Avoiding Complications in Shoulder Arthroplasty

Patrick Denard, MD
Medford, OR

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CURRENT CONCEPTS REVIEW

Complications of Shoulder Arthroplasty

Kamal I. Bohsali, MD, Aaron J. Bois, MD, MSc, FRCSC, and Michael A. Wirth, MD

J Bone Joint Surg Am. 2017;99:256-69

TABLE II Complications of Anatomic TSAs in Studies Published from 2006 to 2015*

Complication	No. of Shoulders	Percentage of All Complications	Percentage of All Shoulders
Component loosening	135	39.1	4.0
Glenoid	130	37.7	3.9
Humerus	5	1.4	0.1
Glenoid wear	78	22.6	2.3
Instability	35	10.1	1.0
Rotator cuff tear	31	9.0	0.9
Periprosthetic fracture	23	6.7	0.69
Intraoperative	19	5.5	0.57
Postoperative	4	1.2	0.12
Neural injury	21	6.1	0.63
Infection	17	4.9	0.51
Hematoma	3	0.9	0.09
Deltoid injury	1	0.3	0.03
Deep venous thrombosis	1	0.3	0.03

*The 33 studies included a total of 3,360 shoulders (studies with mixed types of arthroplasty were excluded).

TABLE I Complications of RSAs in Studies Published from 2006 to 2015*

Complication	No. of Shoulders	Percentage of All Complications	Percentage of All Shoulders
Instability	206	31.3	5.0
Periprosthetic fracture	138	20.8	3.3
Intraoperative	94	14.2	2.3
Postoperative	44	6.6	1.1
Infection	118	17.8	2.9
Component loosening	75	11.3	1.8
Glenoid	48	7.2	1.2
Humerus	27	4.1	0.7
Neural injury	50	7.5	1.2
Acromial and/or scapular spine fracture	40	6.0	1.0
Hematoma	21	3.2	0.51
Deltoid injury	6	0.9	0.15
Rotator cuff tear	4	0.6	0.10
VTE events	4	0.6	0.10
Deep venous thrombosis	2	0.3	0.05
Pulmonary embolus	2	0.3	0.05

*The 78 studies included a total of 4,124 shoulders (studies with mixed types of arthroplasties were excluded).

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General

- Infection
- Hematoma

3

Procedure Specific

TSA

- Instability/Rotator Cuff
- Glenoid Loosening

RSA

- Instability
- Scapular spine fracture
- Scapular Notching

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General

- Infection
- Hematoma

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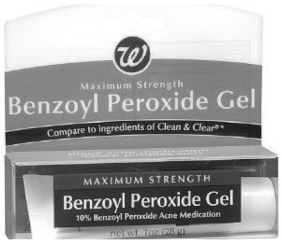
Infection: Pre-screening

- Ramos et al.
  - 14K Total joints & Spine
    - 18% screened positive and treated
      - 4.4% infection MRSA positive
      - 2.4% in negative group

6

Pre-Surgery Skin Prep/Wash

- Sethi
  - 5% Benzoyl Peroxide 48 hrs (5 applications)
    - 6% positive after skin prep vs. 29% in historical reports
- Murray et al.
  - Chorahexadine cloth
    - Coag neg staph 30% vs 70% (p = .001)
    - P. Acnes 46% vs. 58% (p = .32)



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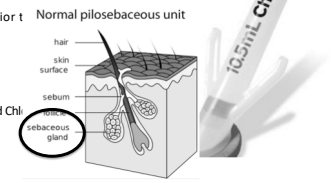
Skin Prep

Efficacy of Surgical Preparation Solutions in Shoulder Surgery

By Matthew D. Saltzman, MD, Gordon W. Nuber, MD, Stephen M. Gryzlo, MD, Geoffrey S. Marecek, MD, and Jason L. Koh, MD

J Bone Joint Surg Am. 2009;91:1949-53

- Anterior shoulder 95% prior t
  - 31% Betadine
  - 19% Duraprep
  - 7% Chloraprep
- Coag-neg Stap
  - Lower with Duraprep and Chl
- P Acnes
  - No difference



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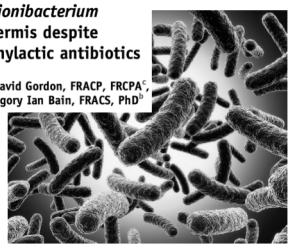
Skin Prep

Frequent isolation of *Propionibacterium acnes* from the shoulder dermis despite skin preparation and prophylactic antibiotics

Joideep Phadnis, FRCS (Tr&Orth)[a,*], David Gordon, FRACP, FRCPA[c], Jeganath Krishnan, FRACS, PhD[b,d], Gregory Ian Bain, FRACS, PhD[b]

- 42% prior to prep
- 14% after prep (Chloraprep)
- 52% dermal swabs



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Skin Prep

SHOULDER

Hydrogen peroxide skin preparation reduces *Cutibacterium acnes* in shoulder arthroplasty: a prospective, blinded, controlled trial

Peter N. Chalmers, MD*, Lindsay Beck, BA, Irene Stertz, BA, Robert Z. Tashjian, MD

Department of Orthopaedic Surgery, University of Utah, Salt Lake City, UT, USA

J Shoulder Elbow Surg (2019) 28, 1554–1561

- Skin wipe with 3% Hydrogen Peroxide prior to Chloraprep

Table II Culture results

Culture	Control (%)	Peroxide (%)	*P* value
≥1 Positive culture	14/31 (45)	11/30 (37)	.500
≥2 Positive cultures	8/31 (26)	3/30 (10)	.182
3 Positive cultures	6/31 (19)	0/30 (0)	**.024**
Air	2/31 (6)	2/28 (7)	1.000
Skin	8/31 (26)	6/30 (20)	.590
Dermis	9/31 (29)	5/30 (17)	.251
Joint	11/31 (35)	3/30 (10)	**.031**

Significant differences are in bold.

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Adhesive Drapes

- Cochrane Review 2015
  - Any adhesive = higher risk (RR 1.2)
  - Iodine = no difference

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Operative hoods

- Der Tavitian et al. 50 TKAs
  - No difference
- Tayton et al. 65,000 TKAs
  - Possible increase

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Laminar Flow

- Tayton et al. 65,000 TKAs
  - Possible increase
- Singh et al. UK joint registry
  - No difference

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Skin Knife

Should we use a separate knife for the skin?

O. S. Schindler,
R. F. Spencer,
M. D. Smith

From Droitwich Knee Clinic, Worcestershire, England

- Positive cultures:
  - Skin blades: 15.3%
  - Inside blades: 10.8%
  - Control: 6.4%

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Glove Perforation

- Carter et al. TKA and THA
  - 3.7% primary surgery
  - 8.9% revision surgery
- Makama et al. RCT single v. double-glove
  - 15% perforation in single
  - 1.2% double

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Vancomycin Powder

Intra-Articular Vancomycin Powder Eliminates Methicillin-Resistant *S. aureus* in a Rat Model of a

Ada

The cost effectiveness of vancomycin for preventing infections after shoulder arthroplasty: a break-even analysis

M. Daniel Hatch, MD, Stephen D. Daniels, BS, Kimberly M. Glerum, BA, Laurence D. Higgins, MD, MBA*

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Betadine Irrigation

An intraoperative irrigation regimen to reduce the surgical site infection rate following adolescent idiopathic scoliosis surgery

B van Herwijnen, NR Evans, GJ Dare, EM Davies

Ann R Coll Surg Engl 2016; **98**: 320-323
doi 10.1308/rcsann.2016.0132

- Group A: Gent irrigation
- Group B: Betadine

No Shoulder Studies…

Table 3 Comp

Infection	Re… (*n*=…	…n B (*n*=71)	Regimen C (*n*=32)	*p*-value
Deep	3 (20.0%)	3 (4.2%)	1 (3.1%)	0.07
Superficial	1 (6.7%)	2 (2.8%)	1 (3.1%)	0.06
Total	**4 (26.7%)**	**5 (7.0%)**	**2 (6.3%)**	0.08

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Surgical Time

- Namba et al. 56K TKAs
  - 9% increase per 15 min increment
  - Other factors
    - BMI> 35
    - Males
    - DM
    - Posttraumatic

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Antibiotic Cement

Antibiotic-loaded bone cement reduces deep infection rates for primary reverse total shoulder arthroplasty: a retrospective, cohort study of 501 shoulders

Robert J. Nowinski, DO[a,*], Robert J. Gillespie, MD[b], Yousef Shishani, MD[b], Brian Cohen, MD[c], Gilles Walch, MD[d], Reuben Gobezie, MD[b]

- 3% without
- 0% with antibiotic cement

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Closure/Dressing

- Staples v. Subcuticular
  - No difference multiple studies
    - Improved satisfaction with sub Q
- Silver impregnated dressing
  - Bowler et al.
    - Efficacy vs. P. Acnes
  - Cochrane review
    - Inconclusive

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General

- Infection
- Hematoma

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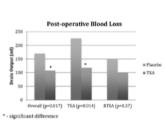
Tranexamic Acid

Neer Award 2015: A randomized, prospective evaluation on the effectiveness of tranexamic acid in reducing blood loss after total shoulder arthroplasty

Robert Gillespie, MD*, Yousef Shishani, MD*, Sheeba Joseph, MD*, Jonathan J. Streit, MD*, Reuben Gobezie, MD*,†,‡

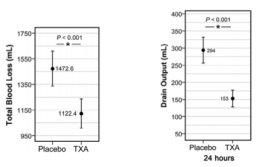
J Shoulder Elbow Surg (2015) 24, 1679–1684



Intravenous tranexamic acid reduces total blood loss in reverse total shoulder arthroplasty: a prospective, double-blinded, randomized, controlled trial

Alexander D. Vara, MD, Denise M. Koueiter, MS, Daphne E. Pinkas, MD†, Ashok Gowda, MD, Brett P. Wiater, MD, J. Michael Wiater, MD*

J Shoulder Elbow Surg (2017) 26, 1383–1389



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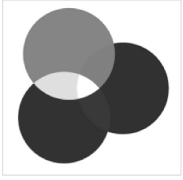
Procedure Specific

TSA

- Glenoid Loosening
- Instability/Rotator Cuff
- -> Anatomic Reconstruction



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3 Rules for Anatomic Reconstruction

- Humeral Head:
  - Restore COR
- Glenoid:
  - Evidence-based reconstruction
  - Preservation of subchondral bone
- Soft tissue:
  - Get the Subscapularis to heal

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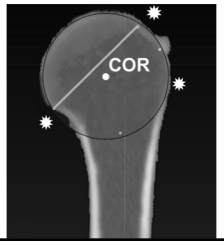
Determination of humeral head size in anatomic shoulder replacement for glenohumeral osteoarthritis

J Shoulder Elbow Surg (2014) 23, 955-963

Ari R. Youderian, MD[b,*], Eric T. Ricchetti, MD[b], Meghan Drews[b], Joseph P. Iannotti, MD, PhD[b,c]

- Medial calcar
- Lateral cortex below GT
- Medial GT



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Restoration of COR

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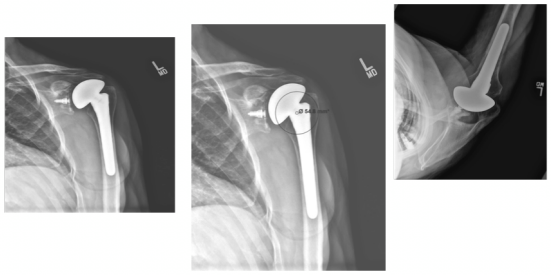
Avoid This!



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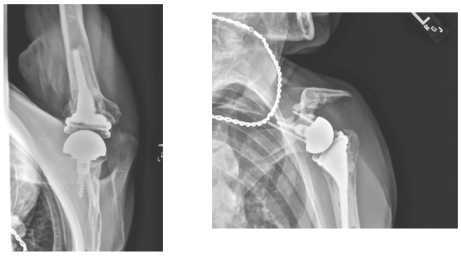

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Mid- to long-term follow-up of total shoulder arthroplasty using a keeled glenoid in young adults with primary glenohumeral arthritis

J Shoulder Elbow Surg (2013) 22, 894-900

Patrick J. Denard, MD[a,b,*], Patric Raiss, MD[c], Boris Sowa, MD[c], Gilles Walch, MD[d]

- Nonanatomic
  6.6 x more lik
  lead to revisi
  – Survival 8 yr
  nonanatomi
  – Survival 13 y
  anatomic

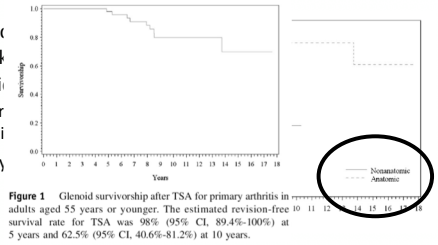

Figure 1 Glenoid survivorship after TSA for primary arthritis in adults aged 55 years or younger. The estimated revision-free survival rate for TSA was 98% (95% CI, 89.4%-100%) at 5 years and 62.5% (95% CI, 40.6%-81.2%) at 10 years.

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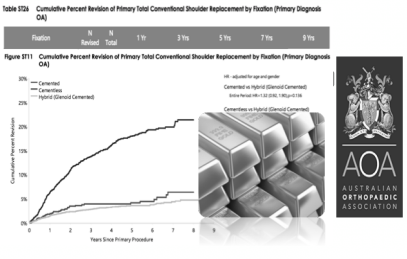
Glenoid Loosening



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Pegged vs. Keel – Is there a Difference?

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AOA Registry

Table ST30 Cumulative Percent Revision of All Polyethylene Primary Total Conventional Shoulder Replacement with Cemented Fixation by Glenoid Design (Primary Diagnosis OA)

Glenoid Design	N Revised	N Total	1 Yr	3 Yrs	5 Yrs	7 Yrs	9 Yrs
Keeled Cemented	30	772	1.2 (0.6, 2.3)	3.5 (2.3, 5.1)	4.2 (2.9, 6.2)	6.4 (3.7, 10.8)	
Pegged Cemented	170	5847	1.5 (1.2, 1.9)	2.9 (2.5, 3.4)	3.5 (3.0, 4.1)	4.5 (3.7, 5.3)	6.1 (3.7, 9.9)
TOTAL	200	6619					

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Results of a convex-back cemented keeled glenoid component in primary osteoarthritis: multicenter study with a follow-up greater than 5 years

J Shoulder Elbow Surg (2013) 22, 940–947

A. Young, MD[a], Barbara Melis, MD[c], Dominique Gazielly, MD[d], Markus Loew, MD[e], Pascal Boileau, MD[f]

even at 10 years. Rates of radiologic loosening and component migration were found in our study to be heavily influenced by surgical technique. Specifically, we found that performing excessive reaming to achieve a perfect backside fit and neutral version of the glenoid component was detrimental and resulted in increased subsidence. As a result of this finding, we recommend respecting the subchondral bone when implanting the glenoid component and performing only the minimal amount of reaming that is necessary.

Table III

	Subsidence
Center 1	
Center 2	
Center 3	18%
Center 4	4%
Difference a	
++ indicate	

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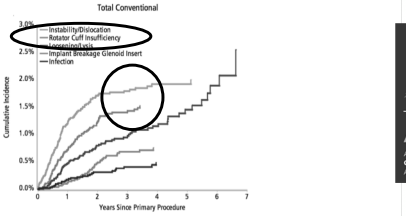
Causes of failure in TSA

Figure ST11: Cumulative Incidence Revision Diagnosis of Primary Total Conventional Shoulder Replacement



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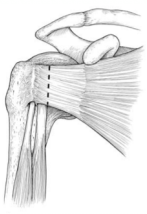
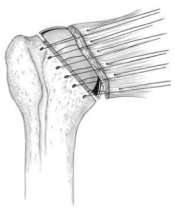
Addressing the Subscapularis

Tenotomy



Peel



Osteotomy

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Integrity and function of the subscapularis after total shoulder arthroplasty

J Shoulder Elbow Surg (2010) 19, 1085-1090

Jeffrey D. Jackson, MD[a], Akin Cil, MD[b], Jay Smith, MD[c], Scott P. Steinmann, MD[a,]

Table II Compared outcome results for the intact and ruptured groups as defined by ultrasound

	Intact	Ruptured	*P* value
Positive lift-off/belly press	3/5 (60%)	3/4 (75%)	1
Able to tuck shirt in back	7/8 (88%)	7/7 (100%)	1
Bear hug test (kg)	17	6	<.01*
Internal rotation (%)	29.8	40.4	.28
IR difference (cm)	3.5	6.9	.87
Active ER (degrees)	47.5	60	.15
Passive ER (degrees)	50	55	.46
Isometric IR strength	34.2	18.3	.01*
Isokinetic IR strength	34.1	17.6	<.01*
DASH Score (0-100)	4.6	25	.04*

* Indicates a significant difference with a *P* value < or = .05.

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Immediate versus delayed passive range of motion following total shoulder arthroplasty

Patrick J. Denard, MD[a,b,*], Alexandre Lädermann, MD[c]

J Shoulder Elbow Surg (2016) 25, 1918–1924

Table III Change in outcome from preoperatively to 1 year postoperatively by osteotomy healing

	Healed		Not healed		*P* value
	Preoperative	Postoperative	Preoperative	Postoperative	
Forward flexion, °	105 ± 31	146 ± 18	109 ± 27	131 ± 25	.214
External rotation, °	20 ± 16	58 ± 14	29 ± 22	64 ± 17	.814
VAS pain score	6.7 ± 1.8	0.7 ± 1.1	4.9 ± 2.3	1.5 ± 1.8	.175
ASES score	35.6 ± 15.5	90.2 ± 10.3	45.0 ± 10.8	81.1 ± 18.4	.008
SST	3.5 ± 2.4	10.2 ± 2.1	2.9 ± 2.2	8.0 ± 3.6	.096
SANE score	34.8 ± 24.6	87.9 ± 16.2	35.4 ± 24.5	80.9 ± 21.2	.092

Data are presented as mean ± standard deviation.
ASES, American Shoulder and Elbow Surgeons; *SANE*, Single Assessment Numeric Evaluation; *SST*, Simple Shoulder Test; *VAS*, visual analog scale.

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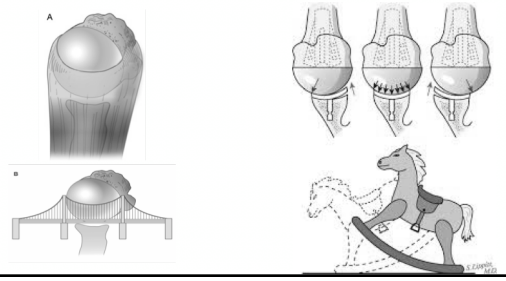
Balanced Force Couples & Rocking Horse



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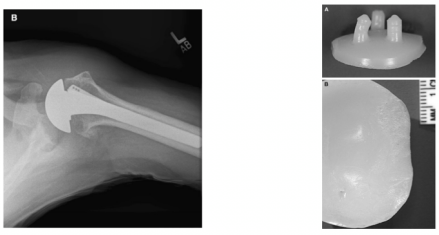
Glenoid component loosening due to deficient subscapularis: a case study of eccentric loading

J Shoulder Elbow Surg (2011) 20, e16–e21

Christopher J. Utz, MD[a], Thomas W. Bauer, MD, PhD[b], Joseph P. Iannotti, MD, PhD[a,*]



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Glenoid loosening and failure in anatomical total shoulder arthroplasty: is revision with a reverse shoulder arthroplasty a reliable option?

J Shoulder Elbow Surg (2012) 21, 342-349

Barbara Melis, MD[a], Nicolas Bonnevialle, MD[a], Lionel Neyton, MD[b], Christophe Lévigne, MD[c], Luc Favard, MD[d], Gilles Walch, MD[b], Pascal Boileau, MD[a,*]

Table I Preoperative associated complications with glenoid loosening or failure

Associated preoperative complications	n	(%)
Rotator cuff tear	24	65%
Supraspinatus tear	21	57%
Infraspinatus tear	13	35%
Subscapularis tear or insufficiency	29	78%
Instability	13	35%
Anterior	7	19%
Posterior	6	16%
Glenoid bone loss	37	100%
Cavitary (central)	27	73%
Combined (central and peripheal)	10	27%

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Loss of subscapularis function after total shoulder replacement: A seldom recognized problem

J Shoulder Elbow Surg
January/February 2003

Suzanne L. Miller, MD, Yassamin Hazrati, MD, Steven Klepps, MD, Alexis Chiang, MD, and Evan L. Flatow, MD, New York, NY

- 41 TSAs with tenotomy approach
  - 67% abnormal belly press/lift off
    - 92% had reduced subscapularis function (shirt tuck)

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How should I fixate the subscapularis in total shoulder arthroplasty? A systematic review of pertinent subscapularis repair biomechanics

Shoulder & Elbow
2017, Vol. 9(3) 153–159

John B. Schrock[1], Matthew J. Kraeutler[1], Charles T. Crellin[2], Eric C. McCarty[1] and Jonathan T. Bravman[1]

Results: Nine studies met the inclusion criteria. In the majority of studies, lesser tuberosity osteotomy (LTO) techniques had greater load to failure and less cyclic displacement compared to subscapularis tenotomy or peel methods. LTO repairs with sutures wrapped around the humeral stem demonstrated superior biomechanical outcomes compared to techniques using only a tension band. In terms of load to failure, the strongest repair of any study was a dual-row fleck LTO using four sutures wrapped around the stem.

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Comparison of Lesser Tuberosity Osteotomy to Subscapularis Peel in Shoulder Arthroplasty

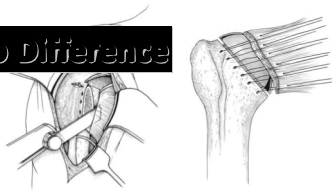
A Randomized Controlled Trial

J Bone Joint Surg Am. 2012;94:2239-46

Peter L.C. Lapner, MD, FRCSC, Elham Sabri, MSc, Kawan Rakhra, MD, FRCPC, Kimberly Bell, BA, and George S. Athwal, MD, FRCSC

- 43 Osteotomies vs. 44 Peels
- No difference in:
  - Postop strength
  - ASES
  - WOOS
  - Healing (Follow-up Study)

No Difference



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Healing rates and subscapularis fatty infiltration after lesser tuberosity osteotomy versus subscapularis peel for exposure during shoulder arthroplasty

Peter L.C. Lapner, MD, FRCSC[a,*], Elham Sabri, MSc[b], Kawan Rakhra, MD, FRCSC[c], Kimberly Bell, BA[d], George S. Athwal, MD, FRCSC[e]

J Shoulder Elbow Surg (2013) 22, 396-402

Table I Healing rates

	LTO	Peel	*P* value (Fisher exact)
CT results			.4938
Frequency (%)			
Healed	39 (95%)	41 (100%)	?
Not healed	2 (5%)	0	

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Subscapularis management in stemless total shoulder arthroplasty: tenotomy versus peel versus lesser tuberosity osteotomy

William R. Aibinder, MD[a], Ryan T. Bicknell, MD, MSc, FRCSC[b,c], Stefan Bartsch, MD[d], Markus Scheibel, MD[e,f], George S. Athwal, MD, FRCSC[a,*]

- 188 patients
  - No difference in ASES
  - ER higher in Peel group
- But…
  - NO Data on Internal Rotation
  - NO Data on Healing
  - 24 surgeons…

No Difference

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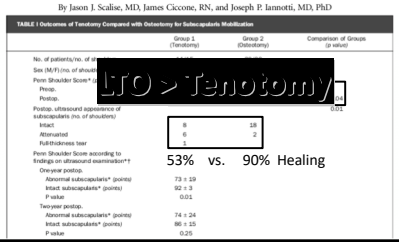
Clinical, Radiographic, and Ultrasonographic Comparison of Subscapularis Tenotomy and Lesser Tuberosity Osteotomy for Total Shoulder Arthroplasty

By Jason J. Scalise, MD, James Ciccone, RN, and Joseph P. Iannotti, MD, PhD



LTO > Tenotomy

53% vs. 90% Healing

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Analysis of subscapularis integrity and function after lesser tuberosity osteotomy versus subscapularis tenotomy in total shoulder arthroplasty using ultrasound and validated clinical outcome measures

J Shoulder Elbow Surg (2014) 23, 1309-1317

Taylor Buckley, MD, Richard Miller, MD, Gregg Nicandri, MD, Richard Lewis, MD, Ilya Voloshin, MD*

- 32 peels vs. 28 LTOs
  - 1 year retrospective
- WOOS 82 peel vs. 92 LTO (p = .05)
- Ultrasound
  - 12.5% abnormal peel vs. 0% LTO (p = .12)
    - Abnormal patients did worse

LTO > Peel

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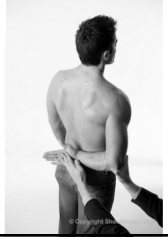
Research Article

Lift-off Test Results After Lesser Tuberosity Osteotomy Versus Subscapularis Peel in Primary Total Shoulder Arthroplasty

Adam B. Shafritz, MD
Michael G. Fitzgerald, MD
Bruce D. Beynnon, PhD
Michael J. DeSarno, MS

- 46 peels vs. 44 LTOs, mean 4 year follow-up
- Lift-off
  - Normal 70% Peel v
- Function
  - SST higher and DASH improved in LTO group

LTO > Peel



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Outcomes for subscapularis management techniques in shoulder arthroplasty: a systematic review

J Shoulder Elbow Surg (2018) 27, 363–370

W. Stephen Choate, MD[a], Adam Kwapisz, MD, PhD[b,c], Amit M. Momaya, MD[a], Richard J. Hawkins, MD[a], John M. Tokish, MD[b,d,*]

	Healing	Belly Press Negative	Shirt Tuck Difficult
Tenotomy	76%	67%	42.5%
Peel	84%	na	na
LTO	93%	79%	15.3%

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Summary

- Subscapularis function after TSA is critical
- Biomechanical evidence favors LTO
- Clinical evidence for healing & function is mixed, but slightly favors:
  - LTO > Peel > Tenotomy
- Limitations of LTO
  - Reproducibility
  - Stemless repair

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Pearls

Top 5 Tips for Subscapularis Management in TSA

Patrick J. Denard, MD

OHSU

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Immediate versus delayed passive range of motion following total shoulder arthroplasty

Patrick J. Denard, MD[a,b,*], Alexandre Lädermann, MD[c]

J Shoulder Elbow Surg (2016) 25, 1918–1924

- RCT of Rehab after TSA with LTO
  - 4 weeks sling
    - Immediate Passive motion
    - Hand/Wrist/Elbow only, Then ROM at 4 weeks
- No differences in ROM by 3 mos
- Healing
  - 82% immediate
  - **96% delayed**

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Reverse Shoulder Arthroplasty

- Instability
- Scapular spine fracture
- Scapular Notching

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Dislocation following reverse total shoulder arthroplasty

J Shoulder Elbow Surg (2017) 26, 1238–1245

Eitan M. Kohan, MD*, Peter N. Chalmers, MD, Dane Salazar, MD, Jay D. Keener, MD, Ken Yamaguchi, MD, Aaron M. Chamberlain, MD

- 10 year period
  - 28 of 1055 (2.7%) - > 19 with follow-up
- 14 Early (<3 mos)
- 5 Late
- Most were Men (60 & 80%)
- Prior surgery (63%)
- 2 Categories
  - Inadequate soft-tissue tension (Early)
  - Liner wear (Late)

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Soft-tissue Tension

- Gutierrez et al.
  - Socket depth most important
    - But beware impingement
- Other factors:
  - Glenosphere Size
  - Inferior Tilt
  - Lateralization
  - Arm Lengthening

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Instability after reverse total shoulder arthroplasty

J Shoulder Elbow Surg (2018) 27, 1946–1952

Emilie V. Cheung, MD*, Eric J. Sarkissian, MD, Alex Sox-Harris, PhD, Garet C. Comer, MD, Jason R. Saleh, MD, Robert Diaz, MD, John G. Costouros, MD

- 11/119 RSAs (9.2%)
- Men
- Subscapularis repair
- **45% a thicker polyethyelene was inadequate**

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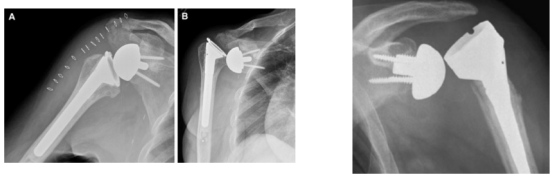

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Classification of instability after reverse shoulder arthroplasty guides surgical management and outcomes

Adham Abdelfattah, MD[a], Randall J. Otto, MD[b], Peter Simon, PhD[c], Kaitlyn N. Christmas, BS[c], Gregory Tanner, MD[a], Joey LaMartina II, MD[a], Jonathan C. Levy, MD[a], Derek J. Cuff, MD[a], Mark A. Mighell, MD[a], Mark A. Frankle, MD[a,*]

J Shoulder Elbow Surg (2018) 27, e107–e118

Reverse Shoulder Arthroplasty Instability Classification			
I	Loss of Compression	a	Undersized implants
		b	Loss of deltoid contour
		c	Humeral height loss
		d	Subscapularis deficiency
		e	Acromial/scapular fracture
		f	Deltoid dysfunction
II	Loss of Containment	a	Mechanical failure
		b	Alteration of D/R ratio (Humerosocket depth)
III	Impingement	a	Soft tissue or bony impingement
		b	Prosthetic malalignment
		c	Body habitus

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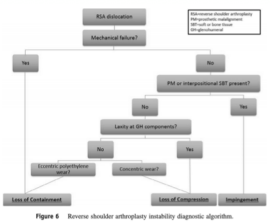

Figure 6 Reverse shoulder arthroplasty instability diagnostic algorithm.

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Reverse Shoulder Arthroplasty

- Instability
- **Scapular spine fracture**
- Scapular Notching

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Scapular fractures after reverse shoulder arthroplasty: evaluation of risk factors and the reliability of a proposed classification

Randall J. Otto, MD[a], Nazeem A. Virani, MD, MPH[b], Jonathan C. Levy, MD[c], Phillip T. Nigro, MD[a], Derek J. Cuff, MD[d], Mark A. Frankle, MD[a,*]

J Shoulder Elbow Surg (2013) 22, 1514-1521

- Osteoporosis in 30%, OR 1.97
- 14 of 16 occurred from a screw tip

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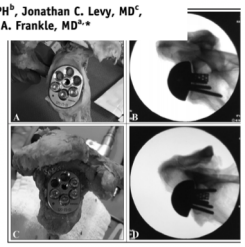
Scapular fractures after reverse shoulder arthroplasty: evaluation of risk factors and the reliability of a proposed classification

J Shoulder Elbow Surg (2017) 26, 1023–1030

Randall J. Otto, MD[a], Nazeem A. Virani, MD, MPH[b], Jonathan C. Levy, MD[c], Phillip T. Nigro, MD[a], Derek J. Cuff, MD[d], Mark A. Frankle, MD[a,*]

- 9/206 (4.4%) with superior screws
- 0/112 (0%) with only inferior screws



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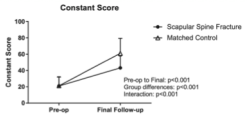
Increased scapular spine fractures after reverse shoulder arthroplasty with a humeral onlay short stem: an analysis of 485 consecutive cases

Francesco Ascione, MD[a,b,*], Christopher M. Kilian, MD[c], Mitzi S. Laughlin, PhD[d], Giulia Bugelli, MD[e], Peter Domos, MD, FRCS[f], Lionel Neyton, MD[c], Arnaud Godeneche, MD[f], T. Bradley Edwards, MD[c], Gilles Walch, MD[a]

Results: A scapular spine fracture following RSA occurred in 21 patients (4.3%), with a mean time to diagnosis of 8.6 months (range, 1-34 months). No preoperative factor was found to be a significant predictor of scapular spine fracture. Both groups showed significant improvements in active mobility measurements and Constant scores from preoperatively to final follow-up ($P < .001$). The control group scored significantly better than the scapular spine fracture group regarding the Constant score and forward flexion.
Conclusion: Scapular spine fractures have shown an increased prevalence after onlay-design RSA. This series was not able to link any clear risk factors. Functional results are limited, regardless of the fracture management.



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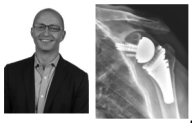
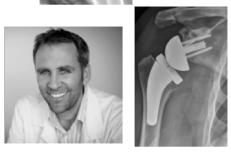
Prelim Study

- Multi-center Study -532 Cases
  - PD 231 cases
  - MF 199 cases
  - AL 102 cases





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Onlay v. Inlay

Onlay

Inlay

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Results

- 11.9% Onlay stem vs. 4.7% Inlay stems (p = .043)

	No Fracture N=400	Scapular Spine Fracture N=26	P value
AHD (mm)	33.7 (±9.1)	37.4 (±8.7)	0.021
Center of rotation offset (mm)	13.2 (±6.6)	14.1 (±6.8)	0.489
Humeral lateralization (mm)	53.9 (±7.0)	52.8 (±8.0)	0.362

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Reverse Shoulder Arthroplasty

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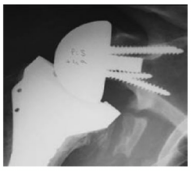
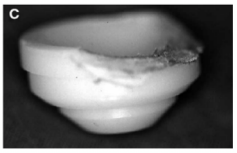
Scapular Notching





- 50-96% at 31 to 84 months with classic Grammont prosthesis

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Range of Impingement-Free Abduction and Adduction Deficit After Reverse Shoulder Arthroplasty

Hierarchy of Surgical and Implant-Design-Related Factors

By Sergio Gutiérrez, MS, Charles A. Comiskey IV, Zong-Ping Luo, PhD, Derek R. Pupello, MBA, and Mark A. Frankle, MD

Investigation performed at the Philip Spigel Orthopaedic Research Laboratory at the Florida Orthopaedic Institute Research Foundation, Tampa, Florida

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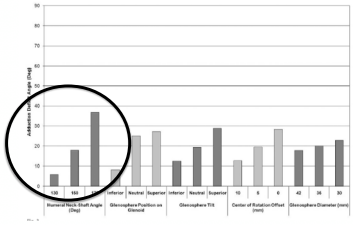
Adduction Deficit



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The influence of humeral neck shaft angle and glenoid lateralization on range of motion in reverse shoulder arthroplasty

J Shoulder Elbow Surg (2017) 26, 1726–1731

Birgit S. Werner, MD[a,b,*], Jean Chaoui, PhD[c], Gilles Walch, MD[b]

Variable*	135° model	135° +5 mm model	*P* value	145° model	145° +5 mm model	*P* value
Abduction	72.4 ± 5.9	80.6 ± 9.1	.05	79.5 ± 7.8	86.4 ± 10.3	NS
Adduction	29.2 ± 8.0	43.3 ± 8.2	<.0001	16.1 ± 8.5	28.3 ± 7.8	<.0001
External rotation at 0°	47.5 ± 12.5	61.9 ± 9.4	.004	29.2 ± 16.5	50.1 ± 11.3	<.0001
Global range of motion	406.1 ± 62.5	515.3 ± 54	.0003	331.5 ± 59.5	434.9 ± 63.2	.009

Conclusion: Lower humeral neck shaft angle and glenoid lateralization are effective for improvement in range of motion after RSA. The use of the 135° model with 5 mm of glenoid lateralization provided the best results in impingement-free range of motion, except for abduction.

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Reverse Shoulder Arthroplasty for the Treatment of Rotator Cuff Deficiency

A Concise Follow-up, at a Minimum of Five Years, of a Previous Report*

Derek Cuff, MD, Rachel Clark, BA, CCRC, Derek Pupello, MBA, and Mark Frankle, MD

- 76 patients, 5 year min follow-up
- 94% survival at 5 years
- 9% notching (all grade 1)
- No baseplate failures

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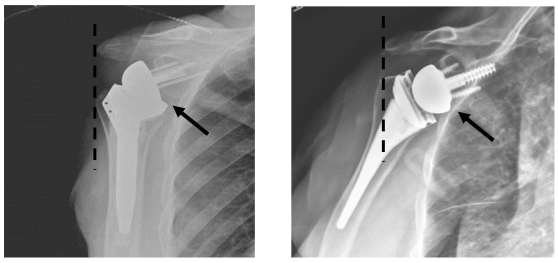
155 vs. 135



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Summary

- General and procedure-specific complications to avoid
- Focus on restoration of anatomy

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