

C-Fit 3F[®]
customized planning & production

Case studies 2019

tumour and revision cases

patient specific implants and instruments


implantcast



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Introduction

The demand for custom-made implant components increases continuously in revision and tumour endoprosthetics. Complicated bone defects after single or multiple revision, deep infection, or large tumour resections often do not tolerate treatment with standard implant components.

implantcast has been planning, designing and manufacturing individual implants in Germany for more than 20 years for customers worldwide. Since 2014 the additive manufacturing, or 3D printing, is used to create implants which match the patients anatomy to fill defects as good as possible. A dedicated software enables us to generate a 3D model of the bone or joint to be reconstructed from high-resolution CT or MRI data. It is possible to segment the body-section radiographs in transversal, sagittal and frontal plane. Thus, relevant bones can be reproduced and separated from remaining tissue. Finally, it is exported as a 3D model, which is the basis for constructive implementation of the custom-made implant component. At the same time, patient specific instruments for the resection and for proper positioning of the implant, as well as fixations screws, are part of the planning.

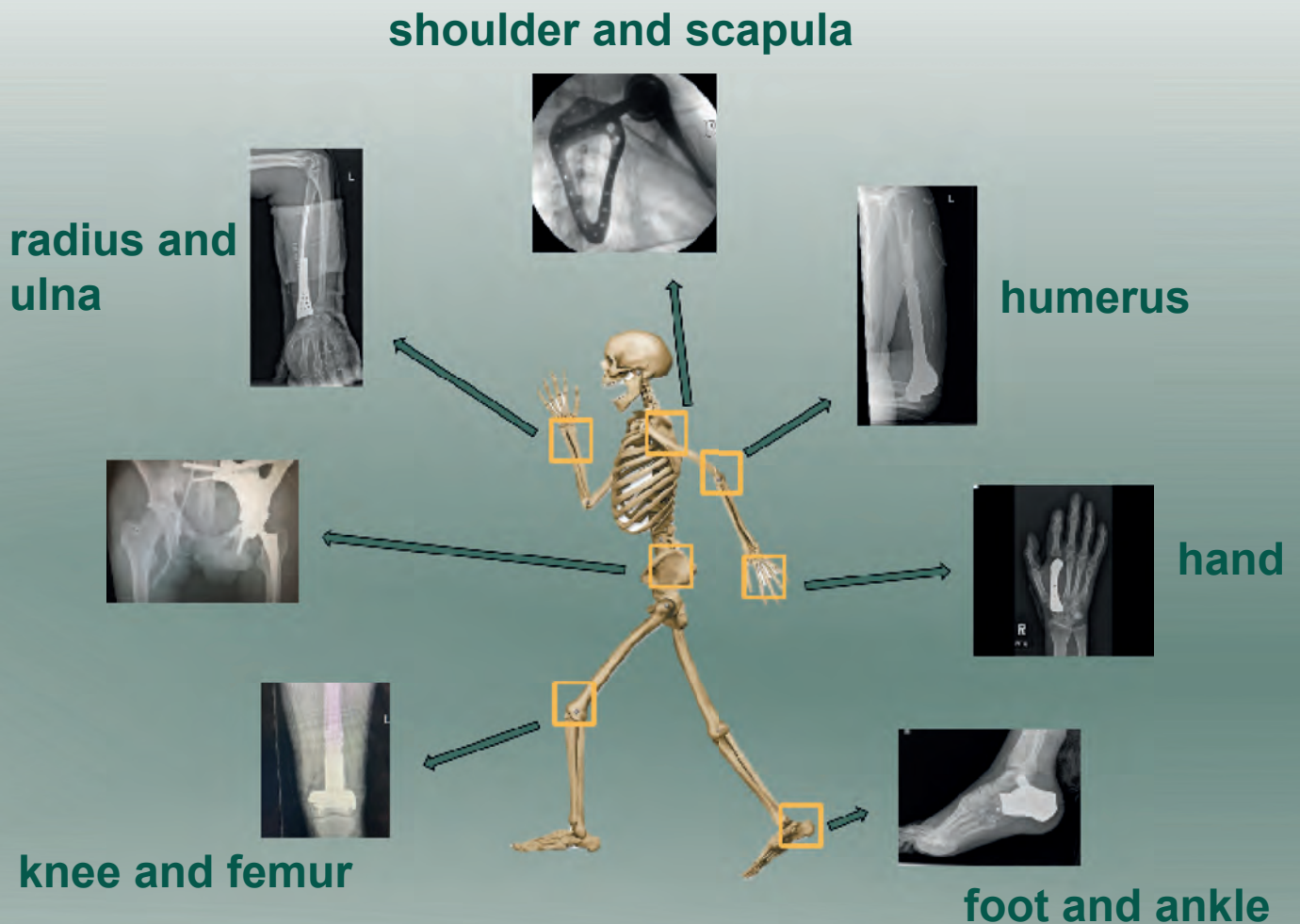
Individual implants and patient specific instruments - really necessary?

A custom-made, well fitting implant incl. the corresponding patient specific instrumentation allows for a less invasive surgical approach and therefore potentially reduces the time in the operating theatre drastically. As a consequence, the risk for an infection decreases. The extensive planning and 3D analysis minimizes potential error sources. The resection is planned in a way to reduce bone loss and to preserve the surrounding soft tissue as good as possible. Patient specific instruments are planned and manufactured accordingly. This makes later revisions much easier and keeps the natural anatomy of the patient mostly intact. An optimal fit of the implant combined with the additively manufactured EPORE[®] surface (porous, cancellous bone-like structure) supports and speeds up the osseointegration and thus the recovery of the patient. Specific coatings (TiN, silver and HA) improve the slide characteristics, minimize the (metal) ion release, help to prevent infections and support bone (in)growth.

If you have any questions or a potential case, please don't hesitate to contact our team of engineers via email: cfit3d@implantcast.de For general information about implantcast or our standard products, please take a look at our homepage: www.implantcast.de

Anatomical overview

Individual implants and instruments are a possibility for almost any anatomical region:



In the following the different case studies should give you an overview of treatment options of custom-made implants and patient specific instrumentation from implantcast.

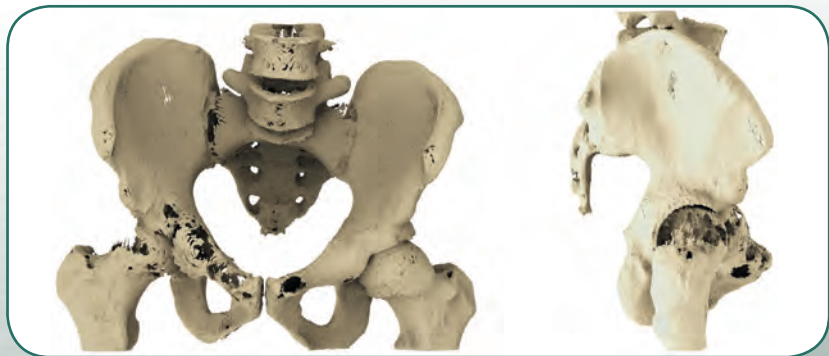
We would like to thank all our customers, especially those who provided all the data for the mentioned cases and wish our patients a quick and successful recovery.

Case 1 - custom m

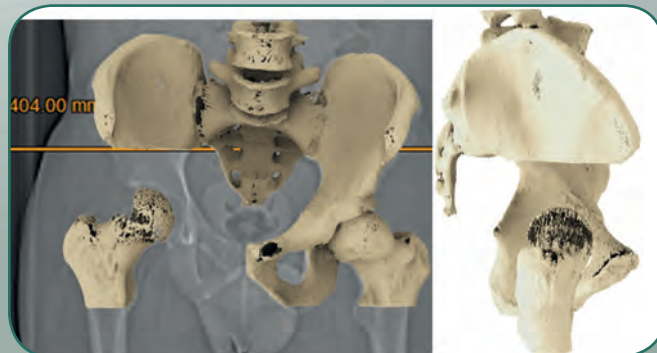
patient data: 38 years – Italy – Clinica Ortopedica de Oncologia Ortopedica,
Università di Padova

surgeon: Prof. P. Ruggieri

indication: Chondrosarcoma of the pelvis



preoperative situation: anterior view, lateral view



planned resection: anterior view, lateral view

custom-made solution:

- MUTARS® LUMiC® hip replacement, right
- hooks for additional stabilization
- EPORE® structure on bone facing surface
- LUMiC® Fit
- screw options for Ø4.5mm cortical screws
- screw options for Ø6.5mm cancellous screws
- screw options for Ø9x70mm modular stem for os ilium fixation

EPORE® modular stem Ø9x70mm

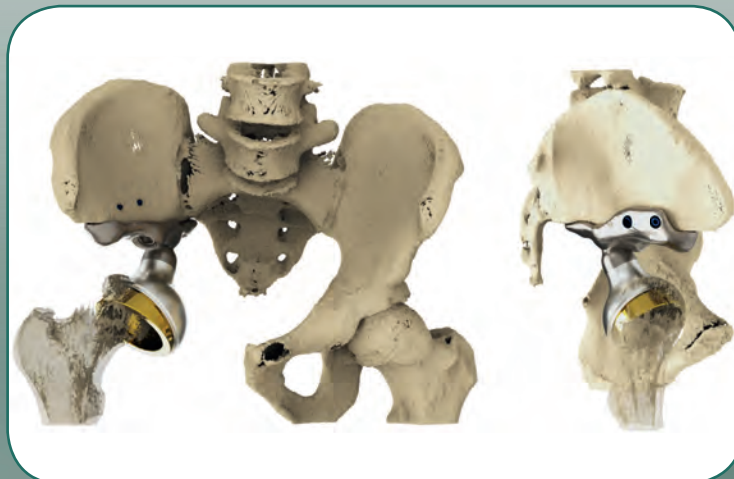


ade partial pelvic replacement

custom-made instruments: PSI resection guide
PSI drilling guide



planned implant positioning:



combination with standard products: MUTARS® LUMiC® treatment silver coated with
tripolar cup system
Ø6.5mm cancellous screws
Ø4.5mm cortical screws
optional: Ø8mm cancellous screws

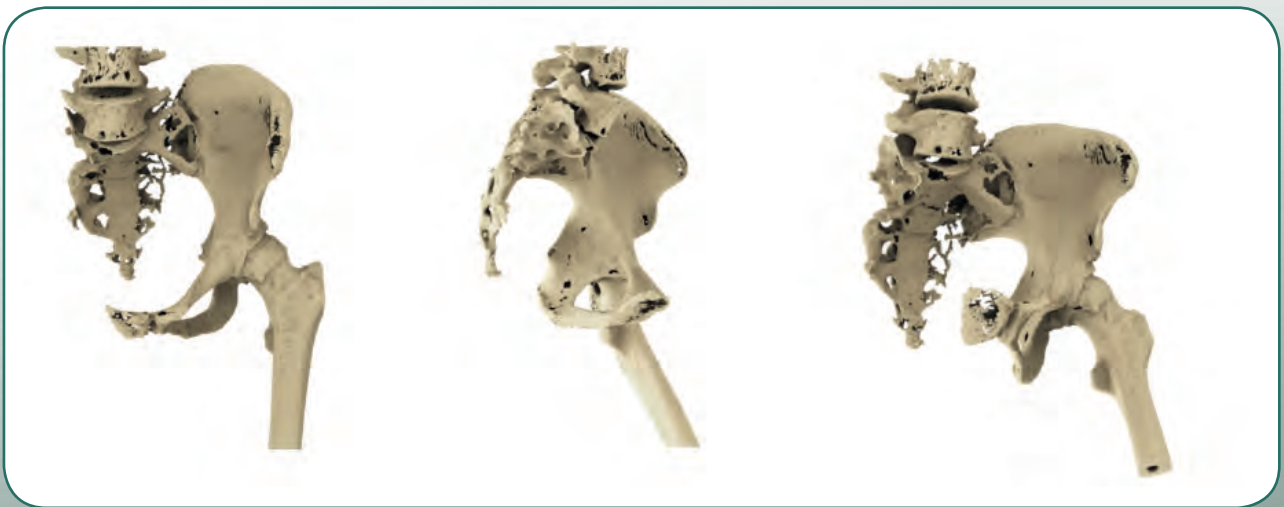
postoperative X-ray:



Case 2 - custom m

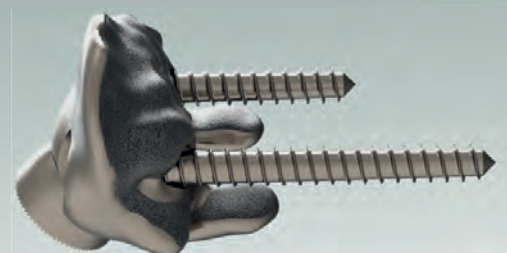
patient data: 52 years – Netherlands – Radboud University Medical Center, Nijmegen
surgeon: Dr. I. van der Geest

indication: Hemipelvectomy due to chondrosarcoma with hip transposition by attachment tube



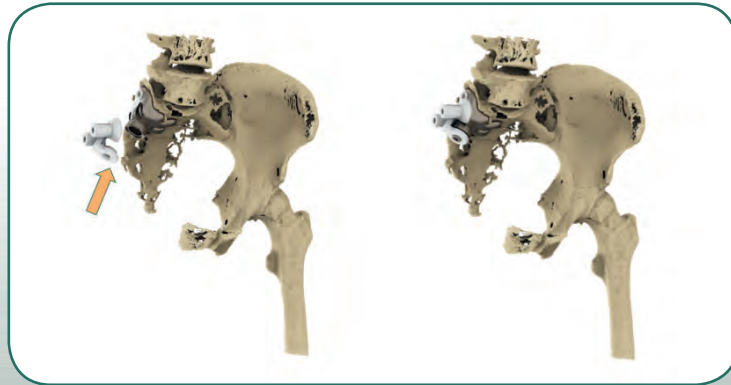
planned resection: anterior view, lateral view and isometric view

custom-made solution: MUTARS® LUMiC® hip replacement, right
 -screw options for Ø8mm cancellous screws
 -EPORE® structure on bone facing surface
 -hooks for additional stabilization
 -attachment for LUMiC® cup
 MUTARS® cancellous screw Ø8x50mm



ade partial pelvic replacement

custom-made instruments: PSI drilling guide



planned implant positioning:



combination with standard products: MUTARS® LUMiC® treatment with tripolar cup system
Ø8x80mm cancellous screw
attachment tube

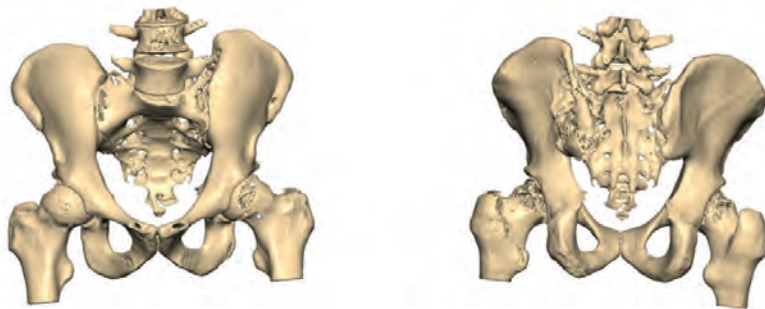
postoperative X-ray:



Case 3 - custom m

patient data: 24 years – Poland – Pomeranian Medical University in Szczecin
surgeon: Prof. D. Kotrych

indication: Osteosarcoma of the pelvis



preoperative situation: anterior view, posterior view



custom-made solution:



MUTARS® hip replacement Ø48mm with two
 -Ø2.5mm holes and EPORE® structure for soft tissue attachment
 -screw options for Ø6.5mm cancellous screws
 -notches for cement mantle
 -hooks for additional stabilization
 -2x poly-axial screw system
 2x MUTARS® EPORE® modular stems Ø9x70mm for fixation in
 Os sacrum and Os ischii



ade partial pelvic replacement

custom-made instruments: PSI resection guide
PSI drilling guide
PSI trial implant



planned implant positioning:



combination with standard products: EcoFit® 2M cup treatment (tripolar system)
Ø6.5mm cancellous screws

postoperative X-ray:



Case 4 - custom m

patient data: 11 years – Spain – Hospital Universitario Infantil Niño Jesús
surgeon: Dr. Juan Carlos Abril
indication: Osteosarcoma of the distal femur



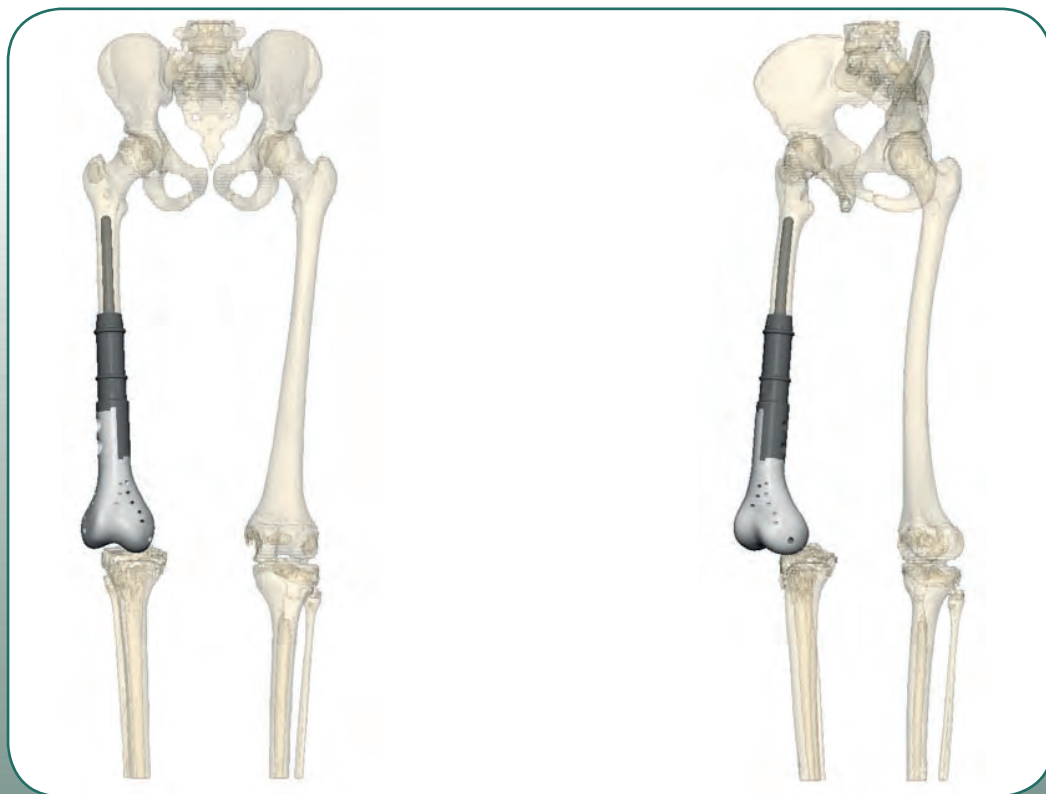
preoperative situation: anterior view, lateral view, isometric view

custom-made solution: MUTARS® distal femur hemi-prosthesis, right
-suture holes for soft tissue attachment
MUTARS® Xpand femoral stem Ø10x90mm cemented, TiN,
TCP-collar



ade dist. femur hemi-prosthesis

planned implant positioning:



anterior view

isometric view

combination with standard products: MUTARS® extension piece 40mm
MUTARS® screw M10x65mm
MUTARS® connecting part for diaphyseal implant
100mm

postoperative X-ray:

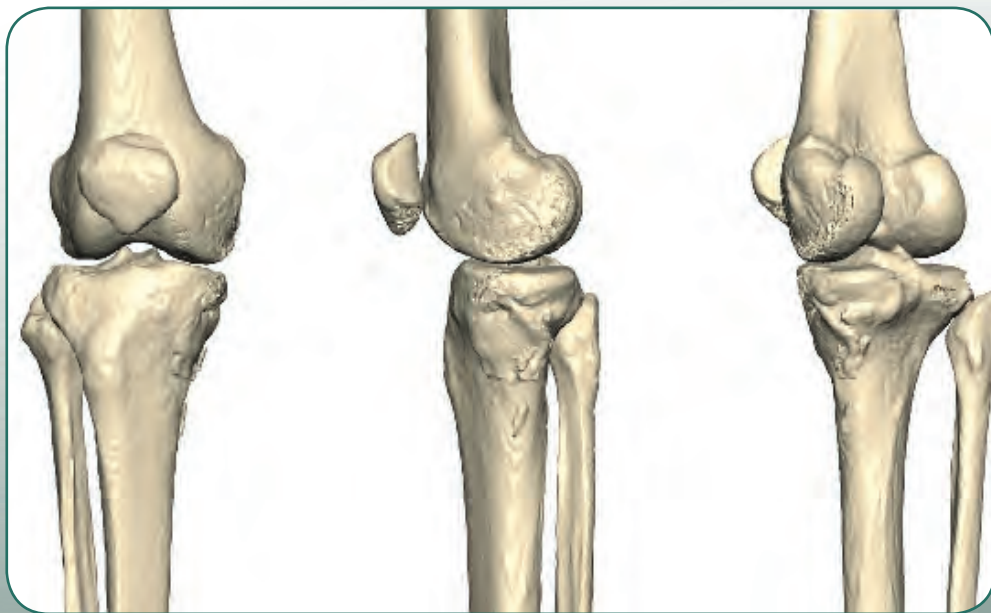


Case 5 - custom m

patient data: 47 years – Italy – S.C. Ortopedia Oncologica e Ricostruttiva del
presidio CTO - Città della Salute e della Scienza Torino

surgeon: Dr. R. Piana

indication: Giant cell tumour of the proximal tibia



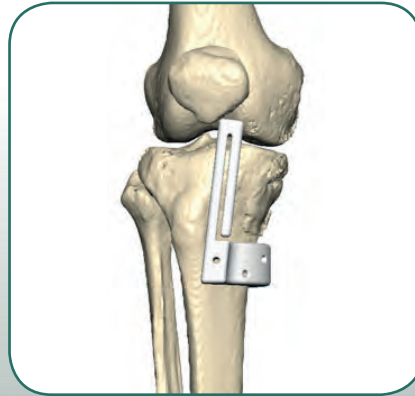
preoperative situation: anterior view, lateral view, isometric view

custom-made solution: MUTARS® EPORE® Uni FB tibial spacer
-EPORE® structure with suture screw options for soft tissue
attachment
MUTARS® cancellous screw Ø8x40mm



ade unicond. tibial replacement

custom-made instruments: PSI resection guide



planned implant positioning:



anterior view

lateral view

isometric view

combination with standard products: PB Uni femoral component cemented sz.2 II/rm
Uni FB PE-insert sz. 2/8mm
Ø8x50mm cancellous screw

postoperative X-ray:



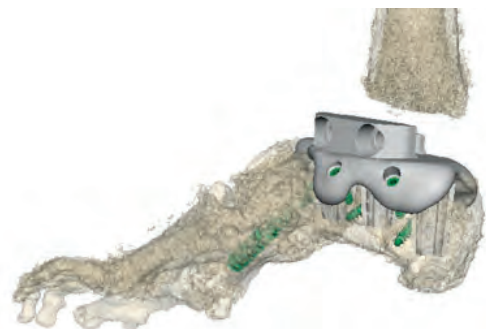
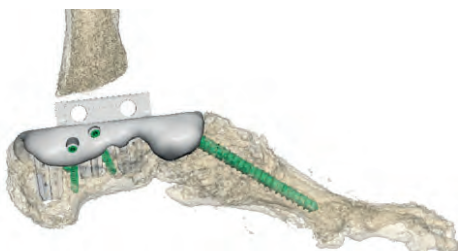
patient data: 68 years – Germany – Unfallchirurgische Klinik der medizinischen Hochschule Hannover MHH

indication: Loss of the talus after two tries for an arthrodesis, neuropathic osteoarthropathy, Charcot-Marie-Tooth-Syndrom



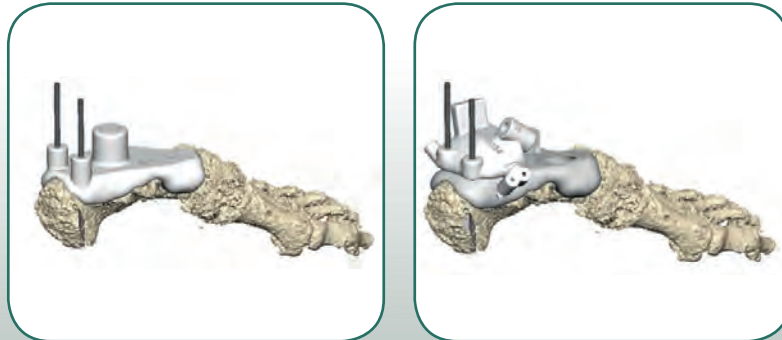
preoperative situation: medial and isometric view

custom-made solution: MUTARS® EPORE® ankle arthrodesis



ade ankle arthrodesis

custom-made instruments: PSI pinning guide
PSI drilling guide

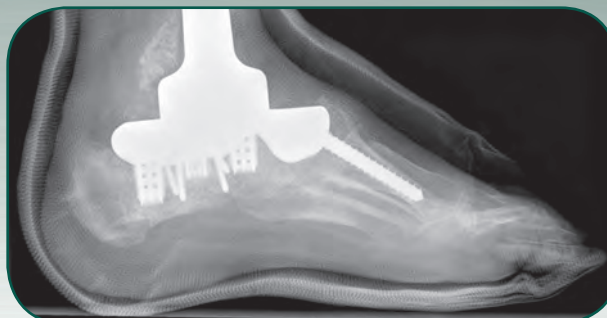


planned implant positioning:



combination with standard products: MUTARS® RS arthrodesis implant tibial component
MUTARS® RS stem
MUTARS® screw for KRI M8x25mm
Ø8mm cancellous screws
Ø4.2mm cancellous locking screws

postoperative X-ray:



Case 7 - custom m

patient data: 15 years – Poland – Institute of Mother and Child, Warsaw
surgeon: Dr. A. Szafranski

indication: Ewing's sarcoma of the proximal phalanx



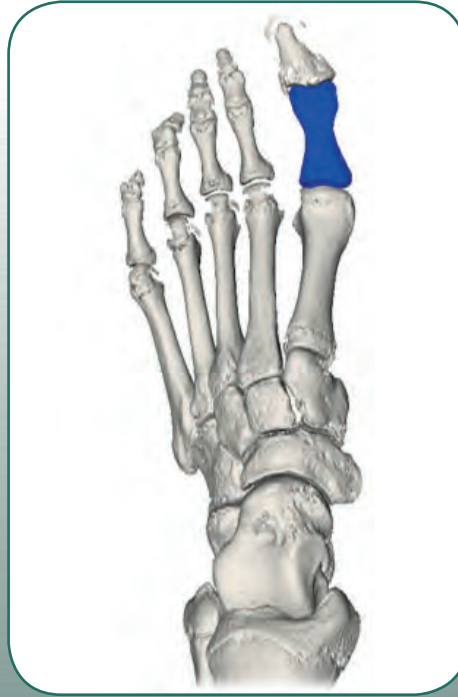
preoperative situation: dorsal view both feet

custom-made solution: MUTARS® proximal phalanx implant, TiN
-with suture holes for soft tissue attachment



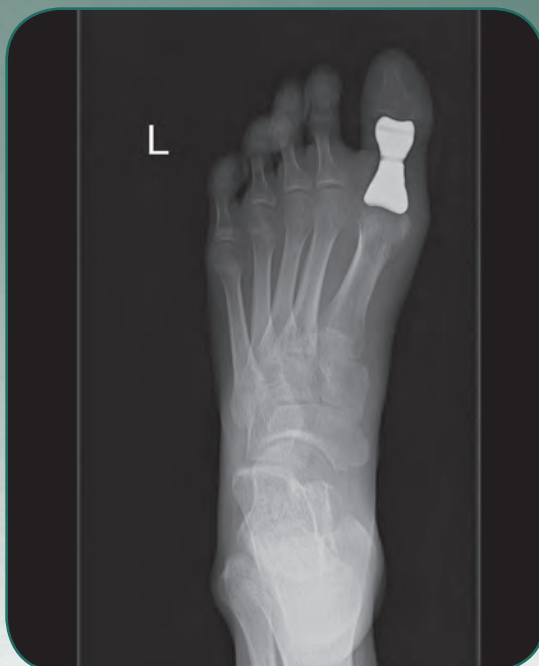
ade phalanx replacement

planned implant positioning:



dorsal view

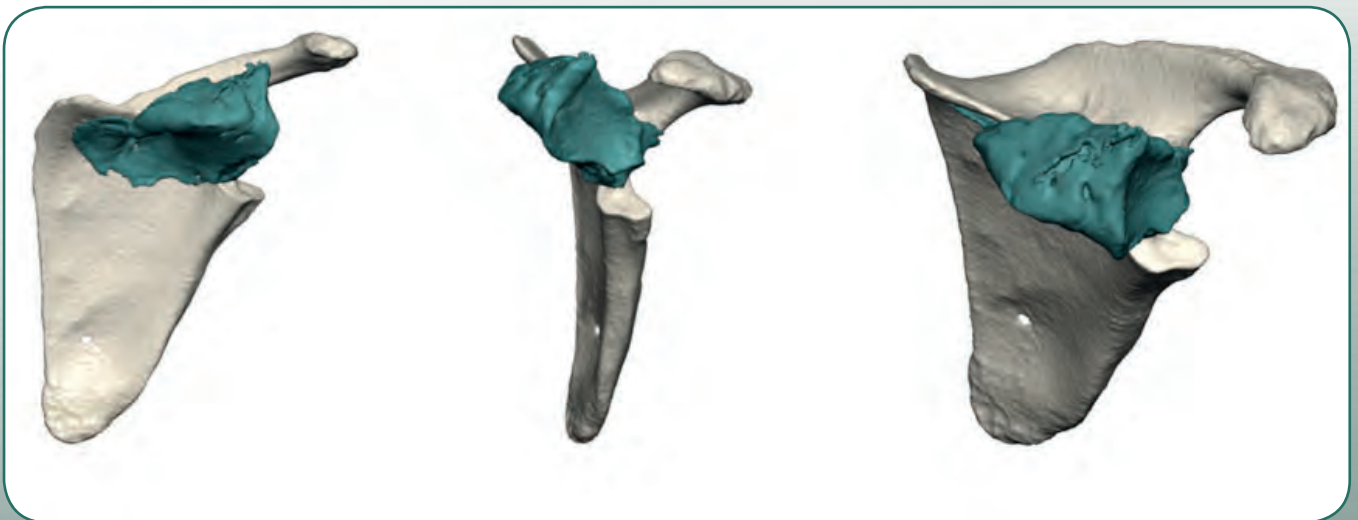
postoperative X-ray:



Case 8 - custom m

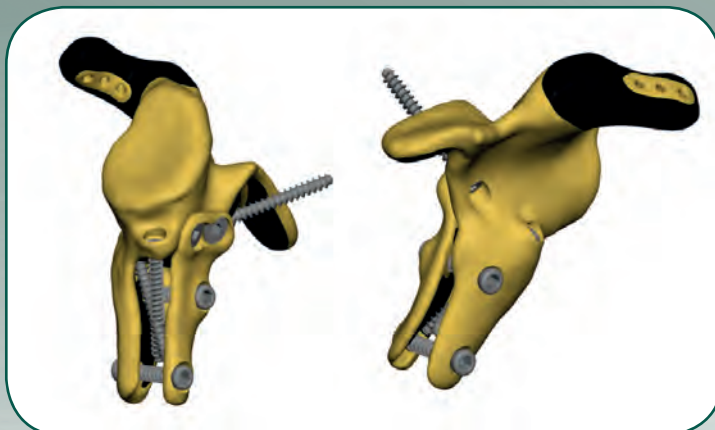
patient data: 17 years – Belgium – Cliniques universitaires Saint-Luc, Brussels
surgeon: Prof. T. Schubert

indication: Chondroblastoma of the glenoid



preoperative situation: anterior view, lateral view and isometric view

custom-made solution: AGILON® MI adapter
MUTARS® hemi-glenoid replacement right, TiN
MUTARS® adaptable flange for hemi-glenoid, TiN
-EPORE® on bone facing surfaces and acromion
-threads for adaptable posterior flange



ade glenoid replacement

planned implant positioning:



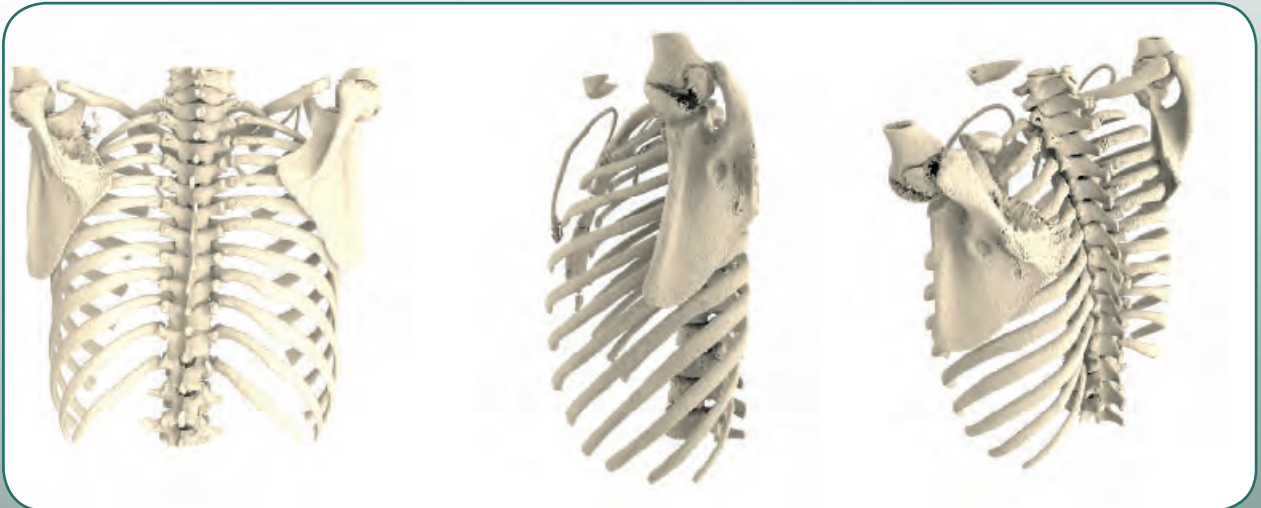
combination with standard products: AGILON® MI
MUTARS® glenosphere 40mm symmetric
Ø4.5mm cortical screws
Ø4.2mm cancellous locking screws

postoperative X-ray:



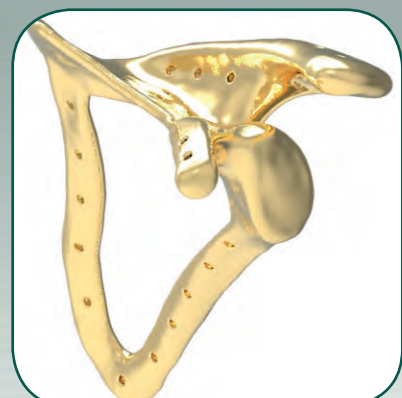
Case 9 - custom m

patient data: 13 years – Poland – Institute of Mother and Child, Warsaw
surgeon: Dr. A. Szafrński
indication: Ewing's sarcoma of the left scapula



preoperative situation: posterior view, lateral view, isometric view

custom-made solution: MUTARS® anatomical total scapula replacement, left, TiN
-suture holes for soft tissue attachment



ade scapula replacement

planned implant positioning:



anterior view

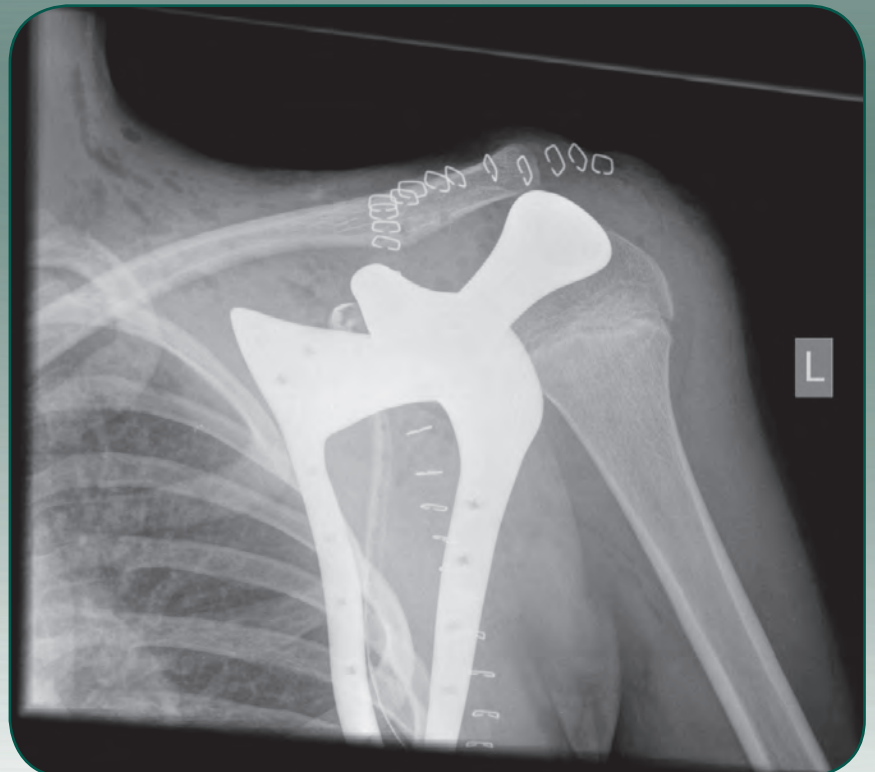


lateral view



isometric view

postoperative X-ray:

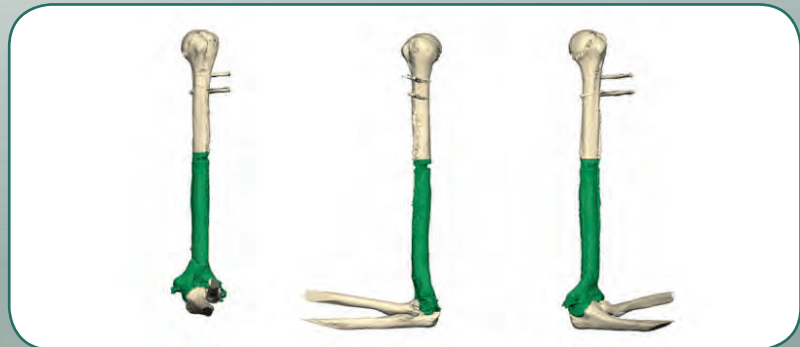


Case 10 - custom ma

patient data: 21 years – Australia – Gold Coast University Hospital
surgeon: Dr. E. Tan
indication: Bone loss of the distal humerus



preoperative situation: anterior view, lateral view and isometric view



planned resection: anterior view, lateral view and isometric view

custom-made solution: MUTARS® distal humeral hemi-prosthesis, left
-connection for MUTARS® humerus connection part
-Ø3mm straight holes for soft tissue attachment



de dist. humerus hemi-prosthesis

planned implant positioning:



combination with standard products: MUTARS® humerus stem cementless HA 11/75mm
MUTARS® humerus extension piece 40mm
MUTARS® humerus connection part 80mm

postoperative X-ray:



Case 11 - custom

patient data: 44 years – Poland – Oncology Centre, Warsaw
surgeon: Dr. Goryn
indication: Osteosarcoma of distal left radius



preoperative situation: anterior view of both extremities

custom-made solution: MUTARS® dist. radius left 6x80mm cementless, TiN
-mirrored from the right hand
-with suture holes for soft tissue attachment



made distal radius replacement

custom-made instruments: PSI impactor



planned implant positioning:



anterior view

lateral view

isometric view

postoperative X-ray:



Case 12 - custom

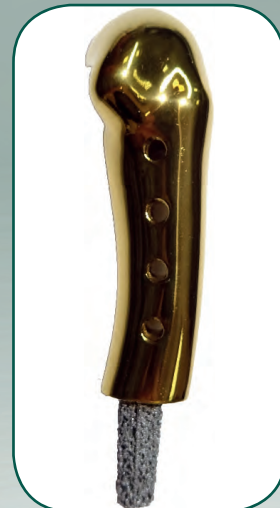
patient data: 24 years – Poland – Oncology Centre, Warsaw
surgeon: Dr. A. Pienkowski
indication: Giant cell tumour of the second metacarpal bone, right hand



preoperative situation: anterior view

custom-made solution

MUTARS® Metacarpal Bone cementless, TiN
- mirrored from the left hand
- with suture holes Ø2.5mm for soft tissue attachment



made metacarpal bone

custom-made instruments: PSI impactor



planned implant positioning:



anterior view

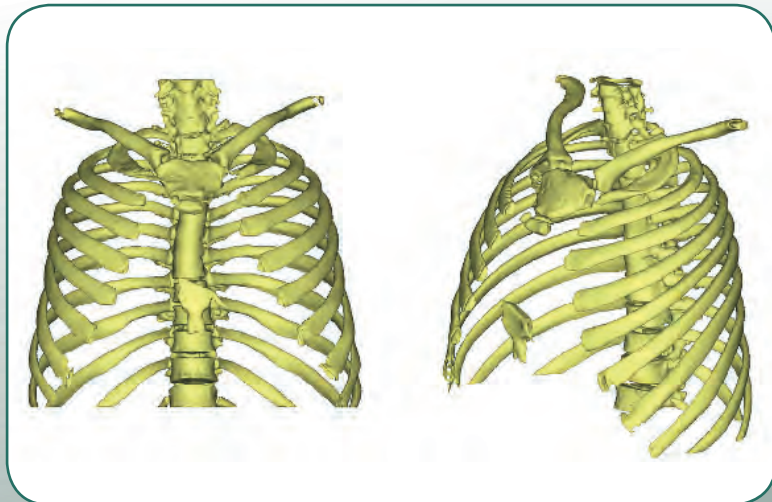
postoperative X-ray:



Case 13 - custom

patient data: 36 years – Russia

indication: Chondrosarcoma of sternum



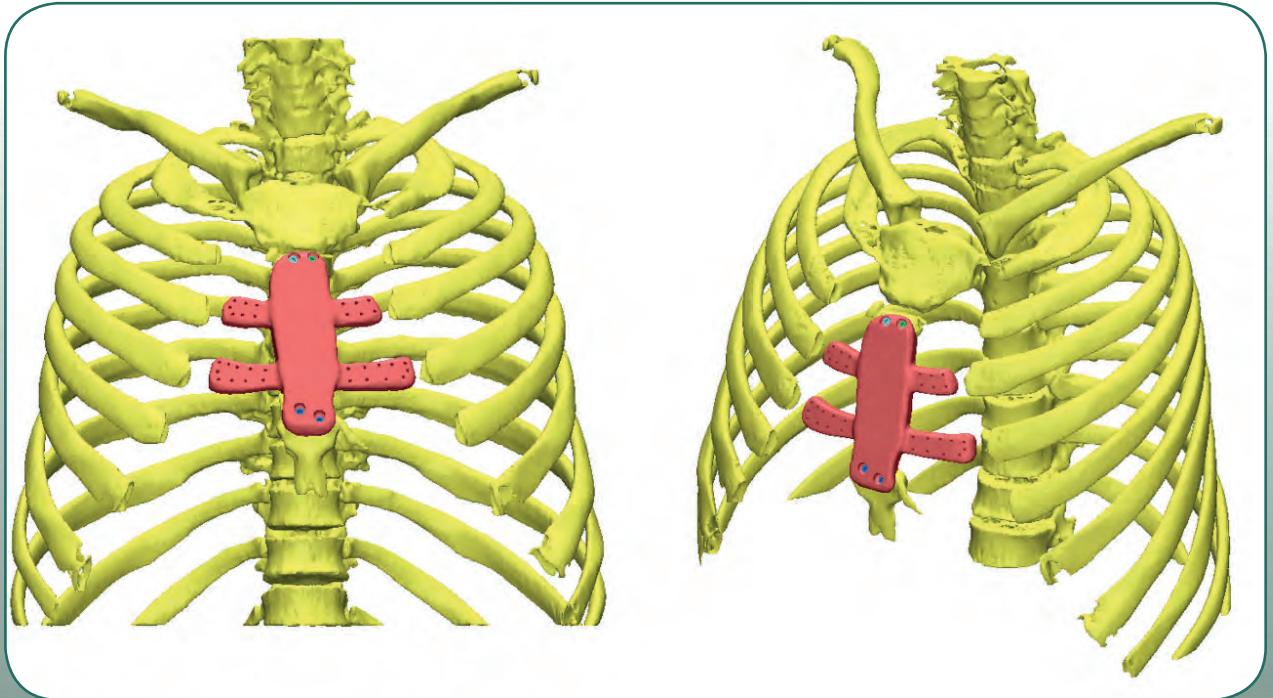
preoperative situation: anterior view and isometric view

custom-made solution: MUTARS® sternum implant
-with suture holes for soft tissue attachment
-Ø4.2x16mm and Ø4.2x14mm cancellous locking screws
for fixation



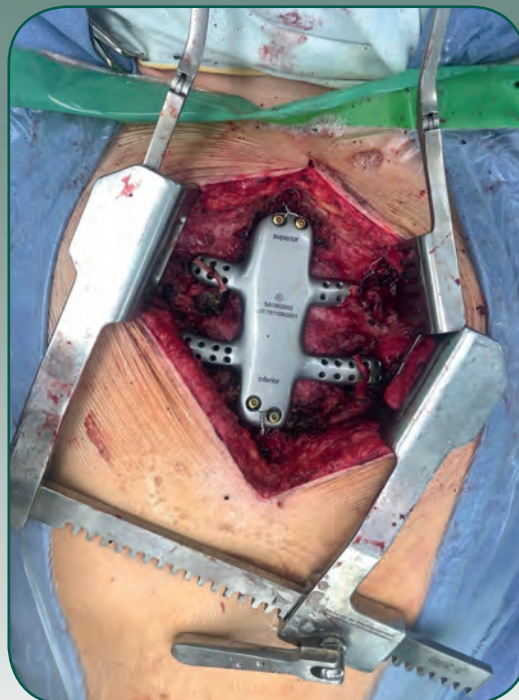
made sternum replacement

planned implant positioning:



anterior view and isometric view

intraoperative image:



Case 14 - custom

patient data: 41 years – Austria – Ordensklinikum Linz Barmherzige Schwestern
surgeon: Dr. Messner and Dr. Mattiassich

indication: Osteosarcoma of the femur



preoperative situation: anterior view, lateral view, isometric view

custom-made solution: Buxtehuder stem cementless
-screw option for Ø8mm cancellous screws

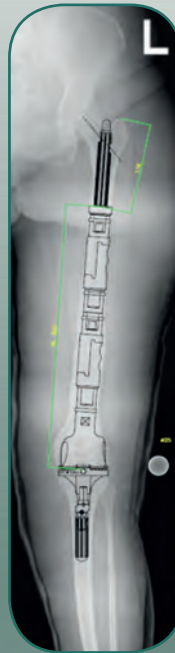


made joint sparing implant

custom-made instruments: PSI drilling guide



planned implant positioning:



combination with standard products: MUTARS® Total Femur MK replacement
Ø8mm cancellous screws

postoperative X-ray:



Case 15 - custom

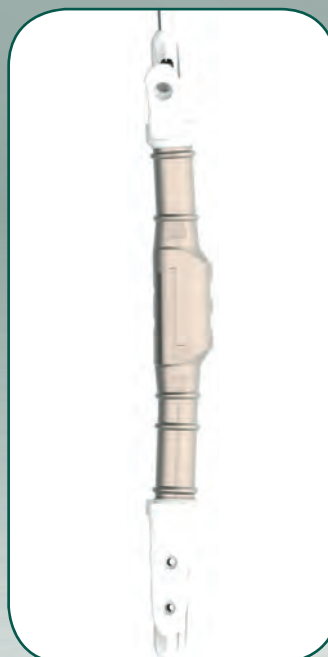
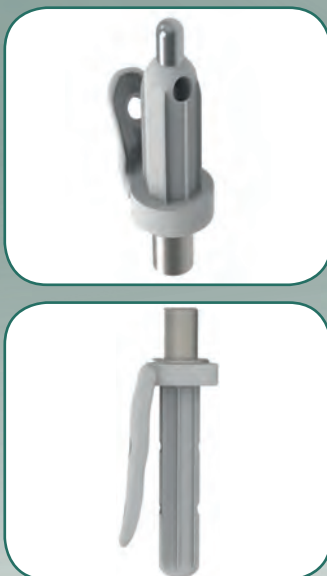
patient data: 17 years – Greece

indication: Resected Ewing's sarcoma right femur with temporary PMMA spacer



preoperative situation: anterior view, lateral view, isometric view

custom-made solution: MUTARS® Buxtehuder stem Ø23x60mm cementless, TCP
MUTARS® knee saving implant Ø21x90mm cementless, TCP



made joint sparing implant

custom-made instruments: PSI drilling guides



planned implant positioning:



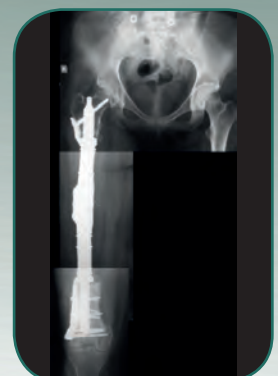
anterior view

lateral view

isometric view

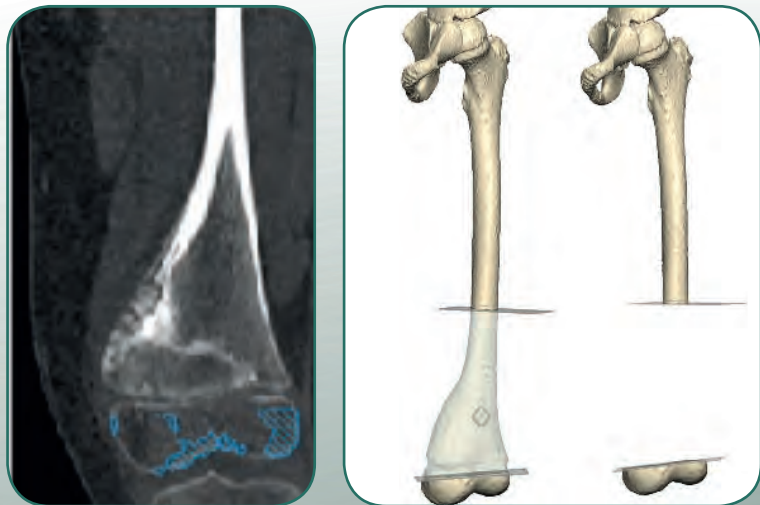
combination with standard products: MUTARS® Arthrodesis implant
MUTARS® extension piece 40mm
MUTARS® extension piece 60mm
MUTARS® screw M10x65mm
MUTARS® screw M10x85mm

postoperative X-ray:



Case 16 - custom

patient data: 6 years – Spain – Hospital Universitario Infantil Niño Jesús
surgeon: Dr. Juan Carlos Abril
indication: Osteosarcoma of the distal femur



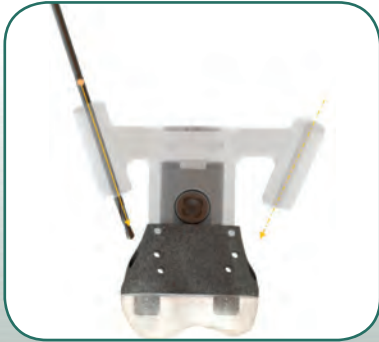
preoperative situation and planned resection

custom-made solution: MUTARS® EPORE® joint-sparing dist. femoral replacement 93mm
MUTARS® connecting part for joint sparing implant
MUTARS® screw for joint sparing implant



made joint sparing implant

custom-made instruments: PSI drilling guide
PSI anatomic bone models
PSI impactor



planned implant positioning:



anterior view

lateral view

isometric view

combination with standard products: Ø6.5mm cancellous screws

postoperative X-ray:



Case 17 - custom

patient data: 19 years – Australia – Sir Charles Gairdner Hospital
surgeon: Prof. R. Carey Smith
indication: Tumour in the distal femur



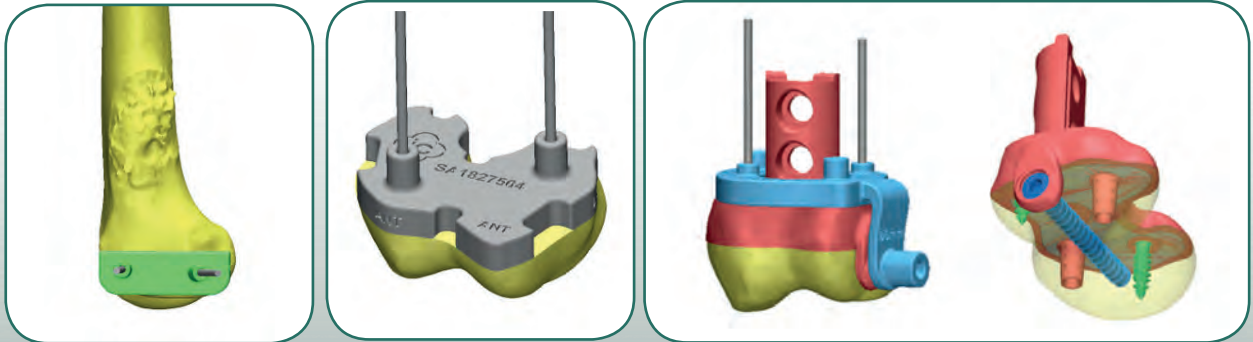
preoperative situation: anterior view, lateral view, isometric view

custom-made solution: MUTARS® knee joint sparing implant



made joint sparing implant

custom-made instruments: PSI resection guide
PSI pin guide
PSI drilling guide



planned implant positioning:



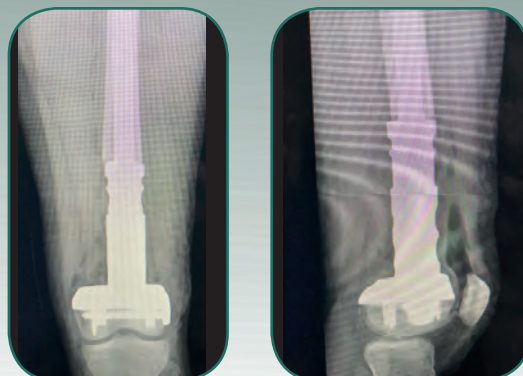
anterior view

lateral view

isometric view

combination with standard products: MUTARS® diaphyseal implants incl. screws
Ø6.5mm cancellous screws
Ø8mm cancellous screws

postoperative X-ray:



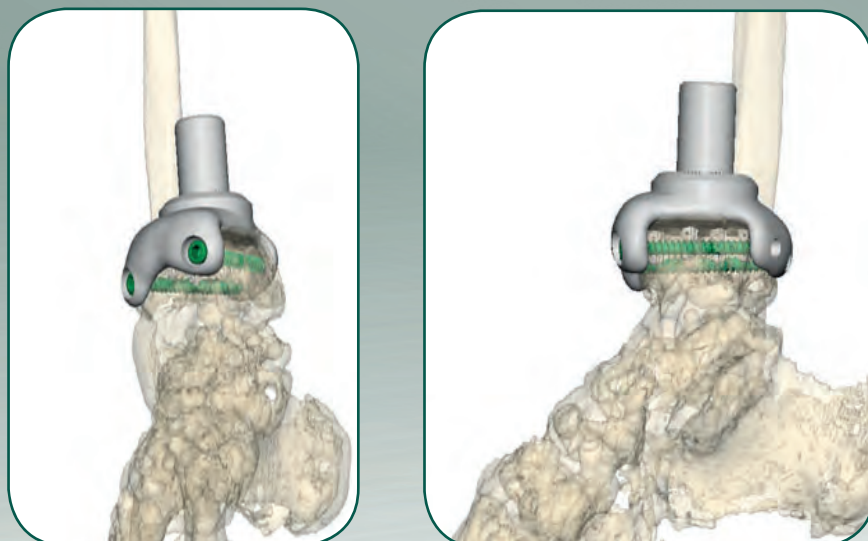
Case 18 - custom

patient data: 61 years – Germany – Orthopädische Klinik Volmarstein
surgeon: Prof. C. Gebert and Dr. M. Weßling
indication: Osteosarcoma of the right distal tibia



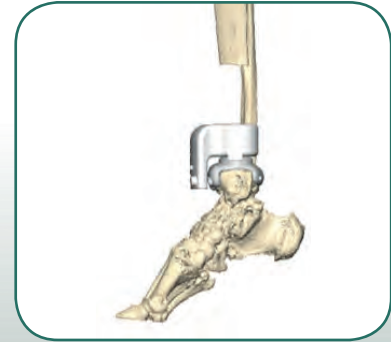
preoperative situation: anterior view, lateral view, isometric view

custom-made solution: MUTARS® upper ankle joint sparing tibia implant, cementless, interlockable

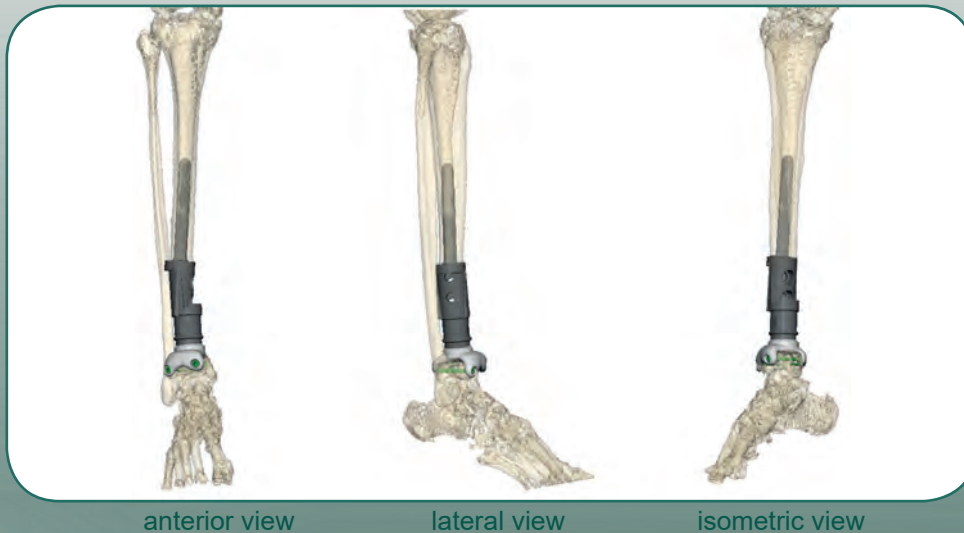


made joint sparing implant

custom-made instruments: PSI drilling guide

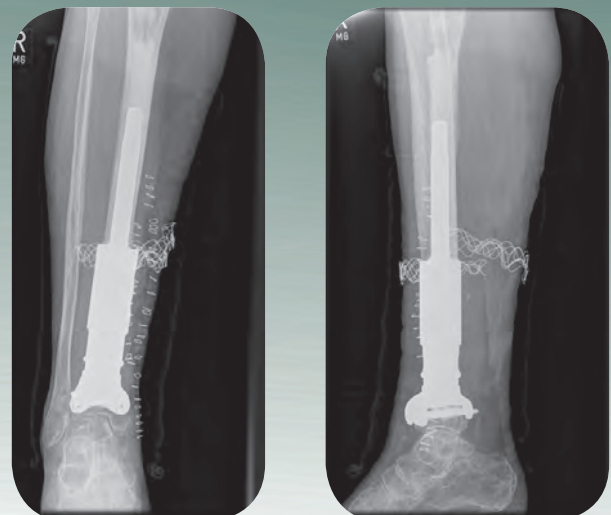


planned implant positioning:



combination with standard products: MUTARS® diaphyseal implant replacement
Ø4.5x45mm cortical screws

postoperative X-ray:

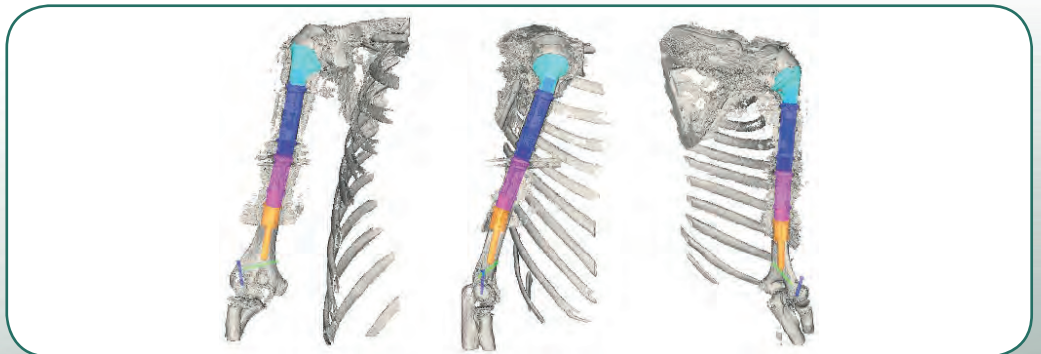


Case 19 - custom

patient data: 61 years - Italy - SOD complessa di Ortopedia Oncologica e Ricostruttiva presso Dipartimento di Oncologia AOU Careggi - Firenze

surgeon: Prof. D. A. Campanacci

indication: Recurrence of chondrosarcoma to the distal part of the humerus



preoperative situation: anterior, lateral and isometric view



preoperative X-ray

constrained MUTARS® humerus invers with custom-made scapula replacement

custom-made solution:

MUTARS® humeral stem joint sparing
-MUTARS® EPORE® anchoring flanges
-screw options for locking locking screws

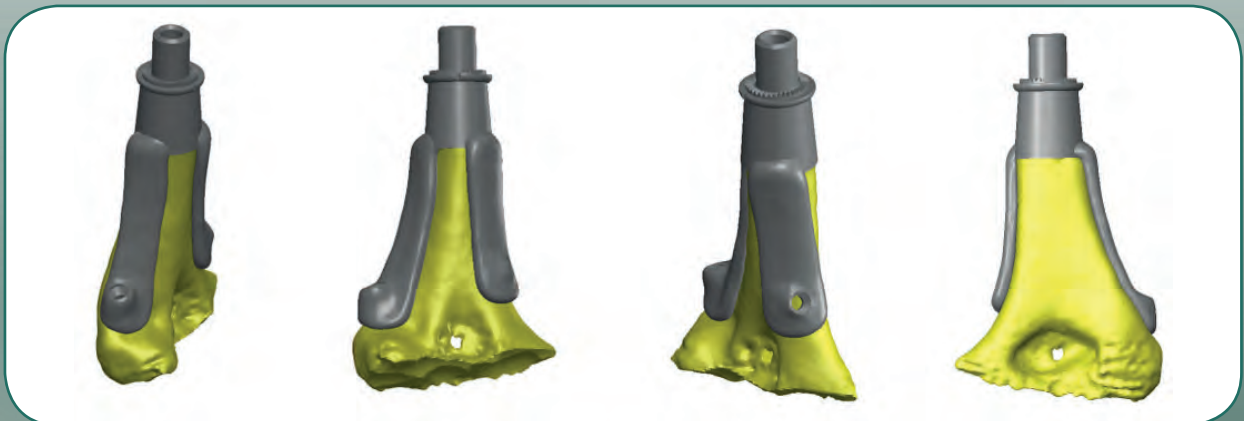


made joint sparing implant

custom-made instruments: PSI cutting guide
PSI drilling guide

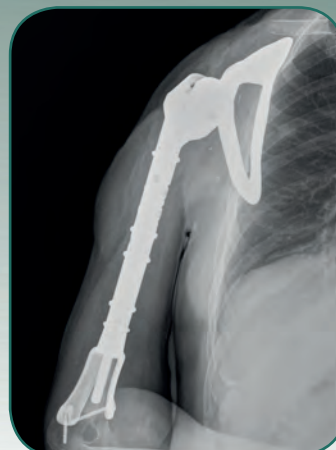


planned implant positioning:



combination with standard products: MUTARS® humerus extension piece
MUTARS® humerus connecting part or humeral component

postoperative X-ray:



patient data: male - 8 years - Spain

indication: Osteosarcoma



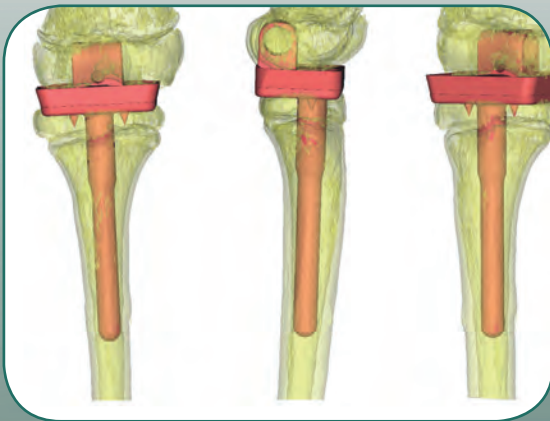
custom-made solution:

non-invasive growing prosthesis MUTARS® Xpand distal femoral replacement

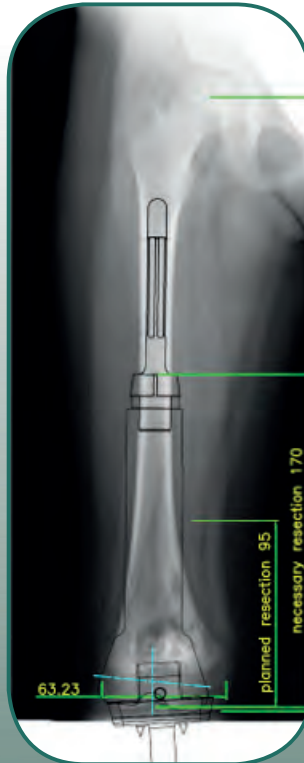
- 160mm resection length, non invasive lengthening 50mm
- MUTARS® Xpand femoral stem 10x90mm cementless
- MUTARS® Xpand distal femur right 160mm
- MUTARS® Xpand bar screw M10x15mm
- MUTARS® Xpand tibial plateau small for hinged knee
- MUTARS® Xpand distal femur accessory kit
- MUTARS® TAM
- Receiver 12V

made growing prosthesis

planned implant positioning:



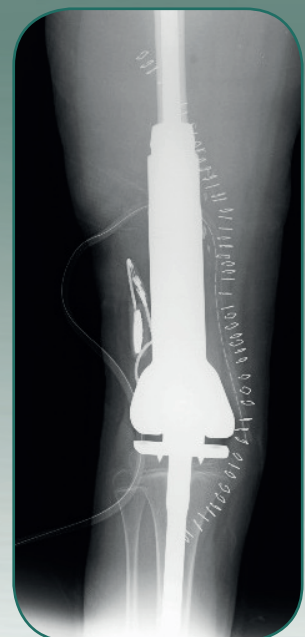
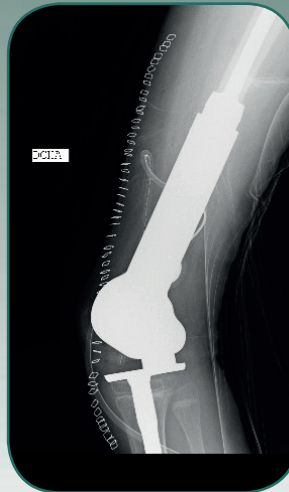
planned position of tibial plateau small



planned implant positioning in 2D X-ray



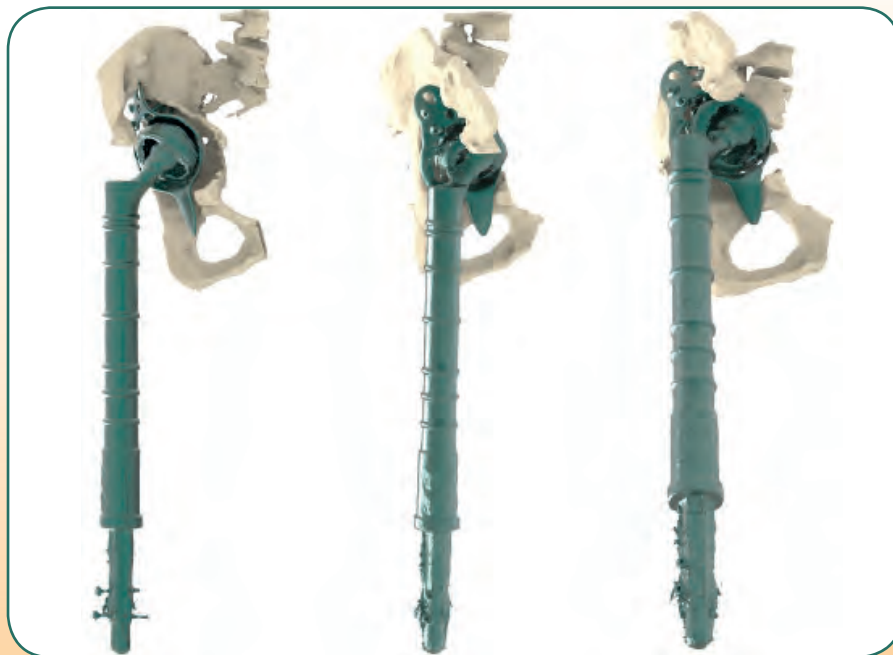
postoperative X-ray:



Case 21 - custom

patient data: 57 years – Germany

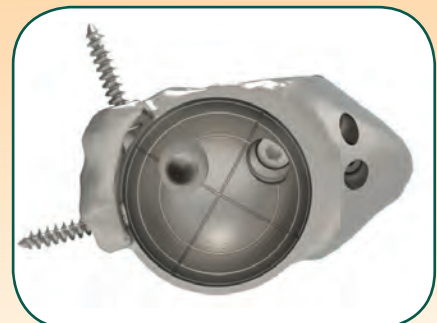
indication: Revision of a large defect of the acetabulum after implant loosening



preoperative situation: anterior view, lateral view, isometric view

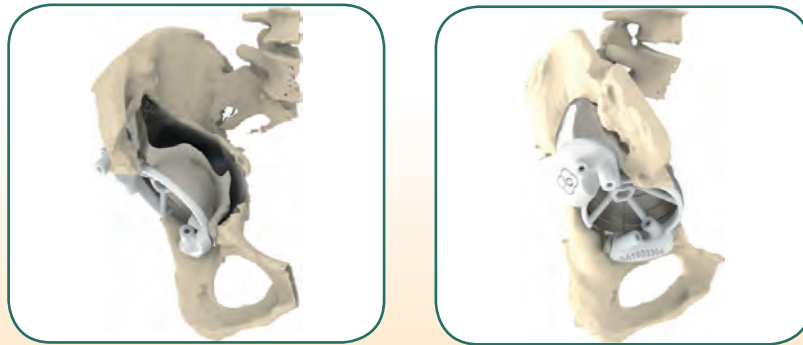
custom-made solution:

- MUTARS® partial pelvic replacement Ø60mm
- screw options for 6.5mm cancellous screws for fixation in os ischii and os pubis
- screw option for MUTARS® EPORE® modular stem Ø9x70mm for ilium fixation
- EPORE® structure on bone facing surface
- MUTARS® EPORE® modular stem Ø9x70mm



made partial pelvic replacement

custom-made instruments: PSI drilling guide



planned implant positioning:



anterior view

lateral view

isometric view

combination with standard products: EcoFit® 2M cup treatment (tripolar system)
Ø6.5mm cancellous screws
MUTARS® prox. femoral replacement

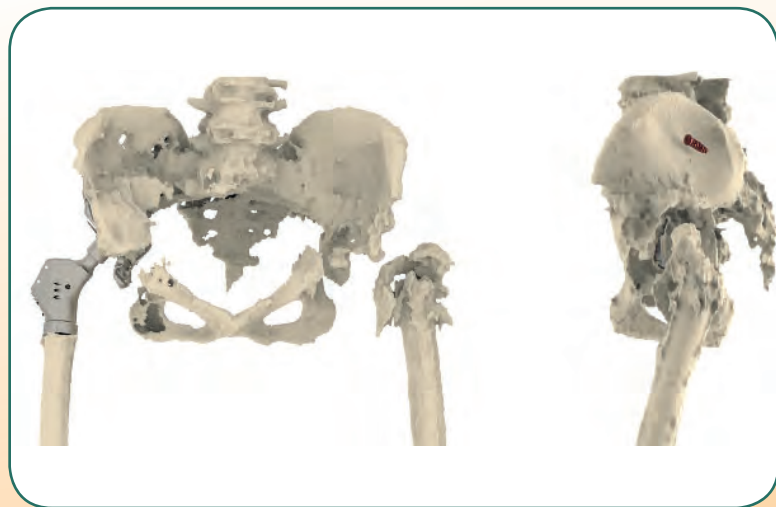
postoperative X-ray:



Case 22 - custom

patient data: 78 years – Germany – Ev. Waldkrankenhaus Berlin Spandau
surgeon: Prof. Nöth

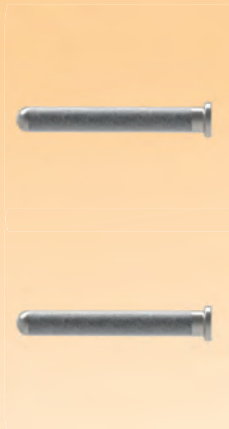
indication: Defect of the left and right acetabulum (surgeries 4 months apart); insufficiency fracture of the sacrum on both sides



preoperative situation: anterior view and lateral view

custom-made solution:

- MUTARS® partial pelvic replacement Ø48mm left
- EPORE® structure on bone facing surface
- extended hook for additional fixation of the insufficiency fracture
- MUTARS® EPORE® modular stem Ø9x70mm
- MUTARS® EPORE® modular stem Ø9x50mm

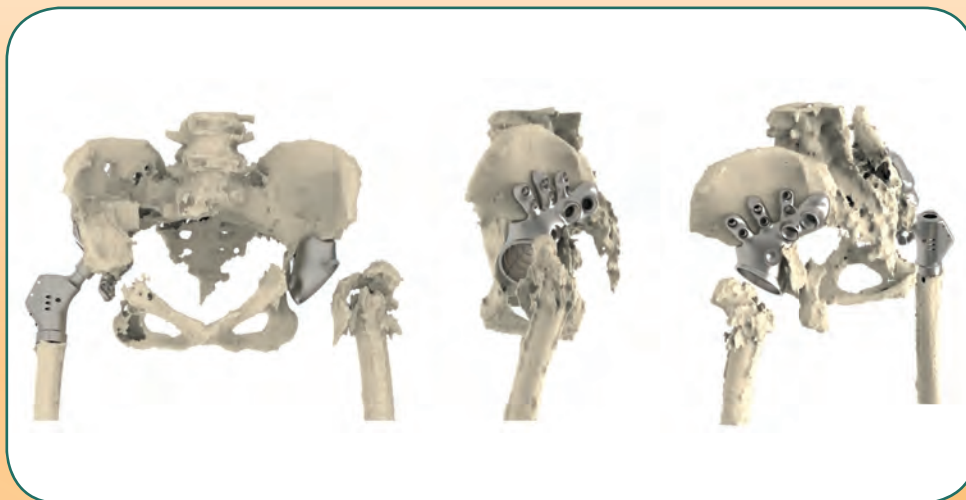


made partial pelvic replacement

custom-made instruments: PSI drilling guide
PSI Pelvic model
PSI trial implant



planned implant positioning:



anterior view

lateral view

isometric view

combination with standard products: EcoFit® 2M cup replacement (tripolar system)
MUTARS® proximal femur revision replacement
Ø4.5mm cortical screws
Ø8mm cancellous screws

postoperative X-ray:



Case 23 - custom

patient data: 60 years – Austria – Kardinal Schwarzenberg Klinikum

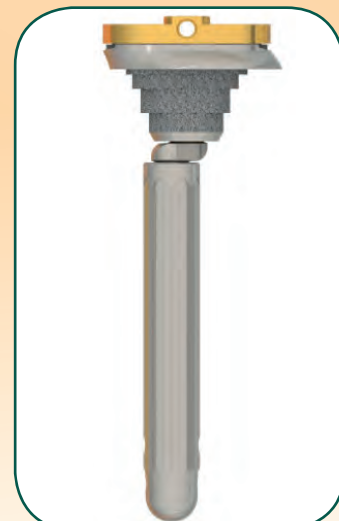
surgeon: Prim. Dr. M. Höflehner

indication: Revision of a loosened total knee endoprosthesis because of sensitivity to bone cement



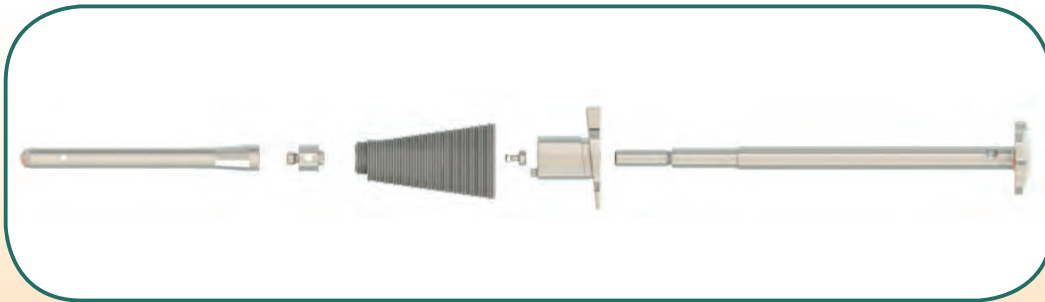
preoperative situation: anterior view, lateral view, isometric view

custom-made solution: EPORE® metaphyseal component femoral
EPORE® metaphyseal component tibial
MK femoral spacer cementless

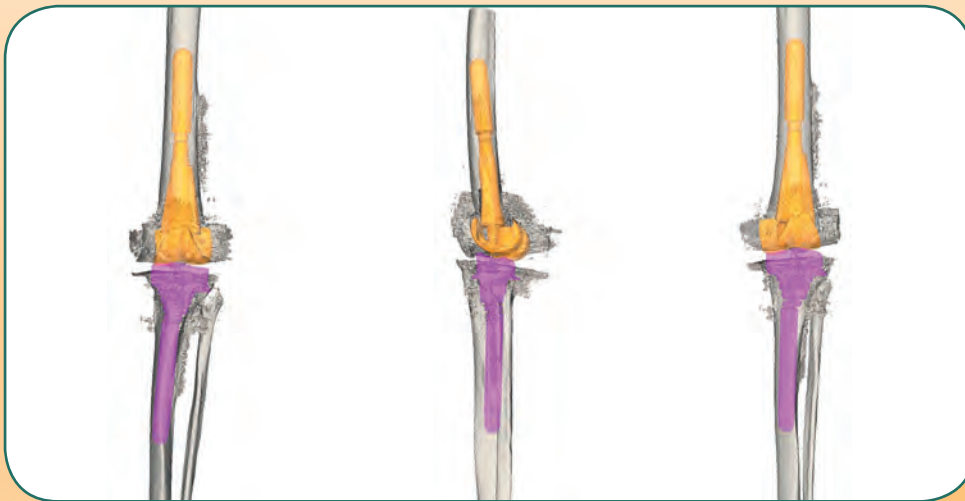


made metaphyseal components

custom-made instruments: PSI rasp for metaphyseal component femoral and tibial, trial components



planned implant positioning:



anterior view

lateral view

isometric view

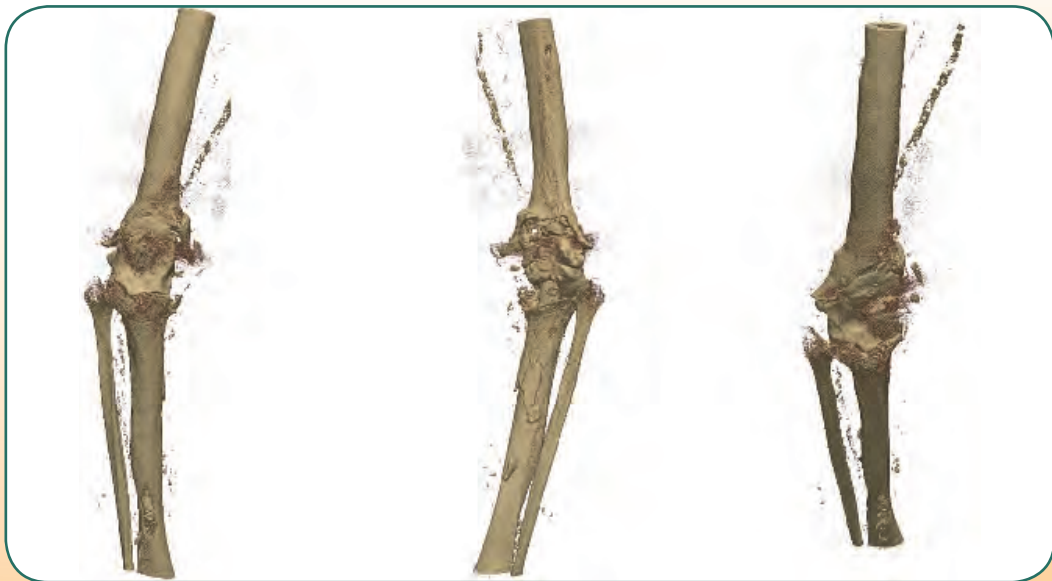
combination with standard products: MUTARS® GenuX® MK replacement

postoperative X-ray:



Case 24 - custom

patient data: 90 years – Germany – Uniklinikum Bonn
surgeon: Dr. H. Kohlhof
indication: Revision of a periprosthetic infection of the right knee joint



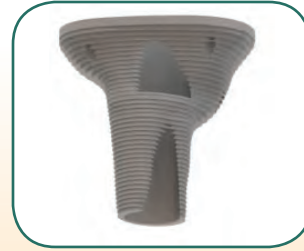
preoperative situation: anterior view, lateral view, isometric view

custom-made solution: MUTARS® EPORE® metaphyseal component tibial
MUTARS® GenuX® MK stem 16/285 cementless, HA



made metaphyseal component

custom-made instruments: PSI rasp used with the standard PSI impactor
PSI trial implant



planned implant positioning:



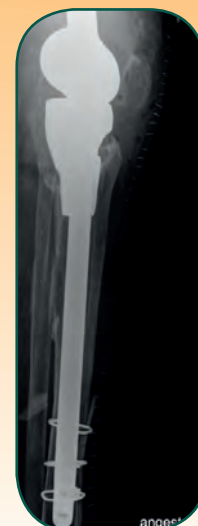
anterior view

lateral view

isometric view

combination with standard products: MUTARS® KRI MK silver replacement

postoperative X-ray:



Case 25 - custom

patient data: 64 years – Germany – Kreiskrankenhaus Dormagen
surgeon: Prof. G. Saxler
indication: Two stage revision of a total knee endoprosthesis because of metaphyseal defects femorally and tibially caused by a cement allergy



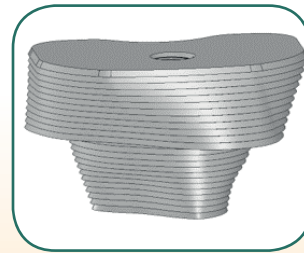
preoperative situation: anterior view, lateral view, isometric view

custom-made solution: EPORE® metaphyseal component tibial +20mm

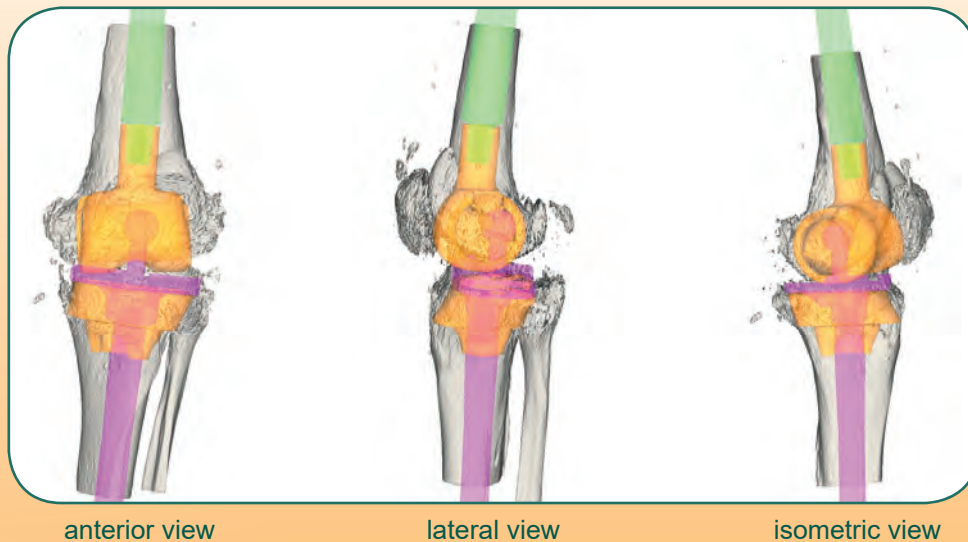


made metaphyseal component

custom-made instruments: PSI rasp used with the standard PSI impactor

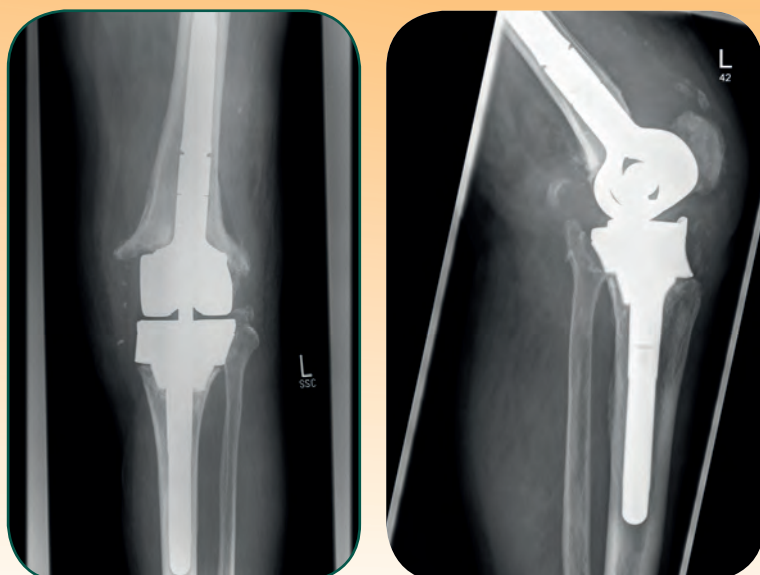


planned implant positioning:



combination with standard products: MUTARS® KRI MOD replacement

postoperative X-ray:



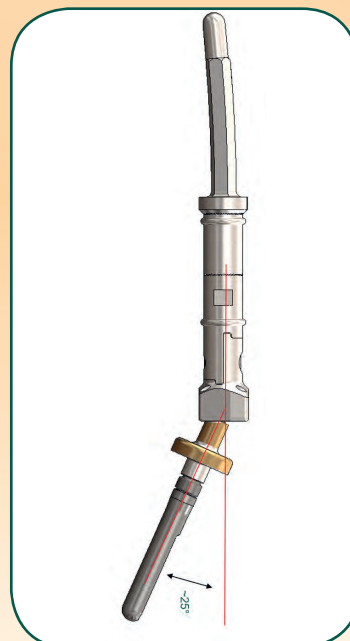
Case 26 - custom

- patient data: 35 years – Italy – Fondazione Policlinico Universitario Agostino Gemelli
IRCCS Università Cattolica del Sacro Cuore
- surgeon: Prof. G. Maccauro and Dr. A. Ziranu
- indication: Revision of a distal femur prosthesis after deep infection. Medical indication for an arthrodesis but the patient does not accept this kind of implant - wants to retain a little bit of movement.



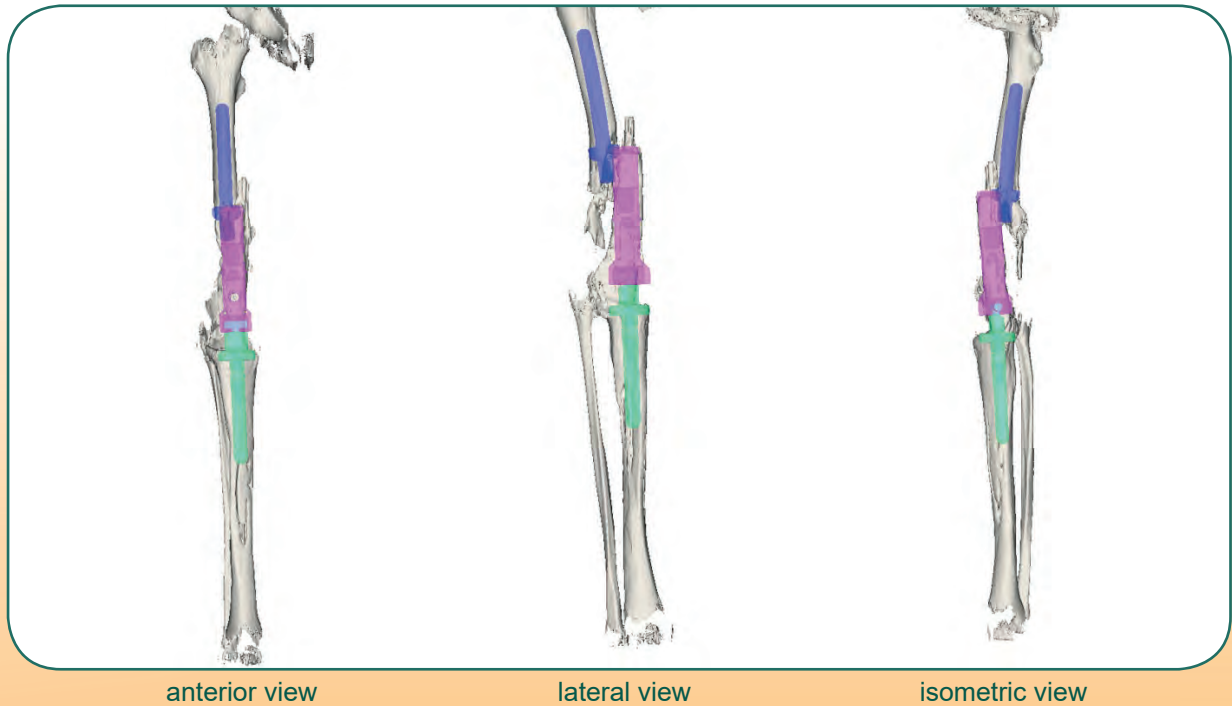
preoperative situation: anterior view, lateral view, isometric view

- custom-made solution: MUTARS® distal femur 25° range of motion, silver
MUTARS® GenuX® tibial component 25° range of motion, TiN
MUTARS® PE insert for distal femur 25° range of motion



made 25° ROM arthrodesis

planned implant positioning:



combination with standard products: MUTARS® femoral stem cementless 17/120mm HA
MUTARS® extension piece 40mm silver
MUTARS® screw M10x65mm
MUTARS® GenuX® MK offset adapter 0mm
MUTARS® GenuX® MK stem cemented 15/150mm

postoperative X-ray:



Case 27 - custom

patient data: 80 years , Lille, France
surgeon: Dr. Szymanski
indication: revision of a dislocated MUTARS® total humerus inverse



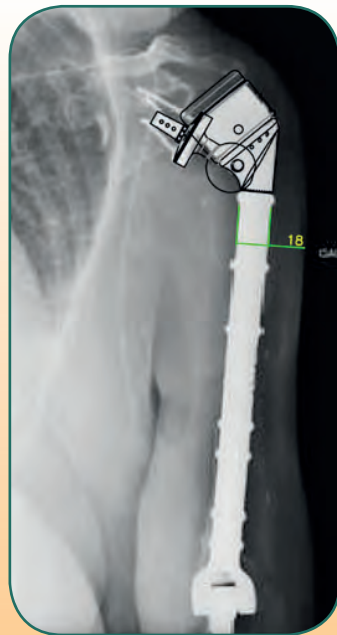
preoperative situation: anterior view

custom-made solution: MUTARS® constrained shoulder

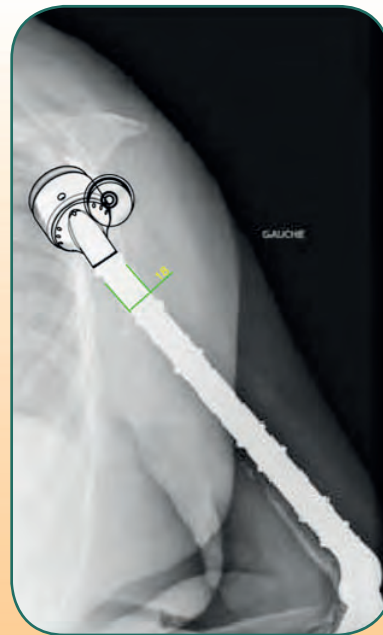


made constrained shoulder

planned implant positioning:



anterior view



lateral view

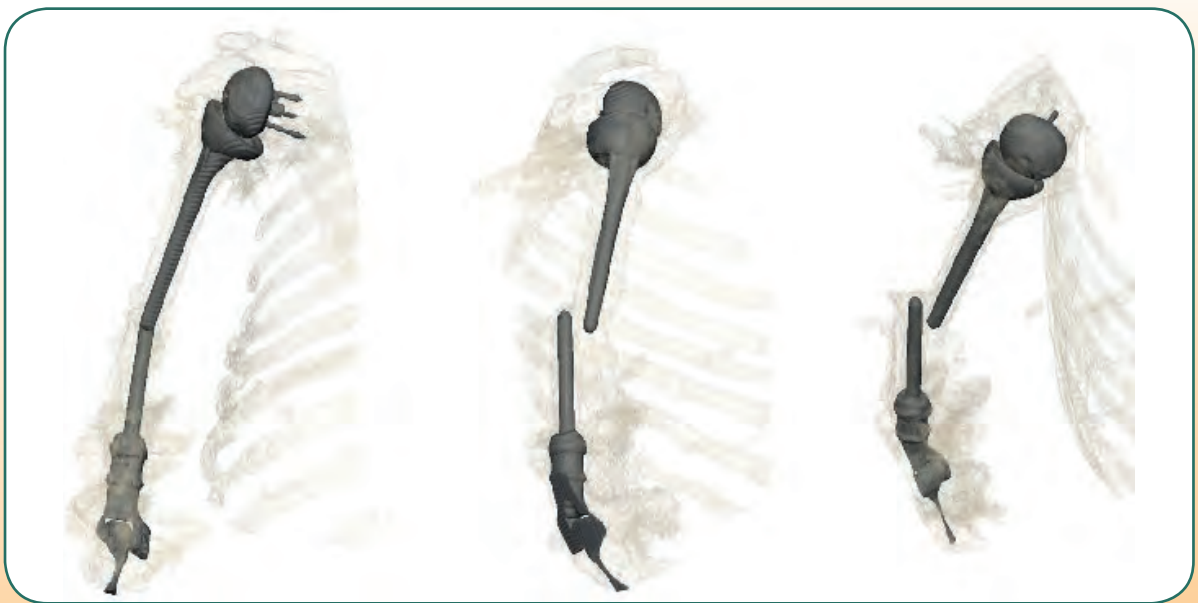
combination with standard products: MUTARS® total humerus replacement

postoperative X-ray:



Case 28 - custom ma

patient data: 63 years – Germany – Evangelisches Krankenhaus Göttingen Weende
surgeon: Dr. B. Kreutzer
indication: Palliative therapy of a periprosthetic fracture



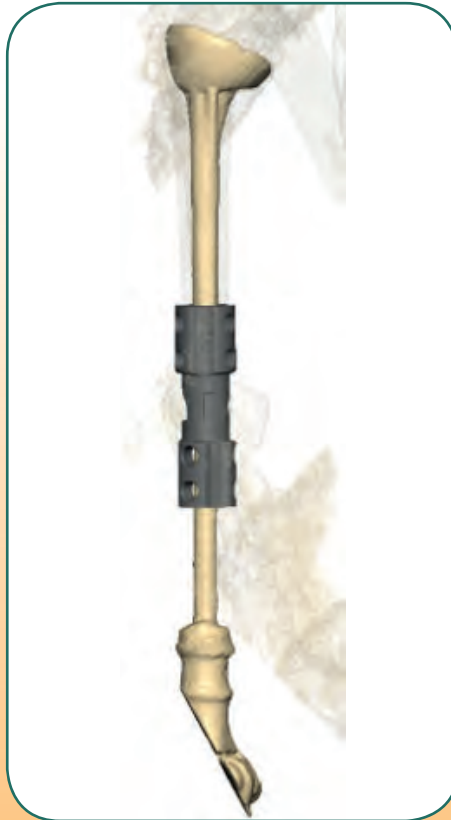
preoperative situation: anterior view, lateral view, isometric view

custom-made solution: MUTARS® stem adapter proximal
MUTARS® stem adapter
MUTARS® stem adapter connecting part
MUTARS® screw for stem adapter (used in combination with cement)



de periprosthetic fracture sleeve

planned implant positioning:



anterior view

postoperative X-ray:



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implantcast GmbH
Lüneburger Schanze 26
D-21614 Buxtehude
Germany
phone: +49 4161 744-0
fax: +49 4161 744-200
e-mail: info@implantcast.de
internet: www.implantcast.de



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