cerclage sutures on the rotator cuff failures like early secondary dislocations occur too often. This is not surprising because there is simply not enough bone to resist the dislocating forces. In these situations the primary fracture prosthesis is the only reasonable treatment option.

Fracture situations are characterized by the fact that many landmarks are destroyed. An ideal prosthesis should help the surgeon to find the original anatomical relations. The implant should be adjustable and individually adaptable but parameters with a low variance can and should be standardized. This not only simplifies the use, but also avoids unnecessary complications and contributes to a reduction of unnecessary components.

Fig 1
EPOCA® shoulder arthroplasty system.

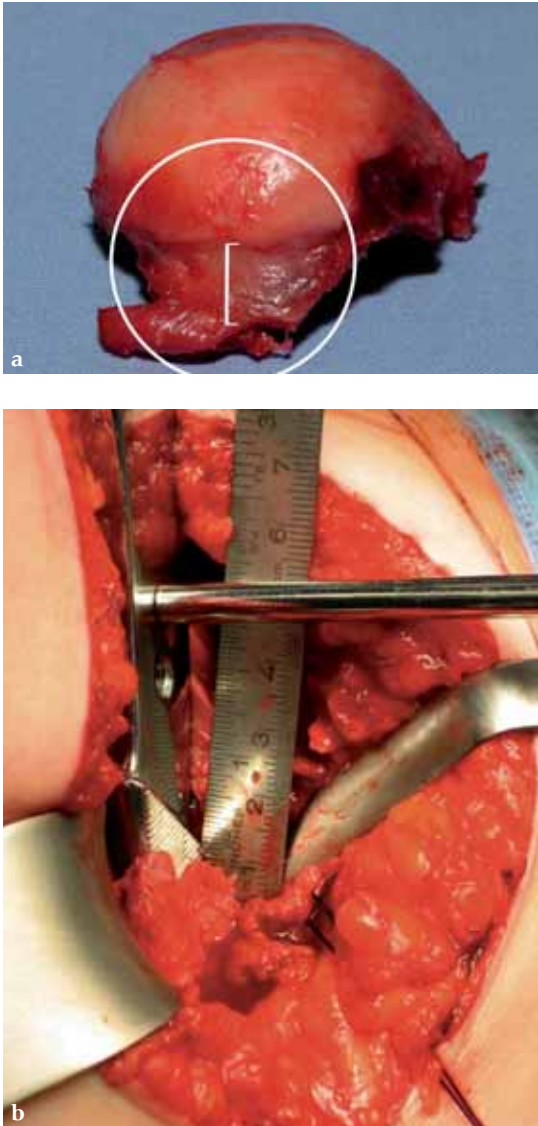


Fig 2a–b
Posteromedial metaphyseal extension
 attached at the humeral head. This short
 calcar segment determines the height of
 the prosthesis on the medial side.

The EPOCA® philosophy is based on anatomical studies [1]. Besides the medial and the trochanter majus offset, the retrotorsion, as well as the size of the humeral head and the humeral shaft show a large variance and are therefore adaptable in the EPOCA® system. On the other hand the inclination of the humeral head, as well as the relation between the humeral height and radius show only a small variance and are therefore standardized.

While the dimensions of the prosthesis components can be easily determined in general, the correct position of the prosthesis concerning height and retrotorsion poses problems, because important references are destroyed by the fracture. Since posteromedially the fracture is usually simple, reference can be taken from this area. The prosthesis height is determined by the length of the posteromedial metaphyseal extension which is still attached to the humeral head (Fig 2a–b). This length can be measured easily and defines the gap between the humeral shaft and the head on the medial side. Concerning retrotorsion a standardized adjustment to fixed references, thus, eg, the forearm axis, is not adequate. To restore the correct retrotorsion for the given patient is difficult in fracture conditions due to the missing landmark. For this reason the EPOCA® stem provides a special, pronounced calcar design. This anatomical design mimics the contour of the medial calcar and the medullary canal. Using the correct size of the stem leads to a self rotation of the stem with an automatic adjustment of the retrotorsion. In addition, it allows a cementless press-fit implantation, in particular fracture situations. In combination with the unique double eccentric cam the head is freely regulated in any position.

In addition, the correct implantation of the prosthesis the postoperative result decisively depends on the healing of the tubercle. Often secondary dislocations or resorptions are observed, so that the rotator cuff is not able to transmit its forces to the humerus anymore. This contributes to arguments in favor of inverse implants for the treatment of acute fractures. Reduction and stable fixation of the tubercles can be achieved very well with two steel cables. These cables can be passed through the tubercle and two holes in the stem in order to embrace and compress the tubercles against the stem. In comparison to sutures this technique shows a fixation five times stronger. The tubercle should be lined with cancellous bone graft harvested from the retrieved humeral head in order to improve primary stability and healing to the shaft. This allows early rehabilitation and lowers the incidence of dislocated tubercle [2, 3] (Fig 3).

In contrast to fracture conditions, degenerative conditions present differently. In omarthrosis the main pathology is defined by the loss of cartilage coverage. Hence, the prosthetic substitute should limit itself only to the exchange of the damaged cartilage. The original bone stock of the humeral head is thereby preserved and admits all options of revision surgery if necessary. Therefore the resurfacing head is an excellent supplement to the stem in degenerative and posttraumatic conditions.

The EPOCA® resurfacing head distinguishes itself not only by its anatomical geometry and its very thin surface, but also by its unique fixation design. A central crown anchors the hydroxyapatite coated prosthesis in a press-fit technique in the peripheral parts of the humeral head. In contrast to the central area which is used by most pegs fixed cups the peripheral area shows a better cancellous bone quality especially in osteoporotic conditions. To date, loosening of the EPOCA® resurfacing head has not been observed in larger series (Fig 4).

61-year-old male with a 4-part-fracture of the humeral head (head-splitting fracture).

Case provided by Norbert P Südkamp,
Martin Jaeger, Freiburg, DE, Ralph Hertel, Bern, CH

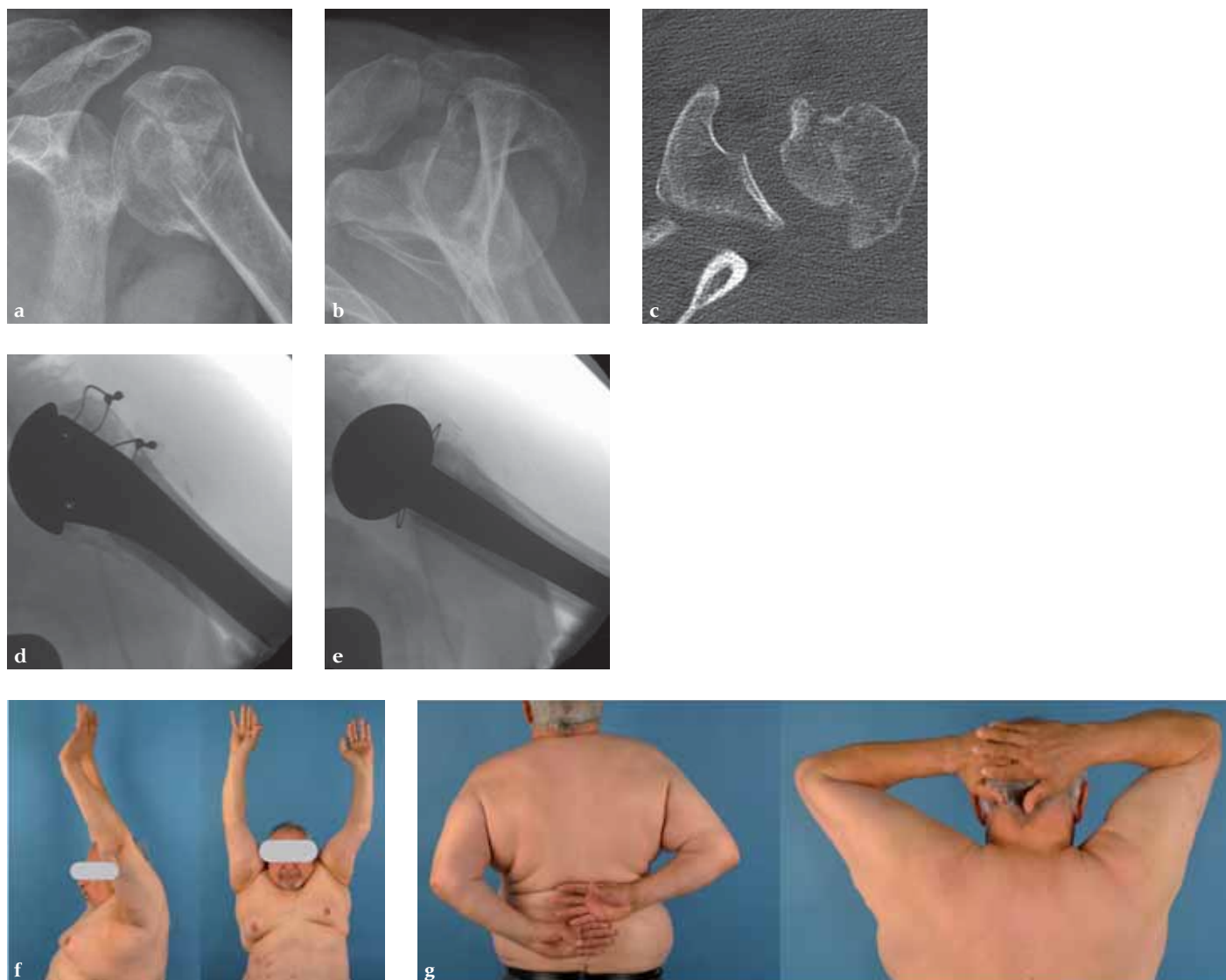


Fig 3a–g
a–c Fracture situation in conventional x-rays and CT scan.
d–e Implantation of a fracture prosthesis type EPOCA®.
f–g Clinical results 6 months postoperatively.

67-year-old female with a primary omarthrosis on the right side.

Case provided by Norbert P Südkamp,
Martin Jaeger, Freiburg, DE, Ralph Hertel, Bern, CH

All humeral components can be combined with a glenoid for total joint replacement. The glenoid itself ensures congruent glenohumeral implant surfaces to avoid point contact and to achieve a normal range of motion. It is possible to perform a hybrid fixation with shell screws or to use a press-fit, very thin metal back glenoid. The latter is recommended in conditions of poor bone quality or major posterior wear and distinguishes itself by a minimal lateralization.

The EPOCA® shoulder arthroplasty system is a rational, versatile, and valuable supplement in the treatment of humeral head fractures as well as in posttraumatic and degenerative conditions.

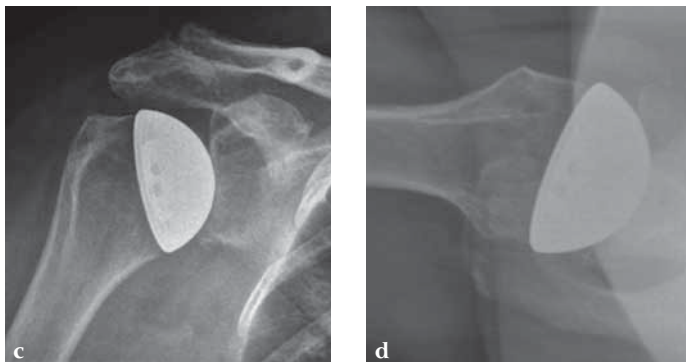
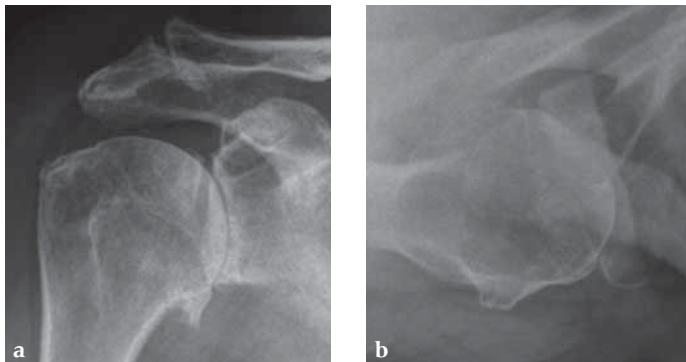


Fig 4a–f

a–b Fracture situation in conventional x-rays.

c–d Implantation of a resurfacing head type EPOCA®.

e–f Clinical results 6 months postoperatively.

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Norbert P Südkamp

NEW UPPER EXTREMITY PRODUCTS



LCP Superior Anterior Clavicle 3.5

The precontoured LCP anterior superior clavicle plate system 3.5 represents another important group of anatomically preshaped plates for the clavicular bone. It is indicated not only for the fixation of fractures, but also for malunions and nonunions of the clavicle.

Anatomical precontouring implies the need for a left and right version. Additionally, the plate system provides different lengths. These various plate lengths accommodate a variety of different fracture patterns, especially fractures with a lateral extension or fractures of the lateral clavicular third with or without ligamentous involvement.

Plates with a lateral extension come in sizes of 3–8 holes, plates without lateral extension in sizes of 6–8 holes. The complete plate system is available both in stainless steel or titanium.

Notches in the plate aid additional contouring. New bending pliers provide further aid in adapting the plate to the bone. Diverging and cross-hatching screw patterns in the lateral end help in creating a stronger construct. The plates use 3.5 mm locking screws in the shaft and feature 2.7 mm locking screws in the lateral extension also allowing for an increased number of screw positions in the lateral extension.

Static and dynamic mechanical tests proved two times the yield strength of the new anterior superior clavicle plate compared to the LCP reconstruction plate 3.5, both under a dynamic compression load as well as under torsional load.

Surgery is very straight forward as in most cases, no or only minor additional contouring of the plate is required, thus minimizing surgery time. The plate has already proven itself in the field and has become our favorite implant for clavicular surgery requiring a plate.

A 21-year old male fell on the right shoulder when playing soccer. He sustained a clavicular shaft fracture type 06 A3 (OTA classification) with dislocation of shaft width and shortening of around 2 cm.

Case provided by
Norbert P Südkamp, Freiburg, DE

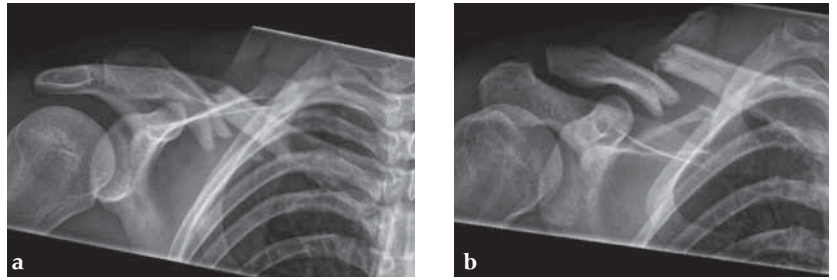


Fig 1a-b
Preoperative x-rays.



Fig 2
Open reduction.
Osteosynthesis using
MIO technique.



Fig 3a-b
Immediate postoperative x-rays.

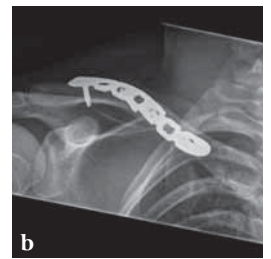
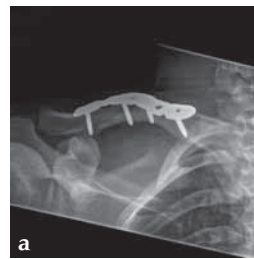


Fig 4a-b
X-rays 9 months postoperatively.



Fig 5a-d
Painfree, unrestricted motion 9 months
postoperatively.



Radiographic Ruler for Small Fragment Plates, 360 mm

The radiographic ruler for small fragment plates enables the correct sizing of sterile plates in the operating room. Scaled increments provide accurate measurements when selecting the appropriate plate and for showing approximate combination hole markings for the proper amount of screws. The ruler is viewable in x-rays.

Doug Campbell, Thomas Fischer, Jesse B Jupiter

NEW HAND PRODUCTS



LCP Distal Ulna Plate 2.0

Fractures of the distal ulna often accompany fractures of the distal radius and occur most commonly through the tip or base of the ulnar styloid process, although some patients have fractures through the ulnar head or neck. An unstable or malaligned fracture of the ulnar head or neck can affect distal radioulnar joint (DRUJ) function and may diminish the stability of the distal forearm, which can increase the risk of nonunion of the distal radius.

The LCP distal ulna plate 2.0 is an anatomically precontoured implant which has been specifically designed for stable fixation of a variety of fracture patterns of the distal ulna and, when required, to treat concurrent fractures of the head/neck region and styloid process.

Indications for this implant are fractures of the distal ulna which result in an unstable radioulnar joint, fractures of the ulna head where the articular surface is either displaced, rotated, or tilted, and comminuted extraarticular fractures of the ulnar neck threatening stable congruency of the distal radioulnar joint.

The plate is designed to fit both small and large ulnae, decreasing the need for prebending. The plate has a low profile of 1.3 mm and is highly polished to minimize soft-tissue irritation. Pointed hooks enable the styloid process fragment to be securely held, irrespective of its size. The 2.0 mm locking screws in the distal part of the plate are intercrossing which enables angular stable fixation of head and neck fragments, and provides a better hold in osteopenic bone.

Dynamic tests have been performed comparing the strength of the LCP distal ulna plate 2.0 with the LCP condylar plate 2.0. When tested over a fracture gap of 14.7 mm, the LCP distal ulna plate 2.0 had a fatigue strength which was 52% greater than the LCP condylar plate 2.0.

The plates are available in stainless steel and CP titanium, and both sterile and nonsterile.



A 48-year-old female had an accident while on vacation. Local temporary treatment was performed with a bridging external fixator and definitive treatment with a plate 2 weeks postinjury.



Fig 1a–c
Preoperative x-rays (AP, lateral, close-up).

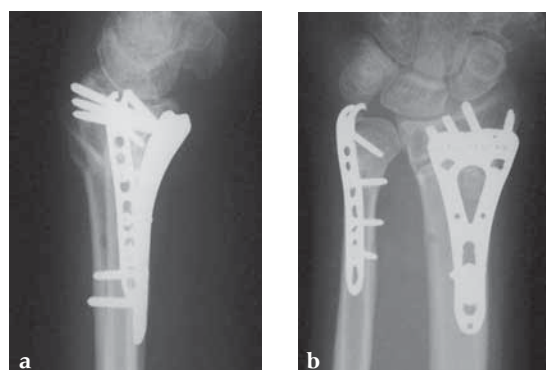


Fig 2a–b
AP and lateral x-rays 4 months after ORIF of a segmental unstable fracture of the distal ulna including basistyloid avulsion and extraarticular fracture of the distal radius.

Case provided by Doug Campbell, West Yorkshire, UK

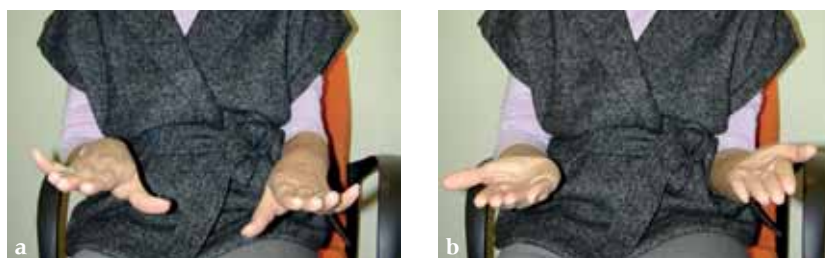


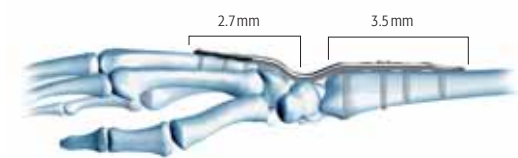
Fig 3a–b
Forearm rotation 4 months postoperatively.



LCP Wrist Fusion Plate

The LCP wrist fusion system is indicated for wrist arthrodesis. Specific indications include posttraumatic arthritis of the joints of the wrist, rheumatoid wrist deformities requiring restoration, complex carpal instability, sequelae of septic arthritis of the wrist, severe unremitting wrist pain related to motion, brachial plexus nerve palsies, tumor resection, and spastic deformities.

The LCP wrist fusion system offers three different plates: a standard bend plate, a short bend plate, and a straight plate. The correct plate is selected according to the condition of the soft tissues and the bony anatomy of the patient's wrist. The standard bend plate is used for radiometacarpal fixation of average-sized individuals. The short bend plate is used for wrist fixation in small-stature individuals and for fusion following proximal row carpectomy. The straight plate is used for wrist fixation when the standard and short bend plates do not fit the anatomy. This plate can be contoured according to the specific needs of the anatomy of the patient's wrist.



All implants are available in implant quality 316L stainless steel and commercially pure titanium.

All plates are precontoured, low-profile, and limited-contact. The fusion angle of 10° of dorsiflexion provides optimum hand position. The plate geometry is identical to the original and widely used LC-DCP wrist fusion plate, except for overall length. A combination hole dorsal to the capitate allows lag screw or locking screw fixation of the capitate to the plate. Distally the plates accept 2.7 mm locking and cortex screws and 3.5 mm locking and cortex screws proximally. Locking screws with threaded heads are used in combination holes to create a fixed-angle construct, particularly advantageous to osteopenic bone. Screws are self-tapping for easy insertion. Self-retaining StarDrive recess provides improved torque transmission and increased resistance to stripping.

The evolution of the technology of locked plating systems has extended the useful application of wrist fusion plate fixation to osteopenic and osteoporotic bone. More patients who have sustained the debilitating effects of periarticular inflammation may benefit from improved screw stability in osteopenic bone. Improvements in screw fixation in normal metaphyseal bone allows for a more stable construct with the proximal screw in the metacarpal that is always in the proximal metacarpal metaphysis on the distal arm of the plate. In cases of previous plate fixation on the third metacarpal; residual screw hole voids are present and the amount of bone material available for salvage fixation is compromised. With previously drilled 2.7 mm cortex screws the residual screw hole defect can be reliably filled with a locking screw of the same 2.7 mm system if the plate alignment allows. This provides plate to bone fixation of the new revision plate bone construct that previously would be accomplished by the use of 3.5 mm screws distally and an unacceptably large plate implant on the smaller metacarpal.

The LC-DCP wrist fusion system has provided a unique anatomically contoured implant. The modification of the implant (to allow for locking screw techniques) further extends the usefulness in patients with bone density defects.

Wrist fusion is an effective end-stage treatment for the injured and painful wrist. Multiply operated wrists and distal forearms have significant alterations of bone mass, bone alignment and the norm is not a dense bone structure. LCP wrist fusion plate techniques have extended the technical improvements found in other areas of the skeletal fixation to the special problem of stable fixation in wrist reconstruction. Stable fixation may provide the stability needed for the functional aftercare of the adjacent distal radioulnar joint that additionally sustains post-traumatic arthrofibrosis with the concomitant loss of pronation and supination.

Case provided by
Thomas Fischer,
Indianapolis, USA



Fig 1
Eight weeks after radiocarpal
fusion.

This case example is of a 73-year-old female now 13 years after a distal radius fracture and 2 years after a scapholunate-advanced collapse wrist procedure with Sauve Kapandji arthrodesis for combined posttraumatic instability of the carpus and posttraumatic arthritis of the DRUJ.

The postoperative course for this reconstruction was complicated by a true reflex sympathetic dystrophy (CRPS Type I) responding to stellate ganglion blocks as well as oral pharmaceuticals.

One year before her wrist fusion with LCP wrist fusion plate the patient underwent Achilles tendon allograft for stabilization of an unstable distal forearm articulation. The forearm was stabilized and her pain resolved only to return with radiocarpal crepitation and pain in the terminus of motion in flexion and extension. Her forearm was stable and her hand was warm and supple but she still suffered from rather severe osteopenia and arthrofibrosis of the small finger joints. Her dorsal wrist pain was of sufficient severity, frequency, quality, and location to justify trading her residual wrist motion for pain management. After diagnostic selective wrist joint injections her radiocarpal joint was determined to be a significant source of pain. She underwent successful radiocarpal arthrodesis with local bone graft.

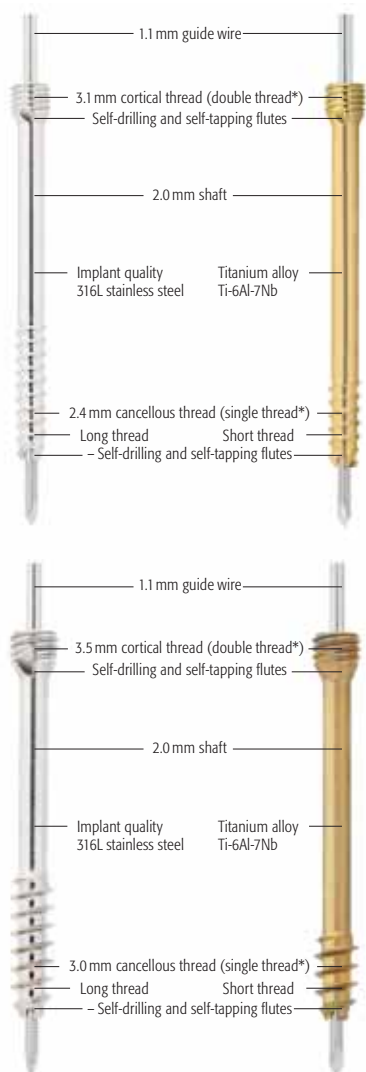
Since wrist fusion her small joint arthrofibrosis of the hand has improved and she is off all pain medications.



Fig 2
One year after distal radius
ulnar joint interposition
arthroplasty.



Fig 3a–d
Functional result 2 years
postoperatively.



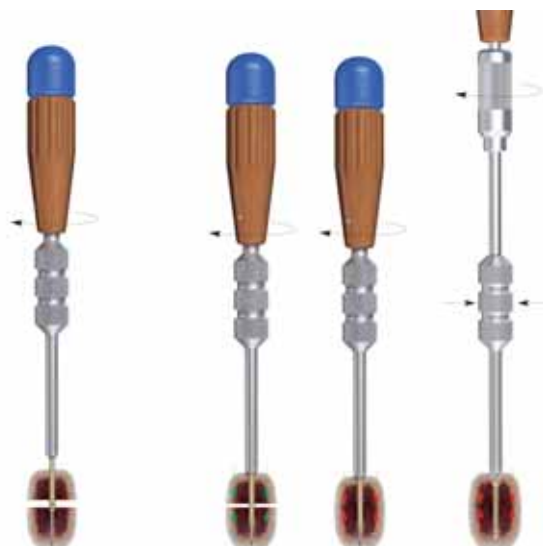
2.4 and 3.0 mm Headless Compression Screws

2.4 mm headless compression screws (HCS) are indicated for fixation of fractures and nonunions in small bones and small bone arthrodeses, including scaphoid fractures; intraarticular fractures of the tarsals, metatarsals, carpals, and metacarpals; bunionectomies and osteotomies; arthrodeses of small joints (eg, phalanges); fractures of the patella, ulna, and radial styloid.

3.0 mm headless compression screws (HCS) are intended for fixation of intraarticular and extraarticular fractures and nonunions in small bones and small bone fragments; arthrodeses of small joints; bunionectomies and osteotomies, including scaphoid and other carpal bones, metacarpals, tarsals, metatarsals, patella, ulnar styloid, capitellum, radial head, and radial styloid.

The use of the small diameter guide wire allows precise placement of the cannulated HCS through small incisions. It is produced in a stainless steel with 1.5 times the usual bending strength. This prevents distortion of the thin wire on insertion, yet retains the accuracy of placement from the narrow diameter. Thread the head of the selected headless compression screw into the tip of the compression sleeve. Insert the screw into the bone using the compression sleeve construct. A guide wire marks the prescribed path for the cannulated HCS and secures the alignment of the fragments while the screw is being inserted.

The tip of the compression sleeve acts as a conventional lag screw head. When the tip of the compression sleeve contacts the bone, the fracture gap is closed and is compressed analog to the function of a lag screw. The instrumentation allows the surgeon to directly control the amount of compression.



1 Insert screw

Thread the head of the headless compression screw into the tip of the compression sleeve. Insert the screw into the bone using the compression sleeve construct.

2 Compress

The tip of the compression sleeve acts as a conventional lag screw head. When the tip of the compression sleeve contacts the bone, the fracture gap is closed and compressed as with lag screw.

3 Countersink

Following compression of the fracture, hold the compression sleeve stationary and use the screwdriver to advance the screw head into the bone.

24-year-old male with an acute scaphoid wrist fracture treated by percutaneous fixation with a 3.0 mm headless compression screw under regional anesthesia.

Case provided by Doug Campbell,
West Yorkshire, GB



Fig 1
Preoperative x-ray.

Following compression of the fracture, hold the compression sleeve stationary and use the screwdriver to advance the screw head out of the sleeve and into the bone.

The screws are available in different thread lengths. The 2.4 mm HCS has a short thread (9–40 mm length, 4–10 mm thread lengths) and a long thread (17–40 mm lengths and 6–16 mm thread lengths). The 3.0 mm HCS comes in almost the same variety. This allows for optimal purchase in the far fragment for maximum compression and stability. All implants are available in implant quality 316L stainless steel and commercially pure titanium.

The ability to provide complete control in compression is a major technical advance in this type of implant. No external jig is required, the optimum path, position, and length of the implant can be selected for each case, and the surgeon retains control over selecting the most appropriate degree of compression. A second, parallel guide wire is often recommended to prevent the significant torque force of the insertion process producing a malunion by rotation of the fragments.

Future line extension will soon be available and feature 1.5 mm (not cannulated), 4.5 mm, and 6.5 mm sizes.

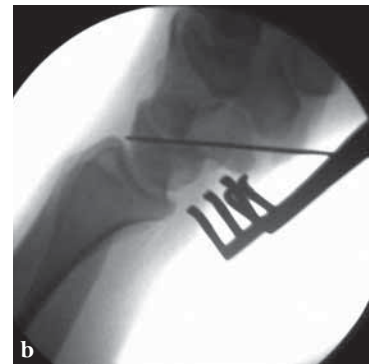
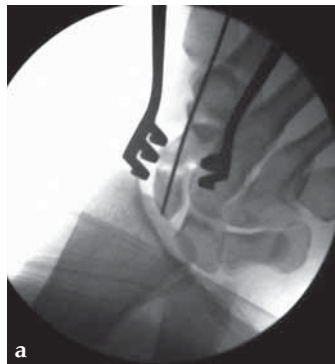


Fig 2a–b
Intraoperative images.



Fig 3a–b
Postoperative images.



Fig 1



Fig 2

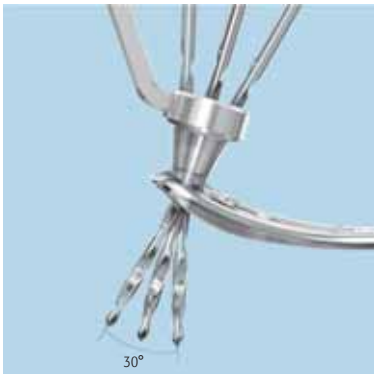


Fig 3a



Fig 3b

Variable Angle LCP Distal Radius System 2.4

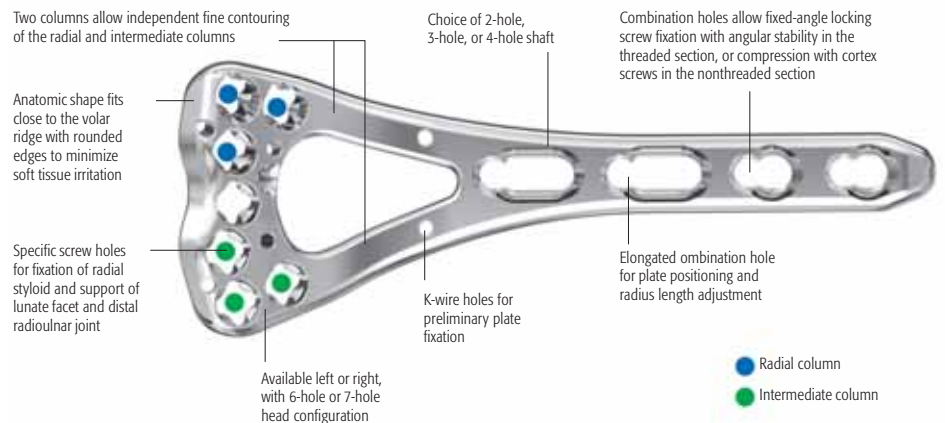
The variable angle LCP distal radius system 2.4 is indicated for fixation of complex intra- and extraarticular fractures and osteotomies of the distal radius and other small bones (Fig 1). The new variable angle technology enhances fragment-specific fracture fixation by providing the flexibility to lock screws in trajectories that diverge up to 15° from the central axis of the plate hole (Fig 2). The plates are precontoured to match the anatomy of the volar distal radius. Variable angle locking holes in the head of the plate enable placement of the screws at the most appropriate position to create a locking construct to support the articular surface and reduce the need for bone graft.

The system consists of the variable angle LCP two-column volar distal radius 2.4 and the variable angle LCP volar extraarticular distal radius 2.4. Both plate types use 2.4/2.7 mm cortex or 2.4 mm locking screws in the plate shaft, and 2.4 mm variable angle locking screws in the head of the plate. The variable angle locking screws are available in sizes from 8 mm to 30 mm. All plates are available in stainless steel or CP4 titanium.

A special drill guide allows up to a 15° angulation around the central axis of the locking hole (Fig 3).

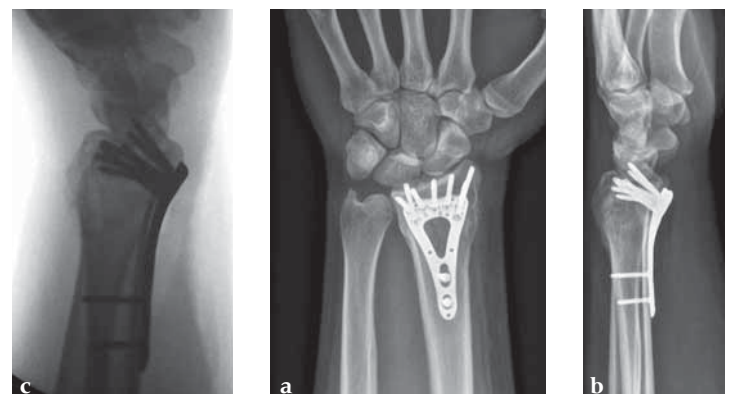
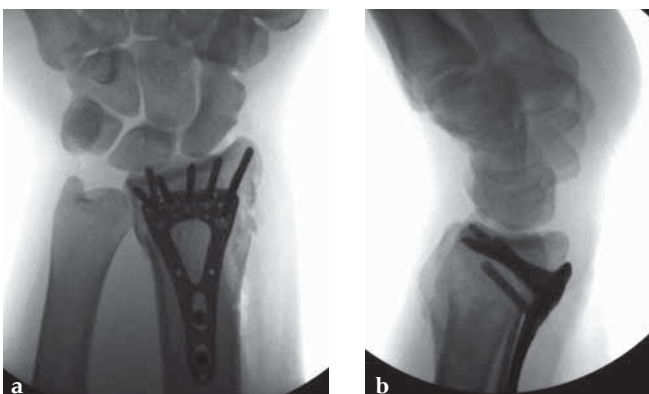
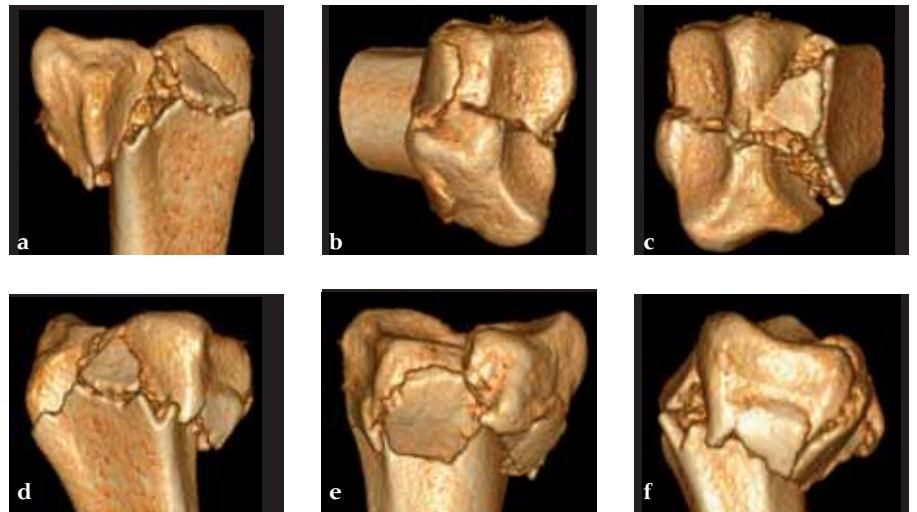
Variable Angle LCP Two-Column Volar Distal Radius 2.4

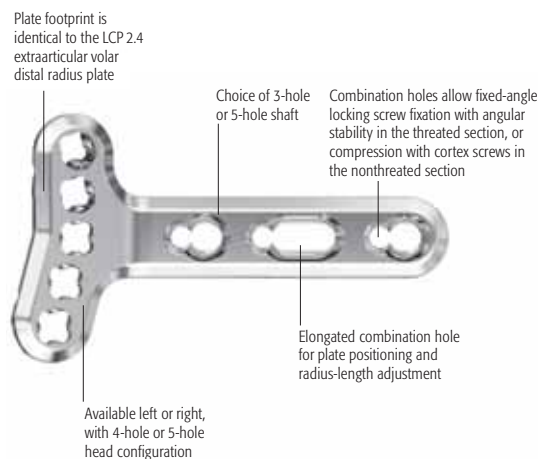
The plates come in a left and right version. The plate head has a 6-hole and a 7-hole head option, the shaft features 2-, 3-, and 4-hole versions. In total, twelve different plates are available (see also case below).



22-year-old male fell off a horse while playing polo.

Case provided by Ladislav Nagy, Zürich, CH





Variable Angle LCP Volar Extraarticular Distal Radius 2.4

The new plate design is based on the existing LCP volar extraarticular distal radius 2.4. In total, eight plates are available, left and right, either 4-hole or 5-hole head option, and 3- and 5-hole shaft versions (see also case below).

36-year-old female fell down on a meadow.

Case provided by Ladislav Nagy, Zürich, CH



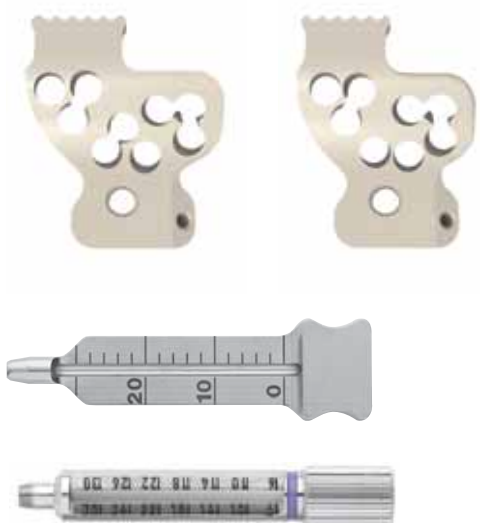
Fig 1a–b
Preoperative x-rays.



Fig 2a–b
X-rays postoperatively.



Fig 3a–b
X-rays 5 months postoperatively.



LCP Volar Column Distal Radius 2.4: Instruments

The LCP volar column distal radius 2.4 is indicated for all fracture types of the distal radius, from simple to complex intra- and extraarticular fractures, and especially for highly comminuted fractures as well as corrective osteotomies of the distal radius.

The LCP volar column distal radius 2.4 is anatomically contoured for the distal radius and has a low profile, which implies less overall implant bulk, minimizing soft-tissue irritations. It provides multiple screw options in the head of the plate (8- and 9-hole head configurations) to better support the articular surface and to address fracture fragments individually. The three-screw cluster addresses the radial styloid. Four screws support the ulnar column.

A few new instruments have been designed to facilitate the use of the plate, simplify plate placement, simplify short drill-guides insertion, and to provide additional options for screw-length measurement, provisional plate fixation, and screw insertion.

Markus Windolf, Georg Gradl, Karsten Schwieger

PRODUCT-RELATED STUDY RESULTS FROM AO RESEARCH AND DEVELOPMENT

Distal Radial Fractures: Biomechanical Stability of a Nonspanning External Fixator compared to Volar Plate Osteosynthesis

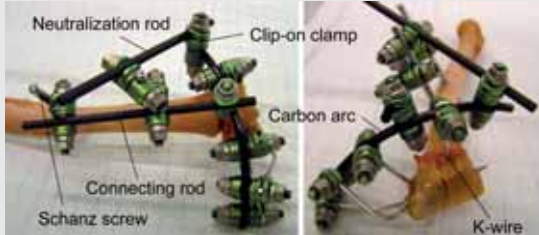


Fig 1
Nonspanning external fixator. Five K-wires are circularly arranged around the distal radius for improved stability. A 23-C2 fracture with dorsal comminution and intraarticular fracture line was simulated.

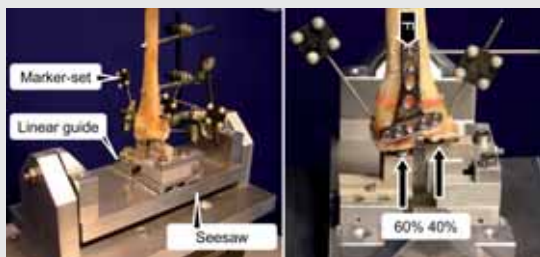


Fig 2
Test setup. A custom-made seesaw was used for physiological load transfer.

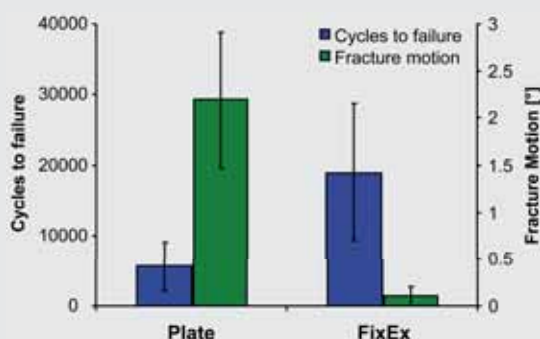


Fig 3
Cycles to failure (5° dorsal tilt) and motion in the fracture gap for both study groups.

Objective

Distal radial fractures challenge the orthopedic surgeon due to complex fracture patterns and demanding functional rehabilitation. Volar plating of the radius has become a popular option since early mobilization of the wrist together with high biomechanical stability can be achieved when using angular stable locking implants. To avoid extensive disturbance of the biological environment as often reported for internal fixation, the use of nonspanning external fixators is considered as alternative treatment. This in vitro study compares the biomechanical performance of a newly proposed external fixator construct, securing the distal radius with multiple K-wires, to a volar plate osteosynthesis (LCP volar distal radius plate 2.4).

Materials and methods

Five pairs of human cadaveric radii were used in the study. The bones were randomly instrumented with either a plate or an external fixator (Fig 1). A 23-C2 (Müller AO Classification of Fractures in Long Bones) comminuted 3-part fracture with volar cortical support was created. Loading at the wrist was simulated by a specially-designed seesaw allowing physiological force transmission of 60% via the scaphoid and 40% via the lunata column (Fig 2). Starting at 100N axial compression, cyclic loading was monotonically increased until failure of the construct (defined as 5° dorsal tilt). Motion of the fragments was measured relative to the shaft of the radius by means of optical motion tracking. Motion in the fracture gap at the beginning of the test and cycles to failure were identified for both study groups. Paired t-tests were used to assess statistical differences between groups.

Results

All plate specimens showed loosening at the bone-screw interface. Only in some cases loosening of the distal K-wires could be observed for the fixator. Motion in the fracture gap was significantly higher for the plate group ($P = 0.003$, power = 0.99). Cycles to failure was found significantly higher for the external fixator construct ($P = 0.034$, power = 0.66) (Fig 3).

Conclusion

This study showed superior biomechanical performance of a nonbridging external fixator compared to angular stable volar plating in a highly unstable distal radial fracture model. However, the outcome strongly depends on the fracture type. Strong volar cortex support is needed for the stability of the external fixator.

Philip Kregor

NEW LOWER EXTREMITY PRODUCTS



Cannulated locking screw.



Cannulated conical screw.



Cannulated T-15 screwdriver with quick coupling.



3.7 mm Cannulated Locking and Conical Screws and Instruments

The 3.7 mm cannulated locking and conical screws have been designed and indicated for use in the metaphyseal areas of LCP 3.5. The system consists of cannulated locking and conical screws in stainless steel and titanium, a 1.6 mm wire guide to allow precise placement of the 1.6 mm drill tip guide wire in the locking hole, a direct measuring device, and a cannulated T-15 screwdriver with quick coupling. These screws are not intended for use in LCP shaft holes.

The 3.7 mm cannulated locking screws are available in lengths of 10–60 mm in 2 mm increments and 60–95 mm lengths in 5 mm increments.

The 3.7 mm cannulated conical screws, self-tapping come in lengths of 10–60 mm lengths in 2 mm increments and 60–95 mm lengths in 5 mm increments.

2.8 mm Guide Wire with Flutes, 450 mm

For the 6.5/7.3 mm cannulated screw system a 450 mm long, 2.8 mm fluted guide wire (drill tip) is available for procedures that require a longer fluted tip wire. This gives the surgeon better tactile feedback with advancement of the guide wire. Until now, only a 300 mm long 2.8 mm fluted guide wire was offered, along with 300 and 450 mm long 2.8 mm threaded guide wires.

Crimp Positioning Pins

The crimp positioning pins are used in conjunction with the orthopedic cable system. It combines a crimp and positioning pin into one in order to simplify cable procedure and reduce incision size. It is used to maintain the position of the cable relative to the plate. The crimp positioning pin is available in two sizes to fit 5.0 mm or 7.3 mm locking holes.

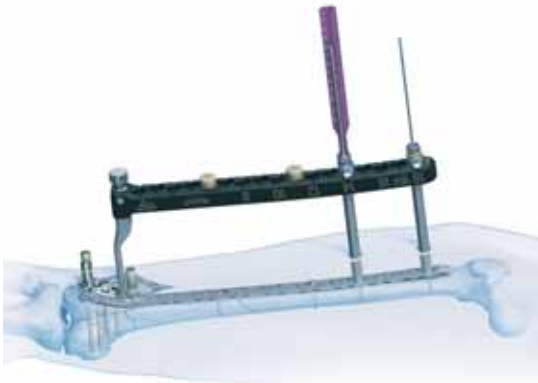




LCP Periarticular Aiming Instruments

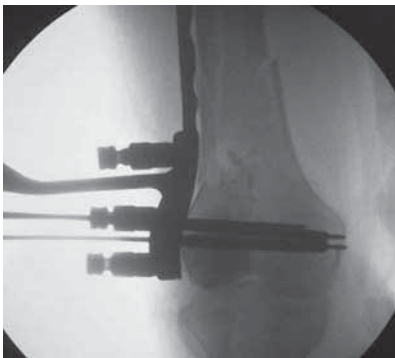
The LCP periarticular aiming instruments are indicated to facilitate percutaneous, submuscular insertion of the LCP condylar 4.5 and LCP proximal tibia 4.5.

The set consists of specific aiming arms and handles designed to percutaneously aim for screw holes of these plates as well as common instruments such as drill sleeves, drill bits, guide wires, and connection parts.



The aiming arms will allow for percutaneous aiming of the LCP proximal tibia plate 4.5 up to 14 holes and the LCP condylar plate 4.5 up to 18 holes straight or curved.

The new aiming instruments feature several changes compared to the previous generation with the ultimate goal to improve handling. The aiming arms have been changed from PEEK to carbon fibre. The connection points have been redesigned to ensure there is no play or loosening in the aiming arm connection with the handle and plate. Snap-in sleeves through the aiming arms eliminate the use of thumb screws. The instrument color coding and labeling has been made more user-friendly.



It is intended to use similar instruments for all future 4.5 periarticular plate aiming systems.

Clifford Turen, Michael Raschke, Dean Lorch, Michael Blauth, Bernd Könemann, Michael Suk

NEW IM NAILING PRODUCTS



Fig 1

Expert Titanium Cannulated Tibial Nail with Proximal Bend

The expert titanium cannulated tibial nail with proximal bend is identical to the existing expert tibial nail system except for the new bend. It is therefore indicated to stabilize fractures of the proximal tibia, distal tibia, and tibia shaft (open and closed). Tibial nonunions and malunions may also be treated with the new nail when an intramedullary implant is deemed appropriate.

The additionally available new tibial nail with proximal bend provides the possibility to choose the optimal solution according to patient anatomy. The new version has a proximal bend of 10.5° with a fixed bend radius of 100 mm at 65 mm from the proximal end and a distal bend of 3° at 52 mm. This version may be used for any fracture pattern and may be preferable in certain populations such as those seen in the Asia Pacific region.

The nail incorporates new features that allow an increased ease of removal of the connecting bolt as well as a more rigid connection between the nail and the insertion instruments.

The new nails are available in diameters from 9 to 13 mm, and in lengths from 255 to 435 mm, in increments of 15 mm.

All other features, such as the proximal and distal locking options and all additional implants and instruments are the same as for the existing expert nail family system.

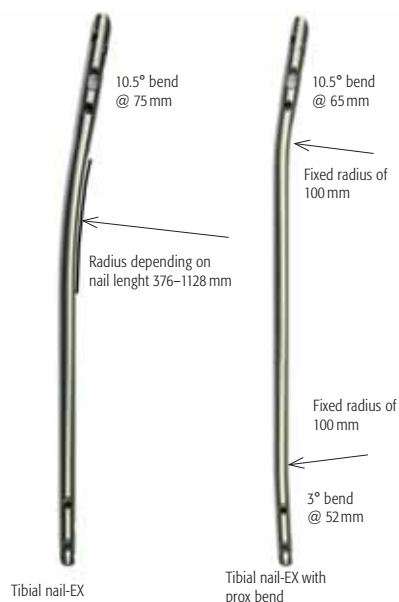


Fig 2

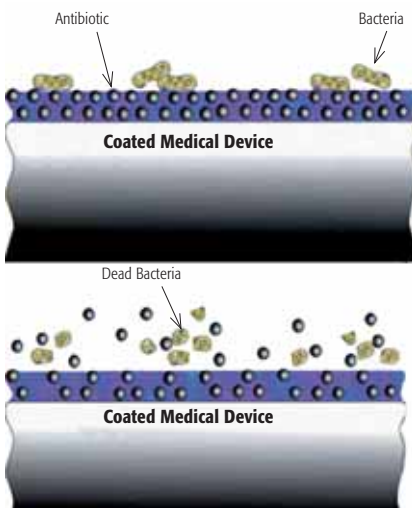
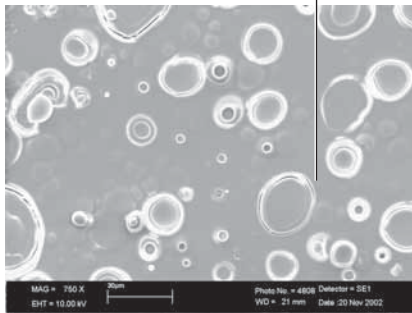
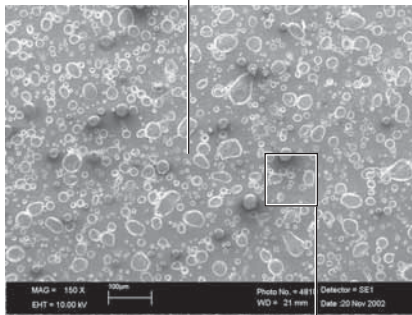
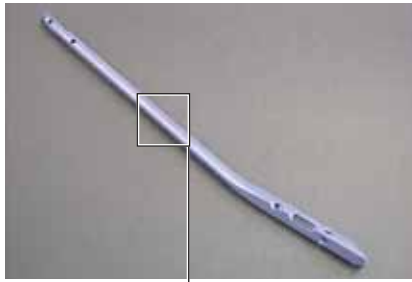
48-year-old male. Tibia shaft fracture with fibula fracture.

Case provided by Hermann Bail, Berlin, DE



Fig 1
Preoperative x-rays.

Fig 2
X-rays 6 weeks postoperatively.



UTN PROtect (UTN, Gentamicin-Coated)

Despite improvements in the prophylactic and the therapeutic measures, soft-tissue damage and consecutive infection remain the major dilemma in the healing process of long bone fractures. Osteomyelitis is a consequence of local contamination by germs combined with a local and/or systemic immunodeficiency. Additionally, blood supply in the traumatized bone is disturbed which means systemic applied antibiotics do not reach the fractured region. In consequence, the further course may lead to severe disability including soft-tissue and/or segmental bone defects, impairment of joint motion, or even amputation. Once osteomyelitis has occurred, removal of the implant and aggressive debridement of the infected bone as well as soft tissue, combined with heavy local and systemic antibiotic therapy often represent the only option of treatment.

Bacteria introduced at the time of surgical implantation from the lower layers of the patient's own skin which are not reached by skin disinfection, or at the time of injury in open fractures, compete with the patient's immune system. This is often described as "a race for the surface". Certain bacteria can colonize the surface of an implant and form a protective biofilm composed of proteins and polysaccharides, protecting the bacteria from the patient's immune system as well as from the action of systemically applied antibiotics.

An antibiotic coating on an implant may prevent the bacteria from colonizing on the implant's surface. In addition a coating with high local antimicrobial concentrations could protect the site of injury and avoid side effects resulting from long term high dose systemic antibiotic therapy.

The UTN PROtect combines the established UTN with a fully resorbable coating consisting of a fully amorphous polylactide (PDLLA) carrier containing gentamicin sulphate. Gentamicin was chosen due to its aminoglycoside, broad antibacterial spectrum, the bactericidal effect (non-proliferating bacteria), its synergistic effect in combination with cephalosporins, and because it is well established for local application in orthopedics (bone cement, PMMA-beads, collagen sponges). The total amount of antibiotic contained on one implant ranges from around 20–40 mg, depending on the size of the implant. The gentamicin is released from the coating immediately after implantation with an initial burst that achieves a high peak concentration in the first hours and fades out over a period of 6 weeks. After coating the implant is packaged and sterilized by gamma irradiation and delivered sterile to the clinics.

The UTN PROtect will be the basis for all future generations of coated expert nails. A coated expert lateral femoral nail has already been used successfully as custom-made device.

Mechanical properties of the nail are not affected by the coating. Tests on cadavers and plastic bones proved the coating to be resistant to the abrasive forces present during insertion into a narrow and moist bone canal. The surgical technique does not differ from the regular standard of care in UTN implantation.

A 33-year-old female sustained a grade III open fracture of the right lower leg.

Case provided by Michael Raschke, Münster, DE

A clinical study run by AO Clinical Investigation and Documentation (AOCID) is ongoing. Preliminary data of the present results seem very encouraging, showing a superior outcome in comparison with published data. No adverse side effects due to the coated implant were detected. However, the study needs to complete before final results can be assessed.



Fig 1a–c
Preoperative pictures.

Fig 2a–d
Two months after implanting a UTN PROtect 9.0 (length 330 mm).

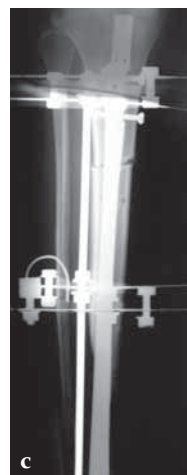


Fig 3a–d
Open bone transport with closure of the soft tissue without additional free flap.

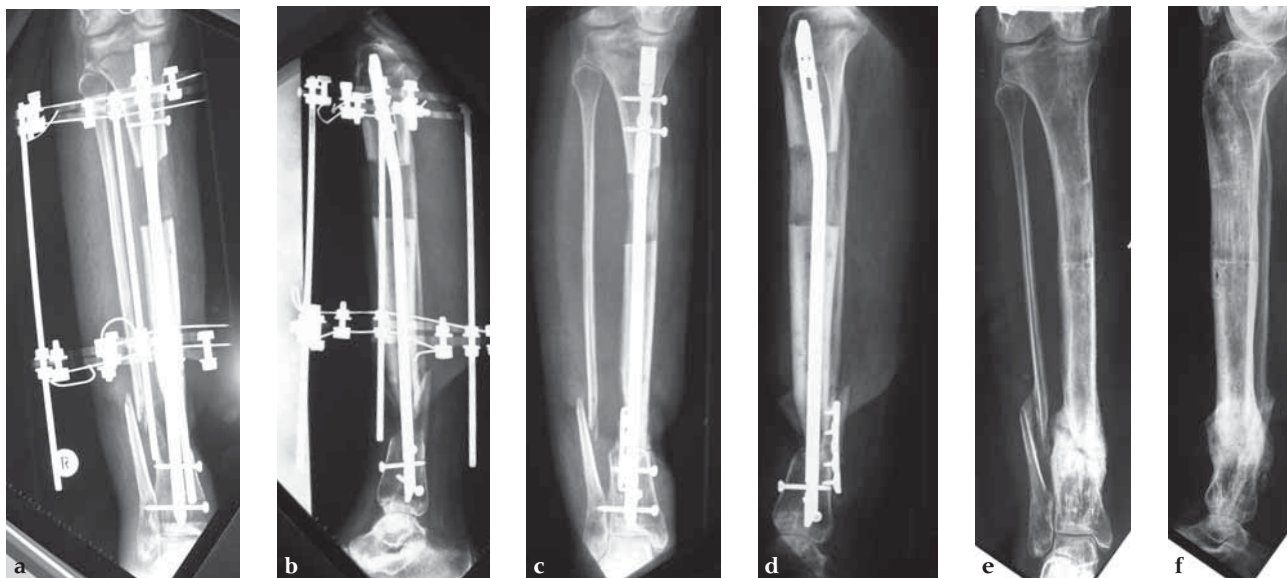


Fig 4a-d
Open bone transport.

Fig 4e-f
Removal of UTN PROtect and dorsal plate 2.5 years postoperatively.



Fig 5a-b
X-rays 5 years postoperatively.

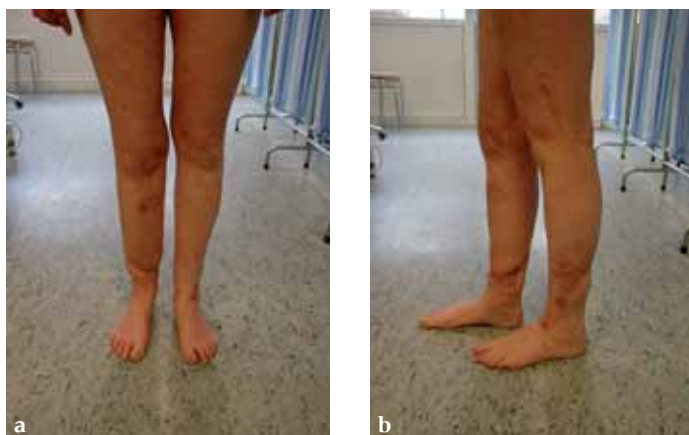


Fig 6a-b
Functional result 5 years postoperatively.



Fig 7
Patient is jumping during competition 4.5 years postoperatively.



TFN Percutaneous Insertion Handle for Obese Patients

For soft-tissue clearance in very obese patients, the standard trochanteric fixation nail (TFN) insertion instruments may be too short, as the barrel of the standard insertion handle only measures 44 mm in length. Therefore, a longer barrel for the percutaneous insertion handle was designed with an increased length of 144 mm. The added length necessitates a longer mating connecting screw and a longer 5.0 mm hexagonal screwdriver to engage the TFN locking mechanism.

Because of its length a more proximal skin incision than typical is needed. By concentrating on a more proximal skin incision in the obese patient one might avoid the necessity to lengthen the skin incision and deep soft-tissue dissection with the existing jig.

This additional handle should not be used on a nonobese patient as the added length of the arm may impinge on the soft tissues making the insertion more difficult.

5.0 mm Flexible Hexagonal Screwdriver, Coated

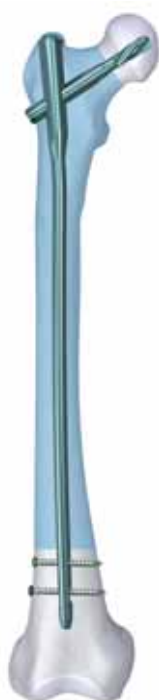
The 5.0 mm flexible hexagonal screwdriver has a silicon-coated flexible screwdriver shaft which was designed specifically to improve cleaning. By impregnating the coils of the flexible shaft with silicon it creates a barrier to blood and debris. The coating increased the overall diameter of the screw driver shaft and also decreased its perceived flexibility.

Furthermore, the hexagonal design has been modified to allow the driver to find its way into the recess easily. The changed screwdriver tip has significantly improved the ease of engaging the TFN blade antirotation device for its ultimate delivery to engage the blade.

PFNA—additional lengths 320–420 mm in SS and TAN

The PFNA is indicated for unstable pertrochanteric fractures, and high subtrochanteric fractures (Müller AO Classification of Fractures in Long Bones: 32-A1). More and more they are also used in stable fracture patterns as an alternative to DHS fixation specifically in osteoporotic conditions with a potential of medial migration of the femoral shaft. The long version is indicated for low and extended subtrochanteric fractures, ipsilateral trochanteric fractures, segmental fractures of the femur, and pathological fractures. Some surgeons interpret fragility fractures also as being pathological fractures and therefore generally use the long version of the PFNA for all fracture types. This may prevent peri-implant fractures around the tip of shorter nails.

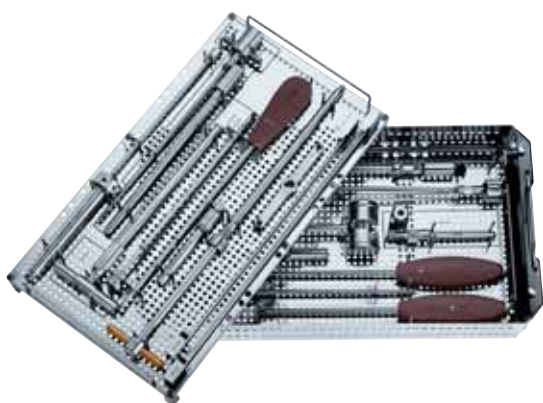
To the existing nails more lengths have been added to 300–420 mm in 20 mm increments for both left and right nails in Ti-6Al-7Nb (TAN) and stainless steel. The proximal diameter is 17 mm; the distal diameter varies between 9, 10, 12, and 14 mm. All nails made out of steel come with flutes. The nails out of TAN have flutes for the versions with 12 and 14 mm diameter, the 9 and 10 mm ones are without flutes. All nails are available with two CCD-angles of either 125 or 130° and are cannulated.





PFNA/PFNA-II Blade Extraction Set

The PFNA/PFNA-II blade extraction set is a special set containing instruments for the extraction of the PFNA/PFNA-II blade. Usually, the blade is removed by the extraction screw for PFNA blade. But in certain cases, especially in younger patients with good bone quality, the PFNA/PFNA-II blade may not be removable with the standard surgical technique and instrumentation. The new extraction set offers special instrumentation for potential issues such as damaged recess of blade, extracted end cap of blade, broken screw, extracted sleeve of blade, and parts of broken instruments in end part of blade.



Proximal Femoral Nail Removal Set

The proximal femoral nail removal set is a comprehensive set containing instruments for the removal of all proximal femoral nails as the trochanteric fixation nail (TFN short, standard, and long), the proximal femoral nail (PFN extra small, small, standard, and long), the proximal femoral nail antirotation (PFNA extra small, small, standard, and long), and PFNA-II (extra small, small, standard, and long).

The proximal femoral nail removal set contains general instruments for implant removal as well as all system-specific extraction instruments for the different proximal femoral nails. This prevents abort of surgery due to wrong set order or wrong identification of nailing system and avoids delays caused by missing or incorrect instruments.

RIA—Bone Graft Filter

The reamer-irrigator-aspirator (RIA) is indicated for the treatment of acute fractures in preparation for acceptance of a nail or prosthesis and for harvesting intramedullary reamings for bone grafting. It should not be used in patients with severe osteopenia.

The RIA provides irrigation and aspiration during reaming, which allows for single-pass reaming and has been shown to reduce intramedullary pressure. Normal saline irrigation flows through the drive shaft and reamer head into the medullary canal. When coupled with adequate suction, the irrigation mixes with the morselized medullary content which is then evacuated through the aspiration tube. RIA mandates a suction device. The procedure has to be abandoned if suction does not work.

RIA also harvests finely morselized autogenous bone and bone marrow for any surgical procedure which requires bone graft to facilitate fusion and/or fill bone defects. A bone graft filter is used with a capacity of 100 cc's. An inner mesh with 0.5 mm pore size captures morselized bone and bone marrow. A plunger can be used to compress and expel the captured graft material. The graft filter is a disposable, single use item which comes sterile packed.

Experience with RIA show a low morbidity, reduced postoperative pain, and a larger volume of obtained graft material compared to traditional iliac crest method.



**ModAD HN.****ModAD LFN.****ModAD AFN
antegrade.****ModAD RFN
retrograde.****ModAD TNS.**

Expert Modular Aiming Device (ModAD)

The current standard technique for distal locking is the freehand technique. The surgeon needs to be experienced in order to hit the hole correctly and he/she is exposed to a lot of radiation. Furthermore, there is a lack of C-arms in certain regions.

The Expert Modular Aiming Device (ModAD) is a purely mechanical aiming support which enables image-intensifier-free locking for the distal interlocking of the expert tibial nail (ETN), expert lateral femoral nail (LFN), expert retrograde/antegrade femoral nail (R/AFN), and the expert humeral nail. The ModAD cannot be used for TFN, PFN, or PFNA.

With a rigid aiming device, the nail-tip locking of an intramedullary nail cannot be performed with the required precision due to the deformation of the nail during insertion. An analysis of this deformation shows a spread of the UTN tip position of more than 19 mm in the sagittal plane and 14 mm in the frontal plane. The torsion of the titanium nail is insignificant and can be ignored.

Based on the above mentioned issues, an aiming device for nail-tip locking was developed, which can correct nail deformation in the sagittal and frontal planes. The reference point for the adjustment is the nail surface at the distal end of the nail. Aiming arm length as well as special spacers are intraoperatively calibrated to the chosen nail prior to insertion of the latter.

After nail insertion, the position of the locking holes can be determined by establishing contact of a spacer tip with the nail surface. Drilling and screw insertion can then be performed as in proximal locking, using sleeve systems through the aiming arm.

Different aiming arms, aiming arm extensions, L-spacers, etc, exist for the different nail geometries and locking options of the different expert nail systems.

2.5 mm Reaming Rod with Ball Tip, Sterile, 650 mm

A 2.5 mm reaming rod with a sterile ball tip, is available in 650 mm length. It is similar to the existing 2.5 mm reaming rods which are 950 mm and 1150 mm long. The new reaming rod provides less cumbersome reaming in the humerus and tibia because it is 300 mm shorter than the shortest existing one. The reaming rod can be used with a depth gauge without extension tube to estimate nail length.



Richard Reynolds

NEW PEDIATRIC PRODUCTS



Fig 1 ALFN.

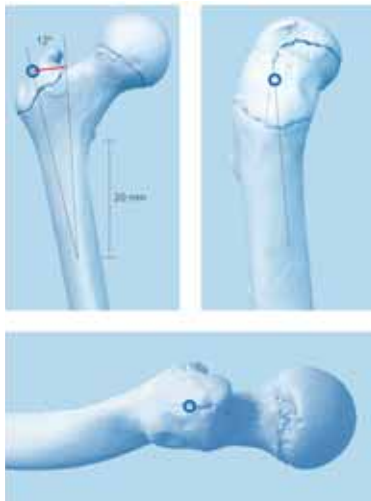


Fig 2 Insertion point.



Fig 3 Nail with new insertion handle.

Adolescent Lateral Entry Femoral Nail

The adolescent lateral entry femoral nail (ALFN) is intended for use in adolescents and small stature adults depending on the persons' weight, body size, physiological development, neurological development, and neuromuscular coordination. The ALFN is indicated to stabilize fractures of the femoral shaft, subtrochanteric, ipsilateral neck/shaft and impending pathological fractures, as well as nonunions and malunions of the femur (Fig 1). The ALFN can also be used to stabilize corrective osteotomies in bone dysplasias such fibrous dysplasia where femoral deformity is an issue.

Conventional antegrade nailing of the femur in this age group is a concern because of the possibility of avascular necrosis of the femoral head. This is rare but devastating. The ALFN has a lateral trochanteric entry point and a double curved configuration (double bend in two planes and additional tip bend) to avoid compromising the ascending branch of the medial femoral circumflex artery near the piriformis fossa. The recommended entry site is on the bare aspect of the greater trochanter 15–20 mm distal to the tip of the greater trochanter and forms an angle of 12–14° lateral to the greater trochanter, as measured from the lateral entry point to a point 20 mm distal to the lesser trochanter (Fig 2).

The ALFN is cannulated and has 8.2 mm shaft diameter and a proximal diameter of 11 mm. The nail comes in lengths from 240–400 mm in 20 mm increments. Additional diameters of 9 mm and 10 mm are under development. For the opening, a 13.0 mm cannulated drill bit is used.

The ALFN features the same proximal locking options as the LFN (two recon locking screws, one transverse slot for a static or dynamic locking screw, and one 120° antegrade locking screw). The recon screws are 5.0 mm solid, self-tapping shaft screws available in lengths from 50–125 mm. For distal locking, two lateral to medial locking screws can be used. It is of major importance to ensure that the wires and drill bits used for the recon screw insertion do not cross the capital femoral physis, and that the distal end of the nail stops 15 mm short of the distal femoral physis.

The adolescent lateral entry femoral nail is part of the expert nail family, therefore most instrumentation is identical, except for a new insertion handle aiming arm (Fig 3), 13 mm drill sleeve, and 5.0 mm recon screw drill bit. The ease of finding the entry point is maximized if the greater trochanter is positioned in profile to the beam of the C-arm. This can be done in either supine or lateral decubitus position.

The entry point starting on the bare aspect of the trochanter is very easy to find even in obese patients. The angle of entry is crucial to having an easy insertion. If the insertion of the nail is difficult then re-evaluate your entry point and angle of insertion (common mistake to have insertion site to distal on the greater trochanter).

When the nail is started, it is rotated 90 degrees anteriorly to allow for the anterior bow of the nail to turn the corner at the lesser trochanter. It is very important when introducing the nail not to forcefully rotate the nail to the lateral position as this may fracture the proximal femur. Let the spiral geometry of the implant turn itself into the correct position.

In early handling tests the ALFN has proved easy to use and successful in its aim to avoid arterial damage and successfully stabilize fractures that would not be suitable for other methods due to fracture configuration or patient characteristics such as excessive weight.

A 15-year-old male sustained an extensive soft-tissue injury with loss of bone after a gunshot (low-velocity, large caliber bullet). Neurovascular status intact, large exit wound.

Case provided by Richard Reynolds, Detroit, USA



Fig 1
Preoperative lateral x-ray.



Fig 2
Immediate postoperative AP x-ray.

The open injury (Fig 1) was debrided and cleansed. There was missing bone from the femur. Open but rapidly closing growth plates. After stabilizing the fracture with an intramedullary nail (Fig 2) the patient was mobilized with weight bearing as tolerated. Uneventful healing and range of motion of the knee and functional ambulation returned to normal. Alignment of the fracture has been maintained with healing and maturation of callus processing as predicted. Blood supply to the proximal femur has been reserved with no signs of avascular necrosis. The ALFN's lateral entry point makes the nail insertion safer and diminishes the risk of circumflex artery injury.



Fig 3a-d
a-b AP x-rays 6 months postoperatively.

c-d Lateral x-rays 6 months postoperatively.

Steffen Berger, Laurent Audigé, Theddy F Slongo

PRODUCT-RELATED NEWS FROM AO CLINICAL INVESTIGATION AND DOCUMENTATION (AOCID)

First Clinical Experience with End Caps in Elastic Stable Intramedullary Nailing of Femoral Shaft Fractures in Children

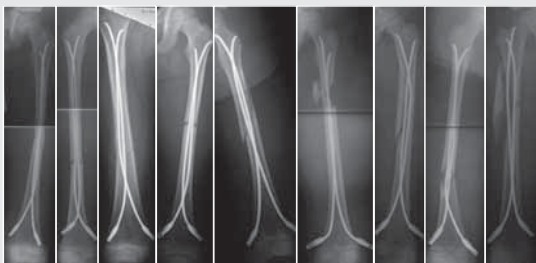
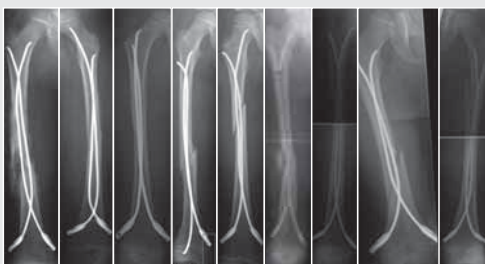
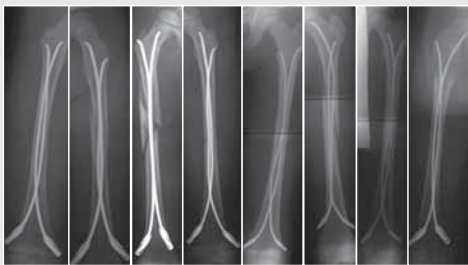


Fig 1
Overview of 34 cases from
Bern, Switzerland.

Introduction

During the last two decades, elastic stable intramedullary nailing (ESIN) has become the method of choice for internal fixation of femoral and tibial shaft fractures in children of 4–14 years of age. In the lower extremity, ESIN treatment may be complicated by loss of reduction following push-out of the nails at the entry site especially in unstable femoral shaft fractures. The rate of this complication, nail migration with subsequent soft-tissue and skin irritation was reported to be as high as 5–12 %. A technically simple method to achieve secure locking of ESIN was not available so far. An end-cap system for ESIN that is now available which locks the nails at the entry point was evaluated clinically. The end caps are equipped with a self-cutting device and are put over of the cut ends of the nails like a hollow screw that is fixed in the cortical bone at the nail entry site.

Methods

34 femoral shaft fractures in pediatric patients were treated by ESIN and end caps at the Department of Pediatric Surgery in Berne from January 2005 to January 2009. Fractures of an unstable type and higher weight or older age of the children were considered as an indication to add end caps to ESIN. Results were evaluated as to applicability of the end-cap system, fracture type, instrumentation stability, and fracture healing, and return to activity by analyzing patient charts, x-rays, and questionnaires including follow-up data.

Results

8 girls and 26 boys with a mean age of 105 ± 38 months (range 4–15 years) were treated with ESIN and end caps. Nails of 2.5–4 mm diameter were used (2.5 mm: 1 case; 3.0 mm: 19 cases; 3.5 mm: 10 cases; 4.0 mm: 4 cases). There were 18 spiral fractures, 11 oblique fractures, 3 transverse fractures, and 1 pathological fracture. 32 fractures were nailed in a retrograde direction, 1 was nailed antegrade, and 1 was nailed with one antegrade and one retrograde nail. The majority of fractures extending from the proximal to the middle third of the femur shaft, only three fractures affected the distal third of the femur. A third fragment was found in 7, multiple fragments were present in 2 children. All fractures were stabilized sufficiently with ESIN and end caps, in 1 patient one end cap was loose and thus not functional. Loss of reduction was observed in none of the patients. Leg-length difference >

8-year-old boy. Fracture of the right femoral shaft (32-D/5.2)

Case provided by Steffen Berger and Theddy F Slongo, Bern, CH



Fig 1
Preoperative x-ray.



Fig 2a–f Postoperative x-rays.
a–b Five weeks postoperatively.



c–d Five months postoperatively.



e–f One year postoperatively.

1 cm resulted in none of the patients at the last available follow-up. Varus/valgus deformity of 10° resulted in 1 patient after an additional trauma, an axial angulation $<10^\circ$ was seen in 3 patients postoperatively. The mean interval between operation and removal of the implants was 5.6 months. Removal of the end caps and nails was rated simple and uncomplicated in all cases (28/34 removed so far).

Discussion

The use of end caps avoided postoperative instability in all cases of pediatric patients with femoral shaft fractures, even in heavier, older patients and with unstable fracture types in a cohort treated by a non-selected pediatric surgical staff (eight different surgeons). To maximize stability of ESIN-instrumented unstable fractures, end caps require properly placed nails that are correctly bent. It is essential to cut the nails to a correct length at the entry site to ensure adequate anchoring of the nails in the caps and anchoring of the cap in the cortical bone respectively. A special bevelled impactor is mandatory for the final nail positioning. The position of the nail inside the end cap can easily be visualized since the caps are semiradiotranslucent.

End caps however, although offering additional stability to ESIN instrumentation, will not completely compensate for operative technical insufficiency concerning reduction or nail placement. They may contribute to axial and length stability especially in proximal spiral fractures, and in fractures that are unstable due to third fragments. It is assumed that end caps provide more comfort to the patient since no sharp nail ends will irritate the soft tissue above the entry points. End caps make the removal of nails easier since a canal is present in the cortical bone around the nail after removal of the cap and nails come out with less effort.

We conclude that end caps should only be applied by surgeons that are fully aware of all technical details and problems of ESIN. With this precondition, end caps might prove beneficial in a standard clinical setting.

Philipp Lobenhoffer

NEW KNEE PRODUCTS



TomoFix Medial High Tibia

High-tibial osteotomy is a widely accepted technique in the treatment of varus malalignment and medial osteoarthritis of the knee. Middle- and long-term results are good if the indications are respected and an adequate correction is achieved. Corrective osteotomy of the proximal tibia may be performed by a subtractive technique (closed-wedge), by a barrel-vault (dome) osteotomy, or by an additive technique (open-wedge). The closed-wedge technique with removal of a bone wedge through a lateral approach and fixation with staples, a plate, or a tension-band system has disadvantages such as risk of peroneal nerve injuries, the need of osteotomy of the fibula, or separation of the proximal tibiofibular joint and of detachment of the extensor muscles. Large corrections cause significant shortening of the leg and an offset of the proximal tibia, which may compromise placement of the tibial component in a total-knee replacement. Open-wedge osteotomy from the medial side can be performed without any muscle detachment, the correction can be “fine-tuned” during the procedure and no leg shortening occurs. Open-wedge osteotomy has regained interest with the development of stable implants which enable the surgeon to fix the correction and to avoid bone grafts in most cases.

The existing TomoFix medial high tibia (TomoFix MHT) for open-wedge osteotomies has been redesigned for better soft-tissue protection and to minimize rotation during compression.



Old design.

New design.

The precontoured plate now has a chamfer at the proximal part and rounded edges at the lateral rims of the plate. A MIPO tapered end at the distal end was added to have a smoother pass to the bone. The two upper LCP holes in the distal part were slightly repositioned in line with the axis of the plate to eliminate the rotation of the plate during compression with cortex screws because of the former asymmetrical alignment of the holes. The two most distal LCP holes were changed to isolated LCP holes to hinder the use of cortex screws.

In a biomechanical comparison, the plates were tested after a right osteotomy. The results show a higher number of cycles with the new TomoFix MHT due to improvements in the manufacturing process. The quality of bone healing with the new TomoFix MHT is similar to the former one but the healing time is expected to be faster and insertion easier. The less prominent design reduces the pain and the higher stiffness activates the use of the compression screw. Handling, use, hospitalizations time, and all other biomechanical characteristics are comparable with the former plate.

The former TomoFix MHT will be replaced with the new version, the article numbers in the catalogue will remain the same.

A 68-year-old female

Case provided by Alex Staubli, Luzern, CH

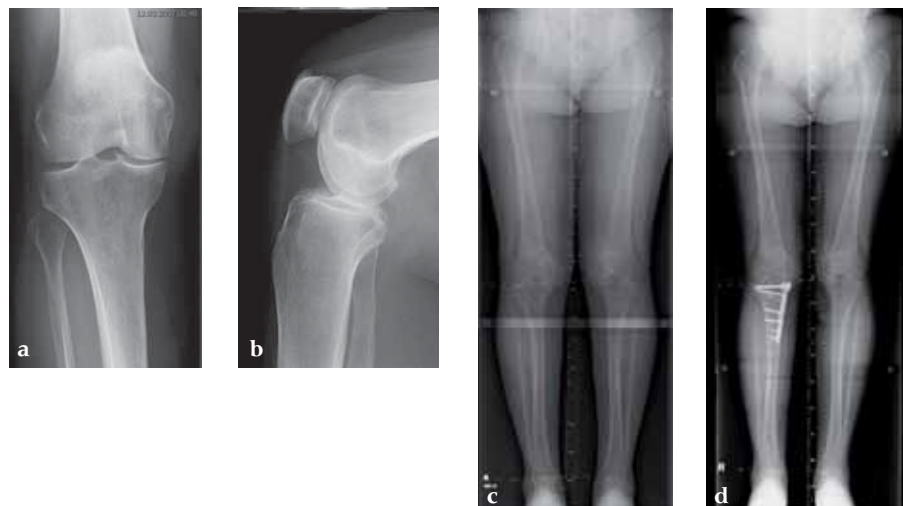


Fig 1a-d
Preoperative x-rays and measuring.

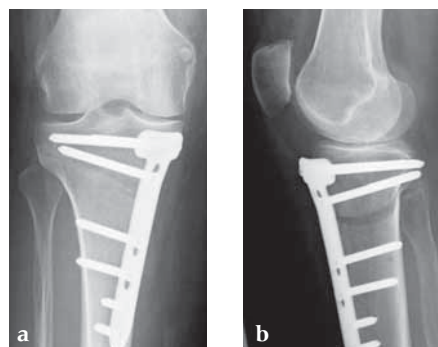


Fig 2a-b
Immediate postoperatively after osteosynthesis with the newly designed TomoFix for open-wedge high-tibial osteotomies.

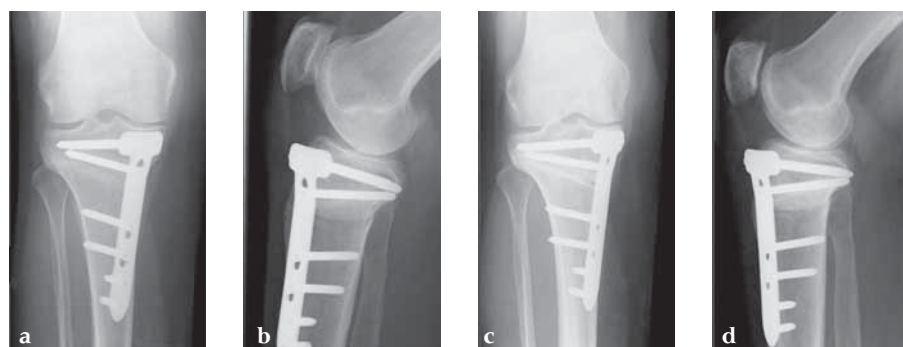
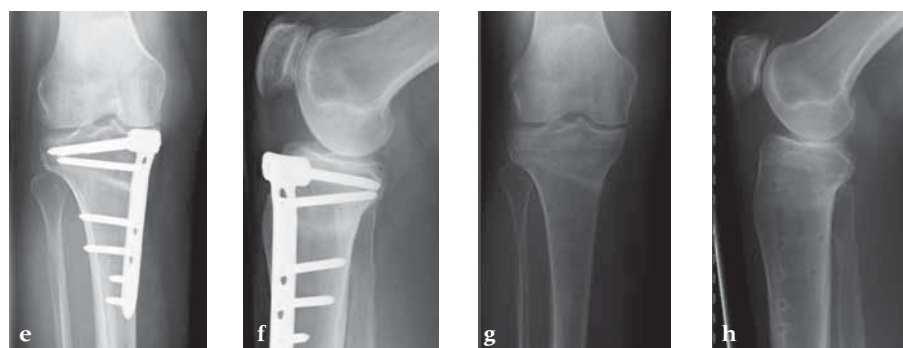


Fig 3a-h
a-b X-rays 6 weeks postoperatively.
c-d X-rays 3 months postoperatively.



e-f X-rays 12 months postoperatively.
g-h X-rays 20 months postoperatively.



TomoFix HTO Small Stature (Asian Version)

Osteoarthritis due to varus deformity of the knee is common in Asian countries. For instance, it is said that 7 million patients need treatment for knee osteoarthritis in Japan. High-tibial osteotomy (closed-wedge or dome) used to be a common procedure for these patients. However, the treatment trend shifted to total knee arthroplasty or unicompartmental knee arthroplasty because of the complications and relatively high rate of failures of the conventional high-tibial osteotomy. Although there is a renewed interest in medial open-wedge high-tibial osteotomy with the TomoFix, the plate was too large for the small stature female patients in Asia. Therefore, the TomoFix HTO small stature (Asian version) was developed by the Knee Expert Group in collaboration with the Asian Pacific Surgery group.

65-year-old female. Osteoarthritic patient complaining of medial knee pain of her left knee.

Case provided by Takeshi Sawaguchi, Toyama, JP



Fig 1a–b
Preoperative x-rays.

This new plate was developed taking into consideration the requests of knee surgeons in Japan. Based on CT scans of the typical Japanese patient (60-year-old female weighing less than 60 kg), the plate widths at head and shaft, plate radius, and the radii surround were reduced. This improved anatomical fit for the typical small stature patient will decrease pain due to minimizing the risk of complications with wound closure or irritation of soft tissue and skin. High-tibia osteotomy (TomoFix HTO) small stature is indicated for all open-wedge osteotomies on tibiae in small patients with less than 65 kg without postoperative restriction. Otherwise, the small stature version has the same indications as the standard plate TomoFix HTO.

Follow-up in this case is short, because the TomoFix small only became available in August 2008.

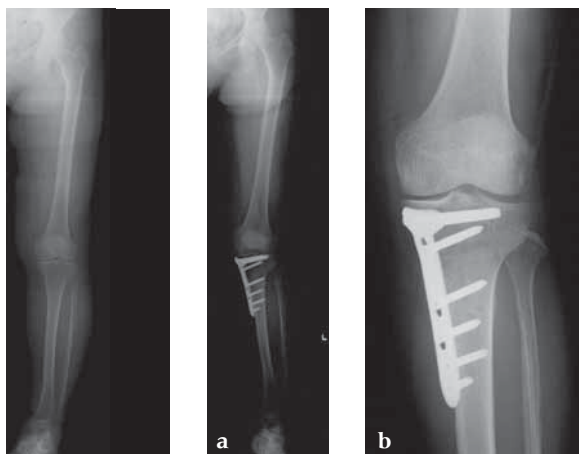


Fig 2
Preoperative x-ray.

Fig 3a–c
Postoperative x-rays.

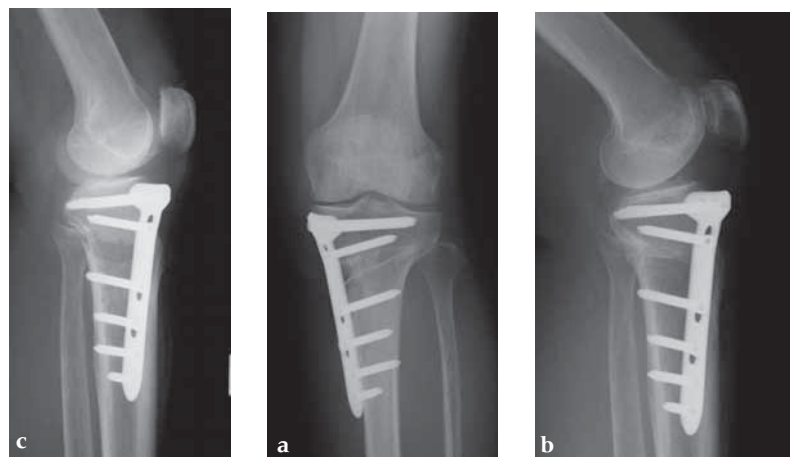


Fig 4a–b
X-rays 4.5 months postoperatively. The patient had no pain. Osteotomy was united with enough bone formation.

Peter Keppler, Christian Krettek, Tobias Hüfner, Paul A Grützner, Ulrich Stöckle, Andreas B Imhoff, Stephan Lorenz, Jan Ljungqvist, Florian Gebhard

PRODUCT-RELATED NEWS FROM AO CLINICAL INVESTIGATION AND DOCUMENTATION (AOCID)

Results from the Prospective Case Series Evaluating Accuracy of Navigated High-Tibial Osteotomy (HTO)

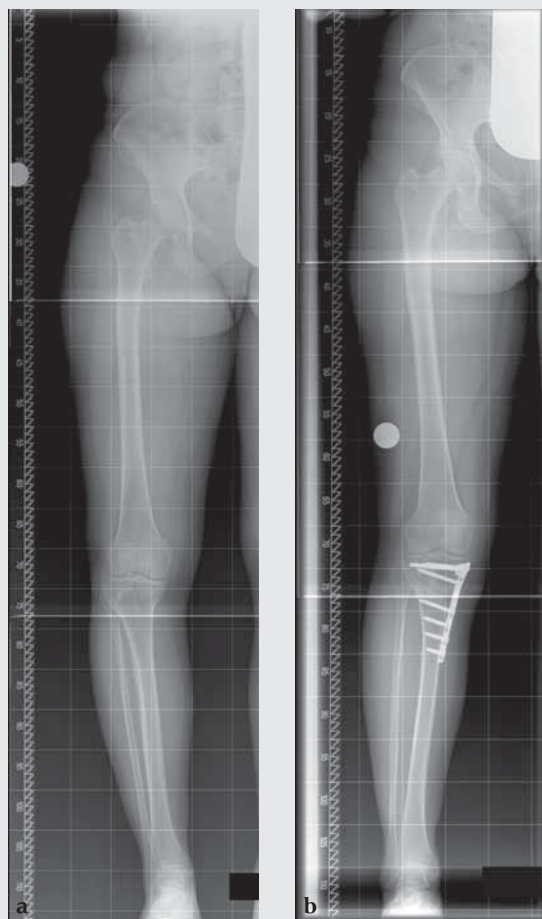


Fig 1a–b
Medial open-wedge HTO.

Today the most common application in the field of computer-assisted surgery is navigated total-knee arthroplasty. The mechanical leg axis is one important factor influencing the mechanical load distribution in the knee joint. Ideal correction of the leg axis is difficult to achieve and postoperative malalignment is observed following HTO. Computer-assisted navigation systems may improve precision and accuracy of the leg-axis correction, while offering simulation tools and being capable of predicting the postoperative alignment.

A prospective case series was conducted by AOCID including patients with medial gonarthrosis or genu varum congenitum undergoing medial open-wedge HTO using computer-assisted navigation at six European trauma centers. HTO was performed with TomoFix and the Brainlab VectorVision Osteotomy 1.0 module (Fig 1).

The main objective of this trial was to evaluate the precision of deviation from the planned leg axis as achieved by navigated open-wedge HTO, as well as document-associated specific indications such as complication rate, surgery duration, and postoperative convalescence.

51 patients receiving navigated HTO, with the mean age of 45 years, were included in the study. 76% of these patients had congenital deformities of their affected leg, with most (82%) also having previously received surgery for this condition.

Navigated HTO surgery was mostly undertaken by consultants (73%) and over 50% of all surgeons had performed ≥ 30 HTO procedures without navigation and between 10 and 29 using a navigation system. 90% of the navigated procedures employed a general anesthesia and the use of a drain. The mean duration of surgery was 105 minutes (range: 60–200 minutes).

The measurements of the planned and actual postoperative leg-axis deviations were made using mFTA (mechanical femorotibial angle or mechanical leg axis) as the main parameter (Fig 2).

Leg-axis deviations up to 3° were tolerated and could be explained by measurement deviations derived from the x-rays and navigation software. Therefore, patients with deviations over $\pm 3^\circ$ were of special interest in this study.

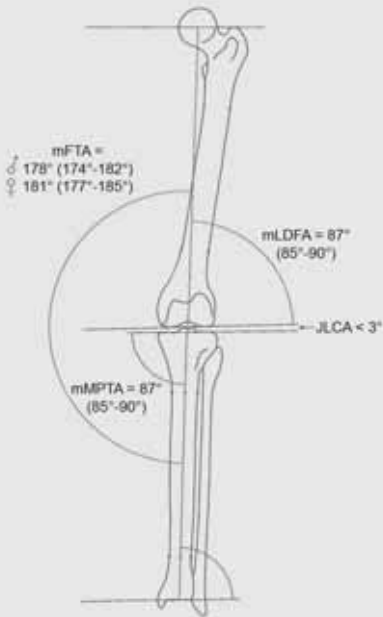


Fig 2
Diagrammatic representation for leg-axis deviation measurements.

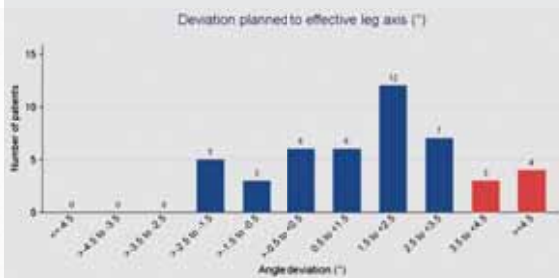


Fig 3
Categorized distribution of the calculated leg-axis deviation for navigated HTO patients.

22 patients (48%) had a leg-axis deviation of up to 2° and 39 patients (85%) had deviations of up to 3°. Seven patients were categorized with leg-axis deviations beyond the tolerance level of 3° and included 3 patients with deviations of 3.5°– <4.5° and 4 patients with deviations $\geq 4.5^\circ$ (Fig 3). Further analyses to observe any potential influence of medial ligament instability (ie, patients with grade II or III medial extension or flexion at baseline or 6 weeks) on these cases of higher leg-axis deviation revealed that there was no ligament instability for these particular patients.

Seven intraoperative complications were documented and resulted from navigation system/software failure, particularly during the learning phase of one study center. All of these patients were not included in the final leg-axis deviation analysis of this study because the HTO surgery was completed without computer assistance. Three postoperative complications were documented throughout the 6-week follow-up period; all events were not directly related to the HTO procedure and included:

- A wound hematoma that required a reoperation for its removal 5 days after HTO.
- A superficial skin infection treated conservatively for 7 days with intravenous antibiotics.
- A broken tibial tuberosity requiring a reoperation with supplemental screw fixation.

A comparison of all eight measured range of motions for the healthy contralateral leg between baseline and the 6-week follow-up showed no significant differences ($P \geq .11$). For the operated leg, there was however a significant decrease for the knee flexion-extension arch measurement from baseline and 6 weeks ($P = .0016$). In addition, patients were on average more satisfied with their affected leg, had lower levels of pain and less problems with their walking ability after surgery, as indicated by a significant increase in the mean visual analogue scale (VAS) score by 2.3 points, a significant 1.4-point decrease in the mean Western Ontario and McMaster Universities Index of Osteoarthritis (WOMAC) pain subscale score, and a significant 1.5-point decrease in the mean Parker Mobility Score (PMS), respectively.

Overall, this first reported prospective case series on navigated HTO achieved an adequate outcome in terms of final leg-axis deviation from the planned parameter in about 85% of the patients (including learning curve). In the hands of trained navigation surgeons, one might expect the accuracy to be even higher. Nevertheless, a navigation system is not a guarantee for a perfect result and a randomized trial comparing navigated and nonnavigated HTO is required.

Florian Gebhard

NEW NAVIGATION PRODUCTS



Fig 1
VV osteotomy 1.0 module.



Fig 2
Dedicated correction position.



Fig 3
Reference arrays.

Surgical Leg-Axis Correction Module (VV Osteotomy 1.0)

High-tibial osteotomy is a common therapy for osteoarthritis of the knee and performed either as open- or closed-wedge osteotomy. For the treatment of medial gonarthrosis the open-wedge option is performed on the medial side of the tibia, the closed-wedge on the lateral side. The open-wedge technique provides an easier surgical approach. But with great correction angles ($>10^\circ$) the opened bone wedge gets unstable but can be sufficiently fixed by special implants using head locking screws (eg, TomoFix). For greater corrections the lateral closed-wedge technique gives more stability. But the approach is more difficult and in most of the cases the fibular bone must be cut.

The leg-axis correction module supports surgical workflows that treat the axial but also rotational correction of the tibial bone, both open- and closed-wedge procedures (Fig 1). The leg-axis correction module uses only registered landmarks as intraoperative data of the patient's anatomy. Any other intraoperative image modalities, such as 2-D fluoroscopic images, or 3-D fluoroscopic image scans are not required. This method saves radiation time for the surgeon as well as for the patient. 2-D data can be created to calculate the distances between points (eg, tibia shaft geometry), the angles between axes (eg, varus/valgus alignment of the leg), or the center of rotation (eg, dedicated correction position at the individual patient anatomy) (Fig 2).

Instrumentation

A reference array is used to establish a coordinate system at a structure of interest, which can then be tracked with respect to its position and orientation in 3-D (Fig 3). The reference array itself consists of an arrangement of a multitude of reference markers, which form a unique spatial geometry. The pointer is used for identifying landmarks or trajectories (Fig 4). The drill guide can be adjusted to the K-wires (Fig 5). Only the guided trajectory, not the length, is of interest. This enables use of the drill guide without recalibration after changing the drill guide tube. The cutting block adapter is an optional tool to be used instead of the drill guide (Fig 6). It also determines the position of the later performed osteotomy but is used to position a cutting block instead of K-wires.

Procedure

Based on preoperative data the surgeon plans the leg-axis correction. The initial intraoperative planning step enables verification of preoperative planning and to define the position of the bone cut in regard of proximal/distal transition and angulation. An automatic plan is calculated. The amount of correction can be adjusted by the surgeon. Two planes in different colors mark the actual and the planned final cutting tool position (Fig 7). After the cutting tool has been positioned and the



Fig 4
Pointer.



Fig 5
Drill guide.

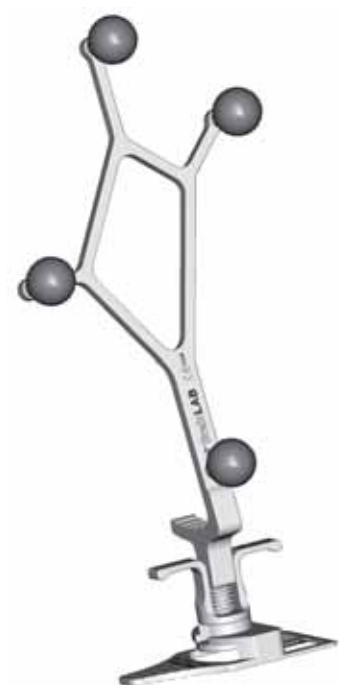


Fig 6
Cutting block adapter.

cut performed the surgeon is able to realign the leg by tracking the shift of the weight-bearing line, the adaption of the varus/valgus position and the intersection point (Fig 8). During fixation of the final leg axis the surgeon is able to continuously monitor the leg axis while tightening the screws thus avoiding implant-related loss of correction.

Conclusion

Tracking patient leg geometry through the osteotomy until bone fixation minimizes the risk of failure during realignment and fixation. Potential undercorrection or misalignment can be improved immediately. The result of the surgical treatment can be simulated intraoperatively; values can be adjusted showing the consequence right away. Furthermore, imaging with the C-arm can be reduced noticeably.



Fig 7
Actual and planned cutting tool position.



Fig 8
Final alignment of leg axis.

Per-Henrik Ågren, Andrew K Sands, Ian G Winson, Michael Castro, Les Grujic,
Juan Bernardo Gerstner Garcés

NEW FOOT PRODUCTS



6.5 mm Midfoot Fusion Bolt

There are situations where the normal architecture and biomechanics of the foot (specifically the medial column) becomes significantly altered. Gait disturbances, skin abnormalities, and ulcerations can develop leading to infections and even possible amputation. This may be painful if sensation is intact. Often, however, decreased sensation is part of the cause.

The causes include posttraumatic cases, inflammatory diseases such as rheumatoid arthritis, and rare problems such as Marfan's disease or neuromuscular tertiary syphilis and paralytic diseases. A common reason today is the increasing population of patients with diabetic neuropathy sometimes causing neuroarthropathy.

These patients may be treated nonoperatively in an orthosis or total contact cast in an attempt to consolidate the unstable foot. However, this is a labor intensive and potentially costly process. The outcome is not always satisfactory.

If the initial treatment has been nonoperative, the further treatment often remains nonoperative. Some are ambulating in calipers and orthoses to relieve pressure from threatening ulcers, others in expensive customized shoes that they object to for cosmetic reasons. The quality of life is diminished immensely for someone with a Charcot foot, and also puts a high cost on health care systems.

A possible solution for pressure points is the "bumpectomy" (local resection of protruding bone with no stabilization). If the joint segments are still unstable (the more common situation) the deformity will however progress.

This is why a reconstructive realignment usually is necessary to achieve a more normal weight bearing and alignment of the foot.

The first recognized success of such treatment was in the early 1990s in Seattle by Sigvard T Hansen, Jr. In many cases, the patient had a long-standing pressure wound on the plantar surface of the foot. Reconstruction was carried out in the presence of an open ulcer, which was covered by a biodressing during the procedure on the rest of the foot. After surgical reconstruction removed the unnatural pressure on the soft tissues, the ulcer disappeared within a few weeks.



47-year-old female. Charcot foot.

Case provided by Andrew K Sands,
New York, USA



Fig 1a–b
Preoperative x-rays.

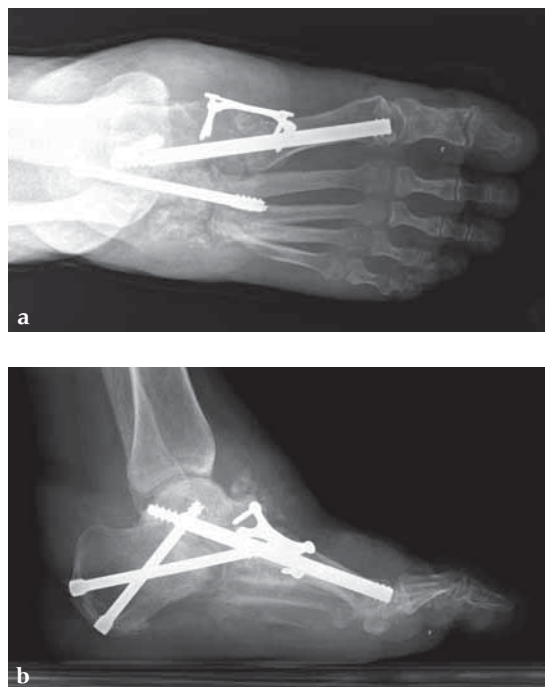


Fig 2a–b X-rays 2 months postoperatively
(after being treated with MFB and
X-plate).

Even very heavy/thick screws fail in these patients (especially as the patients are getting heavier with time). A new implant has been developed specifically to treat the forces and demands in the midfoot area. The midfoot fusion bolt (MFB) is a solid 6.5 mm intramedullary implant that can be used to stabilize and fuse the medial column—the metatarsocuneiform, naviculocuneiform, and talonavicular joints. Alternative uses of the MFB may also be for fusing the lateral column, calcaneocuboid, and 4th metatarsocuboid joint. The MFB aims to achieve permanent fusion of these joints in patients suffering from gross instability such as Charcot neuroarthropathy with or without collapse of the midfoot. The midfoot fusion bolt is a headless solid bolt. It enhances stabilization and alignment, restraining shearing and bending forces better than older implants (I-bolt, 6.5 mm cancellous screw, and 6.5 mm and 7.3 mm cannulated screws). The MFB is recommended for stabilization of the “medial column” or fixation of the “lateral column”. The bones and joints are aligned, measured and drilled with cannulated instruments. The guide wire is removed. The bolt is inserted through the track created by the 5.0 mm drill. Controlled compression may be applied by the T-handle during insertion. After insertion, the bolt head is completely countersunk preventing soft tissue or joint irritation. A blunt tip prevents any damage to soft tissues if the MFB is overinserted.

The MFB is available in lengths of 50–160 mm in titanium and stainless steel.

The Foot and Ankle Expert Group wanted the MFB to be a simple, strong, easy-to-use implant because Charcot foot collapse will be more prevalent over the coming years. First, it needs to be said that it is not meant as a compressive screw. The compression should be achieved by other implants—screws or plates that are added. The threads on the MFB are intended to keep the bolt where it is positioned.

The standard approach to release the midfoot and to produce the necessary corrections is the medial utility incision. It can be extended all along the medial foot from medial malleolus region to the medial hallux. There are several options for the introduction of the implant along the medial column:

- 1) The main track is through the MTP1 transarticularly. With minimal dissection the cannulated drilling and MFB insertion is done with the great toe flexed downwards.
- 2) A variant is to perform a distal osteotomy—shift the head of MT1 laterally (chevron-type) and perform the implantation (adapted in a patient with sensation).
- 3) A third variant is the retroantegrade technique—drilling over the wire in an antegrade fashion—introducing the screw the same way. This lessens the damage in MTP 1 but harms the ankle instead.

48-year-old male. Charcot foot.

Case provided by Andrew K Sands,
New York, USA



Fig 1a–b
Preoperative x-rays.

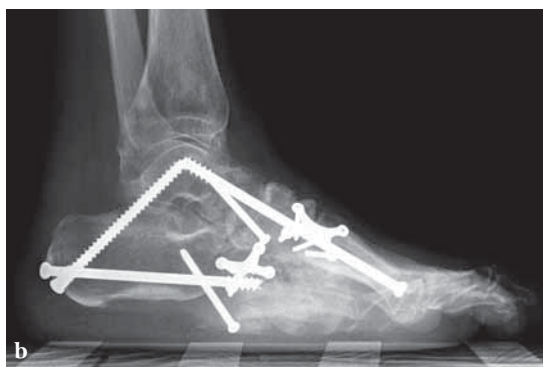
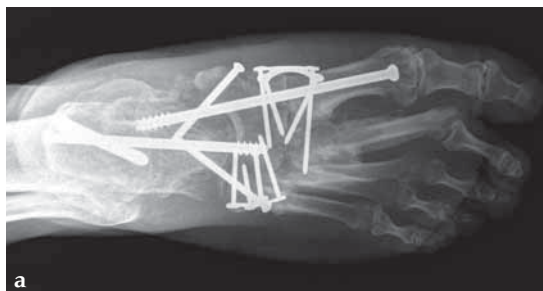


Fig 2a–b X-rays 6 months postoperatively
(after being treated with MFB and
X-plate).

On the lateral side of the foot the drill wire is passed through MT4 cuboid and out through calcaneus while the foot is maintained in the desired alignment. The wire is then overdrilled antegrade from back to front and the bolt is inserted.

The entry point in MT 4 is 2–2,5 cm from the TMT joint to achieve some grip with the bolt.

The postoperative treatment is immobilization in a splint for 2 weeks to reduce swelling. At 2 weeks, the wound is evaluated and gentle range of motion training of joints is initiated. Full weight bearing is anticipated between 10–12 weeks postop based on radiographical evidence of healing.

Producing a stable construct before the foot has progressed to an advanced deformity, when the start of the breakdown is detected, may lead to a better, more reliable result with a better quality of life for these patients. It is also anticipated to lower the high costs of healthcare in diabetic foot clinics and for amputations and prostheses.

There is data in literature in this direction and therefore a randomized-controlled multicenter study run by AO Clinical Investigation and Documentation (CID) is being initiated to compare the effectiveness of surgical arthrodesis with MFB in the early stage of diabetic-neuropathic Charcot feet. This will be compared to nonoperative treatment in terms of maintenance of the correction of the deformity and avoidance of permanent nonreducible foot deformity.



Locking X-Plate 2.4/2.7, Extra Small

Posttraumatic 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 2.4/2.7 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 metatarsal-cuneiform fusions, proximal first metatarsal osteotomies (crescentic, open wedge, Mann, Ludloff, and proximal Chevron), and first metatarsal-phalangeal fusions.

The locking X-plate 2.4/2.7 is a geometric, low-profile, and easy-to-bend implant. This enables further usage for calcaneal osteotomies (Evans and Dwyer), metatarsal nonunions, supramalleolar osteotomies, and diabetic foot reconstruction.

Now an additional size is available, extra small, with a foot print of 16 x 8 mm. Overall, there are four different sizes of the plates, according to the anatomical region and to the size of the foot: extra small, small, medium, and large. It is also likely to be used in countries where the ethnic anatomy is rather smaller than in other parts of the world.

The plate has four locking holes that accommodate 2.7 mm locking or cortical screws, and can be directed using the bending threaded pins so the screws cannot collide. The screw holes are thicker than the actual body of the plate to allow bending without compromising the threads of the holes, and to provide the best stability for biomechanical demands. The two dorsal holes are more angulated and enable the surgeon to cross the osteotomy site when fixing proximal metatarsal osteotomies providing the highest stability. Interfragmentary compression can be achieved through a separate interfragmentary screw.

Plates can be bent with pliers to get the anatomical shape of the bone, although they are available prebent according to the shape of a CT database of the foot. The arch design corresponds to the oldest architectural principles to get an ideal stress distribution with least amount of material and so produce minimal effect on the bone periosteum.

Advantages of using locking X-plates in foot and ankle surgery include more stable fixation of the osteotomy and fusion site, closer bone contact, shorter bone healing time, and thus early weight bearing, avoiding transfer lesions due to minimal shortening, less dorsal malunion or nonunion, and less elevation of the MTPI-head.

16-year-old male. Proximal first metatarsal growth-plate injury resulting in halux-valgus. Arthrosis of first tarsometatarsal and second metatarsal hammer toe. Pain during activities and in general shoe wear.

Case provided by Carl Hasselman,
Pennsylvania, USA

First MTP fusion and modified McBride with a distal soft-tissue release and second metatarsophalangeal (MTP) capsulotomy. A mini tight rope was used to hold and reduce the alignment of the first metatarsal. The X-plate was used to hold rigid fixation of the fusion. A K-wire was used for the second MTP capsulotomy.



Fig 1a-b
Preoperative x-rays.



Fig 2a-b
Postoperative x-rays.



1.25 mm Guide Wire for 3.5/4.0 mm Cannulated Screws

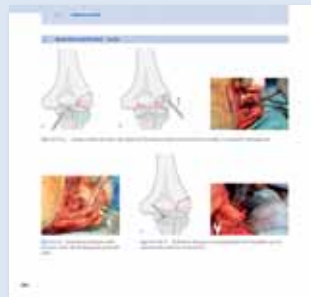
1.25 mm guide wires used with 3.5 mm and 4.0 mm cannulated screws may bend during insertion and even break. This can occur, for example, in foot surgery. Therefore, the existing 1.25 mm guide wire is now available in a new, stiffer, and higher yield strength material that is less likely to fail in clinical applications (compared to 316L). The material, MP35N, is a cobalt alloy. Galvanic corrosion was tested (in the case of breakage of a guide wire which would remain in the body and in contact with a titanium plate). There was only a low-level driving force. The resulting current was too low to create corrosion.

The greater stiffness increases the wire's tolerance to bending before permanent deformation and better resists cutting of the wire during drilling.

The new guide wires are available threaded and nonthreaded.

Cristina Lusti

NEWS FROM AO PUBLISHING



Released in June 2009

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Number of figures and illustrations: 1,800

For more information and ordering please visit
www.aopublishing.com

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AO Manual of Fracture Management

Elbow and Forearm

Jesse B Jupiter

This book provides a comprehensive approach to the indications, fracture patterns, surgical exposures, contemporary implants, and postoperative management of elbow and forearm fractures.

All content is based on case studies and each clinical case concludes with identification of the “pitfalls and pearls” in the management, thus reflecting the vast experience of the surgeon.

The editor and associate editors have accumulated a wide variety of fracture patterns, both simple and complex, provided to them from outstanding trauma surgeons’ worldwide.

“This is an exceptionally, well prepared handbook for every trauma surgeon who is seeking rapid access to information, guidance, and support in decision-making. It reflects the experience of numerous distinguished surgeons working in this specific field, which surely will help the younger and older generations of surgeons provide optimal treatment to their patients. The author must be congratulated on producing such a body of work; there is no other work comparable to it.”

Prof Harald Tscherne, Germany

Dankward Höntzsch, Michael Wagner, Röbi Frigg, Stephan Perren

NEW MIO PRODUCTS



MIO Cable Cutter with Trigger Handle

The cable cutter with trigger handle enables easy cutting of cerclage cables. Its blade cuts flush against the crimp without fraying the cable. Its ergonomic trigger handle maximizes comfort while permitting one-handed cutting. The replaceable nosepiece provides for a simple way to remove dull blades and snap a new blade into place.



Drill Suction Device

The drill suction device is very helpful in cases of problematic screw removal (either locked or conventional). It is indicated to guide, cool, lubricate, and aspirate drill debris when drilling into screw heads with damaged hex or with broken instrument in the hex (eg, screw driver or extraction bolt). The drill suction device allows an efficient aspiration of the drill chips (no debris in the soft tissue) while at the same time cooling and lubricating the drill bit. The lubricating provides the drilling procedure—a craftsman never drills metal without cooling and lubricating. The drill sleeve provides guidance of the drill and protection of the surrounding soft tissue.

The drill suction device consists of one handle and five different attachable drill sleeves with a clip-on mechanism, fitting with the available drill bits for metal (HSS $\varnothing$ 2.5, 3.5, and 4.8mm and carbide drill bits $\varnothing$ 4.0 and 6.0 mm). The handle can be connected to the normal existing suction system of the OR (the vacuum connection is compatible to standard suction device in OR) and to water or saline irrigation with a luer lock connection.

The system is very easy, safe, and quick to handle. All those who have used it once, recommend using it every time there is a need of overdrilling screw heads.

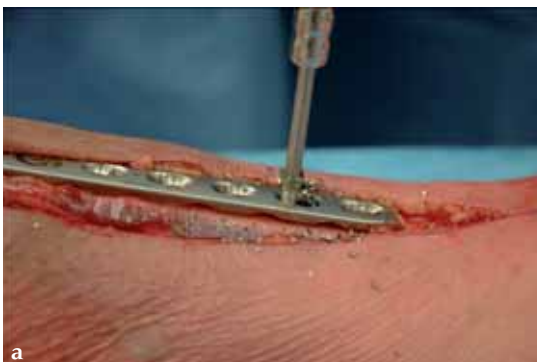


Fig 1a–b
a Debris.

b No debris due to use of drill suction device.

TIPS AND TRICKS FOR REMOVING PROBLEMATIC IMPLANTS



Fig 1



Fig 2

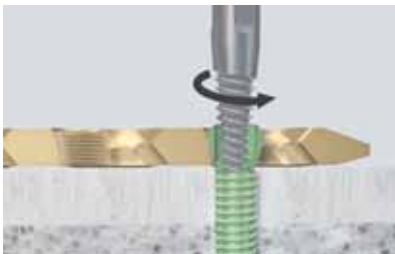


Fig 3

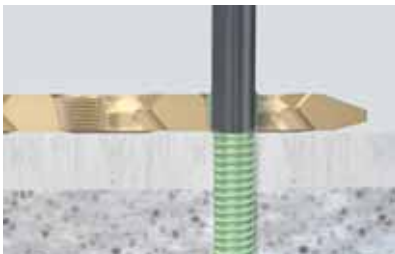


Fig 4



Fig 5



Fig 6

1 SCREWS

Introduction

Difficulties may be encountered in certain cases when removing conventional screws and metal plates and, in particular, locking screws securing plates and internal fixators.

Prevention

- Use a new screwdriver with undamaged hex tip.
- If a hexagon socket screw is damaged during assembly, it should be replaced before the next stage of the operation.
- In case of locking screws, the correct tightening torque must be applied. Use the correct torque limiter.
- If the locking screws are fixed angle, avoid wrong angulation.
- Use of the available insertion guide and compliance with the instructions in the operating manual are strongly recommended.

Removing

- From the outset, only use undamaged, not worn out screwdrivers. From the outset, only use undamaged screwdrivers to prevent stripping of the recess. Check the screwdriver yourself. If the screwdriver blade slips, the internal recess of the hexagon socket screw will be damaged. For this reason, only the best screwdriver is good enough for removal.
- The hexagon socket must be free from any obstruction down to the base of the recess, so that the entire length of the screwdriver tip can be inserted.

If the hexagon socket has been enlarged (rounded corners) (Fig 1):

- Use a tapered, left-hand thread extraction screw (Fig 2). Always use the extraction screw with the biggest possible diameter.
- First, screw the tapered, left-hand thread extraction screw directly into the damaged hexagon socket.
- If this fails to achieve the desired result, or if the extraction screw is not exactly the right size, the hexagon socket can be drilled out slightly oversize (see below) without cutting off the head. A left-hand thread extraction screw of the correct size can then be inserted into the now-cylindrical hole.
- As it is turned in an anticlockwise direction, the extraction screw must cut into the hexagon socket. The diameter and length of the extraction screw must be such that the taper does not project as far as the base of the recess (Fig 3). The extractor pin can then no longer move forward.

If a screw is jammed or damaged to such an extent that it is no longer possible to remove it using an extraction screw:

- The head of the screw must be drilled out in such a way that it is removed from the shaft (Fig 4). The same procedure applies if an instrument—regardless of whether it is a screwdriver or an extraction screw—breaks off inside the hexagon socket (Fig 5).
- Drilling out without a suitable drill bit and tools is a major problem.
- New instruments for drilling out are now available: Carbide drill bits should be used for drilling out. We now have 4.0 mm

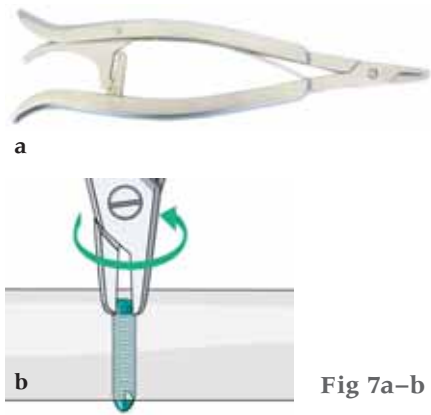


Fig 7a-b

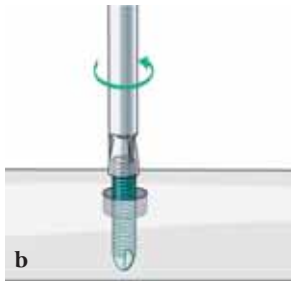


Fig 8a-b

and 6.0 mm carbide drill bits (Fig 6). Due to production engineering constraints, these drill bits are short. If required, they can be extended with the aid of a screwdriver extension. This ensures that the drill bit is sufficiently long.

- In addition, especially hardened HSS drill bits can be used. In every discussion about the best drill bits for each application, the carbide drill bit has proven to be by far the best and latest “all-round” drill bit. These carbide drill bits are disposable and are intended for single use. During sterilization they can cause a film of rust to develop.
- The drill suction device is a very helpful instrument in cases of problematic screw removal (both locked and conventional) (see page 44, “Drill Suction Device”). It allows an efficient aspiration of the drill chips while at the same time cooling and lubricating the drill bit. The lubricating provides the drilling procedure. The drill sleeve provides guidance of the drill and protection of the surrounding soft tissue.

Screw shafts:

- Can be left in place.
- However, if they have to be removed, an attempt should be made to grasp the shafts of the screws (Fig 7). In addition to conventional pliers, eg, from the extraction kit, individual instruments can also be used. Powerful dentists’ pliers are suitable for this purpose.
- If this fails to achieve the desired result, the screw shafts must be bored out using a hollow reamer. The inside diameter should be the same as the outside diameter of the screw. Next the hollow extraction bolt (left threaded) should be rotated in an anticlockwise direction. The shaft of the screw must be removed using a left-hand thread extractor pin (Fig 8).

Algorithm

It is very important to apply an orderly forward strategy and to keep to the algorithm. The instruments must be readily at hand.

- Fully expose and clean the hexagon socket or Stardrive.
- Right from the outset, use the best screwdriver.
- If the socket head has been enlarged, immediately select the appropriate tapered left-hand thread extraction screw.
- If this fails to achieve the desired result, or if the extractor screw or threaded rivet breaks off, immediately begin drilling out, using carbide drill bits and the drill suction device.

If these steps are followed, removing a locked or enlarged screw should not pose any problems from either a technical or time point of view.

2 PLATES

When all the screws have been removed, the plate can also be removed. As a general rule, this should not pose a problem provided that there is sufficient access.

Tips and tricks for removing minimally invasively inserted plates

- In the insertion area, use a chisel to release the plate.
- Try to extract the plate (see below); if this fails to achieve the desired result:
- Release the plate with the aid of a chisel—exactly the same width as the plate—either above or below the plate.
- Use right-angled chisels in order to progress along the entire edge.
- All these chisels should be advanced with care or they should be propelled forward with light hammer blows.



Fig 9

- In our experience, a traditional Küntscher extraction hook with a long shank and a recess for a slot hammer has proved to be effective (Fig 9). Using light hammer blows, the plate can then be loosened and progressively extracted. Other types of hook can also be used.
- Check whether there is any bleeding from the position of the plate and from the entire canal of the former implant.
- Another way of releasing a plate is to rotate it about its longitudinal axis.

3 INTRAMEDULLARY IMPLANTS

- When removing intramedullary nails and all other types of intramedullary devices, it is absolutely essential to identify the type of implant.
- If the implant was inserted at a different hospital, a surgical procedure report should be available whenever possible.
- Hopefully, it will be standard practice to issue the patient with an implant certificate containing the most important data in the future. (However, to date this has proved to be a vain hope.)
- For modern nails (cannulated or solid) the appropriate set of extraction instruments must be available in order to drive out the locking screws and all the additional screws and to insert the set of instruments into the nails correctly.
- Universal nail removal kits are also available. These are characterized by threaded olives of various sizes which feature longitudinal slots. Difficult extraction procedures require that the greatest possible adhesion should be created between the set of instruments and the implant, in order that the extraction forces are transmitted without loss, resonance or elastic yield.

Tips and tricks for traditional Küntscher nails, ie, slotted tubular nails

- The correct taper must be selected.
- When screwing in, for each quarter-turn it is possible to tap at the rear with a hammer so that the taper, like a extractor screw, either fits perfectly into the thread or, in certain cases, even cuts a new thread.
- In the case of slotted tubular nails, the insertion force is limited by the expansion capacity of the nail. Even the traditional nail, with a swallowtail slot, cannot always prevent the proximal end from splitting apart.
- If tapping on the taper has no effect, the traditional extraction hook for Küntscher nails can be suspended in the slotted hole provided for this purpose (Fig 10). The extraction force is limited by the wall thickness. Frequently, if the nails are hard to extract, the solution is to cut into the wall.
- In principle, traditional slotted tubular nails should be released centrally beforehand, using a hand drill. In this way, frequent bone bridges, which have become ingrown in the slot, are removed.
- If it is not possible to extract proximally, extraction hooks can be used; these hooks should be long and thin enough to reach through the entire nail as far as the tip, where they can be positioned (Fig 11). For this procedure, the entire canal must be cleared beforehand, using a hand drill. The extraction hooks have small tips. It is necessary to verify, using the image intensifier, that the hook is suspended on the tip. Then the hook "pushes" the nail in front of it.



Fig 10



Fig 11

- If none of these steps were successful, the solution is distal fenestration. Using a curved plunger, the nail can be pushed from the distal to the proximal position. If conventional plungers are unsuitable, the surgeon can create a “personalized” plunger by bending a Steinmann nail or a Schanz screw.
- As a last resort, if removal is absolutely necessary, a lengthwise osteotomy of the bone can be performed. In this procedure, the lengthwise osteotomy proceeds in stages until the nail is released. It is preferable to carry out a targeted osteotomy rather than producing an uncontrolled comminutive fracture.

Removing broken nails

- An attempt should be made to push a broken nail from the distal to the proximal position (see above) and to keep the nail in one piece. This may prevent the distal fragment, with its sharp fracture edges, from hooking onto the internal surface of the medullary canal.
- If this fails to achieve the desired result, the first step is to remove the proximal fragment, followed by the distal fragment. In the case of slotted tubular nails, the tips and tricks described above can be applied.
- In the case of solid nails, the distal fragment can only be pushed. Individual plungers are recommended (see above).
In some cases it may be possible to extract small distal fragments through a bone window.
- Broken cannulated nails can be removed using an extractor pin from the extraction kit or a “home-made” extractor pin. A typical example of a “home-made” extractor pin for femoral nails is a Schanz screw (Fig 12).



Fig 12

In every case, the objective must be to ensure that the Schanz screw (as long as possible) becomes embedded in the cannulation. A combination chuck or another suitable instrument must then be docked with the end of the long Schanz screw.

Removing broken locking screws

- The facing part does not pose any problem.
- The opposing part can be pierced. The projecting end of the screw shank can then be grasped from the opposite side.
- In certain cases the opposing half of the pin can be unscrewed using the internally threaded extractor pin.

DHS screws, PFN screws, blades, etc.

- Obtain the correct instruments.
- Read the operating manual.
- If other extraction options fail to achieve the desired result, remove using the extractor screws and the other tools for damaged and broken screws.

If these instructions are followed, removing problematic metal fasteners will prove to be an easily surmountable challenge.

Tim Pohlemann, Keith Mayo, Carlos Sancineto, Michel Oransky, Pol Rommens, Frankie Leung

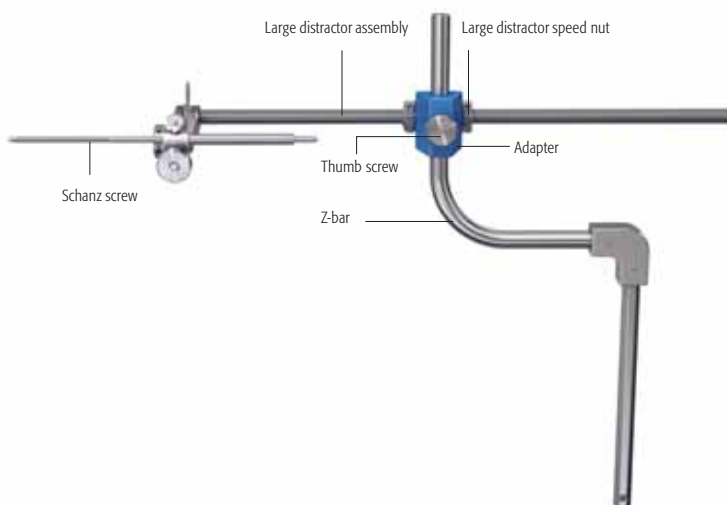
NEW PELVIC PRODUCTS



Pelvic Lateral Traction Device

For reconstruction of acetabular fractures the patients are positioned either on regular OR tables or traction tables according to the personal preference of the surgeon and frequently not at least the availability of a costly orthopedic table suitable for this specific type of surgery. As an example lateral and longitudinal traction of the femur is necessary during the acetabular reconstruction through the ilioinguinal approach. On the regular table this had to be done manually and frequently had to be maintained by a second surgeon. The pelvic lateral traction device was developed by the PEEG as a table attachment for universal use during pelvic surgery. In the sterile region the device is connected to the patient by coupling to a Schanz screw, but also can be mounted to an external fixator. The position can be modified easily after loosening and tightening of a single fixation screw ("one-hand technique"). The range of applications is therefore wide as well in acetabular and pelvic surgery, but can also be of value in other types of orthopedic- and trauma-related surgical reconstruction.

The reduction table attachments consist of the lateral traction device itself, an adaptor, a 10 mm thumb screw, and the 11/16 mm post.



Jörg Auer, Michael Kowaleski, Alessandro Piras

NEW VETERINARY PRODUCTS



Broad LCP 5.5

The broad LCP 5.5 is indicated for treatment of fractures and joint arthrodeses in large animals, such as equine and bovine patients. The plates have a width of 17.5 mm and a thickness of 6 mm and are specifically designed to accommodate the extreme weight of adult large animals and enable immediate weight bearing postoperatively.

The plates feature a centrally located stacked combination hole at one end of the plate, for use in treating metaphyseal fractures. The plates are tapered at the other end to facilitate minimally invasive placement. Limited contact undercuts allow smoother plate contouring. Preservation of blood supply under the plate is not desired in large animals; on the contrary, it is preferred to provide good bone-plate contact, achieved through the initial insertion of cortex screws at strategic locations or the use of the push-pull device.

The plates are available in sizes of 10–18 holes, made out of 316L stainless steel, and are part of the large fragment instrument and implant set.

A 14-year-old Trakehner mare sustained a luxation of the proximal intertarsal joint (calcaneus and talus are displaced palmarly).

Case provided by Alan Ruggles,
Lexington Kentucky, USA

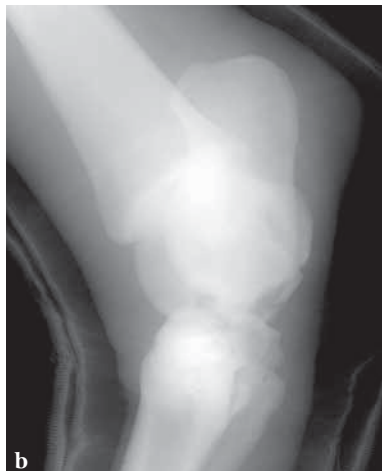


Fig 1a–b
Lateromedial and oblique x-rays.



Fig 2
After reduction of the luxation, a 14-hole broad LCP 5.5 was applied to the palmar aspect of the calcaneus and MtIV.



Fig 3a-b
Lateromedial and dorsopalmar x-rays of the repair, depicting the LCP 5.5 in place.



Fig 4
The mare in it's box stall with the fiberglass cast in place. Presently the mare is out of the cast at home 8 weeks postoperatively, doing very well.

Tibia Plateau Leveling Osteotomy: Saw and Jig

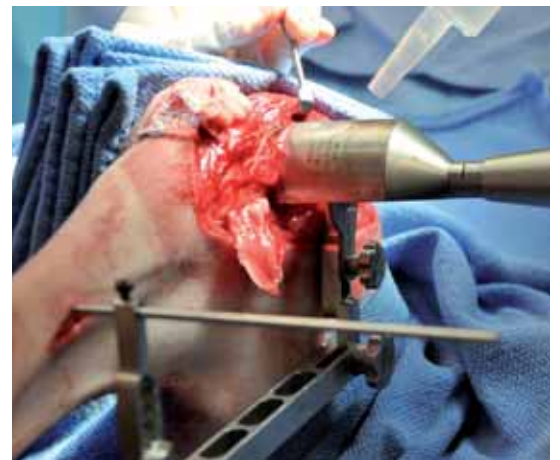
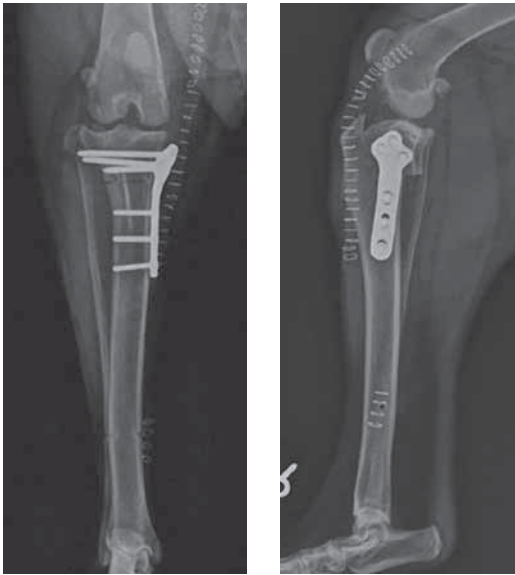
The tibia plateau leveling osteotomy (TPLO) procedure dynamically eliminates cranial tibial subluxation associated with cranial cruciate ligament (CCL) disease in the dog, and thereby stabilizes the knee joint during locomotion. CCL rupture in the dog is similar to ACL injury in humans.

The standard saw and jig are designed specifically for use when performing tibial plateau leveling osteotomy to assist with location, guidance, initiation, and stabilization of the radial saw cut in medium and large breed dogs.

The jig and saw guides can be used bilaterally (for right or left tibiae). Specially designed hinge and saw guide screws within the jig resist loosening under vibration. The hardened steel jig pin screws resist stripping. The saw guides can be positioned in multiple positions along the jig and the jig arm position can be adjusted to allow for optimal placement of the osteotomy. The saw guides are available in three radii of 24 mm, 27 mm, and 30 mm to match the saw blade size selected for an individual patient. The instruments can be easily disassembled for cleaning, and are made of medical grade stainless steel.

A smaller version of the jig and saw guides will be designed in the future for smaller breed dogs.

For description of the TPLO system please see TK News 1108, page 37.



Use of saw.

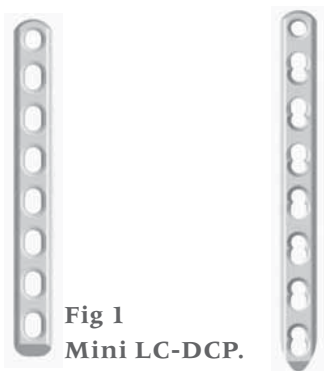


Fig 1
Mini LC-DCP.

Fig 2
Mini LCP.



Fig 3
Overview.

Mini LC-DCP and LCP

The Mini LC-DCPs and LCPs are designed for long-bone fractures in small breed dogs and cats.

The mini LC-DCPs and LCPs utilize the standard LC-DCP and locked plate design with a few minor changes. The plate features the standard toe nail design for MIPO at opposite end.

The most distal hole was changed from either a combination hole to a stacked combination hole or a DCU hole to a round hole at one end for placement as close to the joint as possible, similar to the 3.5 mm broad LCPs for veterinary indications. This allows treatment of metaphyseal fractures and minimally invasive placement. Additionally, the plates are thicker (and stronger) in their longer lengths to withstand greater loads of comminuted fractures in noncompliant animal patients. The plates have a grooved undersurface for limited contact.

Both LC-DCP and LCP come in versions of 2.0 mm/1.5 mm with 4–7 holes (1.2 mm thick), 2.0 mm/1.5 mm with 6–10, 12, 14 holes (1.5 mm thick), 2.4 mm with 4–8 holes (1.7 mm thick), 2.4 mm with 8–10, 12, 14 holes (2.0 mm thick), and 2.7 mm with 4–12, 14, 16 holes (2.6 mm thick).

Both LC-DCP and LCP are made of 316L stainless steel. The 2.7 mm plates fit in the vet small fragment plate set graphic case, the 2.0 mm and 2.4 mm plates fit in the vet mini fragment plate set module.

A 12-week-old Yorkshire Terrier, 1.3 kg.

Case provided by Alessandro Piras, Banbridge, Northern Ireland



Fig 1a–b
Preoperative x-rays.

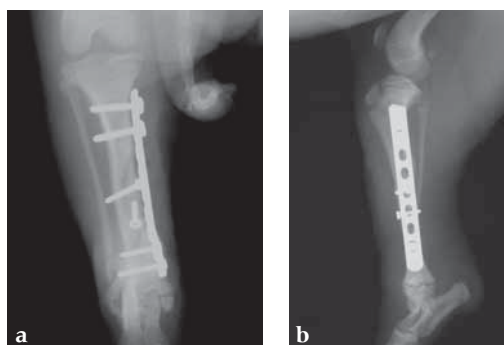


Fig 2a–b
Lag screws and neutralization plate (LC-DCP 2.0) cut to length.

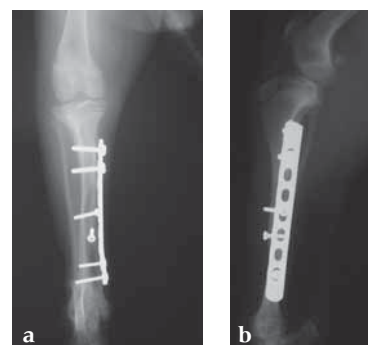


Fig 3a–b
X-rays 6 weeks postoperatively.

William Long

NEW CRANIOMAXILLOFACIAL (CMF) PRODUCTS



Precontoured plates and splints



Intramedullary splint

The Matrix Rib Fixation System

The new matrix rib fixation system is indicated for the fixation and stabilization of rib fractures, fusions, and osteotomies of normal and osteoporotic bone. It was developed under the guidance of the Sternal Surgery WG, an international group of cardiothoracic and plastic surgeons within the CMF branch of the AOTK System.

This new system is based on the matrix platform of plates and screws that have been developed for all areas in CMF surgery. It consists of precontoured locking plates, locking screws, and intramedullary splints for the fixation and stabilization of ribs and is indicated for the fixation and stabilization of rib fractures, fusions and osteotomies of normal and osteoporotic bone.

The need to improve rib fracture care has been recognized for many years. To this end a number of surgeons have been using operative approaches including plates, intramedullary devices, vertical bridging, wire, sutures, and struts to repair the chest wall. Next is the attempt to achieve improvements in pain control, the goal for this system has been to reduce the duration of mechanical ventilation, ICU time, as well as the risk for chest wall deformities.

Although the majority of cases with fractured ribs can adequately be treated nonoperatively, the remaining number particularly severe chest wall trauma cases can be a cause of morbidity and mortality, especially in the presence of a flail chest where paradoxical inward movement of the flail segment in inspiration is found. About 10% of chest wall trauma cases result in a flail chest. Flail chest injuries, defined as fracture of at least three consecutive ribs in at least two locations each [1], are associated with a mortality rate of up to 33% [2].

Implants and screws

The matrix rib precontoured plates are available in sets of four (four left plates and four right plates) with designs that correspond to a specific rib or rib pair. The plates, which cover fractures in all ribs suitable for plating, were designed to accommodate anatomical similarities between specific ribs.

The matrix rib fixation system is used with 2.9 mm self-tapping, locking cortex screws ranging from 6 to 14 mm in length (in increments of 2 mm). These screws are designed to be used with both the Synthes rib plates and IM rib splints. The screws are made of titanium alloy (ti-6Al- 7Nb). A 6 mm nonlocking screw is also available to temporarily secure the plate during insertion of the locking screws. This nonlocking



screw is intended to be removed and replaced with a locking screw prior to soft-tissue closure.

The fixation of plates and screws can be done in the standard fashion, drilling of holes should be done most cautiously to avoid the risk of pneumothorax.

Splints

In addition to the plates, the matrix rib fixation system includes intramedullary (IM) rib splints for fixation and stabilization of rib fractures especially on the posterior side in a minimally-invasive fashion. The rib splints have a rectangular cross-section, provide bicortical screw fixation, and are available in three widths: small (3 mm), medium (4 mm), and large (5 mm).

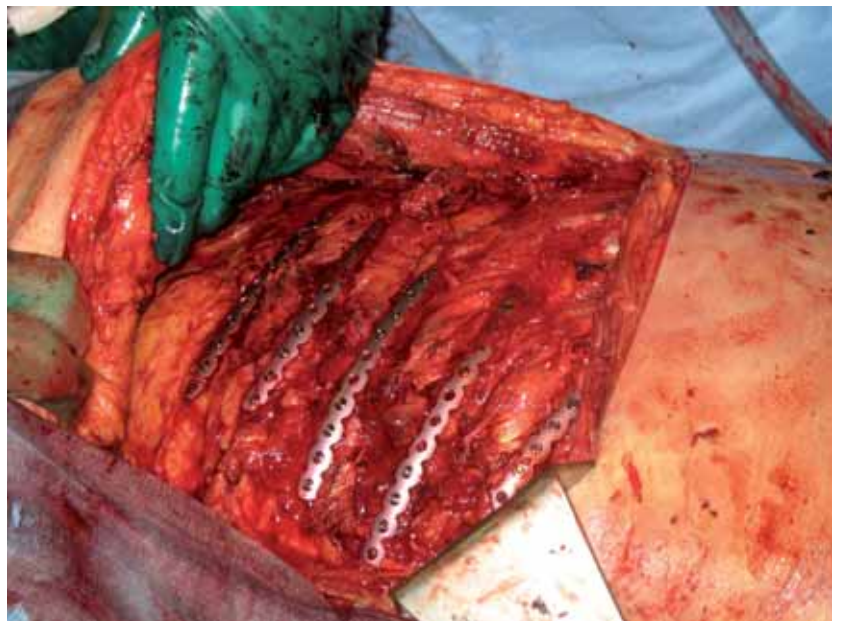
For their implementation, specifically designed drill guides with hook as well as templates to prepare the canal are available.

Instrumentation

The specially developed instrumentation includes three plate holding forceps to assist the positioning of the plates during drilling and screw insertion procedures. These forceps are designed to be inserted from the superior aspect of the rib and hold the plate to the rib. The large version spans across multiple ribs to minimize the number of incisions in the intercostal space.

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Michael Wagner

NEWS FROM AOTRAUMA SPECIALTY



AOTrauma—the oldest new specialty

Creating, uniting, and focusing new values for trauma and orthopedics

The formation of an official trauma specialty is in recognition of 50 years of past achievements and to empower the next generation of trauma surgeons to further advance the AO principles in trauma surgery.

In June 2008, the Board of Directors of the AO Foundation announced the creation of the AO Specialty for Trauma Surgery—AOTrauma. AOTrauma stands for trauma and orthopedics and will include all practitioners across trauma and orthopedic disciplines as well as their relevant subspecialties.

What is a specialty? It is an organization within the AO Foundation dedicated to a defined group (eg, trauma and orthopedics, spine, cranio-maxillofacial, veterinary). It transcends regions, subspecialties, and aims to bring together like-minded individuals to work as a homogenous team—the teams within the specialty freely exchange knowledge, know how, and share their expertise to achieve a set of common goals.

Challenge

I was elected to chair and lead a “Transition” Board. For almost 6 months I listened, and listened, and listened—I was told “we need to change nothing”, I was told “we need to change some things”, and I was told “we need to change everything”. As I talked and listened my thoughts were gradually galvanized: yes, the AO was an icon, we have been a leader for so many years, but in reality we had failed to continually deliver on our founders’ legacy. If we were honest with ourselves our mantle as gold standard had slipped.

I readily agreed to the challenge, I accepted because I believe in the concept of AOTrauma: a united and integrated specialty, which harmonizes and seamlessly links our surgeon and our administrative teams in translational research, clinical research, product development, education, scientific marketing, and membership; our national, regional, and global bodies working together as teams without kingdoms, without borders, and without artificial boundaries.

AOTrauma Transition Board

Since 2009, the new AOTrauma Transition Board (AOTTB) started working. It consists of surgeons from the AO Regions Asia Pacific (Tadashi Tanaka), Latin America (Sergio Fernandez), North America (Jack Wilber and Peter Trafton), Middle East (Mamoun Kremli), Europe (Hans-Jörg Östern and Rami Mosheiff), and members of the top management.

Objectives and structures

The AOTTB has set structures that can implement the transition objectives:

- Drive academic excellence and community spirit
- Bring the organization's ownership back to trauma surgeons
- Develop coherent and aligned projects and activities
- Make the organization leaner, faster, and more efficient
- Work closely with AO Institutes and AO Specialties
- Strong and clean cooperation with Synthes
- Empower regions within the specialty structure

First we have created the inclusion of three global commissions (research, education, and scientific marketing and membership which includes the alumni) into the AOTTB. Each commission comprises of each region's functional representative; the aim being to share, exchange, and leverage expertise and resources across the regions.

Regionalization

The next stage will empower our regional boards and develop country structures to make them responsible with full budgetary and decision-making control to run their

territories for the benefit of the local members and to further our mission. Interestingly, there is a perception that somehow an AO Specialty is divorced from an AO Region. Of course the AOTrauma Specialty will operate in a different way than the old AO regional structures; however, a specialty runs through its local bodies. A specialty is driven by its local surgeon teams for the benefit of the local surgeons.

Outlook

Importantly, the AOTTB wants the new AOTrauma structures around the world to go beyond education: "running more courses" can no longer be the sole goal. Instead we want to ensure our investments in research directly impact product development and patient care, our education delivers life long advantages and changes behavior, and our community development projects makes AOTrauma an appealing community network that creates and distributes value within itself.

Simply put: we will break down barriers, align and refocus the diverse individuals and groups who have traditionally done their own thing to a common set of goals to advance our mission.



AOTrauma Transition Board (AOTTB)

Chairperson: **Michael Wagner**

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EXPERTS' SYMPOSIA

Experts' Symposia were introduced as a special kind of AO meeting to generate a forum for intense exchange between experienced clinicians focused on new implants, advanced solutions for special fracture problems and difficult clinical problems. This format was inaugurated in the year 2000 shortly after the introduction of the LCP, focusing on interlocking implants and meanwhile extended to the new intramedullary nail family. The conclusions drawn from the discussion are directly implemented into technical improvements and recommendations to AO Education for modified teaching strategies.

Since the last TK News issue, those regional events were held in Europe, Asia, the US, and, for the first time, in Africa (Cape Town). Overall, it became quite clear that the recent innovations in interlocking implants and the expert nail family have not only extended the range of indications when either a nail or a plate may be used safely, but also

modified surgical strategies in various aspects. By this several fractures can now be treated by different "AO Principles". These overlaps in indications certainly need further discussion and clarification to keep AO treatment recommendations clear and reproducible. Some of the fields for our future discussions are mentioned below.

Clavicle

Less than 1/3 of clavicle fractures are treated surgically, but with an increasing trend to operative treatment on the basis of patient comfort, early mobility, and immediate restoration of function. Preferred plate position was anterior mid-medial/superior-lateral, but with a lot of controversial discussion. Undefined radiography (no standardized way of measuring fracture displacement), contouring and thickness of the plates, and reduction were considered to be the other challenges. Several groups reported sufficient results with intramedullary techniques like the TEN.



Proximal humerus

In proximal humeral nailing, the discussion focused around different proximal interlocking options. The insertion of several, multidirectional screws for angular stable interlocking in connection with tension banding of the rotator cuff provides enough stability for early movement, whereas the technique of reduction and preliminary fixation still is challenging. This, in addition, has to be seen in the light of good results of interlocking plate fixation, eg, PHILOS, diminished on the other hand by invasivity, scar-tissue formation and the “holding power” of the screws in an osteoporotic head.

In nailing of the humeral shaft, no consensus could be achieved concerning retrograde versus antegrade approach. Even the literature stays unclear as valid studies regarding this specific question are missing.

Lower arm

In the forearm, plate fixation is still the technique of choice in the surgical management of diaphyseal fractures. However, plate fixation can be associated with a number of problems. Nailing could be advantageous in respect to soft-tissue trauma and “biology”, whereas bony consolidation, technical handling of implants in these necessary small dimensions, and reduction techniques are topics for ongoing discussion.

Proximal femur

When nailing proximal femoral fractures, varus/hyperflexion/external rotation of the proximal fragment must be avoided. Reduction techniques and a reliable easy to use technique for implant positioning are still in the focus of continuous improvement efforts.

In plating, it is decisive to obtain adequate fixation in the proximal fragment. DHS blade problems are varus malreduction, unstable reduction, malposition of the hip screw (not centered), screw tip apex distance >25 mm, and lateral wall fracture. Overall, the stability of the implant in highly osteoporotic bone is still an issue for further improvements.

Proximal tibia and tibia shaft

The treatment of tibial plateau and proximal tibia fractures remain difficult and should be reserved to experienced surgeon. Primary malalignment in treatment of proximal third tibia fractures is mainly caused by wrong entry point and tendon tension. The optimal insertion point is now defined at the projected extension line of the medullary canal (AP view) and at the anterior edge of the tibial plateau (lateral view). Secondary malalignment could be caused by insufficient fixation, thin cortex, and osteoporosis. New strategies in interlocking technique could overcome those difficulties.

Distal tibia and foot

In distal tibial fractures, under the aspect of soft-tissue damage, the indication for nailing is extended and overlaps the use of percutaneous plate fixations. Associated problems are reduction, especially in associated articular fractures, soft-tissue handling, and intraoperative reduction control in minimally invasive techniques, all together resulting in a relatively high rate of nonunion and/or infection.

Around the foot, on the basis of increased stability, nailing techniques are now about to be introduced. For example the hindfoot arthrodesis nail allows high stability and is highlighted by good adaptation to the anatomy. A midfoot fusion bolt may increase the treatment possibilities in the frequent problem of “Charcot deformity”.

Nailing in children

Whereas the treatment of femoral fractures in children was for many years a clear indication for nonoperative treatment, TEN is now becoming a standardized, minimally invasive, and reliable technique providing significant advantages in regard to patient comfort, pain reduction, early mobilization, and reduction quality. The same applies to the lower leg, where intramedullary pinning in many regions of the world is now the standard treatment protocol. But nevertheless many details are still waiting for improvements.

On the basis of this and future clinical feedback the TK System will continuously work on new techniques or improvements of existing implants and instruments.

David Helfet

PORTRAIT OF MATTHEW LEE GRAVES



People like Matthew Lee Graves, MD are why the AO is unique and its future is bright.

Matt Lee Graves completed a Bachelor of Science with honors in Biology at Vanderbilt University in 1996. He graduated Phi Beta Kappa with every other honor imaginable. He finished his medical training at the University of Mississippi School of Medicine in May 2000, again winning multiple awards. He completed an AO fellowship with Jeff Mast and an orthopedic trauma fellowship at Harborview Medical Center in Seattle Washington in July 2006. Since then he has been on staff as an Assistant Professor in Orthopedic Trauma at the University of Mississippi Medical Center.

But that only tells part of the story. Over the last 4 years Matt has been extensively involved with not only AO North America, but the AO internationally. He has been a lecturer and instructor multiple times every year and even overseas twice in Russia. What separates Matt from his colleagues is his obvious remarkable enthusiasm and teaching skills. For 2 years running he has won the "Howard Rosen Outstanding Table Instructor Award" at AO Courses and he has also won the "Orthopedic Teacher of the Year Award" at his own institution.

Matt has also been involved in clinical research and has many peer-reviewed publications all dealing with orthopedic trauma, and some, most innovative, ie, new "clam shell" osteotomy for diaphyseal nonunions, management of obese and pregnant patients with pelvic and acetabular fractures, treatment of pelvic injuries with sacral dysmorphism, etc.

Matt is obviously very smart, is a real academic, he thrives on teaching, an excellent surgeon who is also continuously thinking how to do things better. Matt was an integral contributor at an AOTK Think Tank on locked plating and intramedullary nailing in Florida earlier this year.

Matt is also most personable, a role model not only as a surgeon and educator but also as a dedicated family man and we, the AO and TK, are fortunate to have people like this as part of our team and family.

Tim Pohlemann

TK INNOVATION PRIZE

The TK Innovation Prize is the highest prize awarded by the TK System. The TK Executive decided to award the prize to Alberto Fernandez Dell'Oca from Uruguay for his numerous contributions to the improvement of patient care.

Alberto Fernandez Dell'Oca is a lateral thinker, a person who always questions established assertions and wanders off the beaten tracks. He does not only generate new ideas but also possesses the assertiveness to convince others and realize these new concepts. Furthermore, he is a clever tinkerer, a brilliant surgeon-engineer who has developed over the years an incredible number of ingenious tools to ease surgical procedures.

Alberto Fernandez Dell'Oca lives in Montevideo and works at the Hospital Britannico. He is married and has four children and two grandchildren.



The prize to Alberto Fernandez Dell'Oca was awarded by Norbert P Haas, the Chairman of the TK Executive Board, and Pietro Regazzoni.

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