C-Fit 3D®

customized planning & production

Case studies

custom-made prosthetics - patient specific instrumentation

implantcast

Content

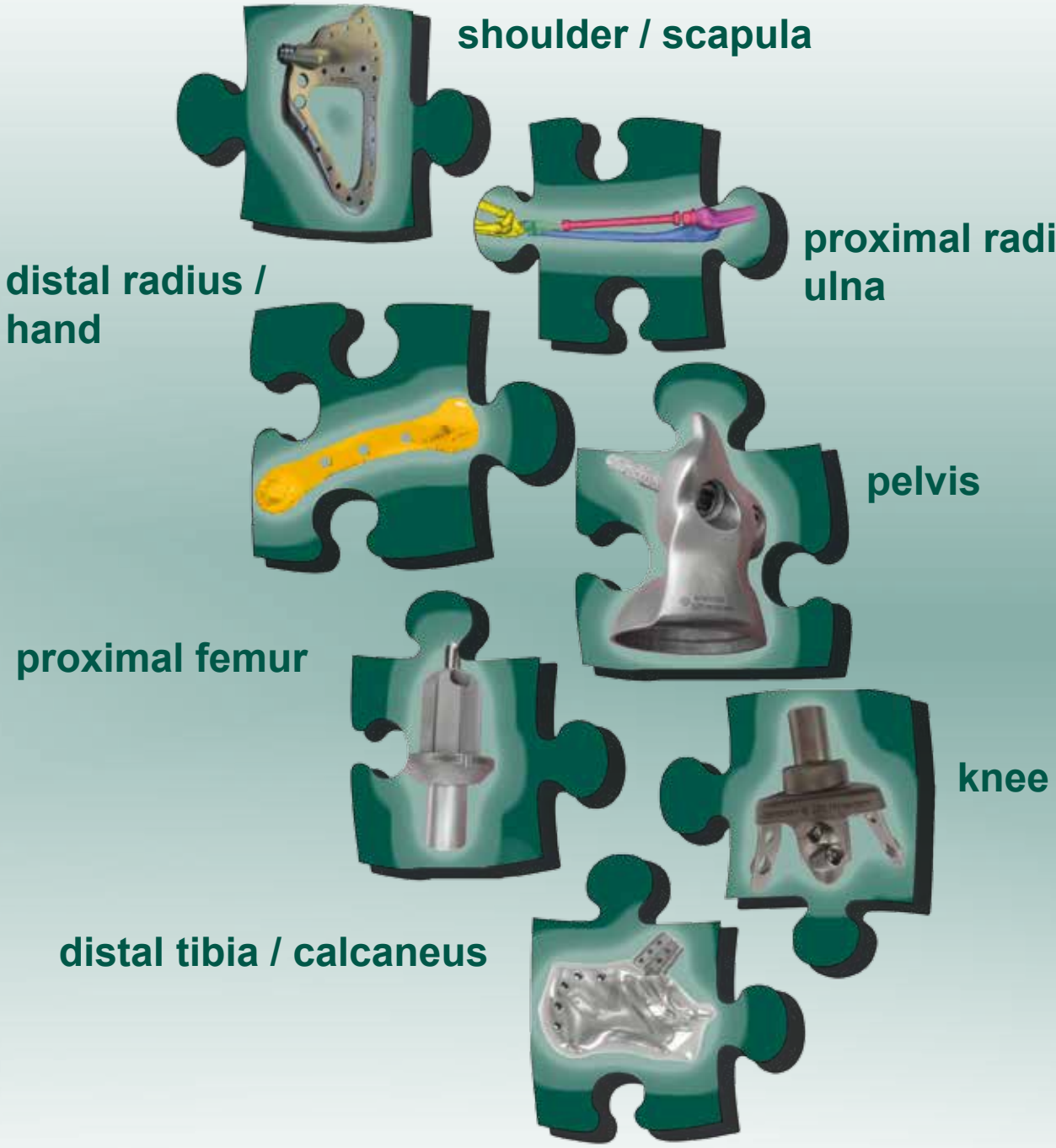
CAUTION: Federal law (USA) restricts this device to sale on or by the order of a physician
USA: only for sale as Compassionate Use Requests.

Introduction

The demand for custom made implant components increases continuously in revision and tumour endoprosthetics. Complicated bone defects after single or multiple revision or large tumour resections often do not tolerate treatment with standard implant components.
implantcast GmbH is able to generate a 3D model of the bone or joint to be reconstructed from high-resolution MRI or CT data. With dedicated software it is possible to segment the body-section radiographs in transversal, saggital 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.
That procedure allows for exact adaptation of the implant to the individual anatomical situation of the patient.
For manufacturing custom made implant components implantcast GmbH uses the additive manufacturing technology to a great extent due to its many advantages.
In the following the different case studies should give you an overview of the possibilities of custom made prosthetics and patient specific instrumentation.

Anatomical overview

In the following anatomical regions implantcast GmbH has experience with custom made implants and instruments.

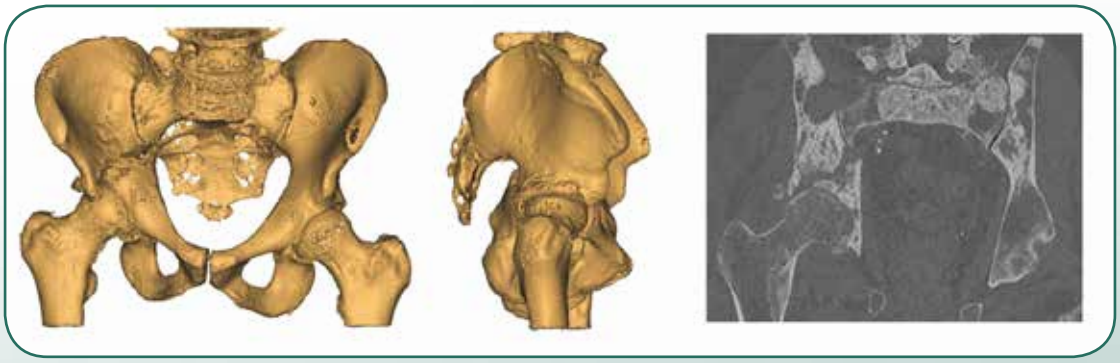


C-Fit 3D®
customized planning & production

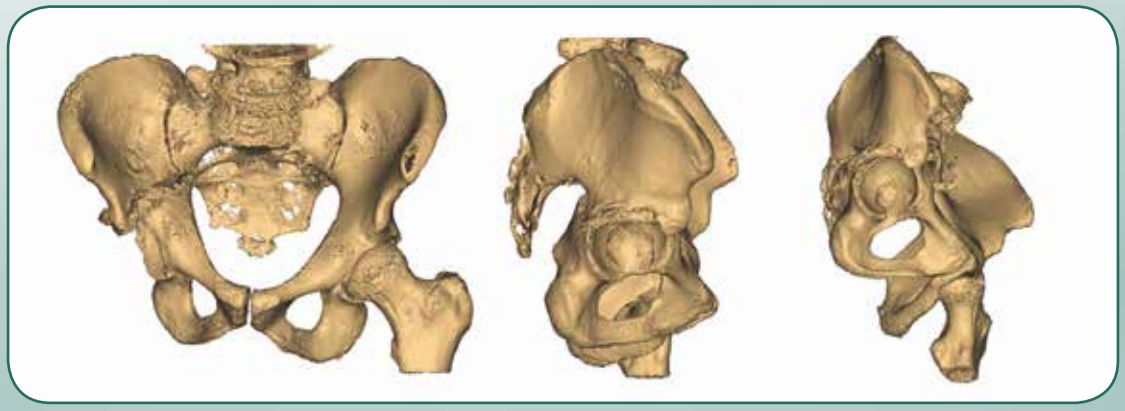
Case 1 - custom m

patient data: male - 81 years - Australia

clinical issue: fracture between right acetabulum and Os ilium



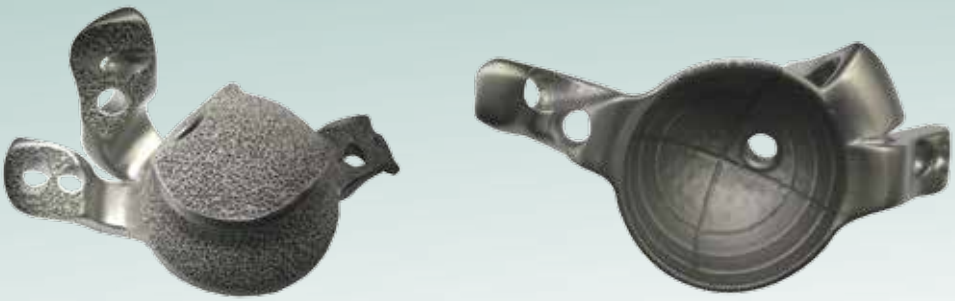
preoperative situation: front view, right view and CT scan



preoperative situation without right femur for improved visibility

custom made solution:

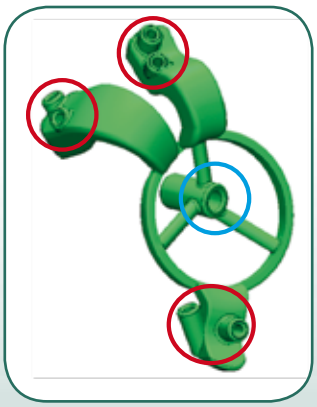
- cementless partial pelvic replacement cup size Ø52/57mm with 3 flaps fixed with 6 screws (Ø6,5mm) in total and with option to place central screw (Ø8mm)
- additive manufactured from $TiAl_6V_4$ (titanium alloy) using EBM (electron beam melting)
- bone contact areas covered with porous EPORE® structure

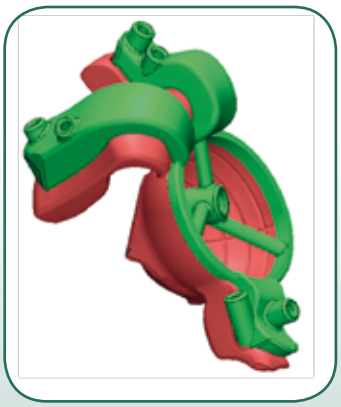


ade partial pelvic replacement

custom made instrument: drill guide made of plastic

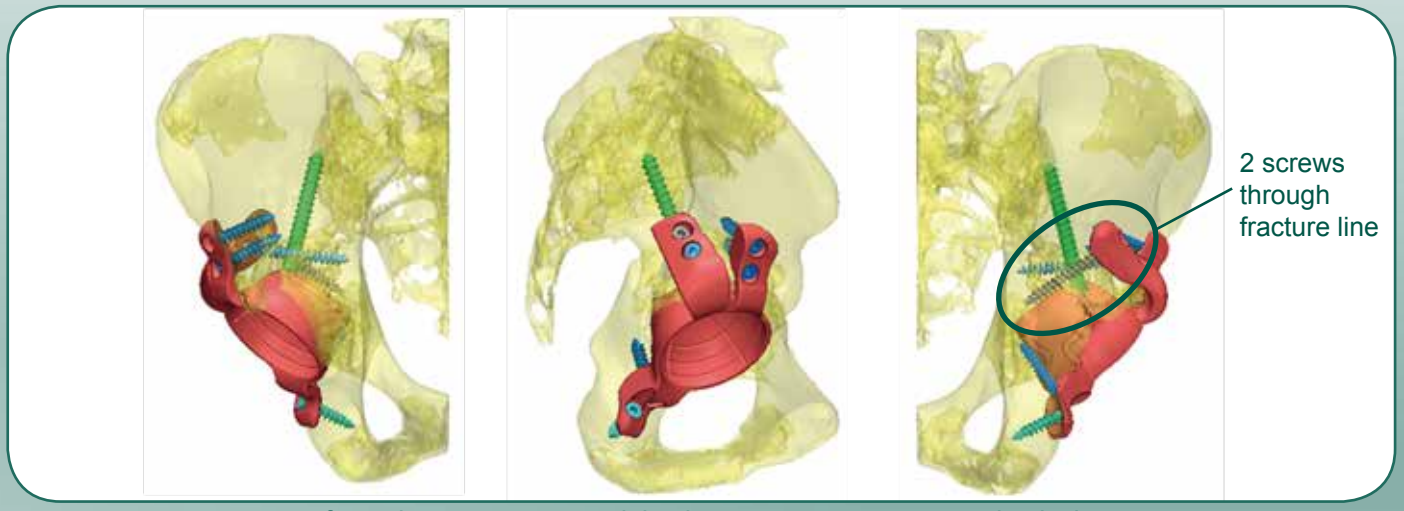
- 6 holes for Ø3,2mm drill
- 1 hole for Ø6mm drill





drill guide positioned on the implant model

planned implant positioning:



front view right view back view

combination with standard product: to be used with tripolar EcoFit® 2M cemented cup 44/50mm and head

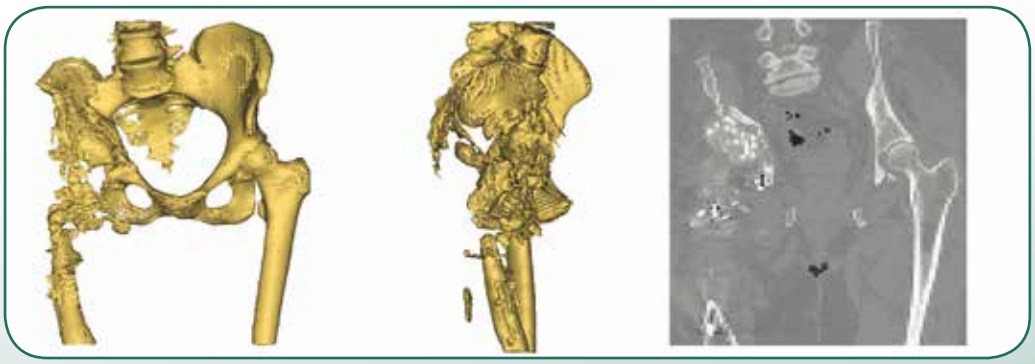
postoperative X-ray:

C-Fit 3D®
customized planning & production

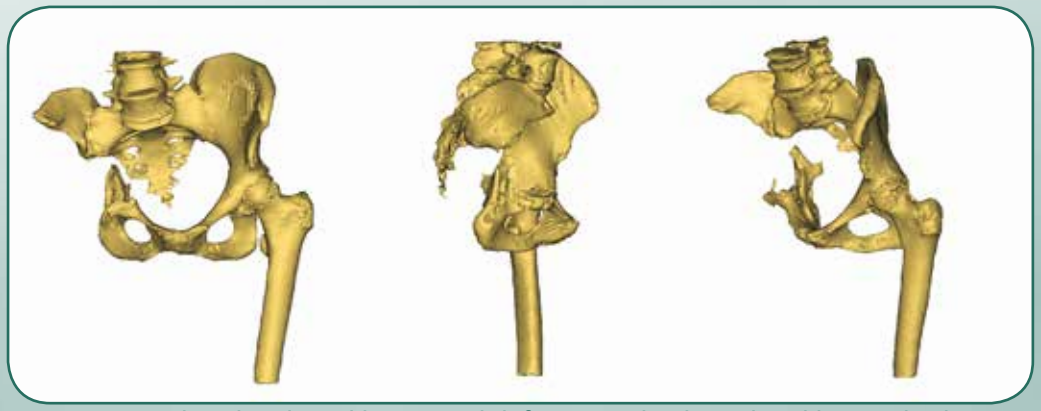
Case 2 - custom m

patient data: female - 72 years - Germany

clinical issue: right acetabular defect after explantation



preoperative situation: anterior view, lateral view and CT scan



preoperative situation with exposed defect: anterior, lateral and isometric view

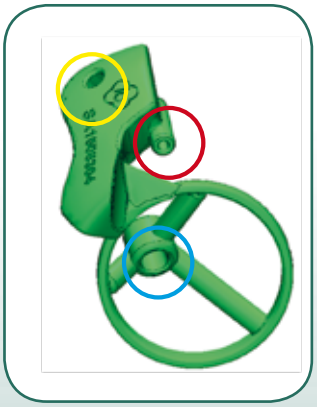
custom made solution:

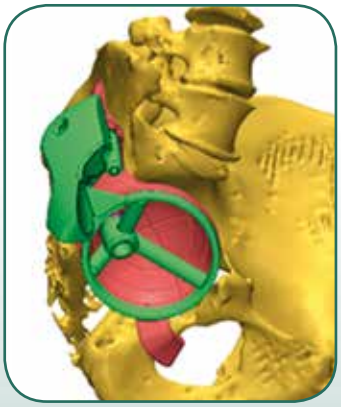
- cementless partial pelvic replacement cup size Ø60/65mm with flap
- fixed with 1 screw Ø6,5mm and 1 screw Ø8mm and with modular stem Ø9x55mm
- additive manufactured from $TiAl_6V_4$ (titanium alloy) using EBM (electron beam melting)
- modular stem with porous EPORE® structure

ade partial pelvic replacement

custom made instrument: drill guide made of plastic

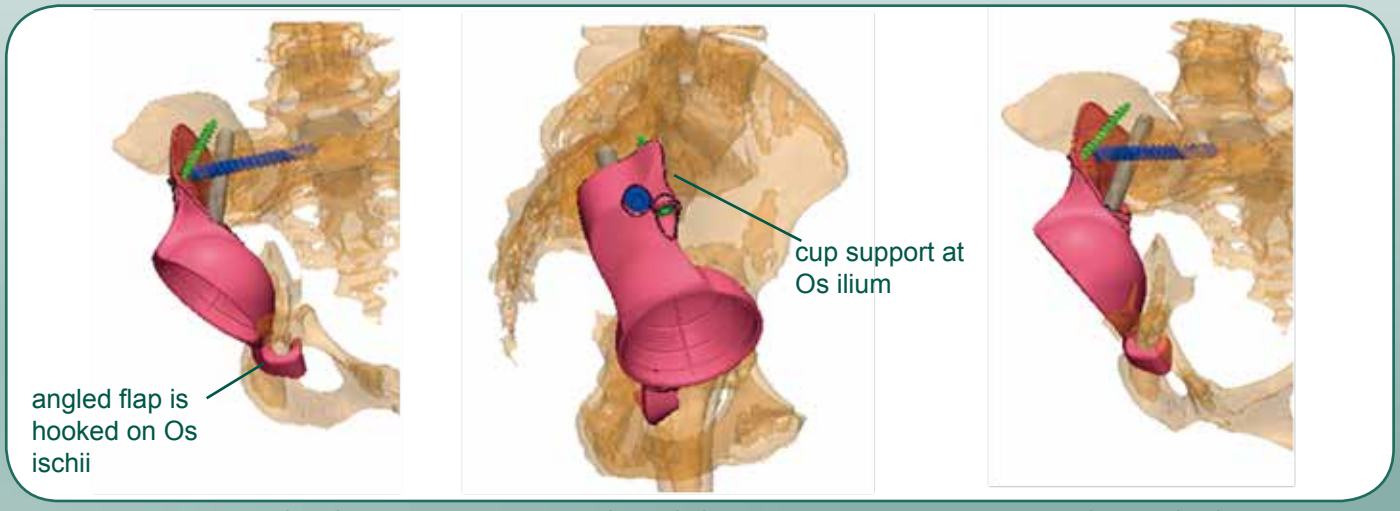
- 1 hole for Ø3,2mm drill
- 1 hole for Ø9mm drill
- 1 hole for Ø6mm drill





drill guide positioned on the implant model

planned implant positioning:



anterior view | lateral view | isometric view

combination with standard product: to be used with tripolar EcoFit® 2M cemented cup 52/58mm and head

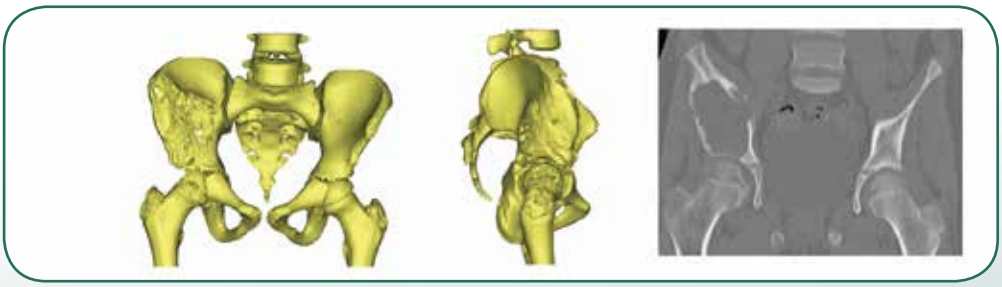
postoperative X-ray:

C-Fit 3D®
customized planning & production

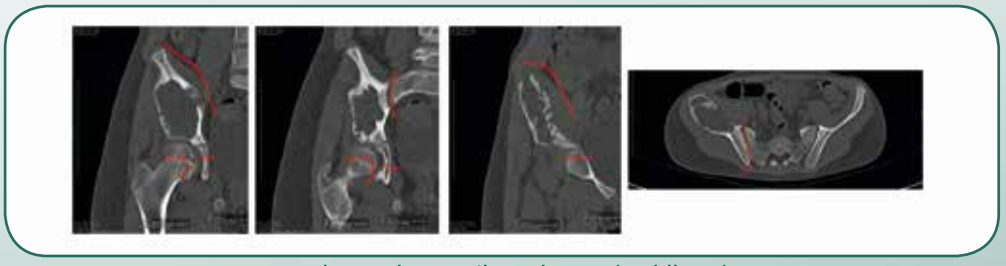
Case 3 - custom m

patient data: female - 10 years - Poland

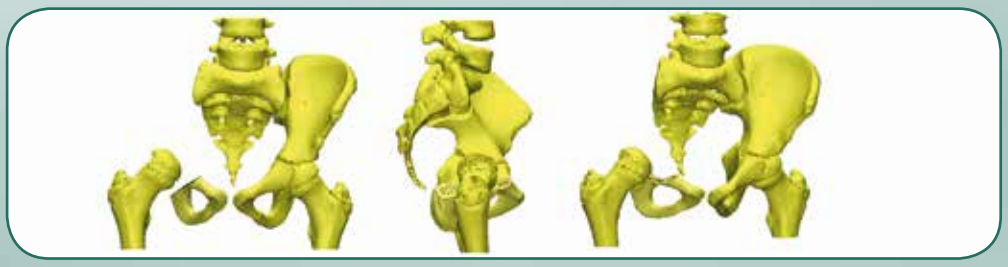
clinical issue: Ewing's sarcoma of right pelvis



preoperative situation: anterior view, lateral view and CT scan



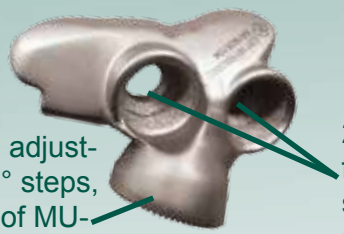
planned resection planes (red lines)



simulated situation after resection: anterior, lateral and isometric view

custom made solution:

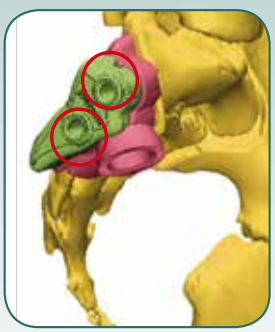
- cementless ilium replacement fixed with 2 screws Ø8mm
- additive manufactured from $TiAl_6V_4$ (titanium alloy) using EBM (electron beam melting)
- bone contact area with porous EPORE® structure



rotational adjustment in 5° steps, adaption of MUTARS® LUMIC® cup

2 holes with thread for Ø8mm cancellous screws with safety screws

drill guide:

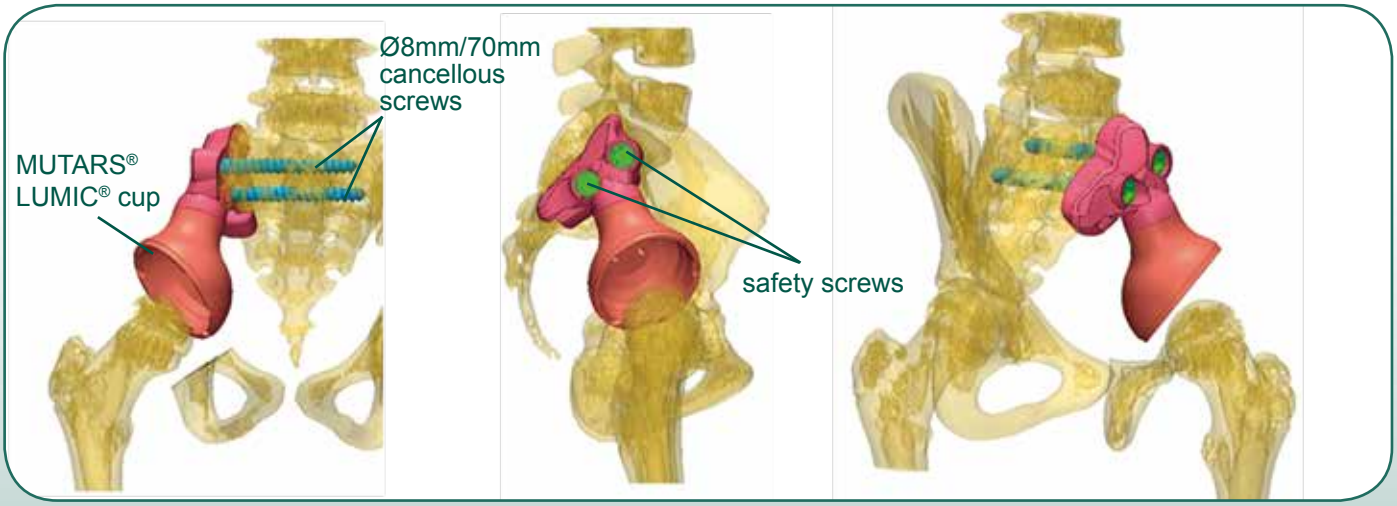


custom made instrument: drill guide made of plastic

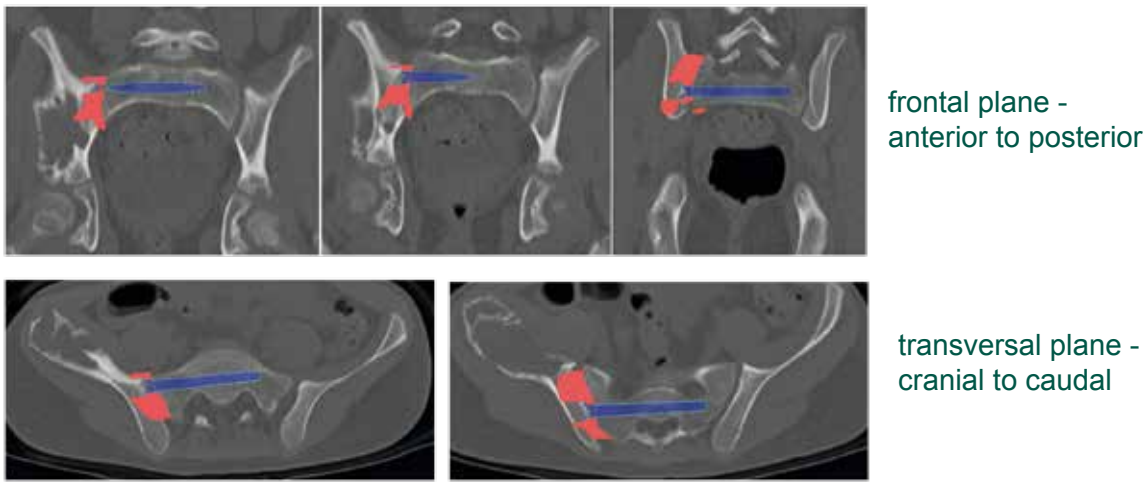
○ 2 holes for Ø6mm drill

ade partial pelvic replacement

planned implant positioning:



anterior view lateral view isometric view



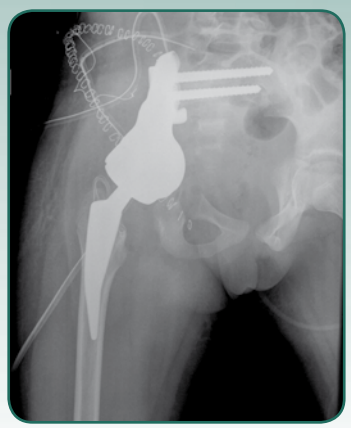
frontal plane -
anterior to posterior

transversal plane -
cranial to caudal

planned implant positioning in CT scan

combination with standard product: to be used with MUTARS® LUMIC® cup Ø54mm

postoperative X-ray:

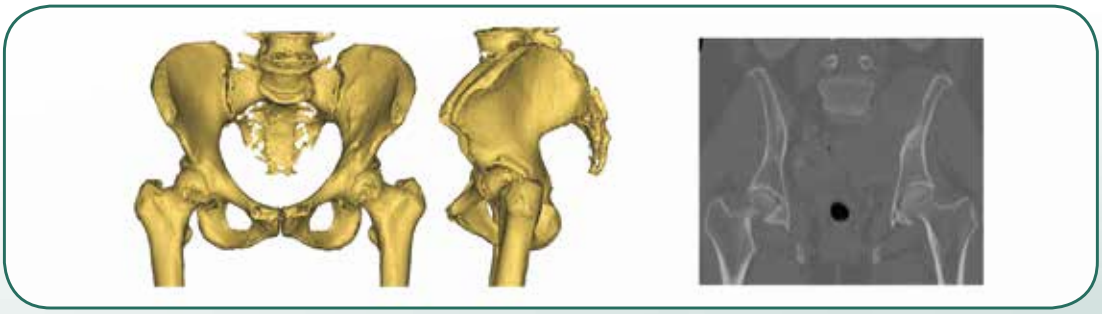


C-Fit 3D®
customized planning & production

Case 4 - custom m

patient data: female - 63 years - Germany

clinical issue: tumour in left pelvis requires complete resection of left pelvis

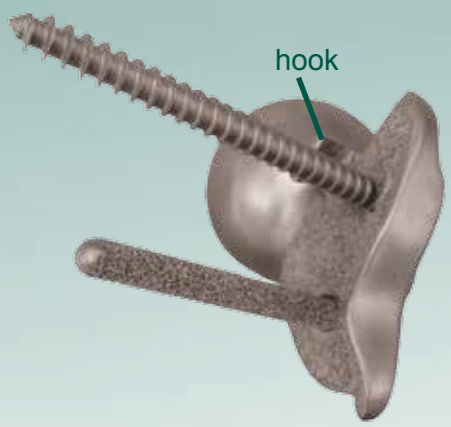


preoperative situation: anterior view, lateral view and CT scan

simulated situation after resection: anterior, lateral and isometric view

custom made solution:

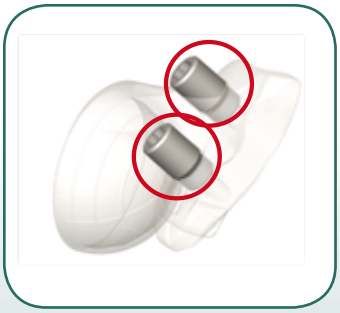
- cementless partial pelvic replacement Ø60/65mm fixed with 1 screw
  Ø8mm and modular stem Ø8mmx75mm
- additive manufactured from $TiAl_6V_4$ (titanium alloy) using EBM (electron beam melting)
- bone contact area and modular stem with porous EPORE® structure



ade partial pelvic replacement

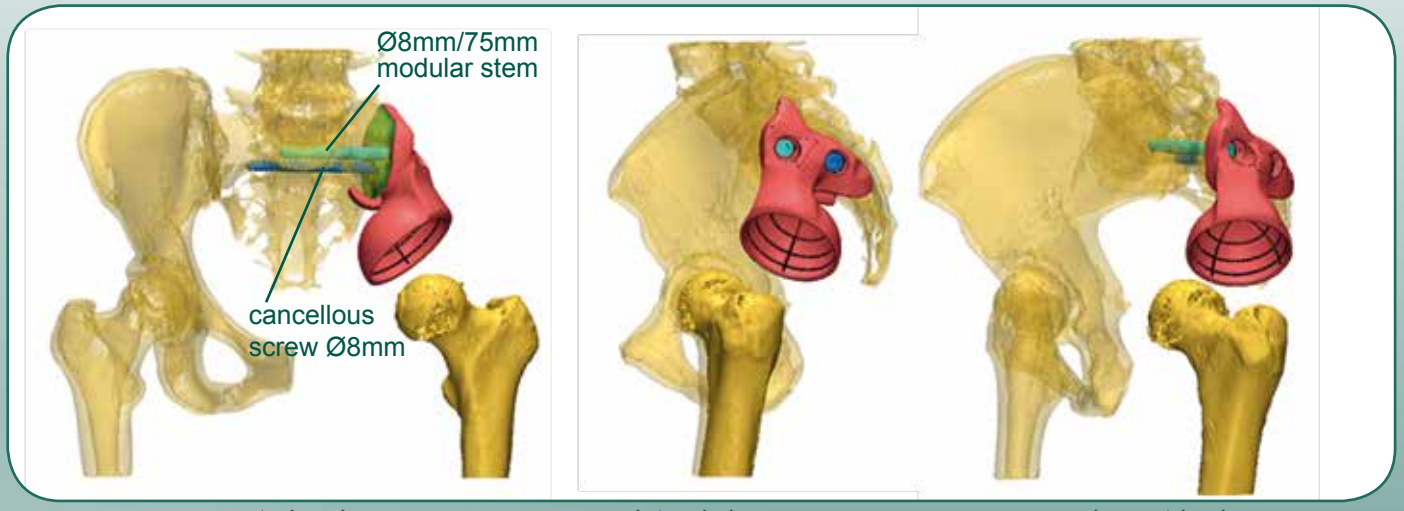
custom made instrument: drill sleeves assembled to the implant which are removed after drilling

◯ 2 drill sleeves for Ø6mm drill



drill sleeves positioned on the implant model

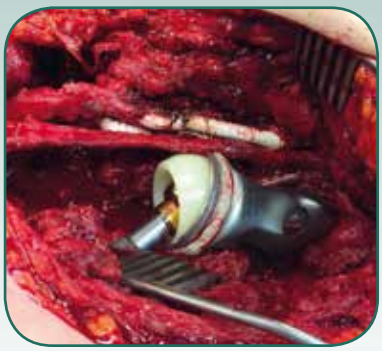
planned implant positioning:



anterior view | lateral view | isometric view

combination with standard product: to be used with tripolar EcoFit® 2M cemented cup 52/58mm and head

intraoperative view:



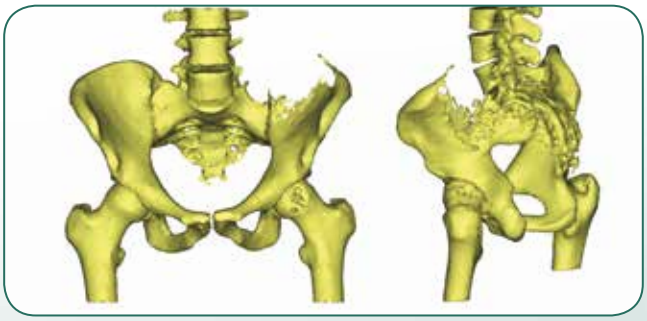
postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 5 - custom m

patient data: male - Czech Republic

clinical issue: Ewing sarcoma of left pelvis



preoperative situation: anterior and isometric view

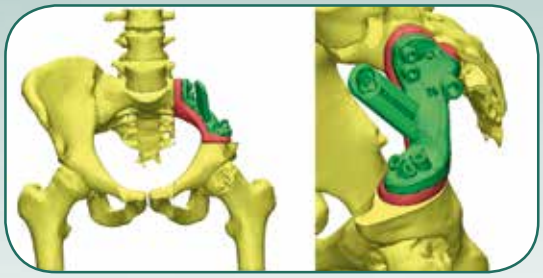
planned resection

simulated resection: anterior, lateral and isometric view

custom made solution:

- ilium replacement with safety screw
- additive manufactured from $TiAl_6V_4$ (titanium alloy) using EBM (electron beam melting)
- bone contact area with porous EPORE® structure

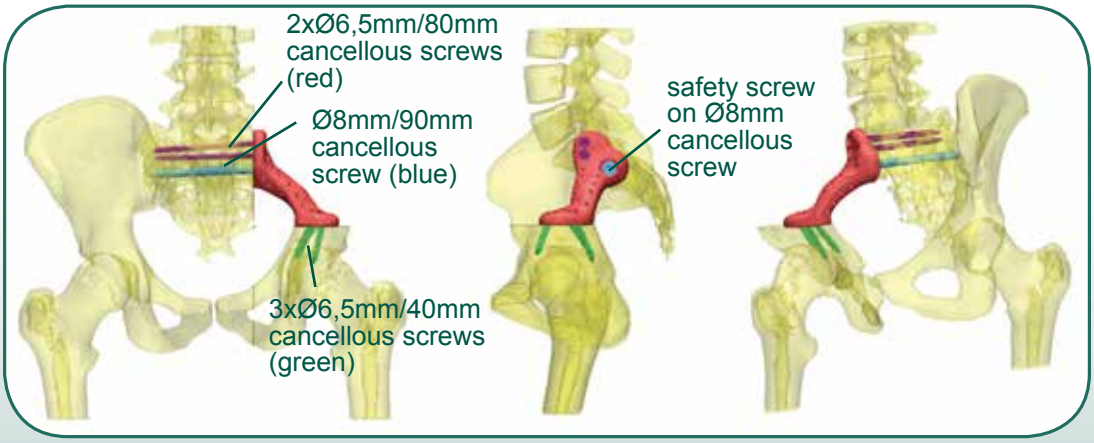
custom made instrument: drill guide made from plastic with holes for Ø3,2mm and Ø6mm drill



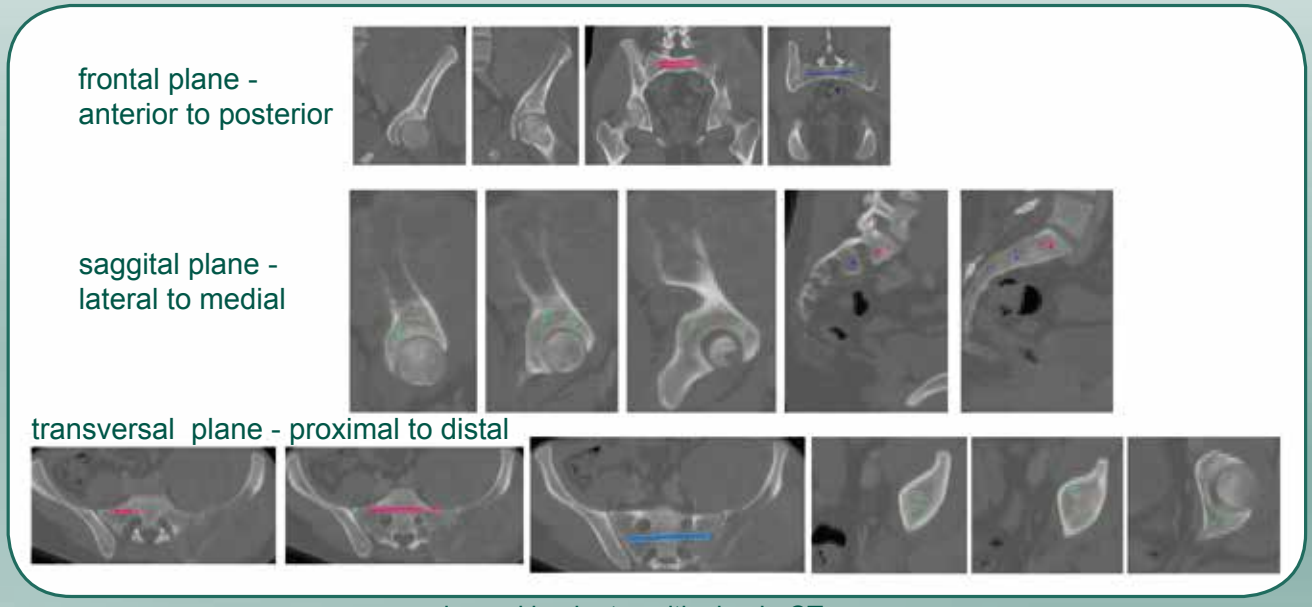
drill guide positioned on implant model; anterior and isometric view

ade partial pelvic replacement

planned femoral implant positioning:



anterior view lateral view isometric view



planned implant positioning in CT scan

combination with standard product: Ø6,5mm and Ø8mm cancellous screws

postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 6 - custom

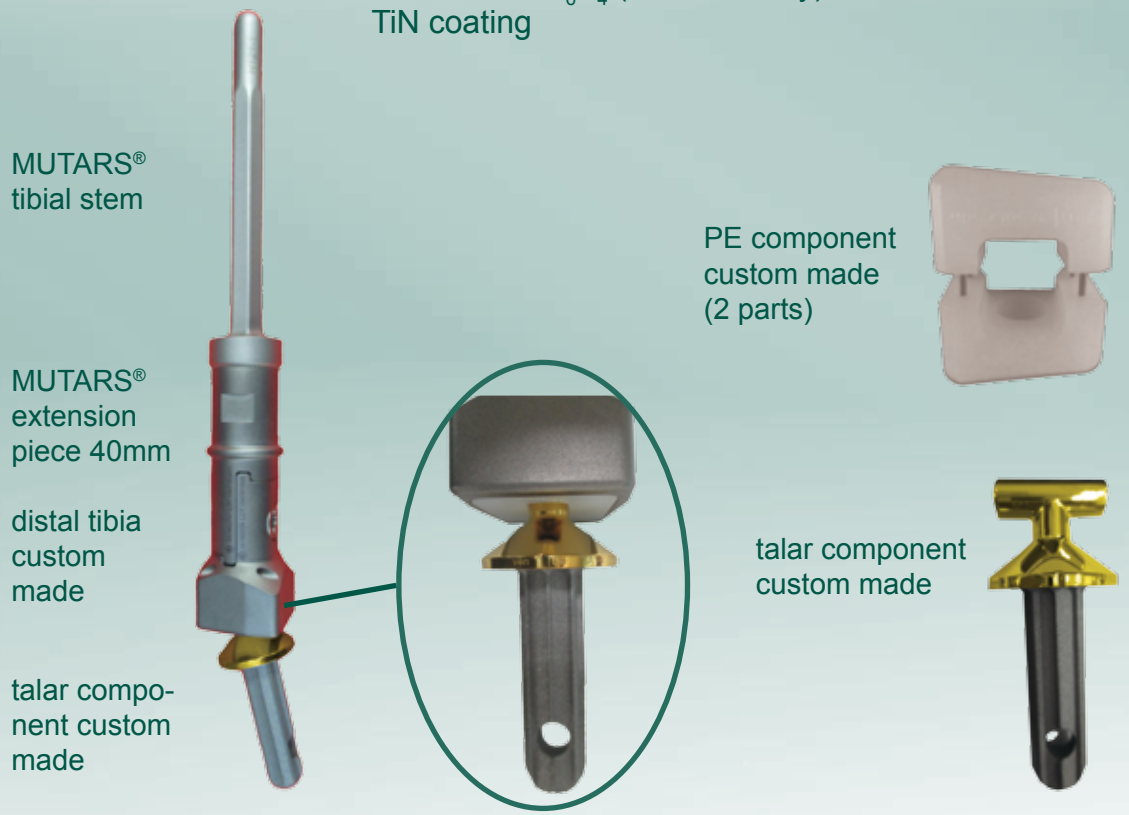
patient data: male - 42 years - Poland

clinical issue: Osteosarcoma distal tibia left

preoperative situation: anterior view, lateral view, CT scan and isometric view

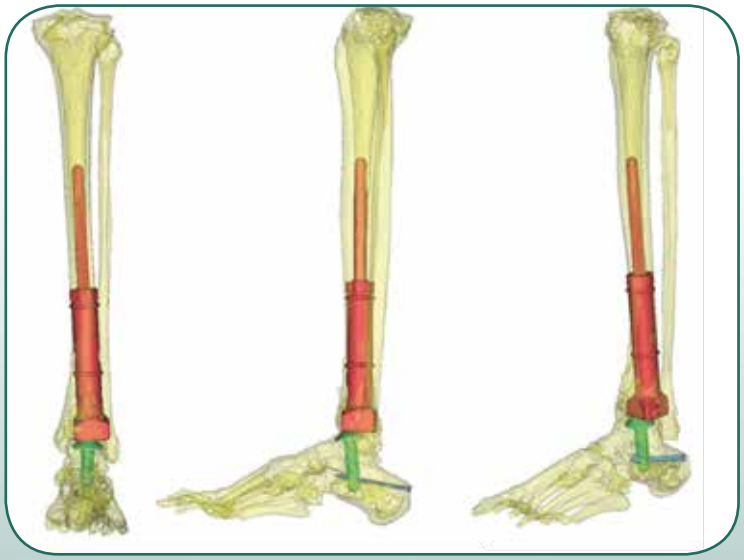
custom made solution:

- cementless modular hinged joint distal tibia prosthesis
- talar component 14/50mm interlockable with Ø6,5mm screw
- PE insert
- materials $TiAl_6V_4$ (titanium alloy) UHMWPE, talar component with TiN coating

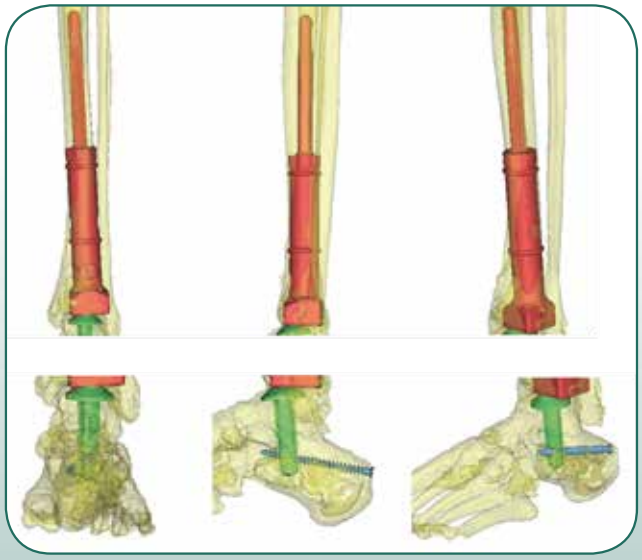


made distal tibial replacement

planned implant positioning:



anterior view lateral view isometric view



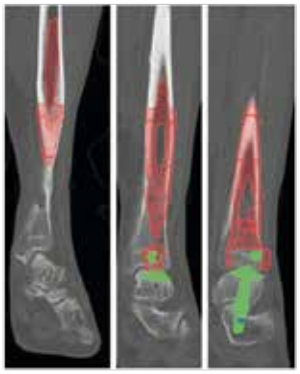
scaled up view: anterior, lateral and isometric view

combination with standard product:

to be used with MUTARS® tibial stem and MUTARS® extension piece 40mm

frontal plane - anterior to posterior

saggital plane - lateral to medial



planned positioning in CT scan

intraoperative view:

postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 7 - custom

patient data: female - Greece

clinical issue: Ewing sarcoma of left talus requires total talar resection and ankle replacement

preoperative situation: front, lateral and medial view

simulated situation after total talar resection: front, lateral and medial view

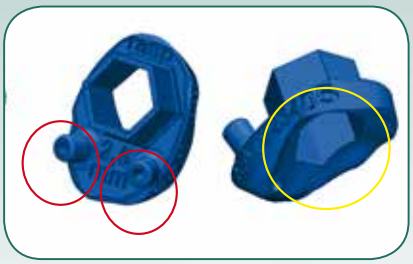
custom made solution:

- custom-made MUTARS® talar replacement cementless with stem Ø16mm interlockable with Ø6,5mm screw
- anatomical shape of talus and articulating surface of TARIC® talus component size 2
- material cementless talar component $TiAl_6V_4$ (titanium alloy) with TiN coating
- bone contact area and stem with porous EPORE® structure

custom made instrument: drill guide made of plastic, rasp for stem Ø16mm made of titanium alloy and rasp guide mad of plastic

pin hole for Ø2,5mm pin

contact surface to calcaneus

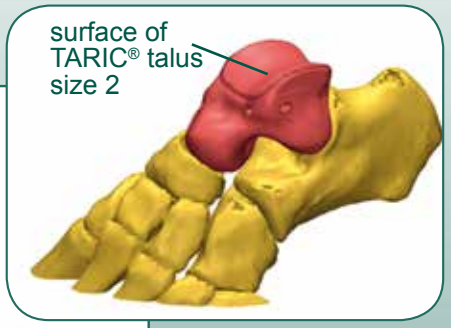


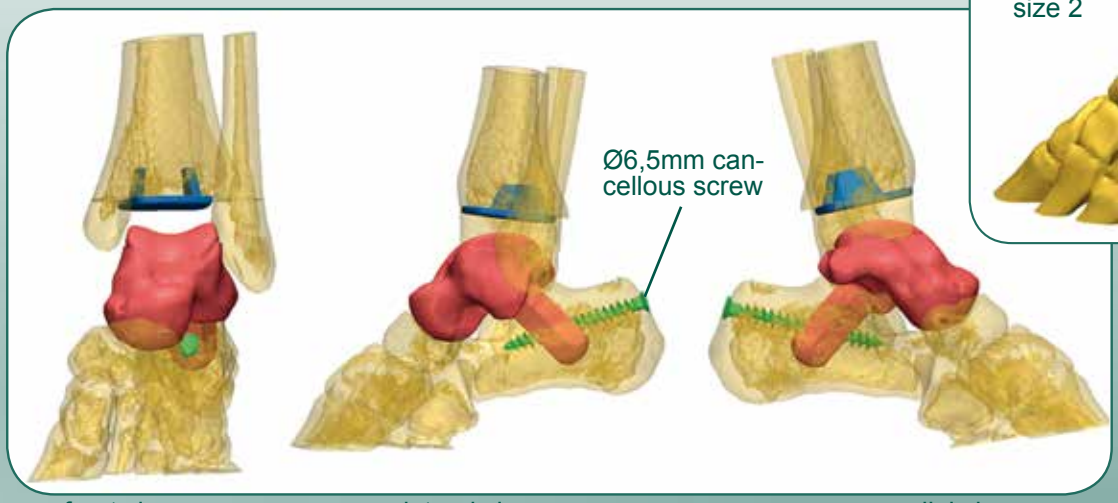
made talus replacement

drill guide fixed to the calcaneus

rasp assembled to impactor and guide fixed to the calcaneus

planned implant positioning:





front view lateral view medial view

combination with standard product: to be used with Ø6,5mm cancellous screw and TARIC® tibial component and PE component

postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 8 - custom

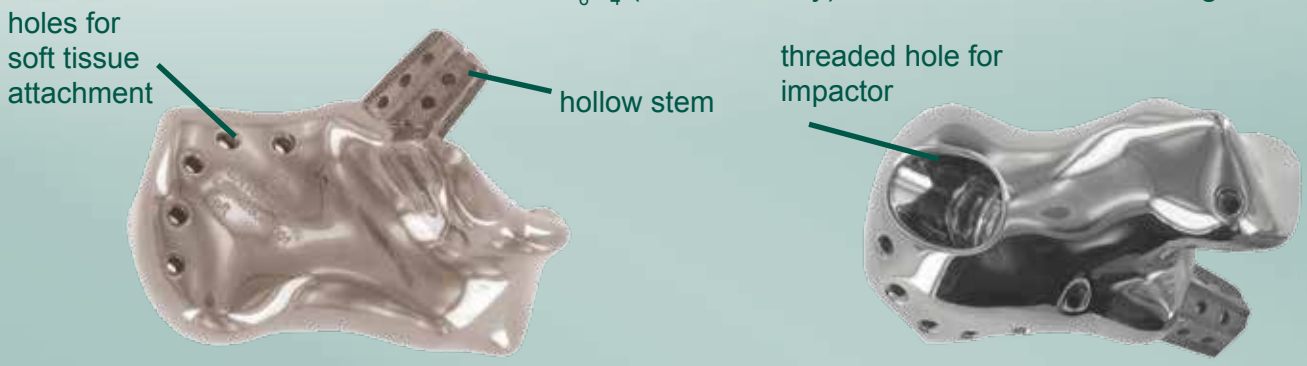
patient data: female - 44 years - Germany

clinical issue: Osteosarcoma left calcaneus

preoperative situation: lateral view, isometric view and CT scan

custom made solution:

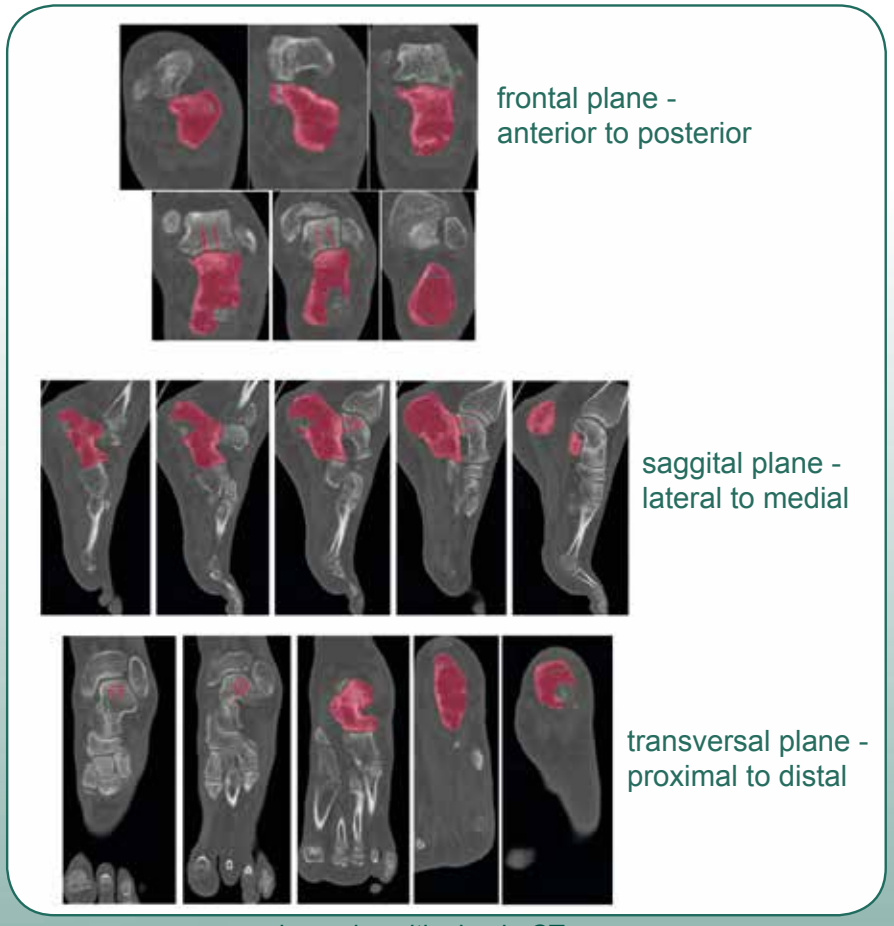
- anatomical calcaneus implant cementless with hollow stem coated with TiN and silver
- guided impaction of the implant
- materials $TiAl_6V_4$ (titanium alloy) with TiN and silver coating



planned implant positioning:

lateral view posterior view medial view

made calcaneus replacement



planned positioning in CT scan

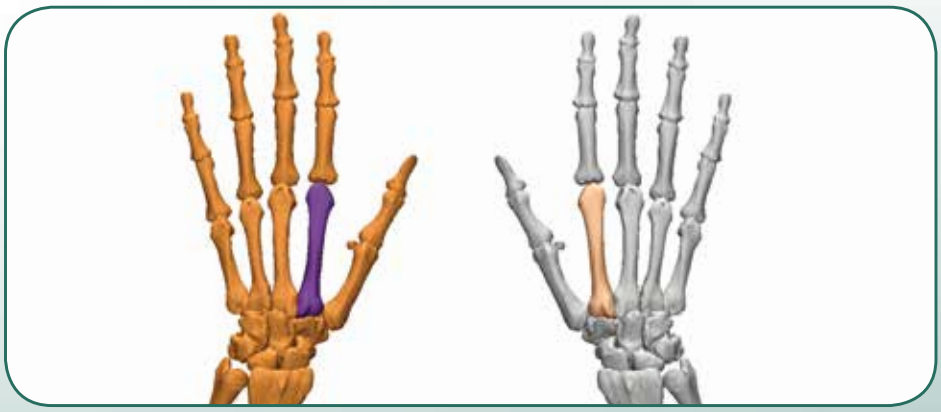
postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 9 - custom ma

patient data: female - 47 years - Poland

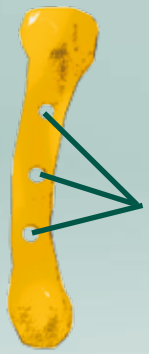
clinical issue: anatomic reconstruction of 2nd metacarpal of right hand



preoperative situation: left hand from CT scan and mirrored right hand

custom made solution:

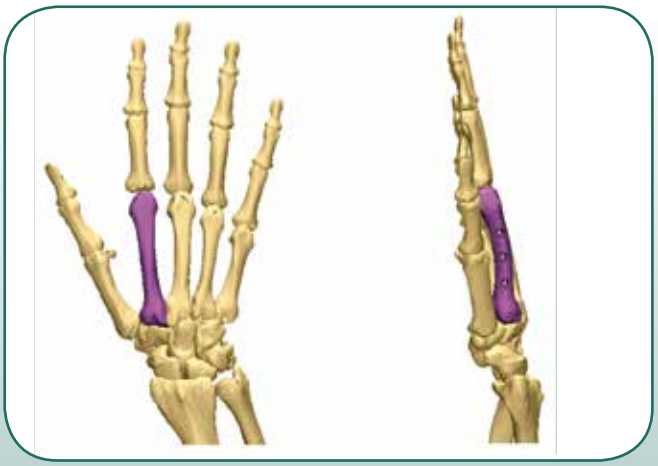
- 2nd metacarpal bone with 3 holes (Ø3mm) in mediolateral direction for soft tissue attachment
- completely polished and coated with TiN
- materials $TiAl_6V_4$ (titanium alloy) with TiN coating



3 holes with Ø3mm for soft tissue attachment

de metacarpal bone replacement

planned implant positioning:



dorsal view lateral view

postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 10 - custom

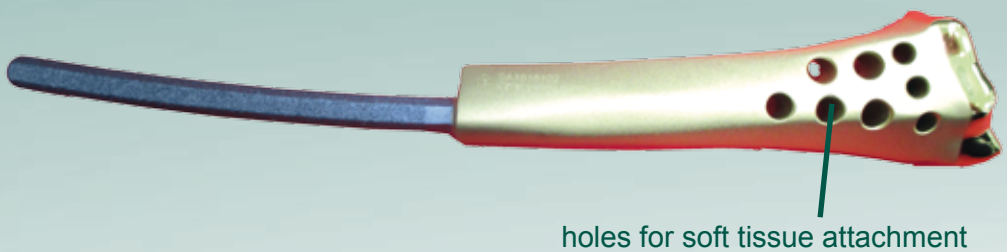
patient data: male - 50 years - Poland

clinical issue: tumour of left distal radius with no damage of articulating surfaces in the wrist joint, resection length 9cm

preoperative situation X-ray: left arm right arm

custom made solution:

- distal radius hemiprosthesis 90mm with stem 6x80mm cement-less
- hexagonal stem with rough surface
- joint area polished and TiN coated
- additive manufactured from $TiAl_6V_4$ (titanium alloy) using EBM (electron beam melting) with TiN coating except the stem
- soft tissue attachment with MUTARS® attachment tube



holes for soft tissue attachment

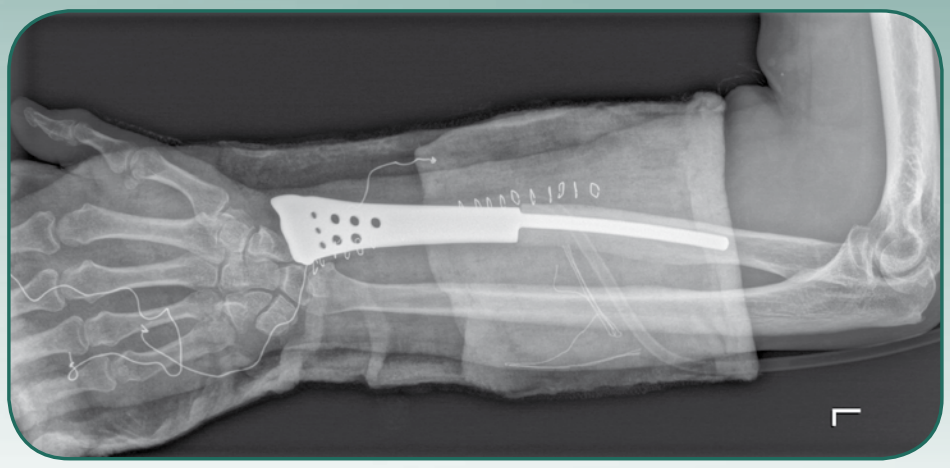
made distal radius replacement

planned implant positioning:

planned 2D implant positioning in X-ray

combination with standard product: MUTARS® attachment tube

postoperative X-ray:



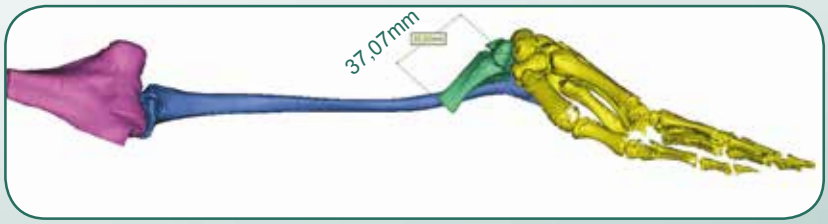
C-Fit 3D®
customized planning & production

Case 11 - custom m

patient data: male - 16 years - Germany

clinical issue: revision of a radius prosthesis due to fracture of left radius

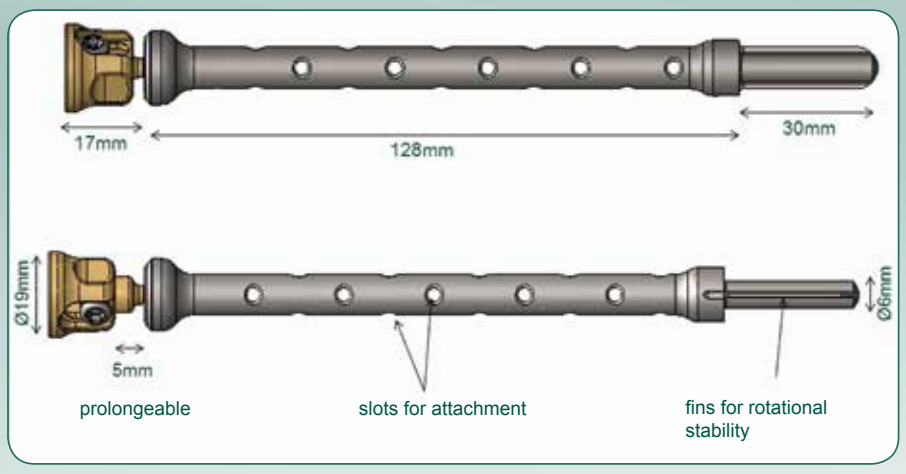
preoperative situation: image and reconstructed left arm as 3D model



preoperative situation after resection of the radius

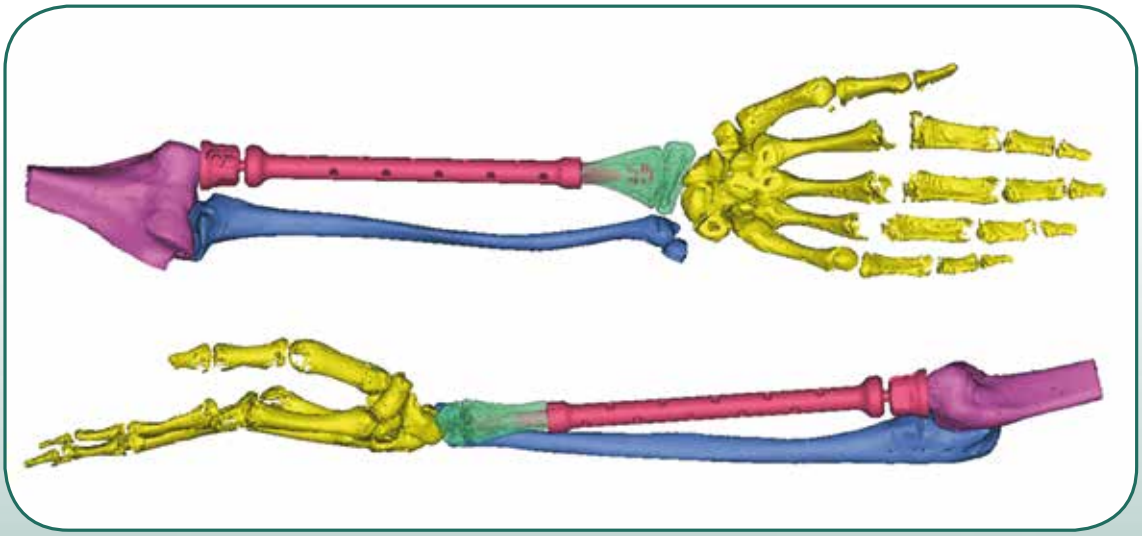
custom made solution:

- cementless radial stem with length 128mm is implanted into the radius via a Ø6mm stem, which has 2 fins for rotational stability with PE-inlay
- radial head 19mm
- the radial head is put into the PE inlay of the radial stem
- the radial prosthesis can be prolonged by 5mm via a telescopic bar, which is fixed with a screw
- manufactured from $TiAl_6V_4$ (titanium alloy)



ade proximal radius replacement

planned implant positioning:



combination with standard product: MUTARS® attachment tube,
ICARA® radial head prosthesis

intraoperative view:

postoperative X-ray:

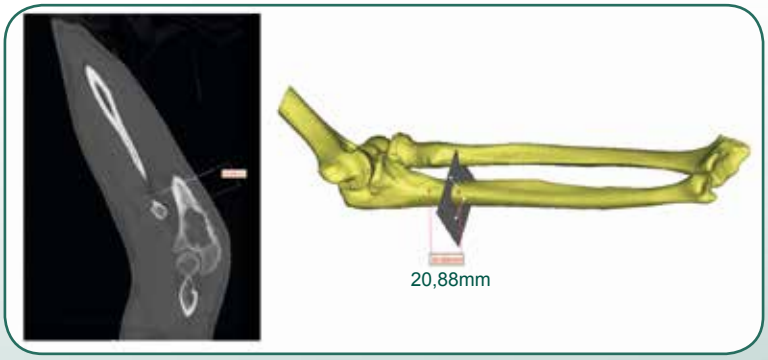
C-Fit 3D®
customized planning & production

Case 12 - custom

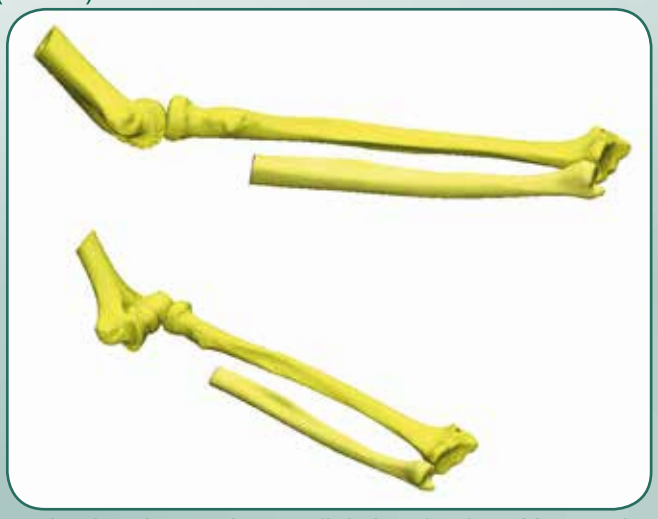
patient data: male - Netherlands

clinical issue: chrondrosarcoma, resection of proximal ulna

preoperative situation: medial view (top) and dorsal view (bottom)



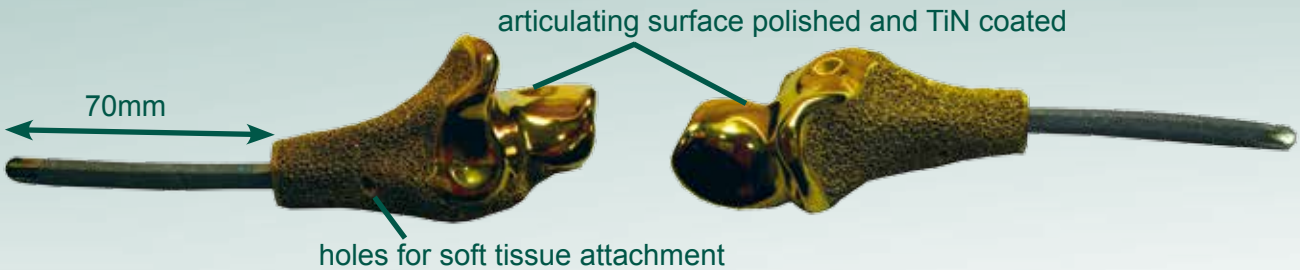
planned resection



simulated resection medial view (top) and isometric view (bottom)

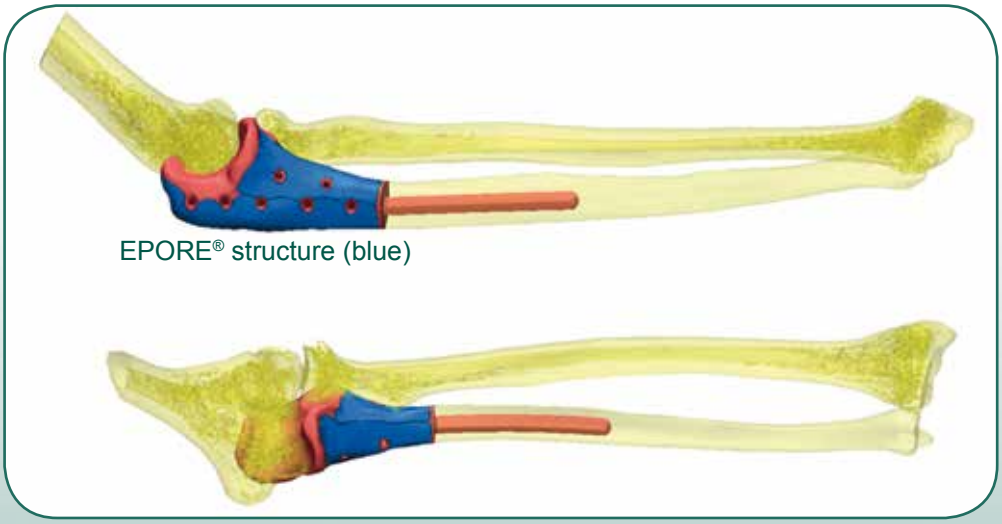
custom made solution:

- anatomical proximal hemi ulna replacement left 7x70mm cement-less and hexagonal cementless stem with curved design
- materials $TiAl_6V_4$ (titanium alloy) with TiN coating
- bone contact area with EPORE® structure



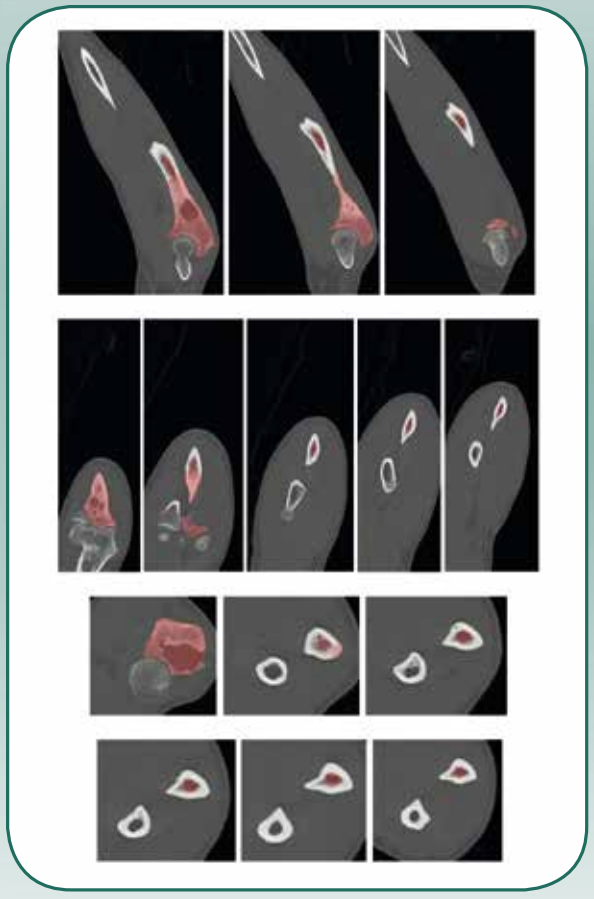
made proximal ulna replacement

planned implant positioning:



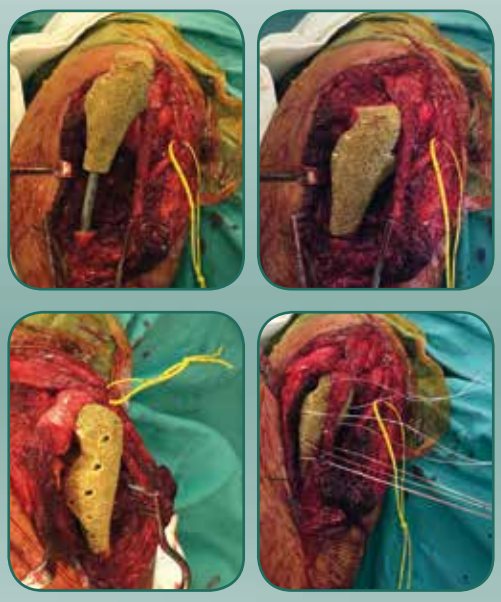
EPORE® structure (blue)

medial view (top) and ventral view (bottom)



planned positioning in CT scan

intraoperative view:



postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 13 - custom

patient data: female - 20 years - South Africa

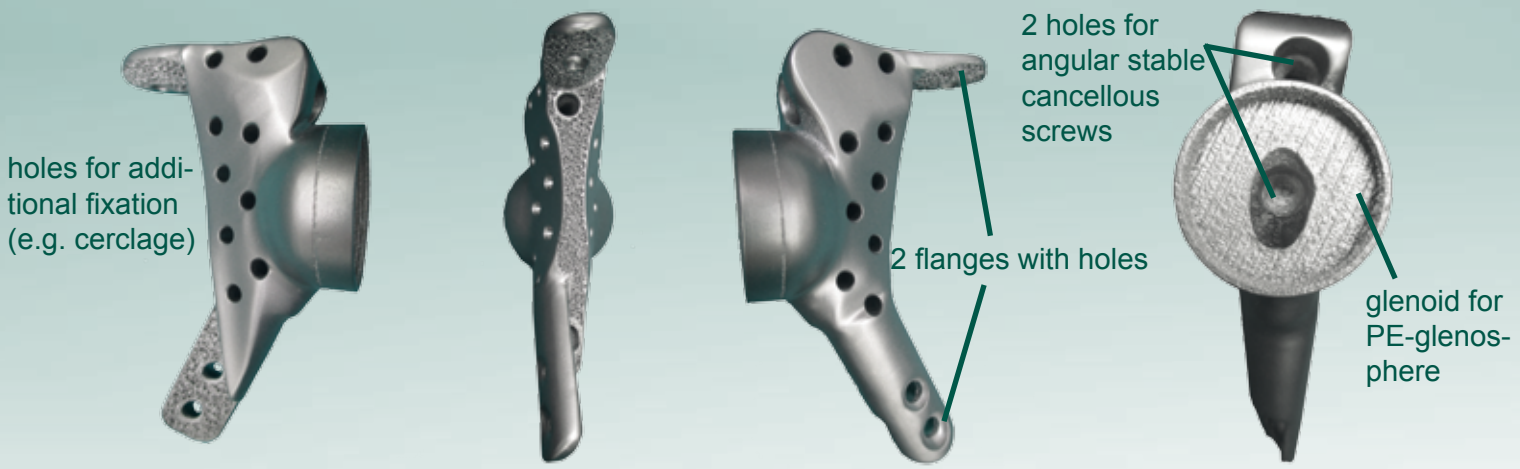
clinical issue: desmoplastic tumour of the left scapula extending into the neck of the glenoid

preoperative situation: anterior view and CT scan

preoperative situation: 3D reconstruction of scapula, anterior, lateral and posterior view

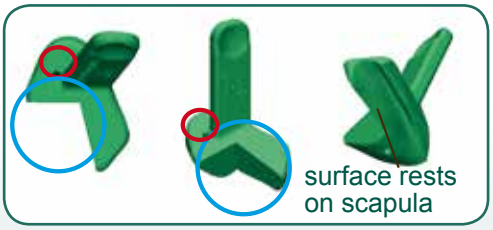
resected scapula: anterior, superior and posterior view

custom made solution:
- glenoid implant with base and flanges
- additive manufactured from $TiAl_6V_4$ (titanium alloy) using EBM (electron beam melting)
- bone contact area with porous EPORE® structure



made glenoid replacement

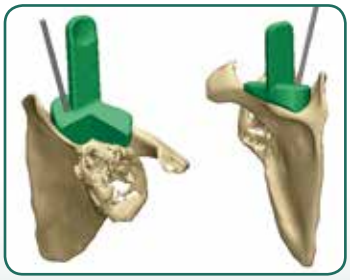
custom made instrument:



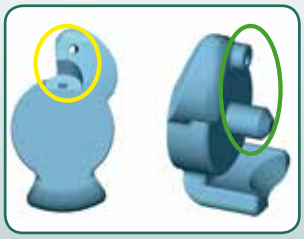
hole for fixation with Ø3,2mm pin

guiding plane for saw blade

resection guide made of plastic:



resection guide fixed to the bone model



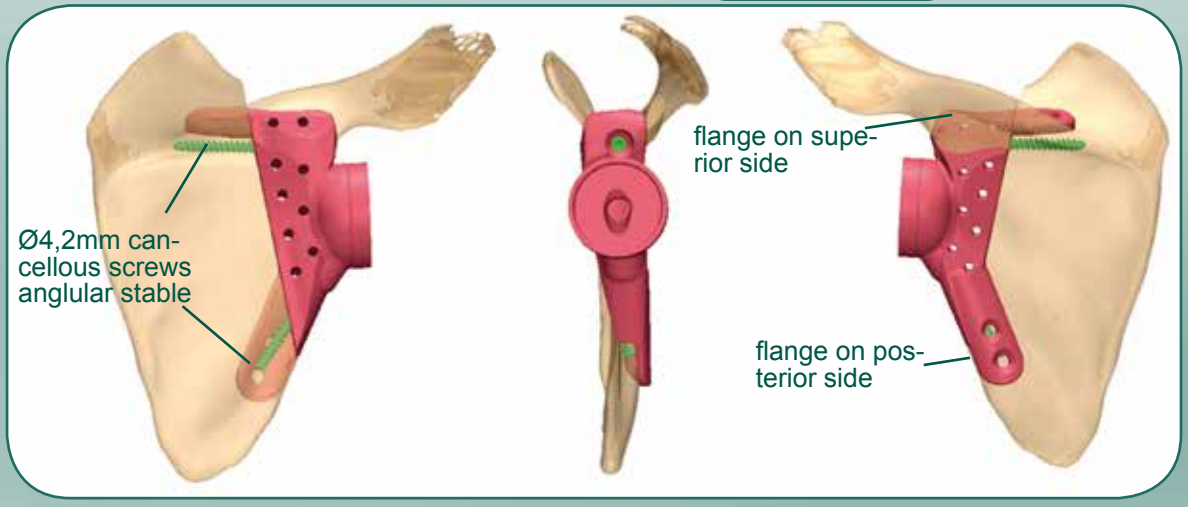
drill guide made of plastic:

2 holes for Ø2mm drill

2 pins for positioning on the implant

drill guide positioned on implant model

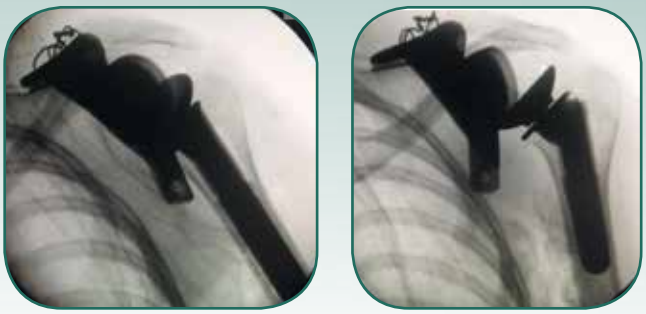
planned implant positioning:



planned implant positioning: anterior, lateral and posterior view

combination with standard product: AGILON® glenoshpere and Ø4,2mm cancellous screws, for humerus AGILON® omarthrosis

postoperative X-ray:

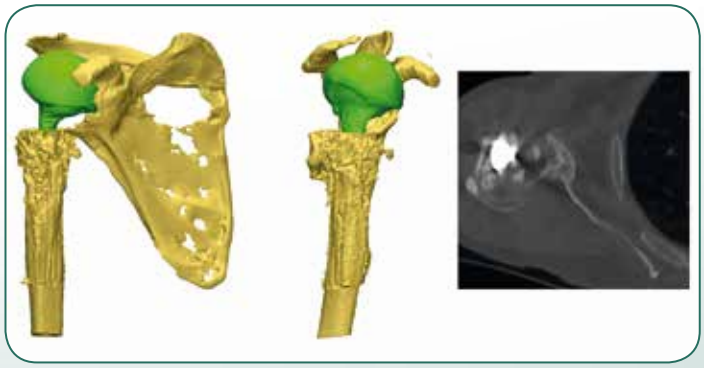


C-Fit 3D®
customized planning & production

Case 14 - custom

patient data: female - 78 years - Australia

clinical issue: patient had primary reverse total shoulder replacement. After a fall the glenoid was grafted due to ripped out glenoid component



preoperative situation: anterior view, lateral view and CT scan

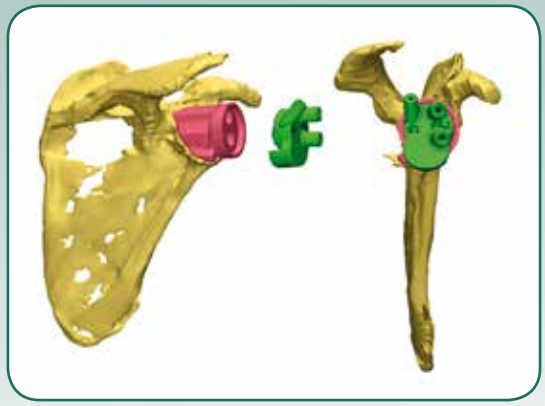
preoperative situation: 3D reconstruction of scapula without implants; anterior, lateral and isometric view

custom made solution:

- glenoid implant fixed with Ø6,5mm and Ø4,2mm cancellous screws
- compatible with MUTARS® glenosphere Ø40mm symmetric
- additive manufactured from $TiAl_6V_4$ (titanium alloy) using EBM (electron beam melting)
- bone contact area with porous EPORE® structure

custom made instrument:

drill guide made of plastic with holes for Ø2,0mm and Ø3,2mm drill

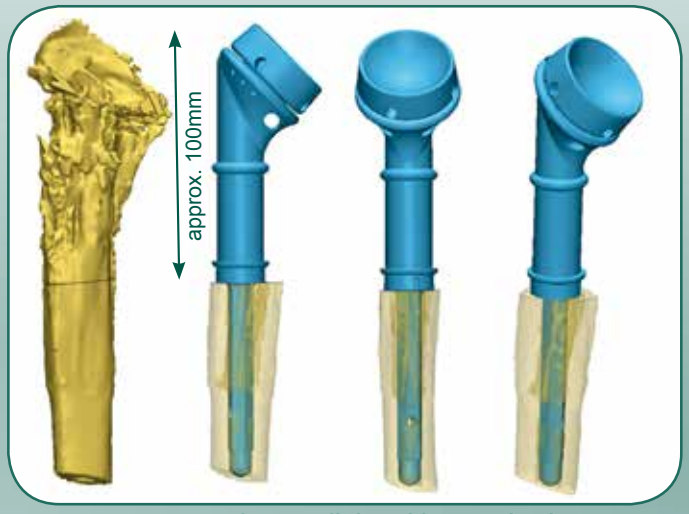


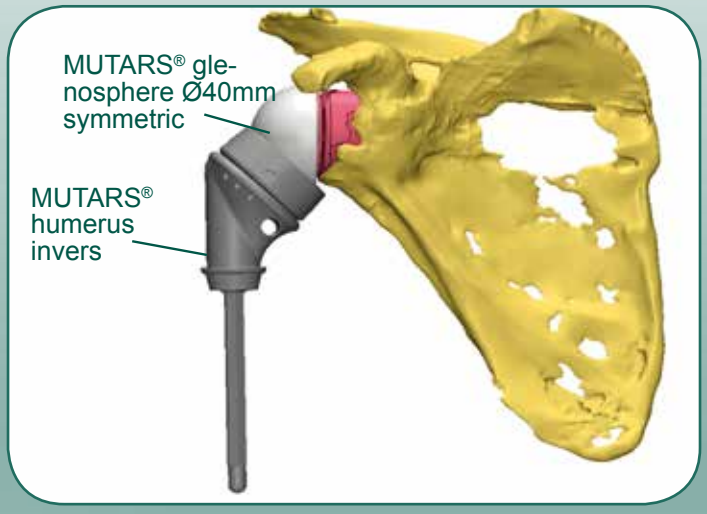
drill guide positioned on implant model

made glenoid replacement

planned implant positioning:

planned implant positioning: anterior, medial and isometric view





anterior, medial and isometric view

combination with standard product: MUTARS® proximal humerus invers

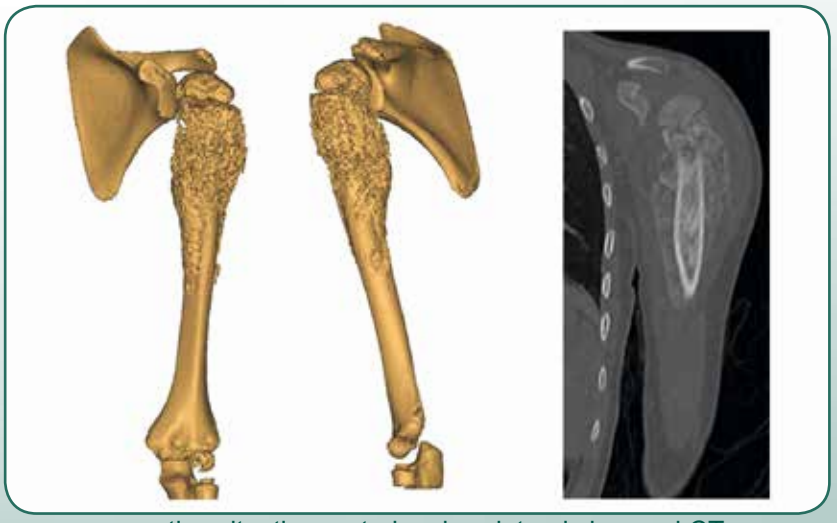
postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 15 - custom

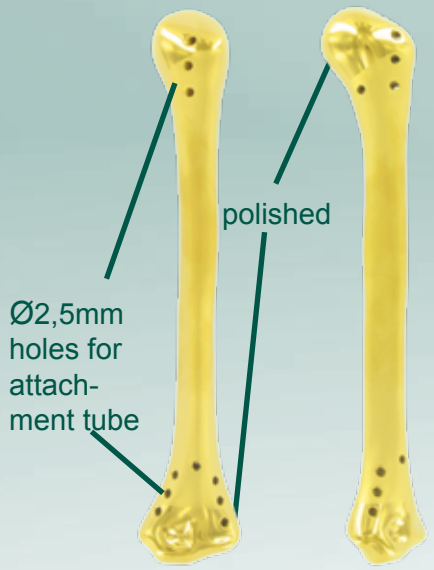
patient data: female - 5 years - Germany

clinical issue: tumour in left humerus, total resection of humerus



preoperative situation: anterior view, lateral view and CT scan

custom made solution:
- anatomic hemi humeral implant with Ø2,5mm holes for soft tissue attachment and TiN coating
- additive manufactured from $TiAl_6V_4$ (titanium alloy) using EBM (electron beam melting)



made hemi humeral replacement

planned implant positioning:

planned implant positioning: anterior, lateral and isometric view

combination with standard product: MUTARS® attachment tube

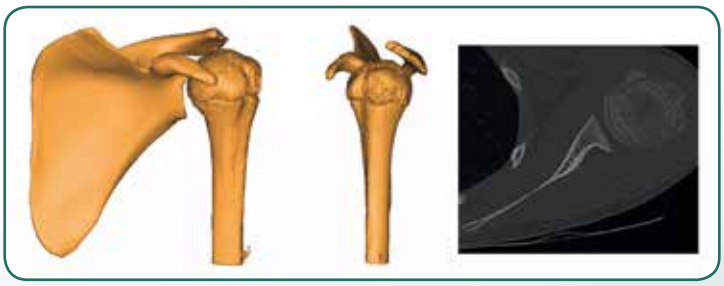
postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 16 - custom

patient data: female - 13 years - Austria

clinical issue: Ewing sarcoma of right shoulder

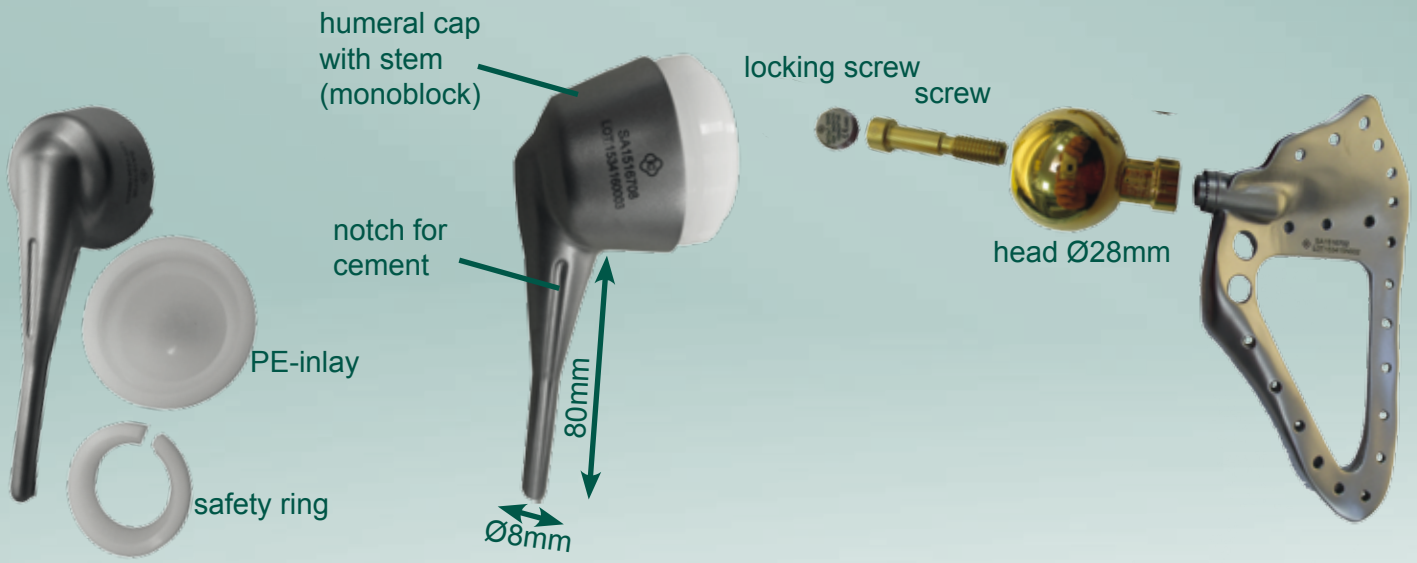


preoperative situation: left healthy shoulder; anterior view, lateral view and CT scan

left healthy scapula without humerus: anterior, lateral and isometric view

Note: left healthy side is mirrored to design implant for right side

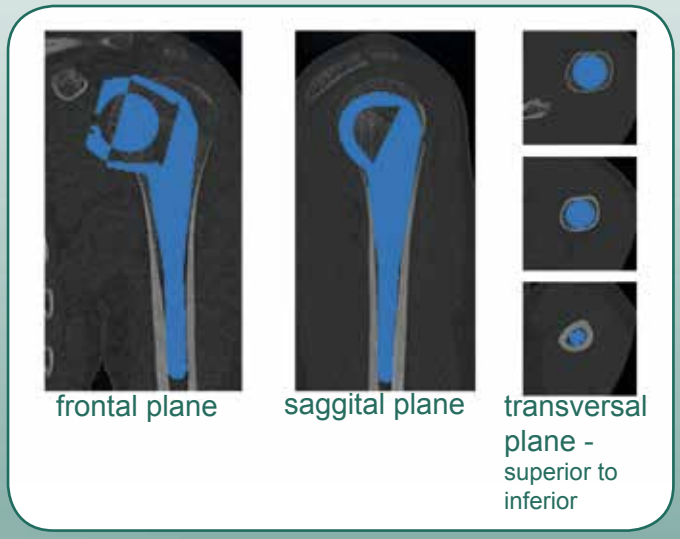
custom made solution:
- coupled anatomic scapula replacement
- TiN coated head with Ø28mm and screw and locking screw
- cemented humeral stem Ø8x80mm with cap and PE-inlay with safety ring
- manufactured from $TiAl_6V_4$ (titanium alloy) and UHMWPE



made scapula replacement

planned implant positioning:

planned implant positioning: anterior, lateral and isometric view



planned implant positioning in CT scan of left shoulder

intraoperative view:

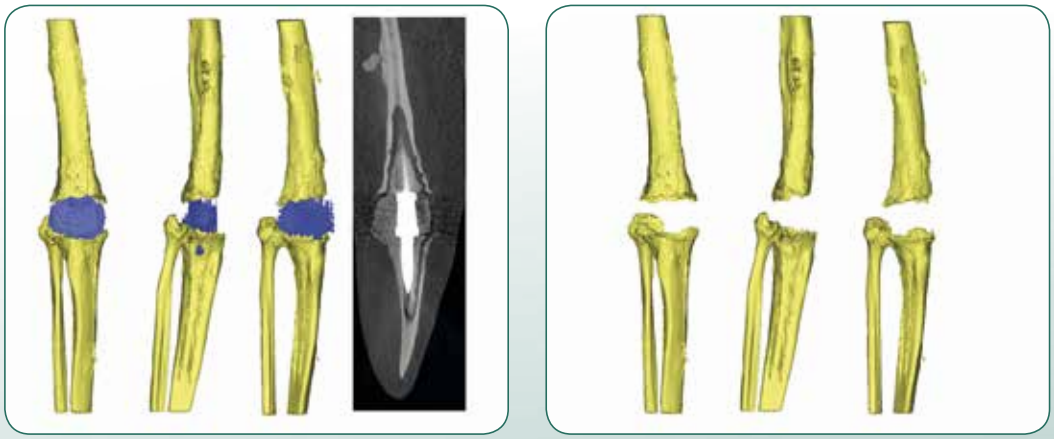
postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 17 - custom

patient data: male - 69 years - Germany

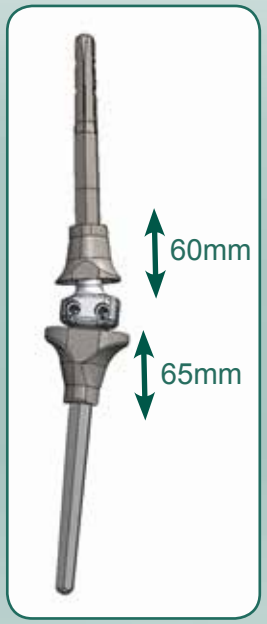
clinical issue: loosened arthrodesis implant of right knee in overweight patient



preoperative situation: anterior, lateral, isometric view and CT scan with cement spacer (left) and without cement (right)

custom made solution:

- custom-made femoral and tibial metaphyseal components for MUTARS® RS arthrodesis
- metaphyseal components are fixed with cement to arthrodesis
- additive manufactured from $TiAl_6V_4$ (titanium alloy) using EBM (electron beam melting)



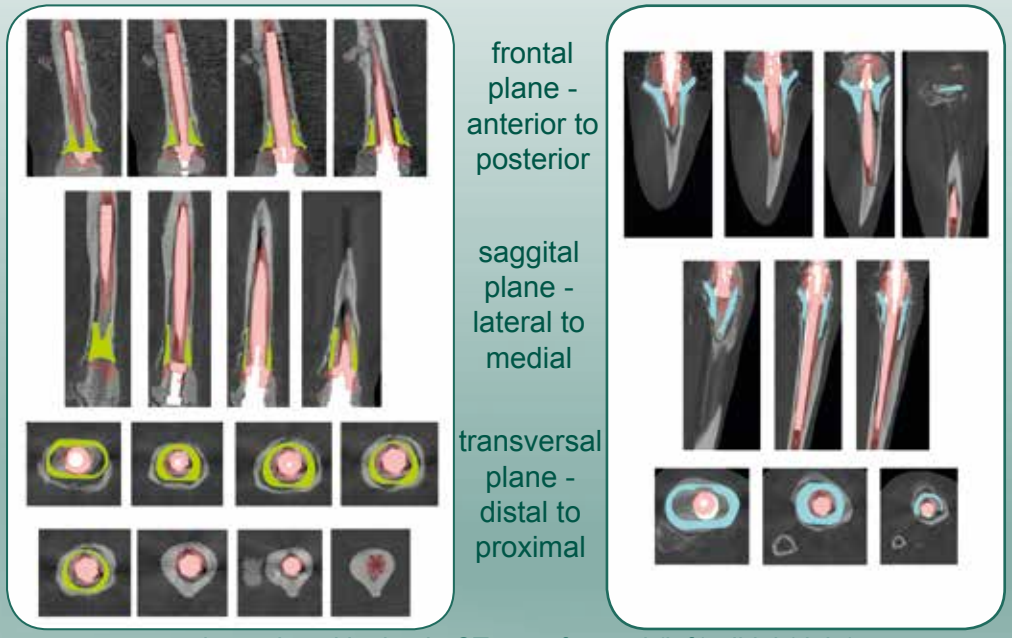
custom made instrument: femoral and tibial rasps

made metaphyseal components

planned implant positioning:

planned femoral (left) and tibial (right) implant positioning: anterior, lateral and isometric view

postoperative X-ray:



planned positioning in CT scan femoral (left), tibial (right)

intraoperative view:

combination with standard product: MUTARS® RS arthrodesis and MUTARS® RS stems cementless 20x200mm and 16x200mm

C-Fit 3D®
customized planning & production

Case 18 - custom

patient data: female - 16 years - Netherlands

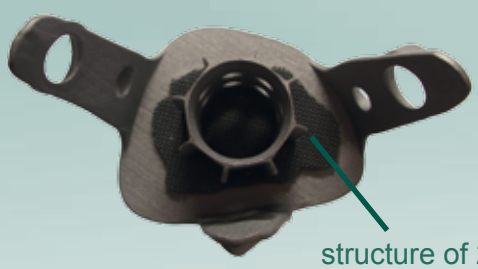
clinical issue: osteosarcoma right midshaft femur, joint sparing bone replacement needed

preoperative situation: frontal, left and back view

preoperative situation with axes and resection plane: frontal, left and back view

custom made solution:

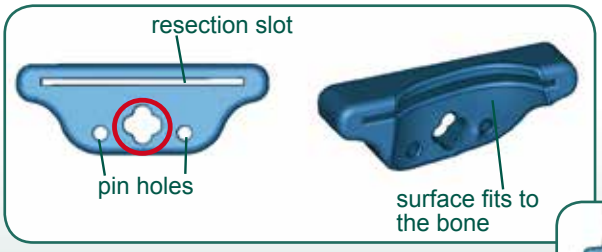
- cementless distal femoral anchorage implant with hollow stem and 3 flanges and MUTARS® connection
- anchorage stem
- femoral stem cementless Ø22mm/80mm lockable
- additive manufactured from $TiAl_6V_4$ (titanium alloy) using EBM (electron beam melting)



structure of 2mm thickness

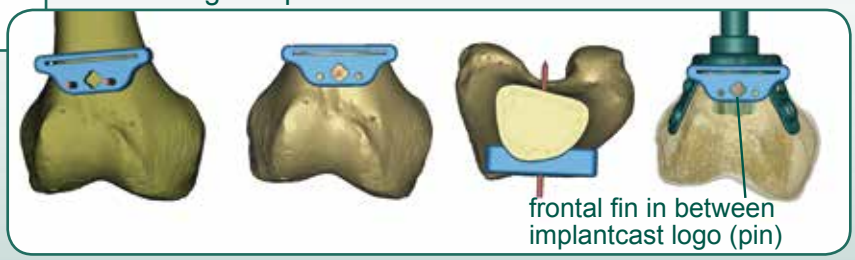
made diaphyseal implant

custom made instrument: resection guide made from titanium alloy



hole for pin postioning for land-mark setting

resection guide positioned on bone model:



planned implant positioning:

frontal view | left view | right view | back view

combination with standard product: MUTARS® arthrodesis

postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 19 - custom

patient data: male - 11 years - Italy

clinical issue: osteosarcoma in left distal femur , resection 250mm

custom made solution:

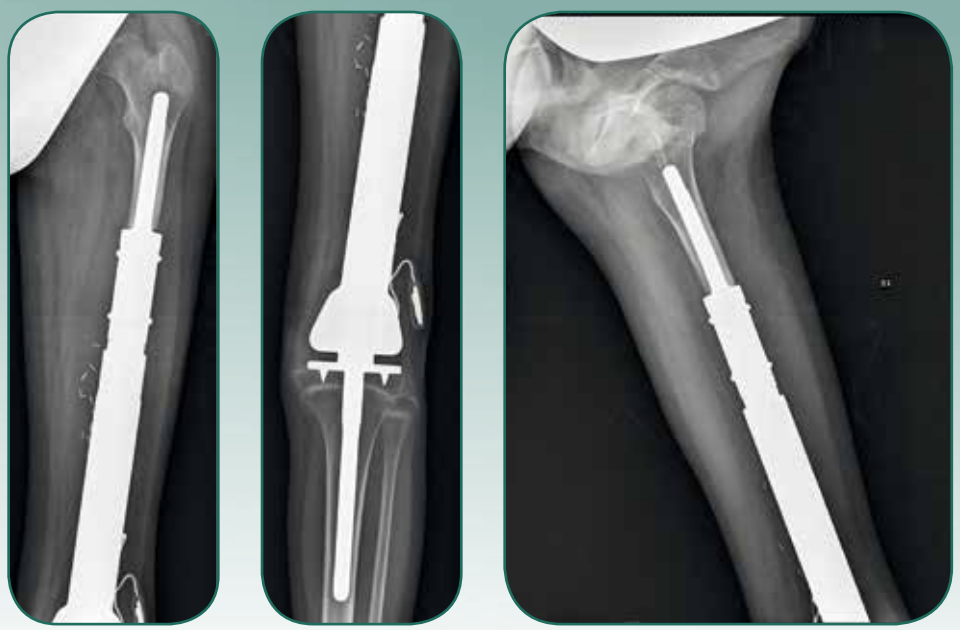
- growing prosthesis MUTARS® Xpand distal femoral replacement 210mm, non invasive lengthening 100mm
- MUTARS® Xpand femoral stem 11mm cementless
- MUTARS® Xpand extension piece 40mm
- MUTARS® Xpand distal femur 210mm left
- MUTARS® tibial joint for hinged knee
- manufactured from $TiAl_6V_4$ (titanium alloy), UHMWPE, CoCrMo and TiN coating

made distal femoral replacement

planned implant positioning:

planned implant positioning in 2D X-ray

postoperative X-ray:



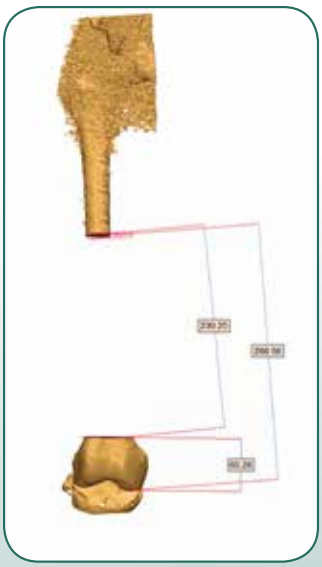
C-Fit 3D®
customized planning & production

Case 20 - custom

patient data: male - 21 years - Netherlands

clinical issue: osteosarcoma right femur, 22cm resection

preoperative situation: anterior view, lateral view and CT scan

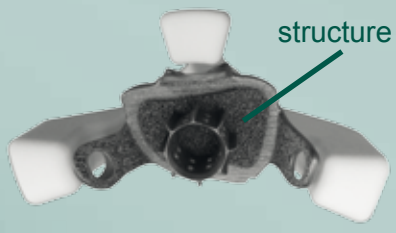


planned resection

custom made solution:

- cementless diaphyseal implant Ø25x20mm interlockable with 3 flanges and hollow stem
- bone contact area with EPORE® structure of 3mm thickness
- additive manufactured from $TiAl_6V_4$ (titanium alloy) by using EBM (electron beam melting)

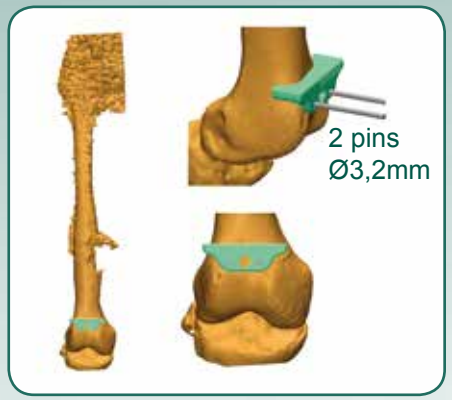
part of MUTARS® arthrodesis assembled to implant



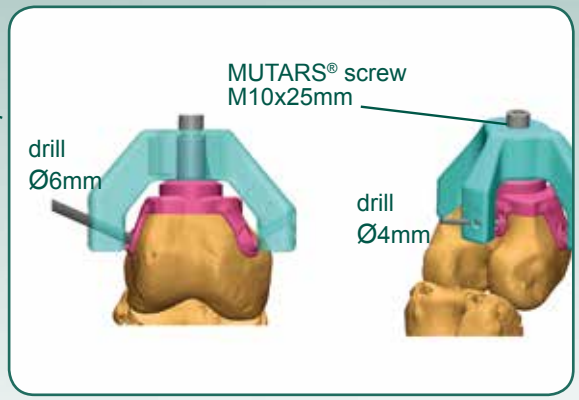
drill guide assembled to implant

custom made instrument: resection guide and drill guide made from plastic

resection guide positioned on bone model

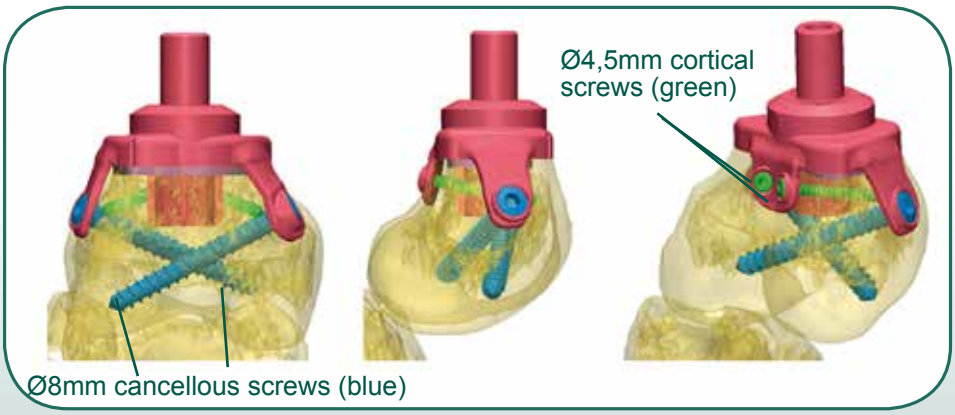


drill guide positioned on bone: anterior and isometric view



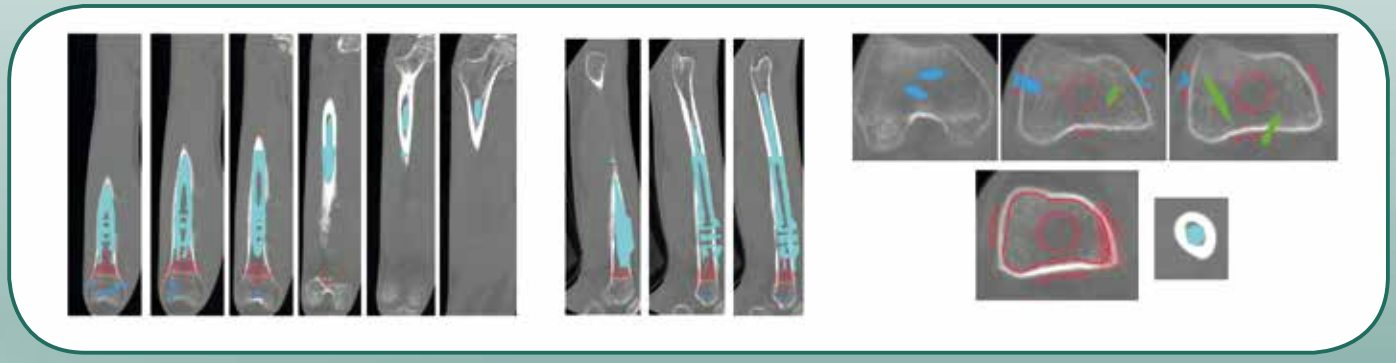
made diaphyseal implant

planned implant positioning:



anterior view lateral view isometric view

custom made implant with arthrodesis



planned implant positioning in CT scan: frontal plane (anterior to posterior), saggital plane (lateral to medial), transversal plane (distal to proximal)

combination with standard product: MUTARS® femoral stem 13mm cementless, MUTARS® extension piece 80mm, MUTARS® arthrodesis

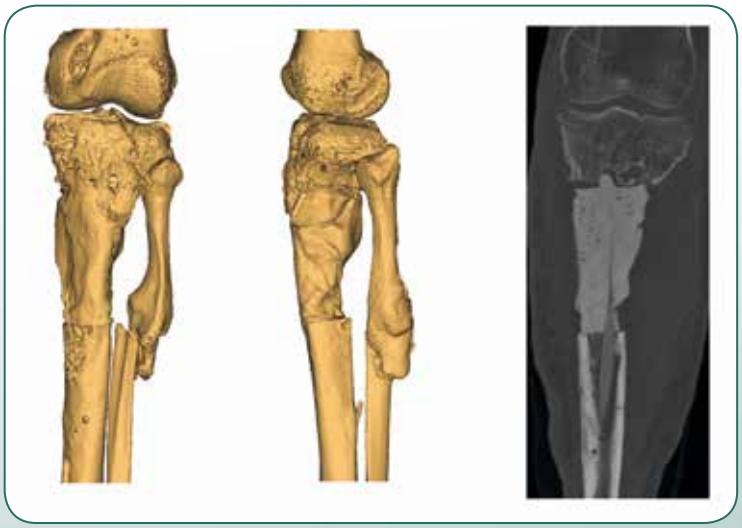
postoperative X-ray:

C-Fit 3D®
customized planning & production

Case 21 - custom

patient data: male - 45 years - Austria

clinical issue: cement spacer, fixation of left tibia with external fixator



preoperative situation: anterior view, lateral view and CT scan

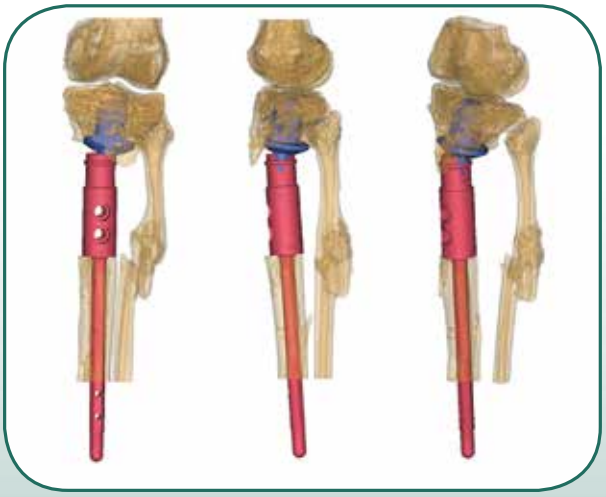
custom made solution:
- option 1: cementless Buxtehude stem tibial stem lockable 30x40mm combined with MUTARS® connection piece 100mm and diaphyseal implant 13x180mm cemented and lockable
- option 2: MUTARS® proximal tibia with connection piece 125mm and custom made tibial stem 13x170mm cemented and lockable
- manufactured from $TiAl_6V_4$ (titanium alloy)

option 1:

option 2:

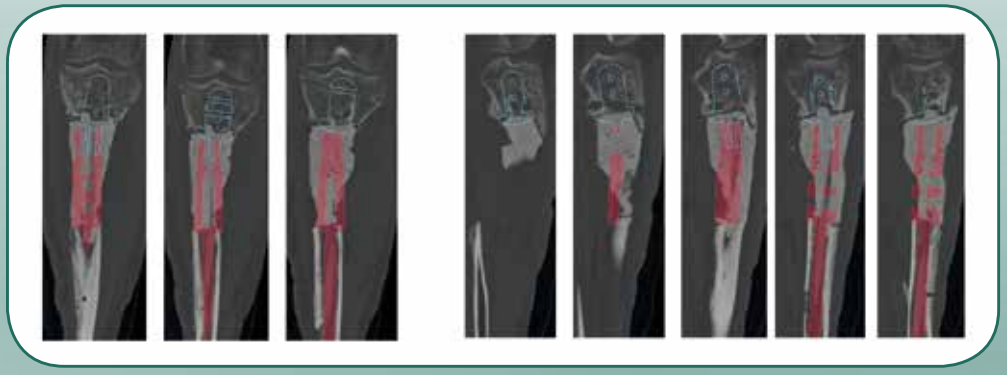
made diaphyseal implant

planned implant positioning:



option 1: anterior, lateral and isometric view

option 2: anterior, lateral and isometric view



option 1:positoning in CT scan: frontal plane (anterior to posterior) and saggital plane (lateral to medial)

option 2: positoning in CT scan: frontal plane (anterior to posterior) and saggital plane (lateral to medial)

postoperative X-ray:

combination with standard product:

option 1: MUTARS® connection piece 100mm
option 2: MUTARS® proximal tibia with connection piece 125mm

C-Fit 3D®
customized planning & production

Case 22 - custom m

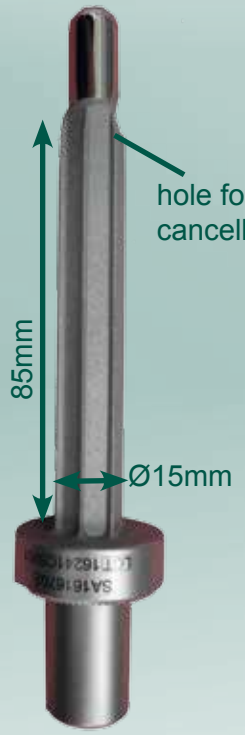
patient data: female - 26 years - Germany

clinical issue: explantation of a left knee prosthesis (first prosthesis due to osteosarcom, then revision due to tibial stem breakage, stem is broken at plateau and plateau is loose)

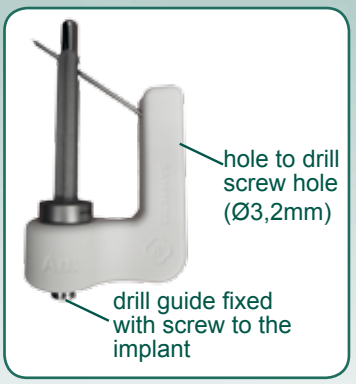
preoperative situation: anterior view, lateral view and CT scan

custom made solution:

- femoral: MUTARS® Buxtehude stem cementless Ø15x85mm lockable with fins for rotational stability
- manufactured from $TiAl_6V_4$ (titanium alloy)

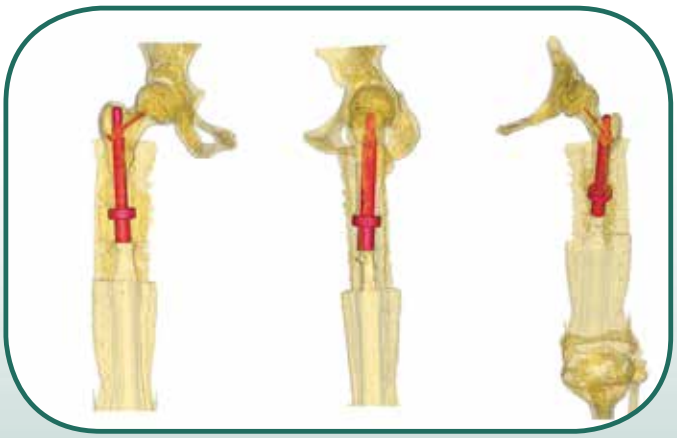


custom made instrument: drill guide made from plastic

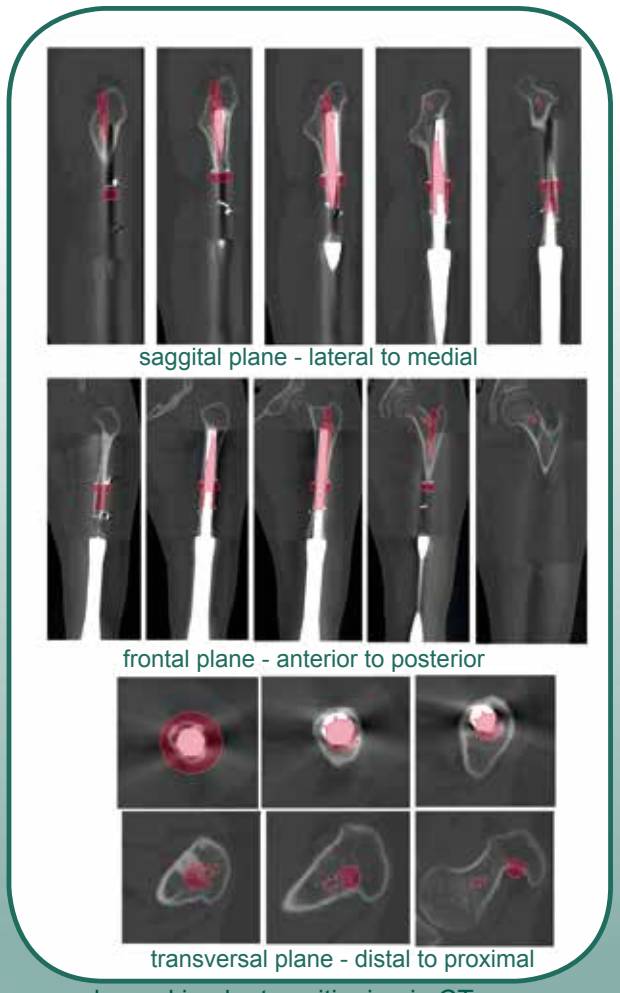


ade distal femur replacement

planned implant positioning:



posterior view lateral view isometric view



planned implant positioning in CT scan

combination with standard product:

Buxtehude stem is compatible with 6,5mm cancellous screw, MUTARS® total femur m-o-m

postoperative X-ray:

Notes

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

CE 0482

Your local Distributor:

CFITCASE-040117