



4th ACASA
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**Rotator Cuff
&
Biceps Tendon Update**
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**Update on Cuff
Disease**



Process


- Eccentric overload
- Cuff fibre failure
- Proximal migration of humeral head
- Impingement
- Cuff tearing

Anterior acromioplasty for shoulder pain 

Impingement

Partial


↓ Y ↓
↓ E ↓
↓ A ↓
↓ R ↓
↓ S ↓

Complete 

Intrinsic Causes

- Rotator cuff degeneration
- Age related changes
- Repetitive microtrauma

↓

Eccentric Overload 


Natural History

Tendonitis (Stage I) ?

↓

Partial Tear (Stage II of III) ?

↓

Complete Tear (Stage III) ? 

Acromion Morphology

Type I

Type II

Type III

Cause of effect ???



Open Acromioplasty

- 188 patients
- 5 year follow – up
- Satisfactory 87%

Hawkins R.J. JBJS, 1988



Open Decompression Results

Satisfactory
Rate
86% - 95%



Arthroscopic Decompression

- Ellman 1983 –
Concept
- Gartsman 1988 -
Cadaveric



Hawkins

- Arthroscopic decompression.
96 patients, failure rate 50%
- Followed by finger identification of
adequacy of acromioplasty. 2 year
follow-up. 40 patients, success
rate 86%



Technique of Arthroscopic Acromioplasty



- Concerned about adequacy of acromioplasty
- Difficult case
- Redo acromioplasty
- Concern about cuff tear
- Learning procedure



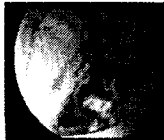
Staging system based on the usual *progression* of rotator cuff degeneration:



Classification

Size

- < 1cm small
- 1 – 3cm medium
- 3 – 5cm large
- > 5cm massive



Stage 1

- Thin or partially torn *Supraspinatus* tendon



Classification

Arthroscopic

- A – Articular
- B – Bursal
- C - Complete

Snyder, Arthroscopy 1991



Classification

Arthroscopic A, B, C:

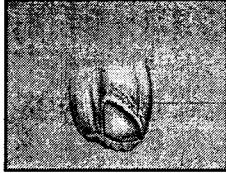
1. Synovial Irritation
2. Tendon fraying < 2 cm
3. Fraying & fragmentation <3cm
4. Partial rotator cuff tear

Snyder, 1994



Stage 3

- Defect involving all of the *supraspinatus* and at least part of *infraspinatus*



Stage 5

Cuff Tear arthropathy (humerus “button – hole” through cuff defect against acromion)



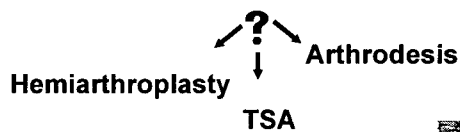
Discussion

Management

Irreparable cuff defects

+

Joint surface destruction



Discussion

Factors that influence repair ability of massive rotator cuff tear

- Acute vs. chronic
- ROM & weakness
- High riding humeral head



Discussion

MRI Findings

- Fatty infiltration in muscle
- Size of tear
- Nature of tissue



Subacromial Arthroscopy

- Scaring ?
- Cuff pathology
 - > Bursal side
 - > Full – thickness
- Acromial pathology



Cuff Size

- Arthroscopically
- Reparability
 - size
 - mobility



Biceps Rupture

- Anterior acromioplasty
- Explore cuff
- Repair biceps



Pathological Changes

Classification:

- Degeneration
- Origin problems
- Instability



Resurgence of Interest

Relates to

- SLAP lesions
- Subscapularis lesions
- Hidden lesions
- Assoc. with SAD failure



Humeral Head Depressor

- Release with massive tears
- No ↑ migrations of head

Walch et al; 1998 ASES Open Mtg.



Question

- Tenodesis Tenotomy
- “Fix it” or “Let It Fly”



Release vs Tenodesis

- Deformity
- Weakness
- Recovery



Release vs Tenodesis

30 of each

Release

- Quicker recovery
- Fewer complications
- Less pain



RELEASE

Half hang in groove with no deformity

Walch, Abrams, Misamore, Hawkins



Biceps Rupture

No Tenodesis

- 21% Loss Supination
- 8% Loss Flexion

Mariani et al; CORR, 1988

Biceps rupture rarely painful except at biceps stump



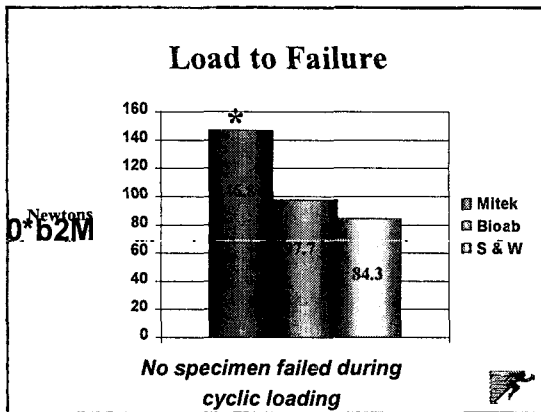
Following release we now apply ACE wrap for 2 weeks



METHODS OF FIXATION

- Screw & washer
- Anchors
- Staples
- Interference screw (Litchfield)





Conclusion

- Tenodesis with all 3 fixation methods sufficient for immediate active ROM of elbow after surgery
- Suture anchor construct had greatest load to failure
- Interference screw and screw & washer had potentially weakens tendon at interface with fixation device

Surgical Management Of Rotator Cuff Tears

Massive Tears

Massive tears had acromioplasty only

Rockwood & Burkhead, Ortho Trans: 1988

Arthroscopy

- Decompression for cuff tear
 - > Ellman '88
 - > Gartsman '91

Results size dependent

Repairs of the Rotator Cuff

- Harryman, Masten et al. JBJS '91 (Ultrasound – 105 Patients)

Correlation of function and integrity

Results

>50% large tears came apart

- Patients satisfied
- Function and ROM not as good as intact cuffs



Cyclic Loading of Anchor-Based Rotator Cuff Repairs: Confirmation of the Tension Overload Phenomenon and Comparison of Suture Anchor Fixation With Transosseous Fixation

Burkhart et al. , J. Arthroscopic & Related Surgery 1999



Experimental Rotator Cuff Repair

- Use of modified Mason-Allen Stitch
 - > #3 braided polyester suture
 - > Cortical-bone augmentation
- Superior to conventional repair
- Transferred weakest part of the repair to suture material

Gerber et al. , JBJS 1999



Goal

Establish an animal model to study factors which influence tendon healing to a bone trough



Which factors are most important in maximizing the success of rotator cuff surgery?



A Biomechanical Analysis of Rotator Cuff Healing in a Sheep Model:

Strength and Stiffness Through 12 weeks

Theodore F. Schlegel, M.D.
John M. Tokish, M.D.
Chad W. Lewis
Susan P. James, Ph.D
Craig H. Mallinckrodt, Ph.D
Richard J. Hawkins, M.D.
A. Simon Turner, B.V.Sc., M.S.



DISCUSSION

Time to Healing

- Progressive increase in strength over 12 weeks
- Only 25% of normal strength at 12 weeks

Arnoczky et al AJSM 1988

Rodeo et al JBJS 1993

St Pierre et al JBJS 1995



Question #2

Best method of fixation?



Tendon Healing to a Trough-in Bone using a Sheep Model

Comparison of Suture Anchors vs. Suture Tough Bone Tunnels

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CONCLUSION

- Structural Properties At 12 Weeks

→ Suture Anchor vs. Transosseous Tunnels

• No Significant Differences

↔ Load to Failure (N) & Stiffness (N/cm)



Question #3

Effect of tension?



The Effect of Immobilization on Long-term Rotator Cuff Healing Using Modified Mason-Allen Stitches: A Biomechanical and Histological Study in Sheep

Theodore F. Schlegel, M.D.

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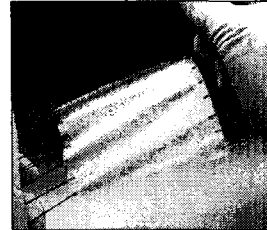
CONCLUSION

- **Structural Properties At 26 Weeks**
 - Load to Failure (N) & Stiffness (N/cm)
 - Less than Controls
- **Healing occurred with a consistent “gap-formation”**



Question #4

Enhancement of healing



The Effects of Swine Small Intestine Submucosa Augmentation on Tendon Healing Under Tension

Biomechanical and Histological Evaluation in Sheep

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Chad Lewis, B.S.
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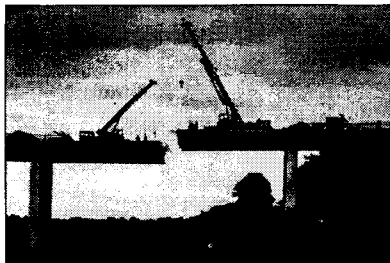


Bioengineered Collagen Membranes

- “Close the hole”
- Bridge gap
- Reinforce repair



To Augment or to Bridge That Might be the Question



Hypothesis

- The biomechanical and histological properties of tendon healing under tension can be improved by augmenting the repair with the rotator cuff patch



The Cuff Patch

- 8 layers of ICL, 6.5 by 9.0 cm
- Low level crosslinking allows remodeling over 1 year
- Approved for reinforcement of soft tissue repairs made with sutures or suture anchors, including, the rotator cuff tendons



CONCLUSION

- **Structural Properties At 12 Weeks**
 - Augmentation of Repair with Patch
 - Load to Failure (N)
 - ♦ Trend towards Patch
 - Stiffness(N/cm)
 - ♦ Statistically significant difference



Discussion

- In a sheep model, the “Rotator Cuff Patch” enhances the short-term biomechanical properties of tissue healing under tension
- Histological evaluation pending
- Provides a potential advantage for augmenting rotator cuff repairs



FUTURE STUDIES

- Chronic Rotator Cuff Repair Model
- Multicenter Clinical Study-2002



Open Cuff Repair

Strive to:

- Maximize suture holding
 - > I.e. Mason Allen
- Drill holes in bone
- Devices to protect tuberosity from suture cutting through



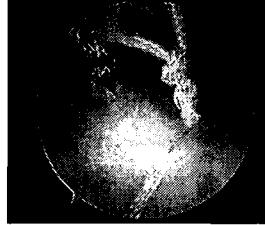
Options

- Arthroscopic – Decompression – Repair
- ASD + mini open
- Conventional - Open



Arthroscopic

- Technicality demanding
- Usually simple suture fixation
- Anchors



Post – Op Management

- Assisted – Early
- Active – Size of tear security of repair
- Brace – Tension

{Six Months}



Large Tear Consideration

- Biceps – incorporate, graft
- Other tissue – fascia lata
- Foreshorten trough
- Synthetics – Merselene
- Latissimus transfer



Massive Cuff Tears

- Debridement & decompression, *Rockwood*
- Debridement & decompression arthroscopic
- Partial cuff repair, *Burkhart*
- Biceps release, *Walsh*
- Conventional repair



Surgical Outcome Considerations

- Deltoid
- Trough
- Achors
- Tension
- Rehabilitation
 - Success



Thank You



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