SCHOUDERPROTHESE OP MAAT – DE TOEKOMST?

Cruising into the future, innovations in orthopaedic surgery
09/12/2023 08:30 |Hogeschool VIVES - campus Brugge

130 Years of Shoulder Arthroplasty

"generation 0"

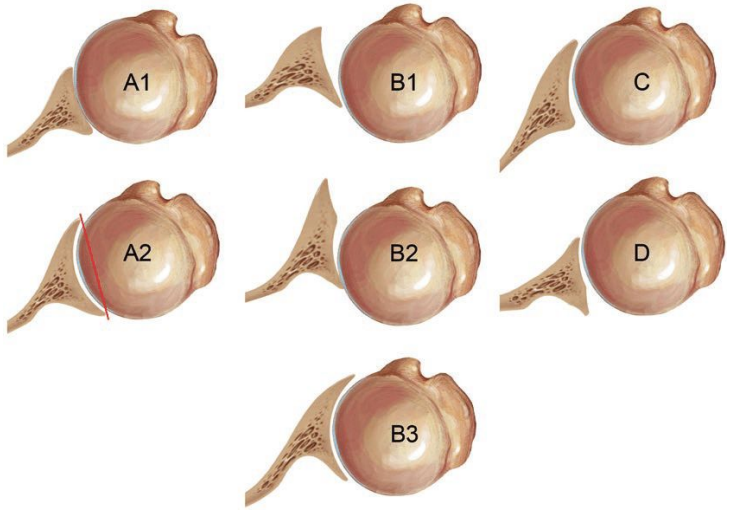
4th generation

virtual unlimited variability to make the implant fit the patient

"Platform system" to change biomechanics

130 Years of Shoulder Arthroplasty

glenoid erosion / retroversion



"high-sided reaming" :

- violation subchondral plate (fixation?)
- medialization (soft tissue balancing?)

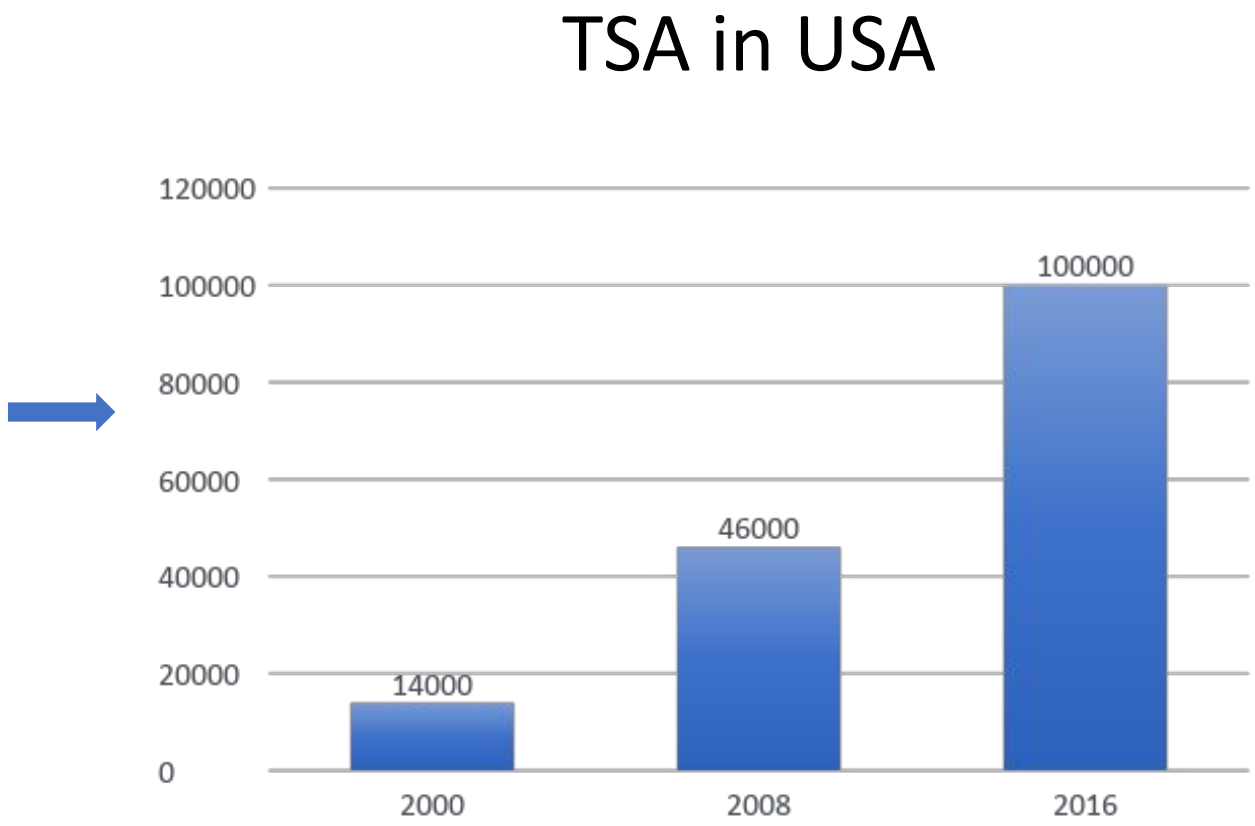
130 Years of Shoulder Arthroplasty

familiarity with implants

implant improvements

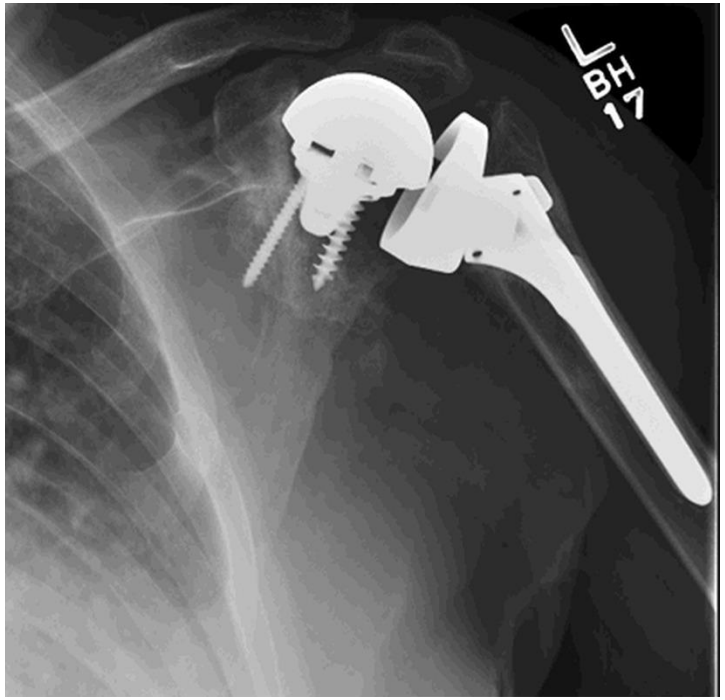
life expectancy

functional demands



Failure Shoulder Arthroplasty

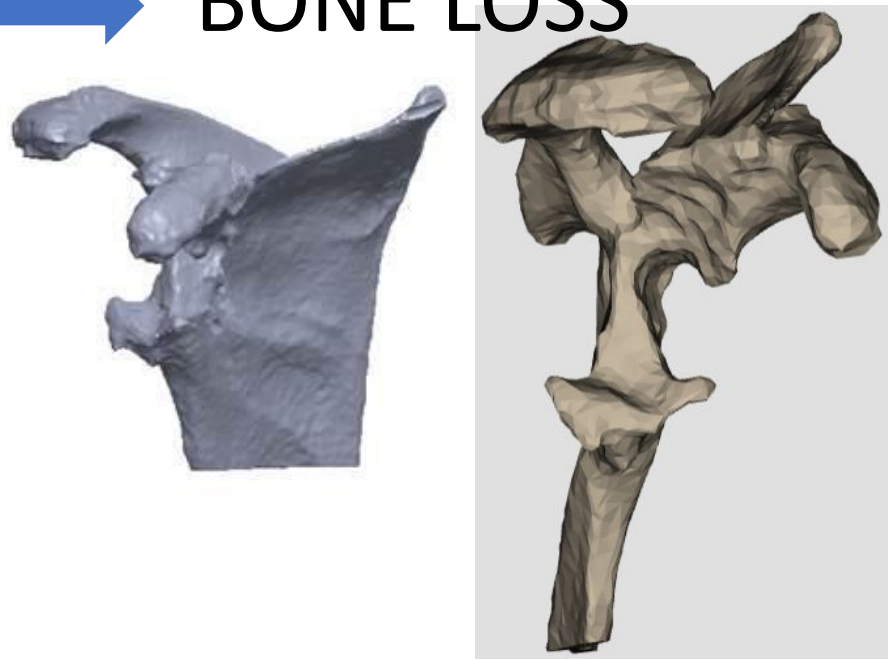
- infection
- instability
- fracture
- wear
- loosening
- …



increase in revision TSA
by 400%

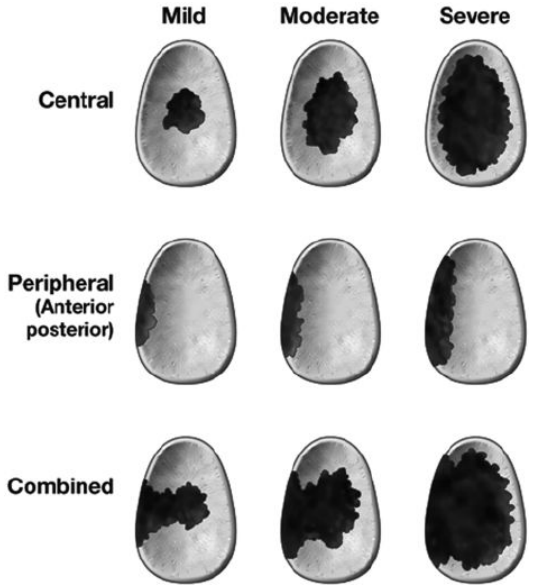
other destructive bone disorders:
- chronic dislocation
- failed fixation devices (fractures)
- …

BONE LOSS



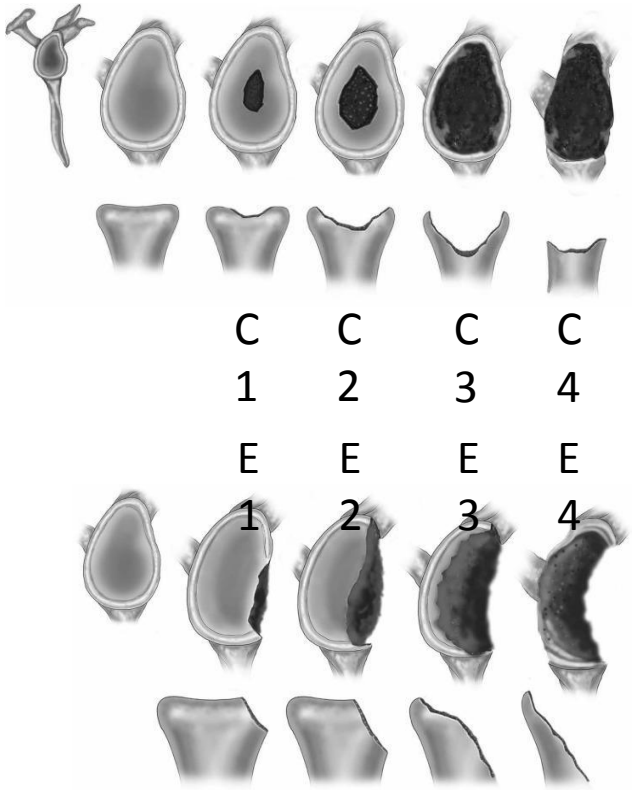
Classification Bone Loss

Antuna



Antuna SA, Sperling JW, Cofield RH, Rowland CM (2001) Glenoid revi- sion surgery after total shoulder arthroplasty. J Shoulder Elbow Surg 10:217–224

Gupta



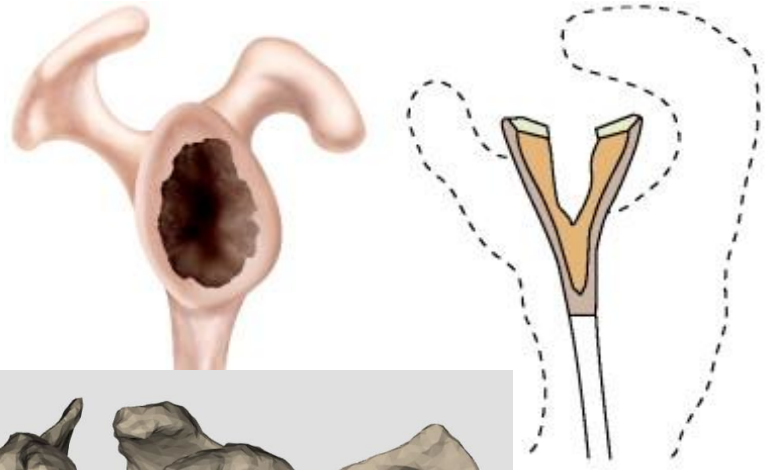
Gupta A, Thussbas C, Koch M, Seebauer L (2017) Management of glenoid bone defects with reverse shoulder arthroplasty–surgical technique and clinical outcomes. J Shoulder Elbow Surg 27(5):853–862

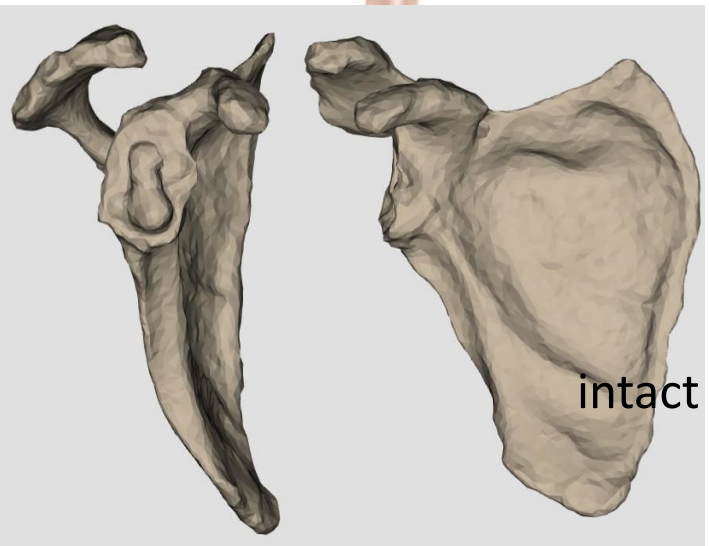
useful to describe the defects, although less beneficial in terms of treatment and surgical plan

Classification Bone Loss

Williams GR, Iannotti JP, Options for Glenoid Bone Loss: Composites of Prosthetics and Biologics J. Shoulder and Elbow Surgery 16S, 267–72 2007

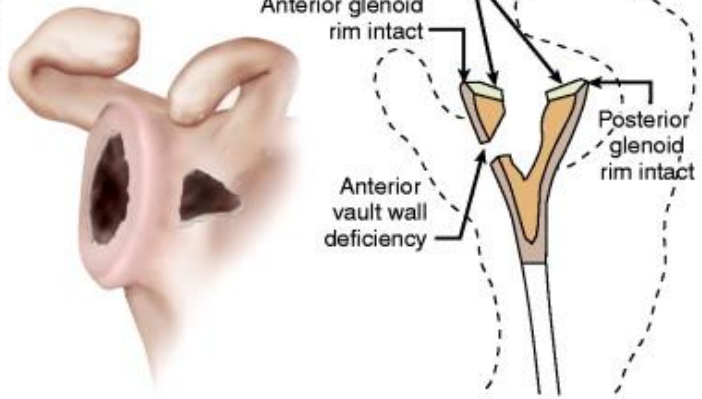
CONTAINED





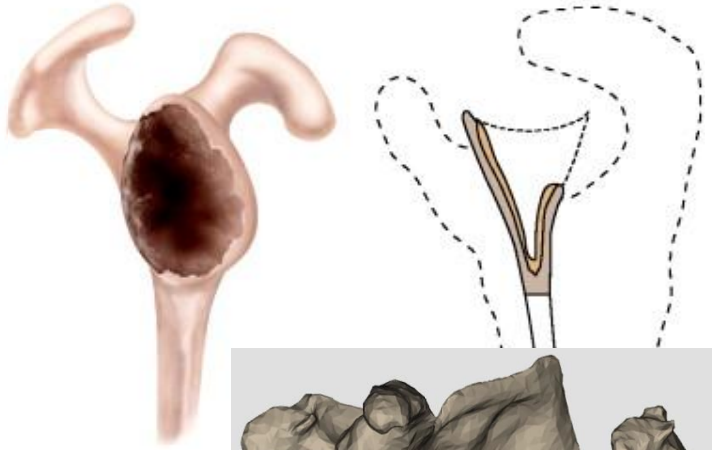
intact glenoid rim

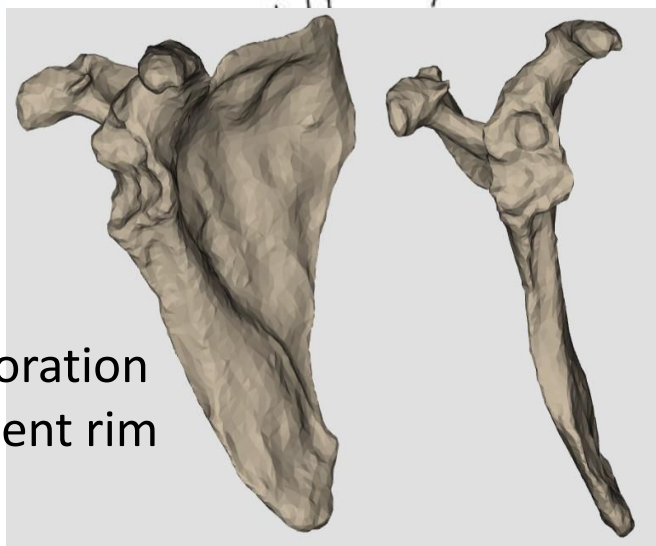
CONTAINABLE



vault perforation with intact rim

UNCONTAINABLE





vault perforation with deficient rim

Revision Principles

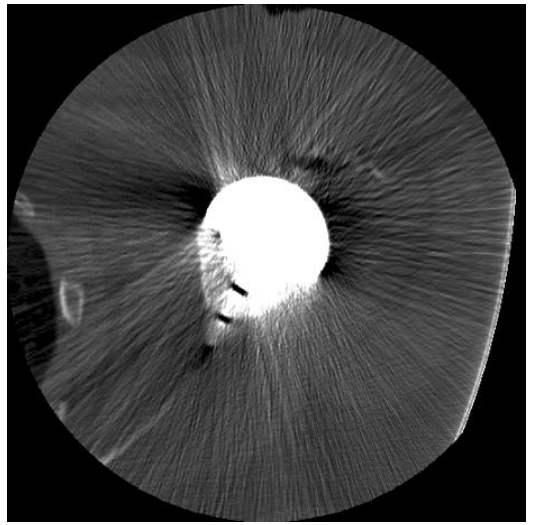
1. the implant must be seated on “viable” bone (>80%)

Revision Principles

2. the implant must be fixed stable to prevent micromotion > 150 µm

central peg > 10 mm into native glenoid
minimum 2 divergent screws > 30 mm

Malhas A, Rashid A, Copas D, Bale S, Trail I. Glenoid bone loss in primary and revision shoulder arthroplasty. Shoulder Elbow 2019 8(4):229–240

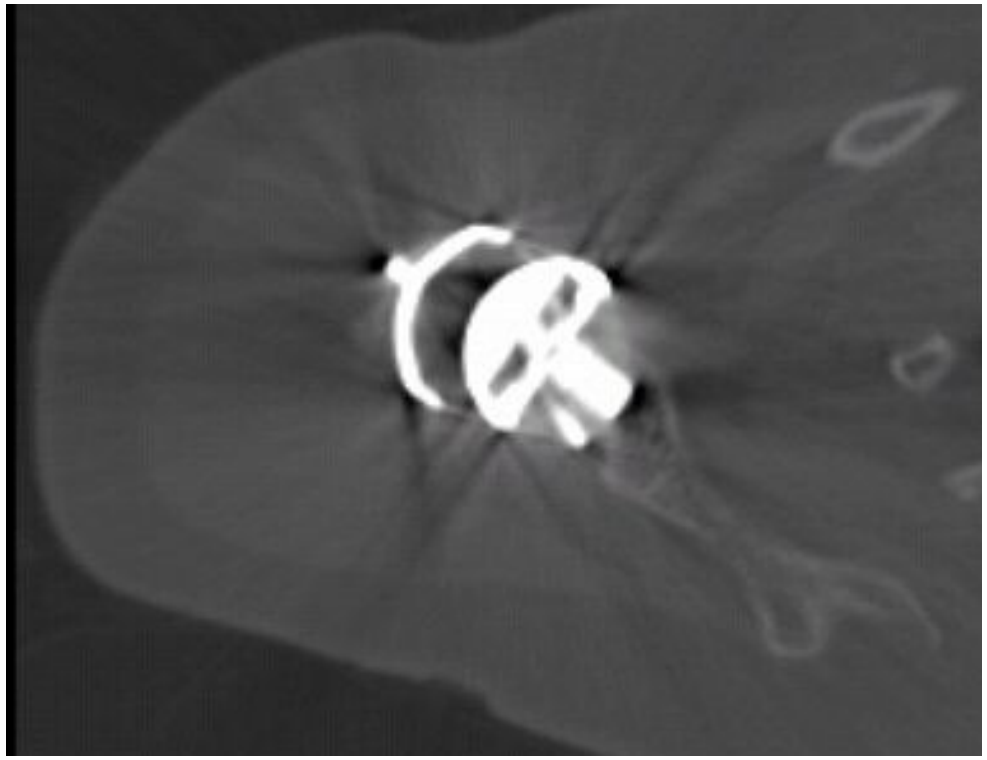


“implant stability is achieved if the peg is almost 50% in length into the glenoid bone”

Malhas AM, Granville-Chapman J, Robinson PM (2018) Reconstruction of the glenoid using autologous bone-graft and SMR Axioma TT metal- backed prosthesis: the first 45 sequential cases at a minimum of two years’ follow-up. Bone Joint J 100-B(12):1609–1617

Revision Principles

3. the implant must be in neutral version

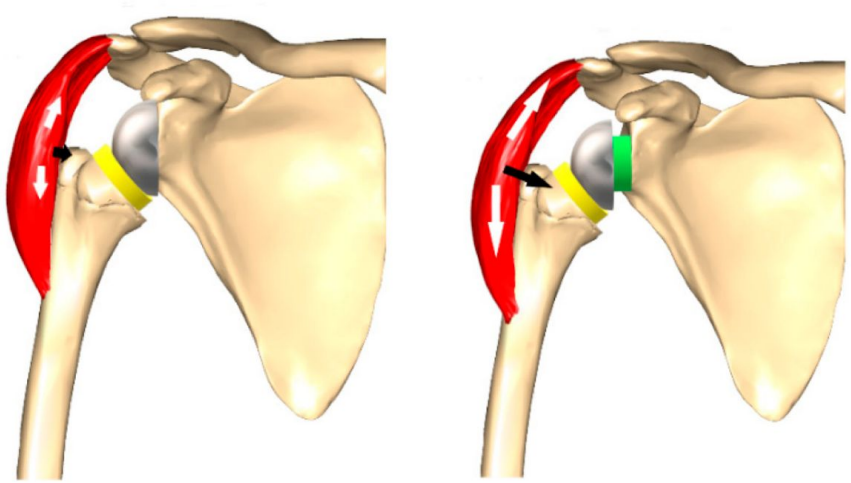


Revision Principles

4. the center of rotation must be :

"restored" *(for ROM, stability and prevent notching)*

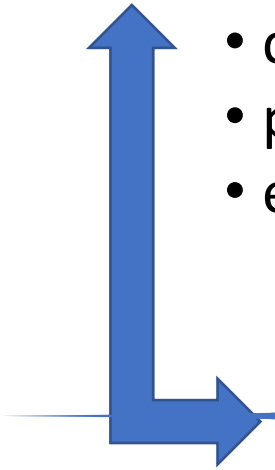
the ideal extent of lateralization of the glenoid remains unclear



situated at implant-bone interface *(to prevent loosening)*

Revision Tools

1. asymmetrical reaming ⟷ compromizing remaining bone stock
2. augmented glenoid components ⟷ COR at implant-bone interface?
3. bone grafts
   - contained : impaction bone graft
   - peripheral defects : autologous graft implant composite
   - excessieve defects without possibility of stable implant : 2 stage bone graft



- bone resorption / graft non-union
- eccentric bone grafts show lower union rate than concentric bone grafts
- poor results of 2 stage grafting

Titanium

1. high stiffness
2. low density
3. corrosion resistance
4. good biocompatibility

trabecular titanium mimics that of trabecular bone, and its porosity enhances cell migration and vascularization, facilitating the transport of oxygen, nutrients, ions and bone inducing factors, encouraging the formation of new bone.

scaffold designs allow osseointegration

3D Printed Design Specifications

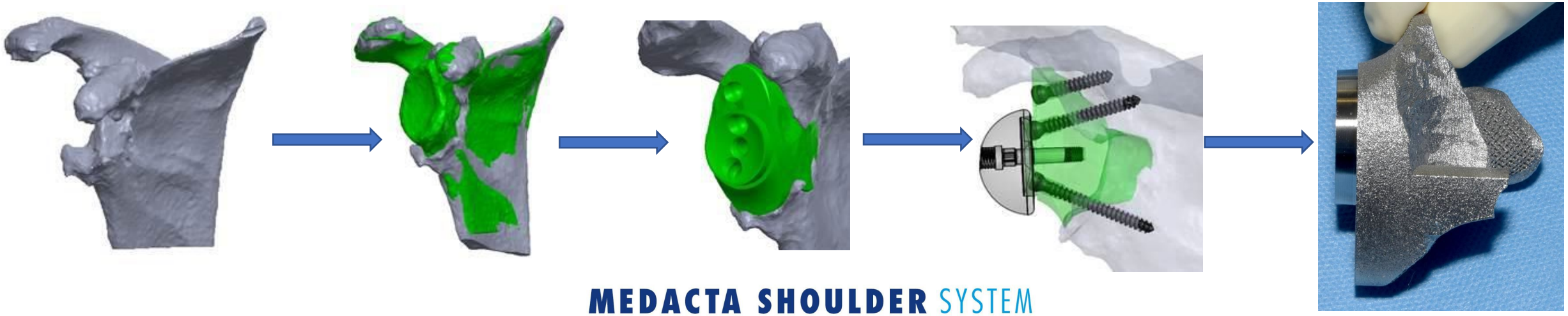
- optimize
  - the metal–bone interface area
  - the primary stability
  - the load transfer
    - with metal engagement on the most supportive areas
    - with ultimately a consecutive phase of bone remodeling

- allowing
  - recovery of biomechanical balance
  - adequate range of motion

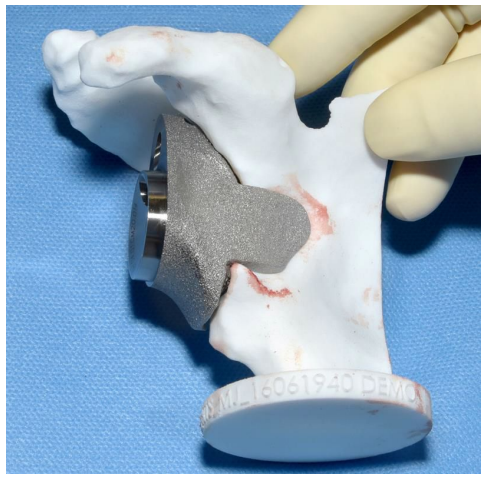
Charles Hull: Apparatus for production of three-dimensional objects by stereolithography. *US; US 4575330 A*, 1984

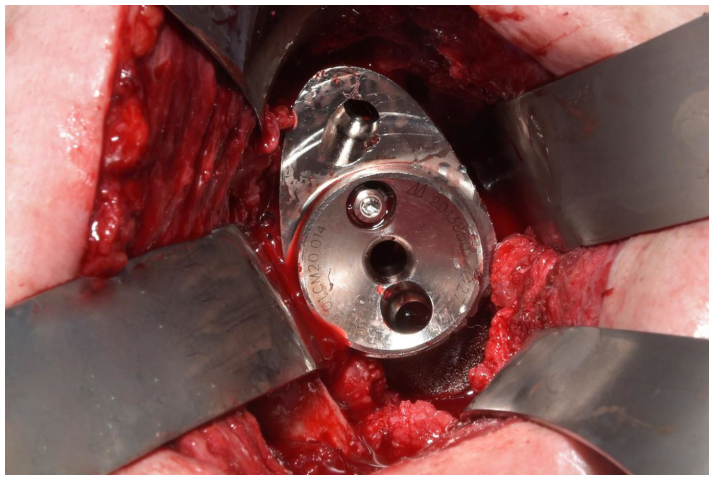
D'Urso PS, Askin G, Earwaker JS, et al. Spinal biomodeling. *Spine*. 1999;24:1247-1251.

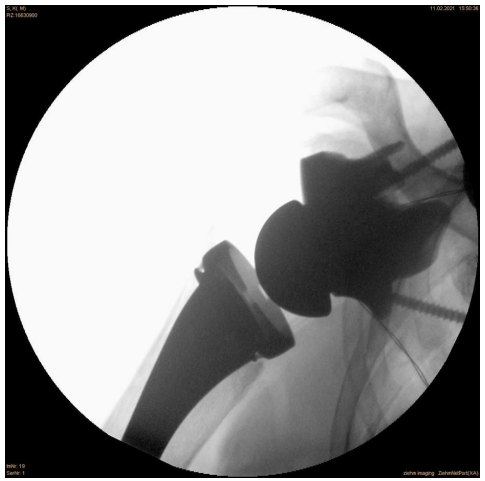
Custom-made implants



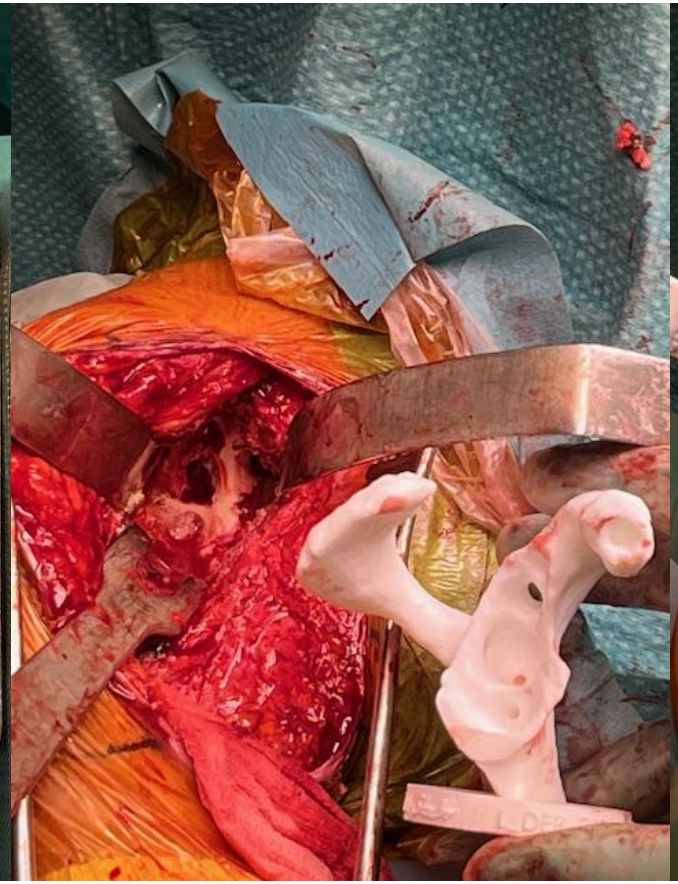
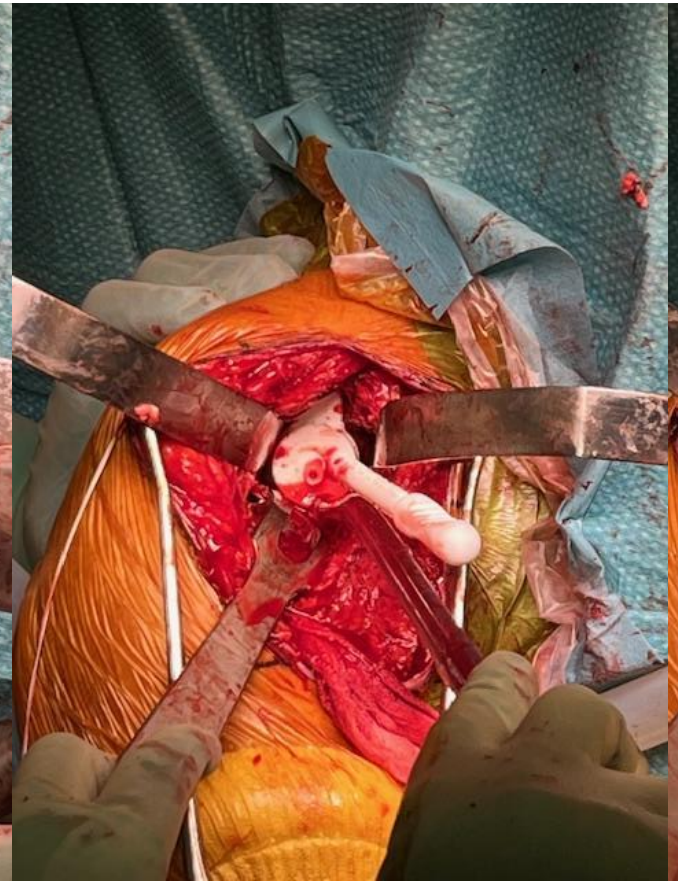
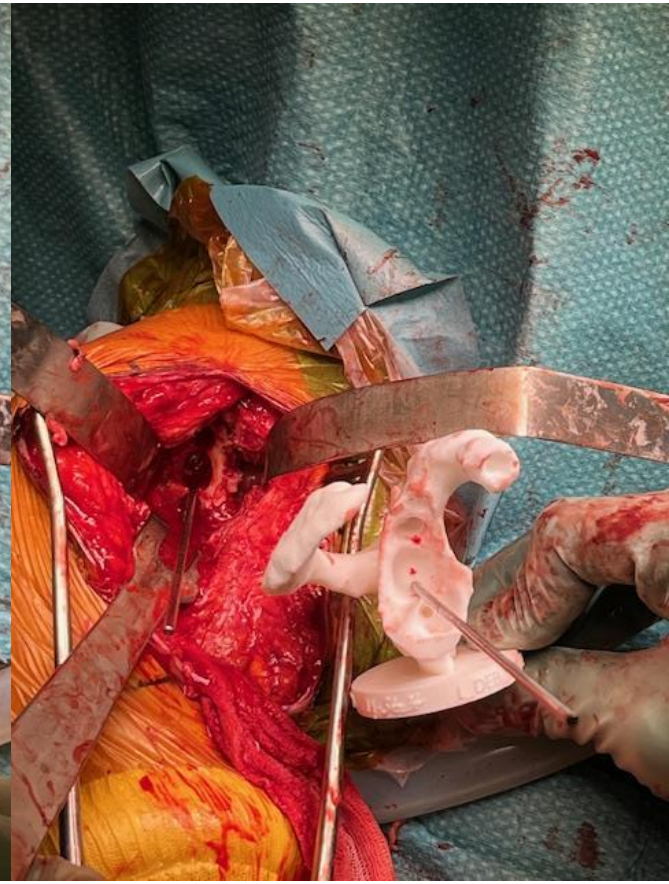
MEDACTA SHOULDER SYSTEM







Custom-made implants

Custom-made implants

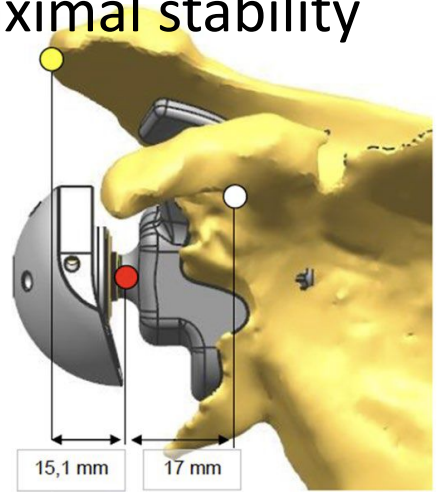


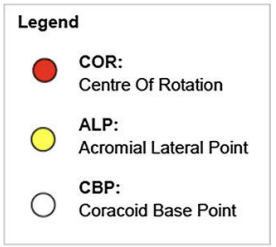


Wrist and Thumb
Anatomy and pathologies
push.eu

Custom-made implants

1. support by intact elements (scapular spine, coracoid)
2. defect-specific shape, hence suitability for extensive bone loss
3. exact planning for screw direction and length : maximal stability
4. adequate reconstruction of joint line
5. correct positioning due to implant guides





1. expensive
2. metal artefacts could trouble planning (2 stage?)
3. time delay between planning and implanting (altered anatomy)
4. beware distance between COR and bone/metal-line

Custom-made implants

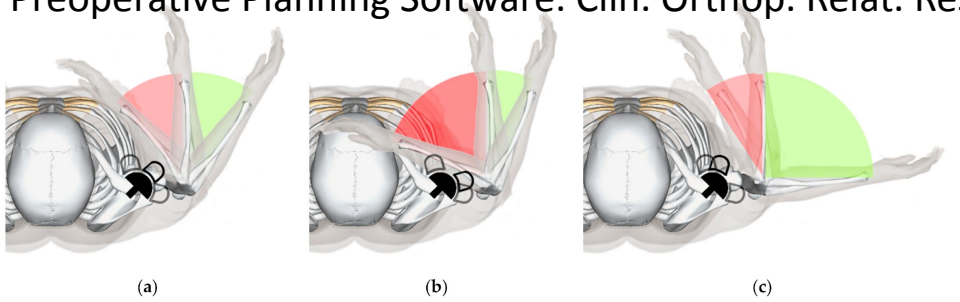
… other possible drawbacks:

1. PSI : difficulty in accessing remaining glenoid
2. accuracy PSI not as favourable b/o remaining soft tissue

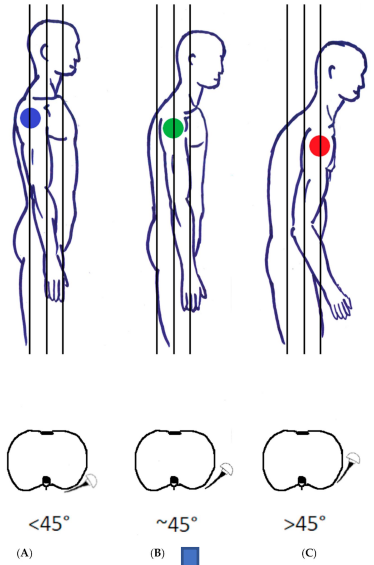
   Lau, S.C.; Keith, P.P.A. Patient-specific instrumentation for total shoulder arthroplasty: Not as accurate as it would seem. J.Shoulder Elb. Surg. 2018, 27, 90–95.

3. scapulothoracic orientation?

   Moroder, P.; Urvoy, M.; Raiss, P.; Werthel, J.-D.; Akgün, D.; Chaoui, J.; Siegert, P. Patient Posture Affects Simulated ROM in Reverse Total Shoulder Arthroplasty: A Modeling Study Using Preoperative Planning Software. Clin. Orthop. Relat. Res. 2021.



Lateralization?
Version?



Proof

"There is nothing in the literature, at this time, to strongly suggest the use of custom glenoid implants for reverse replacements. "

Malhas A, Rashid A, Copas D, Bale S, Trail I. Glenoid bone loss in primary and revision shoulder arthroplasty. Shoulder Elbow. ***2016*** *Oct;8(4):229-40.*

Pubmed : 2017 – 2023 : 11 papers – 121 cases

- 4 case reports
- 4 multicentric studies
- mixed populations (primary + revision)

"Longer clinical follow-up is needed to determine whether the cost of this system rationalizes the potential improved functional outcomes and decreases glenoid revision rates."


Thank
You


Are
we
ready....?