B2 Glenoid Bone Loss and Shoulder Arthroplasty: Bone Grafts and Augmented Glenoid Components

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Presenter Disclosure Information

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Bone Grafts and Augmented Glenoid Components

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Disclosure Information
The following relationships exist:
- DePuy/Johnson and Johnson: Consultant, Royalties
- Biomet: Consultant, Royalties
- Sonoma Orthopaedics: Consultant, Royalties
- Invuity: Consultant, Stock Options
- BioPoly: Consultant, Stock Options

Nothing of value received for this presentation
No "off label" use of any products

Glenoid Bone Loss in Osteoarthritis

- OA is the most common indication for TSA
- At least 75% of patients have some posterior bone loss resulting in increased glenoid retroversion
- In patients with severe OA, mean glenoid version of 11° retroversion (range 2° anteversion to 32° retroversion)
  - *Freidman, et al, JBJS, 1997*

General Rules

- Bone loss must be addressed
- Glenoid rim erosion encompassing greater than 25% to 30% of the articular surface requires grafting
- Correct glenoid retroversion to < 10 degrees
  - ideally < 6 degrees

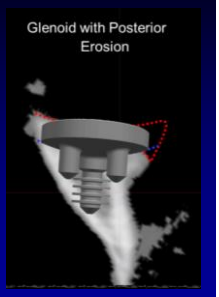
Options for Management of Posterior Glenoid Bone Loss in OA

- Ream the high side to correct version
- Use a bone graft to correct version
- Use a custom implant to correct version
- Reverse total shoulder arthroplasty

Place the humeral component in anatomic version

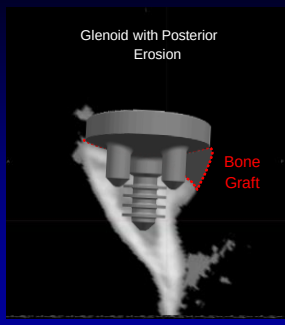
Problems with Eccentric Reaming

- The maximum amount of retroversion that can be corrected with eccentric reaming is 15 degrees
  - *Warner, et al, JSES, 2007;16:843–848*
- Medialization of joint line
- Cuff weakness
- Creates smaller glenoid
- Can result in significant head/glenoid mismatch



Bone Grafting

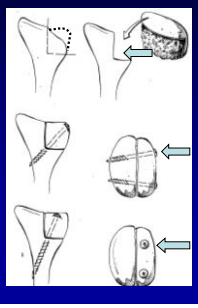
- Restores the original glenoid plane
- Malunion, non-union, and increased surgical time
- 10 fold higher failure rate than normal TSA

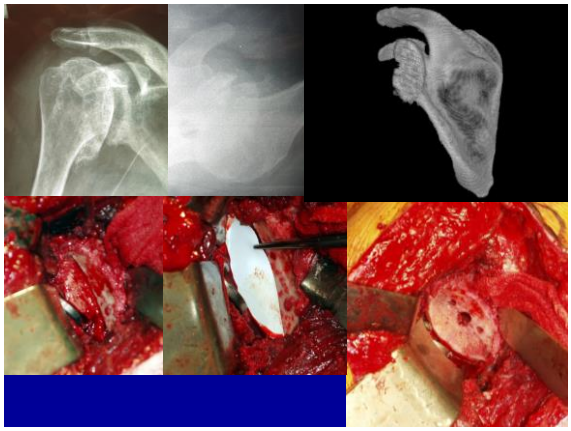


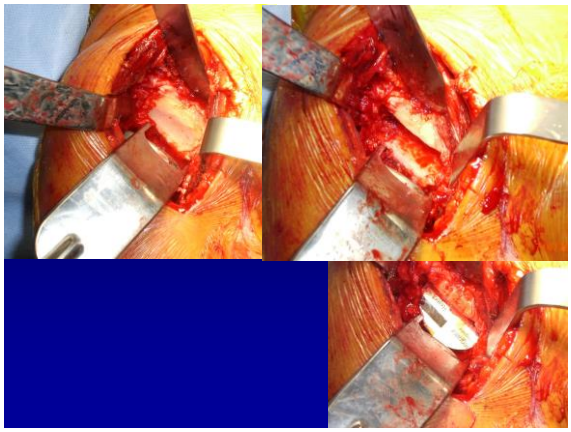
Cuomo, F., Checroun, A. "Avoiding Pitfalls and Complications in Total Shoulder Arthroplasty. Orthop Clin North Am. 1998; 518.

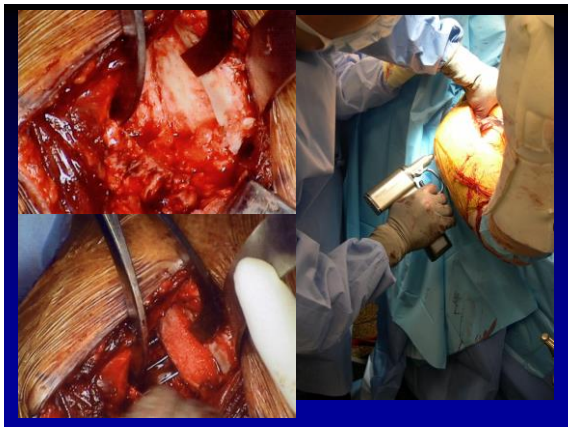
Severe Glenoid Erosion Use of a Bone Graft

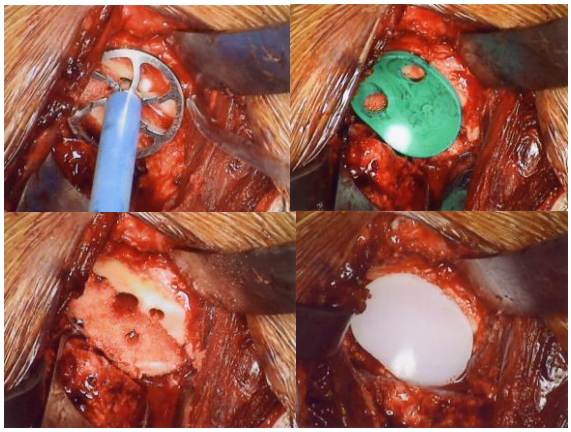
- Greater than 1 cm.
- Bone graft
  - Humeral head
  - Iliac crest graft
- Screw fixation
- Avoid cement wedges





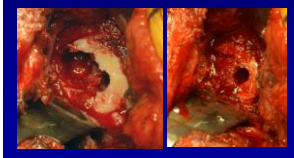


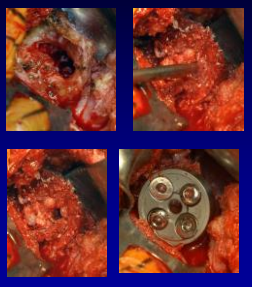




Bone loss with Reverse TSA

- Bone loss
  - Glenoid
    - Reaming
    - Cancellous grafting





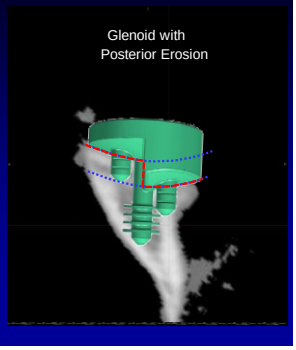
Use of a RTSA

- Problems:
  - In my experience, most of the posterior erosion cases are in active males
  - What do you do with a younger (<70) male with an intact rotator cuff who wants to remain as active as possible?

Can you use an augmented glenoid?

Augmented Glenoid

- No medialization
- No implant undersizing
- No need to bone graft
- Re-establishes normal joint line
- Returns cuff to normal tension

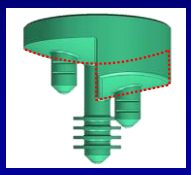


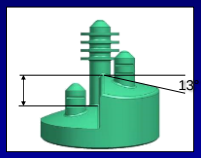
Design Rationale

- Addresses posterior glenoid erosion
  - Walch Type B2
- Same peg fixation design as the Anchor Peg Glenoid
  - Central fluted interference fit peg
  - Two inferior pegs
  - One superior peg
- Novel instrumentation
  - Accurate placement, orientation, and precise bone preparation

Design Rationale (cont.)

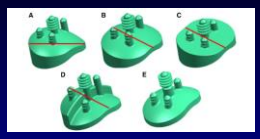
- Spherical anterior backside
- Conical posterior backside (13 degree angle)
  - Design effectively counteracts posterior loading

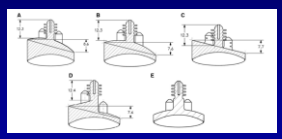




Optimal Augmented Design

- Question:
  - Is there an optimal design that counteracts or minimizes the deforming forces on the glenoid component?

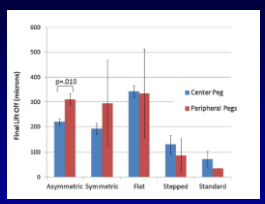




Iannotti, et al, JSES, 2013, 22, 1530-1536

Optimal Augmented Design

- The “stepped” design was the only design that showed no increase in lift off of the component compared to a standard glenoid



Iannotti, et al, JSES, 2013, 22, 1530-1536

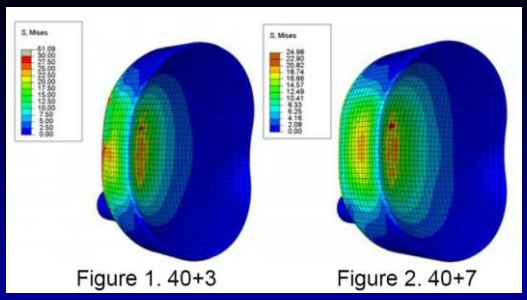


Figure 1. 40+3

Figure 2. 40+7

Size Range

+7mm +5mm +3mm

Amount of Possible Correction

Table III Mean pathologic version and medialization for each glenoid augment size compared with the standard glenoid

Step glenoid augment	Mean pathologic retroversion	Mean medialization, augmented glenoid, 0°	Mean medialization, standard glenoid, 0°	Significance of medialization difference between groups	Mean medialization, augmented glenoid, 6°	Mean medialization, standard glenoid, 6°	Significance of medialization difference between groups
+3 (n = 7)	−9.5° ± 5.1°	−1.5 ± 1.6 mm	−3.5 ± 1.7 mm	$P = .04$	−1.2 ± 1.7 mm	−2.3 ± 1.6 mm	$P = .2$
+5 (n = 7)	−17.5° ± 5.7°	−2 ± 1.9 mm	−6.7 ± 1.8 mm	$P < .001$	−1.2 ± 1.3 mm	−5.4 ± 1.8 mm	$P < .001$
+7 (n = 15)	−27.9° ± 7.9°	−6.1 ± 3.1 mm	−11.7 ± 2.9 mm	$P < .001$	−4.7 ± 2.9 mm	−10.3 ± 3 mm	$P < .001$

Mean pathologic version and medialization at both neutral and 6° retroversion for each augment size. Mean medialization comparisons were made between each augment component size and the medialization of the standard component fit to the same patient. Significance of the medialization difference at both neutral and 6° retroversion was calculated. The mean medialization of the +3 augmented component compared with the standard component was the only difference that did not reach significance.

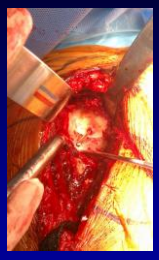
Augmented glenoids allowed correction up to 27.9 degrees (±7.9 degrees) with no significant medialization

Sabesan, et al, JSES, 2014, 23, 964-973

Surgical Technique

Glenoid Exposure
Walch B2

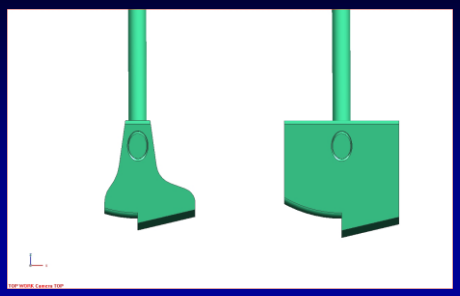
Anterior Reaming



Posterior Guide

Oscillating Rasp

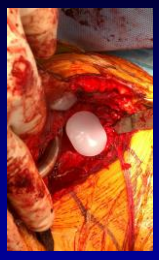
Glenoid “Hoes”



Posterior Step

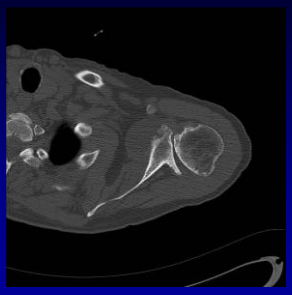
Peripheral Drill Holes

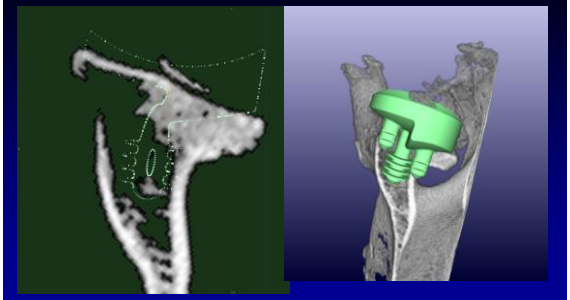
Final Implant

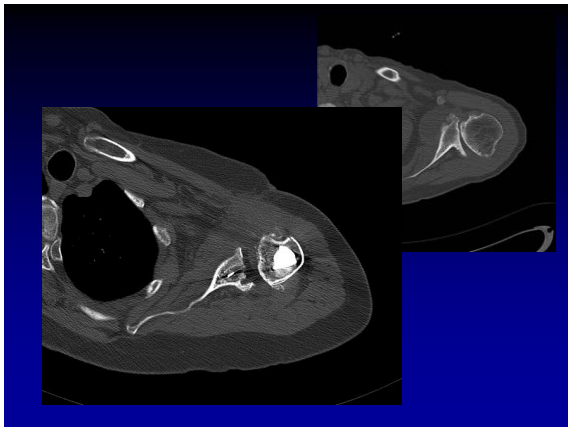


Case Example:
60 year old female

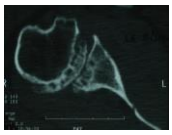
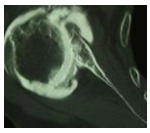
Posterior glenoid erosion





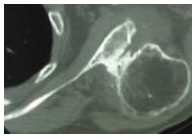
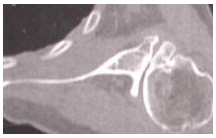


Thanks!

HOW TO DEAL

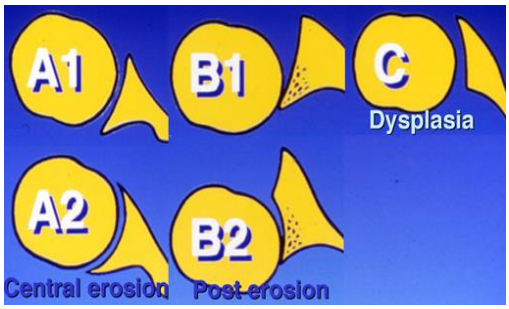
WITH B2-B3 GLENOID ?

Vumedi Webinar Feb 17, 2015

Disclosure

- Royalties: TORNIER
- Equity: IMASCAP
- Board of the French Orthopedic Society



J Arthroplasty 1999

« This classification is not accurate & reliable »
(Scalise & Iannotti)

Pb with degree of retroversion

Type C (dysplasia) is > 25°

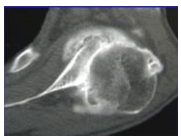
Type B2 (2ary erosion) can also be > 25°

B2 glenoid is the consequence of

1/ static posterior subluxation of the HH

2/ secondary erosion of the posterior part of the glenoid

Need to have the proof of <u>secondary</u> posterior wear



- see the paleo glenoid
- subluxation of the HH

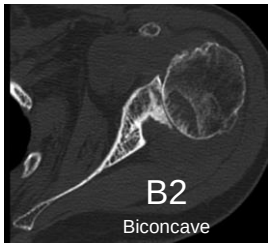
(degrees of retroversion is not part of the diagnostic: 15 to 60° …)

B2 and A2 are sometimes confused if the paleo glenoid is absent

Paleo glenoid not always visible

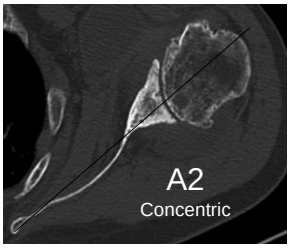
- level of the cut
- osteophytes' anterior reconstruction
- severe erosion and minimal subluxation

concentric or eccentric glenoid…

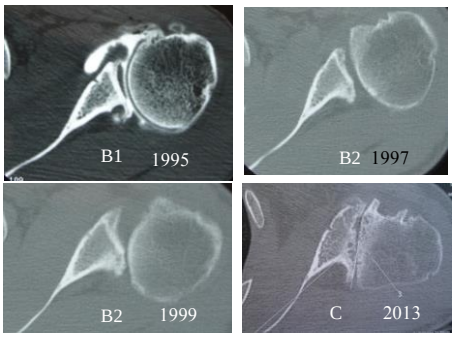


1/ level of the cut may change the glenoid shape

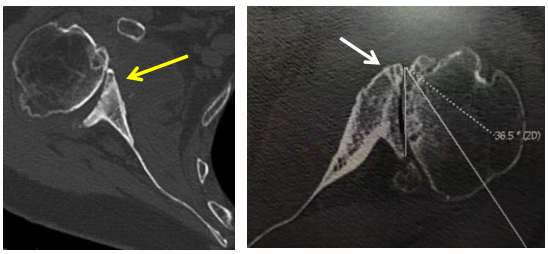
Same patient at 2 ≠ levels



2/ osteophyte's anterior reconstruction
Biconcave becomes concentric…

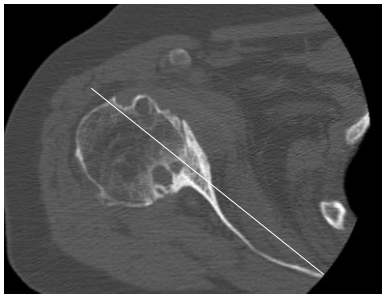


Osteophyte's anterior reconstruction
Eccentric glenoid becomes a concentric one !



3/ Severe erosion – minimal subluxation

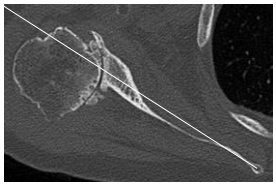
concentric glenoid but severe RV

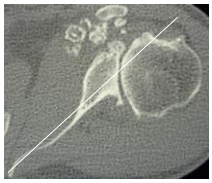


Introduction of
B3 glenoid

- No paleo-glenoid (concentric glenoid, no biconcavity)
- Glenoid erosion & retroversion > 15˚
- Posterior subluxation of the HH > 70%

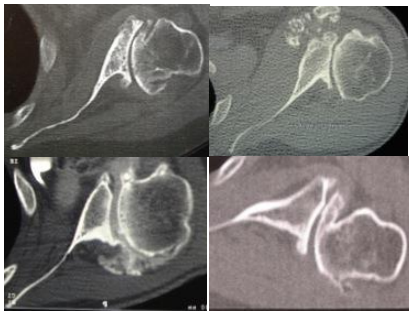
B3 Glenoid





HH subluxation > 70%
Retroversion > 15˚
No paleo-glenoid
Concentric glenoid

Types B2 - B3 How to address ?

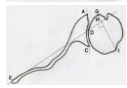


B2 and anatomic TSA 1992-2007
92 cases - 77m f-up
(Eccentric reaming, bone graft, post capsulorraphy, hum antev.)

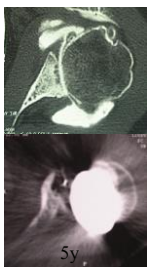
- **66.3% sastisfied or very satisf.**
- **16.3 % Revisions**
- **20.6% glenoid loosening**

Intermed. glenoid RV > 27° = 50% complic

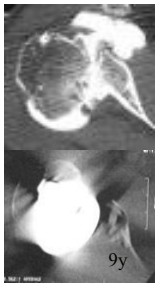
Sublux / scapula > 80% = 50% complic



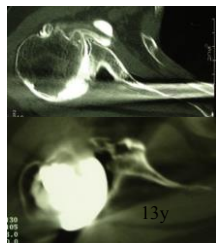
Static posterior subluxation recurs ⟶ glenoid loosening (rocking horse)



Case 1

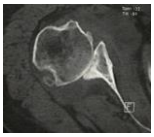


Case 2



Case 3

B2 and Reverse SA 1998-2009
27 cases – 54 m f-up



81% females

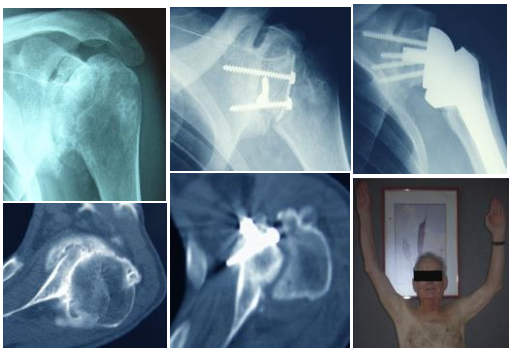
Mean age: 74.1 yo (66-82)

17 dominant shoulders (63%)

Exclusion criteria

Rotator cuff tear (2 tendons or more), Cuff tear arthropathy, Post traumatic arthritis Rheumatoid arthritis,

Reverse Prosthesis (2 stages)



Structural bone graft (1 stage)

	Preop.	Postop.	p value
Pain	4	14	< 0.0001
Activity	7.9	18.5	< 0.0001
Mobility	14.2	35.1	< 0.0001
Strength	4.5	8.7	< 0.0001
Total	30.6	76.3	< 0.0001

93 % Satisfied or very Satisfied, 7 % Disappointed

	Preop.	Postop.	p value
AFE	89°	152°	< 0.0001
RE1 A	3°	27°	< 0.0001
IR	Buttocks	T12	< 0.0001

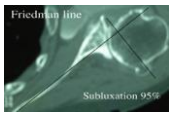
SSV 81.7%

All the graft but one healed, no glenoid RLL

- Scapular notching: 10 cases (37%)
  Grade 1: 6, Grade 2: 4, Grades 3 & 4: 0
- Humerus Radiolucent lines: 2 (8.3%)
  Humerus zone 1: 1, zone 7: 1

Current indications for Reverse in B2-B3 glenoid

- Subluxation HH / scapula > 80%



- Failure to implant correctly a PE glenoid
  - Glenoid RetroVersion > 10°
  - Glenoid reaming > ½ suchond bone surf
  - Seating < 80%

Thank you !

Tricortical Iliac Crest Bone Grafts

VuMedi Webinar:
Bone Loss in Shoulder Arthroplasty
February 17, 2015

Tom R. Norris MD

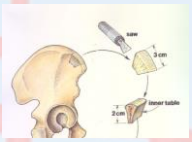
COI Disclosure

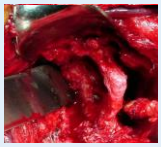
- Tom R. Norris, MD
  - Tornier, Inc.
  - Consultant, stock, royalties, designer, fellowship support
  - Disclosure information on AAOS website and updated 4x/y

Aequalis Adjustable Reversed Extension Project

Glenoid Bone Loss

- Salvaging a failed shoulder arthroplasty with glenoid bone loss is a technically challenging procedure.
- Iliac crest can allow for successful one stage reconstruction of the glenoid vault in cases of massive glenoid bone loss.



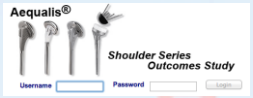



SAN FRANCISCO shoulder elbow & hand CLINIC

Tricortial iliac crest bone graft for massive glenoid bone loss during revision shoulder arthroplasty 2yr follow up

Mark A. Schrumpf MD,
Tom R. Norris MD
ICSES 2013 Nagoya, Japan

Methods



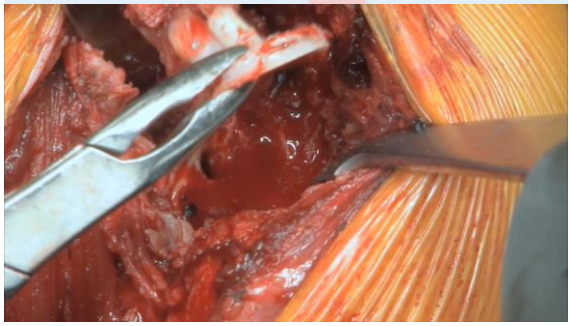
- Database search was performed of a single surgeon's case log from '05-'10
- Patients who underwent reconstruction of the glenoid vault in a single stage revision surgery were identified
- All patients were revised to a reverse shoulder prosthesis.
- Data was collected in a prospective fashion for ASES, Constant, WOOS, SANE and patient satisfaction.

Reconstruction Technique

- Deltopectoral approach used to retrieve all failed implants
- Recipient glenoid was freed of any soft tissue while taking care to protect bone stock
- Iliac crest was prepared in-situ and baseplate implanted in graft
- Graft cut free of pelvis and fixed to scapula with baseplate screws



TICBG



Results

- 23 shoulders were treated in 21 patients
- Average clinical follow up of 27 months
- Patient had undergone an average of 3 prior open shoulder surgeries (max 15, min 1).

Clinical scores

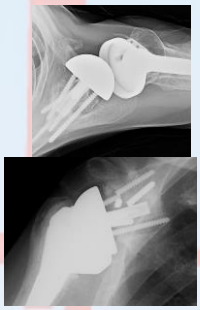
- ASES scores improved from 62.9 to 68.3 (p=0.07)
- Constant improved from 37.0 to 44.2 (p=0.07)
- SANE improved from 32.7 to 41.7 (p=0.36)
- WOOS scores changed from 62.2 to 48.2 (p=0.02)
- Patient satisfaction levels improved by 16.3% (p=0.03)

Range of motion

- Range of motion improved in all directions except active external rotation.
- AFF increased from 87° to 105° (p=0.06)
- AAB increased from 76° to 103° (p=0.01)
- Internal rotation also improved from between the buttocks and lumbosacral junction to between the lumbosacral junction and L3.
- Active external rotation decreased only slightly from 20° to 17° (p=0.65)

Results – graft healing

- 14 of 23 grafts healed completely, an additional 3 had partial incorporation of the crest graft.
- There were only 6 frank graft failures



Complications/Reoperations

- Unfortunately , 11 of the 23 (48%) shoulders required re-operation and removal of some or all of their glenoid components during the follow up period.
  - 3 of the shoulder were revised for base-plate loosing
  - 2 for fracture of the glenoid following low energy trauma
  - 3 for infection
  - 1 for graft non-union
  - 1 for graft fracture
  - 1 for glenosphere baseplate disassociation.
- Three patients had humeral complications with fractures of the shaft around the humeral stem necessitating intervention highlighting the complex nature of this group of patients.

Discussion

- This is a complicated and heterogeneous group of patients for whom glenoid bone loss is only one of the challenges faced in restoring shoulder function.
- The overall all cause reoperation rate was high (48%)
- 14/23 (61%) of the bone grafts healed completely to the native scapula and an additional 3 had some incorporation for a total of **74% adequate graft healing**. This procedure represents a viable option for single stage revision for massive glenoid defects.

Clinical results of revision shoulder arthroplasty using the reverse prosthesis

James D. Kelly II, MD[a,*], Jeff X. Zhao, DO[b], E. Rhett Hobgood, MD[c], Tom R. Norris, MD[a]

Journal of Shoulder and Elbow Surgery

J Shoulder Elbow Surg (2012) 21, 1516-1525

- 12 ICBG (12/30 RSA in study)
- Average F/U 34 mo.
- FOS, AFF, AAB significantly increased
  - Adj Constant: 24.3-64.6
  - ASES: 54.8-71.8
  - AFF: 42.0-105.7
  - AAB: 39.4-97.7

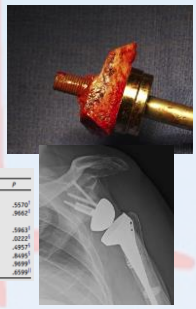
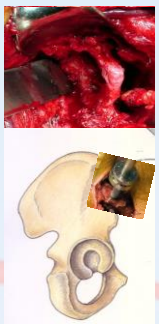


Table V Patient subset with tricortical iliac crest bone grafting (change in variable)

Measure*	With TICBG (n = 12)	Without TICBG (n = 18)	Difference	P
Constant score				
Total	33.3 ± 22.8	28.9 ± 13.1	4.4 ± 17.6	.5570[†]
Adjusted	0.4 ± 0.3	0.4 ± 0.2	0.0 ± 0.2	.9682[†]
ASES				
Total	19.4 ± 14.5	15.5 ± 11.2	3.9 ± 12.6	.5983[†]
Pain	−6.5 ± 2.0	−4.0 ± 3.2	−2.5 ± 2.8	.0222[†]
AFF	57.1 ± 50.1	68.1 ± 37.0	−11.0 ± 42.6	.4957[†]
AFE	1.8 ± 20.7	0.2 ± 24.9	1.7 ± 23.3	.8695[†]
AAB	57.9 ± 44.7	58.4 ± 31.3	−0.5 ± 37.2	.9699[†]
Satisfaction, %	9 (75.0)	15 (83.3)		.6599[‡]

1st Conclusions

- This procedure represents a viable option for single stage revision for massive glenoid defects.
- While this is a complex and difficult group of patients to treat owing to bone loss and multiple prior operations, significant and durable improvements in satisfaction, range of motion and functional scores can be obtained by using iliac crest to reconstruct the glenoid.

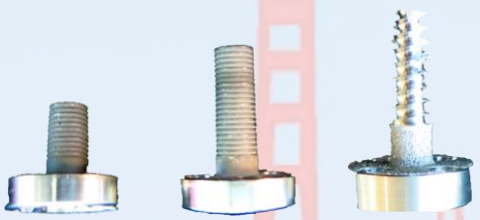


How to improve results?

- Base plate options
- Glenoid anatomy may determine 1 or 2-stage

Design advances
Ingrowth, locking screws

Long post base plate to engage native scapula with bone grafts



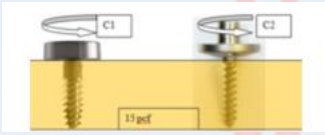
SPBP

LPBP

THREADED or SCREW-IN BP
25-50 mm screw length

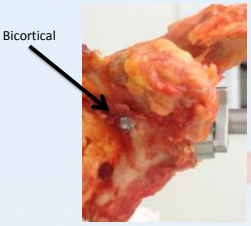
Base plate advances

- Base plate designs-one or multi-piece
- Fixation to native scapula with grafts
- Textures or ingrowth coatings
- **Threaded BP 10-18x torque/compression**
- Length options for **bi-cortical fixation and grafts**



Threaded Post Baseplate

- Fixation achieved at base of glenoid vault



GBL

Norris TR, Abdus-Salaam S. Lessons learned from the Hylamer experience & technical salvage for glenoid reconstruction. In: Walch G, Boileau P, Mole D, Favard L, Levigne C, Sirveaux F, editors. Shoulder concepts 2010: the glenoid. Montpellier: Sauramps Medical; 2010. p. 265-78. ISBN 978-2840232735

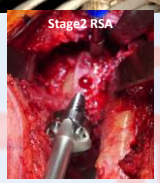
Global Glenoid loss (**GBL type 3**)



- **Sideways TICBG**
- Structural allograft
  - Femoral head, neck or shaft
  - Humeral head when using proximal humeral combined graft
  - BMP
  - Consider staging

TICBG—2-stage reconstruction with threaded baseplate

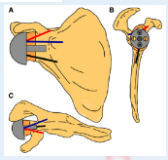




Reconstruction of massive uncontained glenoid defects using a combined autograft-allograft construct with reverse shoulder arthroplasty: preliminary results

Journal of Shoulder and Elbow Surgery
J Shoulder Elbow Surg (2012) 21, 925-934

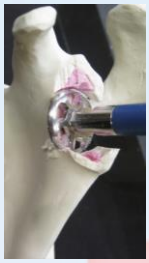
Edward Bateman, FRACS(Ortho)[a,b,c], Simon M. Donald, MBChB[c,*]

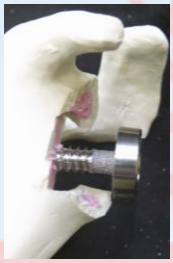


- Autograft-allograft composite
- 5 patients
- Preliminary results show incorporation of the graft in all pts
- ons

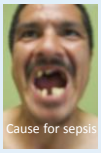


Global GBL





TSAR-RSA-Sepsis GSL-Resection



GL, RCT in TSA 2y

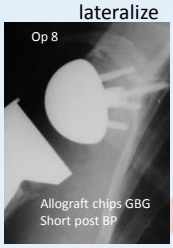
RSA

2 y

Balandran-3ops

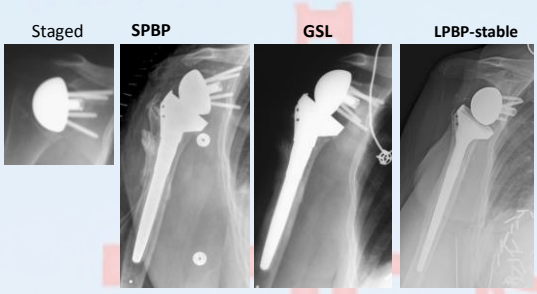
GSL

TSAR-RSA1-GBG allograft chips, SPBP
RSAR-TICBG fracture-NU
RSAR2-subside upwards-HO inferior-instability
RSAR3-PH allograft, FNA to glenoid to lateralize



Burns 11 ops

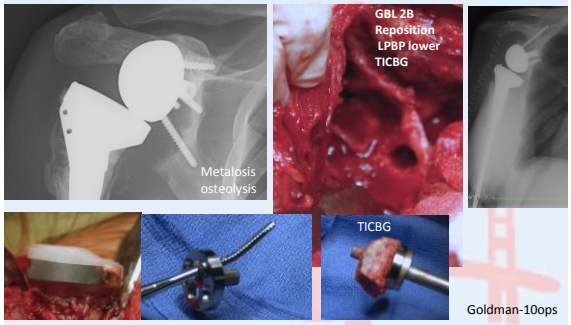
Scapula fx reaming-Staged RSA



Goldkrause 5 ops

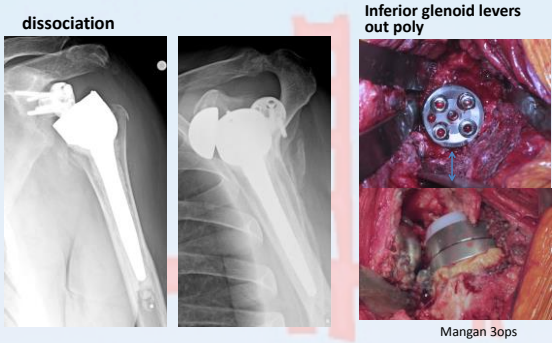
Early RSAs: placed mid glenoid

Impingement, osteolysis, notch, instability, GSL



Goldman-10ops

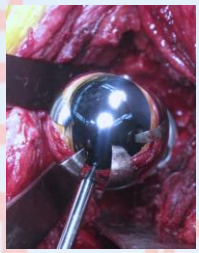
Malposition high, levers out



Mangan 3ops

GS Dissociation-malposition BP high
TICBG, lower BP, GS lateralized





Mangan 3ops

Traumatic GSL in BIORSA
Staged reconstruction for GBL

Ant Fx dislocation-BIORSA GSL-new fall


2-Stage TICBG



digiroloma-3ops

Conclusions

- Tricortical Iliac Crest Grafts offer a good option for reconstructing glenoid bone loss in revision arthroplasty
- Advances on base plate technology with long posts and screws to engage the native scapula will improve our outcomes.
- Scapular bone loss plays an important role in whether the cases can be done in 1 or 2-stages

The Use of Cancellous Bone Graft Harvested from the Humeral Head (BIORSA Technique) to Address Glenoid Deficiency: A CT-Scan Study

Pascal Boileau, Nicolas Morin-Salvo, Gregory Moineau, Thomas D'Ollonne, Patrick Gendre, Charles Bessière

Nice - France

Disclosure

Pascal Boileau – Royalties - Tornier

Preliminary study good results for glenoid without bone deficiency !

Bony Increased-offset Reversed Shoulder Arthroplasty
Minimizing Scapular Impingement While Maximizing Glenoid Fixation
Pascal Boileau MD, Grégory Moineau MD, Yannick Rousseaune MD, Kieran O'Shea FRCSI
CORR 2011

42 patients / 42 BIORSA
FU mean : 28 Months (24-40)

100% graft incorporated
No glenoid loosening
19% scapular notching
Excellent mobility
No instability

AIM

to report the results of the use of BioRSA technique to address glenoid deficiency

1- Is graft large enough for glenoid bone deficiency ?

2- Does such a big graft heal ?

3- Scapular notching

4- Functional outcomes

Retrospective Monocentric study

Inclusion Criteria:

- glenoid bone deficiency : Favard E2,E3,E4 or Walch A2,B2,C
- RSA + bony-lateralization with humeral bone graft
- Patient reviewed with Xray + CT-scan > 1 year

Exclusion Criteria:

- BIO-RSA technique with Allograft or Iliac-crest graft
- Revision shoulder arthroplasty (failed hemi or total SA)

2006 to 2013

93 BIO-RSA for glenoid bone deficiency

allograft 29,
iliac crest 10

63 BIO-RSA
humeral bone graft

2 died
7 lost FU < 1y

N = 54

BIO-RSA for Glenoid Deficiency (n = 54)

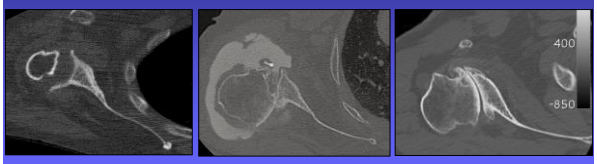
Women 70% - 73 years [52-85]

- Cuff tears arthropathy	CTA	(31)
- Osteoarthritis	OA	(13)
- Osteoarthritis post-instability	OA post-inst	(2)
- Rheumatoid arthritis	RA	(6)
- Fracture Sequelae	SF	(2)

- **FU mean : 33 m [12-81]**

Glenoid Deficiency

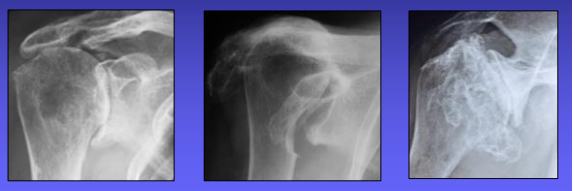
Horizontal Plane (WALCH) A2,B2,C



A2 = 8 B2 = 15 C = 7

Glenoid Deficiency

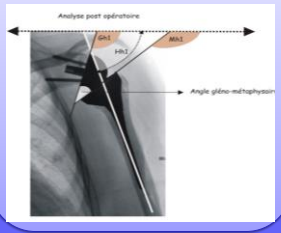
Vertical Plane (FAVARD) E2,E3,E4



E2 = 15 E3 = 21 E4 = 3

Radiographic Measurement of Glenoid Inclination

FAVARD inclination



GERBER inclination

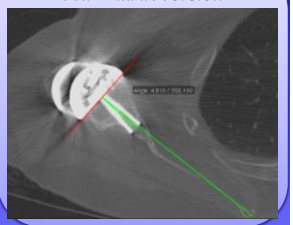
1) ***Falaise, Lévigne, Favard,*** *OTSR 2011 : scapular notching in reverse shoulder arthroplasty: influence of glenometaphyseal angle*
2) ***Maurer, Gerber, et al.*** *JSES 2012 : assessment of glenoid inclination in routine clinical xray and ct-scan;*

2D-CT-Scan Measurement of Glenoid Inclination & Version

MPR mode (Multi Planar Reconstruction)

GERBER inclination

FRIEDMAN version



1) ***Maurer, Gerber, et al*** *: assessment of glenoid inclination in routine clinical xray and ct-scan; JESE 2012*
2) ***Friedman, et al*** *: the use of computized tomography in the measurement of glenoid version; JBJS Am 1992*

RESULTS

Glenoid Loosening

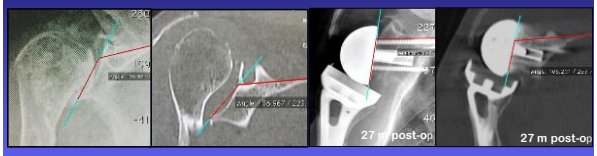
N = 2 (4%)

Revisions

N = 1 (2%)

Correction vertical deficiency

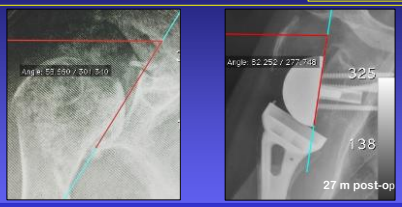
GERBER inclination =10°



	Incl. pre-op Rx	Incl. pre-op Ct-Scan	Incl. post-op Rx	Incl. post-op Ct-Scan
Total series (n = 54)	106.4° (71;142)	104.9° (68;139)	96.1° (ns) (70;122)	95.9° (ns) (71;121°)
Favard E2, E3 (n=39)	111° (95;142)	112.1° (96;138)	97.6° (ns) (70;122)	97.3° (ns) (71;121)

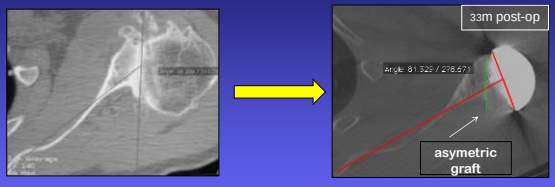
Correction vertical deficiency

FAVARD inclination = 10°



	Incl. pre-op Rx	Incl. post-op Rx
Total series (n = 54)	88.1° (54;117)	98.1° (64;129)(p=0.003)
Favard E2, E3 (n=39)	82° (54;106)	93.5° (68;118)(p=0.001)

Correction horizontal deficiency = 10°

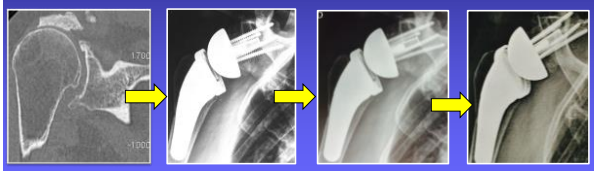


	version pre-op	version post-op
Total series (n = 54)	- 12.1° (-49;+15)	- 4.7° (-32;+21) (p=0.08)
Walch B2, C (n=30)	- 21.1° (-49;0)	-10.6° (-32;+4) (p=0.06)

GRAFT HEALING

FU mean : 33m [12-81]

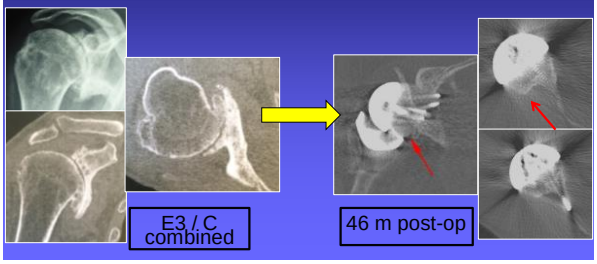
52/54 Graft incorporated (96%)



GRAFT HEALING

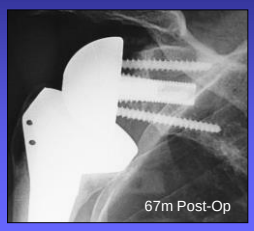
(CT-scan) FU mean : 33m [12-81]

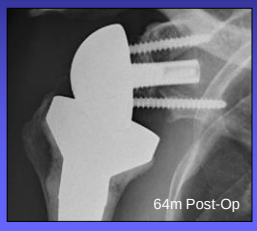
52/54 Graft incorporated (96%)



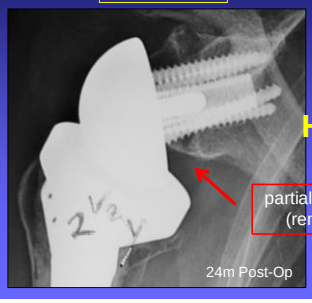
Scapular notching
= 25%

(NONE NOTCH GRADE 4)





partial inferior graft lysis
= 11%



GRAFT HEALED

Clinical outcomes (N=53)

	Preop		Postop
absolut CS	31 (9-62)	→	68 (30-89)
AAE	85° (20-170°)	→	148° (80°-180°)*
ER1	12° (-20°-80°)	→	24° (-20°-70°)*
IR1	S1 (3.2) (0-T12)	→	L4 (5.6) (0-D4)*
SSV	30% (10-80)	→	83% (0-100)

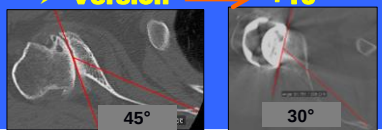
* P < 0.05

NO INSTABILITY

CONCLUSION

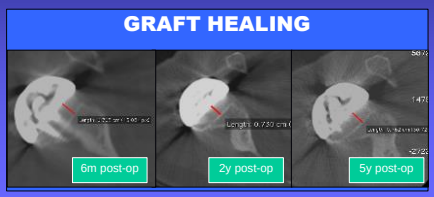
- **Correct axis + Treat glenoid deficiency**
  - **Inclination** → **-10°**

  - **Version** → **+10°**

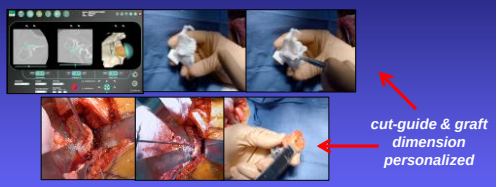


CONCLUSION

- **Graft heals** and remains viable in **96%**
  (2 failures = 1) technical error, 2)traumatic loosening)
- **Notch** 25%



PERSPECTIVES
3D-planning



cut-guide & graft dimension personalized

Thank you for your attention!

Reverse TSA - How to Handle Glenoid Bone Loss

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Disclosure

- Design Surgeon for Exactech
  - –Institutional research support
  - –Royalties

Introduction Glenoid Wear - RTSA

- Reaming solutions
- Bone graft Solutions
- Metal solutions
- Early Outcomes

Glenoid Bone Loss - Reaming

- Ream to correct deformity
  - –Give up valuable subchondral bone
  - –Correct only about 15 degrees
  - –Glenoid shrinks

Eccentric Reaming

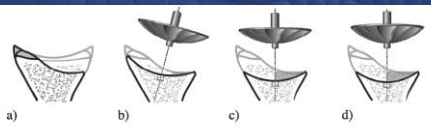
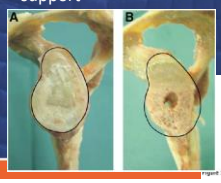


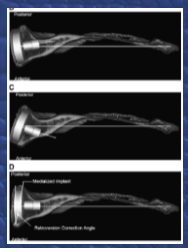
Fig. 5
The biconcave glenoid and strategies in its management by reaming. *a:* The biconcave glenoid (dark lines) is often encountered in osteoarthritis and in capsulorrhaphy arthropathy. *b:* Reaming with a 25-mm reamer without regard to the glenoid centerline results in a concave glenoid surface and preserves the glenoid width, but it produces abnormal version of the surface and fails to restore stability on the low side. *c:* Reaming with a 25-mm reamer along the glenoid centerline decreases the glenoid width but increases stability on the side that was previously low. *d:* Reaming with a 22.5-mm radius of curvature reamer further increases the stability without further compromise of the glenoid width.

How much can I correct it?

Issues w/ eccentric reaming:

- Insufficient bone stock
- Implant downsizing
- Peg Perforation
- Implant loosening loss subchondral support





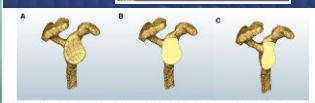


Figure 1 (A) Intact scapula, (B) the same scapula following initial reaming to flatten the glenoid, and (C) after an additional 5 mm of reaming.

Glenoid Bone Loss - Grafting

- Bone Graft defect
  - –Humeral head autograft if present
  - –Allograft or autograft iliac crest
  - –Technically demanding
  - –Graft needs to heal
  - –Use extended post

Cases Humeral Head Autograft

Glenoid Bone Loss – Metal Solutions

- Metal soutions
  - –Posterior augment
  - –Superior augment
  - –Posterior – superior augment
  - –Lateralized glenosphere

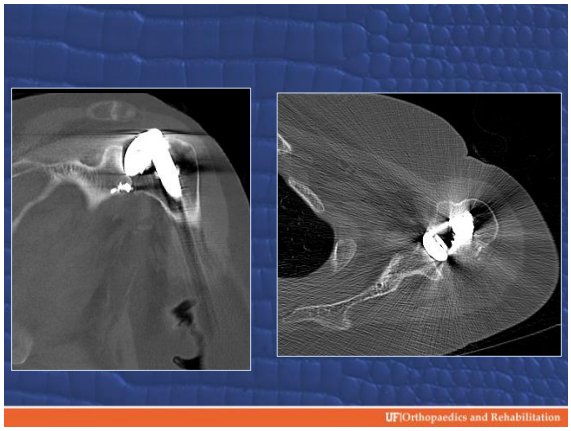
Hypothesis

- Severe Glenoid Wear treated metal augments will have comparable outcomes RTSA patients with normal glenoid

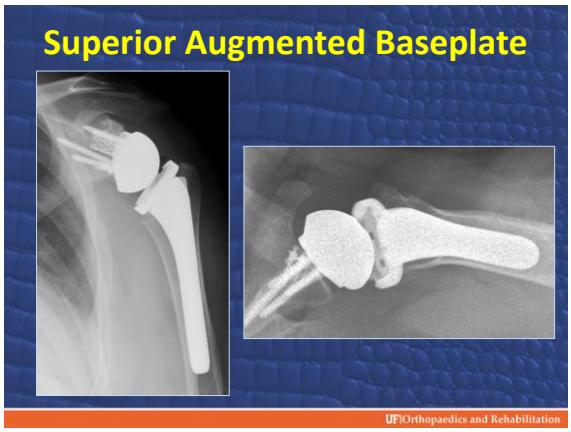
Metal Solutions Augmented Baseplates

Case – Augmentation with Metal

- 60 failed hemi
- Previous surgery for instability
- Pain/ bad function



Superior Augmented Baseplate



Superior Augmented Baseplate

- 29 Patients
  - –20 primary
  - –9 revision
- Age - 70
- Average F/U – 18 months
- Complication – 1 dislocation

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Superior Augmented Baseplate

	SPADI 100	SST	ASES	UCLA	Constant Nrl
Pre op	69	4	33	13	33
Final F/U	32	8	71	28	67
Change	-37 good	+4	+38	+15	+34
Control 2 year	22	9	79	29	76

Superior Augmented Objective Outcomes

	Active elevation	Active External Rot	Active Internal Rot
Preop	75	17	S2
Post Op	116	28	L3
Improvement	+41	+11	+5 anatomic segments
Control	127	27	L3

Augmentation Metal-Lateralized

- Lateral Center of Rotation Implant
  - –Encore – 32std and 32-4
  - –Exactech – lateralized glenosphere
  - –Others

Lateral Center Of Rotation

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Lateralized Glenosphere

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Medial Wear

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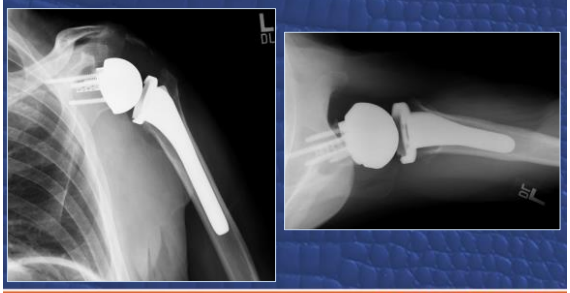
Superior Augment/Lateralized Glenosphere



Lateralized Glenosphere

- N=29
- Age – 67
- Follow-up Ave – 8 months
- One dislocation

Lateralized Glenosphere Functional Outcomes

	SPADI 100	SST	ASES	UCLA	Constant Nrl
Pre Op	75	3	30	11	28
Final F/U	34	8	70	27	59
Improvement	-41 Good	+5	+40	+16	+31
Control 1 year	30	9	70	27	67

Lateralized Glenosphere Objective

	Active Elevation	Active External Rot	Active Internal Rot
Pre Op	61	12	S2
Final F/U	97	19	L5
Improvement	+36	+7	+2 anatomic Seg
Control 1 yr	118	23	L4

Posterior Wear

Posterior Augmented Baseplate

Posterior Augmented Baseplate

- N=42
- Age – 71
- Follow-up Average – 12 months
- Complications – 1 intraop tuberosity fx

Functional Outcomes Posterior Augmented

	SPADI 100	SST	ASES	UCLA	Constant Nrl
Pre Op	58	4	43	15	44
Post Op	19	10	81	30	74
Improvement	-39 Good	+6	+38	+15	+30
Control 1 yr	30	9	70	27	67

Objective Outcomes Posterior Augmented

	Active Elevation	Active External Rot	Active Internal Rot
Preop	**87**	**18**	**S2**
Final F/U	**127**	**26**	**L3**
Change	**+40**	**+8**	**+4 Anatomic Seg**
Control 1 yr	**118**	**23**	**L4**

Posterior Superior Augment

- Severe glenoid wear
- Previously only treatment – bone grafting
- Posterior superior wear patterns – common in CTA
- N=5 only 6 months average f/u

Posterior Superior Augment

Posterior Superior Augment

Posterior Superior Augment Functional Outcomes

	SPADI 100	SST	ASES	UCLA	Constant Nrl
Preop	65	5	46	13	38
Final follow – up 6 months	29	8	75	27	57
Change	36	3	29	14	19
Control 6 months	34	8	68	26	61

Posterior Superior Augment Outcomes

	Active elevation	Active External Rotation	Active Internal Rotation
Preop	62	16	S%
Final Follow-up	101	35	S1
Change	39	19	4
Control 6 months	111	21	L5

Conclusion Ugly Glenoid

- Be Aware
- Know the solutions
- Solutions are in evolution
- Can make a big difference with patient
  - Pain
  - Function
  - Durability implant
- **Based on Short term f/u metal augments are a viable solution**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