Solving individual problems with individual implants in pelvic revision surgery

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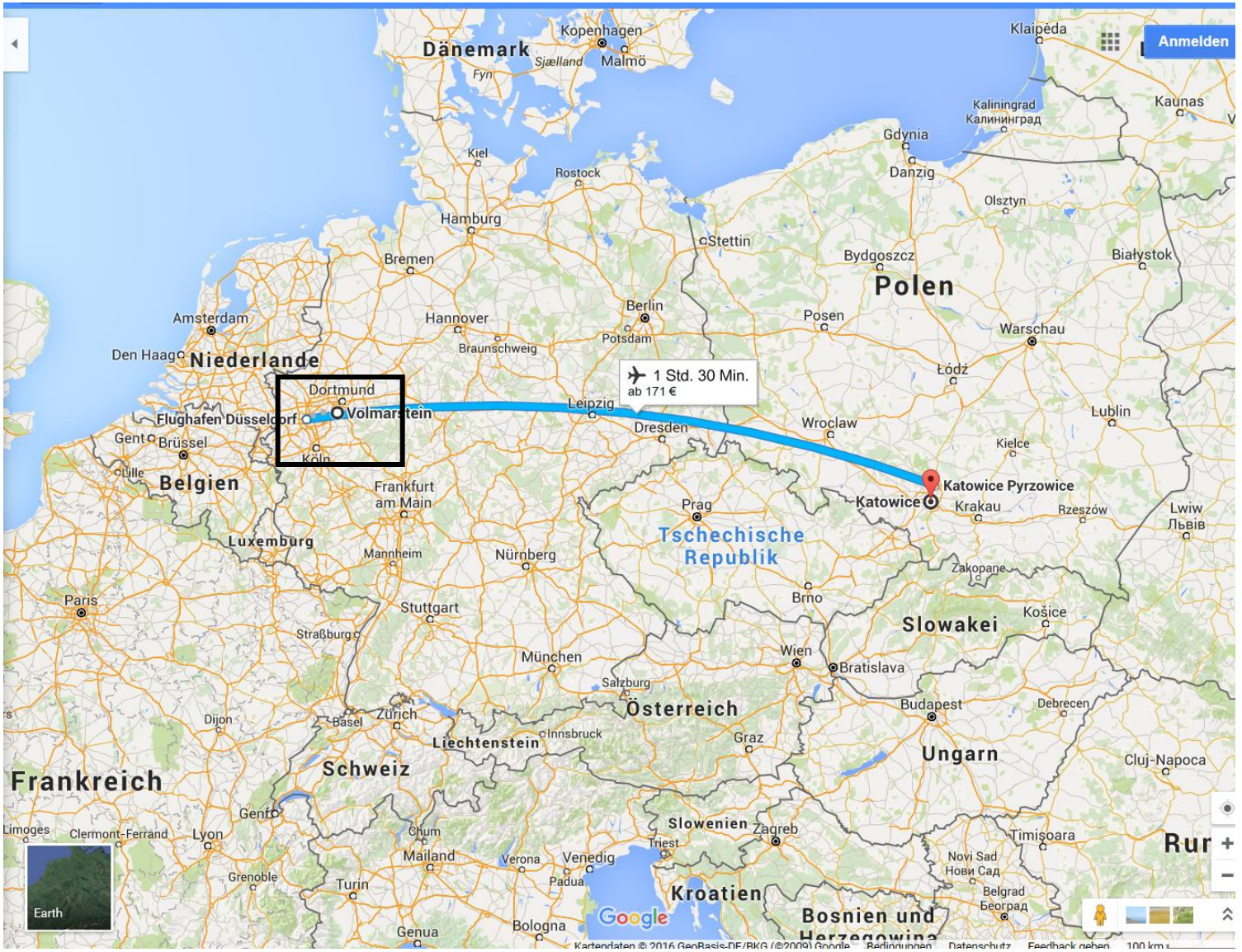
Disclosoure
Martin Wessling

- Serves as a consultant to and receives compensation from Implantcast, Germany

Volmarstein ???



Paprosky Typ IIc and IIIa/b (bad and ugly)

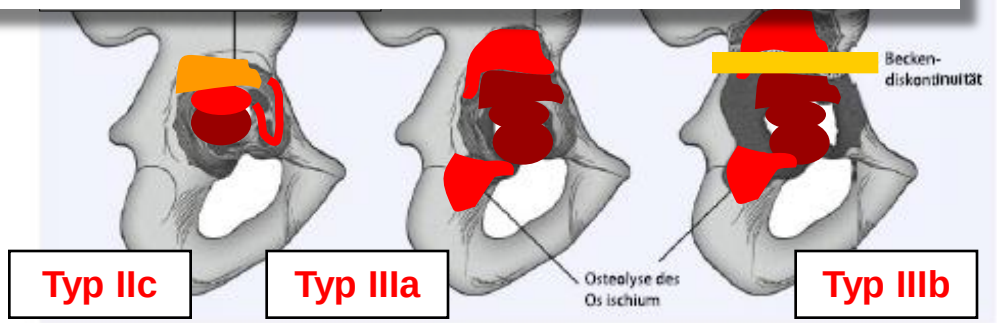
Main problem:

due to the major bone loss

Hooks or ear/connecting links

are often hard to fix !

contained defects
acetabular
column



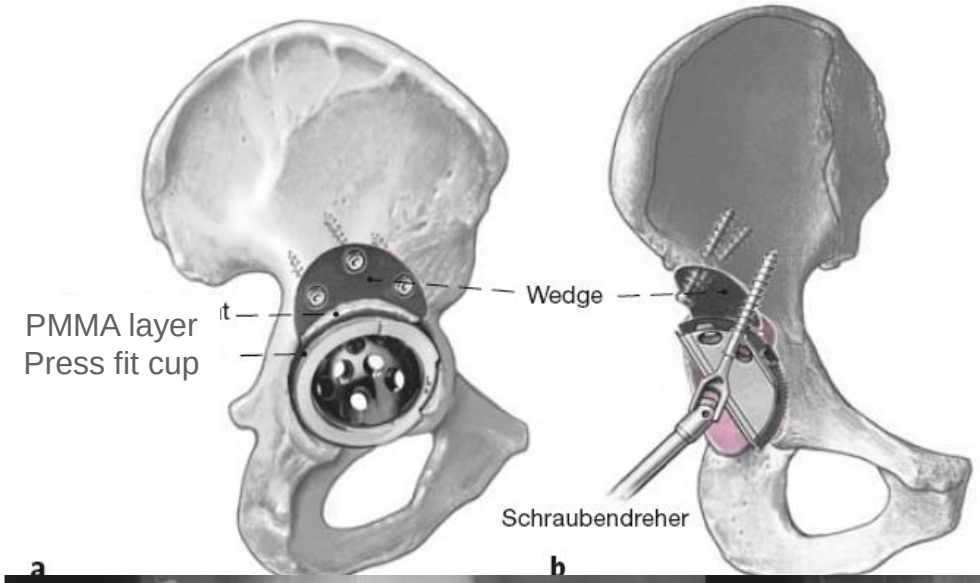
Typ IIc | Typ IIIa | Typ IIIb

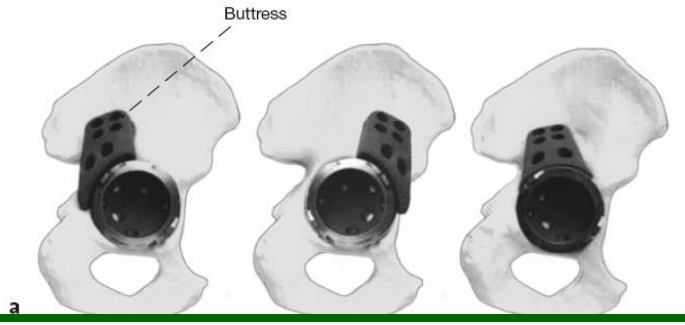
The size of the bone defect correlates strictly to the long-term follow up:

„in case of extensive bone loss due to an insecure contact to the revision cup **… alternative treatment should be concerned..**“

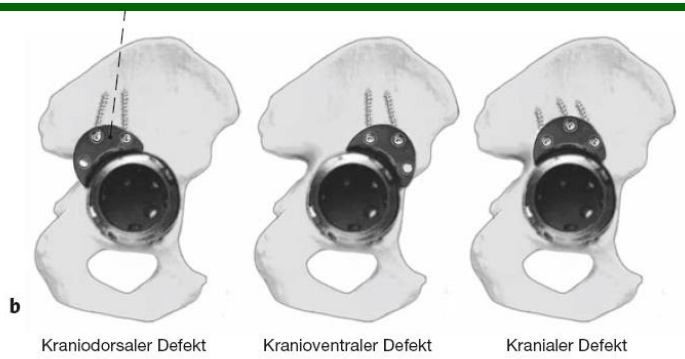
Udomkiat P, Dorr LD, Won YY, Longjohn D, Wan Z (2001) Technical factors for success with metal ring acetabular reconstruction. J Arthroplasty 16:961–969
Perka C, Ludwig R (2001) Reconstruction of segmental defects during revision procedures of the acetabulum with the Burch-Schneider anti-protrusio cage. J Arthroplasty 18:568–574

Trabecular Metal
-modular solution-





Individual solutions are available



Literatur Review

- Good results in revision THA
- Bad results in primary THA
- Implant 5-yr-survival 97%, Mayo-Hip Score 61,7/80
- Implant 10-yr-survival 92%, WOMAC Hip Score 79/100

OPEN ACCESS

Acta Orthopaedica 2018; 89 (x): x–x

Trabecular metal acetabular components in primary total hip arthroplasty

Higher risk for revision compared with other uncemented cup designs in a collaborative register study including 93,709 hips

Inari LAAKSONEN [1,2], Michelle LORIMER [3], Kirill GROMOV [4], Antti ESKELINEN [5], Ola ROLFSON [6], Stephen E GRAVES [3], Henrik MALCHAU [1,2,6], and Maziar MOHADDES [6]

[1] Harris Orthopedic Laboratory, Massachusetts General Hospital, Boston, USA; [2] Harvard Medical School, Boston, USA; [3] Australian Orthopaedic Association National Joint Replacement Registry, Adelaide, Australia; [4] Department of Orthopaedic Surgery, Copenhagen University Hospital Hvidovre, Copenhagen, Denmark; Danish Hip Arthroplasty Register, Aarhus, Denmark; [5] Coxa Hospital for Joint Replacement, Tampere, Finland; Finnish Arthroplasty Register, Helsinki, Finland; [6] Swedish Hip Arthroplasty Register, Department of Orthopaedics, Institute of Surgical Sciences, Sahlgrenska University Hospital, Gothenburg, Sweden
Correspondence: hmalchau@partners.org
Submitted 2017-04-06. Accepted 2017-11-25.

Minimum Five-Year Outcomes with Porous Tantalum Acetabular Cup and Augment Construct in Complex Revision Total Hip Arthroplasty

Derek R. Jenkins, MD, Andrew N. Odland, MD, Rafael J. Sierra, MD, Arlen D. Hanssen, MD, and David G. Lewallen, MD

Investigation performed at the Department of Orthopedic Surgery, Mayo Clinic, Rochester, Minnesota

The Journal of Arthroplasty 33 (2018) 823–828

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Revision Arthroplasty

Acetabular Revision Using Trabecular Metal Augments for Paprosky Type 3 Defects

Cathleen J. O'Neill, IMRCS, MSC, MCH [a], Stephen B. Creedon, MB BAO, MCh [a], Stephen A. Brennan, MSc, MCh, FRCS [b,*], Fiona J. O'Mahony, BMBS, BA [a], Rosanne S. Lynham, MB BCh BAO [a], Shane Guerin, MENG, MCh, FRCS [a], Rehan Gul, FRCS [a], James A. Harty, MSc, FRCS [a]

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Clin Orthop Relat Res (2015) 473:521–527
DOI 10.1007/s11999-014-3861-x

Clinical Orthopaedics and Related Research®
A Publication of The Association of Bone and Joint Surgeons®

SYMPOSIUM: 2014 HIP SOCIETY PROCEEDINGS

Continued Good Results With Modular Trabecular Metal Augments for Acetabular Defects in Hip Arthroplasty at 7 to 11 Years

Michael R. Whitehouse PhD, MSc(Orth Eng), FRCS(Tr&Orth), Bassam A. Masri MD, FRCS(C), Clive P. Duncan MD, MSc, Donald S. Garbuz MD, MHSc

Published online: 15 August 2014

Custom-made individual acetabular

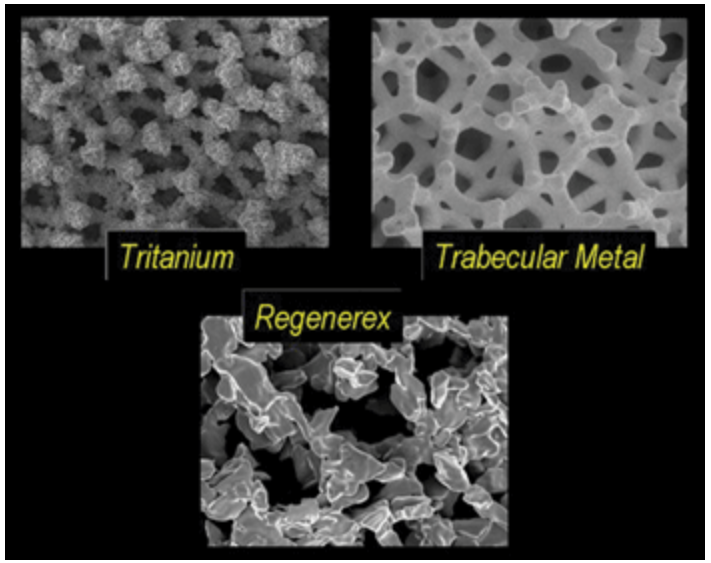
Table I. Results following surgical treatment of pelvic discontinuity (NR, not reported)

Author/s	No of hips with discontinuity	Type of reconstruction	Mean follow-up (yrs) (range)	Revision rate	Clinical score*	Comments
Berry et al[4]	27	Anti-protrusio cage, anterior-posterior plating	3 (0.2 to 7)	9/27 (33%)	16/27 (60%) satisfactory result (based on own criteria)	9 failures: 4 aseptic acetabular loosening, 4 recurrent dislocations. 1 deep infection (1.3 yrs)
Goodman et al[7]	10	Anti-protrusio cage	3.3	5/10 (50%)	NR	Complications: 3 rings loosened, 2 ring flange fractures, 3 dislocations, 1 deep infection requiring resection replacement
Sporer et al[8]	16	Cage, plate, allograft	5 (2 to 8)	5/16 (31%)	MP: 3.7 to 6.8	44% overall loosening rate Complications: 4 sciatic nerve palsies, 1 dislocation, 1 deep infection
Eggli et al[6]	7	Ganz ring, anterior-posterior plating	8 (4.5 to 11)	NR	MP: 7.5 to 13.2. HHS: 33 to 73	1 ischial nerve palsy, 1 recurrent dislocation, 1 loose cup requiring revision, 1 intra-op femoral shaft fracture
Stiehl et al[11]	10	Bulk structural allograft, anterior-posterior plating	6.9	6/10 (60%)	NR	Cementless cups that rested on a bulk allograft had high failure rates. Used extensile triradiate approach with high dislocation rate
Taunton et al[10]	57	Custom Triflange	6.3 (2 to 18)	20/57 (30%)	HSS 74.8 post-op	3 triflange failures (5.3%): 1 aseptic loosening, 2 deep infection resections. 81% had a stable triflange component with a healed pelvic discontinuity, 98% free of revision for aseptic loosening at latest follow-up
DeBoer et al[5]	20	Custom Triflange	10 (7.4 to 13)	No components revised	HHS 41 to 80	6/20 hips dislocated (30%), 6 hips underwent reoperation: 5 for dislocation, 1 for partial sciatic nerve palsy due to loose screws
Kosashvili et al[12]	26	Trabecular Metal™ cup/cage	3.7 (2 to 5.6)	NR	HHS 46.6 to 76.6	2 dislocations, 1 deep infection, 1 peroneal nerve palsy
Sporer et al[9]	20	Trabecular Metal™ cup, augments, distraction	4.5 (2 to 7)	1/20 (5%)	MP: 3.3 to 9.6	1 revision for aseptic loosening at 9 months, 4 patients had radiographic loosening with no pain, complications: 1 colonic perforation, 1 vascular injury (femoral artery), 1 greater troch fracture 1 superficial infection
Sporer and Paprosky[8]	13	Trabecular Metal™ cup/augments, distraction	2.6 (1 to 3)	No components revised	MP: 6.1 to 10.3	1 patient demonstrated acetabular loosening due to screw breakage

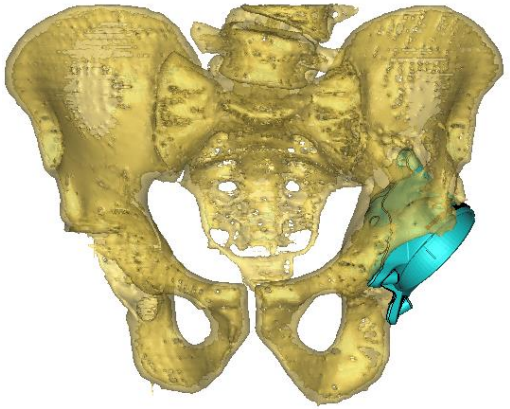
* HHS, Harris hip score, MP, Merle d'Aubigne-Postel score

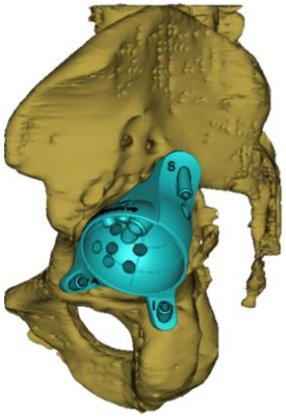
Trabecular Metal in Typ III Defects
-our experience-

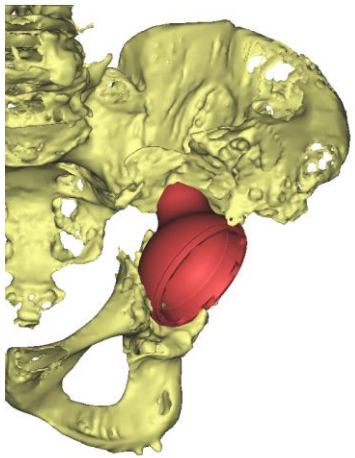
- TM shell +/- Augment: n=63 (since 2015)
- Function: ??
- Revision: N=2 (loosening n=1, infection n =1)
- Individual Implant after Revision surgery

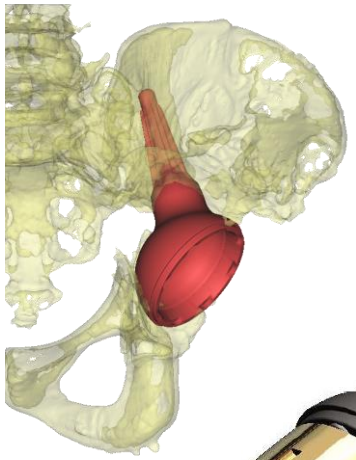


Custom made Implant?









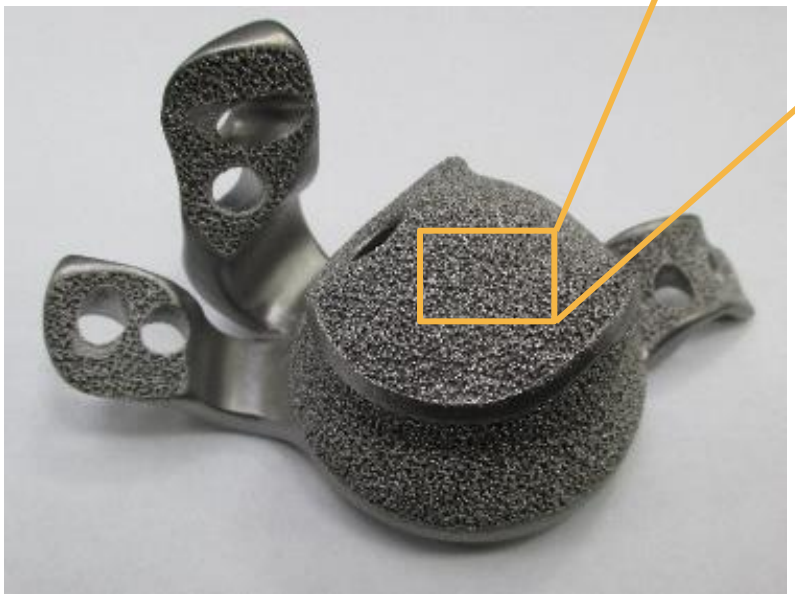
So better use solid individual impla

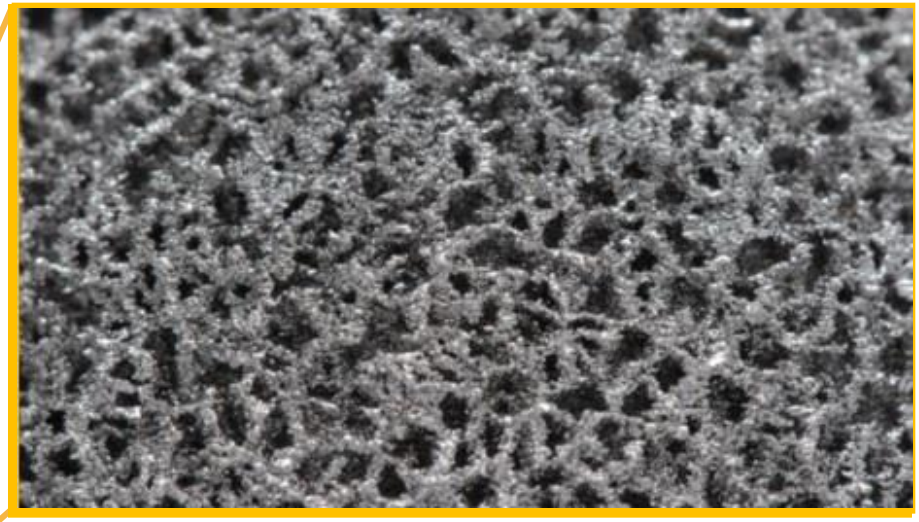
?

More easy to implant ?

EPORE® porous osseointegrative structure

- stochastic open-cellular structure
- application at bone-implant-interface
- part of implant geometry, not a surface coating



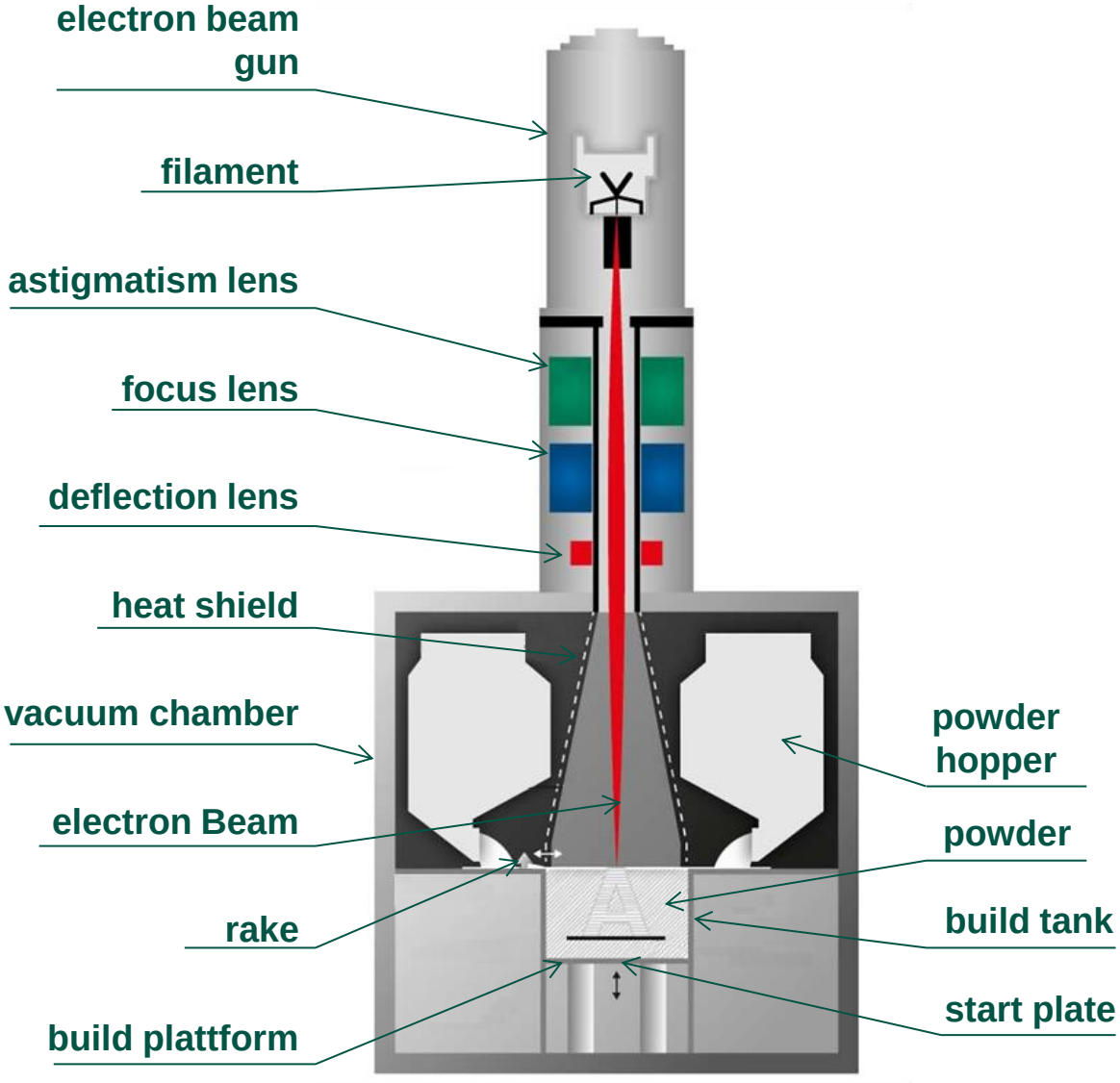


properties in comparison

	cancellous bone	EPORE®
porosity	30-90%	60%
trabecula	0,1-0,2 mm	0,33-0,39 mm
spec. Young's modulus	0,5-5 GPa	3 GPa*

*tensile measurement

Electron Beam Melting (EBM)



Fabrication process:

selective melting of powdered material

fabrication in layers of 50 µm

Source material & binding mechanism:

metal alloy TiAl6V4

kinetic energy transfer through electrons

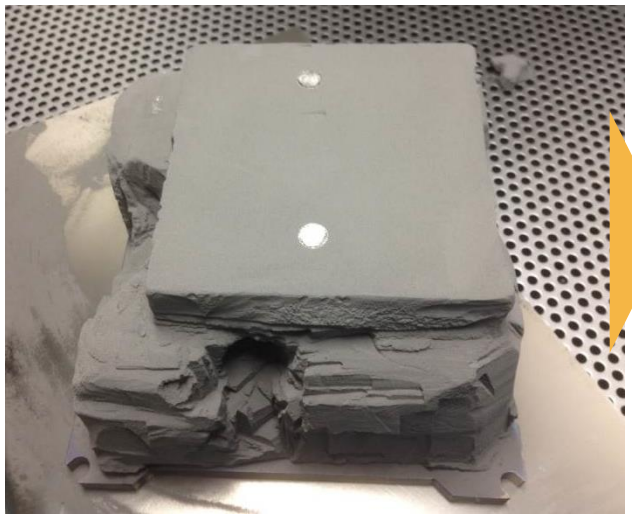
Properties:

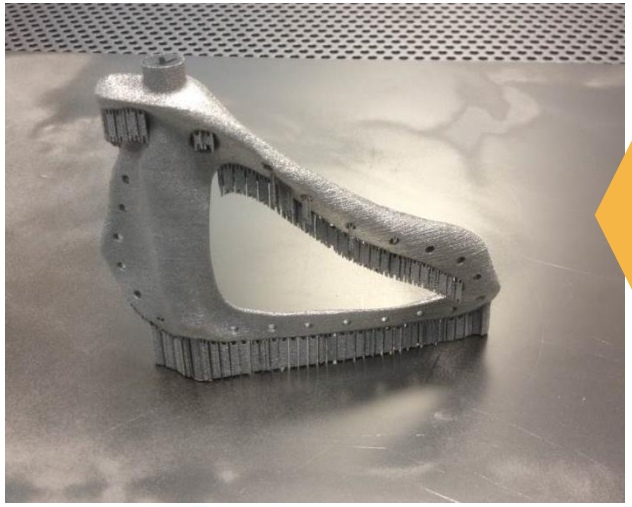
digital process chain

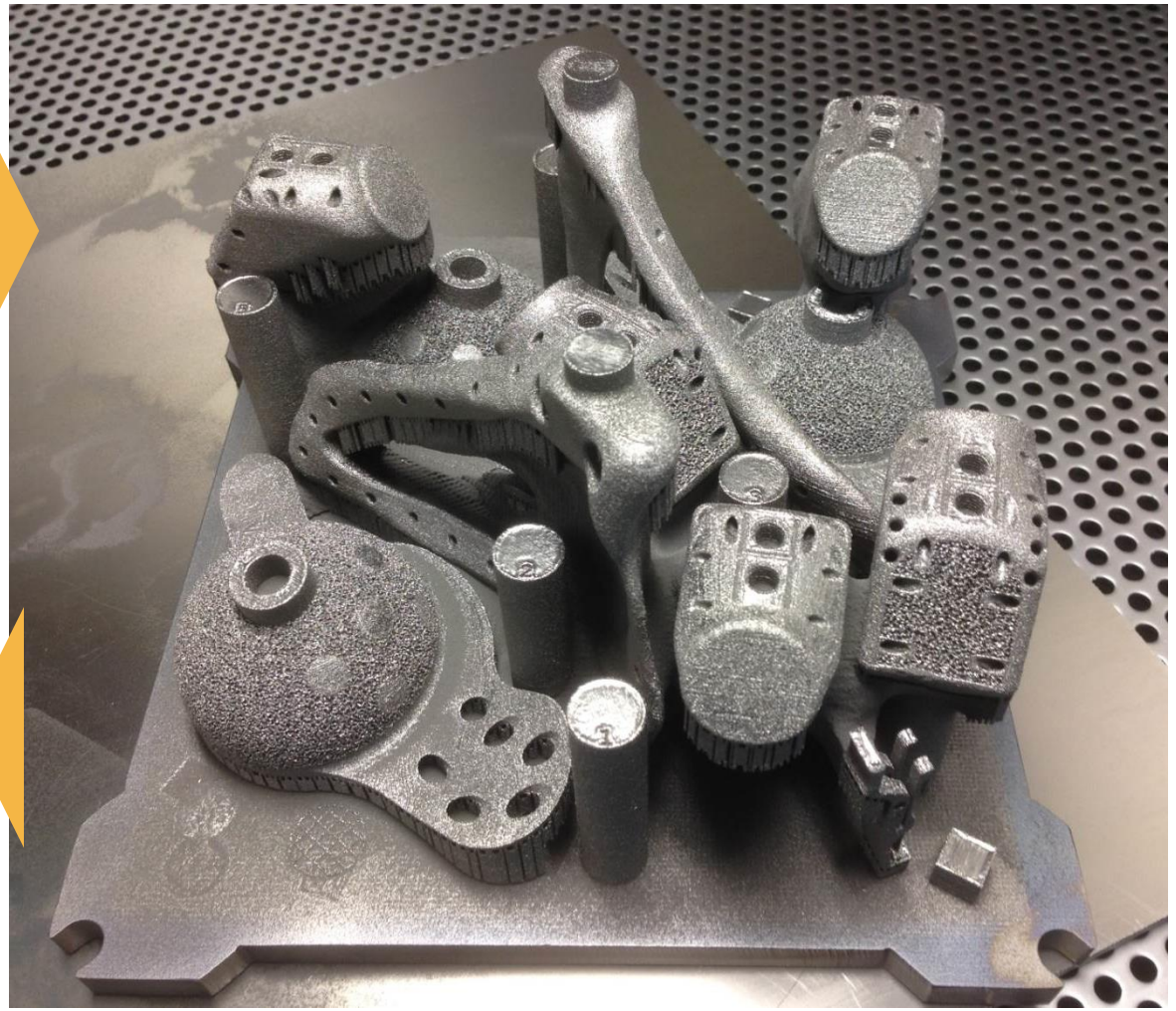
economic manufacturing of lot size 1 and highly complex parts

Source: www.arcam.com

Post processing of additive manufactured implants



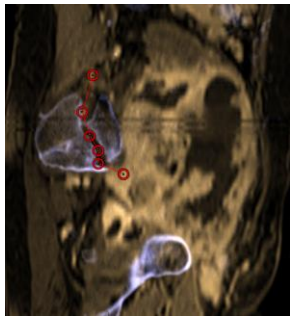


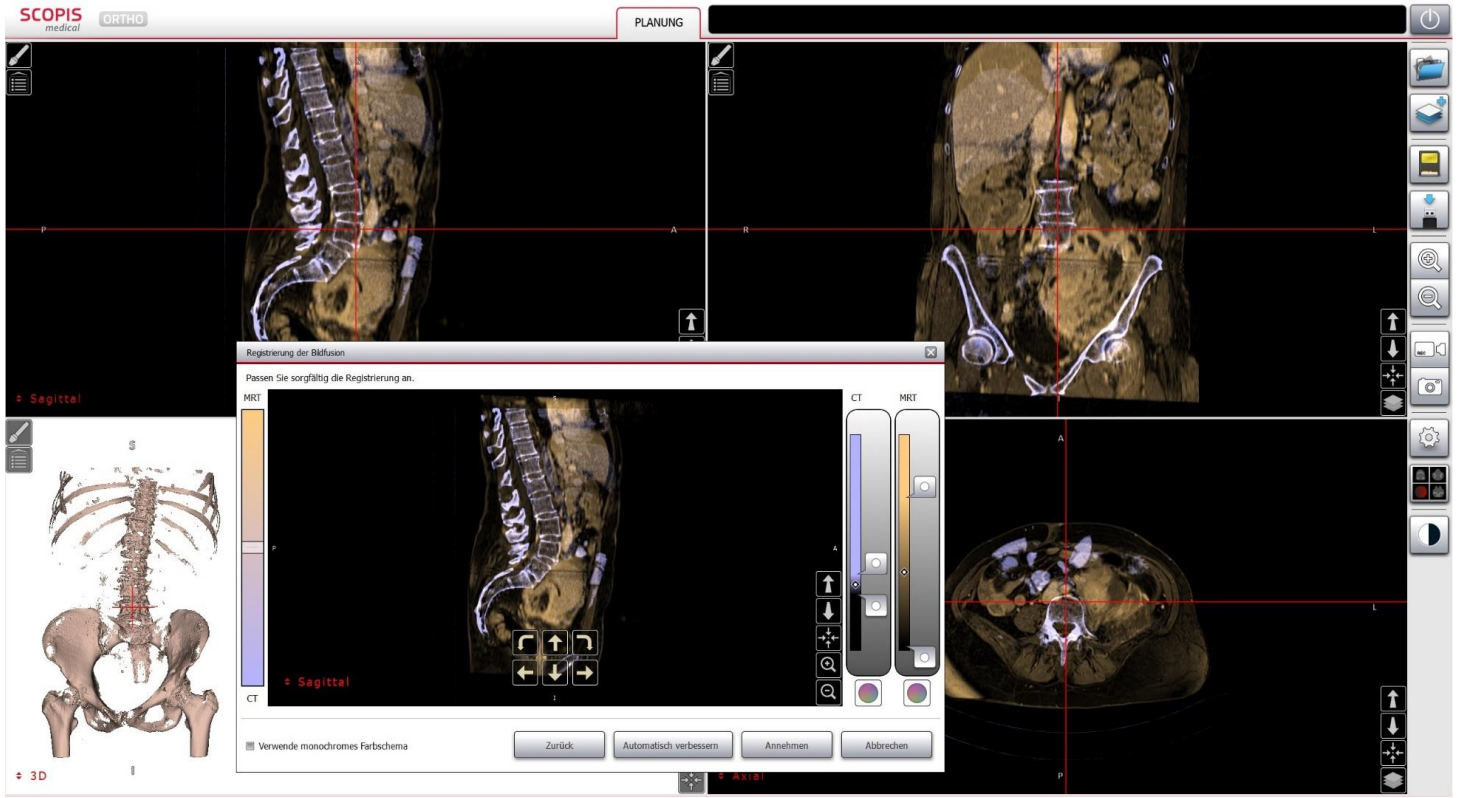


C-Fit 3D – Planning Software

Functions:

- Automatic CT-MRI fusion
- Bone segmentation / definition of resection level
- Automatic artefact reduction

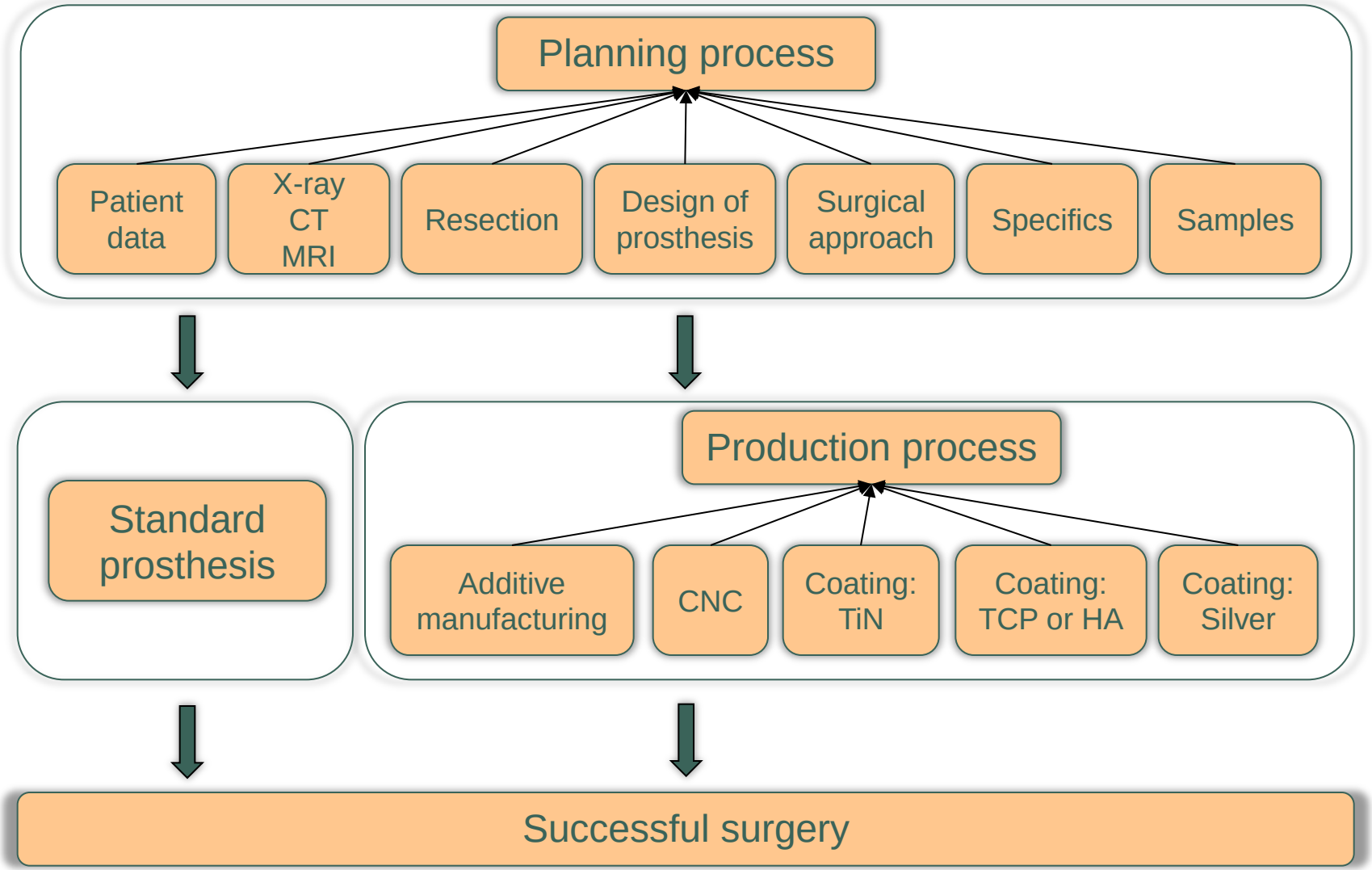




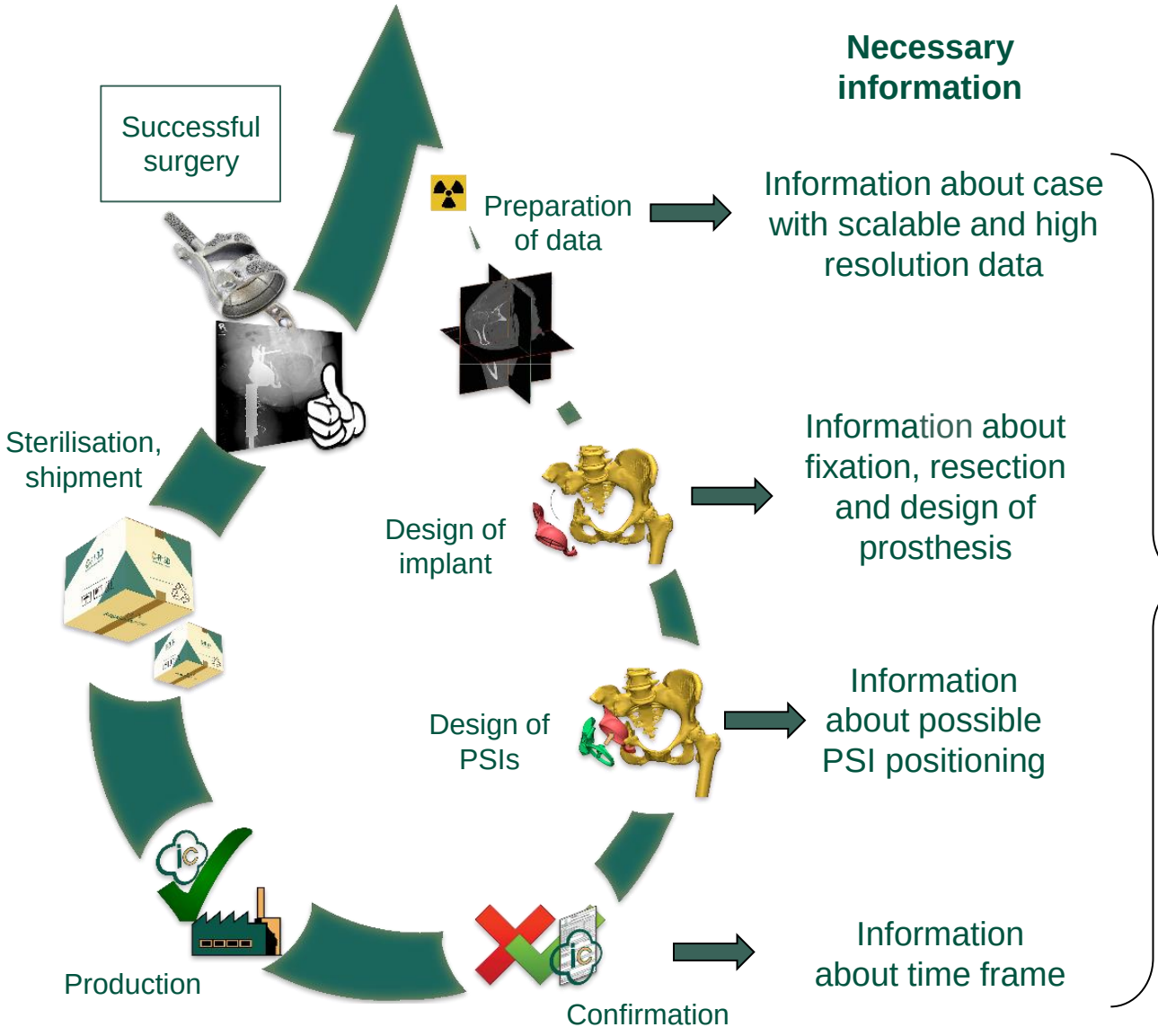
C-Fit 3D®
customized planning & production

VOLMARSTEIN
die evangelische Stiftung

Workflow



Process chain

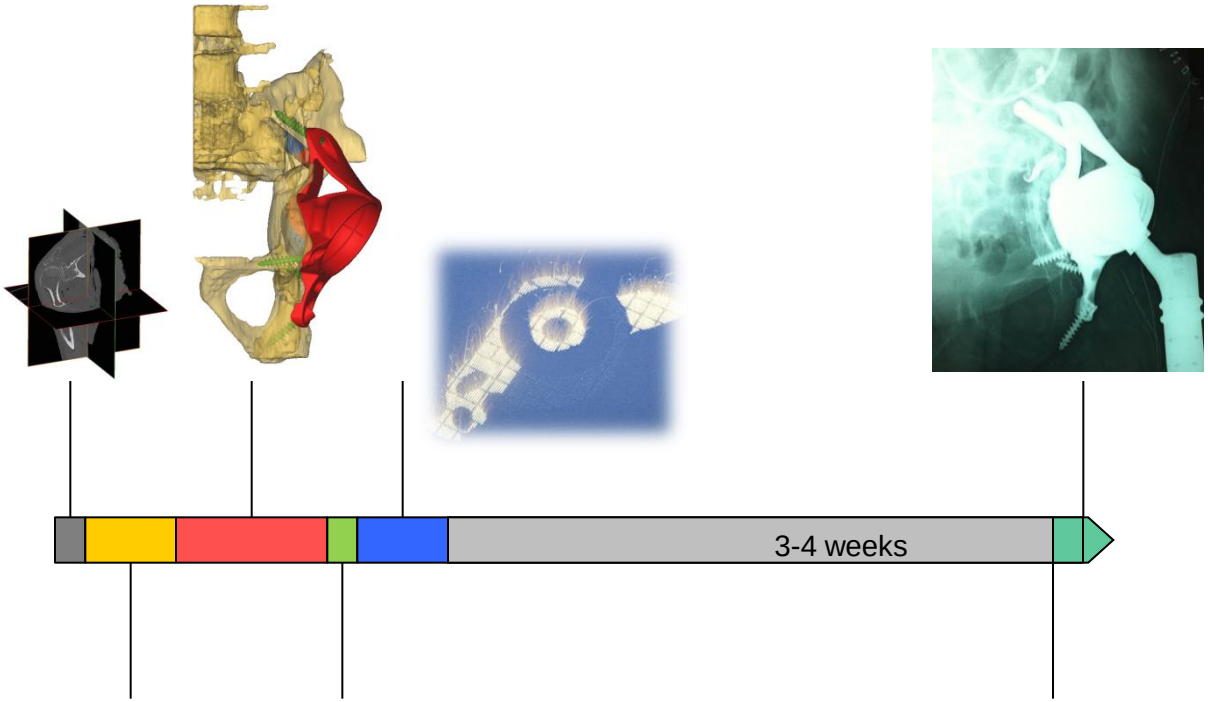


Necessary information

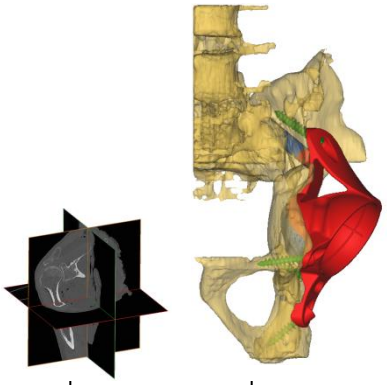
- Information about case with scalable and high resolution data
- Information about fixation, resection and design of prosthesis
- Information about possible PSI positioning
- Information about time frame

Information that influence the success of the surgery

Exemplary process

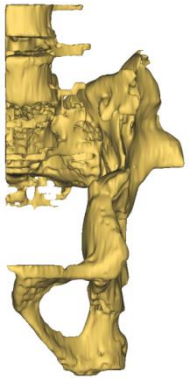


Exemplary process



3-4 weeks + 1 week

TiN coating



Design report

Case: SA14222
Patient: Kacprzak, Martyna
Surgeon: Dr. Daniel Kotrych
Hospital: Stettin

Classification:
Osteosarcoma of pelvis

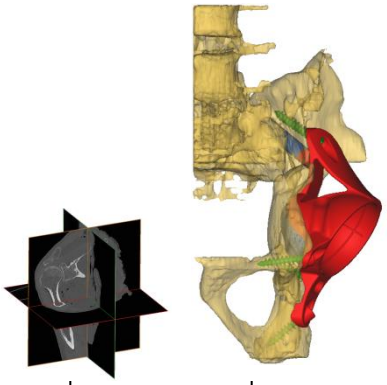
Aim:
- Reconstruction of the preoperative situation
- Sketch of possible design of individual replacement
- Annotations

Provided by:
L. S. Schenk, M.Sc.
27.10.14

Reviewed by:
P. Scheinemann, Dipl.Ing.

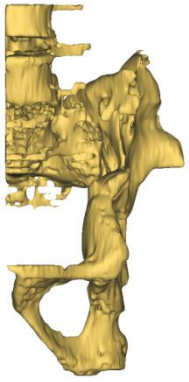
implantcast

Exemplary process



3-4 weeks + 2 weeks

Silver coating



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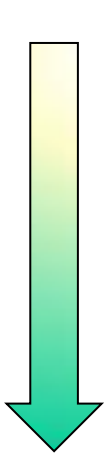
implantcast

Hip revision

Possibilities for hip revision:

- MUTARS® RS cup
- MUTARS® RS cup + acetabulum spacer
- Custom made EcoFit® cup with flange
- Custom made MUTARS® hip replacement with flange(s)
- MUTARS® LUMiC® cup (?)
- Custom made MUTARS® hip replacement (fixed at Os Ilium + Sacrum)

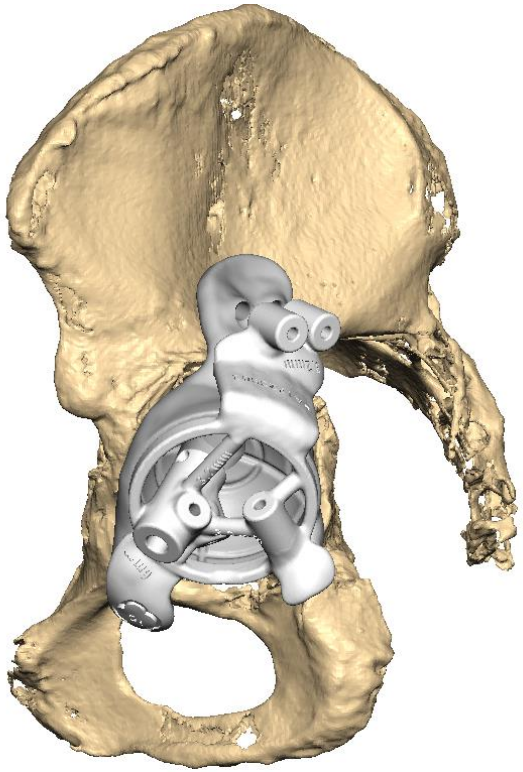


Acetabular defect

Engineering

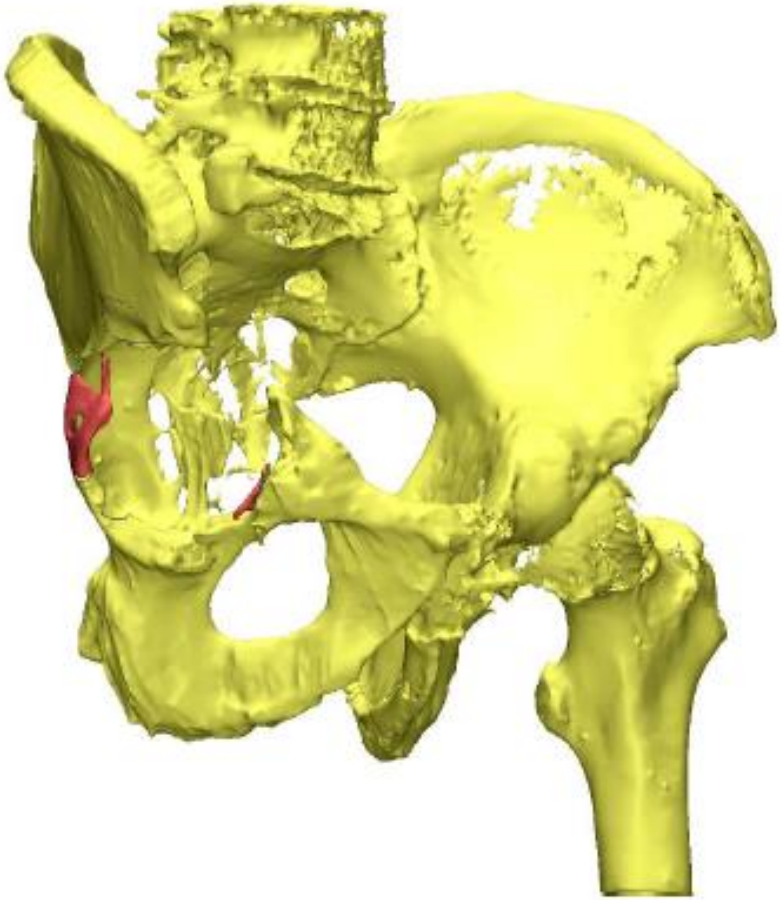
Technical possibilities – PSIs:

Drill guides

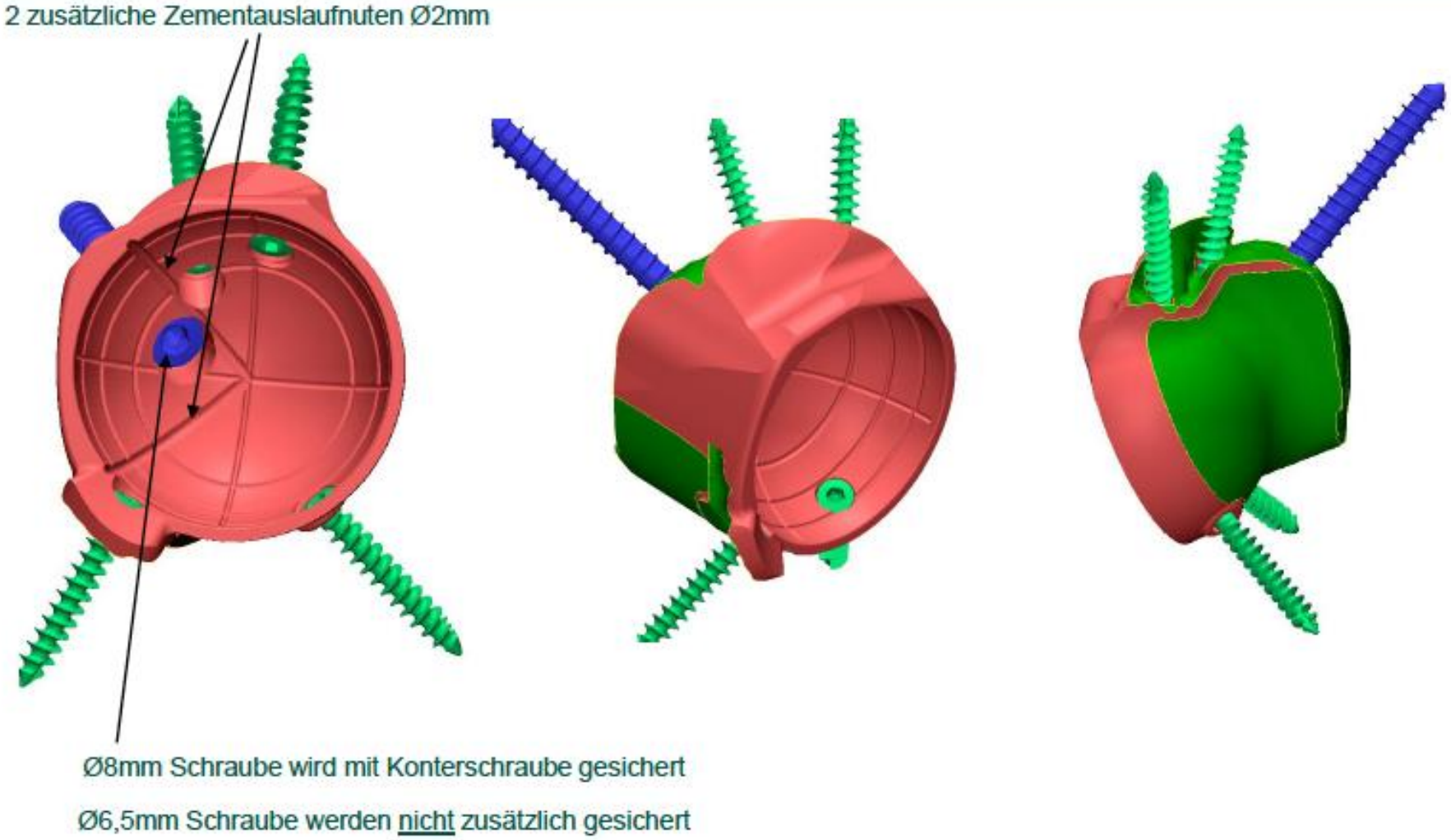


Remember soft tissue

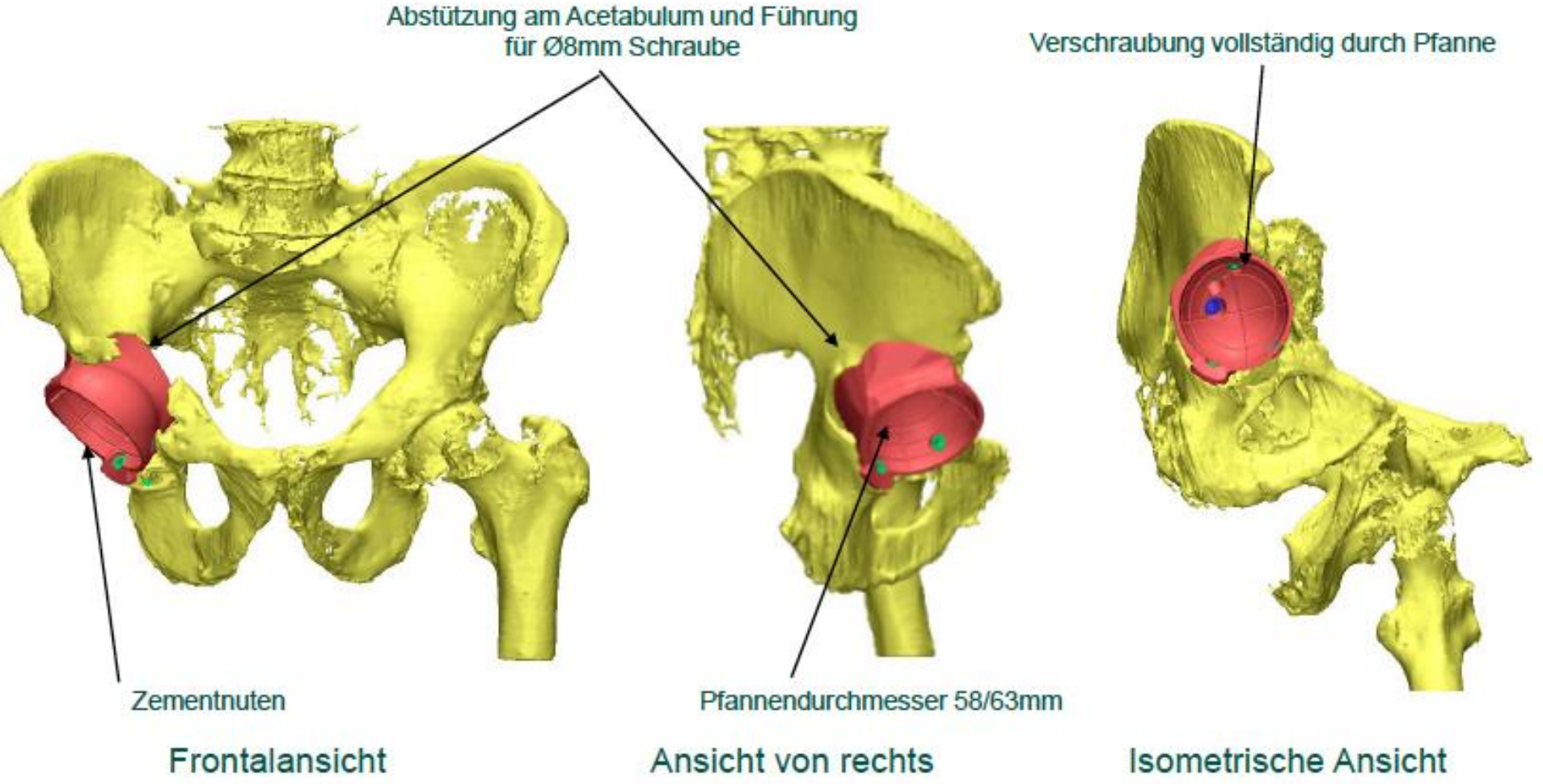
Remove trash !



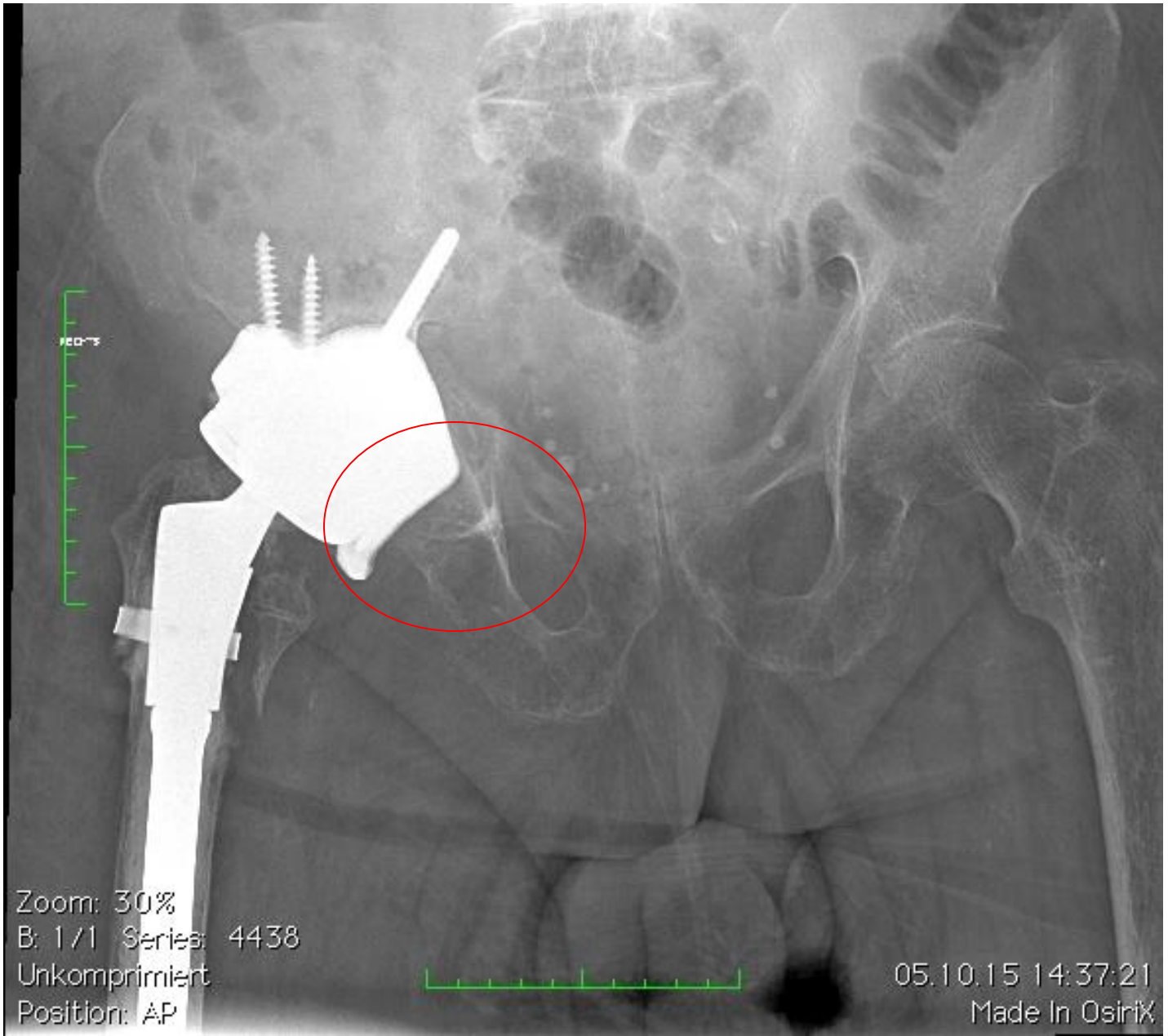
Design the implant – remember the biomechanics



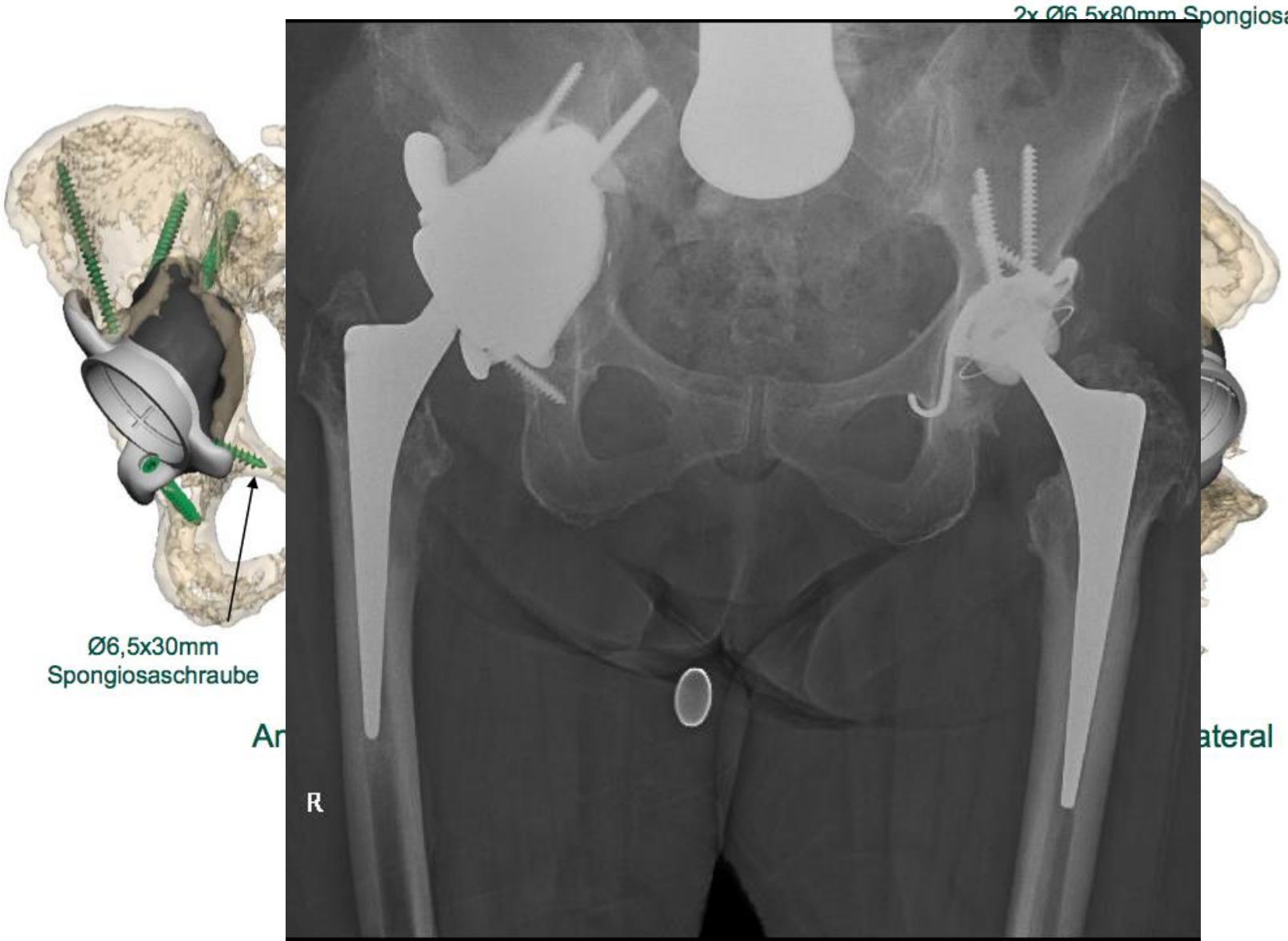
Discuss the final design with friends ;)



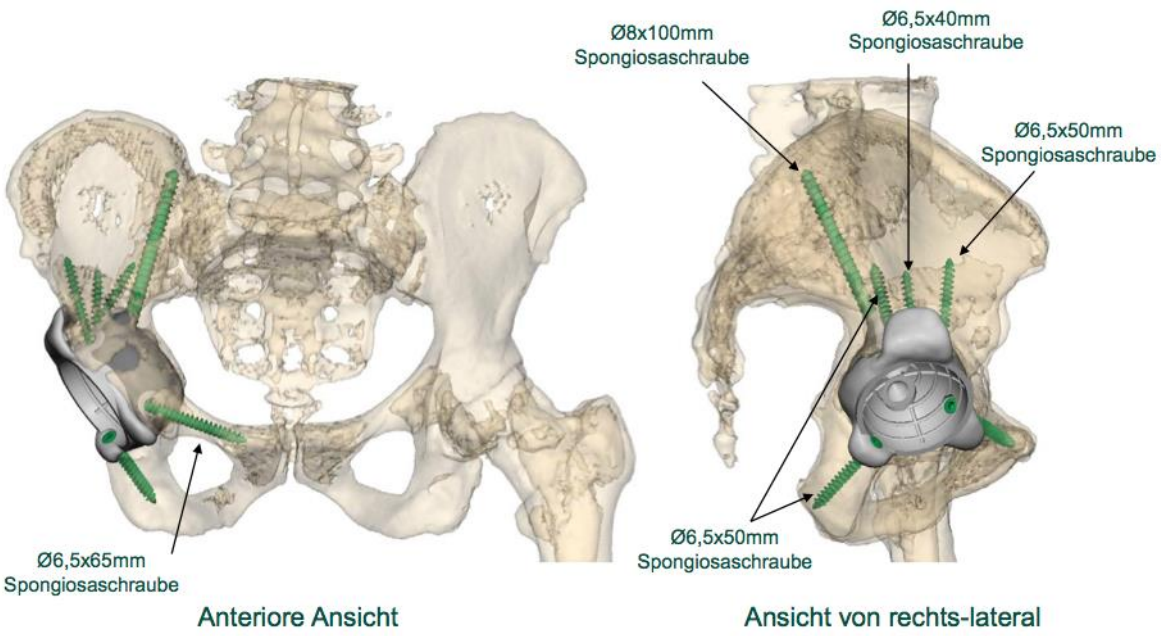
Do it – with a well trained team

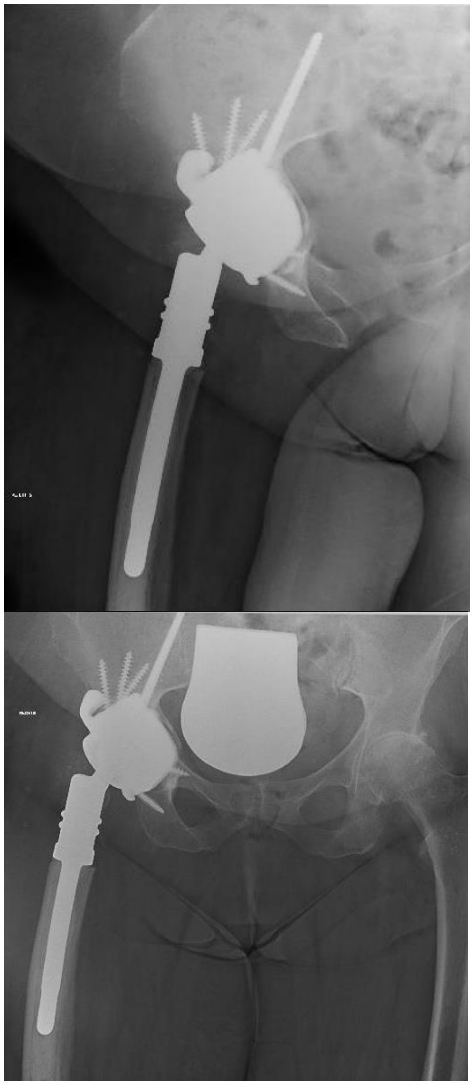


Custom made Implants
Complex shape



Bad bone quality



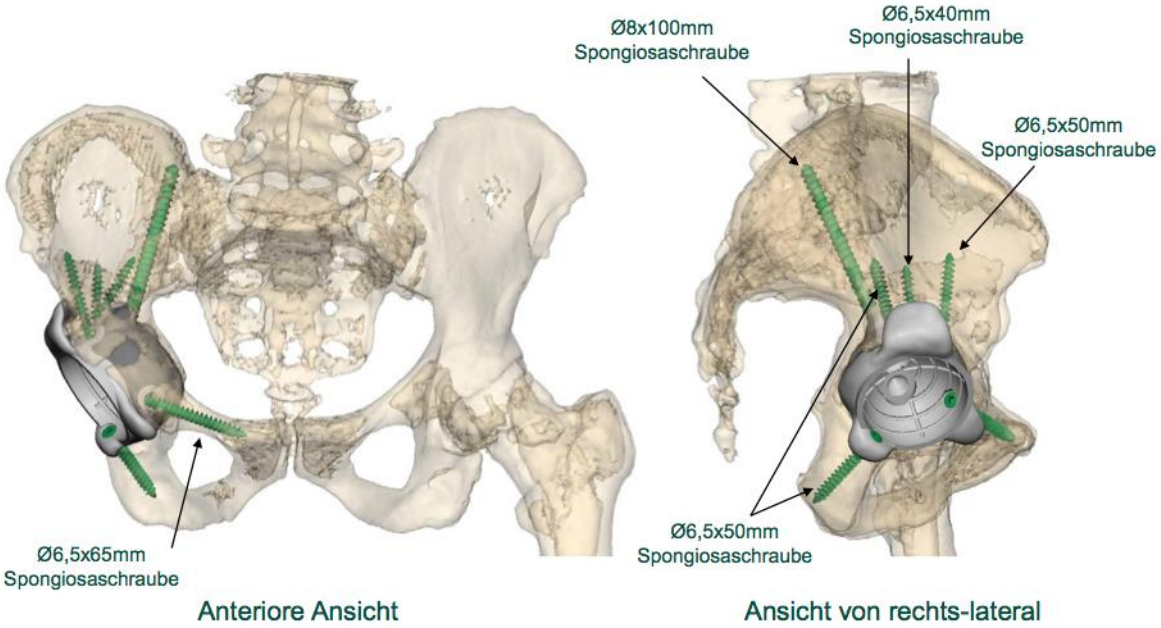


- No fixation with regular TM shell possible
- Good fixation with individual Implant and 8mm screw
- Tripolar cups recommended

Custommade pelvic Implant -our experience-

- Custommade pelvic Implant:

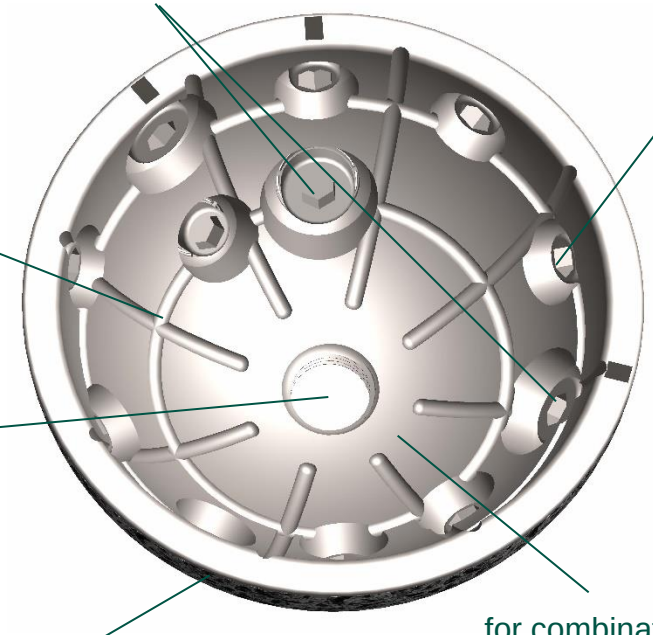
  n=20 (since 2014)
- Function: ??
- Revision: n=1 (infection n=1)
- Girdelstone situation after revision



Improve primary stability

MUTARS® PRS

PRS - pelvic reconstruction shell

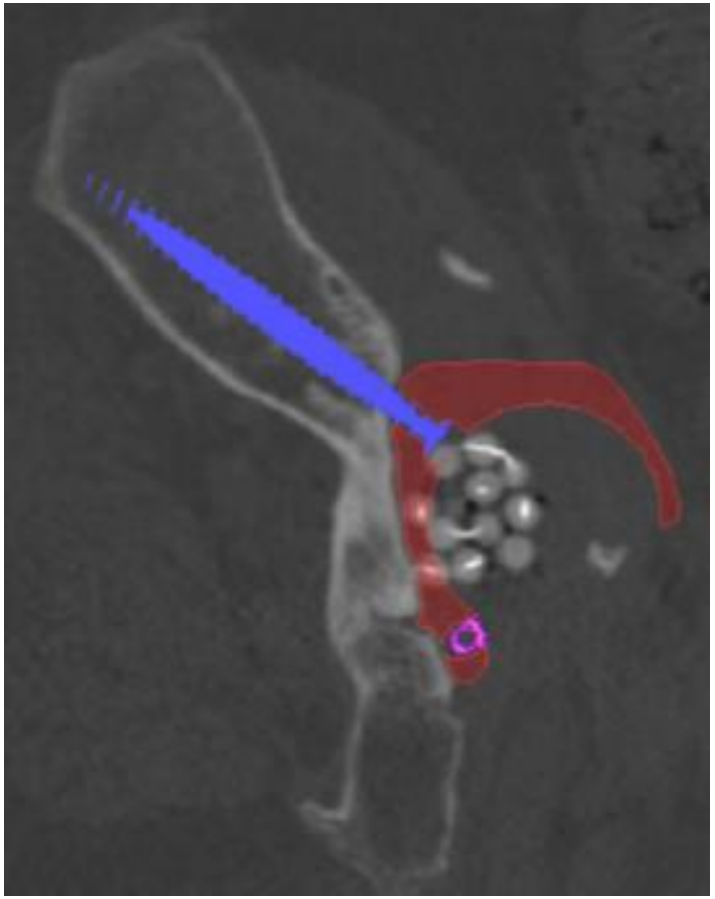


material: TiAl6V4

RE-REVISION SURGERY ?

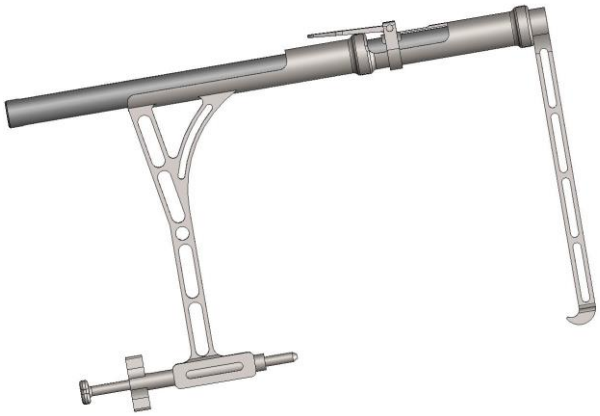
at least it is not boring

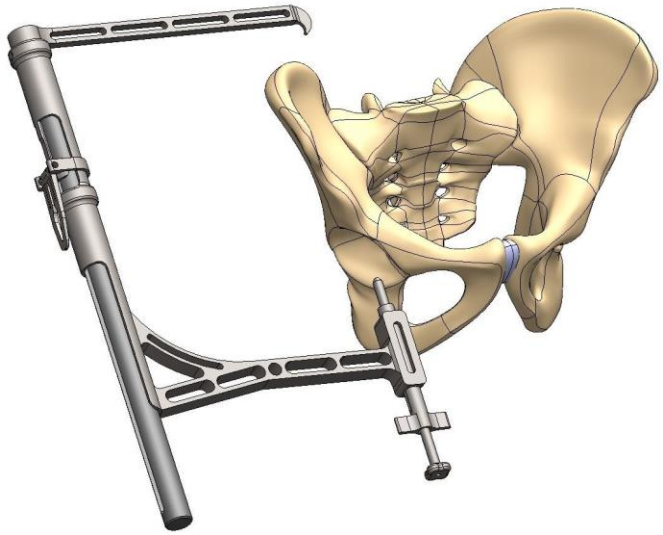
you might have no second try...



Don’t be too fiddly to prevent mechanical failures

Sometimes, if you only have only one try...





The slide to remember

- Individual Implants could solve many (but not all) defects

Success of surgery

- coating possible (silver, HA, TiN)

Plan your operation and operate your plan !

- Combination with tripolar cups recommended

- Planning is crucial (bone stock)

Be careful with one shot Operations

Thank You !