REVERSE SHOULDER ARTHROPLASTY (RSA)

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RSA-NORMAL SHOULDER KINEMATICS

- Abduction/Elevation
  - Joint stability dependent on balance between Deltoid (upwards force) and Rotator Cuff (downwards force)
  - Muscle contraction causes shear (upwards humeral displacement) and compression forces (joint stability)

RSA-NORMAL SHOULDER KINEMATICS

- Deltoid shear forces > compression forces until 60 degrees elevation!

- Abduction torque generated by Deltoid
  - At 30 degrees 70%
  - At 60 degrees 80%
  - At 90 degrees 85%

RSA-CUFF DEFICIENCY

- Deltoid lost counterbalance +/- support (SST, IST, TM, SCC)
- Loss of fulcrum for elevation
- Shear component of deltoid causes humeral upwards migration
- Unstable joint
- Deltoid fibres retract
- Remaining Function depends on remaining anterior/posterior force couple

RSA – CLASSIFICATION OF CUFF TEAR ARTHROPATHY

HAMADA et al.

- Radiographic
- Acromiohumeral Interval (AHI)
- Grade1 AHI > 6mm
- Grade 2 AHI < 6mm
- Grade 3 2 + acetabul.
- Grade 4 3 + GHJ-OA
- Grade 5 HH-collapse

SEEBAUER et al.

- Biomechanical
- Sup. Migration and Degree of Instability
- Type 1A: centred,stable
- Type 1B: centred,medialis.
- Type 2A: decentred,lim.stable
- Type 2B: decentred,unstable

RSA-MECHANICS

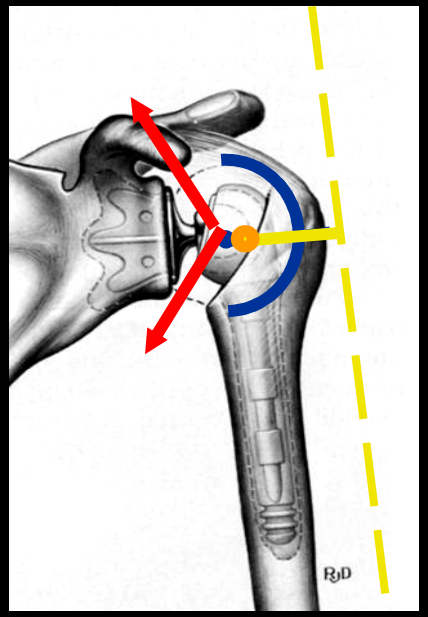
- CUFF REPLACEMENT PROSTHESIS
- NO OTHER ALTERNATIVE
  - CUFF REPAIR
  - SURFACE REPLACEMENT
  - TSA
  - CTA
  - MUSCLE TRANSFERS

RSA-EARLIER DESIGNS

- Constrained-Reversed
  Kölbel 1972, Liverpool 1975, Fenlin 1975, Kessel 1973, MacNab

RSA-EARLIER DESIGNS

- Lateral offset of center of rotation
- Shortened Deltoid-leverarm
- Designrelated limited ROM



- Shearing- und levering forces at the glenoid component - bone inferface

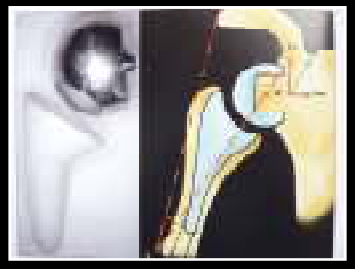
RSA-GRAMMONT PROSTHESIS

- “In fact, our hypothesis is as simplistic as the invention of the wheel:

  is walking the only means of travelling?...”

Paul Grammont, Paris, 1987

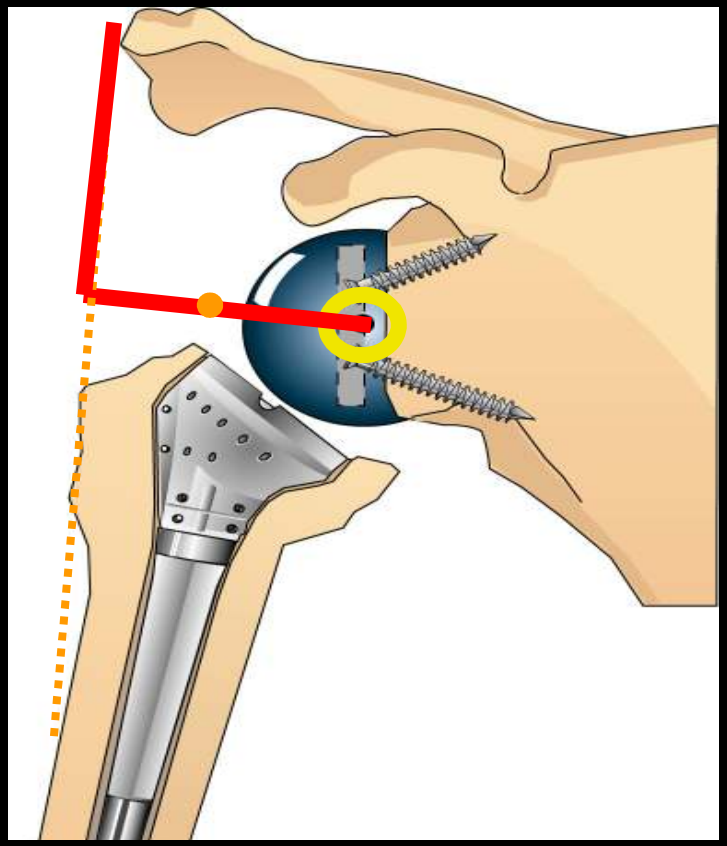
RSA-GRAMMONT PROSTHESIS



- Unconstrained
- Co-adaptation
- Large glenoid hemisphere without neck
- Small humeral cup, almost horizontally inclined
- Minimizes torque on glenoid
- Conversion of centrifugal to centripetal forces on the glenoid sphere (self stabilising system)

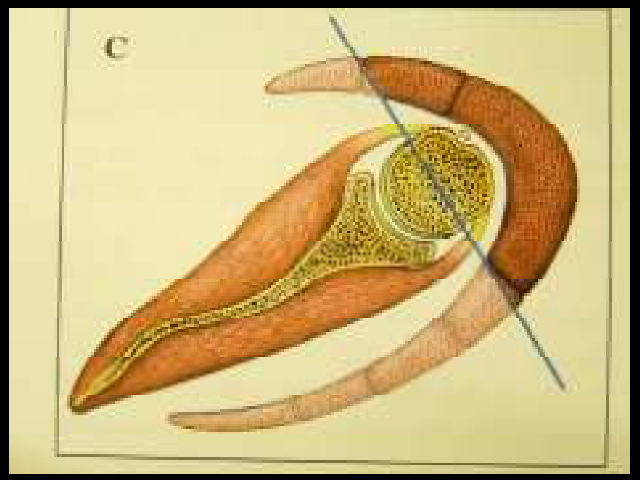
RSA-GRAMMONT PROSTHESIS

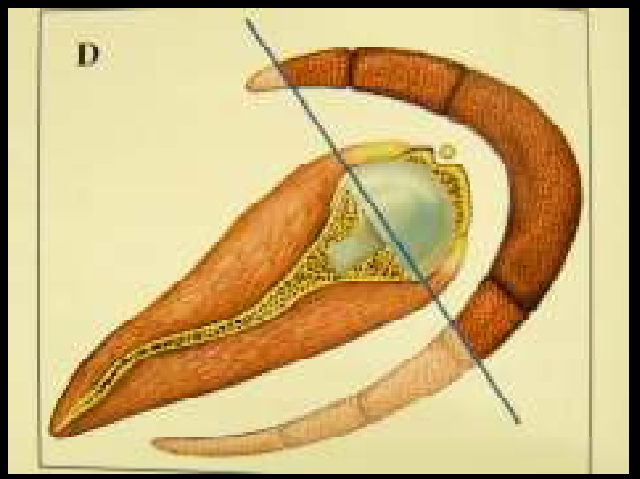
- Optimization of deltoid function through Distalization and Medialization of the Center of rotation.
- Non-anatomical incliniation 155˚
- Small cup



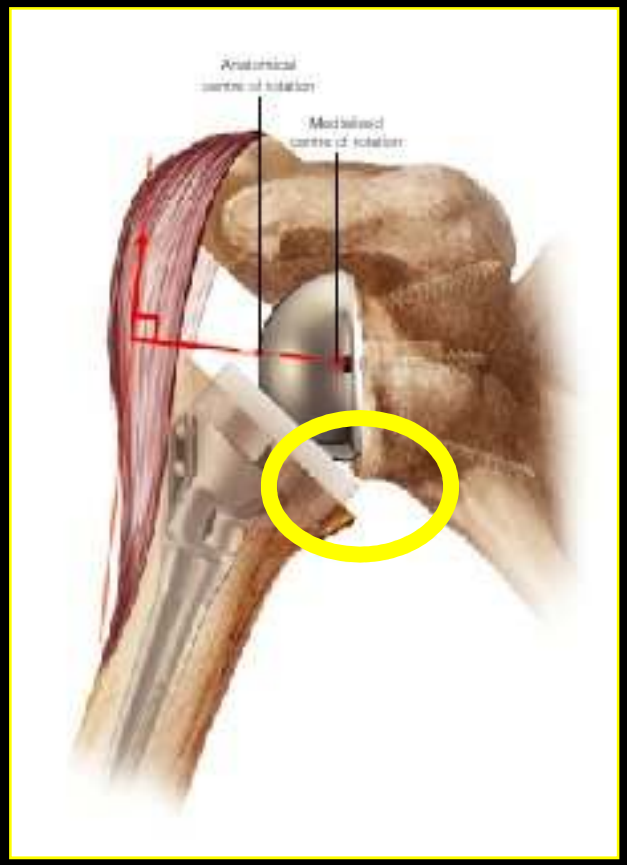
RSA-GRAMMONT PROSTHESIS

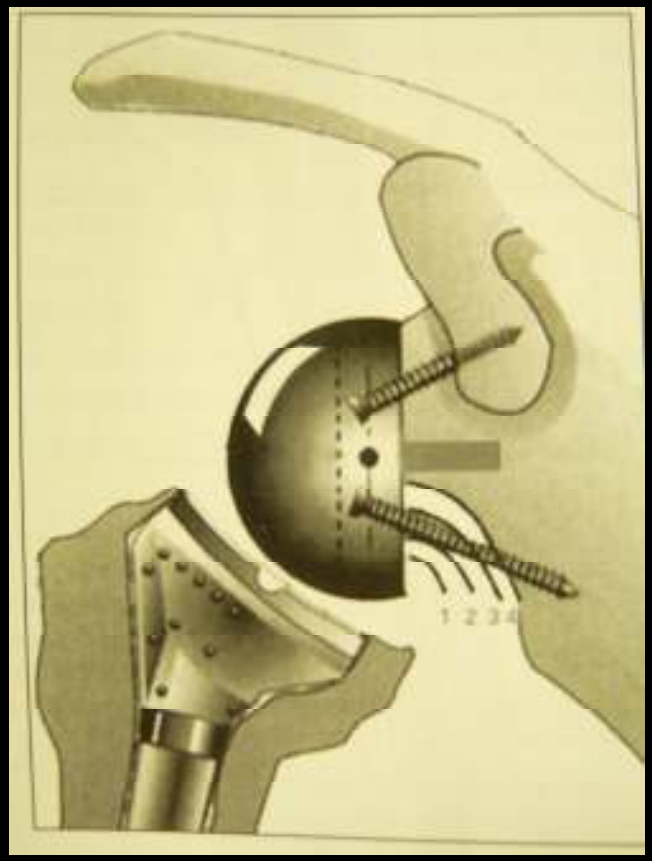
- Increased recruitment of anterior and posterior deltoid fibres for abduction
- Improved deltoid lever arm
- Increased/restored deltoid tensioning





RSA-NOTCHING





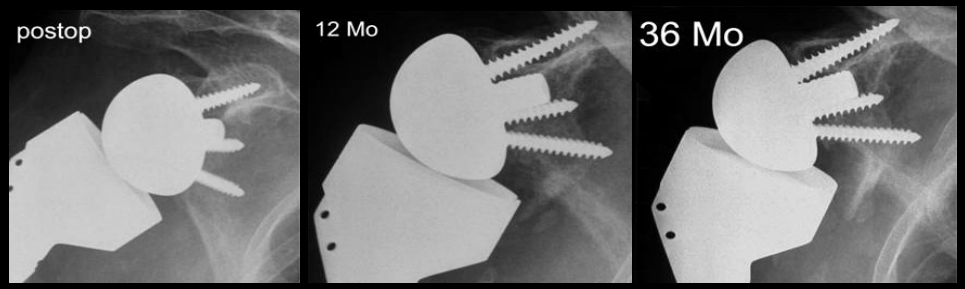
SIRVEAUX

RSA-NOTCHING

Progression in a FU-period up to 7 years

74.6% **stable: 0 → 2 (no further progession / unchanged after 6-12 mo.)**

19,5% **progressive: 0 → (2) → 3 / 4 (Osteolysis / progressive after 24 mo.)**



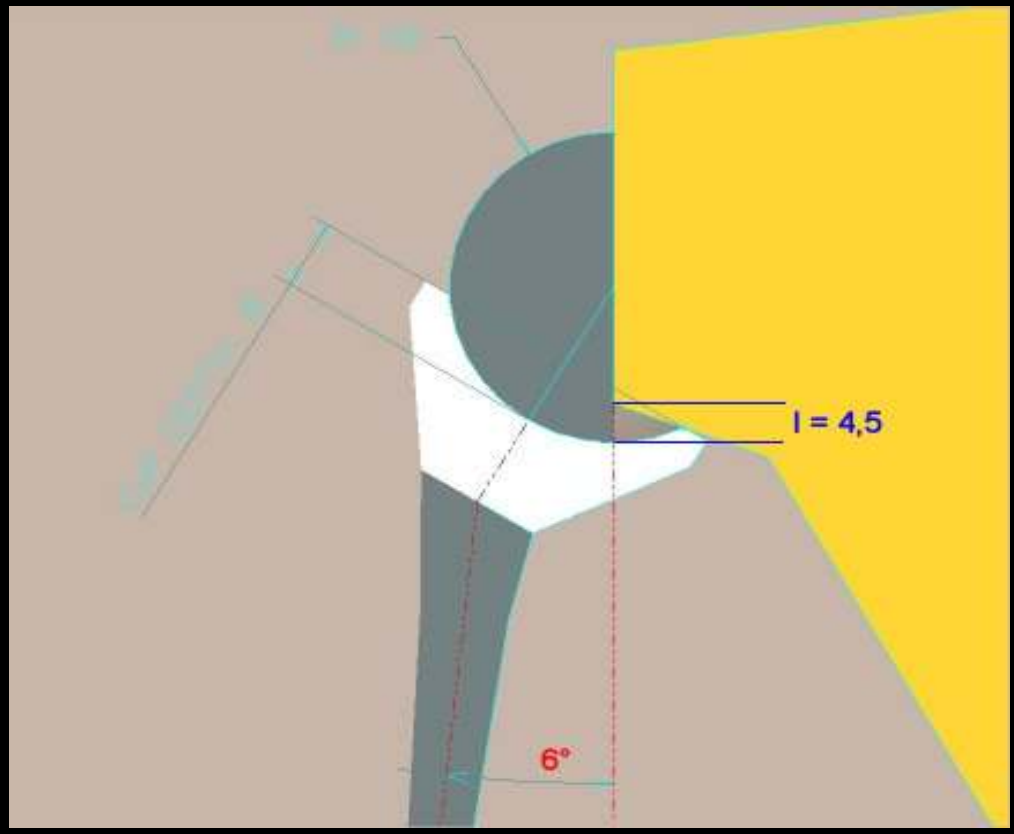
…CORRELATION WITH FOLLOW-UP, SURGICAL APPROACH, POLY-WEAR, RADIOLUCENT LINES (HUMERUS AND BASEPLATE)

…CLINICAL RELEVANCE???

RSA-NOTCHING

↗ overlap ⇒ ↘ impingement

⇒ no influence on stability !



2D Biomechanical Analysis Overlap influence

RSA-INDICATIONS

1. Arthritic shoulder with severe cuff destruction in the elderly (>75)
2. Massive cuff tear
3. Acute Fracture in the elderly
4. Fracture sequelae
5. RA
6. OA
7. Tumors
8. Failure of previous cuff surgery
9. Revision of failed, unconstrained SA

RSA-INDICATIONS









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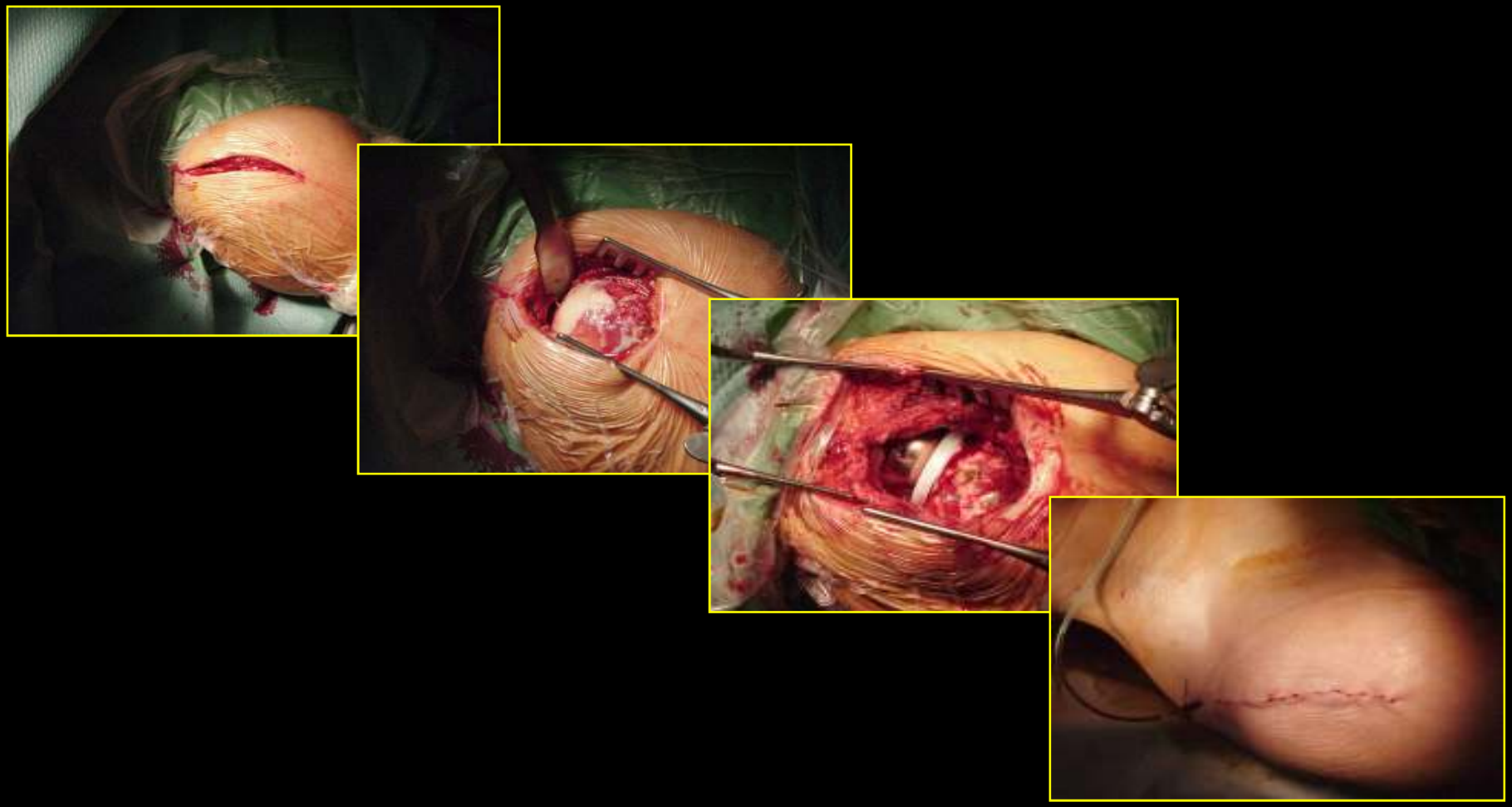
RSA - CONTRAINDICATIONS

- PREVIOUS INFECTION
- NON-FUNCTIONING DELTOID MUSCLE

RSA-SURGICAL TECHNIQUE



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RSA - Study Day

- LIVE SURGERY of Primary and Revision RSA
- Lectures covering
  - Indications
  - Techniques
  - Results…of primary and revision RSA
- Evening Meal and Case Discussion

  Invited Guest Speaker and Surgeon

  Prof. A. Ekelund (Sweden)

- Date: 25-02-2010 Venue: QE, Gateshead

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RSA-RESULTS

- Short follow up (7 years, NICE)
- Post-op elevation: 55 ⇨ 121 degr.
- Constant score 17 ⇨ 59
- ER 7 ⇨ 11
- Patient satisfied 78%
- No/mild pain 67%
- CTA patient RSA> Hemi

RSA-RESULTS

- Re-operation rate 0-15%
- …when prosthetic revision 20-60%

- Most results reported on elderly (avg.72) with limited activity levels!
- Notching in 74%...but no effect on function!
- No revision for loosening (…infection and #)

RSA-COMPLICATIONS

Primary : Revision = 1:3

1. Intra-operative
   - Scapula (glenoid) fracture (<1%)
   - Humeral fracture (same as TSA)
   - Vascular injuries (<1%)
   - Nerve lesions (up to 5%)
2. Post-operative
   - Haematoma (dead space)
   - Dislocation (4.8%, under-tensioning, bone resection, approach, version)
   - Subsidence (?cemented stem?)
   - Disassembly
   - Fractures
   - Loosening
   - Notching
   - Infections

RSA-COMPLICATIONS

- No improvement on rotation
  - Medialisation
    - Slackening of remaining RC
    - Reduction of posterior deltoid fibres
- TM…most important for functional outcome
- RSA…combined with LD/TMa ⇨ restore ER

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RSA-COMPLICATIONS

- Instability:
  - Deltoid under-tensioning, impingement, approach, haematoma, revision
- Fracture:
  - Acromion…fatigue fracture, deltoid over-tensioning
  - Glenoid… pre-op CT, bone grafting, Hemi
- Fixation failure:
  - Glenoid…placement, approach
  - Humerus…cementation, prox. bone loss

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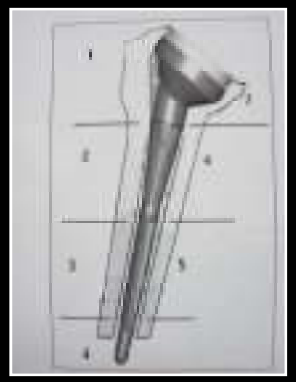

RSA-COMPLICATIONS

- Scapula notching:
  - Concerns remain for polyethylene wear…?
  - ?...”price to pay”

  suggest
  - Low placement of glenosphere
  - Humeral stem in neutral rotation
  - Deltopectoral approach

RSA-COMPLICATIONS

- Infection:
  - Similar to TSA
  - < 1% (primary)
  - Staph. Aureus, Propionibacterium acnes
  - Early…debride + AB's
  - Late…r/o implants + AB's +/- 2nd stage

RSA-SUMMARY

"Give me something different, for there is a chance of its being better."

Ernest Codman, The Shoulder, Boston 1934

RSA-LITERATURE

- Reverse total shoulder arthroplasty after failed rotator cuff surgery.
  - Boileau P, Gonzalez JF, Chuinard C, Bicknell R, Walch G. J Shoulder Elbow Surg. 2009 Jul-Aug;18(4)
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RSA-LITERATURE

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