

directLINK®

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Magazine for Arthroplasty

»There are probably more indications for the Link OptiStem than we can imagine today«

Prof. Carsten Perka on indications, design features and intraoperative advantages of the new LINK stem extension.

LINK SP II

Excellent care despite declining reimbursement rates in the U.S.: Dr. James C. Wittig in an interview

Cementless primary TKA

Dr. Alfredo Rodriguez on the cementless implantation of primary knee arthroplasties

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Dear Readers!

The coronavirus has changed the way we work in some areas and put our creativity and productivity to the test. Together, we are overcoming these challenges.

A number of new products have recently received approval, further expanding our basically complete implant range. For example, the Link OptiStem: a standard version for our Endo-Model knee family is now also part of our portfolio for revisions and distal femur replacements. The stem shape, which is adapted to the distal anatomy of the femur, offers great potential for long-term stable treatment options. Prof. Carsten Perka describes his first impressions of the OptiStem starting on page 2.

Our knee revision portfolio also includes FlexiCones. This solution for compensating for bone deficits and for augmentation is finding more and more users – in Europe and also in many other countries. In the U.S., orthopedic surgeons have found ways to care for their patients under pandemic conditions. Orthopedic surgeon Dr. James C. Wittig from the state of New Jersey reports on how he and his team are managing to maintain their usual high level of care for patients even as reimbursement rates fall; read his interview starting on page 12.

I hope you enjoy these and many other topics in directLINK.

Yours,

Helmut D. Link

Imprint

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»There are probably more indications for the Link OptiStem than we imagine today«

The new Link OptiStem is a stem extension of the LINK portfolio to the Endo-Model knee family. In this interview, Prof. Carsten Perka talks about indications, design features and intraoperative advantages of the OptiStem.

Prof. Perka, you have already treated several patients with the OptiStem, as one of the first surgeons to use it.

What indications do you see for it?

Provided that the bone is of sufficient quality in the transition from metaphysis to diaphysis and is biologically active, the cementless OptiStem would be indicated for defects in the knee joint, for example, due to its newly improved anchorage principle with distal oval fixation.

Why the cementless version?

In principle, I always cement when there is enough cancellous bone in the diaphysis and metaphysis – although cemented stems do not hold as well after the second revision, if not before, due to a lack of sufficient cancellous bone. Cementless stems should therefore at least be considered in all cases where cancellous bone is missing and a good and durable cemented anchorage can no longer be achieved. The cementless Link OptiStem allows such a reliable and durable anchorage. I therefore think that there are probably more indications for the cementless OptiStem than we imagine today.

What are the advantages of the cementless OptiStem design with regard to durable and reliable anchorage?

An important design feature is the Tilastan surface of the cementless OptiStem. It is remarkably rough, has a

very high friction and thus ensures high primary stability. If bone is going to grow into something, it's going to grow into such a surface. The second advantage is the ribs: they really cut into the bone and thus reinforce the rotational stability of the stem component. The third advantage is that the stem radius is more closely adapted to the anatomy of the femur, which offers a high potential for a very large number of long-term stable treatment options. The Link OptiStem thus has several design features that significantly increase the range of indications for cementless revision systems.

»Because of its anatomical design, the OptiStem fixes onto three areas rather than three points as other systems do.«

The stem of the OptiStem is proximally round and distally oval. How do you rate this feature?

This design feature results in large contact areas to the remaining femur. The stems currently on the market have a round cross-section, which does not correspond to the anatomy of a medullary canal with an oval cross-section. Stems with a round cross-section can therefore only anchor selectively in an oval medullary canal – which is why they are



»The surface of the cementless OptiStem is remarkably rough, has very high friction and thus ensures high primary stability. If bone is going to grow into something, it grows in on such a surface.«

Prof. Carsten Perka

ABOUT

Prof. Carsten Perka is Medical Director of the Center for Musculoskeletal Surgery at the Clinic for Orthopedics of Charité – Universitätsmedizin Berlin, Campus Mitte (CCM).



always less suitable. An anatomical stem shape fits better and allows for a really good and durable anchorage.

»With the OptiStem, you have a revision system that can be used in almost any situation.«

Why does an anatomical knee stem anchor better than an ordinary round stem?

If the stem fits well, anchorage is closer to the joint – and the closer a stem is to the joint, the more promising the system is. Today we know that two zones are needed for anchoring in the medullary canal. Because of its anatomical shape, the OptiStem fixes in two zones and with maximum stability due to the large contact areas. This results in more areas for the implant to grow into the bone. The anchoring in the metaphysis and the diaphysis close to the joint also results in a more physiological force transmission. This is a significant advantage over stems that only fix in the diaphysis, which leads to further bone recession.

How important is the high modularity of the OptiStem for you?

The high modularity and the high primary stability of the OptiStem make it possible to anchor the stem where it is needed. Once anchorage in the stem has been achieved after self-positioning, the rotation and distance of the implant can be changed as desired by selecting the appropriate adapter, thereby adapting the joint geometry. With other systems, you have to pay attention to the alignment when inserting the stem – but this is not always possible. With the Link OptiStem it is very simple. Various intermediate elements and components, such as the modular Endo-Model SL and the EVO – M / – W, can also be connected via corresponding adapters. With the OptiStem, you therefore have

a revision system that can be used in almost any situation.

Which surgical challenges does the Link OptiStem help with in particular?

Those are primarily the surgical challenges that arise when large defects have been created by the loss of bone close to the joint, for example as a result of the initial operation, trauma or infection. In septic revisions, for example, it is very often necessary to remove large amounts of cancellous bone together with bone substance, and it is then no longer possible to achieve adequate stability with cement. The OptiStem thus actually helps with all the problems that can occur with multiple revisions and septic revisions.

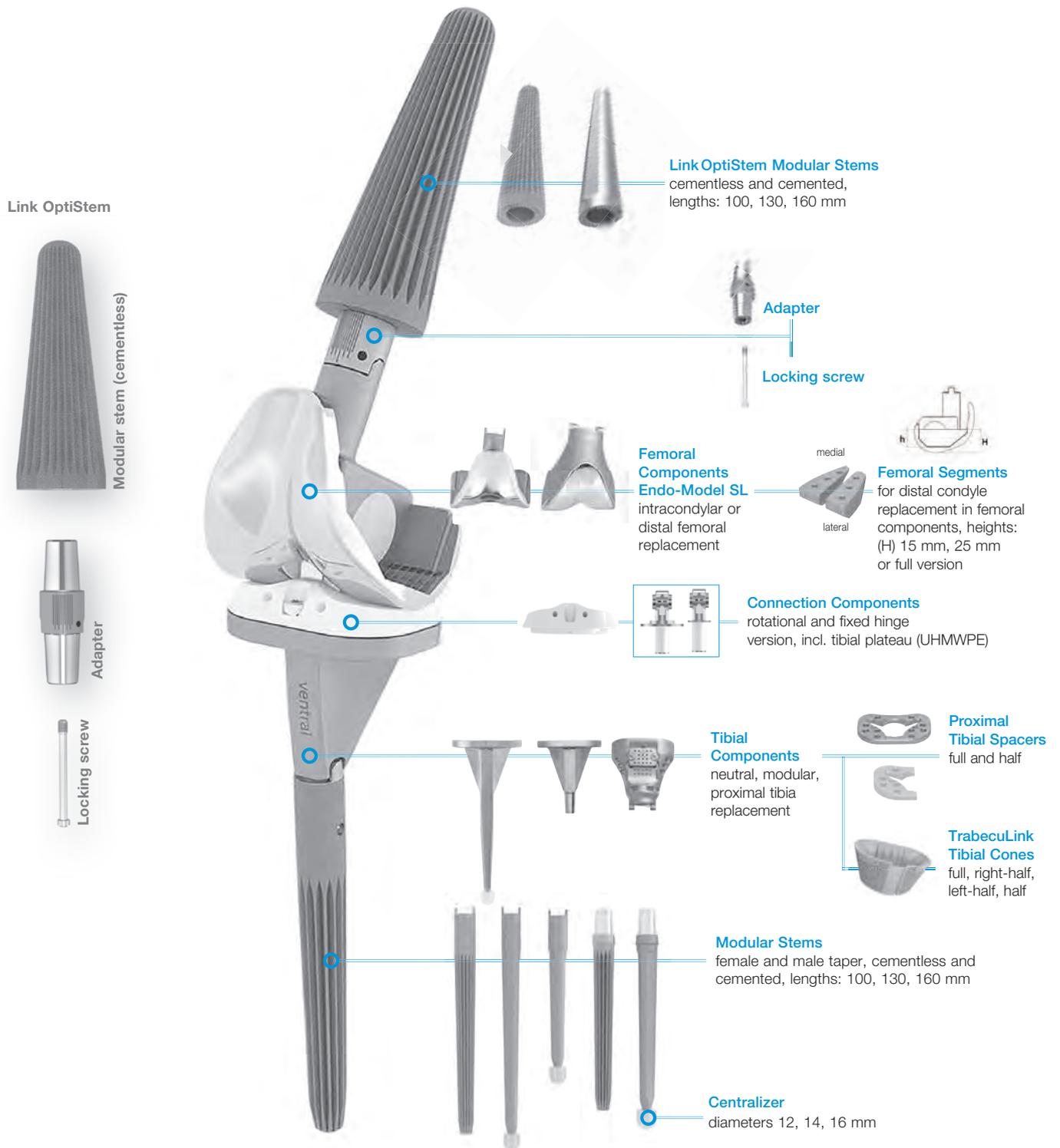
»The OptiStem has three surface features that significantly increase the range of indications for cementless revision systems.«

What has been your experience with the OptiStem so far?

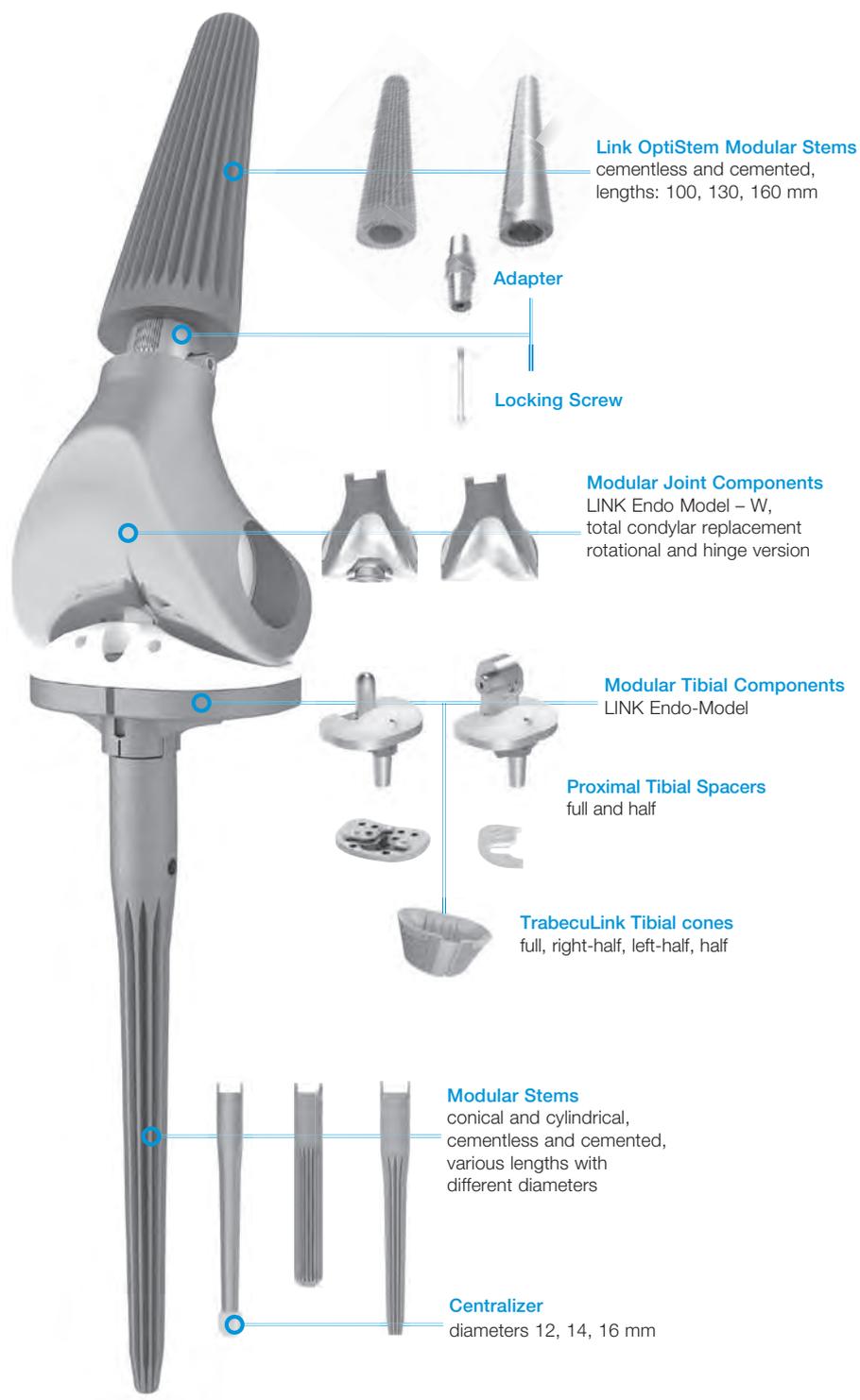
We have had extremely good experiences, even with the very large bone defect situations. In one patient, for example, after a tumor resection only ten centimeters of the femur remained, and it was possible to anchor the replacement well with an OptiStem. We have had no failures so far. The success of modular systems will depend very much on the individually achievable stability of the prosthesis. From my point of view, the OptiStem is a first step away from the ordinary stems on the market and towards an even more individual and better treatment for patients.

Prof. Perka, thank you very much for the interview.

Treatment options for the Link OptiStem with the LINK Endo-Model SL



with the LINK Endo-Model



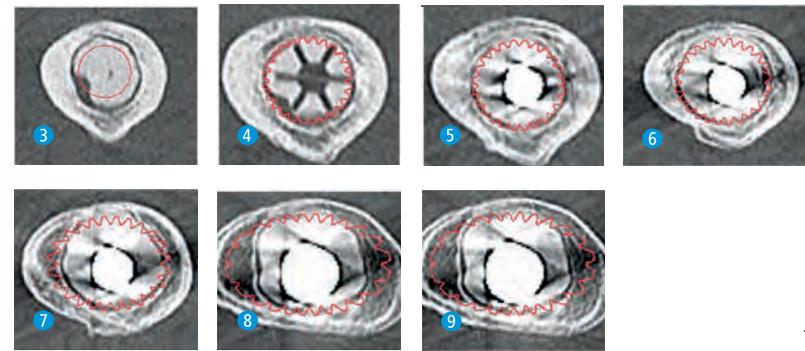
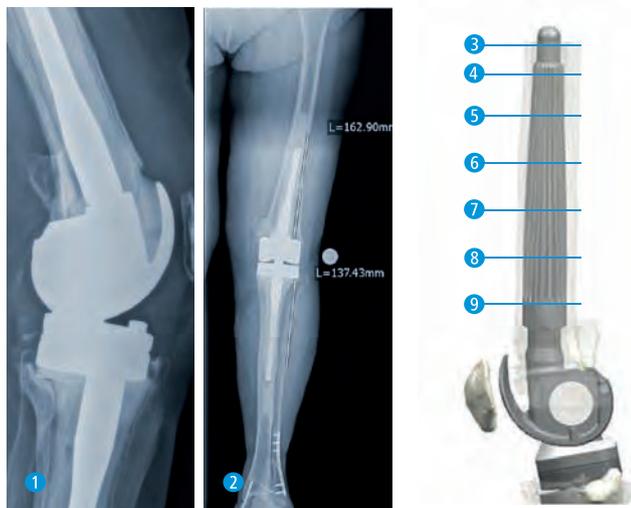
Patient-specific **customLINK** prosthesis with femorally and tibially adapted OptiStem modular stems*



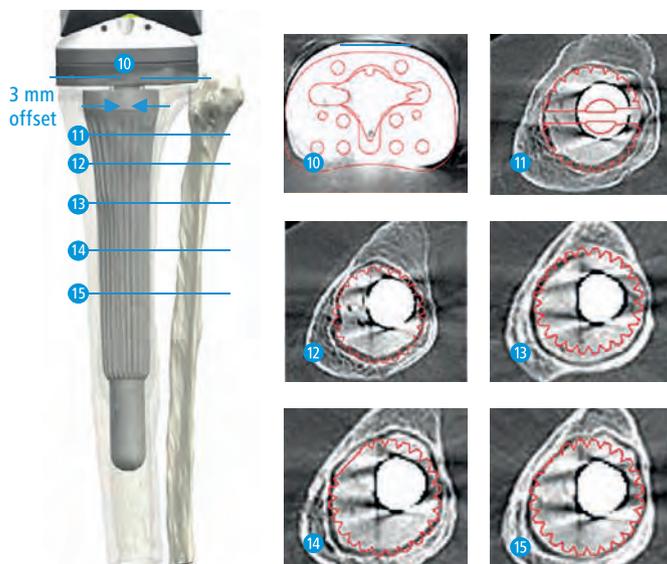
customLINK OptiStem Case Report I: Endo-Model – M with cementless femoral and tibial OptiStems

An 80-year-old female patient with a body weight of 88 kg and a height of 167 cm presented in March 2021 to the Center for Musculoskeletal Surgery at Charité – Universitätsmedizin Berlin because of progressive left knee pain. The medical history revealed the primary implantation of a left knee prosthesis (KTEP) in 2015. In January and February 2016, due to a periprosthetic infection without evidence of germs, a two-stage revision with reconstruction of the KTEP was performed, followed by another,

now one-stage revision due to aseptic loosening in February 2017. Subsequently, an aseptic early loosening developed in September 2017. At the time of presentation, an M-size LINK Endo-Model with augment was in situ. The femoral stem was 135 mm long, and the tibial stem (with washer) was 160 mm long. For the treatment of the patient, LINK was asked to develop a femoral and a tibial cementless OptiStem with individual dimensions.



The preoperative CT slices (1, 2) show the loosened implants and the expected length of the OptiStems to be implanted. The preoperative digital femoral planning (3-9) shows that the customLINK OptiStem is more oval distally than proximally and therefore fits better to the metaphysis of the femur.

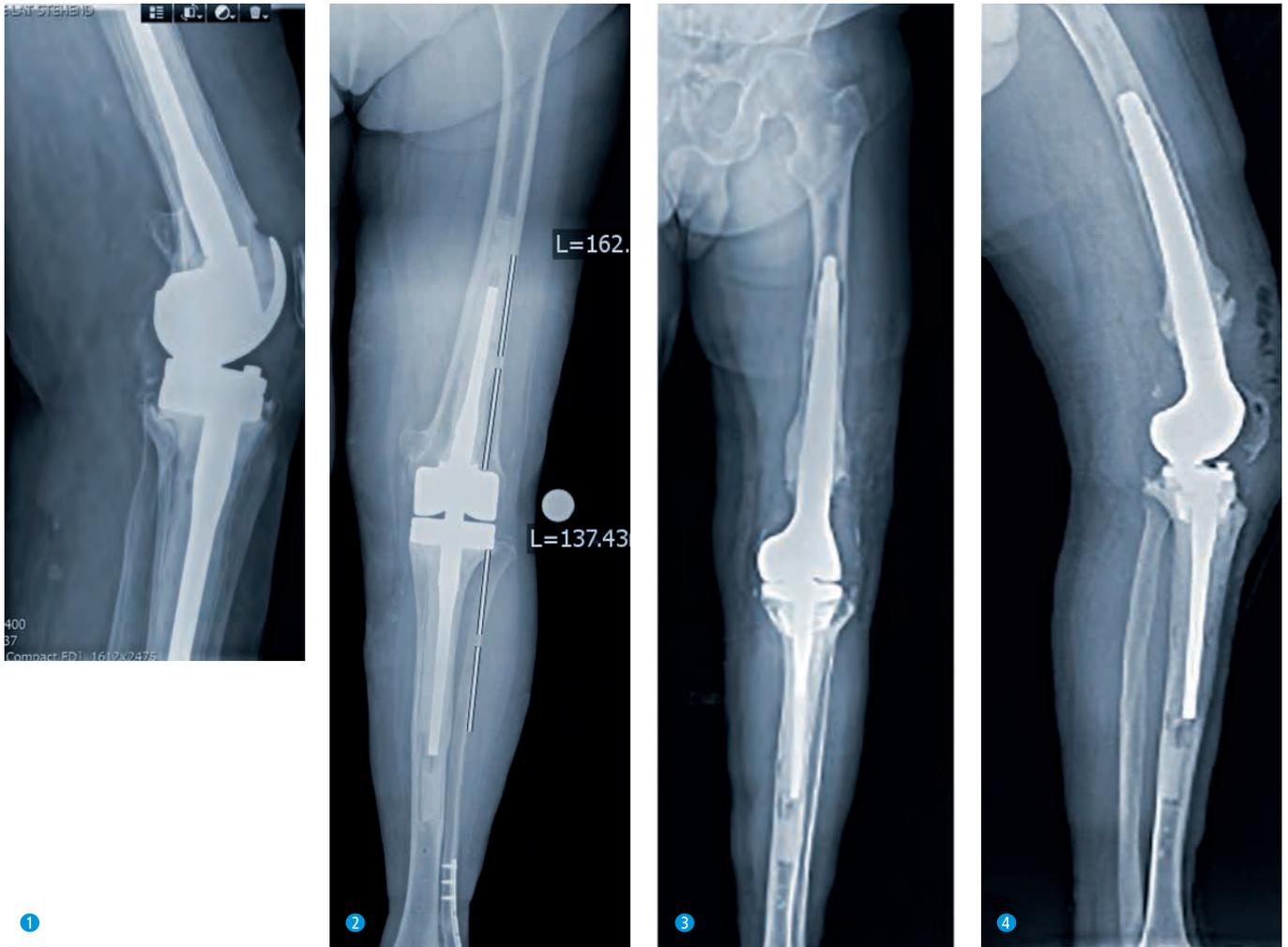


The preoperative digital tibial planning (10-15) shows that the tibial stem has a lateral offset of 3 mm, is adapted to the medullary canal and therefore cannot be rotated intraoperatively. The femoral (16, 17) and tibial customLINK OptiStem (18, 19) are anatomically curved, cementless and each has a polished tip.

customLINK OptiStem Case Report II: Cementless femoral OptiStem and distal femur replacement

A 72-year-old male patient with a body weight of 97 kg and a height of 180 cm presented in September 2021 with aseptic loosening of the extra-long femoral component of a left knee arthroplasty (KTEP). The history revealed that a primary implantation of a KTEP had been performed in July 2010 and a two-stage revision in October 2011, followed by revision with a cementless femoral component in June 2016. Due to loosening, a one-stage revision of the femoral component with a cemented component had been performed in September 2016. At that time, the patient was fitted with an M-size LINK Endo-Model with a femoral stem length of 280 mm, a tibial stem length of 160 mm

and an 8 cm long distal partial femoral replacement of size M. To restore the function of the KTEP, LINK was asked to develop a cementless femoral OptiStem with a length of 165 mm from the distal border of the cortical bone. It was to extend into a distal femoral replacement for coupling with the tibial stem of the Endo-Model that remained in situ. The femoral implant has the individual dimensions of the patient.



The preoperative X-ray images in standing position (1, 2) show the loosened implants and the expected length of the cementless femoral customLINK OptiStem and the distal femoral replacement. The postoperative X-rays in standing position (3, 4) show the correct fit of both implants.



Working meeting at LINK headquarters: Dr. Alfredo Rodriguez and Helmut D. Link discuss cementless fixation in TKA.

»In most primary TKA, there is no reason to avoid cementless implantation of the tibial plateau«

In primary total knee arthroplasty (TKA), the tibial plateau is usually implanted with cement. Dr. Alfredo Rodriguez has been following a different approach for many years. In this interview, he shares his rationale and experience with cementless implantation.

Dr. Rodriguez, you started implanting the tibial plateau without cement in primary TKA as early as 1992. What were your reasons?

At that time, we started using mobile tibial plateaus in TKA to prevent loosening of the tibial component due to shear forces transmitted to the metallic part of the tibial plateau. In addition, we wanted to avoid osteolysis caused by poorly cemented arthroplasties. For both, cementless implantation of the tibial plateau seemed to be the right way to proceed.

Have you defined the indications for cementless implantation of the tibial plateau more precisely?

First and foremost, cementless fixation in TKA is certainly suitable for very young people with good bone quality. In our experience, however, there are no age restrictions here. Exceptions are revisions, polyarthritic patients, and some patients with a very small tibia.

Which LINK products do you use?

We started implanting the GEMINI SL Knee Replacement from LINK about two years ago. The clinical and radiological results are excellent. In our center we implant around 400 TKA per year.

What are your results in detail?

I have used mobile, cementless plateaus

from other manufacturers since 1992 before the GEMINI, and we have not found any osteolytic areas during follow-up examinations. For more than 30 years, we have also not had to perform any revisions due to tibial plateau loosening as a result of PE wear. The range of motion of the knee joint in the patients is very good with an average of 135° flexion, which is also due to the mobile plateaus, as the morphology of the posterior condyles is matched to those of the tibial plateau. One year after surgery, patients regularly report a very good range of motion without instability and say that they were able to resume their normal lives very quickly.



Are there any economic advantages to cementless implantation of the tibial plateau?

The operation time is about 15 to 20 minutes shorter, since both the preparation and the implantation of cement are omitted. The costs for the cement and the corresponding accessories are also eliminated.

What do your colleagues say about your rather unusual approach?

In our hospital, all my colleagues implant the tibial component in a TKA without cement. Some other hospitals in Spain are now also taking this approach and implanting both the femoral and tibial components without cement in a TKA. I am lucky and can choose an implant that I can use without cement. If it should really be necessary, I can intraoperatively switch to a cemented version.

Why are not more surgeons switching to the uncemented implantation technique for the tibial plateau?

I can only speculate on that. 40 years ago, the implant design simply wasn't there to allow bone to attach sufficiently without cement. So cemented TKA was often the only way to achieve good long-term results. Today, however, implant surfaces with TiCaP coating, for example, allow very good osseointegration, so the situation is different. For most primary TKA, there is no reason to avoid cementless implantation of the tibial plateau.

Dr. Rodriguez, thank you for the interview.



ABOUT

Dr. Alfredo Rodriguez, MD, PhD, is Director of the Orthopedics and Traumatology Department at the University Hospital Sant Joan Reus in Tarragona, Spain.

»In over 150 patients, I have never experienced a dislocation, periprosthetic fracture, or infection utilizing the SP II stems from LINK«

Orthopedic Oncologist and Sarcoma Surgeon Dr. James C. Wittig, MD, about delivering continued outstanding care to hip patients despite decreasing reimbursement rates, the need to identify the right device partners, and the advantages of the SP II stem from LINK when treating patients with metastatic cancer to bone.



»At Morristown Medical Center¹ where we perform over 11,000 orthopedic surgeries annually with some of the top outcomes in the nation» [Dr. James C. Wittig, MD](#)

orthopedic surgeries annually with some of the top outcomes in the nation. At the hospital system level, my leadership duties continue, where Atlantic Health System has over 200 orthopedic surgeons and performs over 14,000 surgeries across 5 hospitals. As medical director of orthopedic oncology, my role has been to build a service line that never previously existed in the hospital system. After 3 years, I am pleased to report that in 2021 we are targeted to perform approximately 500 surgeries on various malignant and benign musculoskeletal tumors.

»At Morristown Medical Center¹ where we perform over 11,000 orthopedic surgeries annually with some of the top outcomes in the nation.«

How was the hip fracture program conceived, and why was there a need to build such a program within the Atlantic Health System?

Morristown Medical Center¹, in Morristown, New Jersey, is a Level 1 verified trauma center and hence quality, safety, and service to a broad population is at the forefront. Throughout the system, my colleagues and I treat a multitude of hip fractures in elderly patients. The hip fracture program was born out of CJR

Dr. Wittig, tell us about your practice and the unique patient population you serve.

I have been a practicing orthopedic oncologist for over 20 years. My practice focuses on Limb Saving Surgery for Children and Adults with Bone and Soft Tissue Sarcomas affecting the extremities, pelvis, thorax, and spine. Similarly, I take care of patients with metastatic cancer to bone and soft tissues, pathological fractures, and all types of benign musculoskeletal tumors affecting bone and soft tissue. I attended New York University for medical school and graduated top of my class receiving distinction awards in Alpha Omega Alpha, Surgical Excellence, and honors distinction. My general surgery

internship was completed at St. Luke's-Roosevelt Hospital now Mount Sinai West in Manhattan. Following my internship, I performed my residency at Columbia Presbyterian Medical Center, again in New York, where I ultimately served as executive chief resident. Lastly, I moved to Washington, D.C., and performed a special two-year fellowship at Washington Hospital Center and the National Institutes of Health.

Explain the role of the Department Chair at your clinic group Atlantic Health System (AHS).

As Department Chair, I lead an outstanding group of over 100 orthopedic surgeons at Morristown Medical Center¹ where we perform over 11,000

(Comprehensive Care for Joint Replacement), a government designed program for standard primary joint replacements that focuses on the highest quality outcomes for patients while maintaining considerations for cost and evidence based care. Our goals were to provide similar care pathways and methods applied in the program for our hip fracture patient population by focusing on best practices for the care of these patients.

Why was identifying a partner critical in providing a proven clinical and economical implant solution for the AHS hip fracture program?

With a continuously aging population, meaning more patients living longer and hence experiencing more hip fractures, there are constant pressures by our government for cost containment while still providing outstanding evidence based care and the best outcomes. Our federal government frequently implements reimbursement reductions to hospitals who in turn are still tasked with delivering continued outstanding care to patients. Many of the hip fracture patients are treated with prosthetic replacements which are rather costly and, most times, included in the cost for which the hospital must manage in the care of the patients. With decreasing reimbursements, it has become increasingly important to identify device partners with a long track record of manufacturing prosthetic replacements that provide best outcomes with minimal complications. Likewise, in the spirit of partnership, the manufacturer must be willing to sell the prostheses at rates that are commensurate with the decreasing reimbursement rates.

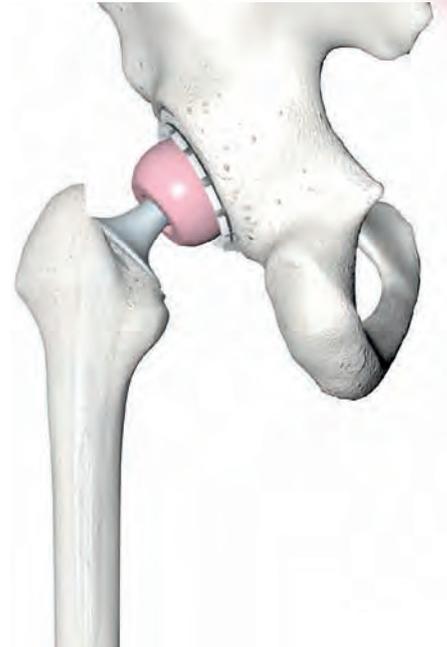
What role has LINK played in the implementation of the hip fracture program?

For years, I have implanted a version of the SP II stem, treating my often very ill

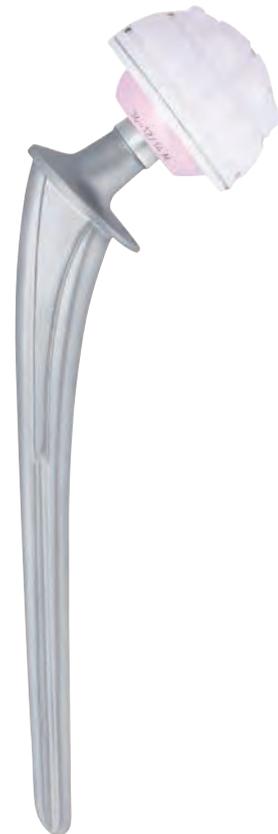
patients with metastatic cancer to bone who have impending or actual pathological fractures. Over this period, I experienced much success, great outcomes, and very a minimal complication rate. In my modest series of slightly over 150 patients, I have never experienced a dislocation, periprosthetic fracture, or infection utilizing the SP II stem. Also, of note, LinkBio, LINK's subsidiary in the United States, has a thorough understanding of the challenges hospitals, surgeons, and other healthcare stakeholders are experiencing with regards to value based care, most especially declining reimbursement. Based on my relationship with LinkBio's team and my overall positive outcomes historically with the SP II, we collaborated to meet the needs of the program design.

In a predominantly cementless market, such as the United States, what features of the SP II stem most appealed to you?

Since hip fractures occur in a primarily elderly population, it has become increasingly important to use cemented stems most especially in females above the age of 75 who are at the highest risk of periprosthetic fracture and failure given their predisposition to severe osteoporosis. The SP II's anteverted neck reproduces the physiologic anatomy and aids in reducing the potential for dislocation. An anatomic S-shaped design promotes a uniform cement mantle around the entire stem within the medullary canal. Varying neck shaft angle options allow optimal intraoperative flexibility to address leg length and offset to match patient anatomy. These features combined with optimizing instrumentation usage and tray efficiency afford my staff the ability reduce the labor burden on sterile processing teams at the hospital and likewise reduce consumption of critical hospital supplies. These factors support the entire



»The SP II's anteverted neck reproduces the physiologic anatomy and aids in reducing the potential for dislocation.» [Dr. James C. Wittig, MD](#)



team in delivering a reliable, reproducible outcome for our fracture cases.

»It has become increasingly important to use cemented stems most especially in females above the age of 75 who are at the highest risk of periprosthetic fracture and failure given their predisposition to severe osteoporosis.«

How does an anatomically curved design support a potential reduction in periprosthetic fractures in elderly patients?

An anatomic S-shaped design promotes a uniform cement mantle around the entire stem within the medullary canal. The canal filling geometry and self-centralizing design of the SP II require a minimal cement mantle and decreases the potential for thermal necrosis. There is very compelling long term clinical data from the Swedish registry as well as data to suggest the hazard ratio due to periprosthetic fracture within 2 years was five times higher with the other cemented stems when compared to the SP II².

How does an early complication such as loosening or periprosthetic fracture impact the stakeholders of the AHS hip fracture program?

This all boils down to the push in the United States to value based care. A hip fracture itself is a devastating event for a patient, let alone developing a second periprosthetic fracture after initial treatment. The cascade is quite significant and often a progressive downhill course for the patient. The event is also very expensive, requiring readmission to the hospital and additional surgeries that often incorporate revision hardware and prostheses that add more trauma to the

patient's anatomy not to mention the tremendous expense to the overall care of the patient. Providing the ideal surgery and prosthesis for the patient first time around coupled with individualized care is of utmost importance to get a patient back to their premier of status as best as possible while minimizing complications that usually have a progressive downhill course. Our philosophy provides best practices in the most economical manner.

Dr. Wittig, thank you for the Interview.

¹ Morristown Medical Center named #1 Hospital in the State Of New Jersey. Top 5% for joint replacement outcomes in the United States. Number 4 highest volume Medicare joint replacement cases nationally. — Source US News and World Report

² Periprosthetic Femoral Fracture within Two Years After Total Hip Replacement — Journal of Bone and Joint Surgery, 2014, e167(1).



ABOUT

Dr. James C. Wittig, MD, is Chair Orthopedic Surgery at Morristown Medical Center¹ and serves as Medical Director Orthopedics, Orthopedic Oncology and Sarcoma Surgery at Atlantic Health System in the State of New Jersey, USA.

www.tumorsurgery.org
Twitter: @DrJamesWittig

International LINKademy events: 1st half of 2022

Date	Program	Location
03/15–16/2022	LINKademy International Level 3 Course, Primary to Revision Hip C.F.P II/MP/MobileLink	Hamburg, Germany
04/07–08/2022	LINKademy Training of Excellence Embrace Shoulder System	Italy
04/26–27/2022	LINKademy International Level 2 Course, Acetabular Treatment MobileLink/BiMobile/TrabecuLink Augments	Hamburg, Germany
05/03–04/2022	LINKademy National Level 3 Course, Primary & Revision of the Hip LCU/MP/MobileLink/BiMobile	Wendisch Rietz, Germany
05/10/2022	Winglet TV Event, Primary Knee Arthroplasty When to Choose What – Uni or Total Knee?	online
05/17–18/2022	LINKademy International Level 3 Course Embrace Shoulder System	Wendisch Rietz, Germany
06/13–14/2022	LINKademy Training of Excellence, in cooperation with Helios ENDO-Klinik Periprosthetic Joint Infection	Hamburg, Germany
06/28–29/2022	LINKademy International Level 3 Course, Complex Hip Revision MP/MobileLink/BiMobile/TrabecuLink Augments	Wendisch Rietz, Germany

For more information, visit www.linkorthopaedics.com or use the QR code below.

To register for a workshop, please contact your LINK Medical Product Advisor or send an email to linkademy@linkhh.de.



LINK is now also on VuMedi

Over 40,000 videos and webinars featuring surgical techniques and more from leading surgeons at hospitals and clinics such as Cleveland Clinic, Mayo Clinic and other trusted institutions and experts are available for physicians and interested parties at www.vumedi.com.

The platform, which originated as a student project in 2007, has more than 500,000 subscribers from over 20 specialties worldwide.

www.vumedi.com aims to improve patient care by providing physicians and other healthcare professionals with access to the insights and extensive knowledge from the world of medicine, enabling them to make optimal decisions for the care of their patients. At VuMedi, a curation team authenticates videos and tags them by specialty and



other factors. A proprietary recommendation algorithm ensures physicians can find the right video at the right time.

In addition to educational content and CME, VuMedi offers discussion forums and opportunities for direct communi-

cation with experts. LINK is now also on VuMedi. The videos for orthopedic surgeons are available for download at www.vumedi.com.

Miniature hinged knee from LINK: After 20 years, the tibial component could be left in situ

The fact that LINK archives the records of custom-made products benefits doctors and patients alike. This is illustrated by the case of a patient who had a miniature hinge knee arthroplasty from LINK implanted on her left side in 2001 at the age of 26. In March 2021, the patient presented to Radboud UMCN Hospital in Nijmegen, the Netherlands, with signs of femoral component loosening.

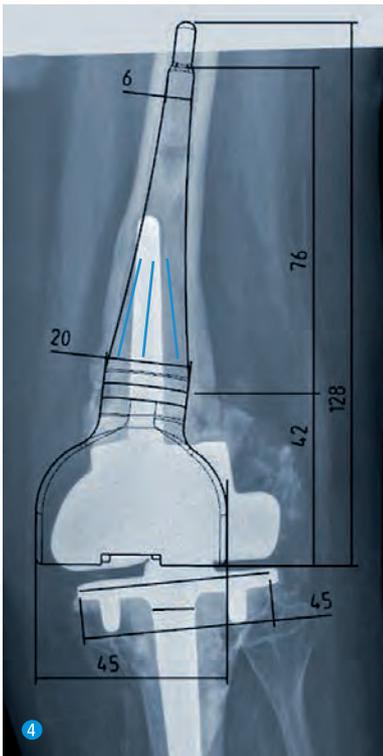
The miniature hinged knee had been custom-made by LINK in 2001 from solid material at the request of the surgeon, as prosthesis blanks were not available for a suitable prosthesis size for the patient of 134 cm at a weight of 34 kg. When the femoral component had to be changed in 2021 due to loosening, the surgeon asked LINK to develop a

new custom-made cementless femoral component compatible with the XXS tibial component in situ. Because the planning documents from 2001 were still available, it was possible to manufacture a custom-fit anatomically adapted cementless exchange component with TiCaP coating (titanium plasma plus calcium phosphate). The tibial com-

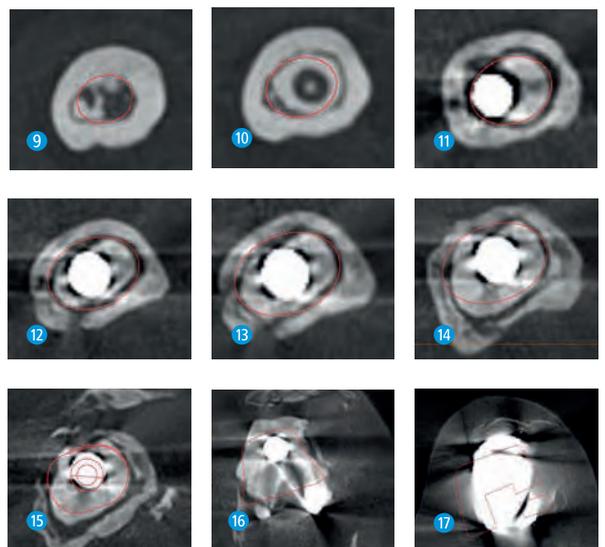
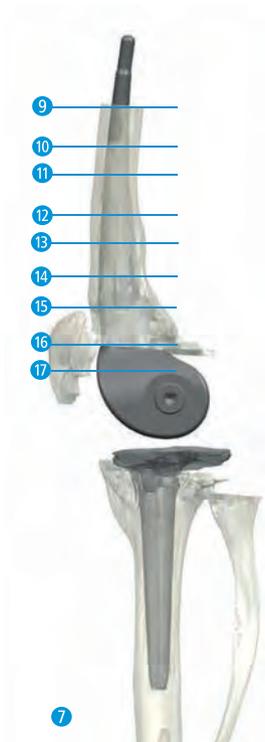
ponent therefore did not have to be changed and remained in situ.



The preoperative X-rays show the miniature hinged knee prosthesis (1, 2), which was custom-made in 2001 by LINK, in situ. In the lateral view, clear signs of loosening are visible, especially femorally (2). The postoperative X-ray shows the correct fit of the anatomically adapted cementless exchange component with TiCaP coating (3).



The X-ray planning plan shows the custom-made cementless femoral component, which is compatible with the XXS tibial component in situ (4, 5). The femoral component is a cementless LINK Monoblock prosthesis used as a hinge joint with an anatomically curved femoral stem (6). The cementless stem is coated with TiCaP and features ribs and a polished tip distally. CT planning (7-17) clearly shows that the anatomical stem follows the medullary canal and rotation is fixed.

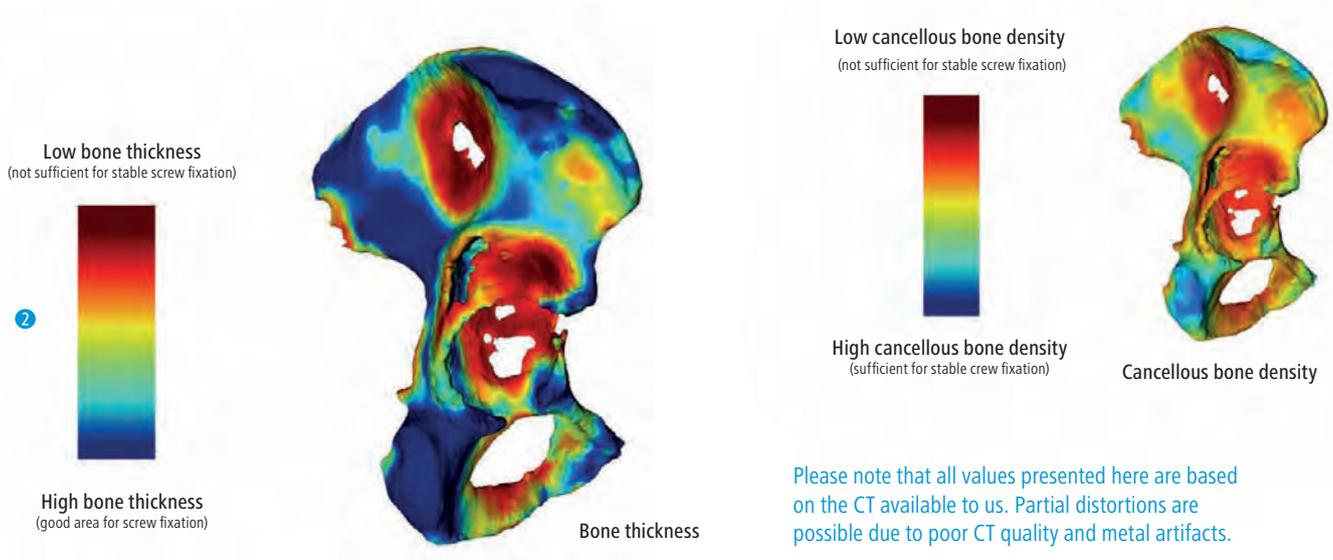
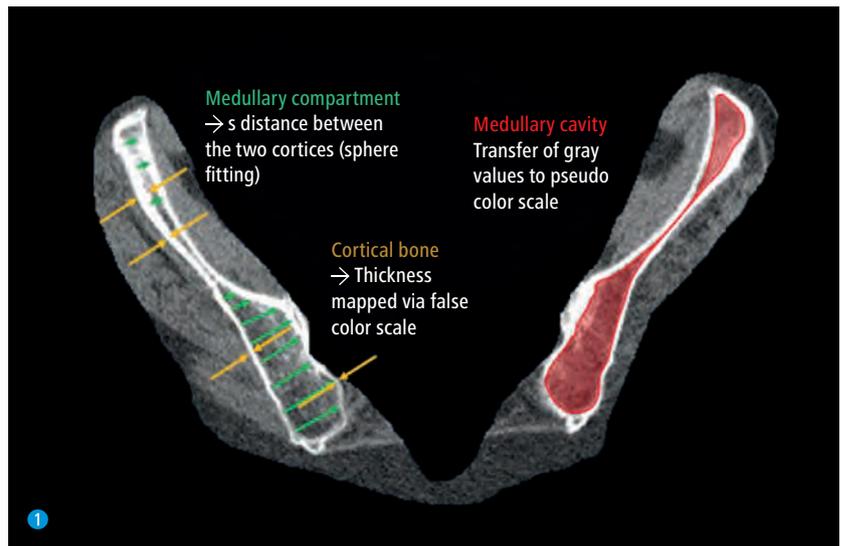


LINK Bone Analysis displays wall thickness, total thickness and bone thickness in color

LINK Bone Analysis is a method developed by LINK for the graphical representation of bone characteristics. The result of the analysis, called LINKScore, is an essential factor in the planning process for a long-term stable and biomechanically favorable surgical outcome.

The basis of the analysis is the CT scan of a specific bone area. The bone is segmented by specially developed software and analyzed by an algorithm. The calculations are based on the Hounsfield values of the CT slices, with the CT gray values being converted into colors. A crucial factor for the analysis is the quality of the CT scan. Some acquisition parameters as well as metal bodies in the examination area can distort the Hounsfield values. Three main characteristics are determined by the analysis (see Figure 1):

- the cortical wall thickness
- the total thickness of the bone
- the cancellous density

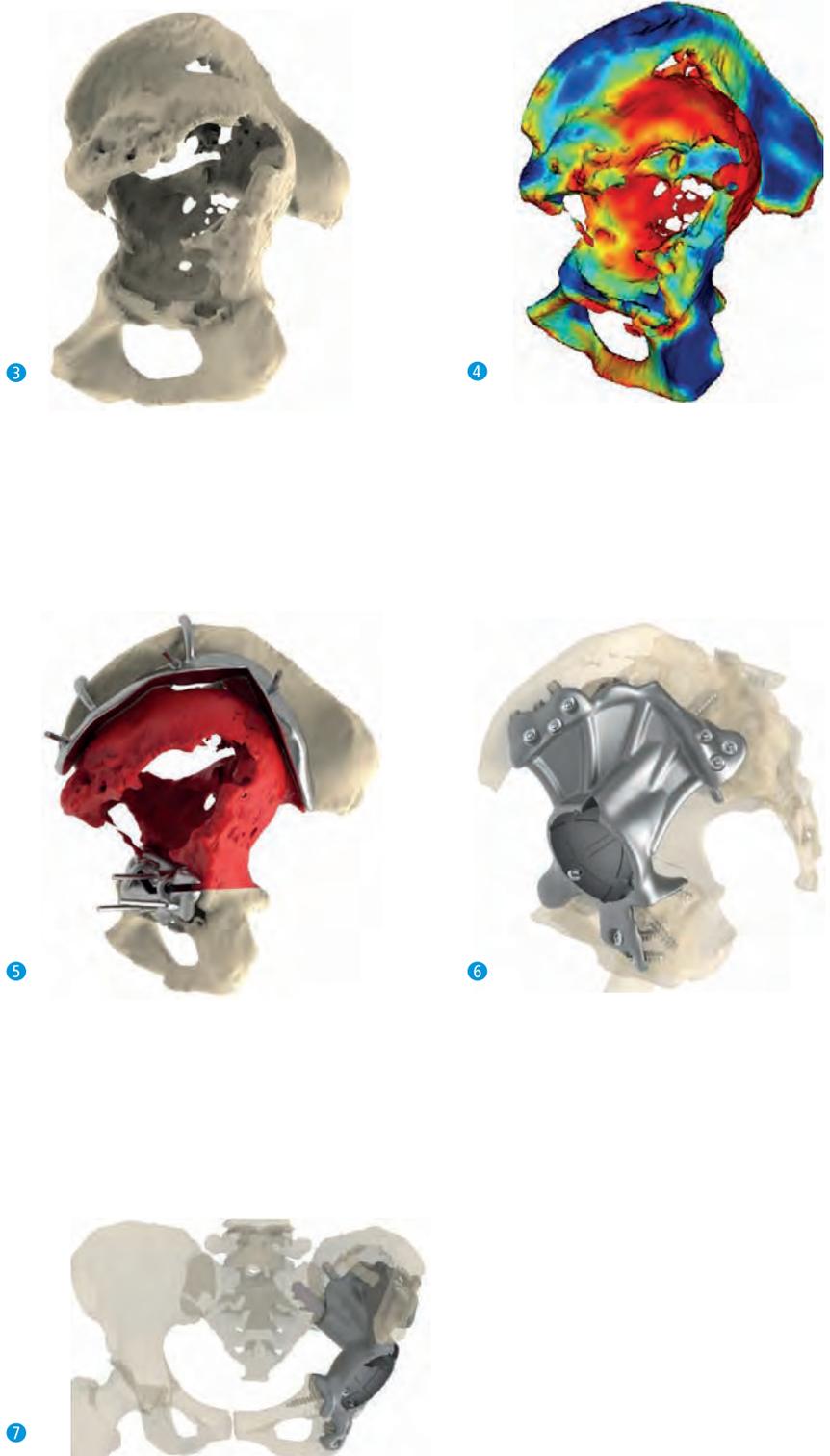


Please note that all values presented here are based on the CT available to us. Partial distortions are possible due to poor CT quality and metal artifacts.

The values are then used to calculate the **LINKScore**, which provides information about the bone quality. Among other things, it shows whether the bone is thick enough to anchor screws. The space between the cortices can also be displayed in color.

This color display of the regionally different values makes it possible to take anchorage-potent bone regions into account in the development process of patient-specific implants. Defective bone regions or thin, porous structures can be displayed quantitatively in an overview for the ordering physician to provide an optimal basis for decision-making in the planning process and allow optimal preparation for the anatomical conditions that will be encountered in the surgical procedure. With the aid of the technique, also known as the false color system, the maximum possible stability of the artificial joint replacement can be realized (Figure 2). The following example shows the application of the **LINKScore**.

The **LINK Bone Analysis System** can be applied to all patient-specific implants planned based on a CT, including custom partial pelvic replacements, for which their use is the preferred option.



The example shows the CT of a defect situation after 3-D reconstruction (3). The analysis of the bone quality results in this color display (4). Based on the analysis, the ordering physician decided in consultation with the designer that the defective area (red) would be resected (5). The implant design precisely adjoins the defined resection areas and thus ensures maximum stability (6, 7).

LINK and mediCAD® cooperate on digital planning software

LINK has reached an agreement with mediCAD® Hectec GmbH on the distribution of the company's software for 2-D and 3-D planning of arthroplasty of knee, hip and shoulder joints. mediCAD® Hectec will in future provide hospitals and surgeons with planning software developed in close cooperation with physicians.

The powerful software of mediCAD® Hectec, based in Altdorf near Landshut, gives users a modern, reliable and time-saving program for the preoperative planning of LINK implants. The software takes into account the known planning methodologies and documents all procedures in a legally compliant manner.

Modular structure, integrated templates

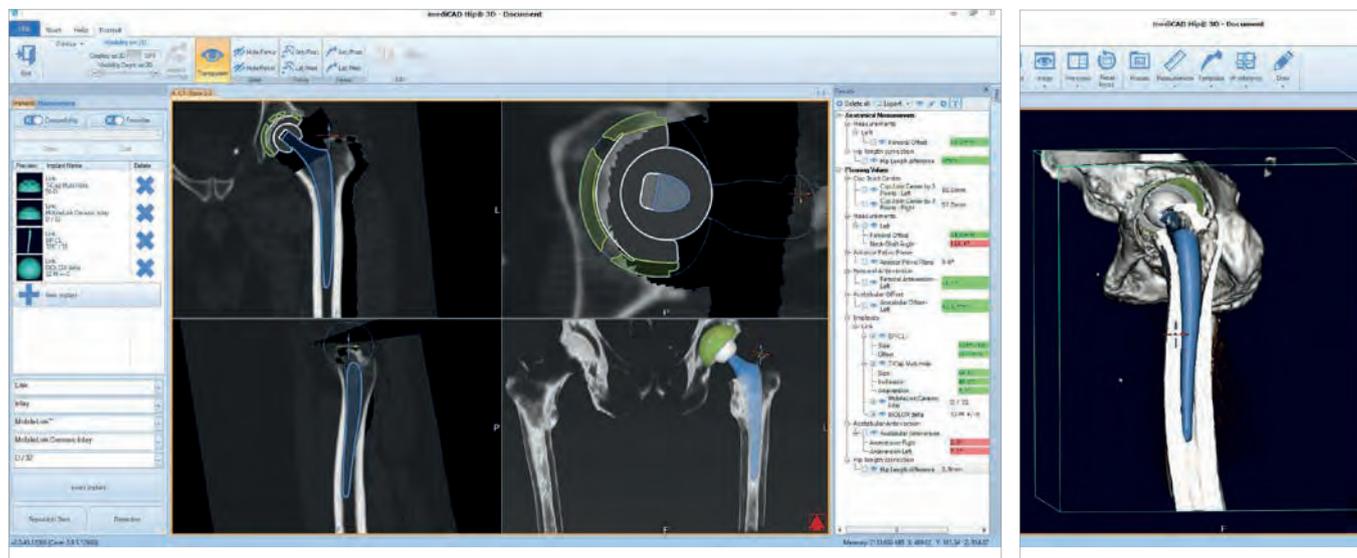
In 1999, mediCAD® was the first software to enable complete digitized preoperative planning of a joint replacement with only a few inputs. Since then, the numerous 3-D modules for operations

on the hip, knee, shoulder and spine have been continuously developed. Today, mediCAD® is the world's most widely used digital planning program for orthopedic surgery, with over 3.500 installations in 23 languages and more than 25.000 users. In addition, mediCAD® has the world's largest implant database with over 500.000 templates from around 130 international implant manufacturers.

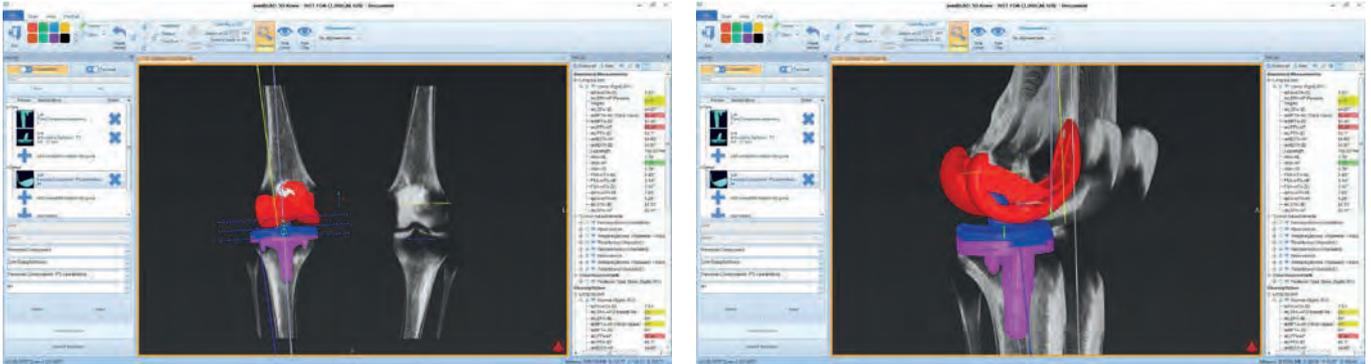
mediCAD® has a modular design, offers many optional add-on modules and is certified and approved as a medical device in many countries. CT-based preoperative planning with precise measurement of the individual bone

situation increases the precision in planning standard implants individually adapted to the anatomy. Overall, mediCAD® enables 90 percent time savings compared to conventional planning and thus also reduces costs. The portal services.mediCAD.cloud complements digital planning with mediCAD®.

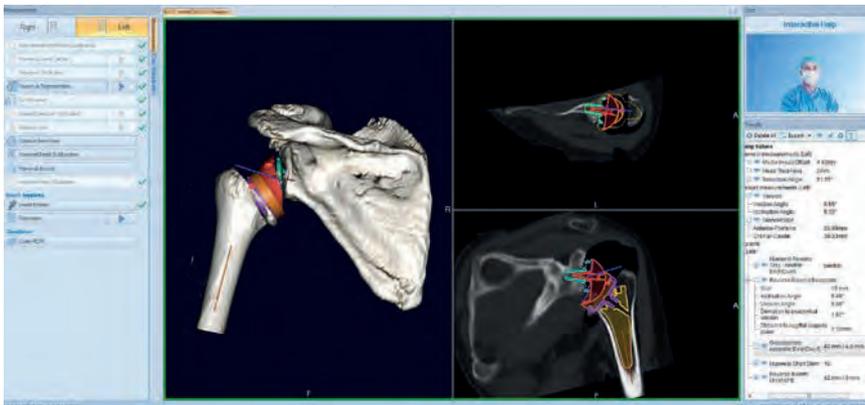
Are you interested in a mediCAD® license? Then please send an email to linkademy@linkhh.de or contact your LINK Medical Product Advisor.



mediCAD® software enables effective planning of primary and revision procedures, helping to reduce surgical time. Features of mediCAD® 3-D Hip include 3-D and 2-D anatomical views, bone segmentation, automatic landmark detection, ROM simulation, and automatic positioning and easy implant selection. For example, for the anatomical LINK SP-CL Hip Prosthesis System together with the MobileLink Acetabular Cup System from LINK (above).



mediCAD® 3-D Knee enables, among other things, precise dimensioning of the leg axes in 3-D, accurate assessment of the anatomy based on the 3-D reconstruction, hybrid planning in 2-D and 3-D, stitching of CT/MRI partial images with different slice thicknesses, automatic or manual adjustment of malpositions, calculation of the mechanical axes or the load-bearing line, and determination of femoral and tibial torsion. This applies to both the LINK GEMINI SL Knee Replacement and the new LinkSymphoKnee.



mediCAD® 3-D Shoulder simplifies the planning of shoulder arthroplasty, for example for the new LINK Embrace Shoulder System. Functionalities include reverse shoulder implant support, fully automatic landmark detection, automatic bone segmentation, humeral segmentation, detection and resection as well as automatic positioning of implants, a transparent view and implant-bone contact visualization as well as a ROM simulation (center, bottom).

Helmut D. Link: Lecture at the Istituto Ortopedico Rizzoli, Bologna



From left: Dr. Paolo Dalla Pria (LINK), Helmut D. Link, Prof. Domenico Andrea Campanacci (Careggi University Hospital, Florence), Prof. Davide Maria Donati (Istituto Ortopedico Rizzoli), Ing. Enrico Sandrini (Lincotek, Bologna).

The fact that LINK has a large portfolio for revision surgery of the lower extremity is also known at Istituto Ortopedico Rizzoli, Bologna. The portfolio includes the LINK FlexiCones and the stem extension for the Endo-Model knee family, the Link OptiStem.

As the only non-Italian representative of an implant manufacturer, Helmut D. Link was invited to give a presentation

at the »Custom Solutions for Severe Bone and Joint Defects« event in October 2021. His topic was »Designing the custom trabecular structure: how to improve integration and reduce the risk of infection.«

The Rizzoli Institute event was aimed at orthopedic surgeons with an interest in reconstruction for large bone and soft tissue defects following tumor resection,

multiple implant failures, severe trauma or infection. Emphasis was placed on 3-D printing for custom reconstruction in pelvic oncology and revision surgery. Complex upper and lower limb cases reconstructed with allografts or custom endoprostheses were also presented.

LINK Booth at the DKOU 2021 in Berlin



»Nice to see you again!« This was the motto of LINK's usual large stand at the German Congress of Orthopedics and Trauma Surgery (DKOU) 2021 in Berlin. The main topics were the LINK Embrace Shoulder System and the LINK FlexiCones.

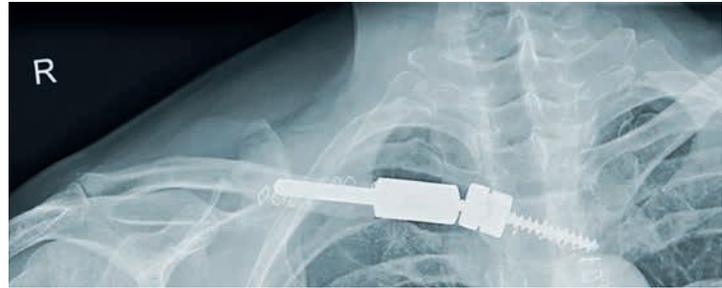
On average, 4,700 interested people visited the DKOU every day from October 26 to 29, many of whom also visited the LINK stand. DKOU 2021 was held with the requirement of either a Covid vaccination or negative test result allowing exchanges without social distancing or masks.

The next DKOU is planned for October 25–28, 2022, again in Berlin.

Well-attended LINK booth at DKOU 2021

Four years postoperative: Sternoclavicular joint prosthesis from customLINK restores full mobility to amateur athlete

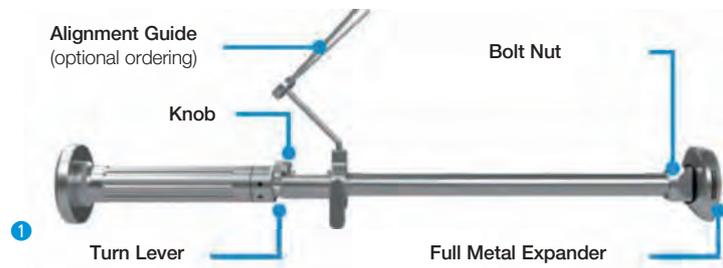
After the implantation of a custom-made right sternoclavicular joint prosthesis from customLINK in March 2018 in a then 64-year-old man with multiple pre-operated comminuted fractures of the right clavicle, he is now fully satisfied with the result. Thanks to the full range of motion, he is able to play table tennis twice a week again without his performance being limited. The mobility of the right and left shoulder is fully restored, and swimming is also possible without any problems.



Top: X-ray image three months postoperatively: The sternoclavicular joint arthroplasty is firmly anchored. Bottom: The full range of motion makes it possible for the patient to play table tennis twice a week again.

BiMobile: New impactor optimizes impact behavior

LINK has further improved the instrumentation of the BiMobile Dual Mobility System with a new all-metal impactor (1) and optimized the impact behavior and stable fixation of the cup with a cup-sized adapter. In addition, the slim design allows a clear view of the cup alignment in the acetabulum.



Customers found the new BiMobile impactor easy to use and particularly highlighted the solid connection and excellent haptic feedback during impact (2, 3). »This is the moon landing of dual mobility acetabular impactors,« said Dr. Steffen Brodt, Department Head of Hip at the German Center for Orthopedics at the Waldkliniken Eisenberg, Germany, about the new optimized BiMobile impactor.



LINK products on world tour

Viewers gained insight into the most exciting areas of hip arthroplasty implant development and fixation concepts, as well as the most interesting trends and developments in materials and coating technologies, at »All About the Hip Day« in Cologne, Germany, on October 8, 2021. The virtual event was a stop on the www.worldsurgerytour.com.



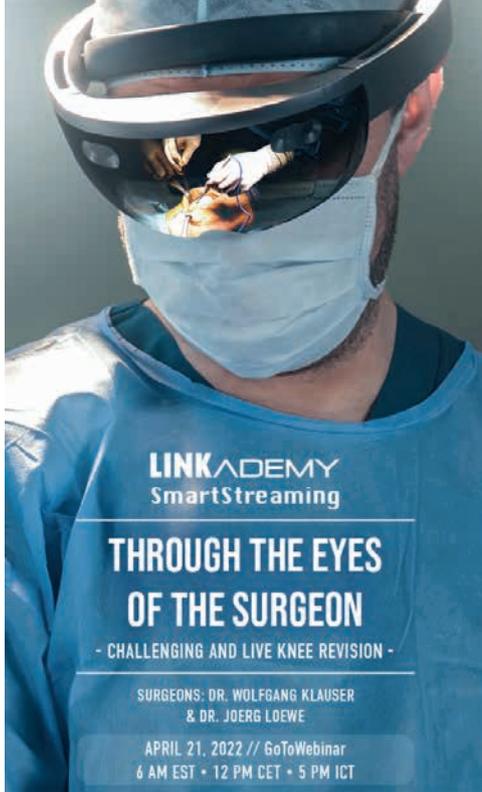
The »All About the Hip Day« was moderated and led by Prof. Carsten Perka (Charité – Universitätsmedizin Berlin, Campus Mitte (CCM)), Prof. Chen Jiying (301 Military Hospital Beijing) and members of the Chinese faculty, Dr. Jörg Löwe (Lubinus Clinicum, Kiel) and Dr. Jörg Beardi (Herz-Jesu-Krankenhaus Fulda). The focus was on acetabular replacement (Paprosky II) with the MobileLink Acetabular Cup System, augments and a DM insert, and femoral replacement (Paprosky III) with LINK's cementless MP Modular Stem.

The »World Surgery Tour« is a series of international live virtual surgical events dedicated to the most demanding challenges of modern reconstructive, spine, sports and trauma surgery: each case is recreated on expertly pre-fractured and injured human subjects. As a result, spectators witness scientific demonstrations under realistic surgical conditions and can participate in insightful discussion sessions. The aim of the »World Surgery Tour« is to optimize surgical

training and surgical outcomes. The next live surgical demonstration will take place in the fall of 2022 on the LINK Embrace Shoulder System. For more information, agenda info and to register, visit www.linkademy.tv.



Leading and moderating the »All About the Hip Day«: Dr. Jörg Löwe, Senior Principal Surgeon of the EndoProthetikZentrums der Maximalversorgung at the Lubinus Clinicum in Kiel, Germany.



»Through the Eyes of the Surgeon« is a live streaming event of the LINKAcademy presenting tips, tricks and surgical techniques for a hip revision with the LINK MP stem and the MobileLink Acetabular Cup System. Viewers use mixed reality glasses to see what the surgeon sees – with Dr. Wolfgang Klauser, Orthopedic Chief Physician at the VAMED Klinik Damp (surgeon), and Dr. Jörg Löwe, Chief Physician of Surgery at the EndoProthetikZentrum der Maximalversorgung at the Lubinus Clinicum in Kiel, Germany (commentator). The streaming event can be found in the archive of www.linkacademy.tv. The next SmartStreaming will take place on April 21, 2022 on the topic of »Complex Knee Revisions« with Dr. Wolfgang Klauser and Dr. Jörg Löwe (topic then: Endo-Model and FlexiCones). Dates of further events can be found in the LINKAcademy.TV Calendar at www.linkacademy.de.

White paper: Biomechanical analysis of FlexiCones in Endo-Model Hinged Total Knee Arthroplasty

Innocenti B., Université Libre de Bruxelles, École polytechnique de Bruxelles, BEAMS Department (Bio Electro and Mechanical Systems), Belgium

The use of metaphyseal cones is a suitable procedure to manage severe bone loss in revision total knee replacement. However, the cones available on the market are rigid and can only adapt precisely to the shape of the patient's bone if they are custom-made, or the surgeon is forced to adapt the bone to the cone.

FlexiCones femoral cones have flexure joints between the flanges, which give them flexibility. This improves the interaction between the cone and the bone, thus reducing stress and the risk of fracture. The FlexiCones largely adapt automatically to the shape of the medullary canal when driven in. Innocenti's in vitro biomechanical study investigated the benefits of using FlexiCones femoral cones compared to rigid cones during surgical impaction. In addition, the performance of FlexiCones femoral cones was analyzed in terms of implant stability during activities such as walking and

standing up. The main findings of the study, conducted as a finite element analysis, are that the flexible cone

- reduces the load on the bone during implantation, thus lowering the risk of bone fracture;
- better distributes the load on the bone, thus improving the stability of the implant;
- does not alter the implant performance achieved with the rigid cones;
- does not exceed the negligible micromovements of the implant as when using rigid cones.

The study can be ordered by emailing info-flexicones@linkhh.de.

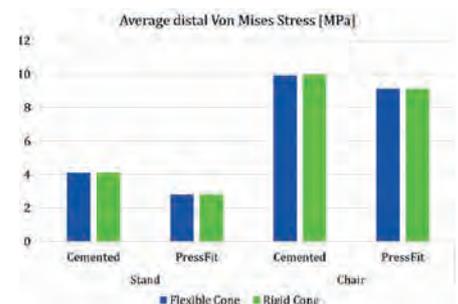


Diagram (top): Average bone load for the different configurations and boundary conditions analyzed in the study.



TrabeconLink FlexiCones from LINK are available in sizes XS, S, M and L and in 3-zone (left and right), 2-zone (neutral) and proximal (neutral) versions.

COMPLEX REVISION CASE? THINK LINK

FLEXICONES

