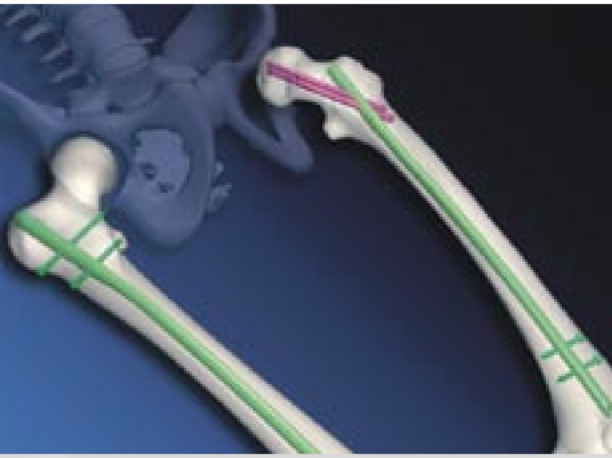
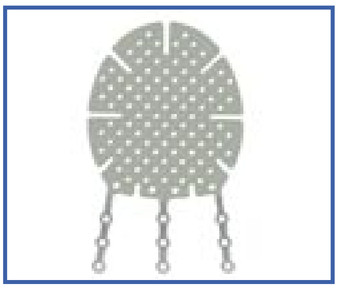
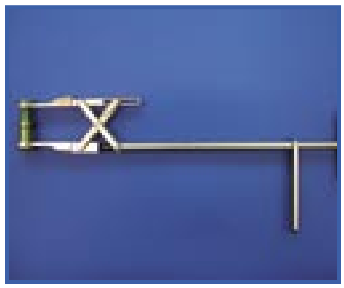
AO Development

News



New Products from AO Development





News—Number 1 | 2004

Dear Reader,

One of the unique features of the AO Foundation is the equal weight given to its four specialties, trauma, spine, craniomaxillofacial, and, last but not least, veterinary surgery.
Regarding animals, most of us human medicine surgeons think primarily about testing of implants and their importance for research. But the author of our lead article, Jörg Auer, shows that state of the art treatment of long bone fractures in animals, mandates—as in human medicine—modern implants of superior quality. The new VetFix, designed by the AO Development Institute in conjunction with the Veterinary Expert Group (VEEG) and the veterinary section of the AO Foundation, proves that impressively.
And after reading his article, you might not be surprised to hear that the VEEG is also interested in angular stable or bioresorbable implants. TK News will keep you updated about future developments for our animal patients.
Needless to say, the AO Foundation is also training veterinarians in internal fixation.

AO Development is a joint effort of the AO Foundation and its affiliated surgeons together with our commercial partner, the now global Synthes company. The development process ends with approval through the AO Technical Commission (AOTK). Only after this final quality check is the AO's commercial partner allowed to produce and market the product worldwide. Shortly after the AOTK approval, this brochure is published by the AO to inform you about the new devices. If these implants and instruments are not yet available through your local Synthes sales representative, please bear in mind that it is logistically impossible to supply all countries simultaneously, especially because of the varying medicolegal device regulations. Nevertheless, you can be assured that everything is being done to provide these products for your clinic as soon as possible.

Once again, I would like to stress that none of the product descriptions in this publication is a 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 SYNTHES® representative.

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

Yours faithfully,

Norbert P. Haas

Contents

Due to varying countries' legal and regulatory approval requirements please consult the appropriate local product labeling for approved intended use of the products decsribed in this brochure.

Jörg Auer

Veterinary Specialty News: The VetFix System (Clamp-Rod Internal Fixator)

State of the art treatment of long bone fractures in animals mandates—as in human medicine—that a wide variety of implants are available around the clock. Therefore, a versatile system, requiring only a minimum of instruments and implants, has been desperately sought. In the late nineties, the AO Development Institute in Davos in conjunction with the Expert Group of AO VET (VEEG), the veterinary section of the AO Foundation, initiated the development of the VetFix System.
The following requirements for the new system were set by the VEEG: simple in its design, user friendly, costs within an acceptable range, and available in different sizes. The VetFix system consists of a round, roughened stainless steel rod with a longitudinal laser-edged line. The rod accepts special symmetrical clamps that slide onto it to any desired position. The clamps can be rotated to either side of the rod to accept cortex screws of the desired length (Fig. 1). The VetFix System, manufactured from the same implant quality stainless steel (1.4441 ISO certification) as used for the Synthes® Dynamic Compression Plates, was developed in the following four sizes (named after the cortex screws that they accept): 4.5/5.5, 3.5, 2.7, and 2.0 mm (Fig 2). End clamps were developed to prevent the bar moving within the clamps (Fig. 3). At the moment, only the 3.5, 2.7, and 2.0 mm systems exist for small animals.

Fig. 1: The rod with the axial laser line and two symmetric clamps that can be flipped to either side of the rod (arrows).

Fig. 2: VetFix standard clamps of different sizes attached to implant rods of corresponding diameters. Screw hole diameter from left to right: 4.5/5.5 mm, 3.5 mm, 2.7 mm, and 2.0 mm.

Fig. 3: End clamps for the four different sizes. The screw can be inserted at different angles. The 4.5 mm system was previewed for large animals but has not been further developed presently.

Drill Guide

For proper centering of the screws in the screw holes of the clamps, the Universal Drill Guides are preferably used (Fig. 4). They have a rounded tip on one side with a centered hole to accept the corresponding drill. This tip fits into the screw holes of each clamp. Inside this centering guide is an inner gliding drill guide which, equipped with a spring mechanism, makes the contact with the bony cortex and guides the drill in the correct direction. On the other side of the drill guide handle, the corresponding tap sleeve can be found. This Universal Drill Guide is available for all system sizes.

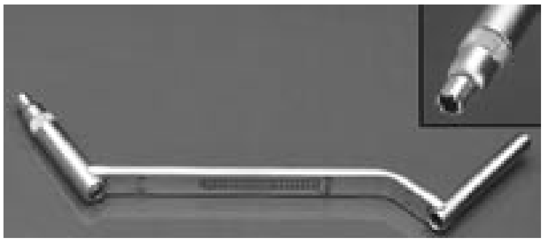


Fig. 4: Universal Drill Guide for proper placement of screws. It is available for all different system sizes. The right upper corner shows a close-up of the drilling tip, which allows precise placement of screws through the clamps.

Holding Forceps

The Holding Forceps contain a ratchet mechanism based on a knurled screw to grasp and secure the rod for contouring, applying the clamps over the rod and for manipulating the implant within the wound.

Fig. 5: The Rod-Holding Forceps with a corresponding rod.

Fig. 6: The Clamp-Spreading Forceps applying a clamp onto the rod which is held by the Rod-Holding Clamp.

Clamp Forceps

These forceps were developed to facilitate applying the Standard Clamps to the implant rod. These forceps are opened, inserted with their blunt tip into the screw hole of the clamp and released, which presses the tip into the slit between the two clamp flanges and in doing so, opens the clamp, widens the clamp ring, and allows frictionless sliding of the clamp over the rod. It can be used during assembling of the implant and later for repositioning clamps within the surgical field.

Clinical application in small animals: A 1-year-old female Dachshund was admitted with a transverse fracture in the distal metaphysis of the femur. Fixation was accomplished with a 2 mm interfragmentary screw in a lag fashion and a 2.7 mm VetFix with five screws. The fracture healed and the implants were removed four months postoperatively. The benefit of the VetFix can be shown on this breed of dog, the females of which do not have one straight bone in their body. The rod was contoured along the bone, which is not possible with a plate.

Pre- and postoperative radiographs of the 1-year-old Dachshund (courtesy K. Zahn, U. Matis, Munich).

The 4-month follow-up radiograph of the same dog as above, immediately before and after implant removal. The fracture has healed completely (courtesy K. Zahn, U. Matis, Munich).

Discussion

The VetFix provides a free arrangement of clamps that enables the surgeon to choose the screw position according to the fracture configuration and the bony contours. A recent comparison of two 4.5/5.5 mm VetFix systems using six and ten clamps respectively on a rod of the length of the broad 10-hole DCP revealed no significant differences in stiffness and strength. This range allows the surgeon to concentrate on the fracture situation and choose the clamp setup that is the most appropriate for the situation.

The clamps were tested in a separate mechanical test setup comparing smooth and roughened (sand blasted) rod surfaces under dry and moistened conditions. Their holding power was tested in rod rotation and pull out and compared to each other. On the basis of these results, the best combinations were chosen for serial production. The VetFix System may be contoured to the surface of the bone in all directions at the same time.

The VetFix System allows compression between fragments only by using lag screw technique. Direct axial compression of the fracture cannot be achieved with the VetFix System. It is used as a neutralization fixation.

The VetFix is similar to a so-called biological fracture fixation system, which represents state of the art fracture treatment in humans and is also widely accepted in small animal trauma surgery. The VetFix is a low contact internal fixation system that is thought to maintain superior blood supply to the periosteum underneath the implant.

Using a rod in connection with the clamps makes the VetFix a more voluminous implant than any of the corresponding DCP implants. The diameter reaches its maximum over the clamps, which may increase soft tissue irritation. Preliminary observations in this respect based on fascia and skin closure, showed no strenuous skin tension when the humerus, radius, femur, or tibia were treated. In the metacarpal/metatarsal area, skin closure may lead to moderate tension.

The AO Veterinary Expert Group decided on the name VetFix: Clamp-Rod Internal Fixator (CRIF).

The application of the CRIF System will be taught at the upcoming AO Advanced Principles Course for Small Animal Specialists, the European College of Veterinary Surgeons Meeting, and the American College of Veterinary Surgeons Meeting.

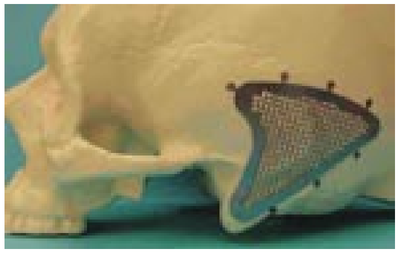
See also "New veterinary products", page 19.

Rainer Schmelzeisen

New craniomaxillofacial products

Contourable Mesh Plate, low profile, 1.6, length 54 mm, TiCP

The Plate is a triangular shaped piece of contourable mesh with ears allowing fixation in the mastoid region of the skull. Its shape is designed for use in procedures where the bone is osteotomized. It can also be used as a crib to assist in reconstruction (using bone substitutes) of the mastoid area.

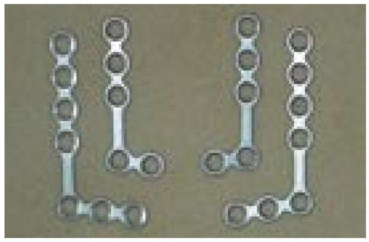


Neuro Orbital Rim Plate, low profile, 1.6, TiCP

The Neuro Orbital Rim Plate with 12 holes was designed for craniofacial applications. The plates can be used with the self-retaining, self-tapping and self-drilling cruciform screws and instruments of the Low Profile Neuro Compact System and fit into the 1.5 Craniofacial Line.

Neuro L-Plate, low profile, 1.6, TiCP

The Ti Low Profile Neuro L-Plates were designed for craniofacial applications. They come in a right and left version with either 2 x 3 or 3 x 4 holes. The plates can be used with the self-retaining, self-tapping and self-drilling cruciform screws and instruments of the Low Profile Neuro Compact System and fit into the 1.5 Craniofacial Line.

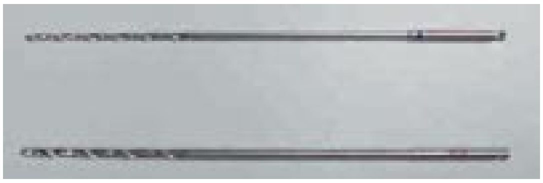


Double Y-Plate, low profile, 1.5, thinner bar, TiCP

The new updated Double Y-Plates are part of the 1.5 mm Craniofacial Fixation System. They are designed for load sharing indications such as fixation of LeFort I fractures, as well as non-load bearing indications in the mid-face. These new plates feature a lower plate/screw profile, thinner bar section, spherical plate hole countersink, and rounded plate edges. The plates are made of CP Titanium, Grade 2, have a thickness of 0.6 mm and are available in lengths of 18 mm and 21 mm.

Single Use Battery Pack for Battery Powered Screwdriver, sterile

The Battery Powered Screwdriver System is used to place screws, especially self-drilling screws. It consists of the handpiece, the battery charger and a rechargeable battery pack. The rechargeable battery pack can be sterilized either via 3-minute flash or STERRAD sterilization. For clinics which cannot or don’t want to sterilize, the AO now offers a single use, sterile battery enabling surgeons to use the Battery Powered Screwdriver without concerns about sterility or the age of their rechargeable battery pack.

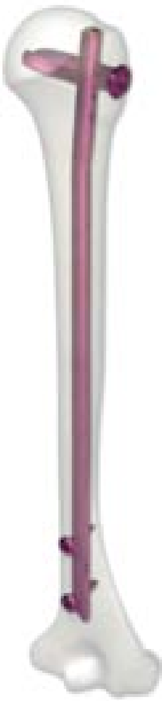


Mandibular Modular Fixation: Drill Bit, Ø 1.5 & 2.0 mm, Stryker Coupling, length 125 mm

For surgeons who would like to use AO devices but the Stryker Drill, a special Drill Bit 1.5 and 2.0 mm, 125 mm length, with Stryker coupling has been designed.

Orbital Floor Plate, anatomic, 1.0 and 1.3, medium, TiCP

The Orbital Floor Plate family has been increased by two new medium size anatomic plates. The 1.0 mm and 1.3 mm plates have three legs designed to bend over the orbital rim along with micro holes 1 mm in diameter. They feature radial slots that allow for maximum adaptability to the orbits. They are especially useful in treating orbital floor defects and provide another fixation option for the various types of orbital fractures.



Norbert Südkamp

New shoulder products

Spiral Blade, sterile, for UHN 6.7, length 32 mm, TAN

This new Spiral Blade is specifically designed for the 6.7 mm Universal Humeral Nail (UHN), which can be used for an antegrade insertion in the humeral shaft. In the antegrade procedure, proximal locking with the Spiral Blade ensures better fixation in osteoporotic bone. The new Spiral Blade is available in lengths from 32–48 mm.
The existing UHN/PHN instrumentation can be used.

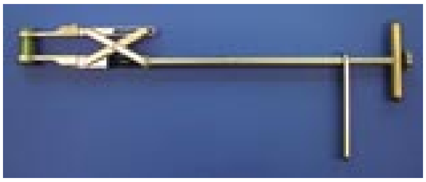
A: A proximal spiral fracture of the humerus shaft with progression into the greater tubercle of humerus following a 74-year-old woman's fall at home. (Preoperative)
B: Treatment with UHN and a Spiral Blade. (Postoperative)
C: X-ray five months after surgery showing healed fracture.

Mike Janssen, Paul Pavlov

New spine products

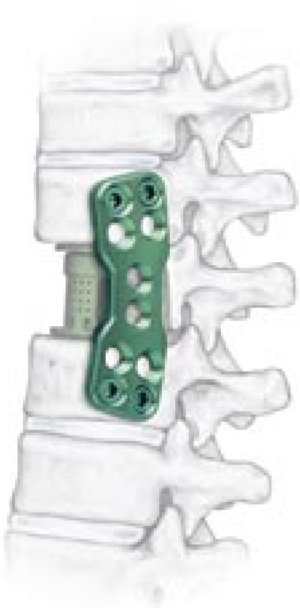
Vertebral Body Replacement: MIS-Spreader for Synex

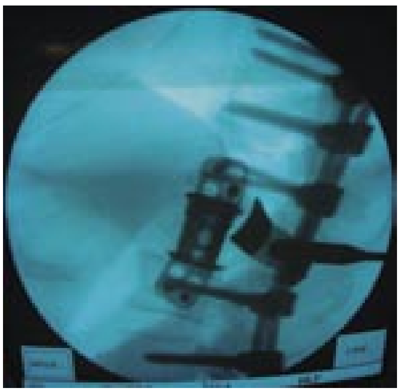
The MIS-Spreader for Synex is used in endoscopic and thoracoscopic approaches. It is a minimally invasive spreading instrument based on the experiences with the spreader for VentroFix MIS.

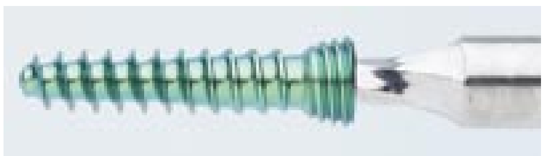


Thoracolumbar Spine Locking Plate (TSLP)

The Thoracolumbar Spine Locking Plate (TSLP) is a versatile, low profile system indicated for use from T1 to L5. The low profile and narrow plate dimensions are advantageous for the mid- to high-thoracic spine. The plates are curved to match the natural kyphosis or lordosis of the spine. The TSLP is available in lengths from 40–109 mm and has multiple screw hole locations that enable optimal screw placement for the best bone/screw interface and avoid screw interference in the presence of a 360 degree fusion.
The 1-step 5.5 mm Ti Cancellous Locking Screw locks flush with the top surface of the plate to minimize soft tissue irritation. They are available in 22–54 mm lengths.
A special instrumentation has been designed to address the anatomy.

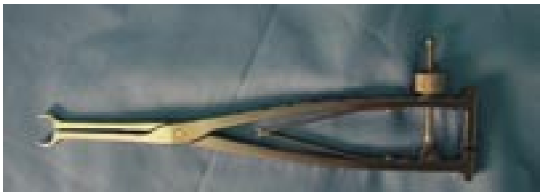






Pathology: 68-year-old male sustained a high energy C-type shear fracture of the L1 vertebra after a fall off of a bridge. The patient had received posterior fixation three weeks before this accident, but still displayed intractable leg pain.
The posterior fixation consisted of Dual-Opening USS pedicle screws at T10-T12 and L2-L3. The preoperative x-rays and MRI showed that the patient had some slippage at the L1-L2 disc and that there were still several pieces of bone impinging on the spinal canal.
Indication: Corpectomy of the L1 vertebral body.

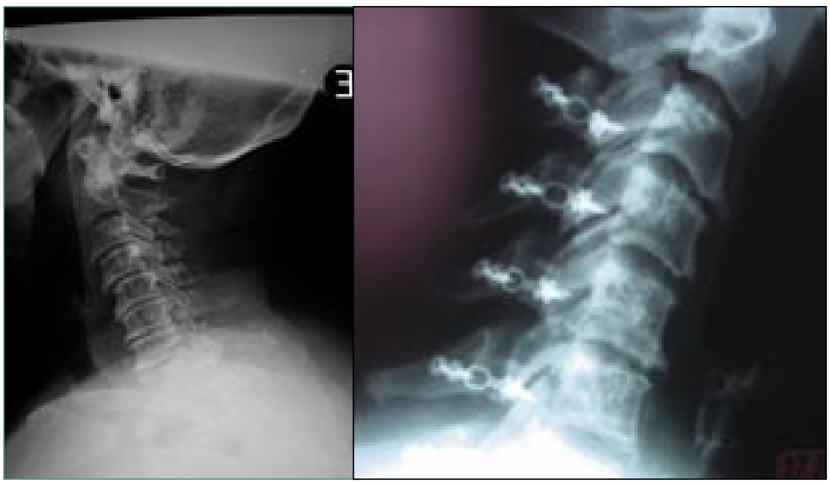
Anterior Cervical Fusion (ACF) Spacer Instruments



A new Implant Holder and an Impactor for ACF Allograft Spacers have been developed to better interface with the CorticoCancellous ACF Spacer. These new instruments also work with the ACF Spacer.
For other ACF Spacer Instruments, see News 1/2003.

Arch Fixation System for Laminoplasty

The Arch Fixation System is indicated for use in the lower cervical and upper thoracic spine (C3–T3) after a laminoplasty has been performed. The Arch Fixation System holds or buttresses the allograft in place in order to prevent the allograft from expulsion or impinging on the spinal cord.
The Arch Fixation System supports the Open Door technique of laminoplasty surgery and comprises titanium implants, trail spacers for allografts, and instruments. The objectives of the system are to expand the spinal cord, secure spinal stability, and preserve the protective function of the spine.
The system uses pre-bent miniplates that are designed to follow the anatomy of the cervical spine. The miniplates are longer on the lamina and shorter on the lateral mass. A slot on the miniplate allows a screw to hold the graft in position and eliminates its migration towards the spinal cord.
The system features 2.0 mm self-drilling and self-tapping screws as well as 2.4 mm rescue screws.
Instruments designed specifically for the graft and miniplate reduce OR time.



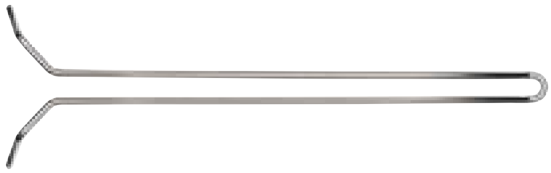
63-year-old female with multilevel cervical myelopathy and stenosis.

Pre-bent Specialty Rods

Stabilization and fusion of severe deformities often require rods with an extreme bend. Pre-bent Specialty Rods ease rod manipulation, reduction, and reduce OR time.

Unit Rod, Ø 5.0 & 6.0 mm, TiCP

The Unit Rods are designed to attach to both sides of the posterior spine. They match the kyphotic and lordotic curves of the thoracic and lumbar spine. The distal ends produce an angle and taper into a bullet point that can be anchored into the iliac wing. The rods are available in lengths from 270–450 mm.

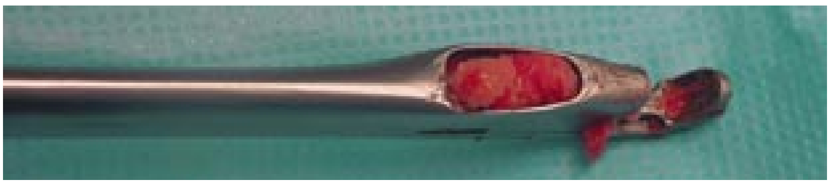


Rod, tapered, Ø 5.0 & 6.0 mm, TiCP

Tapered Rods are 5.0 mm at the proximal end of the rod to mate with the USS Small Stature System and 6.0 mm at the distal end to mate with Click'X, USS, Dual Opening USS, or USS Variable Axis Screws.

Laminectomy Punch with reservoir

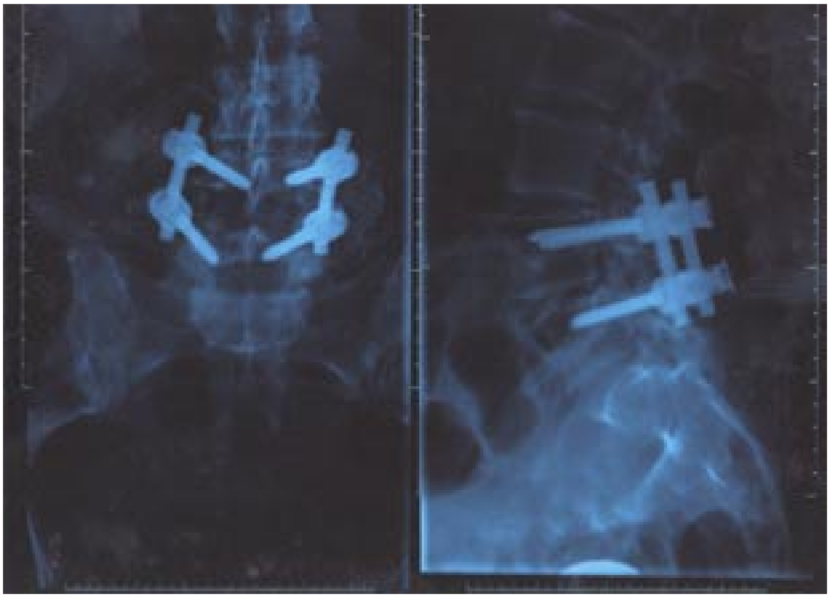
The Laminectomy Punch with reservoir is used in spinal surgery for anterior and posterior approaches. In laminectomy, the reservoir collects bony chips that do not have to be removed after each individual cut, which saves OR time. The reservoir is smoothly embedded within the up-biting tip design with an angle of 40 degrees. Clogging is precluded by a funnel-shaped design that allows for subsequent chip expansion and thus facilitates passage of the resected tissue.
The instrument is available in shaft lengths of 200 and 300 mm.



Click'X Monoaxial Pedicle Screw

The top-loading Click'X Monoaxial Pedicle Screw completes the Click'X System. The Click'X Monoaxial Pedicle Screw allows monosegmental spondylolisthesis reduction and can also be used combined with Click'X Polyaxial Screws for multisegmental instrumentation.
The self-tapping screw features dual core design, double lead thread, and rounded tip. The rotatable head is pre-assembled. The screw head can freely rotate around the screw axis, allowing alignment with the rod without adjusting the screw insertion depth. Compared to the Click'x Polyaxial, the profile has been reduced by 2 mm.

The screws are available in diameters of 5.5, 6.2, and 7.0 mm and eight different lengths from 30–65 mm.
A specific screwdriver and a Holding Sleeve have been designed to pick up the screws from the rack and insert them into the prepared pedicles.
The Reamer from the Variable Axis Screw set can be used.



Monosegmental treatment of an instable lumbar spine segment.

David Helfet, Dankward Höntzsch, Christiaan van der Werken

New long-bone products

Antegrade Femoral Nail (AFN)

The Antegrade Femoral Nail (AFN) is an intramedullary device for treating femoral shaft fractures, as well as combinations of shaft fractures with subtrochanteric and femoral neck fractures approaching the medullary canal just lateral from the greater trochanter tip.

The AFN is available from 9–14 mm in diameter. The proximal diameter varies according to the distal diameter. The core segment lengths range from 300–480 mm.

The nail is cannulated with a 1500 mm radius in the sagittal plane, the average anatomical curvature of the femur. It has a lateral bend in the proximal part of 6°, like the PFN.

The AFN is manufactured from titanium alloy (TAN) in a right and left version, with three distal and four proximal locking holes.

The AFN is generally compatible with the existing UFN/CFN instrumentation. Only a few additional instruments are needed.

Compared to the UFN/CFN, the AFN is advantageous due to the fact that:

- The anatomically pre-contoured nail facilitates insertion and provides a better fit into the medullary canal.
- The cannulation permits unreamed or reamed nail insertion over the central wire.
- The insertion point is easier to access at (or just lateral to) the tip of the greater trochanter. Additionally, it offers benefits regarding possible vascular or neurological lesions (Fig. 1 & 2).
- The 6.5 mm hip screw ensures good hold in the femoral head and the enlarged screw provides compression.
- The cannulated endcap facilitates insertion using a guidewire with a hook.

See also "Antegrade Femoral Nail—AFN Study", page 22.

Fig. 1

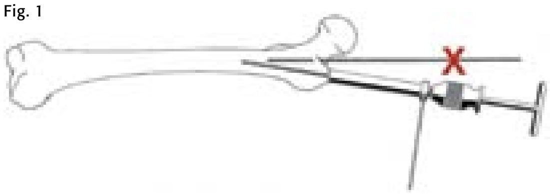
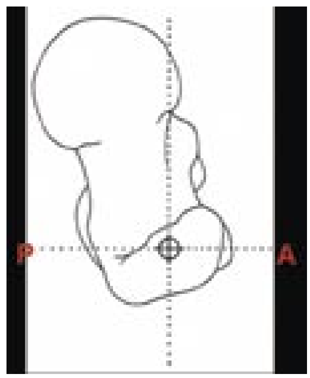
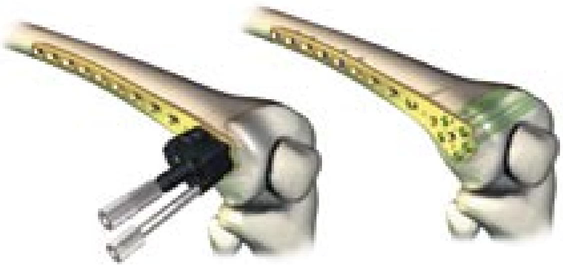


Fig. 2



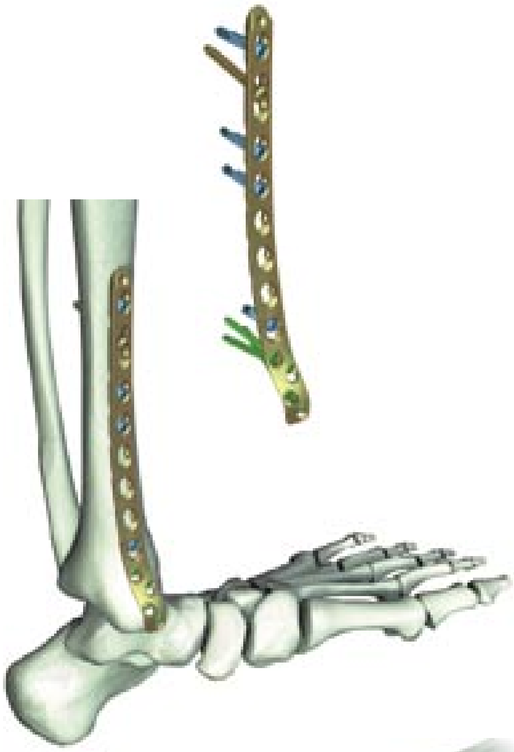
41-year-old male; accident with a motorbike.
Pelvis fracture and multifragmentary femur fracture.
Operation to the femur: 1. External Fixator; 2. AFN.

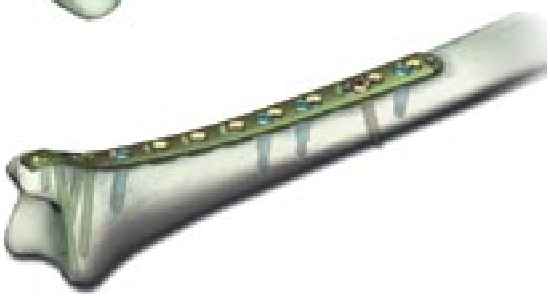
LCP Distal Femur



The LCP Distal Femur is a pre-shaped, low profile plate combining the successful LISS DF with the Combination Hole concept.
The LCP Distal Femur is indicated for distal shaft fractures, supracondylar fractures, intraarticular fractures, and periprosthetic fractures.
The plates are available in a left and right version, both with 5–13 holes.
A Guiding Block is available for both left and right versions.
The implants and instruments of the LCP Distal Femur are fully compatible with the 4.5/5.0 mm LCP Systems.

LCP Distal Medial Tibia





The LCP Distal Medial Tibia has been developed for fractures in the metaphyseal area that may reach into the shaft.
The distal end is anatomically contoured to the distal medial tibia, with a light twist to fit the bone.
The plate is easy to contour to take the peculiarities of the metaphyseal area into account.
The first four threaded screw holes in the distal section are angled to allow optimal fixation of the screws in the epiphyseal area without penetrating the joint.
The dense net of 3.5 LCP combination holes in the thinned plate area allows the insertion of more screws to provide a higher anchoring stability.
The long hole helps to fine-tune the reduction in the longitudinal axis.
The LCP Distal Medial Tibia 3.5/4.5/5.0 is available in a left and right version with twelve different lengths from 4–20 holes.
The LCP Distal Medial Tibia is available in titanium and stainless steel.
A specially adapted Guiding Block allows easy and correct insertion of the drill sleeves into the distal plate area.

LCP Proximal Lateral Tibia

The LCP Proximal Lateral Tibia is a pre-shaped, low profile plate combining the successful LISS PLT with the Combination Hole concept.
The LCP Proximal Lateral Tibia is indicated for proximal shaft fractures, metaphyseal fractures, intraarticular fractures, and periprosthetic fractures.
The plates are available in a left and right version, both with 5–13 holes.
A Guiding Block is available for both left and right versions.
The implants and instruments of the LCP Proximal Lateral Tibia are fully compatible with the 4.5/5.0 mm LCP Systems.

LCP Proximal Tibia Plate 3.5, Ti

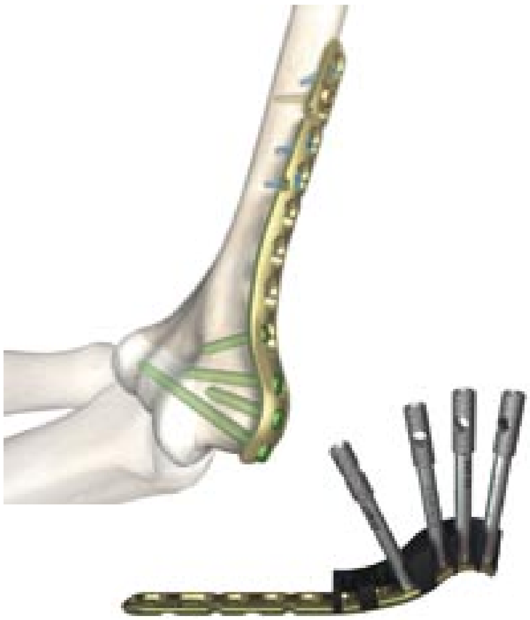
The LCP Proximal Tibia Plates 3.5 are anatomically contoured plates with a limited-contact profile. The plate is indicated for treatment of split and/or depression fractures of the medial and lateral plateau as well as bicondylar fractures, malunions and nonunions of the proximal tibia, and tibial shaft and corrective osteotomies.
The plates are available in a right and left version, 4–16 holes, and lengths from 81–237 mm.
The LCP Proximal Tibia Plates 3.5 are available in titanium and stainless steel.
The plates use existing screws and instrumentation.

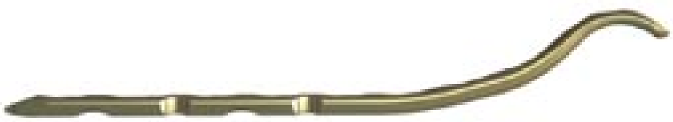
LCP Proximal Tibia Plate 4.5, Ti

The LCP Proximal Tibia Plates 4.5 are anatomically pre-contoured to match the proximal tibia. Their design is the same as the existing LCP Proximal Tibia Plates 4.5 in stainless steel and they use the same instruments (see News 1/2001).
The plate is available in a right and left version with 4–14 holes.

LCP Distal Humerus

The LCP Distal Humerus has been developed for fractures in the metaphyseal area that may reach into the shaft.
The distal end is anatomically contoured to the distal humerus, with three isolated round combination holes. This new round hole allows to use 3.5 conventional cortical screws to facilitate optimal screw positioning in the joint block of the distal humerus.
The screws in the distal section are angled to allow optimal fixation of the screws without penetrating the joint.
The reconstruction cuts in the plate shaft, allowing easy and accurate bending of the plate to adapt to the variance of the diaphyseal anatomy.
The LCP Distal Humerus is available in titanium and stainless steel, in five different lengths with 7, 9, 11, 13 and 15 holes.
A specially adapted Guiding Block allows easy and correct insertion of the drill sleeves in the distal plate area.





Cerclage Positioning Pin, Sterile for Orthopedic Cable System

Sterile threaded and non-threaded Cerclage Positioning Pins for the Orthopedic Cable System are now available in 3.5 and 4.5 mm sizes, manufactured from titanium and stainless steel.

Adjustable Clamp for Distal Radius Fixator, Ø 4.0 mm, MR safe

The existing 4.0 mm Adjustable Clamp of the Distal Radius Fixation System is now available in MR-safe material*, which allows surgeons to place patients in an MRI without having to remove the frame. The clamp function and overall design has not been changed.

Small Combination Clamp, MR safe

The new Small Combination Clamp (MR safe) for the Small External Fixation System is a multi-functional, snap-on clamp designed for rod-to-pin or rod-to-rod attachment. It provides more flexibility for the surgeon by allowing independent pin placement in various frame configurations. Therefore, only this single clamp is necessary compared to the four different clamps needed previously.
The Small Combination Clamp accepts 4.0 carbon fiber rods, 4.0 mm stainless steel connecting bars, 4.0 mm Schanz screws, and 2.5 mm K-wires, and is available in MR-safe material.
A new Wire Cutter and Graphic Case complete the new Small External Fixation System, which addresses fractures of the carpus, metacarpals, and phalanges.

Large External Fixation System: Large Combination Clamp (MR safe) and Dynamization Clip

The new large Combination Clamp (MR safe) and the new Dynamization Clip are 30% smaller and lighter than the former versions and are MR safe. The clamp design now allows Schanz screws to be positioned in either the top or bottom clamp, decreasing the “fiddle” factor. A knurled nut is added to the clamp to allow for improved provisional fixation by finger tightening.

Small Universal Chuck with T-Handle, SS

The Small Universal Chuck with T-Handle is used to insert Schanz screws or wires from 1.0–6.0 mm diameters. The size of the T-Handle has been reduced for lighter weight and easier handling and will be available for all External Fixation Systems.

* *A flyer answering “10 Frequently Asked Questions about Magnetic Resonance Imaging in Patients with Metal Implants” can be ordered at the AOTK Office.*

Hans Zwipp

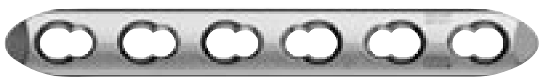
New foot and ankle products

LCP Compact Foot Set: LCP Plates 2.7

The LCP Compact Foot Set is indicated for phalangeal, metatarsal, tarsal, extra- and intraarticular calcaneus fractures as well as osteotomies and arthrodesis in the foot.
With these additions, the LCP Compact Foot Set now offers a wide range of anatomical precontoured and adaptable plates for trauma and orthopedics in three dimensions (2.0, 2.4, and 2.7mm). The low profile design and the completely buried screw heads make the Set soft tissue friendly.
All plates of the Compact Foot Set are now available as Locking Compression Plates (LCP) with the advantages of reduced primary and secondary loss of reduction, reduced pull-out of screws, less periosteal compression, better hold in osteoporotic bone, more stable fixation, and bridging of fragments.
All plates are available in titanium and stainless steel.
The LCP Compact Foot Set comes in a modular structure. Separate Vario cases for forefoot and hindfoot surgery are offered. Color-coded instruments and modules enable easy identification in the OR.

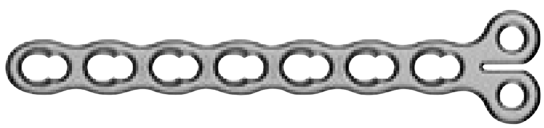
LCP Plate 2.7, straight, 4–12 holes, TiCP

Particularly for metatarsal shaft fractures and correcting osteotomies of the first ray.



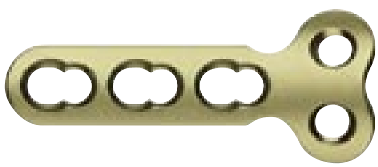
LCP Condylar Plate 2.7, TiCP

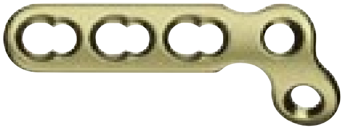
Metatarsal fracture fixation especially in the metaphyseal zone and close to a joint.



LCP T-Plate 2.7, 3 & 4 holes, TiCP

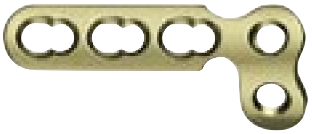
Particularly for medial fusions in the tarso-metatarsal area.





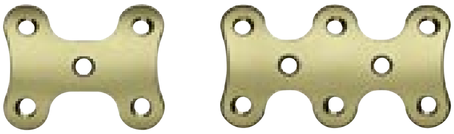
LCP L-Plate, oblique, 2.7, right and left versions, 3 & 4 holes, TiCP

For fracture and fusion fixation, especially the proximal part of the fifth ray.



LCP L-Plate, 2.7, right and left versions, 3 holes, TiCP

For proximal fracture fixation of the fourth/fifth ray or fusions to the cuboid.



Locking H-Plate, 2.7, 5 & 8 holes, TiCP

For fixation of correcting osteotomies of the calcaneus (eg, Evans osteotomy). Calcaneal fracture fixation of the medial and occasionally lateral wall.

Drill Bit, with measuring scale, for Mini Quick Coupling, 2-flut, SS

The Drill Bit incorporates a measuring scale for easy determination of the screw lengths.

Bending Pin for LCP Plates 2.7

A Bending Pin enables bending of the threaded round holes of the LCP Plates 2.7.

James Hunter

New pediatric products

Stainless Steel Elastic Nail (STEN)

Elastic intramedullary nailing is an established technique for stabilizing children's long bones. Since 2002, the AO has offered an elastic nail with optimized geometric and biomechanical properties, the Titanium Elastic Nail (TEN).

Some surgeons routinely prefer a stainless steel implant and in some cases a more rigid osteosynthesis is required. Therefore, the AO has now developed a steel elastic nail with the same features as the TEN. The Stainless Steel Elastic Nail (STEN) is indicated primarily for managing diaphyseal and metaphyseal fractures in adolescents or heavy children. The STEN offers increased strength over the equivalent size TEN, but at the expense of decreased elasticity as it is a more rigid implant. The exact indications depend on the patient's age as well as the type and site of the fracture.

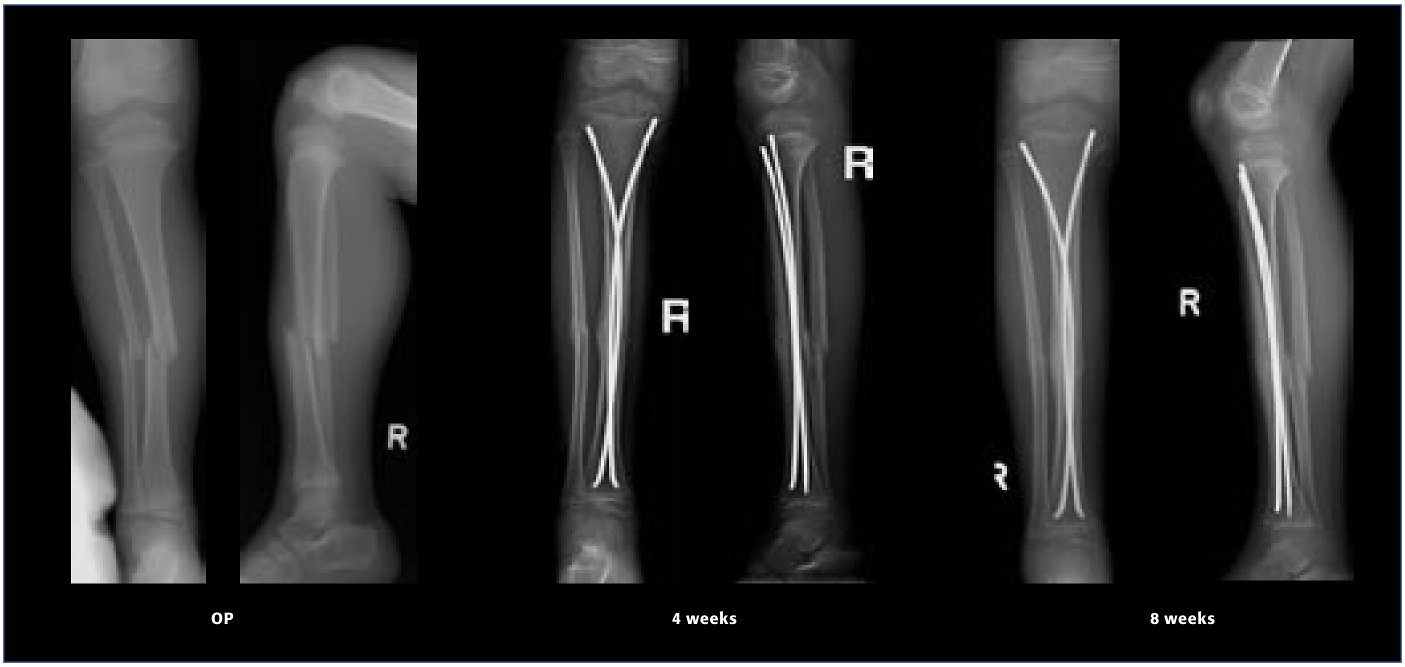
The STEN is available in diameters of 1.5–4.0 mm.

The existing Titanium Elastic Nail (TEN) instrumentation can be used.

Titanium Elastic Nail (TEN)

The Titanium Elastic Nail (TEN) is now also available in 15 mm diameter and 300 mm length.

Case of a 8-year-old boy with a closed lower leg fracture after football game. Control at 4 and 8 weeks after fracture.



Ladislav Nagy

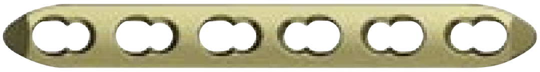
New hand products

LCP Compact Hand Set: Additional Plates 2.0 and 2.4

The Compact Hand Set 2.0 and 2.4 is designed for distal radius, subcapital radial head, phalangeal, metacarpal, and metatarsal (II-V) fractures as well as osteotomies and arthrodesis in the hand. All plates are now available as Locking Compression Plates (LCP) with the following advantages: minor primary and secondary loss of reduction, reduced screw pull-out, less periosteal compression, better hold in osteoporotic bone, more stable fixation and bridging of fragments.
All plates and screws can be obtained either in titanium or stainless steel.

LCP Plate 2.0 and 2.4, straight, 4–8 holes, TiCP

These plates correspond to the respective “former” LC-DC plates, thus are intended for the same indications, including the new features of the combi-hole/locked screws.



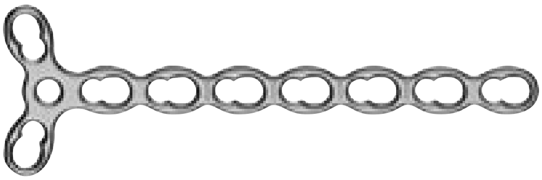
LCP Condylar Plate 2.0 and 2.4, 7 holes, TiCP

These are new designs with respective modifications of the condylar plates. Here, the new geometry eliminates the need for separate left and right plates and also introduces the Locked Condylar Screw (instead of the fixed condylar blade) into the 2.0 mm system.

LCP T-Adaption Plate 2.0 and 2.4, 7 holes, TiCP

This plate has been developed for comminuted articular and metaphyseal fractures of metacarpals and some of the proximal phalangeal base fractures.

LCP Y-Adaption Plate 2.0 and 2.4, 7 holes, TiCP



See T-adaption plate.

Specific instruments have been designed to ease the use of the set:

Bending Pin for LCP Plates 2.0 and 2.4 mm

A Bending Pin has to be used to contour the plate.

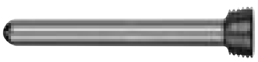
LCP Drill Sleeve 2.0, with Scale

A scale on the Drill Sleeve allows length measurement.

Drill Bit, with measuring scale, for Mini Quick Coupling, 2-flut, SS

The Drill Bits are available for Jacobs chuck and J-latch coupling.

Buttress Pin diameter 1.8, head LCP 2.4, lengths 12–30 mm, TAN

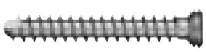


Smooth pins can also be used and locked to the plate as an alternative to a locked or condylar screw.

Screwdriver Shaft Stardrive 2.4, short and long

A Screwdriver Shaft for the Stardrive Screwdriver is offered in a short and long version.

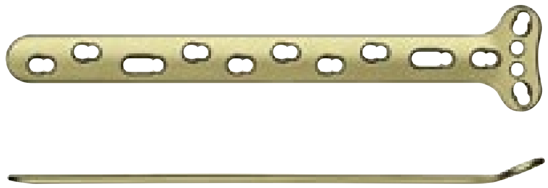
2.0 mm LCP Locking Screw, self-tapping, lengths 6–30 mm



The self-tapping LCP Locking Screws with 2.0 mm diameter are available in lengths from 6–30 mm.

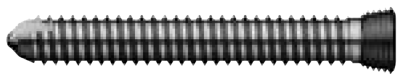
LCP T-Plate 2.4, extralong

This plate is indicated in Colles's fractures with extension into the shaft.
The plate will be available in three lengths: with 8, 10 or 12 holes in the shaft. It is anatomically pre-bent for application on the volar side of the distal radius.
The shaft area features combination holes, two of which are elongated to allow longitudinal adjustment of the plate.
The dimension of the screw holes is 2.4 mm. However, in the shaft, the DC-part of the combination hole allows for a 2.7 mm cortical screw. A specially designed 2.7 mm Locking Screw with a 2.4 mm head can also be used in the shaft.
The plate will be available in titanium and stainless steel.



LCP Locking Screw 2.7 (head 2.4)

The LCP Locking Screw has a 2.7 mm diameter but a 2.4 mm head, which makes it stronger than the 2.4 mm Locking Screw. This feature is important in this application, as the plate has a bridging function and needs stable screw insertion.
The screws are self-tapping and available in lengths from 6–60 mm. They are available in titanium alloy (TAN) and stainless steel.



LCP Drill Sleeve 2.4

For the new LCP Locking Screws 2.7 (head 2.4), a special Drill Sleeve for Drill Bits with 2.0 mm diameter has been developed.

Jörg Auer

New veterinary products

Universal Drill Guide, Ø 5.5 mm (VET)

The 5.5 mm Universal Drill Guide in Stainless Steel is designed for use with the new 5.5 mm Broad LC-DCP and the 5.5 mm Cortex Screws (see News 2/03). The Drill Guide Handle is 12.3 mm wide with a 4.0 mm Drill Sleeve on one end and a 5.5 mm Universal Sleeve, with a compression spring, on the other end.

Thierry Stoll

Bone substitution materials

The last issue contained an overview of materials used for AO approved implants (News 02/2003). This article provides more detailed information about a synthetic, resorbable, and osteoconductive bone substitute material.

Introduction

Although bone has the capacity to repair and remodel in the healing of fractures, lack of sufficient quantities of bone during trauma or major reconstructive procedures is particularly problematic for orthopedic surgeons.
Bone substitutes play an important role in supporting the growth of new bone across those critical osseous defects. Autograft procedures still represent more than half of the bone grafting procedures and are considered to be the most successful bone graft material ("gold standard") because they have osteoconductive and osteoinductive properties. However, bone graft harvesting from the iliac crest requires a second incision and adds significant morbidity. Apart from autografts, allografts, and xenografts, synthetic materials are becoming increasingly popular. These materials are favored because of the absence of disease transmission due to their synthetic origin.

Ceramics

Ceramics are highly crystalline structures formed by heating non-metallic mineral salts to high temperatures (>1000°C) in a process known as sintering. Chemical content and purity during manufacturing have to comply with the ASTM standards. The use of ceramics, especially calcium phosphates (CaP), is motivated by the fact that the primary inorganic component of bone is hydroxyapatite (HA, $Ca_5(PO_4)_3OH$), a subset of the CaP group. However, being the most stable CaP in terms of solubility, HA can be regarded as non degradable over years [1]. On the other hand, the CaP ratio of beta tricalcium phosphate (β-TCP, $Ca_3(PO_4)_2$) makes it a degradable material by osteoclastic activity.
The AO pointed the way to the future in the field of bone substitution materials as early as in the mid-eighties and since then scientific investigations have continuously permitted improvement in their clinical use. The first bone substitutes approved by the AOTK in 1987 were CEROS 80 (β-TCP) and CEROS 82 (HA), both ceramic-based materials. In later years, the interconnecting structure of the implant materials was improved to obtain optimal osteoconductive properties. Thus chronOS™ was born and quickly became another implant material. With its open-porous and interconnecting structure, chronOS™ allows blood vessels and the host tissue to gradually grow into the pores (Fig.1). This way, the requirements of an osteoconductive bone substitute are met and the material can be gradually resorbed via physiological metabolic routes.

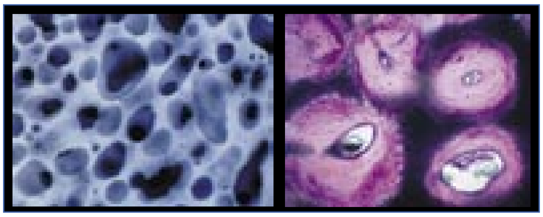


Fig.1: Open-porous and interconnecting structure of chronOS™ (left) and histological cut demonstrating complete bone ingrowth (right) [2].

Clinical applications

New implant developments are all based on comprehensive in-vitro and in-vivo investigations [2]. In open-wedge high tibial osteotomies, chronOS™ wedges are well suited for bridging, filling, and correcting bone defects when associated with a stable fixation system [3]. It has been observed that after twelve months various amounts of chronOS™ were completely resorbed and replaced by new bone (Fig.2).

In spinal surgery, chronOS™ was used in dorsal spondylodesis, where a large amount of bone graft is needed [4]. In interbody fusion (IBF), the AO is currently testing chronOS™ pre-filled IBF cages. First clinical results in cervical anterior fusion using the hybrid radiolucent implant CERVIOS$^{\text{chronOS™}}$ already show excellent fusion results after three months [5]. In the lumbar spine, clini-

Fig.2: Gap healing and chronOS™ resorption in a high tibial open-wedge osteotomy at 3 weeks, 3, 6, and 12 months (from top left to bottom right), [Dr. A. Wymenga, SMK Nijmegen/NL].

cal investigations are still ongoing. The new hybrid IBF implants not only allow avoidance of an additional bone graft harvesting procedure causing patient morbidity, but also significantly reduce both surgery time and blood loss.

In the near future, a solution for the increasing clinical need for injectable and also resorbable materials such as bone void fillers will be offered—chronOS™ Inject, which is a composite material of brushite, a resorbable CaP phase also found in the body, and β-TCP granules. Based on extensive in-vivo studies [6], this new bone substitute is currently being investigated in a clinical study performed by AO CID. More information will be provided soon.

Conclusion

In summary, new advances in material science are permitting mimicry of bone tissue and helping to improve the surgical outcome for the patient. Being synthetic, resorbable, and osteoconductive, chronOS™ meets the requirements of a reliable bone substitute.

Extensive investigations are currently underway to obtain osteoinductive properties.

On the one hand, the temperature at which porous ceramics are sintered can affect biological response by altering the chemical and topographical features of the material surface. Crystal size and form may influence the cell and tissue response by enhancing the adsorption of proteins to the surface and the ability of osteogenic cells to attach, differentiate, and proliferate.

On the other hand, it may be possible with simple intraoperative manipulations to impregnate chronOS™ with autologous wound healing promoting growth factors released from activated blood platelets and/or osteoprogenitor cells from bone marrow (Fig.3).

Thus it may be possible to obtain an osteoinductive bone substitute by autologous means. Promising projects are ongoing at the AO Research Institute in Davos to quantify and understand the osteogenic potential of various autologous substances with a view to clinical application.

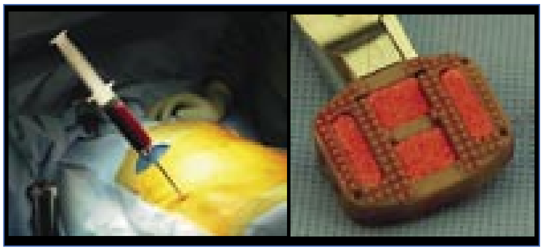


Fig.3: Bone marrow puncture from the iliac crest and spinal IBF implant impregnation before implantation, [Dr. P. Pavlov, SMK Nijmegen/NL].

References

1. **Bohner M** (2000) Calcium orthophosphates in medicine. *Injury;* 31 (suppl 4).
2. **Steffen T et al** (2001) Porous tricalcium phosphate and transforming growth factor used for anterior spine surgery. *Eur Spine J;* 10: 132–140.
3. **van Hemert W et al** Granule or rigid wedge tricalcium phosphate in open wedge high tibial osteotomy. Submitted for publication.
4. **Muschik M et al** (2001) b-tricalcium phosphate as a bone substitute for dorsal spinal fusion in adolescent idiopathic scoliosis: preliminary results of a prospective clinical study. *Eur Spine J;* 10: 178–184.
5. **Pavlov P** (2003) Anterior decompression for cervical spondylotic myelopathy. *Eur Spine J;* 12 (suppl 2): 188–194.
6. **Bohner M et al** (2003) Compositional changes of a dicalcium phosphate dehydrate cement after implantation in sheep. *Biomaterials;* 24: 3463–3474.

Thomas Gross, Peter Messmer, Tobias Hüttl

Antegrade Femoral Nail–AFN Study

The AFN is a new implant designed to stabilize femoral shaft fractures as well as combined fractures of the femoral neck and the femoral shaft. There are two main innovative changes to this nail compared with other AO approved implants used so far:

a) The material and form have been derived from the Proximal Femoral Nail (PFN). The entry point of this specifically curved titanium nail into the femoral cavity should, however, be located at the tip of the greater trochanter. This entry point has been chosen to ease the introduction of the nail and contrasts with the common use of straight femoral nails, like the Universal Femoral Nail (UFN), which in the majority of cases is inserted with more difficulty (especially in obese persons). As a cannulated nail, the AFN can be used in both reamed and unreamed techniques.

b) The AFN offers different proximal and distal locking options. With the new oblique proximal recon locking option, two 6.5 mm screws can be inserted through the nail into the femoral neck and head, thus offering the opportunity to also stabilize subtrochanteric fractures and combined fractures of the femoral neck and shaft. It therefore provides an alternative to more complicated procedures, eg, the "miss a nail technique" with the UFN. Alternatively, the AFN offers a proximal standard locking option with two transverse 4.9 mm pins. Distal interlocking can be carried out by two 4.9 mm pins, locked either in a static or dynamic fashion. The nail is available in several lengths ranging from 300–480 mm (20 mm steps) and three shaft diameters (10–12 mm).

67-year-old man, 184 cm, 93 kg.
The patient sustained a 32B1 fracture after falling 2 m off a ladder.
Follow-up at 6 months.

A prospective multicenter study has been conducted since October 2002 by AO CID to investigate the operative and postoperative complications associated with this new implant. Particular attention is being paid to complications connected with the entry point and the proximal recon locking option. The secondary objectives are to assess surgical details, such as the operative handling by performing surgeons, the anatomical restoration of the fracture, and the functional outcome of the patients.
In twelve teaching hospitals worldwide, 153 patients with femoral shaft fractures with or without additional femoral neck fractures were included in the study and treated with the AFN. Follow-up of the patients and prospective data collection will be performed until one year postoperatively. At each follow-up visit (six weeks, twelve weeks, one year) specifications about the patient, operative/postoperative complications, implant, recovery, and x-rays are documented. The preliminary analysis of the baseline data shows that no major technical problems occurred during nail implantation. The completion of the follow-ups is still ongoing until December 2004. The final report of the study results is planned for early 2005.

See also "Antegrade Femoral Nail (AFN)", page 11.

Berton A. Rahn

Portrait of Dr. med. Dr. med. dent. Ralf Gutwald

Ralf Gutwald is a dedicated craniomaxillofacial surgeon, interested clinically and scientifically in the entire spectrum his specialty has to offer. In both traumatology and orthognathic surgery, the development, laboratory testing, and clinical assessment of mini locking plates and self drilling screws as well as biodegradable implant systems has attracted his interest. In all the fields of craniomaxillofacial surgery, he has assessed the usefulness of new technologies, such as endoscopic techniques, digital imaging, and computer-based three-dimensional reconstruction and computer-aided navigation, with the final goal of integrating these techniques into daily clinical practice. In tumor surgery, he has tried to attain an optimum for the patient using a multidisciplinary approach incorporating neurosurgeons, ENT, ophthalmologists, neuroradiologists, and radiotherapists. Reconstructive surgery after tumor resection, trauma, and especially cleft surgery and craniofacial malformations has given him a wide field for his technical skills. In addition to purely surgical solutions, Ralf Gutwald dreams of a biological supplement to his craftsmanship. Tissue engineering using biodegradable scaffolds, the influence of growth factors (rh-BMP 2, PRP), and the technologies to bring these components into the complex three-dimensional relationship of the craniomaxillofacial skeleton deserve his special attention.

Ralf Gutwald was born in Darmstadt on October 25th, 1961. After school and his basic military training in an air force unit, he started medical school at the Philipps-University in Marburg, where he graduated in 1988. He subsequently entered dental school at the Bavarian Julius-Maximilians-University in Würzburg, graduating in dentistry in 1991. His first practical experiences included surgery, internal medicine, and craniomaxillofacial surgery in Coburg and Würzburg.

He received both his doctoral degrees, in medicine and in dental medicine, in 1995 at the Bavarian Julius-Maximilians-University in Würzburg. Together with his wife Sabine, he has three sons, still at school age and younger. Since 1993, he has had a career position at the Klinik und Poliklinik für Mund-, Kiefer- und Gesichtschirurgie at the Albert-Ludwigs-University, Freiburg, first under the direction of Wilfried Schilli, and since 1997 under Rainer Schmelzeisen. He obtained his board certification in craniomaxillofacial surgery in 1997.

Knowing how dedicated Ralf Gutwald's focus is on his current topic of interest, I can imagine that it is sometimes difficult to persuade him that there are things in life other than research. I remember one of his visits to the AO Research Institute in Davos to which his boss, Rainer Schmelzeisen, had sent him for two to three days to conduct some measurements on a model of an angular mandibular fracture. After Ralf and the engineers—already one day beyond his planned return—realized that only further study would lead to an answer, he asked his boss for an extension. He got the approval to stay as long as necessary, if he came back with the answer to the original question. He succeeded, and the project resulted in a peer-reviewed publication. As the whole incident occurred during peak skiing season, with the most marvelous snow and weather conditions, Ralf's boss specially mentioned how pleased he was that his co-worker had returned with such a pale face.

AO Courses 2004

For registration and further information visit: www.ao-asif.ch/aoi/courses				
General Trauma				
Date	**Event**	**Place**	**Country**	**Language**
September				
04.09.–06.09.	Principles of Operative Fracture Treatment	Dubai	United Arab Emirates	English
04.09.–06.09.	Advances in Fracture Management	Dubai	United Arab Emirates	English
08.09.–09.09	5. AO Kurs Trauma II	Halle	Germany	German
11.09.–17.09.	Surgical approaches and Osteosynthesis	Graz	Austria	German
16.09.–18.09.	Course on MIPO Technique	Oviedo	Spain	Spanish
16.09.	Basic Workshop	Graz	Austria	English
18.09.–20.09.	AO Symposium Becken und Hüftgelenk mit praktischen Übungen	Graz	Austria	German
25.09.	Advanced Course	Taipei	Taiwan, R.O.C.	English
30.09.–02.10.	Orthopaedic Seminar with Workshop	Sao Paolo	Brazil	Portuguese
30.09.–02.10.	AO Course Kindertraumatologie	Freiburg	Germany	German
October				
04.10.–06.10.	Principles of Operative Fracture Treatment	Oporto	Portugal	English
12.10.–15.10.	Advances in Fracture Management	Moscow	Russian Federation	English, Russian
18.10.–20.10.	Prinzipien der Operativen Frakturbehandlung	Salzburg	Austria	German
21.10.–23.10.	Principles of Operative Fracture Treatment	Salvador	Brazil	Portuguese
22.10.	Current Solutions in Femoral Trauma		Belgium	English
23.10.–30.10.	AO Advanced Symposium	Aruba	Netherlands	English
25.10.–27.10.	Principles of Operative Fracture Treatment	Warsaw	Poland	Polish, English
28.10.–31.10.	Principles of Fracture Management Course for Residents	Little Rock	USA	English
30.10.–31.10.	1. Norddeutsches AO Seminar	Rostock	Germany	German
31.10.–03.11.	Principles of Operative Fracture Treatment/Advances of Fracture Treatment	Athens	Greece	English
November				
04.11.–06.11.	39. AO Kurs Trauma I	Bochum	Germany	German
04.11.–06.11.	MIPO Seminar with Demonstration	Buenos Aires	Argentina	Spanish
11.11.–13.11.	Principles of Operative Fracture Treatment	Sao Paolo	Brazil	Portuguese
15.11.–19.11.	3. Homburger Beckenkurs	Homburg	Germany	German
18.11.–21.11.	Principles of Fracture Management Course	Toronto	Canada	English
18.11.–21.11.	Advanced Controversies in Fracture Care Course	Toronto	Canada	English
21.11.–25.11.	Advanced Course—Upper Limb	Madrid	Spain	Spanish
25.11.–27.11.	Principles of Operative Fracture Treatment	Rio de Janeiro	Brazil	Portuguese
December				
04.12.–09.12.	Prinzipien der Operativen Frakturbehandlung	Davos	Switzerland	German
04.12.–09.12.	Fortschritte in der Frakturbehandlung	Davos	Switzerland	English
04.12.–09.12.	Masters Course	Davos	Switzerland	French
04.12.–09.12.	Swiss Residents Course	Davos	Switzerland	German, French
12.12.–17.12.	Principles of Operative Fracture Treatment	Davos	Switzerland	English
12.12.–17.12.	Advances in Fracture Management	Davos	Switzerland	English
12.12.–17.12.	Masters Course	Davos	Switzerland	English
Hand				
November				
21.11.–25.11.	Advanced Course—Upper Limb	Madrid	Spain	Spanish

Craniomaxillofacial				
Date	**Event**	**Place**	**Country**	**Language**
September				
04.09.–06.09.	Craniomaxillofacial Course	Dubai	United Arab Emirates	English
13.09.–16.09.	Craniomaxillofacial Course	Salvador	Brazil	Portuguese, English
14.09.	AAFPRS AO Principles Workshop	New York	USA	English
29.09.–02.10.	Maxillofacial Principles Course	Erfurt	Germany	German
October				
15.10.	Neurosurgery Workshop	San Francisco	USA	English
November				
01.11.–03.11.	AO Face Head and Neck Course	Gauteng	South Africa	English
06.11.–07.11.	Principles of Operative Treatment of Craniomaxillofacial Trauma and Reconstruction	Dallas	USA	English
10.11.–11.11.	Craniomaxillofacial Basic Course	Leeds	United Kingdom	English
December				
04.12.–05.12.	Principles of Operative Treatment of Craniomaxillofacial Trauma and Reconstruction	Vancouver	Canada	English
04.12.–09.12.	Craniomaxillofacial Principles Course	Davos	Switzerland	English
Spine				
September				
01.09.–30.09.	AO Wirbelsäulenkurs	Hamburg	Germany	German
09.09.–12.09.	Advanced Concepts in the Management of Spinal Disorders	Ponte Vedra Beach FL	USA	English
15.09.	Masterclass	Nottingham	United Kingdom	English
18.09.	Solutions in Degenerative Disc Diseases		Belgium	English
22.09.–23.09.	Spine User Group	Nottingham	United Kingdom	English
30.09.–02.10.	10th AO Spine Course	Tokyo	Japan	English
30.09.–02.10.	Comprehensive Spine Course	Guayaquil	Ecuador	Spanish, English
October				
01.10.–31.10.	LASEC Seminar	Santiago	Chile	Spanish
11.10.–16.10.	Spine Seminar	Guangzhou, Xian	China	Chinese, English
November				
11.11.–13.11.	AO Seminar Wirbelsäule – Trauma	Murnau	Germany	German
11.11.–12.11.	Spine Seminar with Workshop for ORP	Murnau	Germany	German
24.11.–25.11.	Instructional Spine Course for Junior Trainees Modul II—The Painful Spine	Glasgow	United Kingdom	English
December				
04.12.–06.12.	Spine Course	Dubai	United Arab Emirates	English
12.12.–17.12.	Spine Course Interactive I—Degenerative & Reconstructive	Davos	Switzerland	English
12.12.–17.12.	Spine Course Interactive II—Degenerative & Trauma	Davos	Switzerland	English
12.12.–17.12.	Spine Masters Course I	Davos	Switzerland	English
12.12.–17.12.	Spine Masters Course II	Davos	Switzerland	English

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