Patient Guide to the **Ream and Run Procedure** AVATAR Same Day Joint Replacement Surgery













- Fellowship-trained shoulder surgeon with subspecialty interest in shoulder replacement
- Member of the American Shoulder and Elbow Surgeons
- Founding member of the New England Shoulder and Elbow Surgeons
- Specialist in outpatient joint replacement surgery

Basic Shoulder Anatomy: Ball and Socket





Glossary of Terms

- Glenoid: shoulder socket
- Humeral head: ball
- Labrum: ring of fibrocartilage tissue that surrounds the glenoid
- **Capsule**: connective tissue that surrounds the joint and is reinforced by ligaments
- Rotator Cuff: a group of 4 tendons that surround the humeral head and provide motion and stability to the joint



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Shoulder Anatomy



Shoulder Arthritis

- Loss cartilage between the ball and socket
- Adaptive changes
 - Osteophytes (bone spurs)
 - Flattening of the humeral head
 - Bone cysts
 - Glenoid wear









Glenoid Wear

- Arthritis results in different patterns of glenoid erosion
- In some cases (B1 and B2), this wear increases the angle between the socket and shoulder blade (retroversion)
- In these same patterns the humeral head becomes decentered posteriorly (toward the back)



A modification to the **Walch** classification of the glenoid in primary glenohumeral osteoarthritis using three-dimensional imaging.Bercik MJ, Kruse K 2nd, Yalizis M, Gauci MO, Chaoui J, Walch G.J Shoulder Elbow Surg. 2016 Oct;25(10):1601-6





Glossary of Terms

- Retroversion: increased angle between the face of the glenoid and the body of the scapula that results from arthritic wear
- Posterior Decentering: (also known as subluxation) when the humeral head rests on the back of the glenoid rather than the center of the glenoid
- Biconcavity: when the decentering causes eccentric posterior glenoid wear, carving a second concavity



Current **Technique** for the **Ream**-and-**Run** Arthroplasty for Glenohumeral Osteoarthritis. Matsen FA 3rd, Lippitt SB.JBJS Essent Surg Tech. 2012 Oct 10;2(4):e20. doi: 10.2106/JBJS.

The Pathologic Triad

• This figure demonstrates a typical case showing measurement of the posterior decentering







How to center the head on the B2 glenoid

<u>Total shoulder arthroplasty with an anterior-offset humeral head in patients</u> <u>with a B2 glenoid</u>. Frederick A. Matsen, MD, Shoulderarthritis.blogspot.com (June 24, 2020)





Biconcavity and Retroversion

- This wear pattern is very common in patients presenting for the Ream and Run
- These pathologic changes to the glenoid shape and orientation must be addressed to restore proper shoulder function
- Humeral head resurfacing alone cannot address these glenoid sided problems



<u>Results of anatomic nonconstrained prosthesis in primary osteoarthritis with</u> <u>biconcave glenoid</u>.Walch G, Moraga C, Young A, Castellanos-Rosas J.J Shoulder Elbow Surg. 2012 Nov;21(11):1526-33

Examples of Shoulder Arthritis







Total Shoulder Replacement

- Replaces both the ball and socket
 - Different stem designs: standard, short stem, stemless
 - Different glenoid designs: anchor peg, cage







Downsides of Total Shoulder

- Glenoid implant loosening
- Glenoid implant wear
- Glenoid implant fracture
- All of these result in clinical failure and the need for revision

The radiographic evaluation of keeled and pegged glenoid component insertion.Lazarus MD, Jensen KL, Southworth C, Matsen FA 3rd.J Bone Joint Surg Am. 2002 Jul;84(7):1174-82









Grade 0

Grade 2





Grade 4

Grade 1







Glenoid Failure Statistics

- Historically quoted as 1% per year
- Much higher in younger patients
- Not meant to withstand heavy activity
- Studies have shown radiographic failure of nearly 60% at 10 years particularly in younger patients and those with glenoid wear (Ream and Run Candidates)





Loosening and Osteolysis

- Glenoid loosening leads to bone loss in the narrow glenoid vault
- This can make revision surgery challenging











Other Surgical Options

- CAM Procedure (comprehensive arthroscopic management)
- Surface Replacement Arthroplasty
- Biological Resurfacing with or without humeral head replacement
- Allograft resurfacing
- Fusion





What is the Ream and Run?

- Type of Shoulder Replacement that involves
 - Replacement of the arthritic humeral head
 - Reshaping the native glenoid to a smooth, concave surface
 - Recentering the humeral head
 - Avoidance of placing a plastic glenoid implant









Ream and Run Background

- Pioneered by Frederick Matsen, MD at the University of Washington
- Spurred by the recognition of glenoid implant failure and the need for better solutions for young patients with arthritis and those with high functional demands





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Advantages of the Ream and Run

- Allows unrestricted activity without the risk of glenoid implant failure
 - Particularly attractive in younger patients where the long-term risk of glenoid failure is high
 - Also attractive in older patients with high functional demands who are also at risk of potential glenoid implant failure
- Can provide outcomes comparable to total shoulder replacement in select patients





Activity Restrictions after Ream and Run







Principles of the Ream and Run

- Create a single, smooth concavity that is congruent with the replaced humeral head
- Recenter the humeral head through soft tissue balancing
- Preserve bone stock on the glenoid
- Maximize range of motion





Principles of the Ream and Run





Current Technique for the Ream-and-Run Arthroplasty for Glenohumeral Osteoarthritis. Matsen FA3rd, Lippitt SB.JBJS Essent Surg Tech. 2012 Oct 10;2(4):e20. doi: 10.2106/JBJS.



<u>Healing of reamed glenoid bone articulating with a metal humeral</u> <u>hemiarthroplasty: a canine model.</u> Matsen FA 3rd, Clark JM, Titelman RM, Gibbs KM, Boorman RS, Deffenbaugh D, Korvick DL, Norman AG, Ott SM, Parsons IM 4th, Sidles JA.J Orthop Res. 2005 Jan;23(1):18-26



Indications

- The Ream and Run is indicated for a select subset of patients with the following criteria
 - Moderate to severe glenohumeral osteoarthritis
 - Motivation to comply with a prolonged recovery period
 - Motivation to avoid the risks of glenoid implant failure
 - No history of inflammatory arthritis
 - A functioning/intact rotator cuff
- Well-informed patients who desire high levels of activity and who are fully committed to complete the required rehabilitation may be candidates for the ream and run.
 - Frederick A. Matsen, MD







Who is not a good candidate?

- Patients who want a quick path to recovery are better served by a standard total shoulder
- Patients who are unwilling or unable to comply with an extensive rehabilitation program
- Patients who are unwilling or unable to take an active role in managing their outcome





Other Factors Associated with Poor Outcomes

- Inflammatory arthritis
- Smoking
- Poorly controlled diabetes
- Heart disease
- Lung disease
- Liver disease

Chronic Medical Conditions

 Worker's compensation claim or other litigation related to shoulder arthritis





What About Gender?

- In general, Ream and Run results in women have been less predictable with higher failure rates due to ongoing glenoid-sided pain
 - Lower bone density
 - Higher likelihood of inflammatory component to arthritis
- That said, some women may be an appropriate candidate and this needs to be vetted on a case by case basis





Preparing the Glenoid

- Any remaining cartilage on the front of the glenoid can be scraped off with a curette
- In glenoids with a double concavity (B2), the central ridge must be removed to create a single concavity





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Preparing the Glenoid

• Custom reamers are used to shape the glenoid into a smooth concavity

• In order to preserve subchondral bone, retroversion is not corrected back to neutral





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Diameter Mismatch

- <u>Custom reamers</u> have a diameter 2mm larger than the chosen head size
- This allows for nearly conforming surfaces but some ability for the head translate on the glenoid surface
- Too much constraint may lead to excessive joint friction and further wear
- Too much mismatch may lead to point contact and load concentration
- 2mm mismatch allows a balance between optimal conformity and sufficient but not excessive constraint





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Glenoid Preparation



The pink area represents bone that would be removed by eccentric reaming

- Off-axis Reaming does not correct retroversion but preserves subchondral bone and overall bone volume
- Eccentric Reaming corrects retroversion but results in bone loss and violation of the subchondral bone





Preparing the Glenoid

- Failing to address glenoid pathoantomy will allow the replaced humeral head to remain in a decentered location
- This will cause excessive load concentration over a small area leading to further wear and retroversion
- Reaming and balancing recenters the head into a single congruent concavity
- This allows distributed load transfer over the entire surface which reduces the potential for wear





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Humeral Head Height

- Many systems offer different head thickness for each diameter
- The head height (thickness) can be adjusted to optimize the balance between mobility and stability
- The experienced surgeon must know how to best choose a head size that will this goal





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- The shoulder joint is surrounded a capsule that is reinforced by ligaments
- These ligaments contract with arthritis causing stiffness
- Release of these ligaments helps to restore range of motion
- This must be done selectively to prevent recurrent decentering of the humeral head



Preoperative Planning

- Allows precise determination of glenoid shape and orientation
- Allows quantitative assessment of how to balance version correction with bone preservation
- Can be transferred into the operating room for surgical navigation







Intraoperative Navigation

- Exactech GPS (Guided Personalized Surgery)
- Allows the surgeon to precisely prepare the glenoid according to a preoperative plan
- Provides real-time, intraoperative feedback on reamer orientation and depth







Navigated Reaming









Humeral Implant Choices

- Standard Stem
- Short (Preserve Stem)
- Stemless
- Resurfacing

Resurfacing Head

• Pros:

- Most bone preserving
- No violation of humeral canal

• Cons:

- Overstuffing and non-anatomic placement are more common
- Difficulty with glenoid exposure
- Only one head height per diameter





Stemless Humeral Head

• Pros:

- Bone preserving
- No humeral canal violation
- Better access to glenoid

• Cons:

- Only 1 or 2 head sizes per diameter
- Overstuffing and non-anatomic placement more likely







Short Humeral Stem

• Pros:

- Less stress shielding and canal violation than standard stem
- Variable head sizes for each diameter
- Multiple stems sizes to accommodate different anatomy and bone quality

• Cons:

• Stem malalignment possible





Standard Stem

• Pros:

- Secure fixation
- Variable head sizes for each diameters

• Cons:

- More potential for stress shielding of bone
- Maximal canal violation







Factors that influence humeral implant decision

- Surgeon preference
- Altered humeral head shaft relationship
- Preoperative stiffness (may favor smaller head height
- Bone quality (may favor a stem)

• Keys

- The implant achieve immediate solid fixation
- The implant allows the surgeon to achieve the desired goals of the reconstruction
 - Centering
 - Stability
 - Motion





Causes of Technical Failure

- Overstuffing the joint
- Improper humeral head positioning
- Failure to properly address glenoid pathoanatomy
- Failure of the subscapularis repair













Postoperative Goals

- Protection of subscapularis repair
- Immediate range of motion to avoid stiffness







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How Long Does Recovery Take?

- Total Shoulder patients get better faster and achieve near full function by 1 year
- Ream and Run patients peak at 30 months but achieve the same outcome

How long is the recovery?



Nonprosthetic glenoid arthroplasty with humeral hemiarthroplasty and total shoulder arthroplasty yield similar self-assessed outcomes in the management of comparable patients with glenohumeral arthritis. Clinton J, Franta AK, Lenters TR, Mounce D, Matsen FA 3rd. J Shoulder Elbow Surg. 2007 Sep-Oct;16(5):534-8.





Long-term results of the Ream and Run

> J Bone Joint Surg Am. 2017 Dec 6;99(23):1999-2003. doi: 10.2106/JBJS.17.00201.

Functional Outcomes of the Ream-and-Run Shoulder Arthroplasty: A Concise Follow-up of a Previous Report



Jeremy S Somerson ¹, Frederick A Matsen 3rd ²

- 10 year follow-up
- 16% of patients underwent a second procedure of which 12% were revisions
- The revision decreased with time while that of total shoulder increased with time (15% at 10 years)
- Patients that did not have a revision had maintained function







Disadvantages

- A longer, harder recovery process
 - Because the glenoid is not resurfaced, it is normal for patient to have a more prolonged period of postoperative discomfort as the native glenoid adapts and molds to the replaced humeral head
- A 10-15% risk of failure due to persistent glenoid sided pain
 - This may require further surgery to replace the glenoid





Reoperation After Ream and Run: 10-15%

- **Stiffness**: manipulation under anesthesia or arthroscopic release
- Infection: debridement and antibiotics versus implant removal and full revision
- Continued glenoid-sided pain: conversion to anatomic or reverse shoulder replacement



Tend to occur within the first two years



Can It Make Me Worse?

- Any surgery has the potential to make patients worse if complications or technical problems occur
- 6% of patients are subjectively worse after surgery (Lynch et al.)
- Causes: infection, subscapularis failure, nerve injury, glenoid wear





Message on Outcomes

- Failures tend to occur earlier in the course of follow-up
- This highlights the importance of patients being will to commit to a longer recovery
- Some failures are due to technical issues with the surgery
- This highlights the need to consult with an experienced Ream and Run Surgeon





Is the Ream and Run Right for Me?

- Desire for unrestricted activity
- Willingness to commit to a prolonged recovery
- Willingness to exchange some potential residual discomfort in exchange for no risk of glenoid implant failure





Contact Information

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