Developments in Shoulder Arthroplasty

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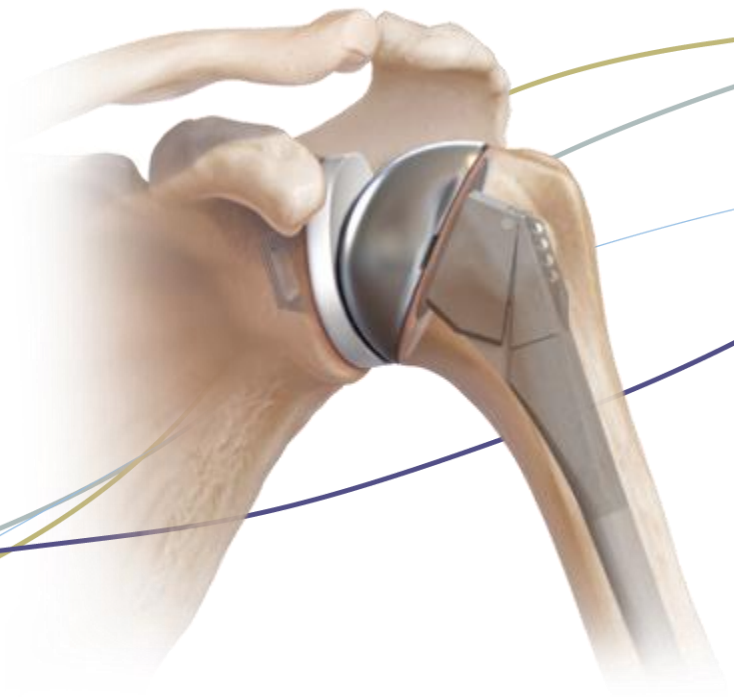

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Excellence in orthopaedic and sports injury treatment

Glenohumeral Joint Arthritis

Relatively uncommon

Not as common as hip/knee/hand

UK National Joint Registry 2016:

Hips	183107
Knees	113023
Shoulders	**7369**
Elbows	762

Causes of Glenohumeral Joint Arthritis

Primary

- Unknown
- Genetic
- Dysplasia?

Secondary

- Caused by something else

Causes of Glenohumeral Joint Arthritis

Secondary:

(i) Atraumatic osteonecrosis

Alcohol induced

Corticosteroid therapy

Cytotoxic drugs

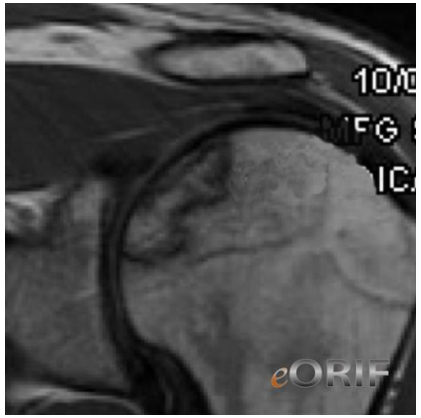
Radiation

Sickle cell disease

(ii) Inflammatory joint disease

Rheumatoid

Gout



Causes of glenohumeral joint arthritis

(iii) Post-traumatic

Dislocation (too loose)

Intra-articular fractures

Malunion of the proximal humerus

(iv) Post-surgical

Capsulorrhaphy arthropathy (too tight)

Intra-articular hardware (e.g., screws, staples, anchors)

Infection

Presentation

Pain

- Global Pain
- Posterior jointline

Stiffness

Crepitus

Slowly progressive

GHJ arthritis - Examination

Stiffness	Global loss of motion
	Active and passive ROM
Crepitus	Coarse and deep
	Audible and palpable
Rotator cuff	Strong
	Negative impingement

Early GHJ arthritis

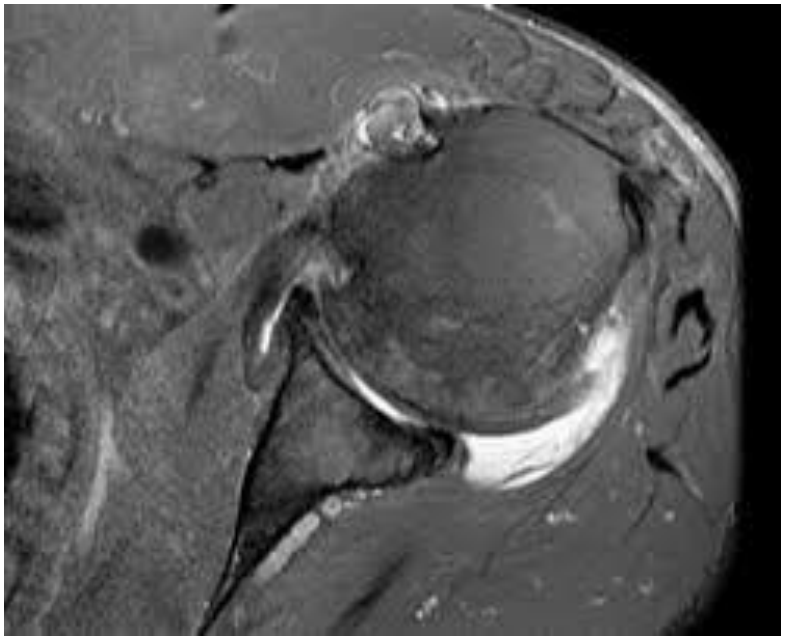
Beware the active middle-aged male

Ongoing shoulder pain

Not settling

Ache after exercise

Subtle instability



Normal Xray

MRI useful

Differential diagnosis

Frozen shoulder!

Xrays are the answer:

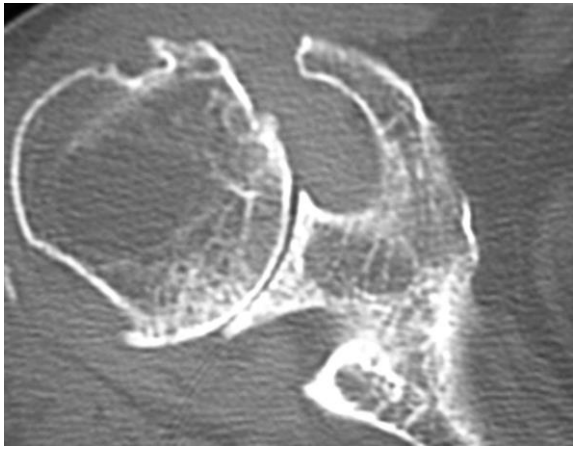
AP/Lateral/ Axillary

- Loss of joint space
- Osteophytes
- Subchondral sclerosis
- Subchondral cysts

GHJ arthritis: imaging

CT

- Doesn’t help diagnosis
- Does help surgical planning
- ?enough bone stock



MRI

- ?cuff tear
- ?repairable
- ?degree of muscle wasting

Treatment options

Nonoperative

Rest, ice, heat, NSAIDs

Physiotherapy to maintain ROM

Injection therapy - steroids

- hyaluronan

Operative

Arthroscopy

Arthroplasty - resurfacing

- replacement

The birth of total shoulder arthroplasty

Shoulder replacement first performed in 1893 by a French surgeon, Jules Emile Pean

Platinum and rubber

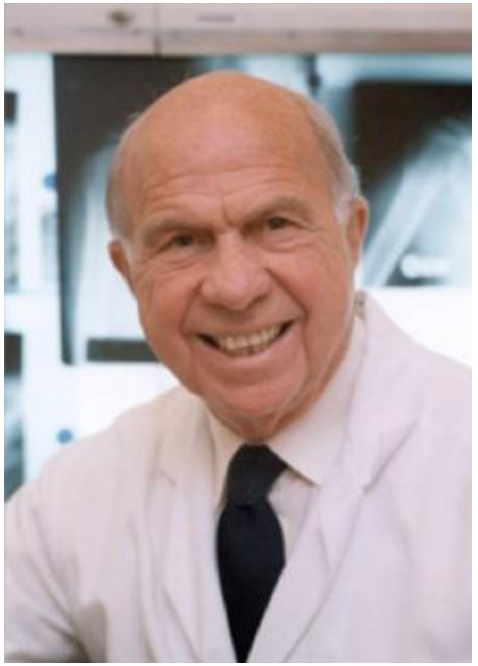
1950's Charles Neer

Columbia Presbyterian NYC

Modern CoCr prosthesis

Monobloc humerus

Keeled polyethylene glenoid



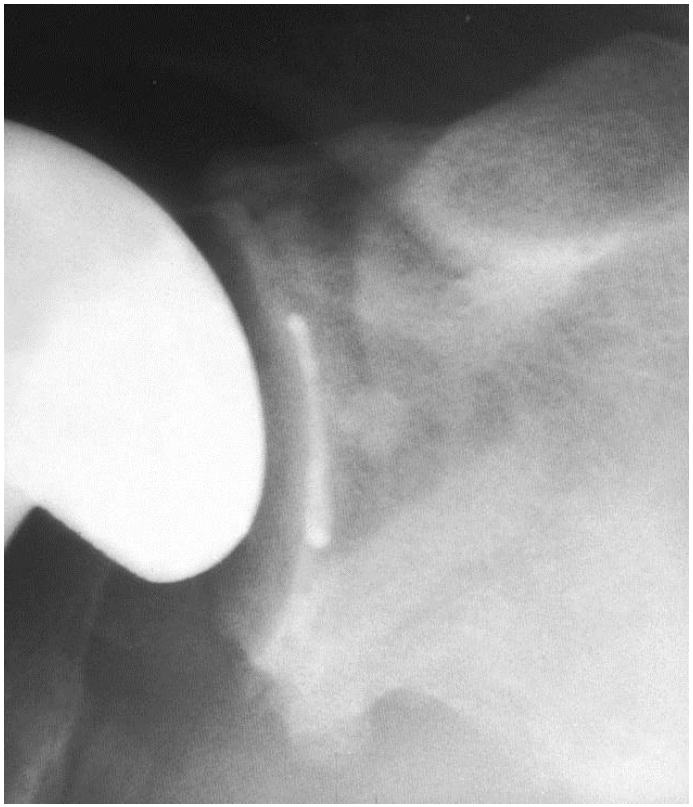
First generation TSR

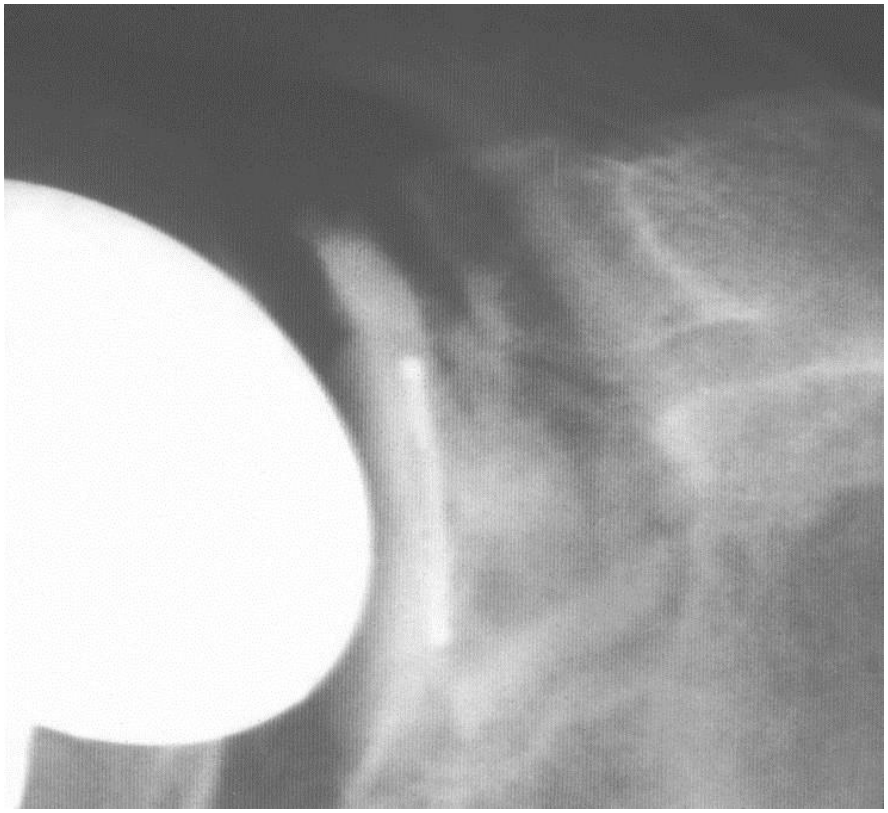
Cemented monobloc CoCr stem + head

Keeled cemented polyethylene glenoid

- Lots of cement (both components)
- Limited sizes (x3); uniaxial stem
- Make the patient fit the implant
- Difficult to revise if loose
- After 10 years: glenoid lucency 30-50%
  revision 5-10%

The birth of total shoulder arthroplasty





Surface replacement arthroplasty

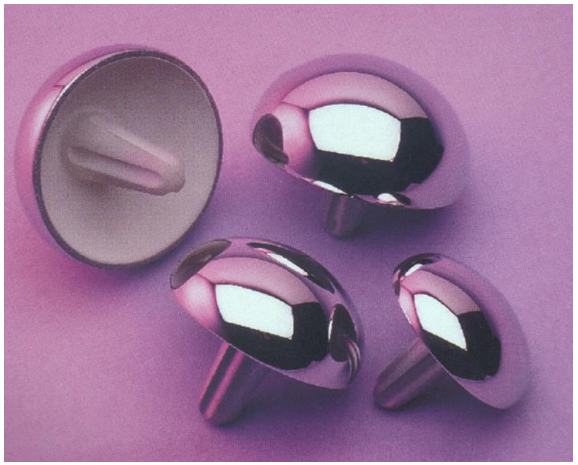
1980's Steve Copeland (Reading UK)

Stems were problematic

Large amounts of perfectly decent bone was being removed

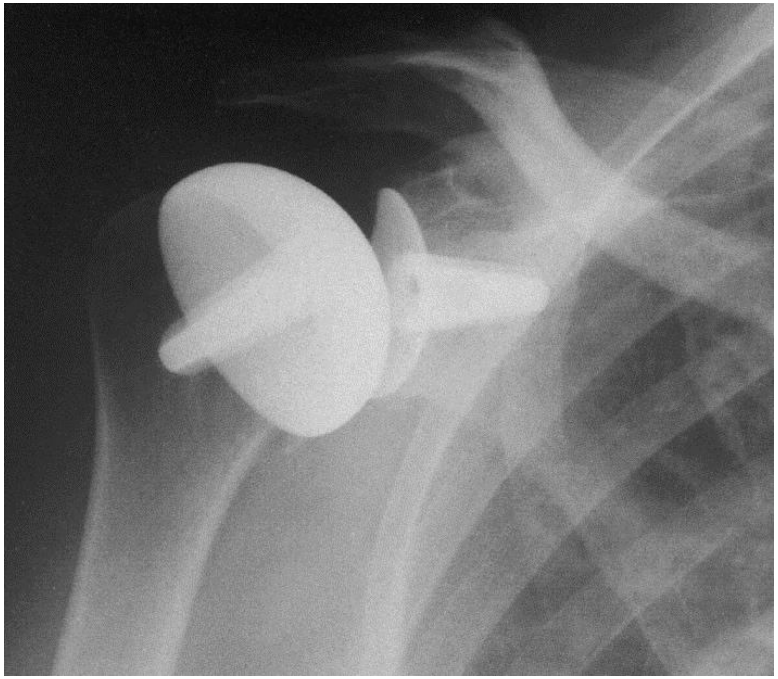
Surface problem only

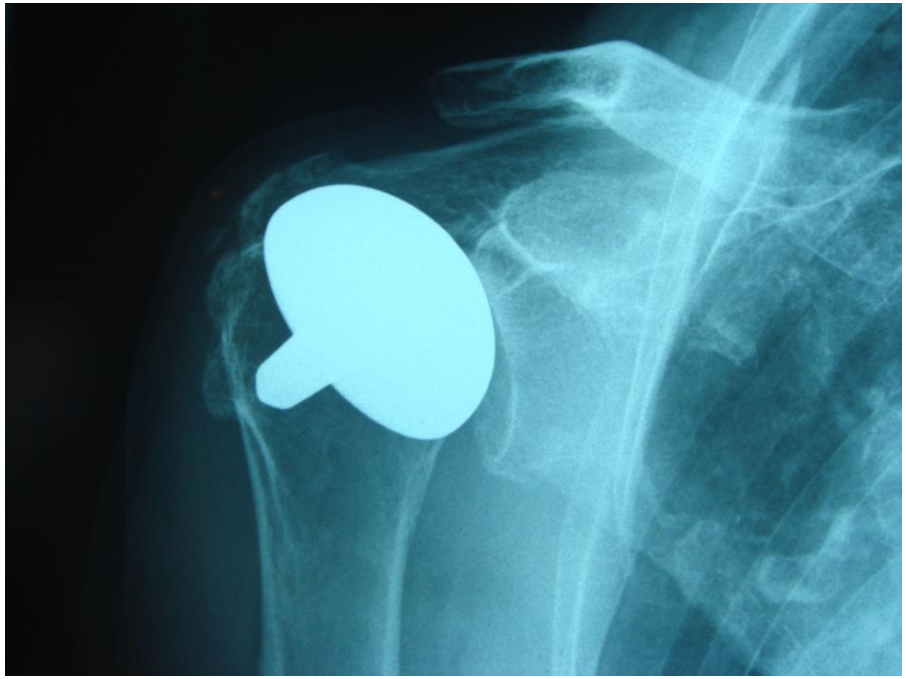
Access to glenoid difficult



Most were hemiarthroplasty

Surface replacement arthroplasty

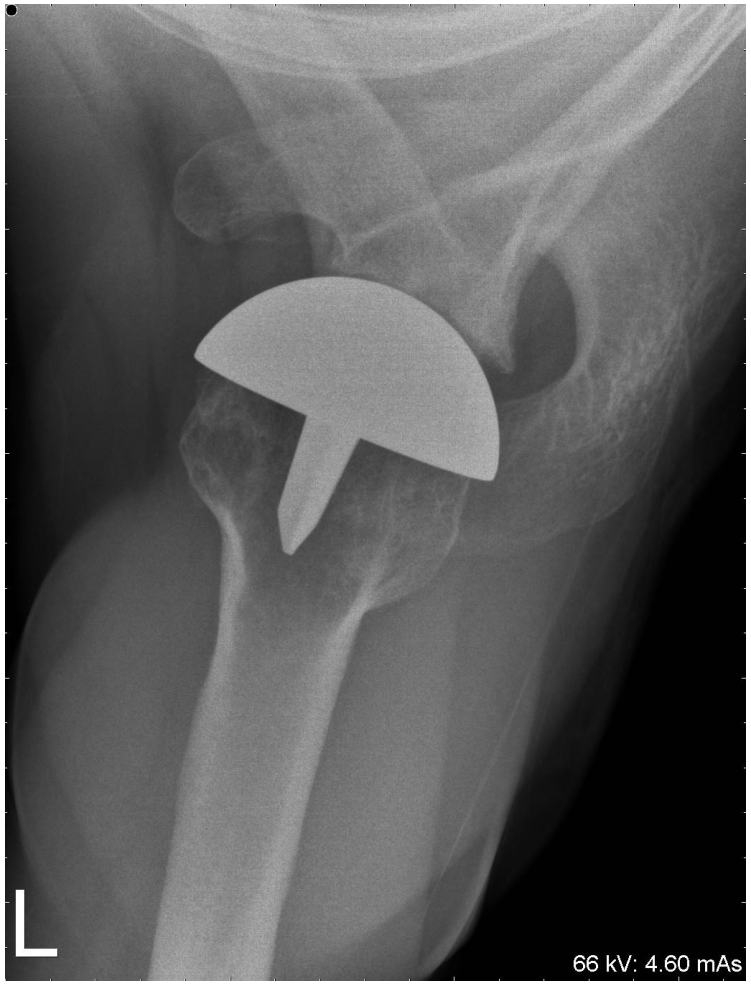




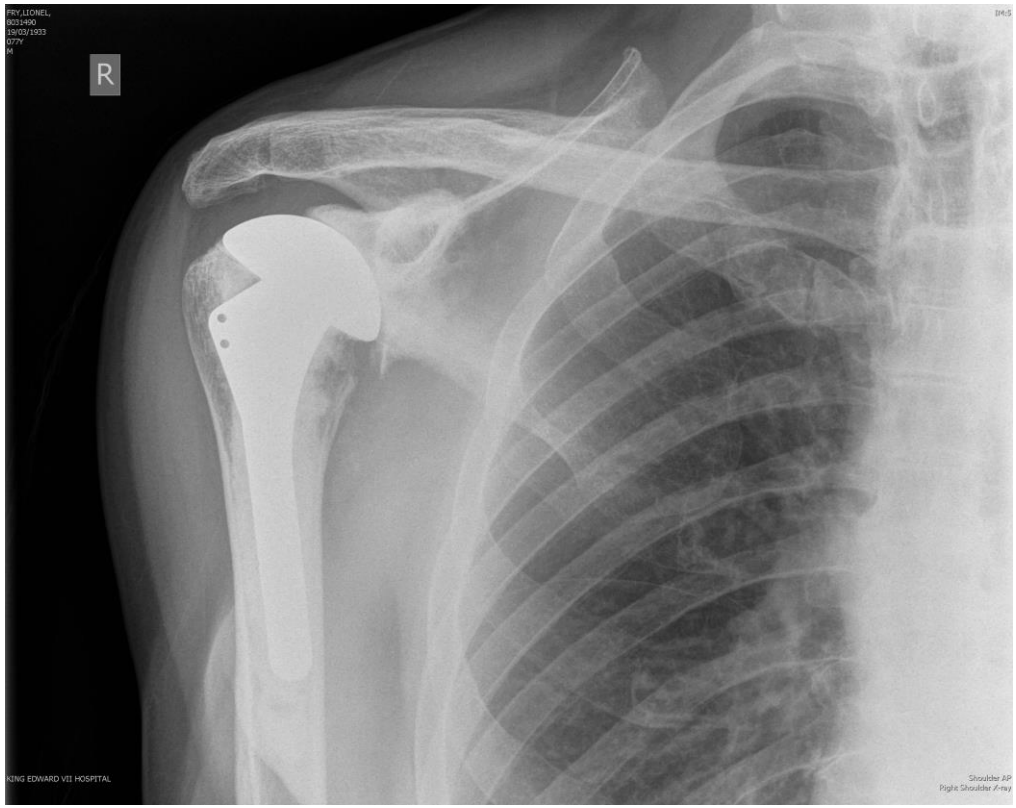
Issues with hemiarthroplasty

Pros	Easy and quick procedure
	No need for glenoid exposure
	Allows biologic resurfacing: ‘Ream and run’
	Modular implants make revision easy!
Cons	Pain
	Erosion
	Biological resurfacing doesn’t last
	Revision to TSR not so easy!

Issues with hemiarthroplasty



Issues with hemiarthroplasty



Second generation TSR

More options!

Modular humeral head sizes

Titanium cementless stems

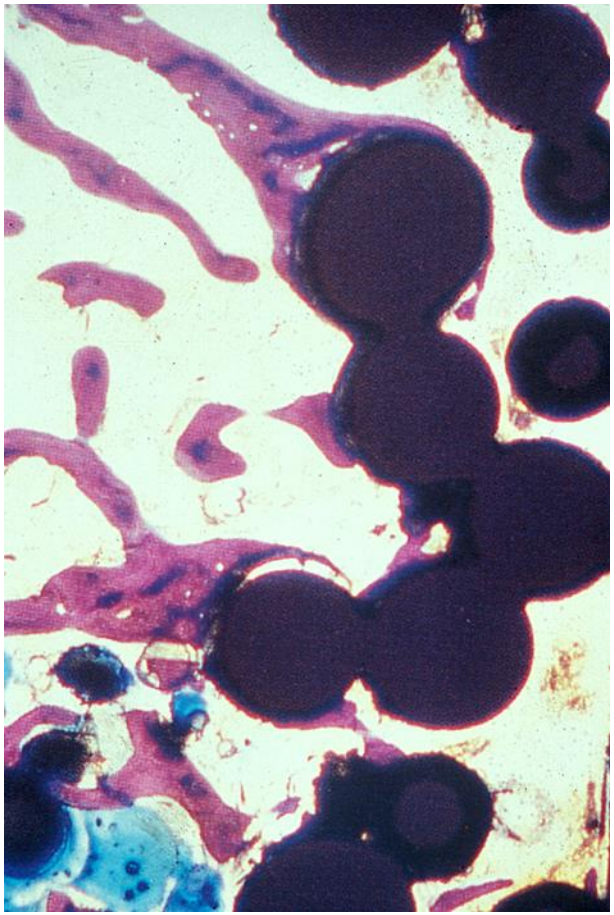
Ingrowth capability

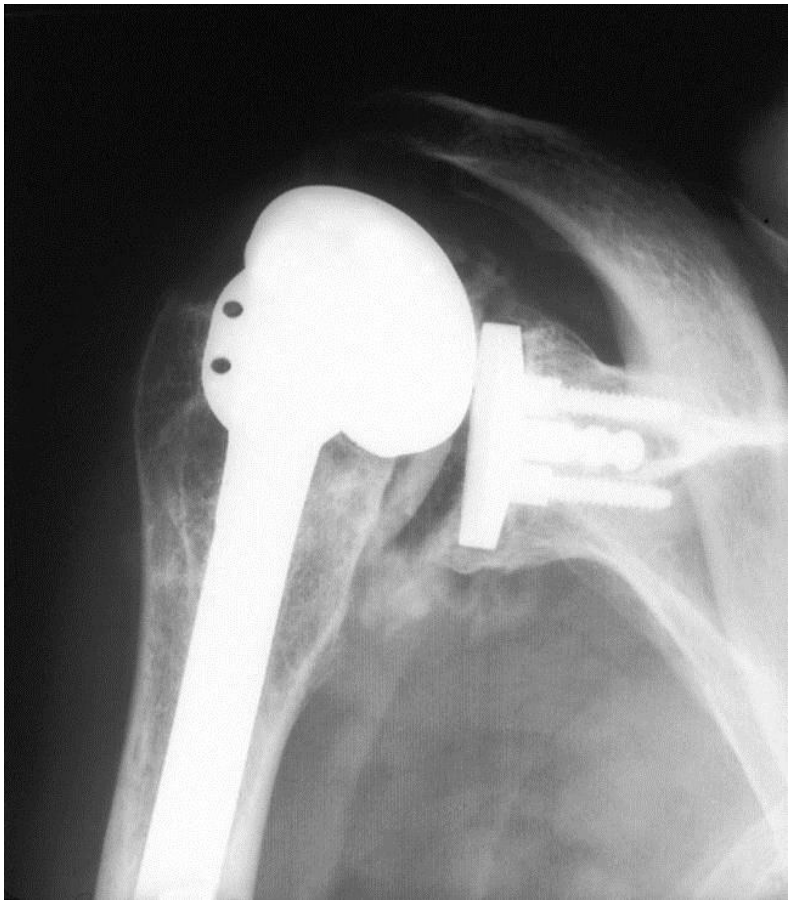
Glenoid design:

Pegged

Metalbacked polyethylene

Second generation TSR





Third generation TSR

Based on normal anatomy

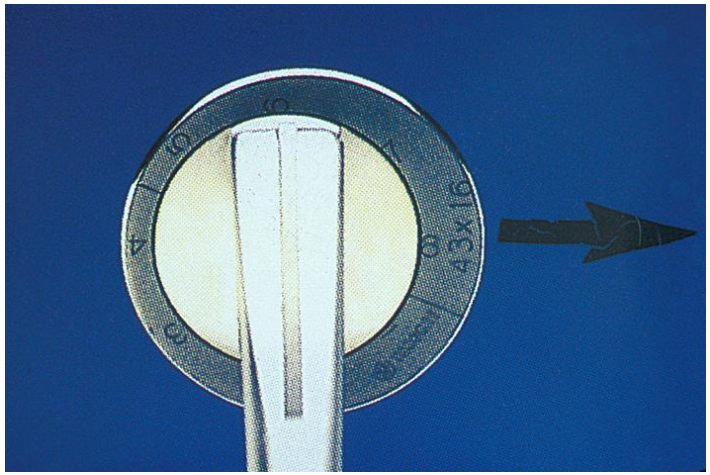
Variable!

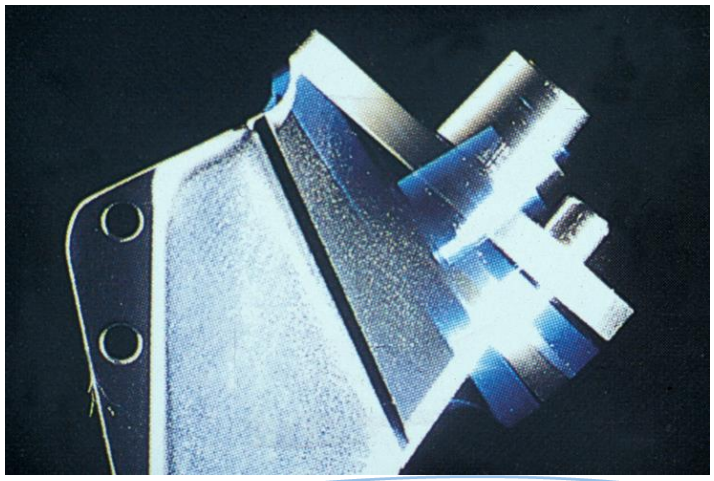
Offset humeral head

Variable neck shaft angle

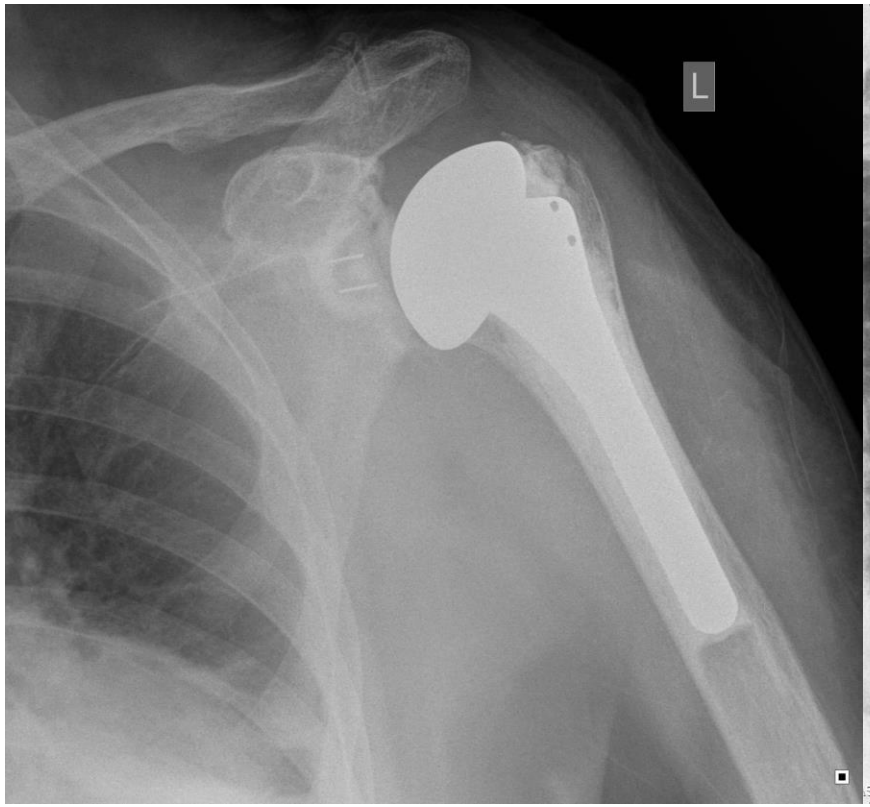
Shorter cementless stems

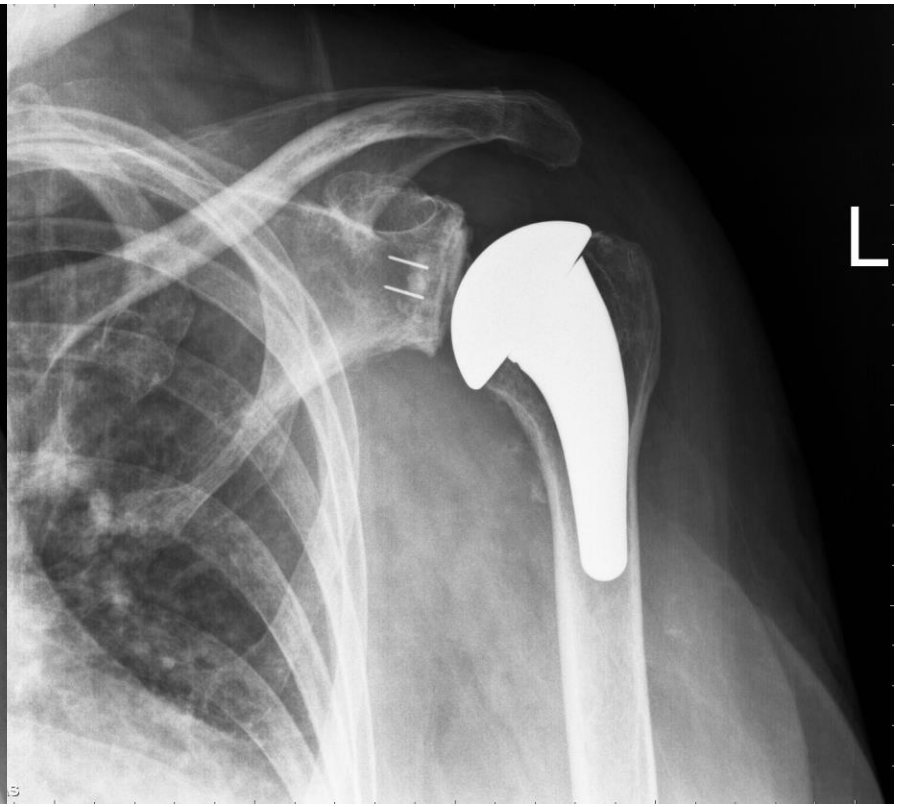
Make the implant fit the <u>patient</u>





Third generation TSR





Recent developments in TSR

Partial resurfacing

Stemless humeral implants

Trabecular metal (tantulum) composite glenoids

Newer bearing materials to reduce wear

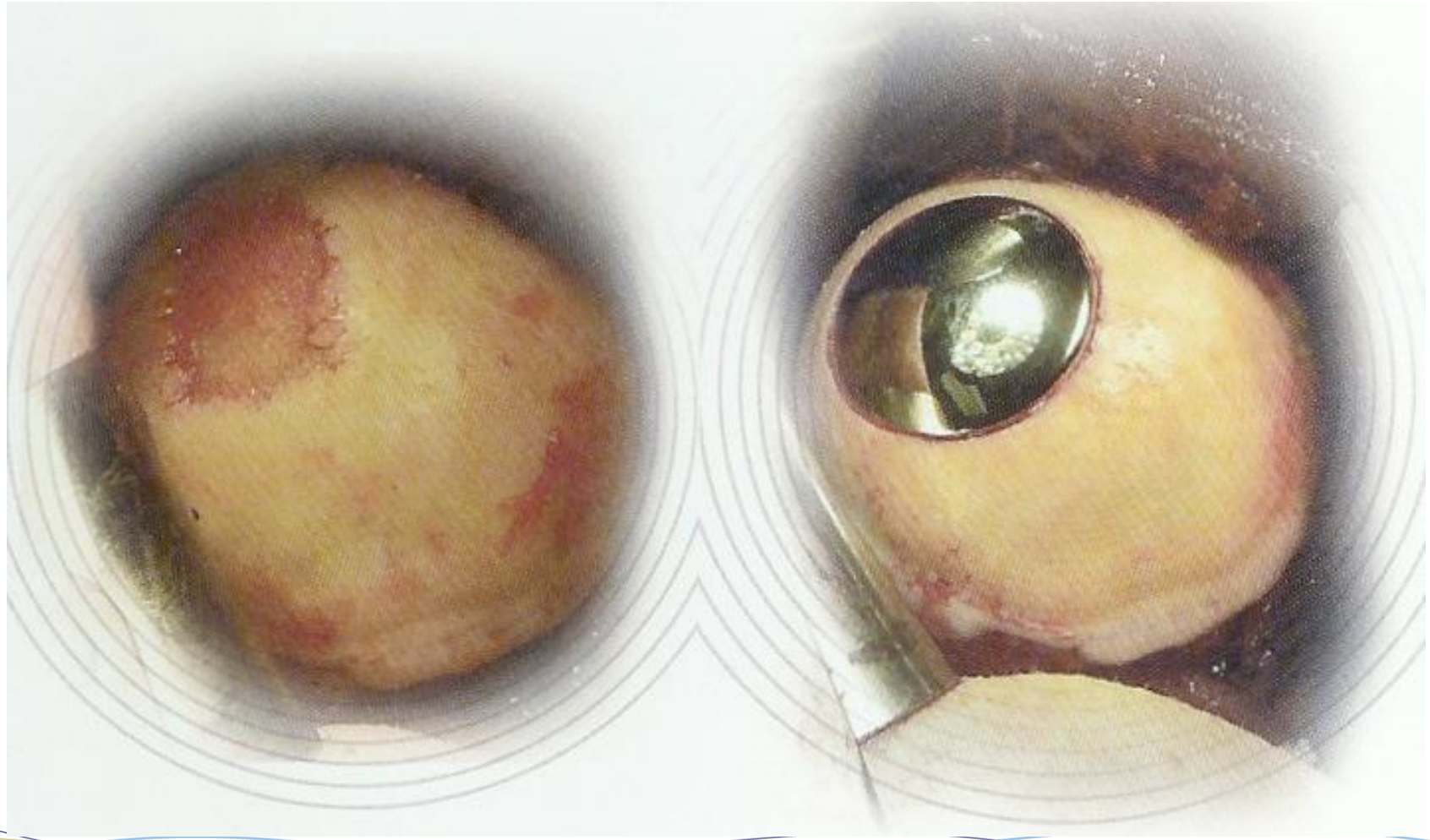
- ceramic
- pyrocarbon
- polyethylene (crosslinked, Vitamin E)

Computer guided navigation

Antibiotic impregnated spacers for infection

Partial resurfacing (Hemicap)

Partial resurfacing (Hemicap)



Outcome of ‘inlay’ partial arthroplasty

19 patients

Average age 48 years

Followup 3 years

ROM improved by 20-30 degrees in elevation and ER

90% satisfaction

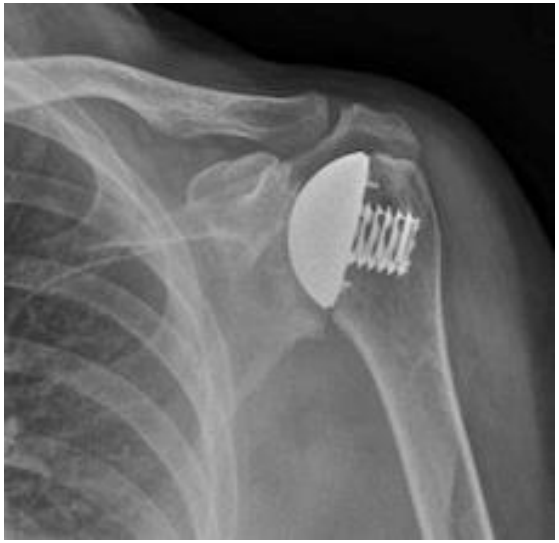
No loosening, fracture, osteolysis

Revisions: x 1 for glenoid wear

x 1 for infection and SSC rupture

Sweet et al 2015

Arthroplasty – current designs



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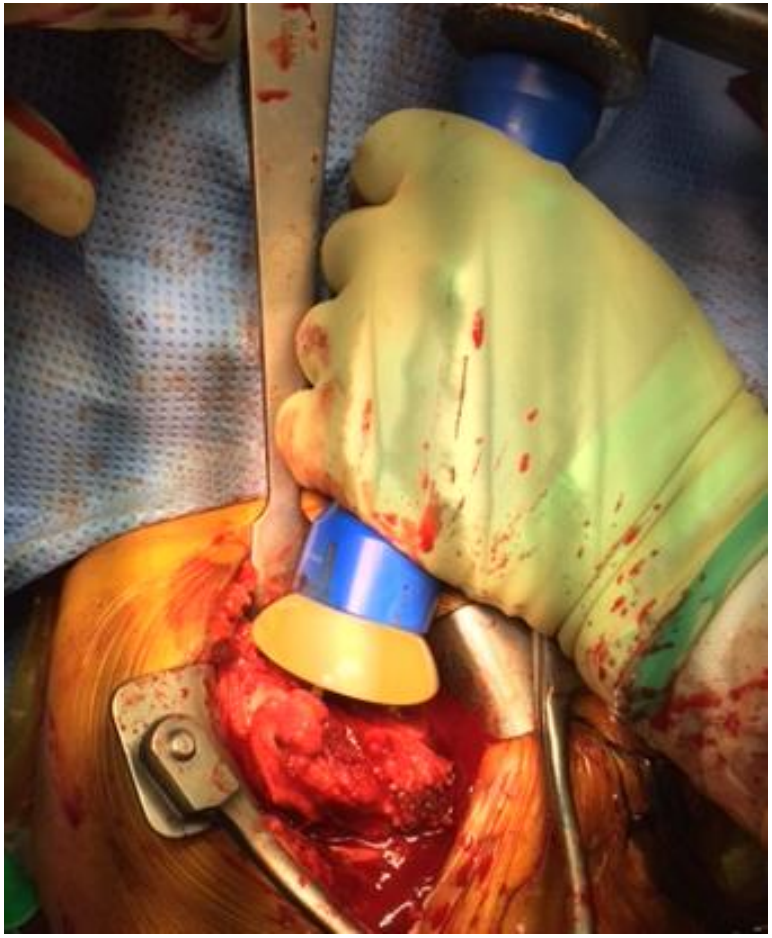

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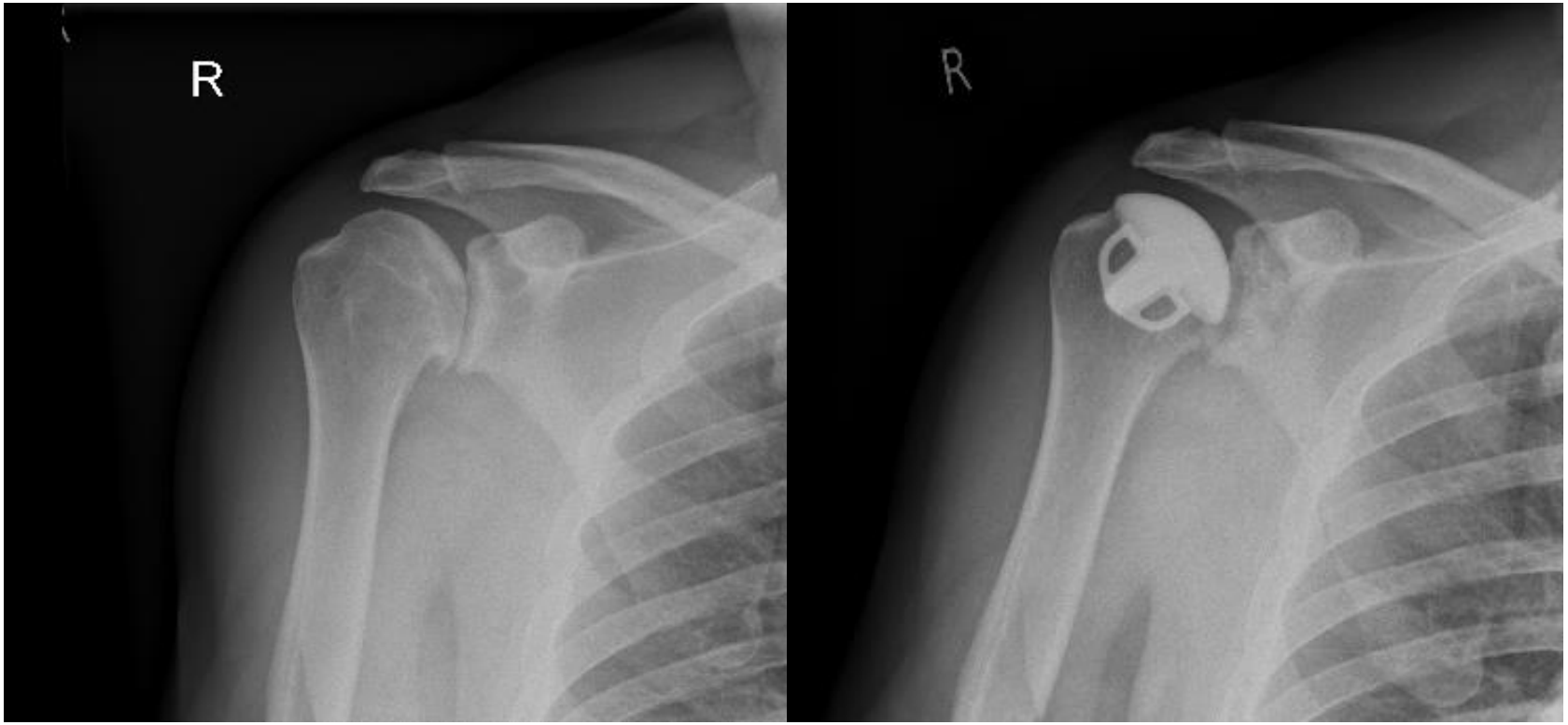


Challenges for current generation of TSR

Minimise bone resection

Replicate native anatomy

Secure fixation

Integration

Durable

Facilitate revision

Convertible

Cost effective

Rehabilitation

Phase I:	protect SSC repair (limit ER to 30)
(0-4w)	active assisted elevation (pulley)
	elbow and scapular setting
Phase 2:	resume driving
(4-8w)	progress to full range
	isokinetic strengthening
Phase 3:	conditioning for RTS
(8-12w)	swimming

Outcomes of TSR

Glenoid component at 8 years *(Kilian 2017)*

- radiographic lucency: 36% keeled; 44% pegged
- implant revision: 20% keeled; 7% pegged

Midterm results of 2nd Generation TSA *(Schoch 2017)*

7.5% reoperation rate for all causes (instability, infection, cuff failure, fracture, loosening)

Equates to a failure rate of 1% per year after 2 years

Survivorship 90% at 10 years

Glenoid lucency still an issue

Return to sport (Aim et al 2017)

Meta analysis of 613 patients

Mean age 72 years

Better than expected

Golf, tennis, swimming

81% overall return to sport

- 79% golf
- 76% swimming
- 64% tennis

Lower rate with reverse TSR

TSA – poor prognostic factors

Younger patient, especially male

< 65 years: 17% revised at 10 years

54% glenoid lucency

60% survivorship at 20 years

Obesity

Diabetes

Parkinson's disease

Smoking

TSR in cuff arthropathy

Cuff tear arthropathy

(Milwaukee shoulder)

End stage cuff disease

Painful, swollen

Severe wasting

Pseudoparalytic shoulder

Loss of fulcrum

TSR in cuff arthropathy

Reverse TSR in cuff arthropathy

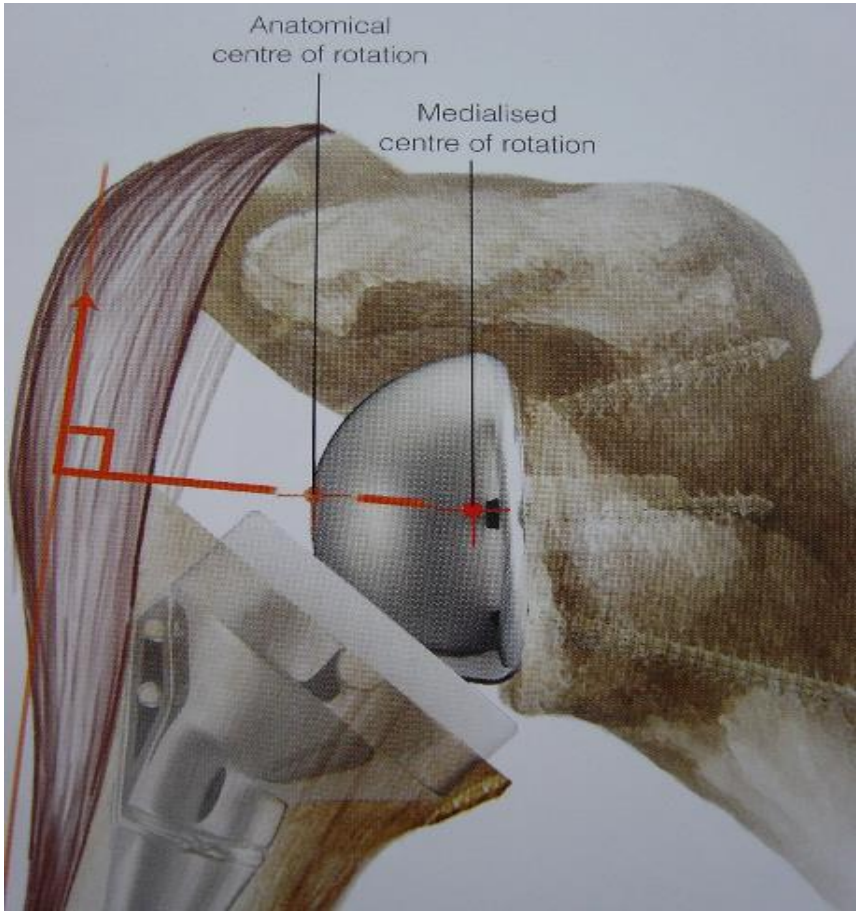
Grammont 1980s (Dijon, France)

M = F x d

Stable fulcrum

Less force needed for elevation

Limited rotation



Reverse TSA

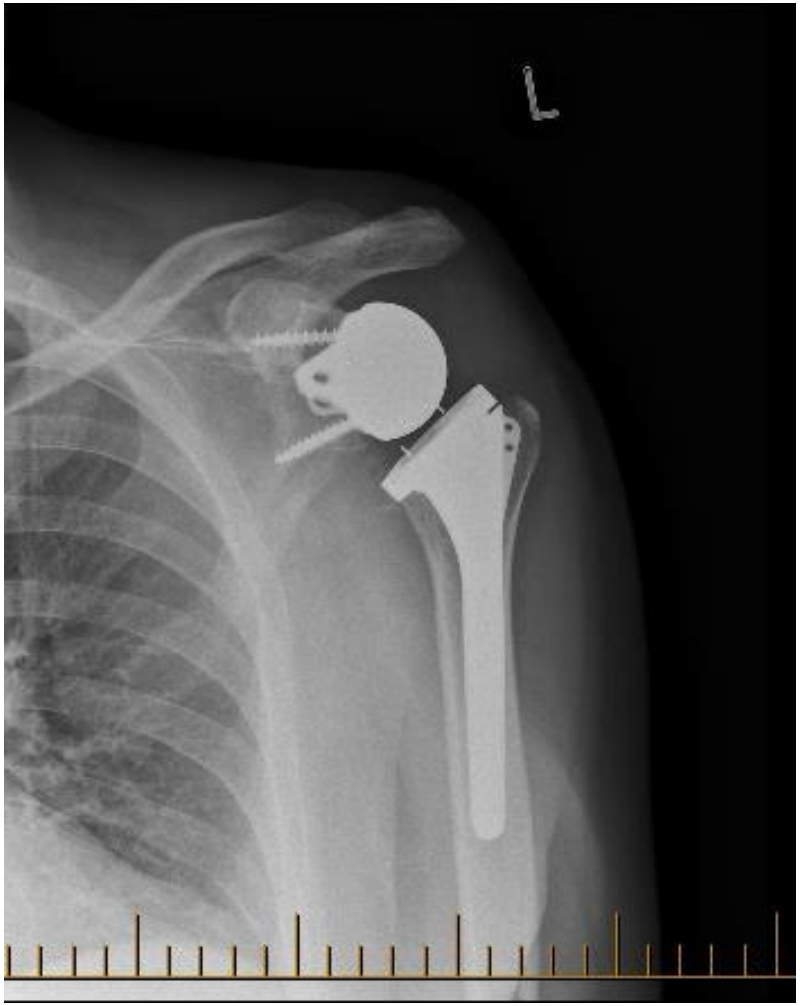
Pain relief

Overhead function

Rapid rehabilitation

Good for elderly patients

- CTA
- failed cuff repair
- fractures



Complications and challenges

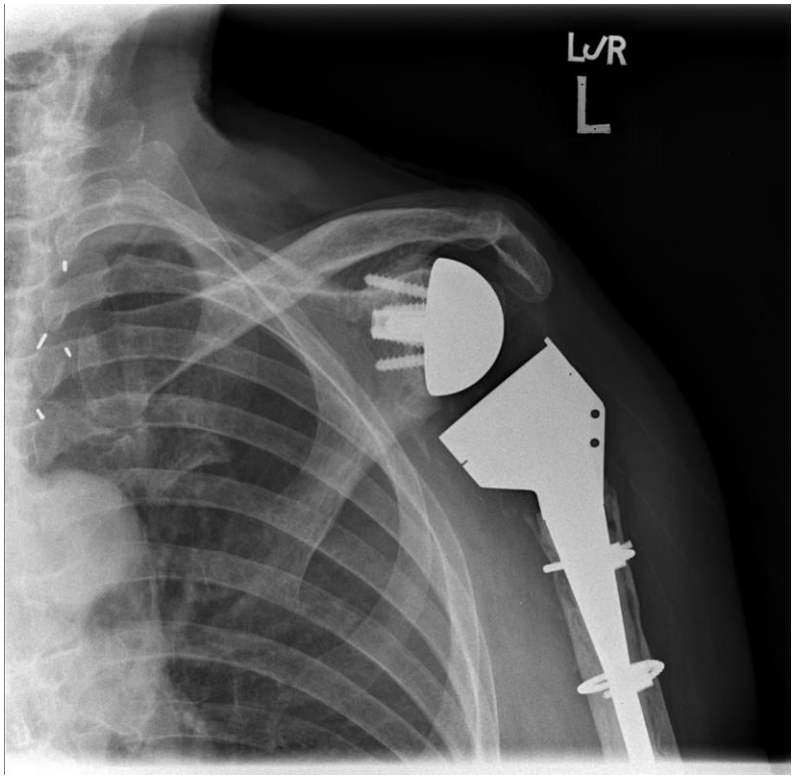
Deformity

Overtensioning of deltoid

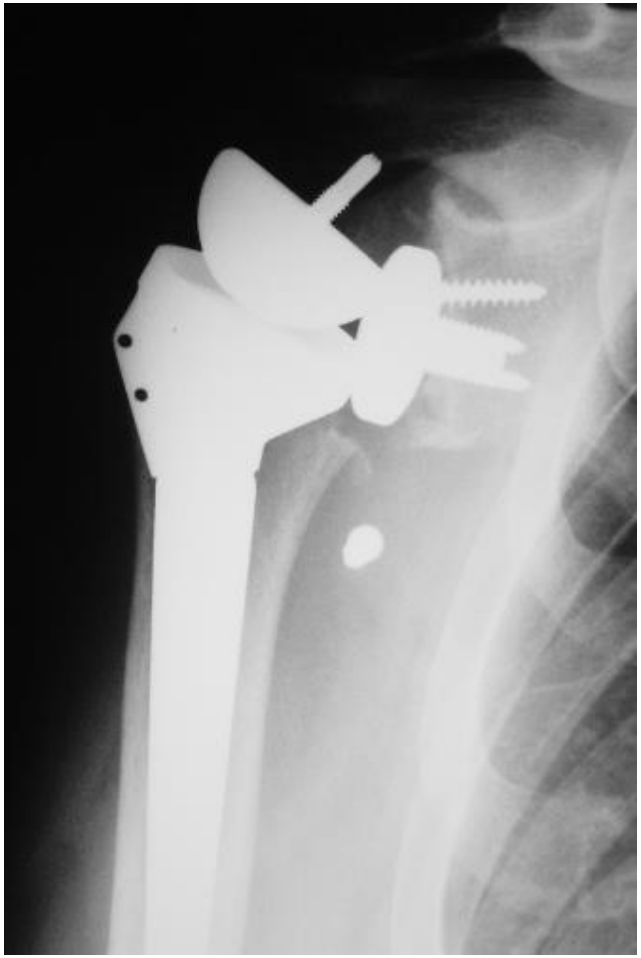
Scapular stress fracture

Infection

Instability



Complications – reverse TSR

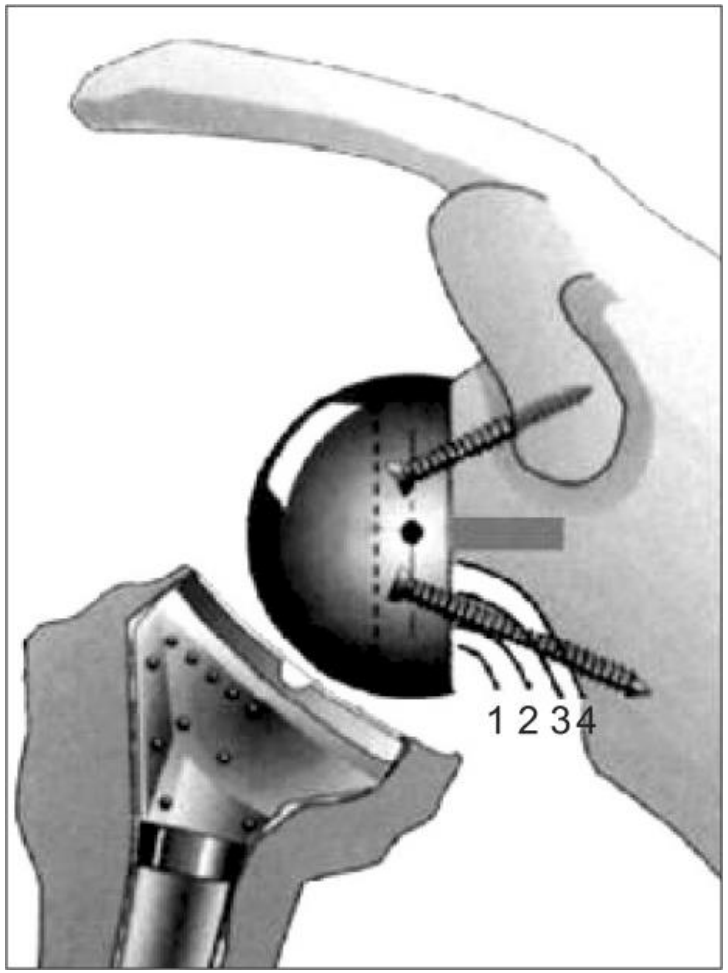


Complications – reverse TSR

Scapular notching

Premature liner wear

? Earlier loosening



Notching in reverse TSR

476 patients at a minimum of 2 years

Prevalence of 10%

Poorer clinical outcomes
Less strength
Less ROM
Higher complication rate

Mollon 2017

Developments – reverse TSR

Glenosphere size (36, 38, 39, 42)

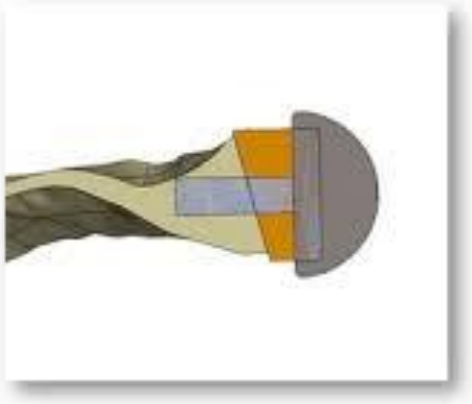
Neck shaft angle (135 vs 150 deg)

‘BIO’ (bony increased offset) reverse TSA

Inferior placement, tilting, eccentric glenosphere

‘Platform’ systems

Developments – reverse TSR



Rehabilitation of reverse TSR

Phase 1: (0-4 w)	active assisted elevation (pulley) supine rotation (stick) avoid full ER/IR
Phase 2: (4-12w)	active elevation and rotation elbow flexion/extension scapular setting
Phase 3: (12w +)	deltoid strengthening swimming return to activity

Outcomes of reverse TSR

Constant score:	25 to 83
Subjective shoulder value:	27 to 90%
Complication rate:	7-10%

Loosening: 1-2% at 7.5 years

Return to sport *(Liu 2016)*

- overall	86%
- tennis, golf	60%
- rowing, fishing	100%

Utility of national shoulder registries

Diagnoses

Patient demographics

Indications

Procedures

Prostheses

Revision (reason, rate, timing)

Globally > 250 000 entries

Incidence of shoulder arthroplasty / 10^5

Germany	34
Australia	16
New Zealand	16
Denmark	19
Sweden	13
Norway	10
UK	6
Netherlands	?

Conclusions

Shoulder arthroplasty is increasing

Indications are expanding

Patient expectations are high

Technology continues to evolve rapidly

Registries will have a important role

No implant yet lasts a lifetime

Glenoid durability still the weak link

Conclusions

The best outcomes can be achieved by…

the right patient	30%
the right surgeon	30%
the right therapist	30%
the right implant	10%

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Excellence in orthopaedic and sports injury treatment