Citations Classics Shoulder & Elbow

Reverse Shoulder Arthroplasty Outcomes

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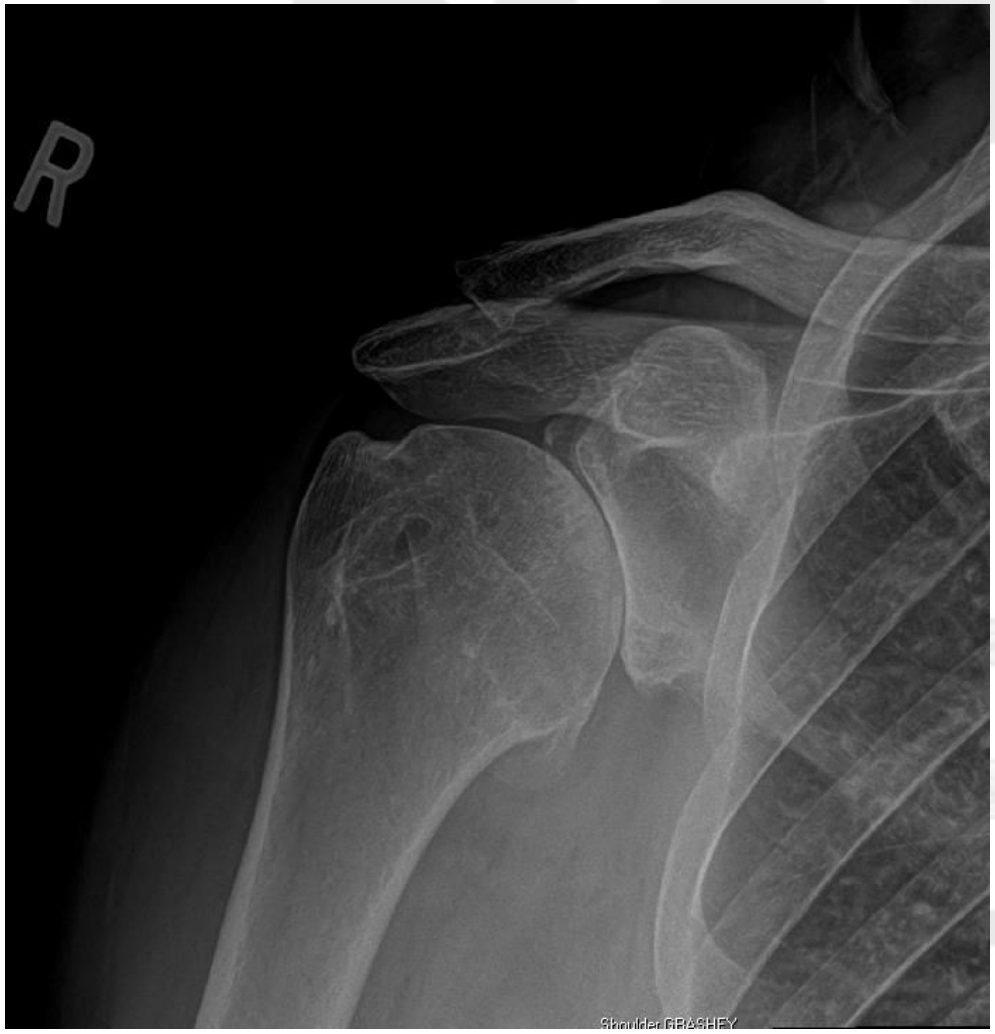
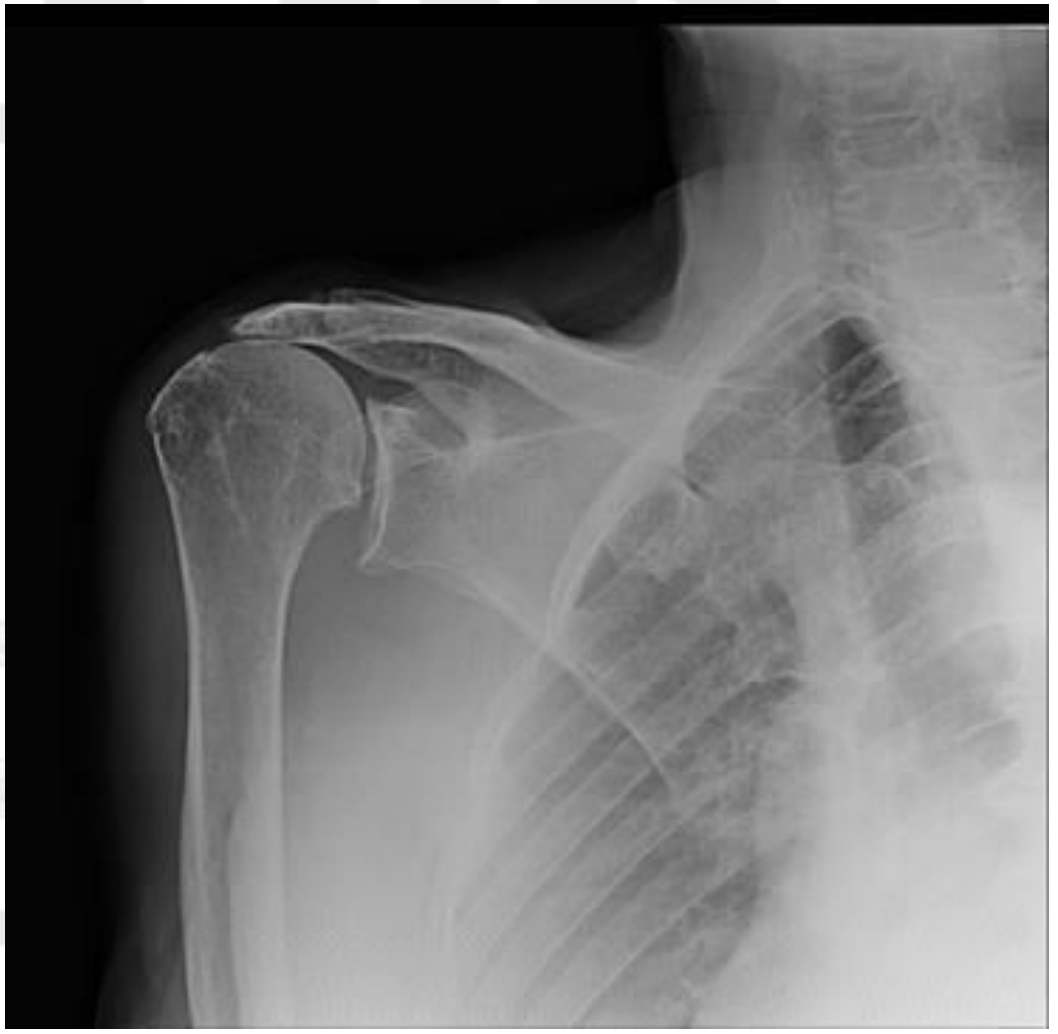
Glenohumeral Arthritis





Multicenter Study > J Bone Joint Surg Br. 2004 Apr;86(3):388-95.
doi: 10.1302/0301-620x.86b3.14024.

Grammont inverted total shoulder arthroplasty in the treatment of glenohumeral osteoarthritis with massive rupture of the cuff. Results of a multicentre study of 80 shoulders

F Sirveaux [1], L Favard, D Oudet, D Huquet, G Walch, D Molé

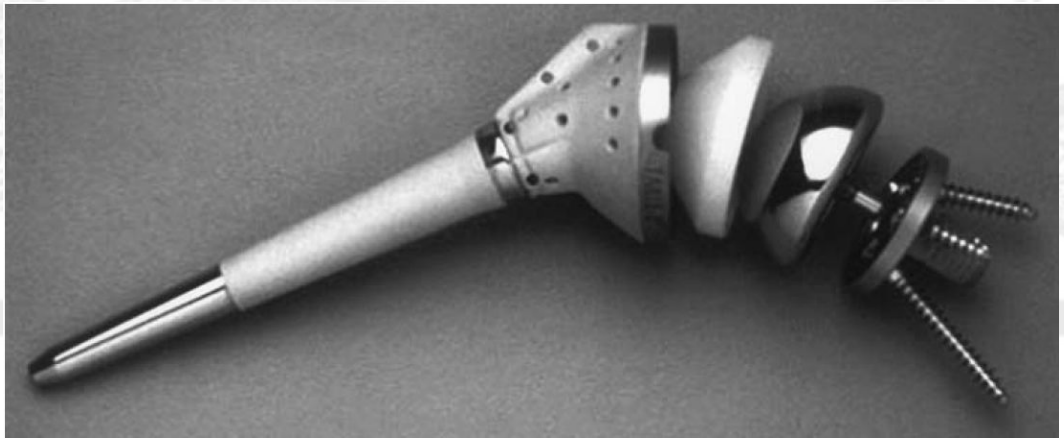
Background

Unconstrained TSA produced good results with intact rotator cuff but poor results with absent or deficient rotator cuff

1970s solution was more constrained TSA with fixed center of rotation

High rates of loosening and mechanical complications

Grammont reverse prosthesis invented 1985



Study Design

Initial index surgery between December 1991-March 1999

Shoulder OA with massive irreparable rotator cuff tear

92 cases, 6 lost to follow up, 6 died

Examined 80 shoulders (77 patients)

Clinical results examined using 100 point Constant-Murley shoulder score and ROM testing

Radiographs examined with serial XRs

Survivorship examined by need for revision or loosening

Population

Mean follow-up 44 months (range 24-97 months)

Mean age 72.8 years (range 60-86 years)

Approach

- superolateral approach with anterior deltoid release: 58 (72%)
- deltopectoral approach in 16 (19%)
- transacromial approach in 3 (3.7%)
- mixed approach in 3 (3.7%)

38 cemented, 42 uncemented

Results

Table II. Clinical results according to the Constant score (mean, range) in 77 patients*

	Pre-operative	Follow-up	Improvement
Pain (15 points)	2.7 (0 to 10)	13.4 (5 to 15)*	10.7
Activity (20 points)	6 (0 to 12)	16.9 (8 to 20)*	10.7
Mobility (40 points)	12.3 (2 to 34)	27.8 (10 to 40)*	15.1
Strength (25 points)	1.9 (0 to 10)	7.4 (0 to 20)*	5.4
Constant score	22.6 (4 to 50)	65.5 (34 to 85)*	42.3

* $p < 0.001$

Table III. Range of movement pre-operatively and at follow-up (AFE, active forward elevation; PFE, passive forward elevation; AER 1, active external rotation with the arm at the side; PER 1, passive external rotation with the arm at the side; AER 2, active external rotation in 90° of abduction; PER 2, passive external rotation in 90° of abduction; IR, internal rotation, out of a score of 10 points (buttock, 2; sacrum, 4; L3, 6; T12, 8; T7 to T8, 10)

	AFE	PFE	AER 1	PER 1	AER 2	PER 2	IR
Pre-operative range of movement in degrees	73	121	3.5	23	17	49	4
Follow-up range of movement in degrees	138	146	11.2	32	40	67	4.8
p value	<0.001	0.01	NS*	NS	<0.001	0.02	NS

* not significant

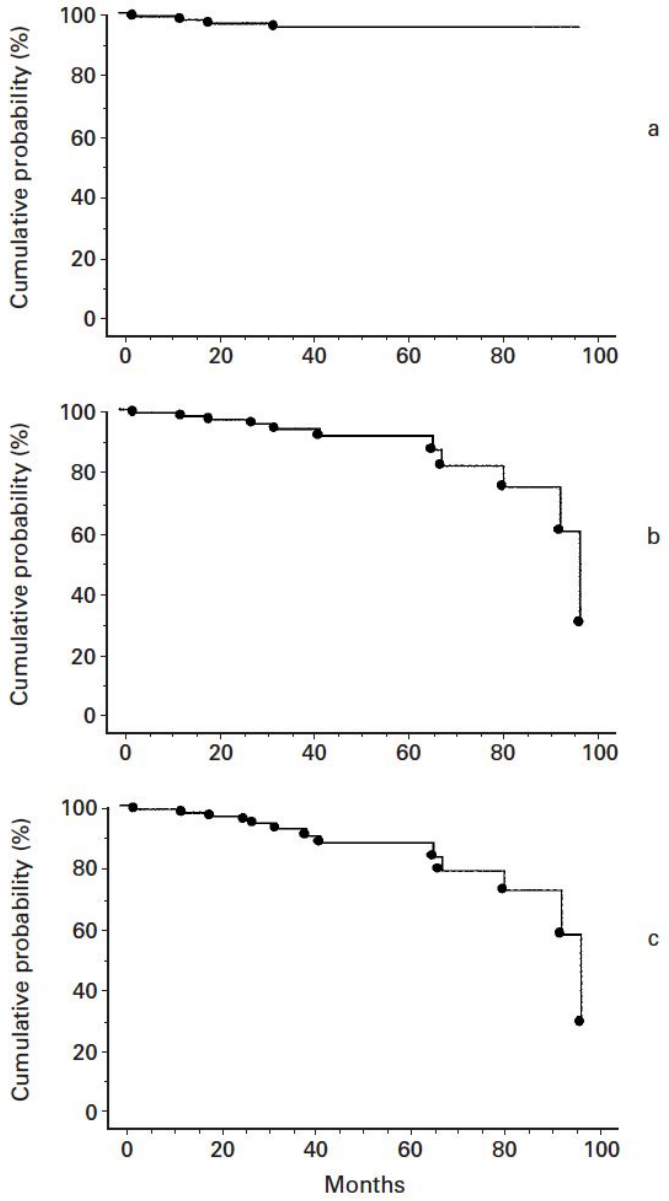


Fig. 4

Kaplan-Meier survivorship (95% confidence interval) curves to show the probability of failure as defined by revision of the prosthesis (a), revision or failure of the component (b), glenoid or humeral loosening, glenosphere dissociation, and revision or failure of the component or significant pain (< 10 points on the Constant score) (c).

Conclusions

Teres minor necessary for a good Constant score

Constant score did not correlate with the status of subscapularis or with the positioning of the implant

Recommend the use of a cemented humeral component and use of a lateralized plastic insert in order to restore appropriate tension to the deltoid

High probability of failure of the inverted prosthesis more than 7 years

However, the implants used during this period were the first designs

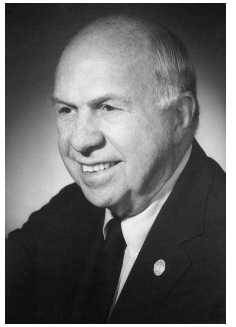
This procedure should be reserved for patients who have failed to respond to conservative therapy and who have adequate bone support for firm anchorage of the glenoid component

J Bone Joint Surg Am. 2007 Jul;89(7):1476-85. doi: 10.2106/JBJS.F.00666.

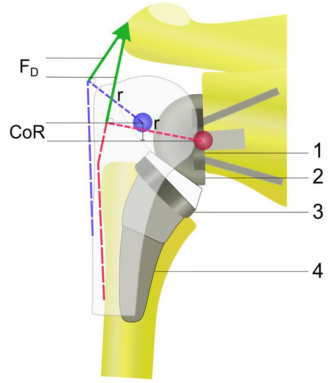
Reverse total shoulder arthroplasty: a review of results according to etiology

Bryan Wall [1], Laurent Nové-Josserand, Daniel P O'Connor, T Bradley Edwards, Gilles Walch

Background



- 1983 Neer et al. def. cuff tear arthropathy
  - Glenohumeral joint changes and humeral head collapse sec. to rotator cuff attrition.
- Grammont et al. first to report on reverse shoulder prosthesis
  - ⅔ of a sphere and medialized to position center of rotation near the native glenoid
- During this time RSA has been utilized to treat a number of complex reconstruction problems such as…
  - Revision arthroplasty, tumor resection and rheumatoid arthritis
- At time of publication largest series of RSA was with only 80 pts with RC arthropathy
- No study to date demonstrated results based on etiology
- Purpose: To determine whether the short term results of reverse shoulder arthroplasty are affected by etiology



Study Design

- Retrospective study
- May 1995 - June 2003, 240 consecutive RSA
- One of two surgeons, 2 different prosthesis types
- Many indications for RSA
- RC compromise def.
  - Irreparable tear of >2 tendons or grade 3-4 fatty infiltration of infraspinatus or subscapularis on pre op CT
- Severe post. or sup. glenoid bone loss = indication for RSA
- Pts. were examined pre and post operatively by someone other than the acting surgeon
- Pre and post ROM and constant scores were collected
- Subjective results also taken
- Preop CTs taken
- Postop stand. radiographs
- Similar operative plans
- Data analysis plans - ANOVA, Chi-squared

Population

- No specific age limit, avg. age 72.7 (23-86)
- 240 prosthesis implanted into 232 pts.
  - 8 pts w/ bilat. procedure
  - Sex
    - 184 F. pts.
    - 56 M. pts.
  - Shoulder
    - 173 R. shoulder
    - 67 L. shoulder
  - Hamada classification
    - Grade preoperative radiographs to differentiate RC arthropathy from massive RC tear w/o arthritis

TABLE I Number of Cases According to Etiology for Reverse Total Shoulder Arthroplasty

Indication	Total Number of Shoulders (N = 240)	Number of Shoulders with Two-Year Follow-Up (N = 196)
Rotator cuff tear arthropathy	74 (30.8%)	59 (30.1%)
Revision arthroplasty	54 (22.5%)	45 (23.0%)
Massive rotator cuff tear	41 (17.1%)	34 (17.3%)
Primary osteoarthritis	33 (13.8%)	25 (12.8%)
Posttraumatic arthritis	33 (13.8%)	28 (14.3%)
Tumor	2 (0.8%)	2 (1.0%)
Acute fracture	2 (0.8%)	2 (1.0%)
Rheumatoid arthritis	1 (0.4%)	1 (0.5%)

TABLE II Classification According to Hamada Stage

Hamada Stage	Number of Shoulders* (N = 115)
1	5 (4.3%)
2	22 (19.1%)
3	14 (12.2%)
4a	17 (14.8%)
4b	27 (23.5%)
5	30 (26.1%)

*Hamada staging was only performed for patients in whom it was necessary to differentiate between rotator cuff tear arthropathy (n = 74) and massive rotator cuff tear without arthritis (n = 41), as described in the text.

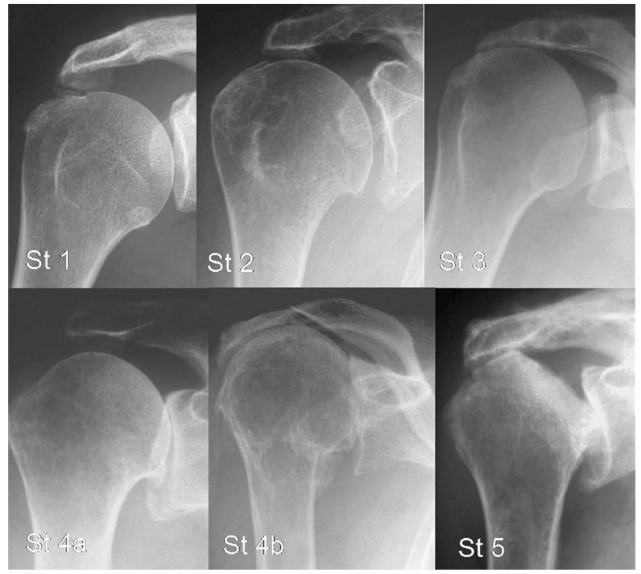


Fig. 1
Radiographs demonstrating the classification of massive rotator cuff tears according to the system of Hamada et al.[18], as described in the text. St = stage.

Results

- 232 pts. → 227 pts. → 186 pts. w/ 191 shoulders
- Avg. f/u of 39.9 mths, avg. age 75.3 (26-89)
- <u>Overall functional Improvements</u>:
  - Avg. constant score improved from 22.8 to 59.7 at follow up time
  - Active elevation (86 to 137 deg.)
  - Internal rotation (L5 to L4)
  - no sig. change on external rotation

TABLE III Changes in Constant Scores According to Diagnosis*

Etiology	Duration of Follow-Up† *(mo)*	Constant Score‡									
		Total		Pain		Activity		Mobility		Strength	
		Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Rotator cuff tear arthropathy	40 (24 to 86)	21.7	65.1	3.1	13.0	5.8	16.7	11.7	27.4	1.2	8.1
Revision arthroplasty	40 (24 to 93)	19.7	52.2	4.3	11.3	4.9	14.3	8.9	20.5	1.4	5.3
Massive rotator cuff tear	34 (24 to 118)	27.8	63.4	3.8	12.2	5.6	15.0	16.9	28.4	1.5	7.8
Posttraumatic arthritis	42 (24 to 97)	19.7	53.0	3.2	12.2	5.2	13.1	10.0	20.6	2.1	6.6
Primary osteoarthritis	38 (24 to 81)	24.7	65.1	3.0	12.7	5.5	16.4	14.0	28.0	2.2	8.0
Other	43 (29 to 68)	37.3	61.3	6.3	12.6	11.7	16.8	17.3	26.5	2.0	5.6
All patients	40 (24 to 118)	22.8	59.7	3.5	12.3	5.6	15.3	12.2	24.9	1.5	7.0

*The changes between the initial and final scores were significant for all subscales and all groups ($p < 0.001$). †The values are given as the average, with the range in parentheses. ‡The values are given as the average.

TABLE IV Changes in Range of Motion According to Diagnosis*

Diagnosis	Elevation		External Rotation at 0° of Abduction		External Rotation at 90° of Abduction		Internal Rotation	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Rotator cuff tear arthropathy	76°	142°	5°	7°	29°	43°	L5	L3
Revision arthroplasty	58°	118°	5°	9°	24°	26°	Sacrum	L5
Massive rotator cuff tear	94°	143°	14°	8°	40°	41°	L2	L3
Posttraumatic arthritis	77°	115°	4°	6°	22°	35°	Sacrum	L4
Primary osteoarthritis	77°	115°	7°	9°	31°	39°	Sacrum	L3
Other	107°	131°	17°	20°	40°	63°	L3	L2
All patients	86°	137°	8°	6°	34°	40°	L5	L4

*The values are given as the average.

Results cont.

- Functional and clinical outcomes
  - Substantial clinical and functional improvement was seen in all etiology groups
    - Primary RCA, primary OA w/ RCT, massive RCT w/o OA had greater outcomes than those with posttraumatic arthritis and revision arthroplasty
  - Patients who received the reverse prosthesis at the time of revision arthroplasty had higher complication rate than those who received the reverse prosthesis at the time of primary arthroplasty.
- Subjectively
  - 173 of 186 were “satisfied” or “very satisfied”, 11 “uncertain”, 2 “dissapointed”
- Complications
  - 38 of 199, Dislocation (n=15) and infection (n=8) most common complications among 199 shoulder that were followed for 2 years or were revised prior to the min 2 year follow up

Conclusions

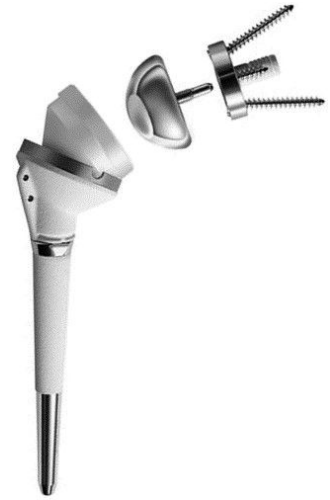
- Limitations
  - Retrospective design - no direct comparison between RSA and other treatment options
  - Selection bias by high volume experienced surgeons, may not have same results from less experienced surgeons
  - Minimum duration of f/u was short (24 mths)
- Demonstrates that RTSA can be used from a number of complex shoulder problems other than patients with cuff tear arthropathy
- **Post traumatic arthritis** and **revision arthroplasty** have less improvement and increased complication rates than those with other etiologies
- Advanced age of patients and short duration of follow-up suggests that the prosthesis should continue to be used judiciously, at the time of publishing.

J Shoulder Elbow Surg. 2006 Sep-Oct;15(5):527-40. doi: 10.1016/j.jse.2006.01.003.

Neer Award 2005: The Grammont reverse shoulder prosthesis: results in cuff tear arthritis, fracture sequelae, and revision arthroplasty

Pascal Boileau [1], Duncan Watkinson, Armodios M Hatzidakis, Istvan Hovorka

Background



- Unconstrained shoulder prosthesis: Less effective in cases with damaged glenohumeral joint and deficient rotator cuff.
  - Arthritis with massive, irreparable cuff tear
  - Fracture sequelae distorting proximal humeral anatomy
  - Revision cases after previous arthroplasty failure with a deficient cuff
- Conventional approach: Unconstrained hemiarthroplasty provides pain relief but restricted active elevation and durability (Neer's "limited goals")
- Grammont Solution with reverse prosthesis design
  - Large glenoid component, nonanatomic humeral cup inclination (155°)
  - Restores mobility with a stable center of rotation
  - Semi-constrained with congruent joint surfaces, minimizing torque
- **Purpose** - evaluate midterm results and complications of the Delta prosthesis in three patient groups: Cuff Tear Arthrosis (CTA), Fracture Sequelae (FS), and Revision Surgery.

Study Design

- Retrospective analysis of 50 Grammont shoulder replacements performed between 1997-2002
- 5 excluded: 2 (death), 1 (stroke, unrelated), 1 (tumor excision), 1 (Alzheimer's)
- Study groups
  - Massive and irreparable cuff tear arthropathy (CTA)
  - Sequelae of a proximal humeral fracture (FS)
  - Revision prosthesis after failure of a previous arthroplasty (revision)
- Implant System - Delta No. 3 reverse shoulder prosthesis (Depuy)
- Operative technique - Deltopectoral approach with subscapularis repaired (41/45)
- Clinical analysis - Constant score, range of motion, ASES score, satisfaction
- Radiographic analyses
  - Preoperative CTs - trophicity and fatty infiltration of cuff muscles, glenoid bone stock
  - Postoperative radiographs - scapular notching and glenoid or humeral radiolucent lines

Population

- 45 patients with mean follow-up of 40 months (24-72 mo)
- **CTA** - 21 patients with mean age of 77 yrs
  - Significantly older than those in revision and FS
  - 19 (90%) women, 18 (86%) dominant side
  - 6 (29%) Hamada grade 3 (humeral head migration, acetabulization), 10 (48%) grade 4 (+ glenohumeral joint narrowing)
- **FS** - 5 patients with mean age of 72 years
  - 3 (80%) women, 2 cases failed pinning, 3 conservative treatment
  - 3 type IV fractures, 1 type III, 1 type 1
- **Revision** - 19 patients with mean age of 67 yrs
  - 14 (70%) women, 10 (53%) dominant side
  - 2 failed hemi, 1 failed arthrodesis, 16 failed TSA for fracture
  - 2-stage revision in 4 patients due to concomitant deep infection

Results

- Complications - 14 in 11 patients (24%)
  - 9 in Revision, 4 in CTA, 1 in FS group
- 4 reoperations (9%) for hematoma, dislocation
- 6 revisions (13%) with 5 in revision group for intraop glenoid fx, deep infection, aseptic loosening, periprosthetic humeral fx

Complications (N = 14)	No.	Treatment
Axillary nerve palsy	1	—
Late acromial fracture	2	—
Hematoma	1	Evacuation
Dislocation	3	Reoperated: cup extension in 2 and change of polyethylene cup in 1
Intraoperative glenoid fracture	1	Revised to hemiarthroplasty (Delta 1 prosthesis)
Deep infection	3	Revised: prosthesis removed in 2 and exchanged in 1
Aseptic humeral loosening	1	Revised to cemented long stem
Periprosthetic humeral fracture	2 (1 perioperative and 1 late traumatic)	Immobilization in 1 and revised to long stem in 1

Results cont.

At mean follow-up of 40 months,

- Satisfaction: CTA 95%, revision 82%, FS 60%

	Anterior elevation (°) [mean (95% CI)]		External rotation (°) [mean (95% CI)]		Internal rotation		Pain score (visual analog scale)
	Preoperative	Follow-up	Preoperative	Follow-up	Preoperative	Follow-up	
CTA (n = 21)	53 (41 to 65)	123 (108 to 139)	9 (1 to 16)	14 (7 to 21)	S1	L3	1.7/10 (0.4 to 2.9)
FS (n = 4)	56 (44 to 68)	122 (96 to 148)	−2 (−12 to 8)	9 (−10 to 28)	GT	D12	2.6/10 (0.4 to 4.8)
Revision (n = 17)	56 (44 to 68)	113 (100 to 126)	8 (−2 to 19)	1 (−6 to 7)	S1	L5	4.5/10 (3.1 to 6.0)
Overall series (N = 42)	55 (47 to 63)	121 (111 to 131)	7 (1 to 13)	11 (5 to 16)	S1	S1	3.2/10 (1.6 to 4.8)

- Radiographic outcomes (n=38)
  - Glenoid Components: Radiolucent lines in 45%, mainly in zone 1
  - Scapular Notching: 68%, varying grades
  - Humeral Components: Radiolucent lines in 60%, varying zones, widths
  - Heterotopic Ossification: Seen in 45%, often with scapular notching

Conclusions

- CTA group showed better outcomes in pain, PROMs, and active elevation compared to FS and revision.
- No difference in external rotation, based on status of teres minor
- Less predictable outcomes, with higher complication and revision rates in revision surgery patients and those with severe FS with nonfunctional cuff, compared to CTA patients.

- Strengths: 1st study to analyze semiconstrained Delta system by underlying pathology, minimal loss to follow-up, and radiologic analysis of preop cuff and prosthesis postop
- Limitations: midterm outcomes, patient population primarily women, limited sample size especially FS and revision groups

J Bone Joint Surg Am. 2005 Aug;87(8):1697-705. doi: 10.2106/JBJS.D.02813.

The Reverse Shoulder Prosthesis for glenohumeral arthritis associated with severe rotator cuff deficiency. A minimum two-year follow-up study of sixty patients

Mark Frankle [1], Steven Siegal, Derek Pupello, Arif Saleem, Mark Mighell, Matthew Vasey

Background

- Previous European studies had demonstrated good results using Reverse Shoulder Arthroplasty (mostly using Delta III)
- 2005 Study by Mark Frankle and Colleagues using the “Reverse Shoulder Prosthesis (RSP)” in the United States
- RSP design aimed to improve some shortcomings of the Delta III
  - Less Center of Rotation (CoR) medialization - tension cuff, deltoid wrapping
  - Baseplate monoblock design with 6.5 mm central screw - improve fixation
  - 145° neck cut - less distalization and more humeral offset to advantage cuff muscles and deltoid and to avoid scapular notching

Study Design

- 60 patients indicated for reverse total shoulder arthroplasty between December 1998 to September 2002
- Minimum 2 year follow up (m: 33 months, range: 24-68)
- All patients had either glenohumeral arthritis with rotator cuff insufficiency or rotator cuff arthropathy
- All patient must have at least 25 mm bone between glenoid face and medial border of scapula (measured on CT)
- Exclusion: active infection, axillary nerve palsy, insufficient glenoid bone stock, nonfunctioning deltoid, very high level of activity
- Outcome Measures: ASES Score, VAS pain and function, Overall Satisfaction, Preoperative and Postoperative range of motion

Population

- Age
  - Mean: 71 (Range: 34-86)
- 11 primary rotator cuff arthropathy (RCA) with humeral head collapse (HHC), 17 RCA without HHC, 23 failed RCR, 7 rotator cuff tear with pseudoparesis, 1 post traumatic arthritis, 1 RA
- 5 patients had acromial fracture preoperatively
- Preoperative IR/ER range of motion only available for 16 patients

Results

TABLE I Clinical Results for Pain, Function, and Range of Motion*

	Preoperative	Follow-up	Improvement
American Shoulder and Elbow Surgeons system scores *(points)*			
Total	34.3 (0 to 65)	68.2 (15 to 100)†	33.9
Pain	18.2 (0 to 45)	38.7 (10 to 50)†	20.5
Function	16.1 (0 to 40)	29.4 (0 to 50)†	13.3
Visual analog scale scores *(points)*			
Pain	6.3 (1 to 10)	2.2 (0 to 8)†	4.1
Function	2.7 (0 to 9)	6.0 (1 to 10)†	3.3
Range-of-motion measurements *(deg)*			
Forward flexion	55.0 (0 to120)	105.1 (30 to 180)†	50.1
Abduction	41.4 (0 to 110)	101.8 (30 to 180)†	60.4
External rotation	12.0 (–15 to 45)	41.1 (10 to 65)†	29.1

*The values are given as the mean, with the range in parentheses. †The difference was significant ($p < 0.0001$).

Results

- 41 (68%) rated outcome as good to excellent, 16 (27%) were satisfied, 3 (5%) were dissatisfied
- Prior surgery vs. No prior surgery
  - Patients with prior shoulder surgery had better ASES total, pain, and function scores
- 13 complications in 10 patients
  - 3 acromial fractures in 2 patients
  - 1 patient with pre-existing acromial fracture with hardware failure and infection requiring revision surgery
  - 1 patient with glenoid failure
  - Seven patients with 8 failed devices at mean of 21.4 months
    - 2 converted to hemiarthroplasty

Conclusions

- No scapular notching seen
- Potential improvements in external rotation (limited by missing data)
- Identified 2-year measure as stress limit of implant without osseous ingrowth
- Successful treatment of 6 failed RSAs in 5 patients

J Shoulder Elbow Surg. 2013 Sep;22(9):1199-208. doi: 10.1016/j.jse.2012.11.016. Epub 2013 Feb 4.

Reverse total shoulder arthroplasty for massive irreparable rotator cuff tears in patients younger than 65 years old: results after five to fifteen years

Eugene T H Ek [1], Lisa Neukom, Sabrina Catanzaro, Christian Gerber

Background

- **2006, Guery et al.** RSA should be exclusively used in patients age >70 & low functional demands
- **2011, Favard et al.** Constant-murley score and radiographic changes deteriorated over time
- Unclear functional longevity of RSA
- Risk vs. reward of complications & early revisions
- At the time, no current long-term clinical outcome studies in younger patients
- **Purpose:** Evaluate the mid to long-term clinical and radiologic results of RTSA performed in patients younger than 65 years for massive irreparable rotator cuff tears, with or without GH arthritis

Study Design

- Single institution (May 1997 - November 2006)
- Indications for RSA
- Patients with 5 years or greater of clinical follow up
- Pre and post op clinical assessment & functional score
- Constant-Murley outcome score
- Validated electronic dynamometer strength measure
- Subjective shoulder value
- Pre and post op standardized radiographs
- RCT grade using Hamada-Walch classification
- Data analysis: t tests, kruskal wallis test, kaplan-meier

Population

- 46 RSAs in 41 patients
  - 24 men, 17 women
  - Mean age 60 y/o (46-64)
  - 36/40 involved dominant shoulder
  - 5 patients had b/l shoulders
  - Patients with less than 5 years follow up were excluded (5)
  - Mean follow-up of 93 months (60-171)
  - 21 shoulders demonstrated stage 1 to 3 Hamada-Walch classification GH. 19 shoulders demonstrated stage 4 to 5.
  - 23/40 underwent a previous surgery

Table I Staging of massive rotator cuff tears and number of patients with or without previous surgery

Variable	No. (%)
Staging (Hamada-Walch)[20,29]	
Grade 1 (AHI ≥6 mm)	13 (33)
Grade 2 (AHI <6 mm)	5 (13)
Grade 3 (AHI <6 mm with acetabularization)	3 (8)
Grade 4a (glenohumeral arthritis without acetabularization)	7 (18)
Grade 4b (glenohumeral arthritis with acetabularization)	4 (10)
Grade 5 (collapse of humeral head, "cuff tear arthropathy")	8 (20)
Group	
A – no previous surgery	17 (43)
B – previous surgery	23 (57)

AHI, acromiohumeral distance.

Table II Previous failed surgery

Variable	No. (%)
One previous operation	(n = 16)
Rotator cuff debridement	14 (61)
Failed rotator cuff repair	1 (4)
Latissimus dorsi tendon transfer	1 (4)
Two previous operations	(n = 3)
Rotator cuff repairs (2)	2 (9)
Shoulder arthroscopy (1) and cuff repair (1)	1 (4)
Three previous operations	(n = 1)
Rotator cuff repairs (2) and cuff debridement (1)	1 (4)
Four previous operations	(n = 3)
Rotator cuff repairs (2) and acromioplasty (2)	1 (4)
Rotator cuff repair (1) and cuff debridements (3)	1 (4)
Rotator cuff repair (1), deltoid flap (1), osteotomy of acromion (1), removal of metalware (1)	1 (4)

Results

- 40 shoulders (35 patients)
- <u>Functional improvements for all shoulders</u>
  - Relative constant score improved from 34 to 74
  - Pain: 5.9 to 12.7
  - Strength: 0.8 to 4.6
  - SSV: 23 to 66
  - Active flexion: 72 to 119
  - Active abduction: 67 to 112
  - no significant change in active external rotation
  - no sig. change in clinical outcome between patients with previous surgery vs. those without.

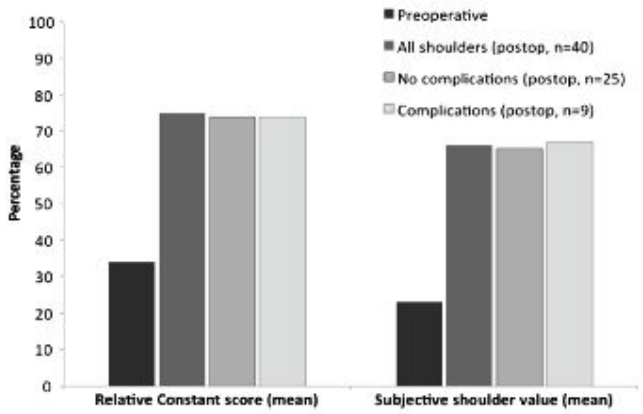


Figure 2 Preoperative and postoperative mean relative Constant scores and subjective shoulder values for all shoulders, those with no complication (n = 25) and those who had at least one complication (n = 9).

Table IV Preoperative and postoperative functional scores for shoulders with no previous surgery (group A) and shoulders with previous surgery (group B)

Variable*	Preoperative	Postoperative†	Gain	P
Constant score				
Relative, %				
All shoulders	34 ± 16 (11-74)	74 ± 24 (31-100)	+40	<.0001
Group A	35 ± 15 (11-67)	69 ± 28 (31-100)	+34	<.0001
Group B	33 ± 16 (12-74)	77 ± 21 (40-100)	+44	<.0001
Absolute, points				
All shoulders	27 ± 13 (10-67)	57 ± 20 (22-87)	+30	<.0001
Group A	27 ± 10 (10-56)	53 ± 22 (22-83)	+26	<.0001
Group B	28 ± 14 (10-67)	60 ± 18 (22-87)	+32	<.0001
Pain				
All shoulders	5.9 ± 4.1 (0-15)	12.7 ± 3.3 (5-15)	+6.8	<.0001
Group A	5.3 ± 3.7 (0-13)	14 ± 2 (10-15)	+9.7	<.0001
Group B	6.5 ± 4.4 (0-15)	13 ± 3 (5-15)	+6.5	<.0001
Strength				
All shoulders	0.8 ± 1.9 (0-6)	4.6 ± 5.6 (0-16)	+3.8	<.0001
Group A	0.4 ± 1.5 (0-6)	5.0 ± 5.5 (0-15)	+4.6	<.0001
Group B	1.2 ± 2.1 (0-6)	4.1 ± 5.8 (0-16)	+2.9	<.0001
Subjective shoulder value,‡ %				
All shoulders	23 ± 16.4 (0-80)	66 ± 28 (0-100)	+43	<.0001
Group A	25 ± 13 (0-40)	61 ± 34 (0-100)	+36	<.0001
Group B	21 ± 19 (0-80)	68 ± 25 (20-100)	+47	<.0001
Active forward flexion, deg				
All shoulders	72 ± 38 (30-170)	119 ± 34 (50-160)	+47	<.001
Group A	78 ± 27 (40-130)	109 ± 45 (50-160)	+31	< .0001
Group B	68 ± 45 (30-170)	126 ± 26 (75-160)	+58	<.0001
Active abduction, deg				
All shoulders	67 ± 37 (30-170)	112 ± 39 (45-165)	+45	<.0001
Group A	65 ± 28 (30-130)	98 ± 44 (45-150)	+33	<.0001
Group B	69 ± 43 (30-170)	120 ± 34 (55-165)	+51	<.0001
Active extension rotation, deg				
All shoulders	27 ± 27 (−20 to 90)	26 ± 20 (−30 to 60)	−1	.77
Group A	18 ± 21 (−15 to 70)	23 ± 23 (−30 to 50)	+5	.54
Group B	35 ± 30 (−20 to 90)	28 ± 19 (0-60)	−7	.41

NS, not significant.
* Data are presented as mean ± standard deviation (range).
† Postoperative data exclude patients that had removal or conversion of their prosthesis and those who had phone interviews. All shoulders (preop, n = 40; postop n = 26), group A (preop, n = 23; postop, n = 10); group B (preop, n = 17; postop, n = 16).
‡ Postoperative subjective shoulder value includes patients who were interviewed by phone: group A, n = 11; group B, n = 21.

Results cont.

- No sig. deterioration in constant score, SSV, or changes in ROM over 10 years
- infrascapular neck notching was seen in 56% of patients
  - a sig. difference in RCS in patients with no notching was 85.6% vs those with notching was 65.6
- Overall survival rates:
  - 5 years: 88%
  - 10 years: 76%
- Complications
  - 15/40 (37.5%) occurred complications
  - 11/40 required at least 1 reoperation
  - 10 revision for component exchange or convert to hemiarthroplasty

Table V Preoperative and postoperative clinical results

Variable*	2-5 years	5-7 years	7-10 years	*P*
Shoulders, No.	29	26	8	
Constant score				
Relative, %	73 ± 23	70 ± 25	77 ± 20	.80
Absolute, points	57 ± 18	55 ± 19	59 ± 17	.87
Pain	12 ± 3	13 ± 3	11 ± 4	.25
Strength	5.8 ± 4.9	4.1 ± 4.8	6.4 ± 6	.25
Subjective shoulder value,† %	61 ± 25	62 ± 26	66 ± 30	.93
Range of motion, deg				
Active forward flexion	122 ± 33	106 ± 43	122 ± 22	.59
Active abduction	114 ± 36	98 ± 42	118 ± 30	.44
Active external rotation	24 ± 22	23 ± 26	13 ± 27	.47

* Data are represented as mean +/− standard deviation.
† Subjective shoulder value includes patients who were interviewed by phone.

Table III Complications and treatment

Complication	No.	Definitive treatment
Postoperative nerve palsy	2	Conservative management
Soft tissue impingement	1	Arthroscopic debridement of scar tissue in subacromial space
Scapula fracture	3	Conservative treatment (n = 1; 14 months) ORIF (n = 1; 81 months) ORIF and conversion to hemiarthroplasty* (n = 1; 130 months)
Periprosthetic humeral fracture	1	ORIF (72 months)
Early dislocation (<6 weeks)	2	Change of liner and cup extension
Late dislocation	5	Closed reduction only (n = 1; 50 months) Change of liner and cup extension (n = 2; 35 & 64 months) Conversion to hemiarthroplasty† (n = 1; 93 months) Revision of humeral component and liner change (n = 1; 35 months)
Polyethylene wear	1	Change of liner and cup extension (18 months)
Glenoid component loosening	3	Conversion to hemiarthroplasty (76, 89 & 130* months)
Infection	5	Debridement, change of liner, and antibiotics (n = 1; 64 months) Removal of prosthesis and cement spacer (n = 3; 29, 94† & 120 months) Temporary spacer and reimplantation of RTSA (n = 1; 5 months)

ORIF, open reduction and internal fixation; *RTSA*, reverse total shoulder arthroplasty.
* Same patient, fracture extended to glenoid component resulting in loosening.
† Same patient, this patient later had removal of prosthesis and a cement spacer because of infected hemiarthroplasty.

Conclusions

- Use of RSA in this population yielded great results through 10 years
  - significantly improved overall function & patient satisfaction
  - risk vs. benefit for high complication and reoperation rate must be thoroughly discussed
  - Previous surgery status did not affect complication rate
  - Patients with complications that didn't require removal of prosthesis had similar SSV and functional outcomes as those with no complications
- Limitations
  - Small sample size
  - Varying prosthesis type
  - Single Center
  - No direct comparison to other treatment options

Citations Classics Shoulder & Elbow

Reverse Shoulder Arthroplasty Outcomes

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