



# News 1 | 08

## New Trauma Products from AO Development



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



Dear reader

This TK News issue will focus on new trauma techniques and information around these, plus a few selected items from spine and CMF surgery.

In the lead article of this issue, James Hunter and Theddy Slongo from the Pediatric Expert Group (PAEG) will give you a comprehensive overview of the latest developments for trauma and orthopedic surgery in adolescents. The revival of elastic nailing—not only in children—has been driven by the innovations of the PAEG.

Three years ago, the AO Foundation started a collaboration with BrainLAB. In late 2007, the Technical Commission approved the first navigation modules for surgical trauma, axis reduction and alignment, and posterior pelvic ring fixation. These modules were developed by the AO's Computer Assisted Surgery Expert Group (CSEG) under the leadership of Prof Christian Krettek from Hanover.

With the hindfoot arthrodesis nail, the Expert nail family is now complete. In the future, the AO will work on optimizing these products to provide more variety, such as very small versions, or nails adapted to regional anatomical needs, such as the PFNA Asian size. Furthermore, the instrumentation and aiming devices such as SureLock will be improved.

In the distal radius, the LCP volar column distal radius plates 2.4 set provides the most complete system available, addressing all distal radius fracture types in a single set. In foot surgery, the locking cuboid, talus and navicular plates complete the locking foot module which will be relaunched in the near future as a new set.

The column *Portrait* features Rami Mosheiff from Israel who has done a tremendous amount of research and development as well as teaching on intramedullary nailing. I would like to encourage you to follow his example and to share your talents with us. You can approach the AO anytime if you have an idea for the improvement of patient treatment as he did.

Once again, I would like to stress that none of the product descriptions in this publication are substitute for the AO's OP techniques or the AO teaching tools. You can obtain more detailed information on these products from the AO or your local distributor.

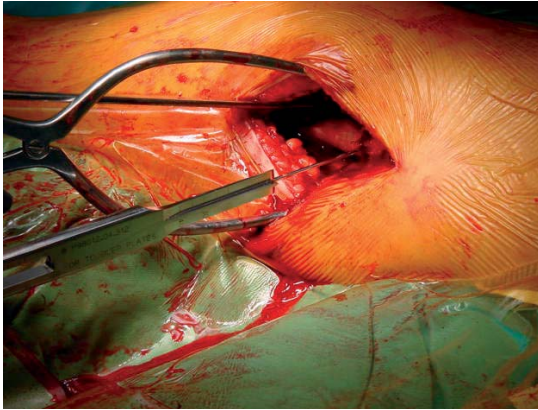
If you have any comments or questions on the articles or the new products, please don't hesitate to contact me.

Yours faithfully,

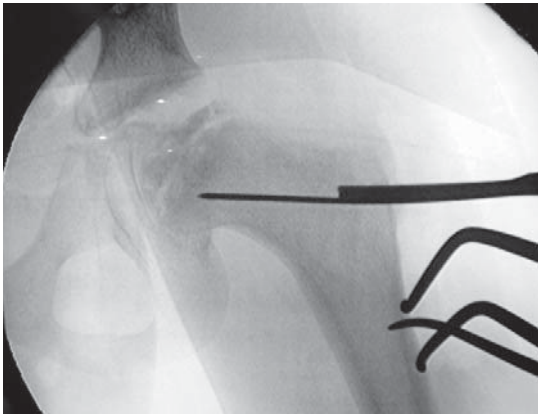
Norbert P Haas

James Hunter, Theddy Slongo

## AO'S PEDIATRIC EXPERT GROUP



**Fig 1a**  
CAPOS chisel in use.



**Fig 1b**  
Fluoroscopic view of CAPOS chisel.

The Pediatric Expert Group (PAEG) was first convened in December 1997. Prior to that, AO's involvement in pediatric fracture care and orthopedics had been fairly minimal. Fixation of pediatric fractures had a bad reputation. Implants for children were few and far between, and many were out of date and had not been subject to any development process. Within AO quite a lot of work had been done within children's documentation, but few senior figures in the organisation had continued with a significant children's practice. The main drivers for the formation of the PAEG were firstly, that children's orthopedic and fracture surgery was about to develop in response to modern health care requirements and secondly, that new ideas, particularly in fracture surgery, were already being promulgated and required investigation. Elastic nailing of long bone fractures had been described in the French literature from the 1980's onwards and had been accepted through much of central Europe by the mid 1990's. However, despite publications in major Anglophone journals, there had been little acceptance of this technique in either the UK or the US.

### Osteotomy of the Proximal Femur

Although the AO had designed osteotomy implants for the standard procedures required in children's orthopedics, they were not favored by the majority of pediatric orthopedic surgeons. The reasons were varied—some of the implants were too big, they were quite demanding to insert, and some disliked the concept of hitting a chisel towards the femoral head of a child or infant. Solutions were forthcoming. The first product produced was the "Toddler" osteotomy plate which had a large blade attached to a DC plate 3.5. This was ideal for children with cerebral palsy (CP), who tend to have a well developed proximal femur with rather gracile shafts. This remains an implant with very high usage. Next we addressed the problem of the implants being demanding to use. Our original plan had been to create angled blade plates that could be inserted over a guide wire; problems of strength and engineering prevented this, but a system for inserting the chisel over a guide wire was developed—the cannulated pediatric osteotomy system (CAPOS). With this technique a guide wire could be inserted into the ideal position, imaged, the chisel inserted over the wire and then the chisel removed and replaced with the appropriate blade plate (Fig 1a–b). This was a considerable improvement but some surgeons were disappointed that the implant could not be placed over the guide wire. Ultimately, the ideal osteotomy implant should be introduced into the proximal femur without hammering. Having completed the CAPOS project, essentially a way of inserting existing implants, the PAEG immediately started work on a new generation of osteotomy implants to be based on locking compression plates (LCP). The result was the LCP pediatric hip plate system (PHP) that was completed in 2007. This series has 4 neck shaft



**Fig 2a**  
LCP pediatric hip plate (PHP)  
insertion—angled guide wire.



**Fig 2b**  
Sliding PHP over guide wires.



**Fig 2c**  
Healed varus osteotomy with PHP.

angles (soon to be five) and replicates the techniques and calculations of blade plating without requiring a chisel. Surgeons of a different generation less familiar with calculating osteotomy angles from the shaft can easily work off the line of the femoral neck (as if they were doing a DHS). The angles currently available are 100°, 110°, 120°, 150° (130° plate is planned). The technique is simple; a slim guide wire is inserted in the high center position of the femoral neck, followed by two more substantial guide wires below it. The osteotomy is performed. The plate is brought to the femur with locked drill guides maintaining the angle. (Fig 2a–2b) The two main guide wires are sequentially replaced with locking head screws whilst the two other fixes are maintained. After the plate has been attached to the proximal femur the shaft is fixed using either cortex or locking head screws as the situation demands. Finally, a screw is put into the proximal fragment that engages the calcar, enhancing stability to a level greater than the blade plate. The increased stability appears to reduce perioperative pain whilst healing occurs reliably (Fig 2c). The design of the plate makes it lower profile resulting in retrieval being down to patient choice rather than mandated by prominence. Early results have been most encouraging and the system is becoming very popular particularly amongst surgeons with a CP practice, as in these patients bone can be very osteoporotic, a good indication for locking compression plates. A smaller version for hip dysplasia surgery in infants is planned.

### Slipped Upper (Capital) Femoral Epiphysis (SUFE)

This condition is seen frequently by trauma surgeons as well as pediatric orthopedic surgeons. Conventional treatment is to stabilize in situ using a cannulated screw, and the 7.3 mm screw has proven useful due to its stiff 2.8 mm guide wire. The difficulties of removing these and other screws have been circumvented by leaving them in. Newer concepts of SUFE have affected the developments. The Bern school has suggested that much osteoarthritis is caused by impingement of metaphyseal bone on the acetabular margin, and the condition that causes this par excellence is SUFE. They suggest that pinning in situ may only be the best treatment for the mildest forms of SUFE, and that moderate slips may require metaphyseal bump resection, and more severe cases open replacement of the epiphysis. Both these latter are typically done through a hip dislocation approach, and fixation with threaded K-wires is their standard. This is all relatively controversial even within the PAEG, but we have agreed that an implant that is easy to retrieve is a prerequisite to a flexible approach. Such an implant is in the late stages of design.

### Femoral Shaft Fractures

Femoral shaft fractures are controversial for a number of reasons. Firstly they consume a disproportionate amount of resource, both for health care providers and parents. As a result the traditional treatment, traction, is infrequently used except for the smallest infants. Secondly children and adolescents are getting much heavier (it is now not unusual to see 100 kg children in the clinic). Elastic nailing of the





**Fig 3a**  
Instable femoral shaft fracture in 12-year-old boy; weight 65 kg.



**Fig 3b**  
Insertion of end cap over nail.



**Fig 3c**  
Fracture stabilised by TEN and end caps.

Case provided by James Hunter, Nottingham, GB

femur—the standard treatment of shaft fractures between ages of 5 or 6 and late adolescence—may not be robust enough for heavier children and adolescents, or those with unstable fracture patterns (Fig 3a).

The first solution offered by the PAEG is the end caps for elastic nails. These are inserted over the top of the nails after insertion and cutting of the nails (Fig 3b). They prevent backing out of the nails in fractures that are unstable either due to configuration or patient weight. Biomechanical studies performed in the AO Center show that these increase the push-out force six times over that of conventionally inserted nails, and the group has collected clinical experience to demonstrate efficacy (Fig 3c). The end caps also protect the soft tissues from the cut nail ends, and improve retrieval because the cap facilitates nail location and creates a space around the nail ends for the extraction pliers. Only one small extra instrument, the driver for the caps, is required.

The second solution is the adolescent femoral nail (Fig. 4). 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. It is thought that it can be avoided using a lateral trochanteric start point. The adolescent femoral nail avoids the blood supply to the proximal femur by a far lateral starting point and a double curved configuration. Initial experience in the US has been very favourable.

Current areas of study for the group include fixation around the growth plate, stabilisation of osteogenesis imperfecta and osteotomy of the distal femur.



**Fig 4**  
Adolescent femoral nail.

Jesse Jupiter, Martin Langer

## NEW HAND PRODUCTS



### LCP Volar Column Distal Radius Plate 2.4

The LCP volar column distal radius plate (VCP) 2.4 is indicated for fixation of complex intra- and extraarticular fractures, and especially for highly comminuted fractures, as well as corrective osteotomies of the distal radius.

The implant design is based upon a concept by Rikli and Regazzoni, who identified the structural columns of the distal radius and the need to not only reduce the articular components but also provide support for both the radial and ulnar sides equally.

The LCP VCP is anatomically contoured for the distal radius and has a low profile, which implies less overall implant bulk, minimizing soft-tissue irritation. 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. A 3-screw cluster addresses the radial styloid. Four screws support the ulnar column.

The plate shaft is available in 3-, 4-, and 5-hole versions and accepts 2.4/2.7 mm cortex or 2.4 mm locking head screws.

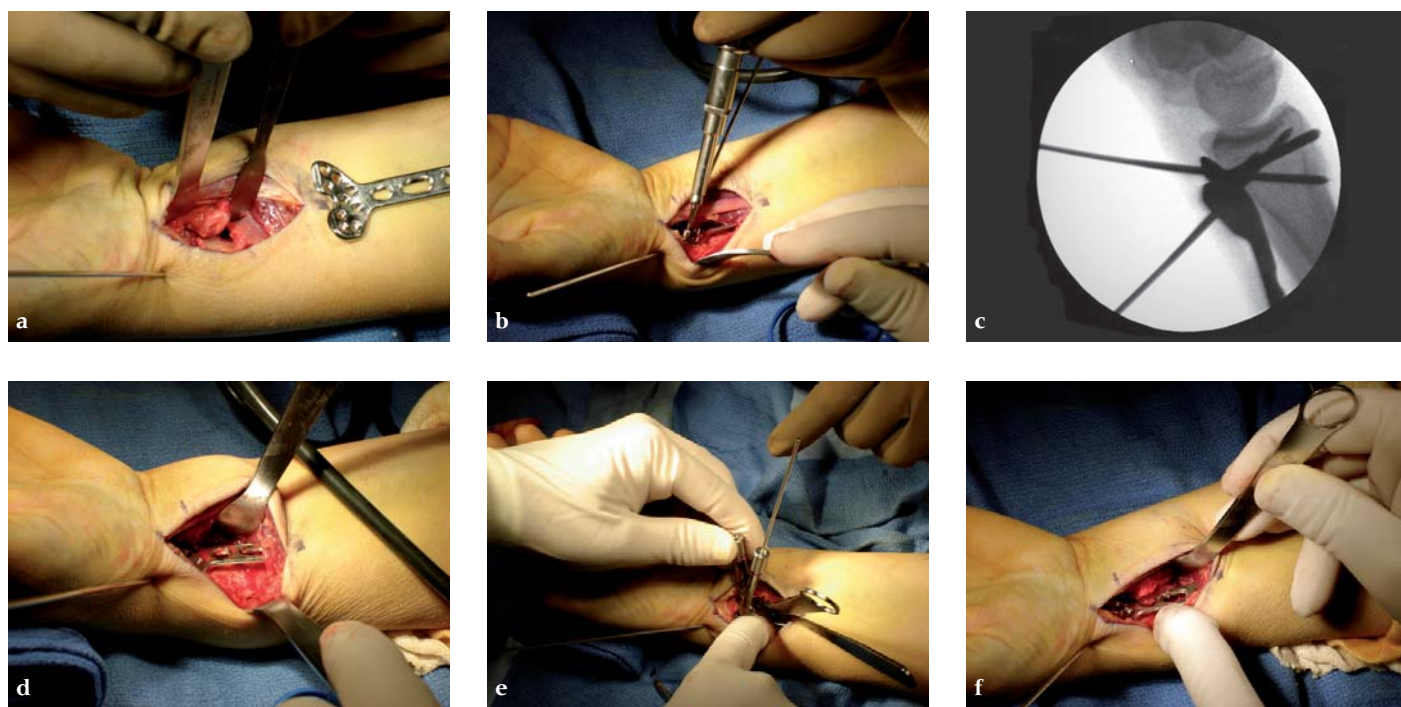
The LCP VCP provides the option to use mini drill guides and standard threaded drill guides to confirm screw trajectory options.

The LCP VCP 2.4 comes in left and right versions. All plates are available in stainless steel and titanium. Overall, the system consists of 40 different plates, making it the most complete set for distal radius fractures available.

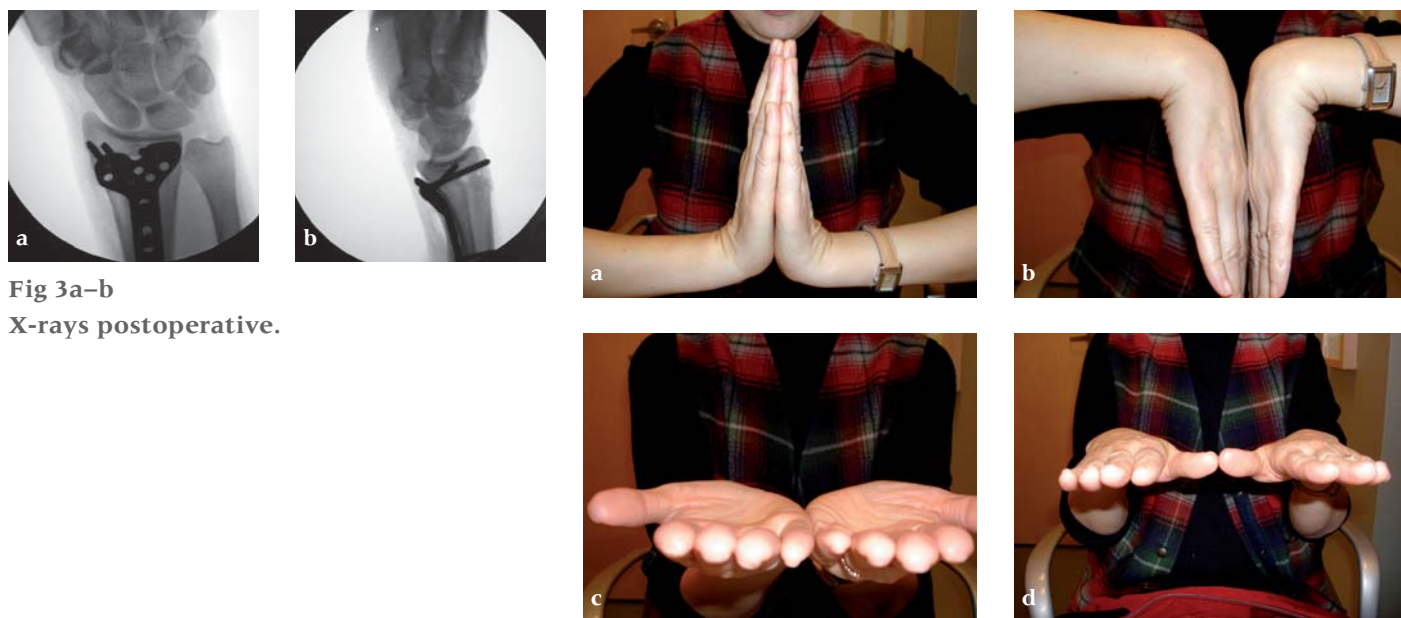
### 28-year-old woman.



Fig 1a–b  
X-rays preoperative.



**Fig 2a-f**  
Step-by-step operative procedure.



**Fig 3a-b**  
X-rays postoperative.

**Fig 4a-d**  
Full motion recovery.





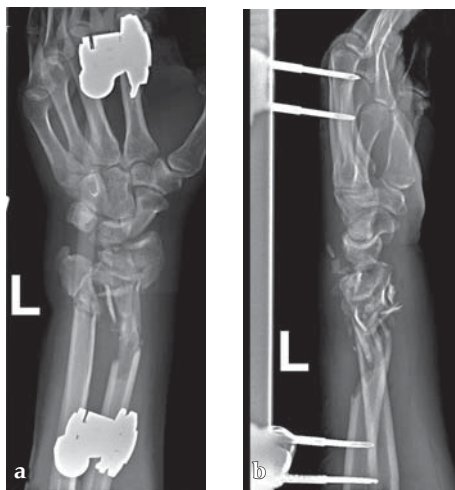
### LCP Meta-Diaphyseal Volar Distal Radius Plate

The LCP meta-diaphyseal volar distal radius plates have been designed as longer distal radius plates, to treat fractures with a proximal extension into the diaphyseal regions of the radius.

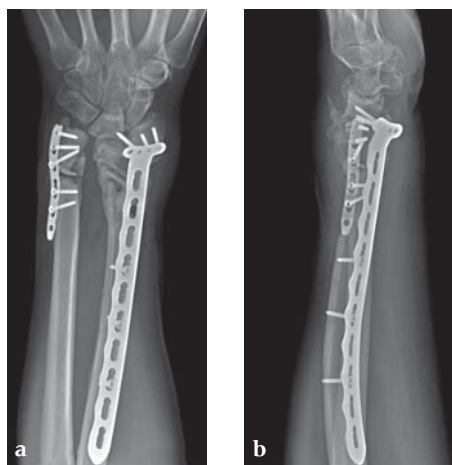
The meta-diaphyseal volar distal radius plate is effectively a plate combining the head of the LCP volar distal radius plate with a similar shaft to the LCP 3.5. But the meta-diaphyseal volar distal radius plate can be placed more proximal than the LCP volar distal radius plate, and it is significantly stronger.

The meta-diaphyseal volar distal radius plate is precontoured to match the volar surface of the distal radius. It features a 25° angulation equivalent to the normal anatomy of the distal radius. The plate head offers 4 threaded round holes which accept 2.4 mm locking head screws. The plates are available with 5, 7, 9, 11, 13, or 15 holes in the shaft, ranging from 95–240 mm. A precontoured radial bow is included in the shaft of the plates after 95 mm to match the anatomic curve of the radial shaft. Relief cuts are included after every other hole, beginning after the 7th hole (after 95 mm) to ease additional contouring needed to match the patient's specific radial bow. The plates are available in left and right configurations and in stainless steel or CP titanium.

**34-year-old male, with open fracture after motor vehicle accident.**



**Fig 1a–b**  
Preoperative x-rays; primary stabilization with external fixator.



**Fig 2a–b**  
Eight months postoperative; full forearm rotation and 75% grip strength and wrist motion.



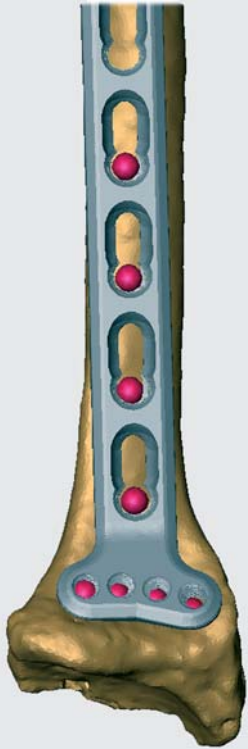
Case provided by Jesse Jupiter, Boston

**Fig 3a–b**  
Full motion recovery.

Hansrudi Noser, Dave Little, Ladislav Nagy, Thomas Kaup

PRODUCT RELATED NEWS FROM THE AO DEVELOPMENT INSTITUTE (ADI)

## Technical Know-how in Image Processing



**Fig 1**  
The placement of homologous landmarks on the radius surface through the holes of a manually aligned template of a meta-diaphyseal volar distal radius plate prototype.

### We support your Clinical Development and Publication

#### About us

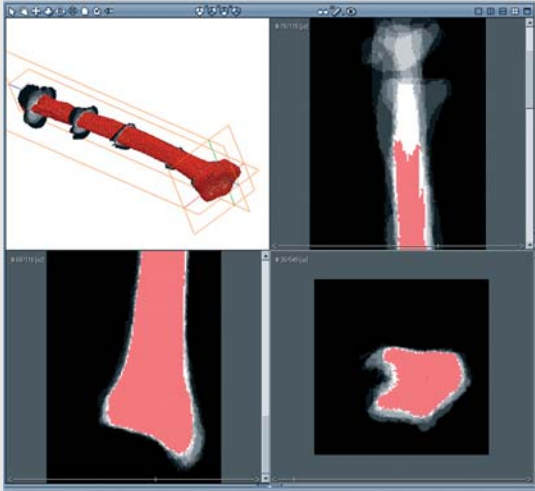
The Human Morphology Service Center (HMSC) of the AO Development Institute (ADI) maintains a database of CT scans of cadaveric human specimens used in other projects in the AO institutes. Additionally, the database includes virtual bone models of the entire skeleton which are derived from the CT scans. This database is registered at the relevant regulatory authorities in Switzerland. A major task of the HMSC is to offer support in implant design and optimization to the AO Network and external partners, based on its database, know-how, and resources.

#### Services

Since its foundation in 2002 the HMSC has acquired more than a thousand bone data sets, know-how in medical image computing, and statistical shape analysis of 3-D bone models. Moreover, it has excellent software resources (Amira, Geomagic, Unigraphics, Matlab) to accomplish its support task. The service offerings include CT scans of cadaveric bones, image processing, segmentation, reverse engineering, statistical shape analysis, principal components analysis (PCA), rapid prototyping and CMF related image computing.

#### Example

An example of our services is the response to a request from the AO Hand Expert Group (HAEG) which was interested in the shape variability of the distal radius and shaft, with respect to the meta-diaphyseal volar distal radius plate. Together with a medical and a technical mentor, a sample of 15 radii from the database was selected and evaluated. To identify the region of interest (ROI) on the virtual specimens, we aligned a virtual template of a plate prototype on the radii, and placed landmarks on the bone surfaces through the first eight distal plate holes as illustrated in Fig 1. These landmarks were used to align the bones to each other by a generalized Procrustes fit, which minimises the sum of the distances between homologous landmarks. Then, the aligned surfaces were scan-converted and superposed, resulting in a 3-D image in which the grey values of the voxels represent the number of bone model intersections as illustrated in Fig 2. This 3-D image carries statistical information for the complete sample. It enables us to extract the median surface and to visualize local deviations from the median bone.



**Fig 2**

The different cuts through the superposed radii give insight into the shape variability with respect to the region of interest (the plate). The red color represents the median segmentation used for median surface generation.

Fig 3 shows three surfaces of the aligned and superposed volumes of the radii:

1. envelope of all radii
2. median intersection
3. common intersection

The median region of interest (ROI) is intended to be a template for potential preshaped plates. It can be observed that the shape variability is very small around the landmarks used for aligning the bones and that the variability increases with a growing distance from them. By carefully choosing only the ROI relevant for the implant, the aligning and averaging of the bone surface results in optimal templates for preshaped implants. The implant has to fit well only to the ROI. Variations outside are of no interest for the plate design. Such investigations can result in a basis for decision-making to engineers of implant manufacturers.

#### Interested in collaboration?

The HMSC would be glad to support you in solving your clinical problems and open questions related to bone variability. With us as partner you get rid of time-consuming segmentation and data management and you can focus on your core business. We are looking forward to discussing your study idea.

#### Contact.

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**Fig 3**

The surfaces of the envelope, the median, and the common intersection surfaces (from left to right) of the aligned and superposed volumes of the radii of the sample.



### LCP Rotation Correction Plate 2.0

Fractures of the metacarpals and proximal phalanges which heal in malposition can lead to severe impairment of hand function. In particular, rotational misalignments are problematic because of crossing and scissoring digits whenever full flexion of the fingers to a fist is attempted. Optimal recovery of hand function includes the meticulous restoration of alignment, length and rotation of digits and metacarpals. A careful approach needs to be chosen in order not to further compromise the soft-tissue situation which again requires proper reconstruction. The fixation has to be stable enough to facilitate immediate active and passive finger exercises.

The LCP rotation correction plate 2.0 enables intraoperative correction of malrotation, adjustment to the bone and restoration of correct alignment, prevents scissoring of the digits, and is easily adaptable to condylar-near fractures.

The LCP rotation correction plate 2.0 is anatomically precontoured, has a low plate-and screw profile, rounded edges and polished surfaces which minimize irritation of soft tissue and ligaments. The plate features a 2.5 mm slotted hole in the medial lateral direction. This oblong hole, positioned transversally to the shaft's axis, enables intraoperative verification of the result of the reduction and, where required, intraoperative correction of the rotational axis of the bone. The optimal posture of the digit can be set through loosening and tightening of the cortex screw in the transverse hole.

The plate is available in shaft lengths of 34 mm (3 combination holes) or 40 mm (4 holes) which allows fragment-specific treatment of metacarpal fractures and fractures of the proximal phalanges. Both versions are 1.3 mm thick, and available in stainless steel and CP titanium, as well as sterile and nonsterile.

**30-year-old male,  
work accident with buzz-saw.**

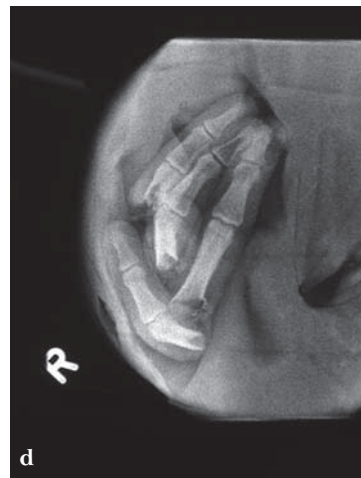
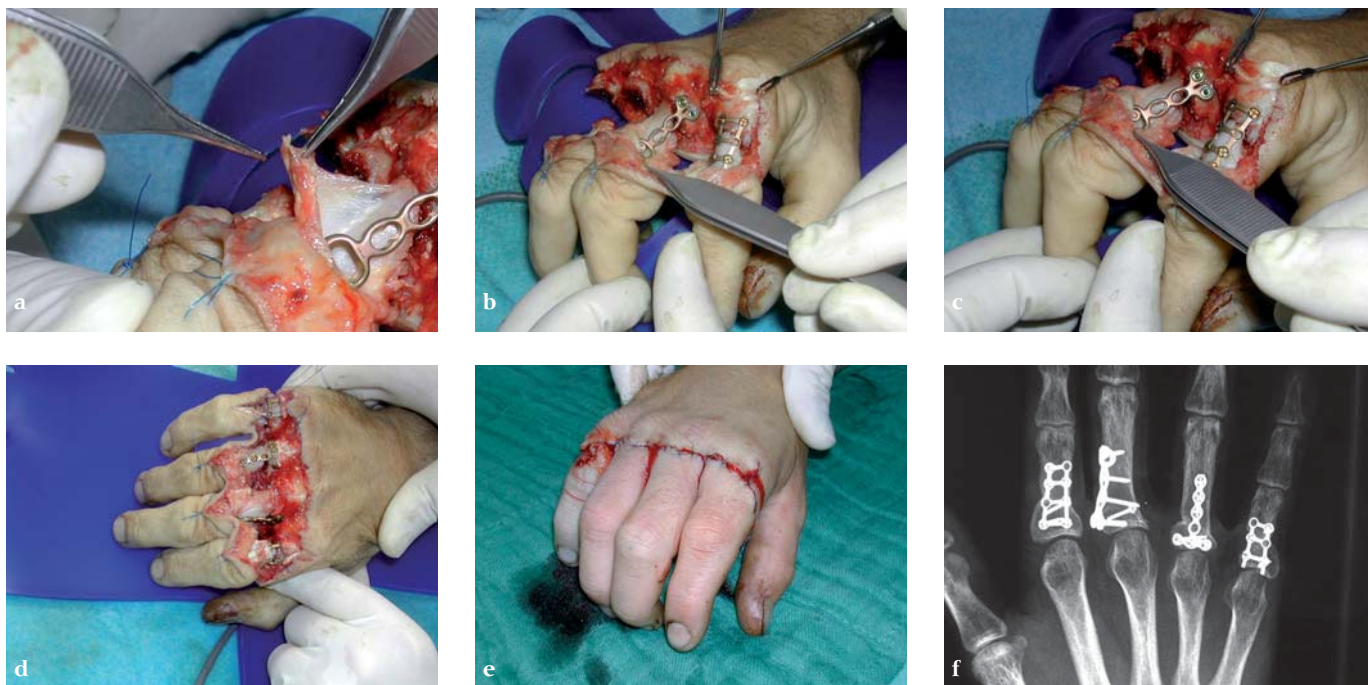


Fig 1a–d

Preservation of the short base of the proximal phalanx for the extremely important flexion of the metacarpophalangeal (MP) joint.





**Fig 2a-f**

Primary treatment of the index fingers phalangeal fracture using the compact hand set 1.5.

Afterwards angular stable fixation at the very small MP-joint fragment of the middle fingers proximal phalanx, and precise adjustment of rotation with LCP rotation correction plate 2.0.



**Fig 3a-c**

Full motion recovery 4 months postoperative.

Andrew Sands, Les Grujic, Per-Henrik Agren, Juan Gerstner, Ian Winson, Michael Castro

## NEW FOOT PRODUCTS

The LCP foot plates (cuboid, talus and navicular) are intended for use in selective fractures, osteotomies, reconstructive procedures and revisions of the foot.

The plates have a locking hole for many sizes of locking head and non-locking head screws. They are designed for optimal fit in each anatomic area. Connecting ribs between the plate holes enable easy bending and contouring of the plates. The plates are of a boss and rib design, in which the weakest cross section is across the connecting ribs. When the plate is contoured, it deforms across the connecting ribs and not across the bosses. This assures that the threaded locking holes maintain their ability to lock to the screws distorting the internally-threaded holes.



The plates are available in 316L stainless steel.

### Locking Cuboid Plate 2.4

The locking cuboid plate has the same shape as the current nonlocking cuboid plate, but now includes locking holes. The plate is available in right or left versions.

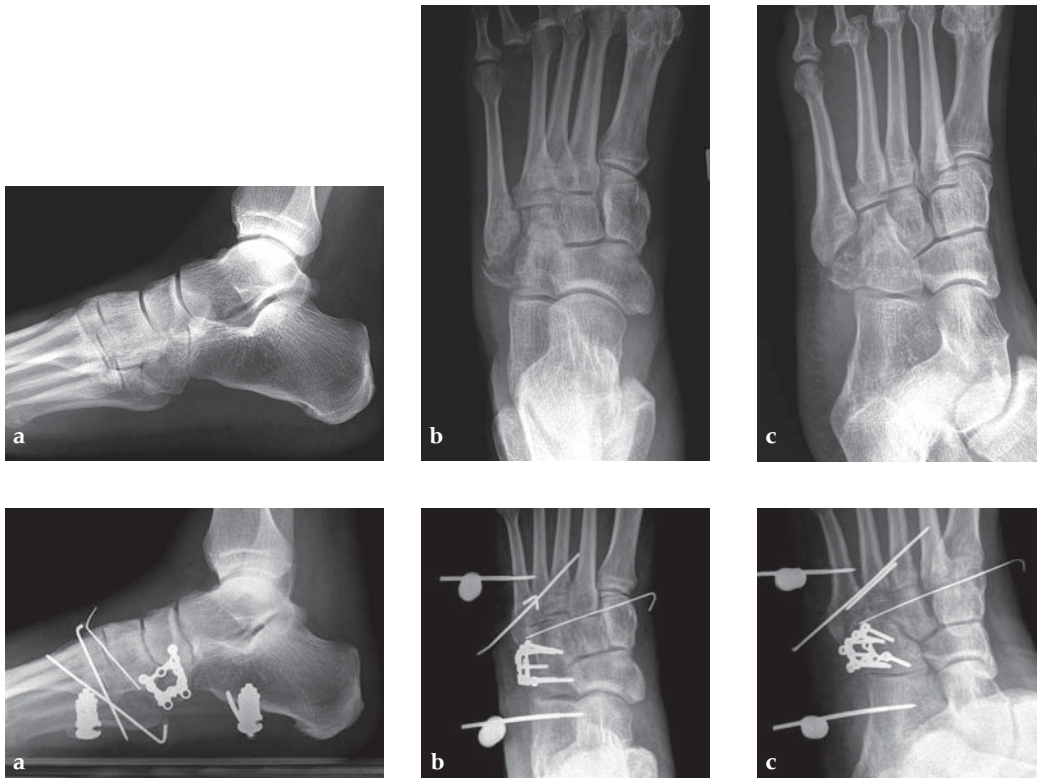


Fig 1a–c  
Preoperative x-rays.

Fig 2a–c  
Postoperative x-rays.

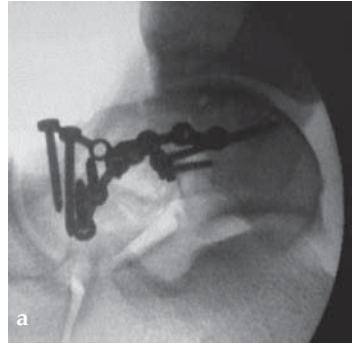


#### Locking Talus Plate 2.4

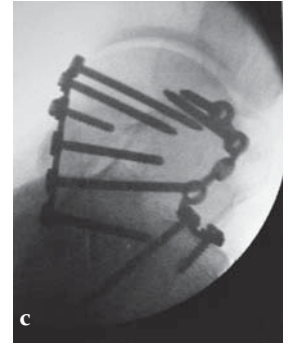
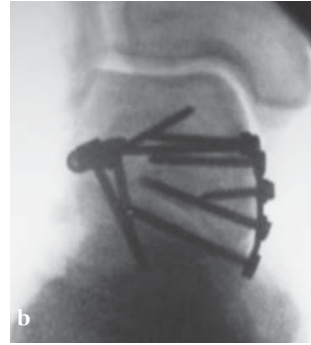
The locking talus plate 2.4 is a 6-hole plate that can accept 2.4mm locking or 2.7mm locking head screws. The plate can be contoured to fit on either the medial or lateral side of the talus. If necessary, one or more locking holes can be cut off to assure proper fit the talus.



**Fig 1**  
**Preoperative.**



**Fig 2a-c**  
**Postoperative.**



#### Locking Navicular Plate 2.4

The locking navicular plate is designed for dorsal application but can be used medially as well. It has multiple points of fixation on the main row, which sits proximally and the arms, which sit distally. The plate can be contoured as needed to fit the navicular, and to make sure the screws do not penetrate the hemispherical underlying talonavicular joint.



**41-year-old male with a motor vehicle accident.**

**Fig 1a-b**  
**Preoperative x-rays.**



**Fig 2a-b**  
**Postoperative x-rays.**



### Expert Hindfoot Arthrodesis Nail (HAN)

The Expert hindfoot arthrodesis nail (HAN) is indicated to facilitate tibiotalar calcaneal arthrodesis to treat severe foot/ankle deformity, arthritis, instability, and skeletal defects; these include, but are not limited to neuro-osteoarthropathy (Charcot foot), avascular necrosis of the talus, failed joint replacement or failed ankle fusion, distal tibial fracture nonunions, and osteoarthritis, rheumatoid arthritis and pseudoarthrosis, and tumor resection and reconstruction.

The cannulated hindfoot arthrodesis nail has a lateral bend of 12° which allows an entry point in the center of the lateral column of the calcaneus. The nail enables proper hindfoot alignment and restores 3–5° hindfoot valgus positioning.

The nail design, a rotating insertion handle and the aiming arm enable targeted medial-to-lateral or lateral-to-medial proximal locking. Distal locking options are with spiral blade in the calcaneus for more stability in osteopenic bone, with a 6.0 mm Stardrive™ locking head screw from the calcaneus into the cuboid, or with a 5.0 mm Stardrive™ locking head screw from the talus into the navicular or further distal in the medial column. An end cap for screws and for spiral blades is available.

As part of the Expert nail family, the HAN uses most of the instrumentation of the humeral, femoral and tibial nails, except for an extended length 5.0mm calibrated drill for extra long 6.0mm locking head screws.

The nails are available in 10, 12 and 13 mm diameters, in 150, 180, and 240 mm lengths, right and left designs.

**42-year-old, female with severe insulin-dependent diabetes mellitus (IDDM); Charcot foot, wheel chair since 1 year.**

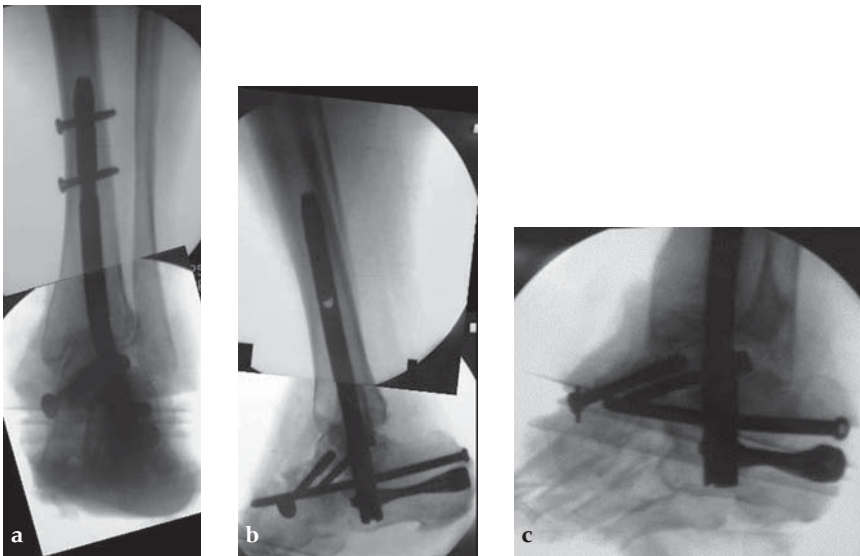


**Fig 1a–c**  
Preoperative x-rays.





**Fig 2a–c**  
Preoperative soft-tissue condition.

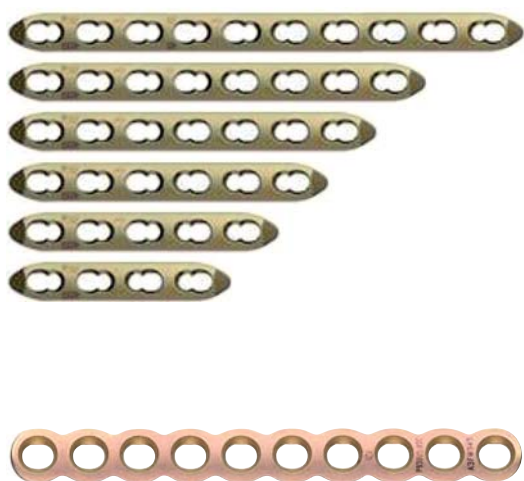


**Fig 3a–c**  
Image intensifier check postoperative.



**Fig 4a–c**  
Follow-up 3 months after surgery; Patient can walk for about 15 minutes, and stand on the foot without pain.

Case provided by Hermann Bail, Berlin, DE



### Modular Mini Fragment LCP 2.0, 2.4, 2.7

The modular mini fragment LCP system (in some countries it is called the LCP compact hand system) is intended for fixation of fractures, osteotomies, nonunions, replantations, and fusions of small bones and small fragments, particularly in osteopenic bone.

The modular mini fragment LCP system includes 2.0 mm, 2.4 mm, and 2.7 mm modules. Several plates were added to the existing set to provide more variety and to keep the plate lengths and number of holes consistent for all the different modules. These are the LCP 2.7 with 10, and 8 holes, and the LCP 2.7 adaption plate with 12 holes. Both versions are available in stainless steel or CP titanium.

Furthermore, a 40 mm length, 2.0 mm cortex screw, self-tapping with Stardrive™ recess (in stainless steel and CP titanium) has been added to the set.

### Female, 10 years, after bone tumor (Ewing's sarcoma) resection and allograft implantation, fistula to necrotic allograft.

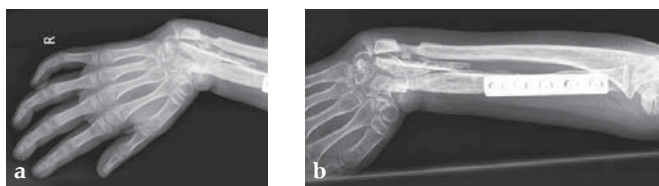


Fig 1a-c

a-b Preoperative x-rays.

c Hand without any function.



Fig 2a-b Resection of necrotic radius, temporary ExFix and pallacos spacer.



Fig 3a-b

- a Microvascular osteocutaneous free fibula flap for reconstruction of radius and dorsal skin.
- b Proximal osteosynthesis with two screws and arthrodesis of wrist with LCP 2.7.

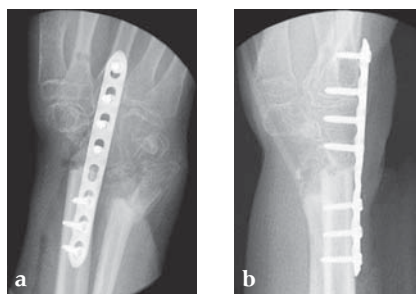


Fig 4a-c Postoperative.

Case provided by  
Martin Langer,  
Münster, DE



Fig 5a-b Outcome after 2.5 months.



Takeshi Sawaguchi, Kodi Kojima, Michael Blauth, Michael Suk, Christoph Sommer, Michael Schütz, Toru Sato, Philip Kregor

## NEW LOWER EXTREMITY PRODUCTS

### PFNA Asian Size

The design of the PFNA was developed based on the anatomy of the Caucasian population. For the average Asian patient, the fit of these implants is not optimal. Therefore, cadaver studies using CT scans were performed to adapt the design of the PFNA to the anatomy of the Japanese and other Asian population.

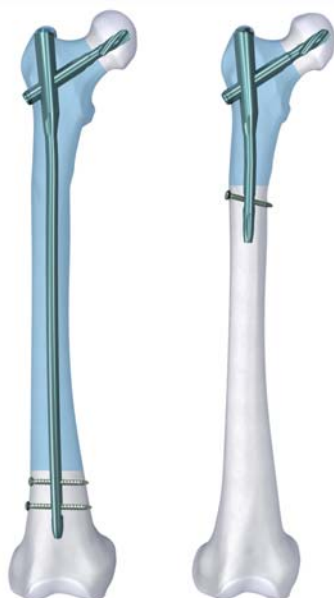
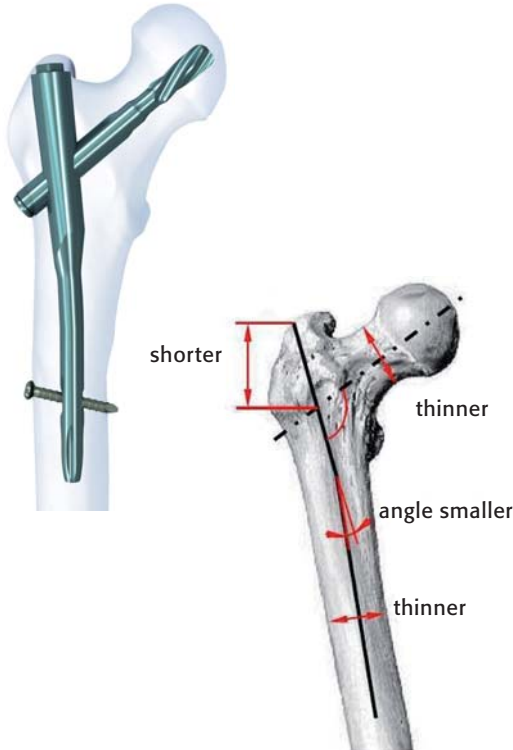
The PFNA Asian size has a better fit to the smaller trochanteric area and narrower intramedullary canal of the Asian population. It features a lateral flat surface which makes insertion easier and lowers the pressure on the lateral cortex. The bend has been reduced to 5° versus 6° compared to the PFNA. The proximal diameter has been reduced to 16.5 mm (versus 17.0 mm). Furthermore, the spiral blade diameter has been reduced to 10.3 mm.

The PFNA Asian size comes in four different distal diameters from 9–12 mm, each in three lengths (170, 200, and 240 mm\*). The long PFNA Asian size (300 and 340 mm) is available in two distal diameters of 9 and 10 mm. Additional lengths of 260–420 mm in 20 mm steps are planned. The blade is available in lengths of 75–120 mm in steps of 5 mm. The nail is made out of titanium aluminium niobium (TAN) and sterile packaged.

In addition, some selected instruments have also been specifically designed for the smaller stature of the population and to the needs of the Asian surgeons.

The PFNA Asian size is indicated for pertrochanteric fractures (Müller AO Classification 31-A1 and 31-A2), intertrochanteric fractures (31-A3), and high subtrochanteric fractures (32-A1). The long version is indicated for low and extended subtrochanteric fractures, ipsilateral trochanteric fractures, combination fractures in the proximal femur, and pathological fractures.

\* The 240 mm nail comes in two different distal diameters 9 and 10 mm only.



**90-year-old male, injured by fall down.**



**Fig 1a–b**  
Preoperative x-rays.



**Fig 2a–b**  
X-rays 2 weeks after surgery;  
patient could stand and walk  
with one cane.



**Fig 3a–b**  
X-rays 6 months postoperative.



Case provided by Toru Sato, Okayama, JP

**77-year-old male.**



**Fig 1a–b**  
Preoperative x-rays.



**Fig 2a–c**  
Postoperative x-rays.



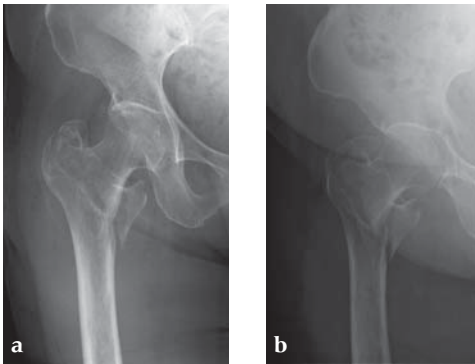
**Fig 3a–c**  
X-rays 3 months postoperative.



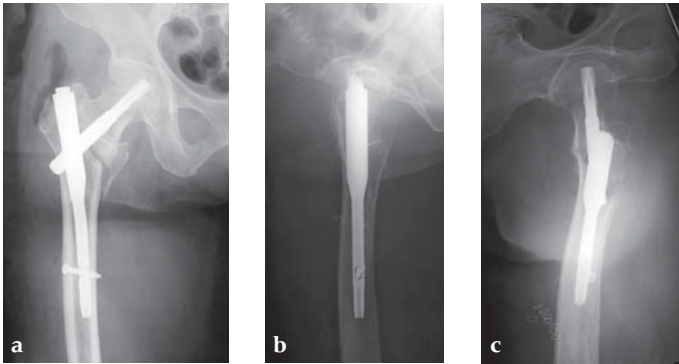
Case provided by Takeshi Sawaguchi, Toyama, JP



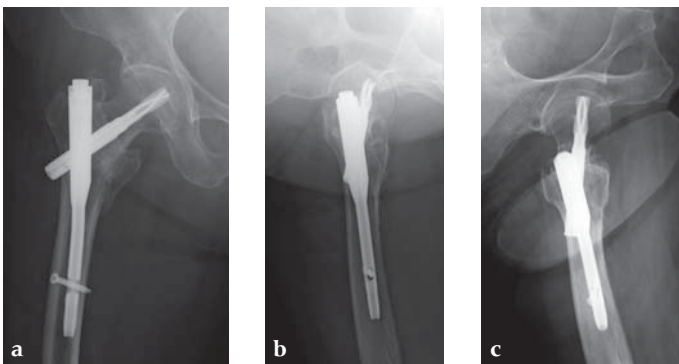
**78-year-old female.**



**Fig 1a-b**  
**Preoperative x-rays.**



**Fig 2a-c**  
**Postoperative x-rays.**



**Fig 3a-c**  
**X-rays 3 months postoperative.**

Case provided by Takeshi Sawaguchi, Toyama, JP

Sabine Goldhahn

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

## Japanese Proximal Femoral Nail (Antirotation) Study

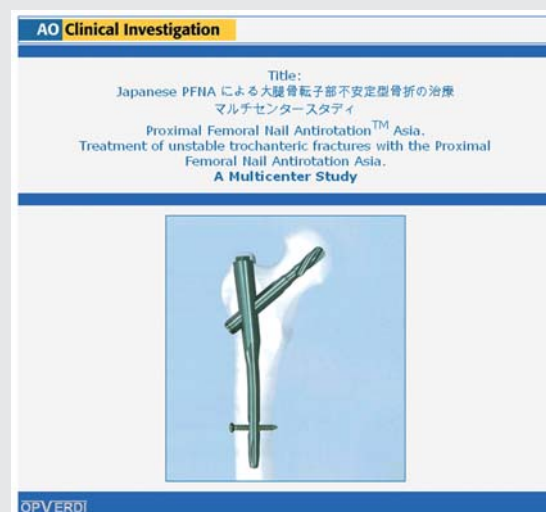


Fig 1

## The AO's First Completely Bilingual Study

AO Clinical Investigation (AOCID) has, in cooperation with Japanese colleagues, initiated the first multicenter study in orthopedic trauma in Japan. The proximal femoral nail antirotation Asia (PFNA study) will occupy Japanese researchers at 29 hospitals over the next 2 years. The first patients were already included. When the study is completed, more than 300 cases of patients over 65 years with proximal femoral fractures (more specifically isolated, unstable, closed trochanteric fractures) will have been examined. Among Japanese patients aged 65 years and older with proximal femoral fractures, the proportion of those aged 90 years and older has increased over the last decades from 3% in 1983 to nearly 20% in 2004. One reason for this is the increasing number of patients with osteoporosis in the older population. Compared to other ethnic groups, Asian people have the lowest bone mass.

## Study background

The idea for the study came from the Asian Trauma Working Group (ASWG) because Asian people have different geometric proportions of the femoral bone compared to European or American populations. For example, studies have shown that Asian women have shorter femoral necks, smaller femoral neck angles, and a more anterior bowing of the shaft than white Americans. The new PFNA Asia has specially adapted sizes and geometry to better suit the local population. It boasts a flat lateral side, higher bending point of the nail resulting in a straighter tip point, a smaller medial-lateral bending of 5°, and adapted surgical instruments. Japanese doctors were the driving force behind the development of the PFNA Asia and are pivotal to this study. In addition to the principal clinical investigator, Dr Takeshi Sawaguchi, Drs Tadashi Tanaka, Yasuhiro Nanri, and Atsushi Sakurai are also central to the study's success.

Although original PFNA have been in clinical use since 2005 in Japan, no data on the rate of mismatch are available yet. Therefore, one of the study's goals is to determine whether potential mismatch exists between the new PFNA Asia and Japanese patients, and whether both Japanese patients' and surgeons' needs will be met.

ベースラインモジュール > 受傷状況 (Description of injury) 0210 受傷状況 (Description of injury)

15. 受傷状況 (Description of injury)

15.1 受傷日 (Date of injury) [日/月/年] 19/11/2007

15.2 受傷機転 (Mechanism of injury)

15.2b 交通事故 ※ 具体的に記入ください (Traffic accident ※ specify)

15.2c その他 ※ 具体的に記入ください (Other ※ specify)

15.3 患肢 (Side of fracture) 右股骨 (Right femur)

15.4 AO分類 (AO classification) 31-A2

Fig 2

### Objectives of the study

The primary objective of this prospective multicenter case series is to assess any fracture fixation complication and revision rates during the clinical use of the proximal femoral nail antirotation Asia (PFNA Asia) for the treatment of unstable, closed trochanteric fractures, classified according to the Müller AO Classification type 31-A2 or 31-A3. Fracture fixation complications include any bone/fracture- or implant/surgery-related event.

In addition to the assessment of potential mismatches of femoral medullary cavity and the PFNA Asia at the femoral great trochanter (lateral to blade insertion point), the middle medial portion and distal end of the nail are investigated: soft tissue, wound or general complications, prognostic factors for the occurrence of complications (eg, bone mineral density, dementia), length of hospital stay, walking ability, capacity to return to pre-injury status, quality of life, mortality, anatomical restoration (clinically and radiographically), length of surgery (skin to skin time) and operative handling of the implant and the instrumentation.

The follow-up schedule applying to this study includes initial hospitalization, as well as follow-up visits at 6 weeks, 12 weeks, 6 months and 12 months (these are the defined time intervals). The final evaluation of x-rays and complications will be performed by a study review board at the end of the study.

### First completely bilingual study

Every document in the study is written in both Japanese and English. For example, every question on each case report form is asked in Japanese and English. The aim of this is to ease the filling out of the case report forms for Japanese colleagues. Additionally, for the first time, the OpVerdi database has been completely created in both languages. This naturally created a lot of work for the AO's team of computer specialists due to the different characters used in both languages. The key to success for the planning phase of this study was the close collaboration between the principle clinical investigator (PCI) in Japan and the responsible AOCID study manager, despite a distance of more than 10,000 kilometres between them.

ベースラインモジュール > 手術詳細 (Operation details) 0212 手術詳細 (Operation details)

17. 手術詳細 (Operation details)

17.1 手術日 (Date of surgery) [日/月/年] 22/11/2007

17.2 皮切から縫合までの手術時間 (Length of surgery, skin to skin time) 37 min

17.3 患肢の側 (Side of surgery) 右股骨 (Right femur)

17.3b その他 ※ 具体的に記入ください (Other ※ specify)

17.4 インプラントの長さ (Length of implant) 170 mm

17.5 固定法 (Fixation method) Distal locking

17.6 インプラントアングル (Implant angle) 125°

17.7 ディスタルロッキング (Locking type, distal) Distal locking

Fig 3



### **SureLock**

The current standard technique for distal locking of intramedullary nails is the freehand technique. This requires an experienced surgeon in order to hit the hole correctly. Even if the procedure is performed quickly, the surgeon is exposed to radiation.

During the nail insertion there is almost no deformation of the nail in torsion and varus-valgus, but a small deformation can occur in the AP plane. SureLock allows simple, fast and precise distal locking despite this deformation, without making a hole in the anterior cortex, in long proximal femoral nails as the PFN, PFNA, and TFN and decreases surgeon's exposure to radiation.

The OR technique has three main steps after the SureLock has been assembled and calibrated to the respective nail. First, the C-arm is rotated until it is in the exact same plane as the nail-aiming-arm construct. This is achieved by rotating the C-arm until the dotted line on the lateral side of the aiming arm is overlying the median line on the medial side of the aiming arm. This can be done either by eye or with exact calculation of the degrees using the scales on the aiming arm. Secondly, the aiming arm is tilted until it is lined up with the nail. This can again be done either by eye or by calculating the millimeters the aiming arm needs to be moved. Finally, drilling through the sleeve assembly and insertion of the screws.

The technique is easy to learn, simple to use, and so precise that even unexperienced surgeons can hit the distal hole on a first attempt. Furthermore, SureLock enables more working space for the surgeon since the C-arm does not need to be positioned perpendicular to nail (drilling not in axis with C-arm).





### R/AFN Arm for Proximal Aiming Device

The retrograde/antegrade femoral nail (R/AFN) is a cannulated intramedullary nailing system for the treatment of distal femur and/or diaphyseal fractures of the femur in which a retrograde approach is indicated. The R/AFN also enables fixation of fractures of the femoral shaft with an antegrade approach through the piriformis fossa.

A proximal aiming device (PAD) enables surgeons to lock the nail distally and proximally completely without fluorescent x-ray. After determination of the nail length the surgeon must calibrate the proximal aiming device to the proposed nail. The proximal guide part leads to the correct location and orientation of the locking holes of the nail. For drilling and screw placement, the proximal guide is used in the same way as a normal aiming arm. Compared to the free-hand technique, the PAD offers a simple and effective solution for proximal locking of short nails.

For the short R/AFN (160–200 mm), a new proximal aiming arm enables distal and proximal locking. It consists of a long aiming arm which is mounted onto the R/AFN insertion handle. The arm features drill holes for the proximal interlocking. It also accepts two inserts for distal interlocking, one for distal standard locking and one for distal spiral blade locking.

An aiming sleeve 12.0/8.0 mm with crosshairs, length 188 mm is used to check if the nail locking holes are still in line with the aiming arm holes.

### R/AFN Guiding and Calibration Unit

The calibration unit and the guiding unit allow for proximal interlocking with short R/AFN (160–200 mm length) using the proximal aiming device (PAD). Compared to the distal femur nail (DFN) the distance between the calibration pins is smaller since the R/AFN proximal interlocking holes are closer together.

The guiding unit is mounted onto the arm of the PAD and used in combination with the calibration unit for proximal locking of the short R/AFN.



### Dynamic Hip Screw (DHS) Blade

The dynamic hip screw (DHS) blade is indicated for pertrochanteric fractures of type 31-A1 and 31-A2, intertrochanteric fractures of type 31-A3 (in combination with the trochanteric stabilizing plate), and femoral neck fractures 31-B according to the Müller AO Classification. It is especially appropriate for use in elderly people with osteopenic/porotic bone.

The DHS blade replaces the DHS screw. Due to the shape of the blade and the locking mechanism there is better rotational stability of the femoral head neck fragment which reduces the risk of cut-out, delayed union and varus angulation in unstable trochanteric fractures. The blade allows for compaction of the bone which leads to better anchorage of the implant in the femoral head, especially beneficial in osteoporotic bone. In a cadaver model performed at the AO Research Institute (ARI), the superior performance of the DHS blade regarding cut-out resistance compared to the DHS screw could be shown (see separate article).

The surgical technique of the DHS blade is very similar to the existing DHS. The only difference is that the DHS blade is hammered into position compared to the screw which is turned into position. The rotational locking of the DHS blade takes place after the alignment of the DHS plate onto the femoral shaft to enable a rigid construct. The locking takes place with a special screwdriver and a 1.5 Nm torque-limiting attachment. No additional antirotational screw cranial to the DHS blade is necessary (contrary to the original DHS screw).

### Müller AO Classification type 31-A2 fracture in an 83 year-old female with severe osteoporosis.

The DHS blade is fully compatible with the existing DHS plates. It is available from 65–145 mm in increments of 5 mm in both stainless steel and titanium. It is only available sterile.

Case provided by Christoph Sommer, Chur, CH

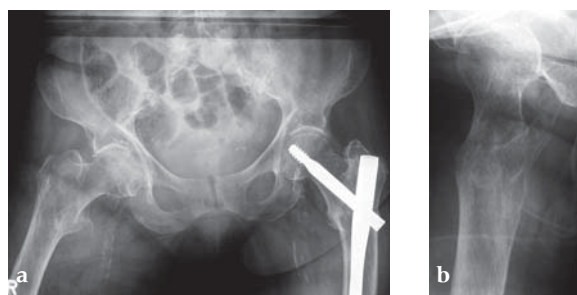


Fig 1a–b  
Preoperative x-rays.

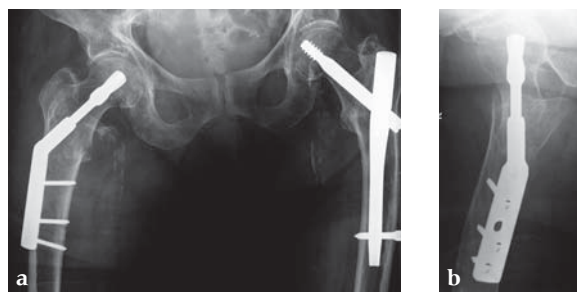


Fig 2a–b  
X-rays postoperative.

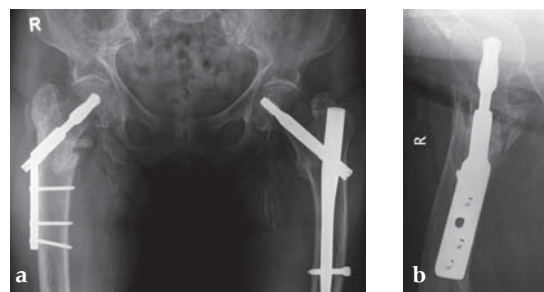


Fig 3a–b  
X-rays after 6 months; no clinical problems.

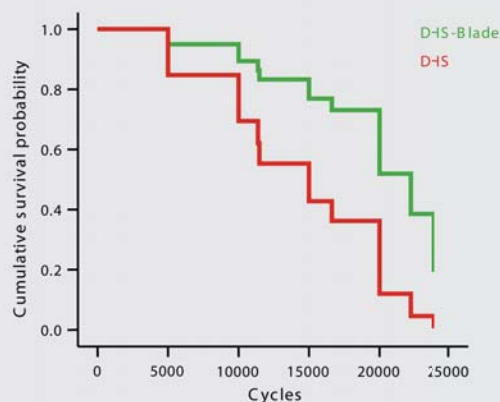
Karsten Schwieger, Markus Windolf

PRODUCT RELATED NEWS FROM THE AO RESEARCH INSTITUTE (ARI)

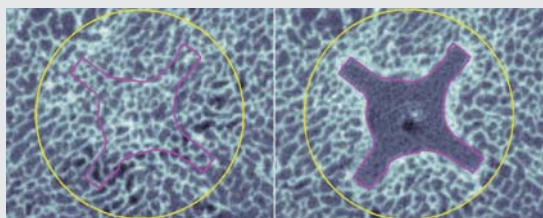
## Treatment of Unstable Femoral Neck Fractures



**Fig 1**  
Unstable femoral neck fracture model with posterior and medial bone wedges removed.



**Fig 2**  
Survival probability of the DHS (red) and DHS blade (green).



**Fig 3**  
Cancellous bone structure before (left) and after insertion of the DHS blade (right).

### Is the DHS Blade a Superior Alternative to the Dynamic Hip Screw?

#### Objective

The dynamic hip screw (DHS) is a well established implant for treatment of trochanteric and femoral neck fractures. However, cut-out of the screw as a postoperative complication occurs in 1–6% of all clinical cases. The DHS blade has been developed as an alternative to the screw to reduce the cut-out rate. This in vitro study compares the DHS blade to the standard DHS with regard to cut-out resistance of the implant in an unstable femoral neck fracture model.

#### Materials/methods

Ten pairs of human cadaveric femora were used. Left and right bones of every femoral pair were randomly instrumented with either a DHS blade or a DHS using 4-hole side plates. Tip-apex distance was standardized to 10 mm. After implantation an unstable type 31-B2 fracture according to the Müller AO Classification (Fig 1) was created using a custom-made saw guide. Cyclic loading was performed to the femoral head applying load trajectories as measured in vivo in total hip replacement (THR) patients (Bergmann et al., 2001). The passive function of the iliotibial band was simulated by a cable. Starting at 1500 N the peak load was increased by 500 N every 5000 cycles until cut-out or complete failure of the construct. X-rays were taken at 5000 cycle intervals. A survival analysis was performed based on the numbers of cycles until cut-out, defined as the first visible implant migration as determined from x-rays.

#### Results

With the applied loading regime a total of 100% cut-outs occurred in the DHS group compared to 50% in the DHS blade group. The survival probability in terms of cut-out resistance was significantly higher for the DHS blade (Fig 2) ( $P = .023$ ).

#### Conclusion

Based on the data available, we conclude that the DHS blade performs superior compared to the DHS in terms of cut-out resistance under cyclic loading. This might be due to cancellous bone compaction around the helical blade during implant insertion (Fig 3), which should be investigated in further studies. This in vitro study supports the usage of the DHS blade in order to reduce the cut-out rate in treatment of unstable femoral neck fractures.



### LCP DHS with Collar

The LCP DHS with collar is used to treat femoral neck, inter- and pertrochanteric fractures. The LCP DHS with collar is a modification of the existing DHS. The collar allows for a moderate lateral buttress and accommodates the head of the antirotational screw. Additional features are the LCP holes and a bullet nose at the distal end. The angle of the collar is 15° and has been specifically designed to match the Asian anatomy. The LCP DHS with collar is compatible with the trochanter stabilization plate and the locking trochanter stabilization plate.

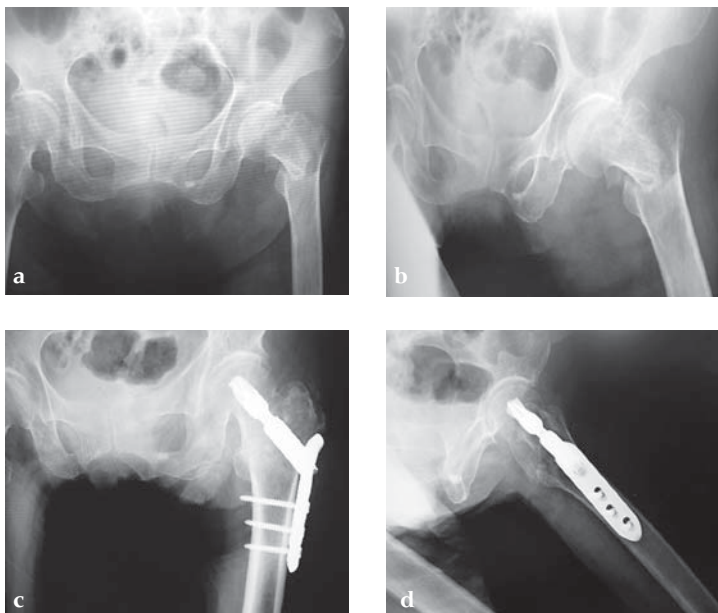
The surgical technique of the LCP DHS with collar is the same as that of the DHS. The only difference is that the antirotational screw must be inserted through the collar. However, the changes in geometry of the LCP DHS with collar (collar, LCP hole, undercuts, bullet nose at the distal end of the plate) offer the surgeon the possibility to achieve angular stability of the fixation and to choose a less invasive approach. Undercuts help to improve the periosteal blood supply.

The clinically well established geometry of the barrel (sliding mechanism) has not been changed.

The static test reveals a slightly higher stiffness for the new LCP DHS with collar plate/screws system compared to the standard DHS plate/screw system. With all performed dynamic tests the plate is the critical component of the DHS system and is the first to fail.

The LCP DHS with collar is currently available in titanium aluminium niobium (TAN) only. The system will start with sizes 135° (3–5 holes) and 140° (3–5 holes). Additional sizes will be added later.

### 80-year-old female.



**Fig 1a–d**

**a–b Preoperative x-rays.**

**c X-ray 4 weeks postoperative.**

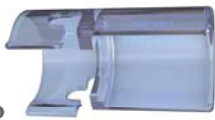
**d Postoperative x-ray.**

**Case provided by Takefumi Kuroki, Fukuoka, JP**





Reamer Head



Locking Clip



Drive Shaft with Locking Clip



Irrigation-Aspiration Tube

## Reamer—Irrigator—Aspirator (RIA)

### Introduction

The RIA is indicated for the treatment of acute fractures of the femur in preparation for acceptance of an intramedullary implant or prosthesis and for harvesting intramedullary reamings for bone grafting.

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 contents which is then evacuated through the aspiration tube.

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. These procedures include spinal fusion, joint arthrodesis, total joint replacement, fracture repair, nonunion, maxillofacial reconstruction, pathology sampling and tumor removal.

### Reamer Head

Expanding the range of options for intramedullary sizing, the RIA system reamer heads are now available in additional diameters of 11.0, 17.5, 18.0, 18.5, and 19.0 mm. This will offer an overall range from 11.0–19.0 mm in 0.5 mm increments. They are sterile packaged and intended for single-patient use.

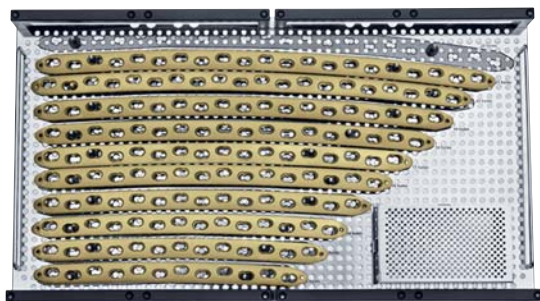
### Locking Clip

A locking clip to prevent the RIA tube assembly from detaching from the RIA drive shaft during reaming has been added. The locking clip is attached to the RIA system after the drive shaft has been connected to the tube assembly and is designed to clip and remain in place during reaming. The locking clip is sterile packed and intended as a disposable, single-patient use item.

### Irrigation-Aspiration Tube

Specially sized irrigation-aspiration tubing has been designed to further facilitate adequate aspiration. A small plastic clip can be used to close off the irrigation until reaming begins.

The tubes come together in one sterile package but can easily be separated from each other so that they can be attached to the two locations in the operating room.



### **LCP Broad Curved 4.5/5.0, 19–26 holes**

For diaphyseal fractures in tall patients with an extended comminuted fracture zone the existing line of LCP broad curved plates 4.5/5.0 from 12–18 holes are too short. There is also a need for longer plates due to an increasing number of periprosthetic fractures. The LCP system with its possibility of angular stability aids in treatment of such fractures.

The LCP 4.5/5.0 features a radius of 1500mm according to the ante curvature of the femoral shaft (similar to LISS/LCP DF and UFN). A bullet nose enables minimal invasive surgery and undercuts preserve the blood supply.

The existing line of LCP broad curved 4.5/5.0 from 12–18 holes was extended up to 26 holes (479mm length). The plates are available in stainless steel and CP titanium.



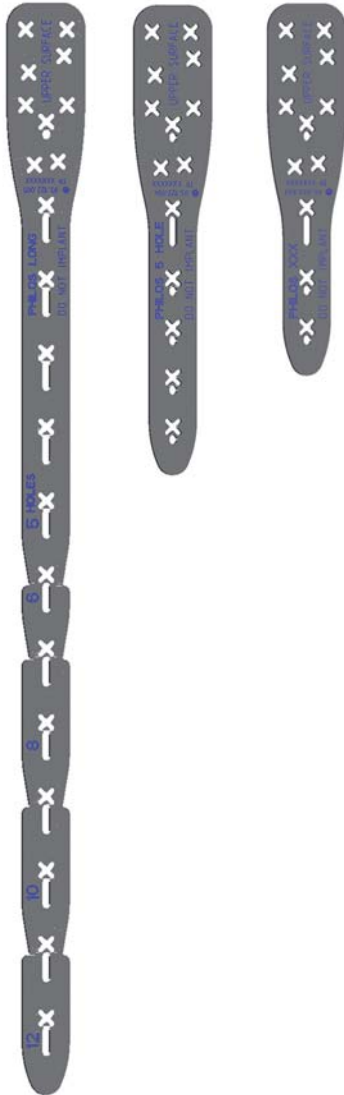
### **Cannulated 4.0mm Hex Cerclage Cable Buttons**

The cannulated 4.0mm hex cerclage buttons are part of the orthopedic cable system. Cables placed through such buttons can be used for temporary reduction of spiral fractures and for additional fixation when screws are not possible, particularly in treatment of periprosthetic fractures.

Cable buttons help to position the cable over screws and prevent slippage. Currently, cable buttons exist for noncannulated screws. The new cannulated cable buttons fit the recess of 5.0mm, 6.5mm and 7.3mm cannulated screws. The cerclage buttons are available in titanium and stainless steel.

Norbert Südkamp

## NEW UPPER EXTREMITY PRODUCTS



### PHILOS Sizing Templates

The PHILOS sizing templates are a simple solution for the intraoperative selection of implant size. They are designed for surgeons working with sterile packaged implants where a visual comparison of the implant to the fracture pattern is impossible without opening the package and to ensure maximum precision in determining the correct implant size.

The templates are available in three lengths, equivalent to PHILOS 3-holes, 5-holes, and long. The outer contours reflect the shape and size of the implants. They can be washed and sterilized. Temporary positioning with 1.6 mm K-wire is possible.

Philipp Lobenhoffer

## NEW KNEE PRODUCTS



### TomoFix Medial Distal Femur (MDF)

The goal of distal femur varus osteotomy is to shift the mechanical leg axis from the lateral to the medial compartment. There are various possibilities for surgical correction of valgus malalignment. The AO Knee Expert Group (KNEG) favors closing wedge osteotomy of the distal femur for valgus correction, because open wedge osteotomy on the lateral side causes significant morbidity due to tensioning of the iliotibial tract, and friction over the implant. The KNEG also found that distal femur opening wedge osteotomy did not show the same healing capacity as on the tibia and that bone grafting was necessary to avoid pseudarthrosis. Biomechanical testing confirmed superior stability of medial closing wedge techniques as compared to lateral open wedge techniques and favorable axial and torsional loading characteristics of an angular stable internal fixator, the TomoFix medial distal femur (MDF).

The TomoFix MDF features anatomically preshaped plates with a bending angle of 20°. If needed during the operation, this angle can be further bent by using the bending press. The plate profile is 4 mm. The TomoFix MDF is available in a left and right version. The head of the plate offers four isolated LCP holes for 5.0 mm locking head screws. The screw axes of these four LCP holes are converged by 2°. Through this alignment a cut-out of the screws can be prevented and the distance to the cruciate ligament is improved. The bolt angulation of 15° in the frontal plane enables use of longer screws and thus a more stable fixation. Bolt placement is easy and safe due to the anatomically adapted shape. The plate shaft features four standard 4.5/5.0 LCP combination holes which are shifted throughout the longitudinal axis. The end of the plate has a bullet nose for use of a MIO technique. Specific guiding blocks for the left and right plates help to insert the drill socket in the correct axis onto the plate.

The plate is inserted distally under the vastus medial muscle after screwing the threaded LCP drill guides into the four distal plate holes using the guiding block. The distal drill holes are oriented in a 20° angle inclination on the frontal plane to avoid a posterior perforation of locking head screws in the distal femur.

Biomechanical studies demonstrate that interfragmentary compression has a positive effect on bone healing. For this reason a lag screw is positioned in the dynamic compression unit directly above the osteotomy for compression of the osteotomy site.

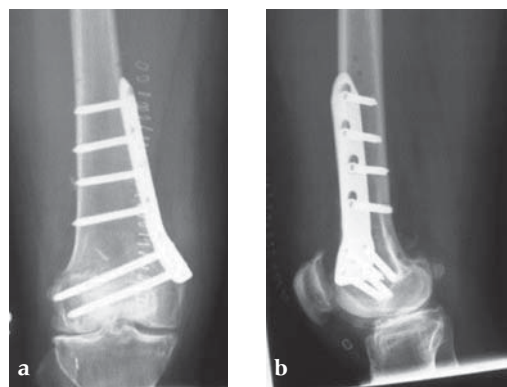


The Patient can be mobilised as early as day one after surgery. Partial weight bearing is recommended for 6 weeks, active movement of the knee is encouraged. X-ray control after 6 weeks should demonstrate bony healing. Full weight bearing can be allowed in many cases after this time period, if the osteotomy site is still painful and bone healing is incomplete, weight bearing should be delayed for further 3–4 weeks.

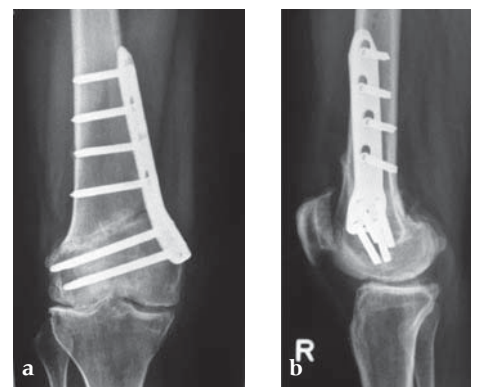
**27-year-old male developed severe lateral joint line pain after lateral meniscectomy.**



**Fig 1**  
Preoperative x-ray.



**Fig 2a–b**  
6° correction was performed to normalize the mechanical axis.



**Fig 3a–b**  
6 weeks postoperative the patient was able to fully weight bear, and had free range of motion.

Case provided by Philipp Lobenhoffer, Hannover, DE

Tim Pohlemann, Jeff Mast, Keith Mayo

## NEW PELVIC PRODUCTS



### Pelvic Spring Plate for Reduction

The pelvic spring plate for reduction is intended for use as a reduction instrument for pelvic and acetabular reconstructive surgery. It is primarily an intraoperative reduction aid and would generally not be part of the final fixation construct.

The plate is 11 mm wide by 3.3 mm thick and has four 2 mm length spikes. It has a 30° prebend between the 2nd and 3rd hole of the plate. At the topside of the bend is a threaded hole to accept screws with a 2.5 mm hex or T15 Stardrive™ recess. The plate is available in stainless steel only.

The plate can be attached to forceps to reduce or keep small fragments in place against larger bone fragments in the pelvis, when the small fragments are too small to use a screw. This is achieved by sinking the two front spikes into the small fragment and pulling towards the larger fragment before pushing the rear spikes into the larger fragment to maintain the reduction. Therefore, the fracture can be reduced in stages.

The plate can also be used as an implant by installing a 3.5 mm cortex or pelvic screw in the 1st or 2nd hole, before removing the forceps and then the screw with 2.5 mm hex or T15 Stardrive™ recess.



### Cannulated Percutaneous Guiding System

The cannulated percutaneous guiding system is a drill guide and soft-tissue protector to assist in pelvic and acetabular reconstructive surgery. The cannulation accepts drill sleeves and 3.5 mm pelvic or cortex screws. A 2.5 mm and a 3.5 mm drill sleeve are part of the system. Localization for screw placement is established by a guide wire, normally with fluoroscopic guidance. The drill guide is then advanced over the guide wire with the appropriate drill sleeve in place. Screw length determination is drill bit based. The guide wire holds position, simplifying screw insertion, and provides an area of alternate starting points if needed.



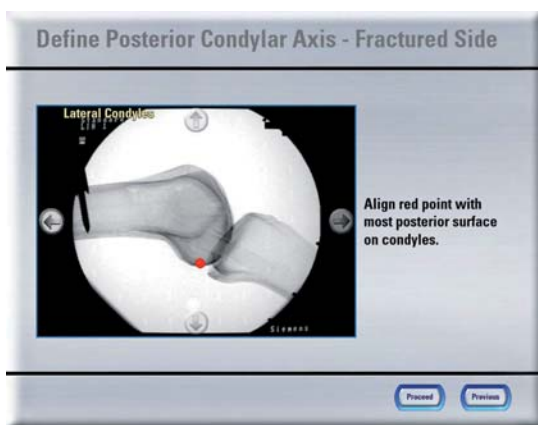
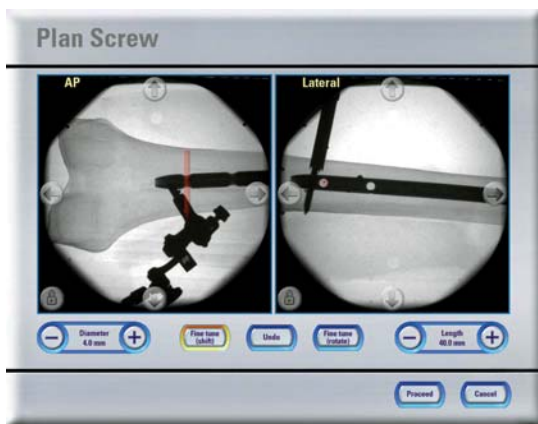
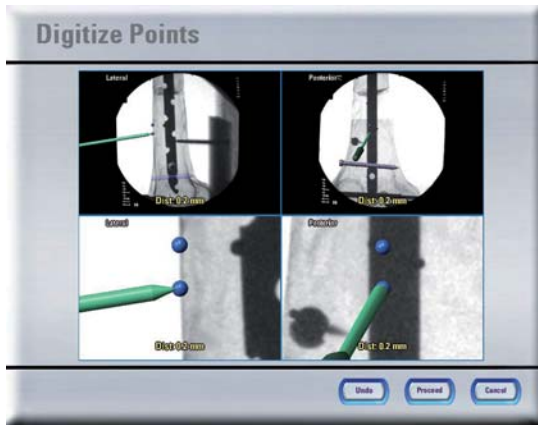
### **Spined Disks—Round and Rectangular**

The rectangular spined disk (13×30) for 6.5 mm ball and the round spined disk (20 mm) for 6.5 mm ball are intended to assist in pelvic and acetabular reconstructive surgery. They are used in conjunction with the reduction forceps.

They are identical to existing round and rectangular disks in the low profile pelvic system, but with spikes added on the bone contact surface. This will limit slippage as force is applied obliquely to the disc on cortical surface such as the quadrilateral surface.

Christian Krettek

## COMPUTER ASSISTED SURGERY (CAS)



### Navigation

#### Surgical Trauma Module

The Surgical Trauma Module for computer-assisted surgery (CAS) is a software solution for a wide range of surgical trauma interventions on a computer platform.

CAS means simultaneous navigation in multiple 2-D images acquired by a C-arm at the same time. Thus fluoroscopic navigation enhances the capability and display options of any regular fluoroscope without extra radiation.

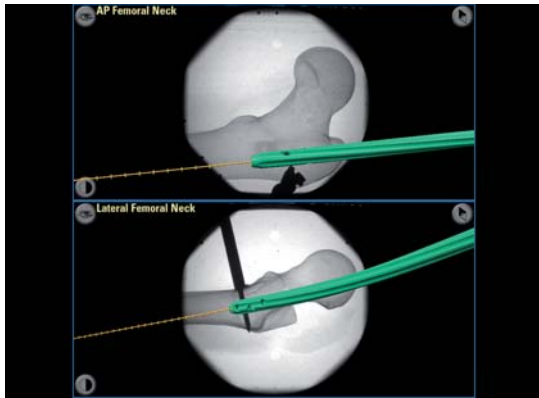
Once acquired, fluoroscopic images are stored by the Surgical Trauma Module. The relevant information on these images (eg, position and orientation of instruments such as drills or osteotomes) is constantly updated throughout the entire procedure. This process is called “virtual fluoroscopy” and is based on real-time tracking of the fractured bones with attached reference arrays. At the same time, the Surgical Trauma Module also precisely displays the position of surgical instruments relative to the treated bones, such as a drill guide or osteotome. By providing simultaneous information on multiple fluoro images CAS improves visualization and minimizes radiation exposure.

An intuitive workflow concept guides the surgeon through the CAS procedure whilst comparing real-time information of the anatomy and surgical instruments to a previously created plan. Another useful function of CAS with the Surgical Trauma Module is the “digital ruler”, which can be applied for a variety of measurements, eg, calculation of the length and diameter of an intramedullary nail, length of screw, femoral neck antetorsion or simply the alignment of a tool in relation to a planned trajectory.

From simple to complex cases the Surgical Trauma Module offers guidance and intraoperative verification of the obtained result. This instant feedback also makes this module an effective teaching and training tool.

Since all steps can be saved together with additional information, such as the time needed to complete a surgical task, the system is also an ideal quality tool to document intraoperative results.





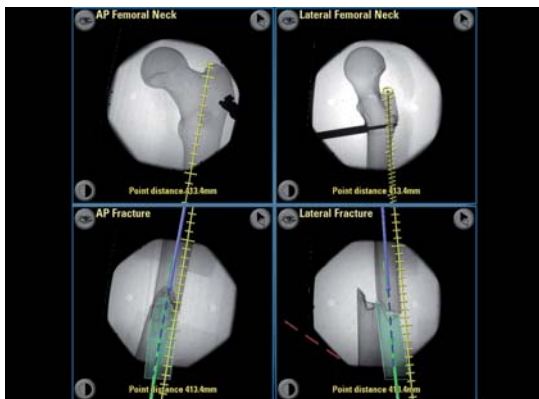
### Axis Reduction and Alignment Module

The Axis Reduction and Alignment Module supports femoral fracture reduction procedures, nail insertion, bone alignment such as torsion (rotation), leg length control, and implant positioning. It is applicable to all extraarticular fracture types from 32-A to 32-C according to the Müller AO Classification.

The module provides reliable quantitative information to restore the prefracture situation with respect to shaft axis alignment, rotation, and leg length, as well as the possibility to restore symmetry to the contralateral side, if it is uninjured. The placement of interlocking screws is also supported without an additional C-arm, thus limiting radiation.

Designed for the intramedullary fixation of femoral shaft fractures, this module can be used for any kind of reduction of shaft or metaphyseal fractures, unrelated to the fixation device.

Intraarticular fracture reduction is not supported by the module.



### Posterior Pelvic Ring Fixation Module

The Posterior Pelvic Ring Fixation Module guides surgeons through the complex anatomy of the pelvis during a screw fixation of the posterior pelvic ring. An easy-to-use interface enables intuitive planning and insertion of sacroiliac screws, based on multiple intraoperatively obtained C-arm images. The display simultaneously shows the surgical instruments in all relevant views (inlet, outlet, AP and lateral), and the surgeon is safely guided to the desired target position. This virtual fluoroscopy also substantially reduces radiation time, and is particularly useful for C-type fractures, according to the Müller AO Classification.



Kenneth A Johnson, Alessandro Piras, Brian Beale, Randy J Boudrieau

## NEW VETERINARY PRODUCTS



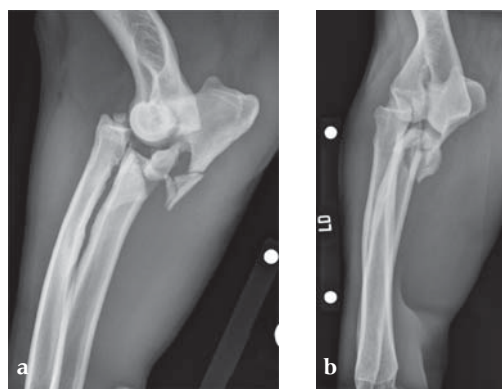
### LCP Broad Plate 3.5

The LCP broad plate 3.5 is indicated for long bone fractures in large breed dogs.

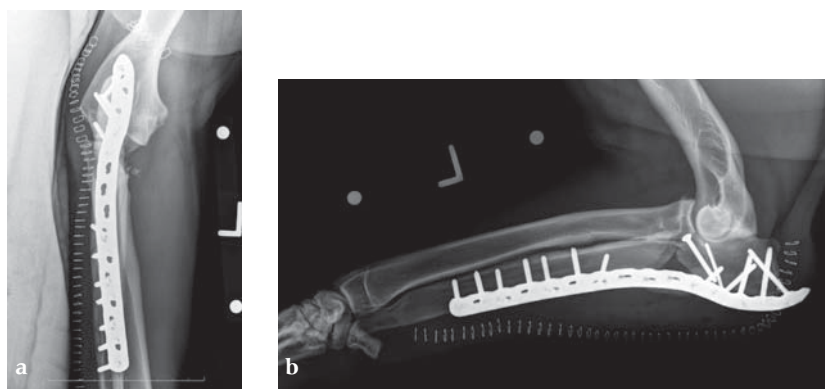
This plate utilizes the standard human LCP with limited contact design, except for a few minor changes. It features a central, stacked combination hole at one end, which facilitates treatment of metaphyseal fractures.

The LCP broad plate 3.5 system contains 14 plates with lengths from 7–22 holes. The holes are staggered. It uses compression screws, 3.5 mm locking head, 3.5 mm cortex, and 4.0 mm cancellous bone screws offering much greater versatility than conventional plates. The implant material is 316L stainless steel. The plates will be housed in the small fragment plate set graphic case. No additional instruments or screws are needed.

**5-year-old male English Mastiff, road traffic accident.**



**Fig 1a–b**  
Comminuted fracture of the left ulna.



**Fig 2a–b**  
Reconstruction of articular component with screws placed in lag fashion. Shaft stabilized with bridging plate fixation using locking head and standard cortex screws.

Case provided by Michael P Kowaleski, North Grafton, MA, US



### Tibia Plateau Leveling Osteotomy Plate (TPLO)

Cranial cruciate ligament (CrCL) injuries are one of the most common canine orthopedic problems. These injuries frequently are treated using tibial plateau leveling osteotomy (TPLO).

The AO Veterinary TPLO system is indicated for osteotomies of the canine proximal tibia. It combines six new plates with a basic instrumentation set. The 6 plates are precontoured to match the anatomic configuration of the proximomedial tibia with a limited contact design. The plates are available in left and right configurations and feature locking screw technology. The plates have three different sizes; 2.7, 3.5, and 3.5 broad according to the screw diameter. Until recently, only the TPLO plate 3.5 had been released, but now all three plate types are available.

The plates and screws are available in 316L stainless steel. The TPLO plates utilize either locking head or compression screws; 2.7 mm and 3.5 mm locking head and 2.7 mm and 3.5 mm cortex, and 4.0 mm cancellous bone screws.

**Three-year-old neutered female Tosa, 60 kg,  
chronic (6 months) lameness, painful stifle.**



**Fig 1a–b**  
X-rays preoperative.



**Fig 2a–b**  
Postoperative x-rays.



**Fig 3a–b**  
10-week follow-up  
shows a healed  
osteotomy.

Case provided by Randy Boudrieau, North Grafton, US

Markus Windolf<sup>1</sup>, Kenneth A Johnson<sup>2</sup>, Karsten Schwieger<sup>1</sup>

PRODUCT RELATED NEWS FROM THE AO RESEARCH INSTITUTE (ARI)

# Biomechanical Consequences of the TPLO PROCEDURE

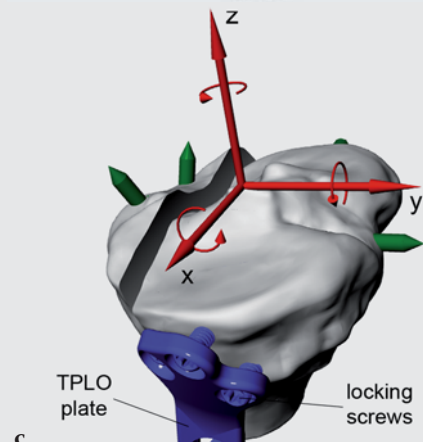
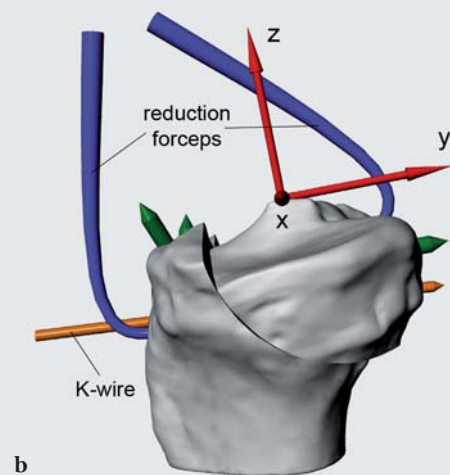
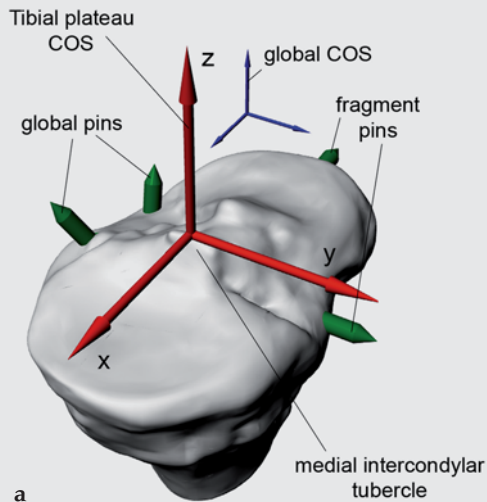


Fig 1a–c

Determination of tibial plateau orientation for the intact bone (a), after osteotomy and provisional fixation (b) and after plate fixation (c).

## Objective

Tibia plateau leveling osteotomy (TPLO) is a surgical procedure developed for the treatment of cranial cruciate ligament deficient stifles in dogs. TPLO is proposed to decrease cranial tibial thrust by controlled rotation of the tibial plateau. Currently, conventional and angular stable plate fixation can be performed to stabilize the cylindrical osteotomy. This study investigated the biomechanical consequences of the procedure including the effect of using either conventional or locking head screws in the tibial plateau fragment.

## Materials/methods

Eight pairs of cadaveric dog tibiae were instrumented with titanium reference pins in order to track the tibial plateau fragment orientation by means of CT imaging. Position of the tibial plateau was determined for the intact bone, after rotation of the fragment, and after plate application (Fig 1). Bones were pairwise instrumented by an experienced surgeon with TPLO plates using either conventional or locking head screws in the tibial plateau fragment. All specimens were biomechanically tested in physiological orientation using cyclic axial compression at 1000 N for 30.000 cycles. Stiffness at the beginning of the test and plastic deformation of the construct at the end of the test were determined in terms of displacement of the machine actuator.

## Results

The conventional screw group revealed a significant larger translation of the fragment towards the plate ( $P = .006$ ) and a greater variance in fragment rotation as a result of plate application (Fig 2). However, maximum deviations of the achieved tibial plateau orientation from the preoperatively planned orientation were up to  $5^\circ$  for both groups. The amount of this rotation correlated significantly with the plastic deformation of the construct after testing in the conventional screw group ( $R = 0.81$ ,  $P = .005$ ). Neither plastic deformation nor construct stiffness were significantly different between conventional and angular stable plate fixation.



### Conclusion

This study demonstrated less variation of the tibial plateau position due to instrumentation with an angular stable TPLO plate. However, the fixation type did not affect the biomechanical stability of the construct. Within the conventional group a higher biomechanical stability can be achieved due to a lower degree of rotation which leads to a larger bony contact between the fragments.

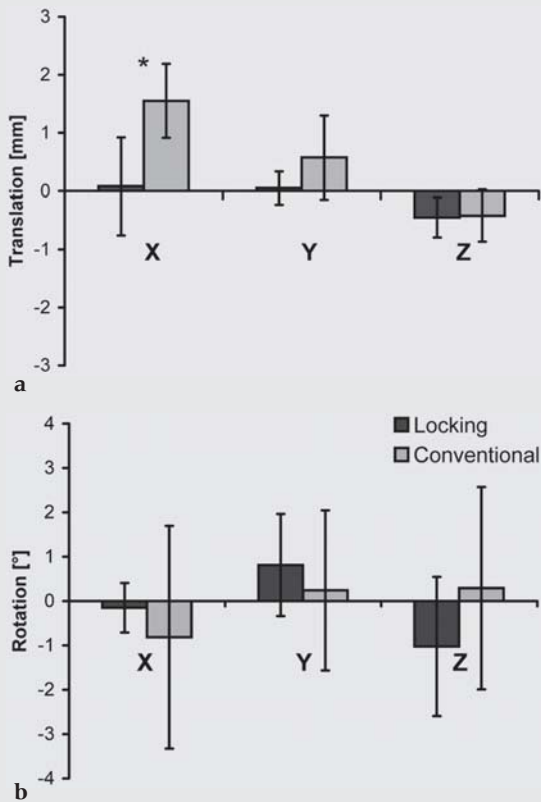


Fig 2a-b

Translation and rotation of the tibial plateau fragment between provisional fixation (a) and plate fixation (b) for both groups. Values are given as mean  $\pm$  standard deviation relative to the coordinate system depicted in Fig 1.

- 1) AO Research Institute, Clavadelstrasse 8, 7270 Davos, Switzerland
- 2) The Ohio State University, Department of Veterinary Clinical Sciences, 601 Vernon, Tharp Street, Columbus Ohio, US



### Small Fragment Plate Set

The implants in the small fragment plate set are indicated for long bone fractures in small breed dogs and cats.

The small fragment instrument and implant system (2.7, 3.5, 4.0) was recently introduced. These systems are now available in a single graphic case which houses the small fragment DCP set, the small fragment LC-DCP set, and the small fragment LCP set.



### Mini Fragment Implant and Instrument Set

The implants in the mini fragment system are indicated for long bone fractures in toy breed dogs and cats.

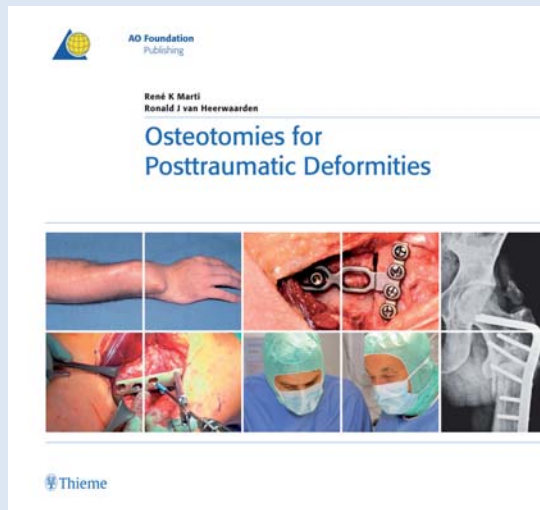
The mini fragment implant and instrument system combines existing 1.5, 2.0, and 2.4 implants (DCP, LC-DCP, and LCP) into an organized set. The implants are made of 316L stainless steel.

The set is designed as a compact, organized storage system in order to fit into the smaller sized autoclaves commonly used in veterinary clinics.



Cristina Lusti

# NEWS FROM AO PUBLISHING



Release in June 2008

**Number of pages: 700**  
**Number of figures and illustrations: 1800**

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## Osteotomies for Posttraumatic Deformities

René K Marti, Ronald J van Heerwaarden

An international group of renowned surgeons present an outstanding hands-on approach to perform correction osteotomies in posttraumatic deformities from the clavicle to the foot.

Most of the content is based on case presentations and each case provides step-by-step descriptions of case history, planning, surgical approach, osteotomy, fixation, rehabilitation, and finally pitfalls and pearls. Hundreds of full-color pictures, precise illustrations, and x-rays demonstrate the significant steps in deformity corrections. Long-term follow-ups demonstrate the efficacy of osteotomies in the treatment of malunions.

In the principles preceding the case presentations relevant theoretical information on posttraumatic deformities and osteotomies, indications, operative techniques, and fixation methods, as well as the formation of a surgical plan is provided.

This book should convince creative orthopedic and trauma surgeons to consider joint-preserving techniques in the treatment of posttraumatic deformities and arthritis.

Frank Kandziora, Robert McGuire

## NEW SPINE PRODUCTS

### ArcoFix and Synex II: the AOSpine Anterior Fracture Solution

AOSpine type A fractures of the thoracolumbar spine account for 66% of all spine injuries. They often cause an initial or, if left untreated, a subsequent kyphotic deformity. Especially the type A2 and A3 fractures commonly require a fusion. Furthermore, these fractures are a symptom of osteoporosis. A very accurate reconstruction and a strong mechanical support is crucial for a good outcome.

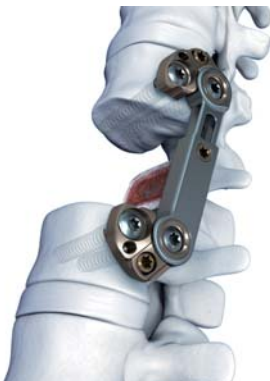
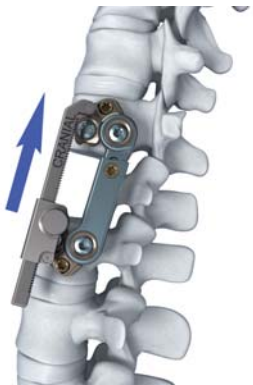
With the ArcoFix/Synex II combination, the AOSpine TK developed straight forward instrumentation for the minimal invasive anterior stabilisation of thoracolumbar tumors and fractures.

The development of this combined system was based on the following requirements:

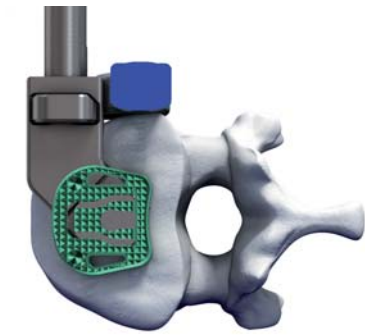
- Implant and instrument must allow a maximum intraoperative versatility with regard to the realignment of the spine (kyphosis correction).
- Ease of use with a short learning curve.
- A less invasive procedure.
- Compatibility with previously developed technology.
- Respecting the AO philosophy for fracture treatment.

### ArcoFix

ArcoFix basically consists of three parts. The telescopic part allows for distraction and compression and the two swivelheads that enable a kyphosis or lordosis correction. Thanks to these unique features, the system allows the surgeon to first insert, position and fix the implant (vertebral body screws) and then perform the kyphosis correction and height restoration before everything is finally tightened (golden screws) and secured.







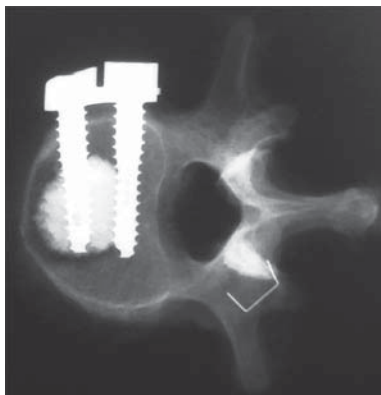
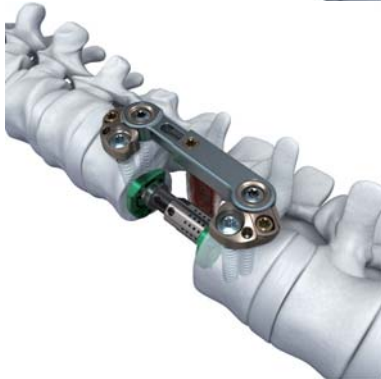
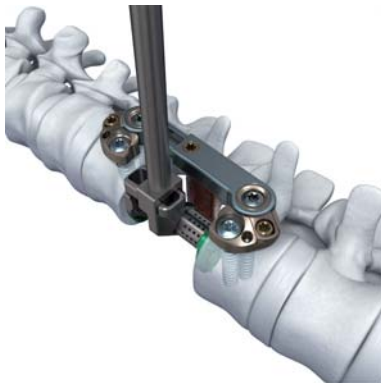
### Synex II

After the fracture is reduced and stabilized, the Synex II expandable cage is introduced with the angled Synex II spreader tip.

Once Synex II is in place it is expanded until the implant and the vertebral endplates are in full contact. Synex II is a modular system. Eight different central bodies can be combined with 15 different types of endplates. This helps to reach an ideal cross-sectional load distribution and thus to provide a very good mechanical support of the previously achieved correction.

The central body of Synex II was slimmed down compared to the Synex I. This leaves more space to be filled with more bone thus promoting fusion.

AOSpine TK approval: The approval of the AOSpine TK for Synex II was achieved last May. The approval for ArcoFix is in progress and is expected after the extensive clinical trial phase which is already underway, and is expected to be finished soon.



### Optional augmentable screws

For the many cases of weak or questionable bone quality the system also offers augmentable vertebral body screws. These screws are canulated with additional cross-holes. This feature allows a cement distribution around the front half of the screw. This results in an area augmentation providing a higher load resistance which then leads to a significant reduction of screw cut-outs.

Injecting the cement with the optimal viscosity, low enough to run around the screw but high enough to not leak out, is absolutely crucial. Therefore the AOSpine TK also developed Vertecem, a system which ensures that the cement always has the ideal viscosity at the time of application.

Scott P Bartlett, Lim K Cheung, Carl-Peter Cornelius, Daniel Buchbinder

## NEW MANDIBLE PRODUCTS

### Mandible External Fixator II

After the release of the first mandible external fixator in July 2004 the feedback from clinicians, often requesting more technical ease and versatility, led to the development of the mandible external fixator II.

Although the mandible external fixator II system comes with many new features, it addresses the same clinical indications as the original system:

- Severe open mandibular fractures
- Highly comminuted closed fractures
- Nonunions and delayed unions (especially associated with infection)
- Tumor resections
- Facial deformity correction
- Gunshot wounds
- Panfacial fractures
- Burn maintenance
- Bone grafting defects

A strong impetus from surgeons was the request for an increased number of snap-on clamps in the kit. Thus, instead of the original eight, the new system contains a larger number of clamps.

The set contains self-drilling anatomic Schanz screws with two thread lengths for each anatomical region (symphysis, body, ramus) and a shoulder stop to prevent overinsertion. The shaft length of the screws is adapted to the local skin thickness and respects the regional geometry of the mandible (symphysis, body, ramus). The Schanz screw shaft allows for use with rapid driver systems.

The 4.0mm titanium connecting rods are available in four sizes (full mandible, full mandible with ramus, three-quarter mandible, and one-half mandible). Anatomically prebent to the mandibular shape the metal rods cover a wide anatomic variety but can be contoured to match individual patient needs with the included rod bender.

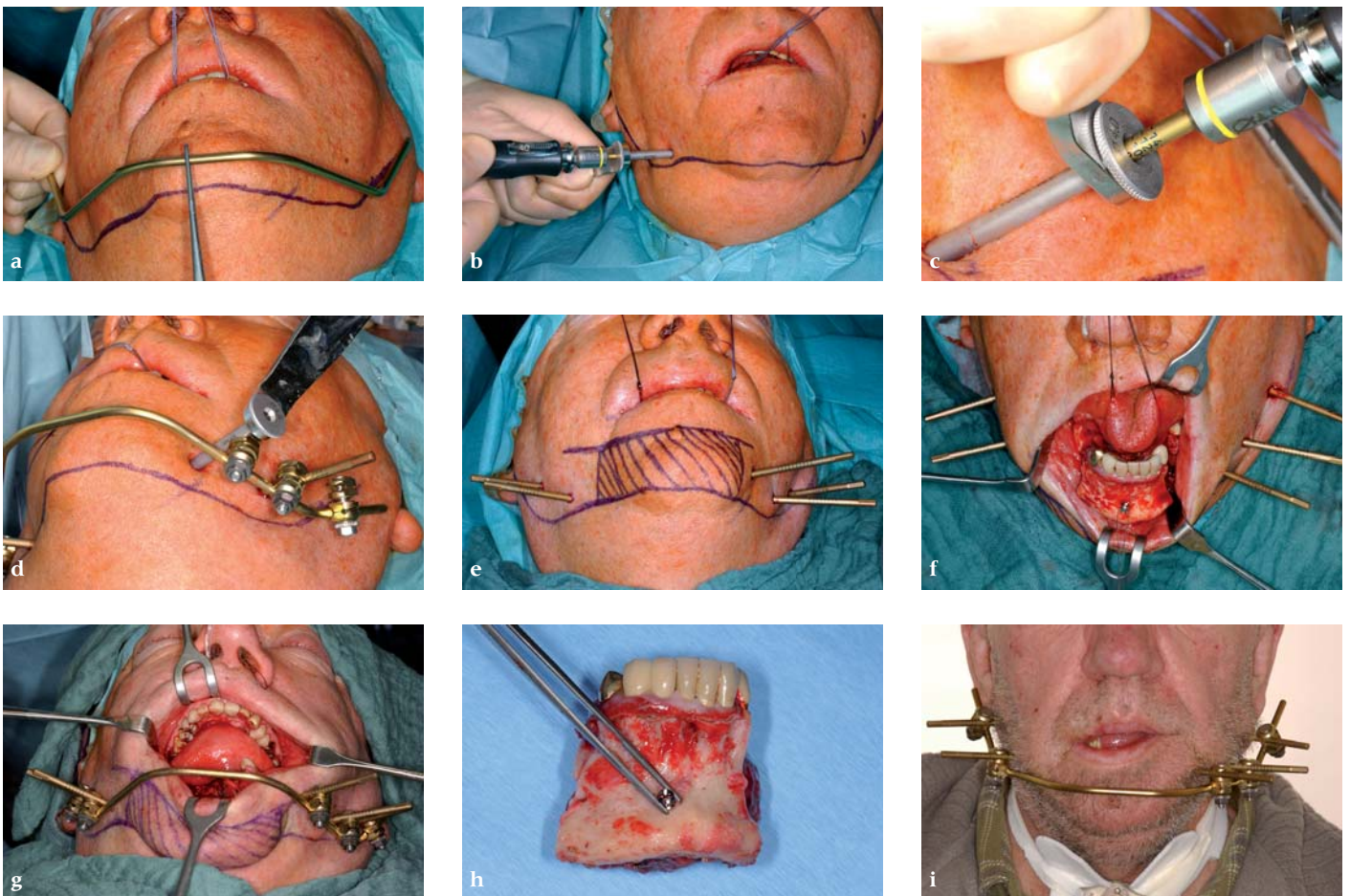
To ensure optimal stability of the framework construction the connecting rods should be positioned approximately one fingerbreadth away from the patient's skin surface, evenly around the mandibular circumference, in order to keep the cantilevers along the Schanz screws short. At least two Schanz screws should be placed on large segments: One in close proximity (10mm) to the fracture or resection line and another one preferably another 10mm away from that.



To allow the surgeon to build a longer modular frame, a new 120 mm carbon fiber connecting rod has been included in the set. Extended carbon fiber rods with lengths of 140, 160, 180, and 200 mm are available on request, but will not fit inside the tray of the graphic case.

Instruments specifically designed for this system are the ratcheting screwdriver handle, the rapid driver and the Schanz screw adapter for tightening of the Schanz screws.

The new mandible external fixator II can be adjusted throughout the whole operating procedure and is MR safe.



**Fig 1a-i**

**Stabilization of the mandible during primary resection of a floor-of-the-mouth carcinoma with infiltration of the symphyseal bone. The sequence shows the application starting in the angles, stepwise assembly, temporary removal of the connecting bar for en bloc tumor resection and remounting.**

Case images courtesy of Carl-Peter Cornelius, München, DE



Norbert Haas

## EXPERTS' SYMPOSIA

Experts' Symposia are a special kind of AO meeting to exchange clinical experience with the latest implants and devices. It was started in the year 2000 shortly after the introduction of the LCP and meanwhile extended to the new intramedullary nail family.



In 2007, three Experts' Symposia were held. Most of the time was spent discussing the cases presented by the participating surgeons. The shared cases were either difficult ones or clinical situations in which problems occurred using the new techniques. The more difficult, original or problematic these cases were, the more interesting the discussion turned out to be. The anonymous response system (ARS) was used so that presentations were halted to ask the audience what they would have done next in the given situation. Typically, during the course of the symposia it became harder and harder to tell the "faculty" and participants apart. The very open and honest exchange has made these events very special and extremely beneficial to improve handling of the new devices. Furthermore, the conclusions drawn from the discussion have been turned into recommendations for AO Education for future teaching in this area.



On July 13–14, 2007, the 2nd Experts' Symposium on intramedullary nailing took place in Innsbruck, Austria. A total of 85 surgeons from 23 different countries participated. In the proximal femur, repositioning is, and will remain, the source of most complications. The spiral blade offers more rotational stability. For fractures of the femoral shaft, the superiority of a lateral entry point compared to the trochanter tip was shown. It was also demonstrated that curved nails are more forgiving than straight nails. In cases of extreme osteoporosis and very distal femoral fractures it was recommended to avoid nailing and to use locking compression plates instead. A study on the new tibia nail (TNS) showed a 13% nonunion rate after one year, a result which is demonstrably better than that found in the literature, but which is still too high. The use of TNS for distal shaft and segment fractures leads to a significant improvement. Proximal tibia fractures remain a complex area and therefore should only be tackled by experienced surgeons.



The first ever Experts' Symposium in the Asian Pacific region took place on August 6, 2007 at the Bumrungrad Hospital, Bangkok, Thailand. A total of 45 surgeons from twelve different countries exchanged their clinical experiences gained using the LCP family. Implant removal was intensively debated because it is over proportionally carried out in Asia at the behest of the patient for traditional reasons, and consequently is an area of Asian expertise. In the case of the proximal humerus, it is repositioning—despite all the advances in implants—which is the cause of most problems. It was recommended to more intensively school course participants in repositioning, eg, in the use of tension band wiring through the holes made for this purpose in the head of the Philos plate.



The Experts' Symposium held in August in Chicago was a double premiere: it was the first one held in the US and it dealt with LCP and intramedullary nailing at the same time. In proximal humerus, it was perceived that the existing plates make it seem too easy to fix these difficult fractures properly. Inexperienced surgeons often underestimate the complexity. Teaching is vital and should include imaging, as poor radiology leads to poor outcome. An increase of incidence of very distal humerus fractures with decreasing fragment size was observed (complex elbow fractures). For proximal femur fractures, a very strong trend towards intramedullary nailing was identified compared to the dynamic hip screw (DHS) due to the faster and easier procedure, less blood loss and more "fun". The lateral femoral nail new entry point enables easier access and less soft-tissue damage. In the distal tibia, plating has a lower complication rate than nailing if a good reduction can be achieved percutaneously. The anterolateral distal tibia plate was perceived advantageous but most surgeons still use the medial approach.

The 3rd AO Experts' Symposium on intramedullary nailing will take place in July 11th, and 12th, 2008 in Mainz, Germany. The 2nd Asian one will be held on August 2nd in Tokyo and deal with LCP and intramedullary nailing which is also the content of the 2nd meeting in North America on January 10th, and 11th, 2009 in Florida.



Thomas Rüedi

## TRIBUTE TO PROF RAMI MOSHEIFF



Rami Mosheiff was born in 1957 in Jerusalem and spent most of his life in that exciting city.

After high school he served from 1975–78 in the Israel Defence Forces as a paratrooper, paramedic and instructor, and has been in the reserves of the medical corps since then.

He graduated in 1985 from the Hebrew University Medical School, Jerusalem with a thesis on “Stress fractures in highly motivated military recruits—a prospective study”. This focused him from the beginning of his residency on orthopedic trauma at the Orthopedic Surgery Department of the Hadassah University Hospital in Jerusalem.

Exactly 20 years ago, and during his residency he attended his first AO Principles Course in 1988 in Davos. In 1991, he received an AO fellowship at the BG Unfallklinik in Ludwigshafen and 2 years later he spent 6 months as a research fellow at the ARI in Davos, studying the “distraction osteogenesis in the treatment of severe bone defects”. Dr Mosheiff spent most of 1994 abroad again as a fellow in orthopedic trauma surgery with 2 months each at the Maryland Shock Trauma Center in Baltimore, Harborview Hospital in Seattle, Hospital for Special Surgery in New York City, and at the Medical University in Hanover, Germany.

At home at the Hadassah University Hospital he rapidly climbed the career ladder from instructor to associate professor for orthopedic surgery and in 2005 became the head of the Orthopedic Trauma Service at the Hadassah Medical Center. In that position he “unfortunately” gathered an unequalled experience in the management of mass casualties from terror attacks. He shared this expertise with the AO at the Experts’ Symposia which brought him into contact with the TK System. He is also an expert in the navigation of intramedullary nailing.

Rami acted as Faculty Member in many AO Courses at home and abroad. Today he is responsible for regional courses and large international events in Slovenia, Turkey, Greece, as well as in Davos.

In 1993, Rami joined the AO Alumni and since 2000 he has been chairman of the Israeli AOAA chapter. In 2003 he was elected to represent his country in the Board of Trustees of the AO Foundation.

Since 1978 Rami has received many awards and prizes for outstanding contributions and achievements in the field of orthopedic trauma. His profound interest in research is reflected by twelve considerable research grants which he has received for his institution in the past years.

Probably more important than the impressive list of publications, honors and a long list of palmares is the fact that Rami is a most experienced and engaged clinician and surgeon, a highly respected colleague and a great friend with a wonderful personality. In the AO Dr Mosheiff represents the next generation of young, enthusiastic and faithful members, who hopefully will be able to carry on the “feux sacrés” of the founding fathers into the future.



Norbert P Haas

## TK PRIZES 2007



### TK Innovation Prize 2007

The TK Innovation Prize is the highest prize awarded by the TK System. In 2007, the TK Executive Board decided to award the prize to two surgeons from Japan to honor their contributions and to stress the successful regionalization strategy of the whole TK System which was implemented 3 years ago.

Takeshi Sawaguchi, MD was honored for his numerous contributions to developments in the tibia, as well as adaptations of existing implants to the Asian anatomy. He is the medical director of the department for orthopedic and joint reconstructive surgery at Toyama Municipal Hospital, Japan.



Toru Sato, MD received the prize for his numerous contributions to developments in intramedullary nailing and adaptations of existing implants to the Asian anatomy. He is the chief of orthopedic surgery at the Okayama Medical Center, Japan. Furthermore, he is one of the clinical investigators of the ongoing PFNA study in Japan.



### TK Certificate of Merit 2007

Peter Messmer, MD from Basel, Switzerland was honored with the TK Certificate of Merit for his outstanding contributions to the development of the co-axial clamp.

### Hazards

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Number of copies: 16,800

Issued: May 2008

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