

# **Equivocal Post-Operative Pain and Function after Biceps Tenodesis using Expedited Sling Protocol**

**Alexis Restrepo, BS; Mark A. Glover, BS; Gabriel J. Sowards, BS; Andrew J. Recker, MD; Garrett S. Bullock, DPT, DPhil; Nicholas A. Trasolini, MD; Brian R. Waterman, MD**

**Wake Forest School of Medicine**

**Sports Medicine & Shoulder Surgery**

**Department of Orthopaedic Surgery & Rehabilitation**

**Presentation #37**

# Disclosures

---

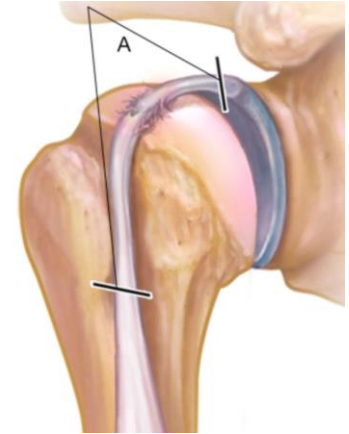
- Alexis Restrepo: Nothing to Disclose
- Mark Glover: Nothing to Disclose
- Andrew Recker: Nothing to Disclose
- Edward Beck: Nothing to Disclose
- Garrett Bullock: Nothing to Disclose
- Nicholas Trasolini: Nothing to Disclose

Thanks to the Wake Forest School of Medicine Department of Orthopaedic Surgery & Rehabilitation as well as Nina Cruz-Diaz and Erica Hartzell for their help.

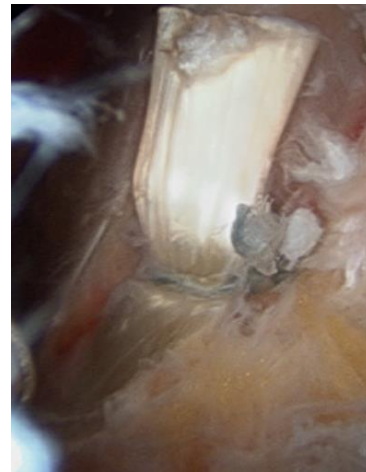
- Brian Waterman:
  - AAOS: Board or committee member
  - American Orthopaedic Society for Sports Medicine: Board or committee member
  - Arthrex, Inc: Research support
  - Arthroscopy: Editorial or governing board; Publishing royalties, financial or material support
  - Arthroscopy Association of North America: Board or committee member
  - Elsevier: Publishing royalties, financial or material support
  - FH Ortho: Paid consultant
  - Kaliber AI: Stock or stock Options; Unpaid consultant
  - Sparta Science: Unpaid consultant
  - Vericel: Paid presenter or speaker
  - Vivorte: Stock or stock Options

# Background

- Biceps Tenodesis (BT) is indicated for pathology of the long biceps head and superior labrum anterior and posterior (SLAP) lesions
- Clinical norm is four to six weeks of sling immobilization
- Sling use increases fall risk, difficulty with ADLs, and discomfort



Mayo 2016



Creech. *Knee Surg Sports Traumatol Arthrosc.* 2016.  
Boileau. *Am J Sports Med.* 2009.  
Werner. *AM J Sports Med.* 2014.  
Sonoda. *Prosthet Orthot Int.* 2018.

# Methods

---

## Objective:

Evaluate safety of expedited sling immobilization & earlier timeline to return to normal ADLs after BT.

## Hypothesis:

No significant differences in 1° & 2° outcomes between standard (4-6 week) & expedited (0-2 week) sling immobilization



# Methods: Study Design

---

- **Retrospective cohort study**
- **135 patients**
  - Expedited sling rehabilitation
    - 0-2 weeks of sling immobilization
    - 66 patients
  - Standard sling rehabilitation
    - 4-6 weeks of sling immobilization
    - 69 patients
- **June 1<sup>st</sup>, 2018 to January 1<sup>st</sup>, 2022**
- 3 surgeons

## **Inclusion Criteria:**

- Over 18 years old
- Isolated BT surgery

## **Exclusion Criteria:**

- Concomitant procedures affecting rehabilitation protocol
- Less than one year of follow up
- No documented sling rehabilitation protocol

# Methods: Primary and Secondary Outcomes

---

- **Primary Outcomes:**

- Loss of fixation
- Popeye deformity
- Surgical revision
- Abduction, forward flexion, & external range of motion (ROM) at 2-, 6-, 12-, and 24-weeks post operation.

- **Secondary Outcomes:**

- Patient reported outcomes (PROs) at 3-, 6-, and 12-months post operation:
  - Pain: VAS, PROMIS-10
  - Function: ASES, SANE, PROMIS-10



Abduction sling; Credit: shoulderelbow.org

VAS: Visual analog scale for pain  
PROMIS-10: Patient Reported outcomes  
Measurement Information System  
ASES: American Shoulder and Elbow Surgeon  
SANE: Single Assessment Numeric Evaluation

# Methods

---

- **Data analysis**
  - **Missing data prevalence: 73%, at random**
    - Controlled via multiple imputation with chained equations were performed with 70 iterations.
  - No missing data for age, sex, BMI, or days of follow up

# Methods

Missing data prevalence						
	Pre-op	6 wks	12 wks	24 wks	1 yr	2 yrs
Forward Flexion	38%	39%	54%	85%		
Abduction	21%	36%	53%	83%		
External Rotation	18%	36%	50%	84%		
VAS	50%	53%	55%	61%	65%	84%
SANE	53%		55%	61%	65%	84%
ASES Shoulder Function	50%		55%	61%	65%	84%
ASES Shoulder Index	53%		55%	61%	65%	84%
Promis-10 Mental	56%			62%	67%	85%
Promis-10 Physical	56%			62%	67%	85%
QuickDASH	56%		59%	63%	67%	86%



# Methods

---

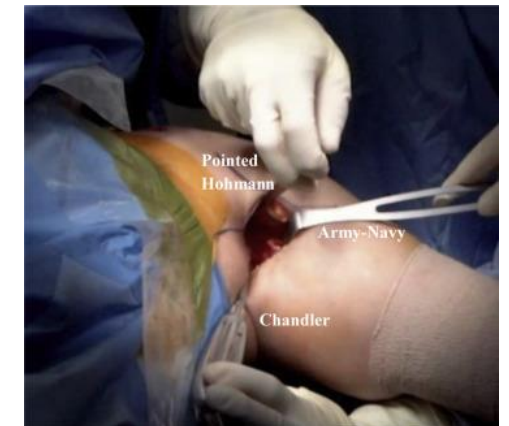
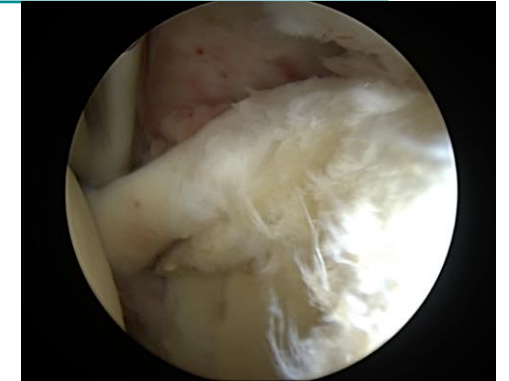
- **Data analysis**

- Complication prevalence confidence intervals were calculated using the Clopper Pearson method.
- To assess differences between sling interventions in PROs and ROM, a series of hierarchical mixed effects linear regressions were performed.

# Results

## Patient Characteristics

Variable (mean ± st. dev.)	Standard	Expedited	P-value
Age (years)	49 ± 14	47 ± 14	0.341
Gender (Male/female)	34/32	33/36	0.671
BMI (kg/m <sup>2</sup> )	30 ± 6	31 ± 7	0.636
Follow-Up (years)	3.09 ± 1.04	2.09 ± 0.77	<b>0.001</b>
Race (White, Black, Other)	55/9/2	57/11/1	0.777



Gifford. *Arthrosc Tech.* 2020.

# Results: Surgical Complications

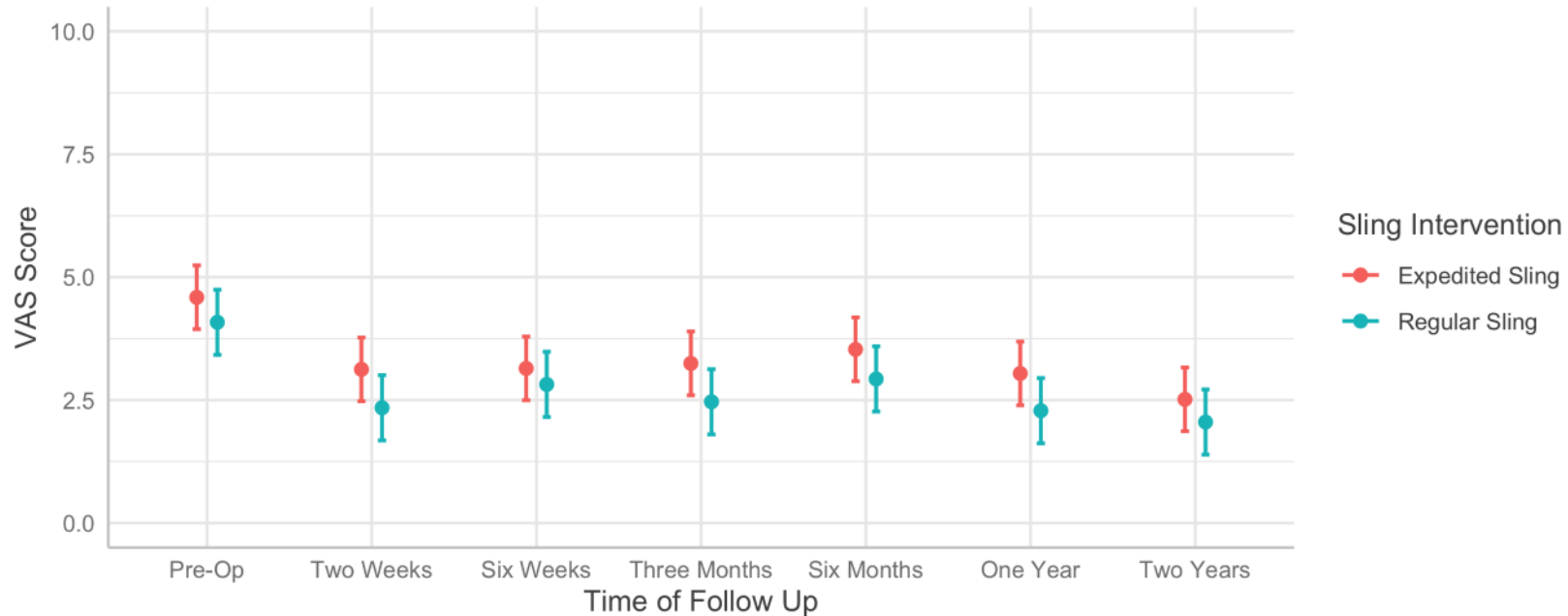
---

- **Complication rates**

- Expedited sling group: 0.4 complications per 10,000 exposure days
- Standard sling group: 0.3 complications per 10,000 exposure days
- **Rates of complications: No differences [1.4 (95% CI: 0.2, 10.0),  $p = 0.727$ ]**

# Results: PROs

- The **standard sling group reported greater improvements in pain measured by VAS** [-0.8 (95% CI: -1.2, -0.30)] over the follow up period compared to the expedited sling group



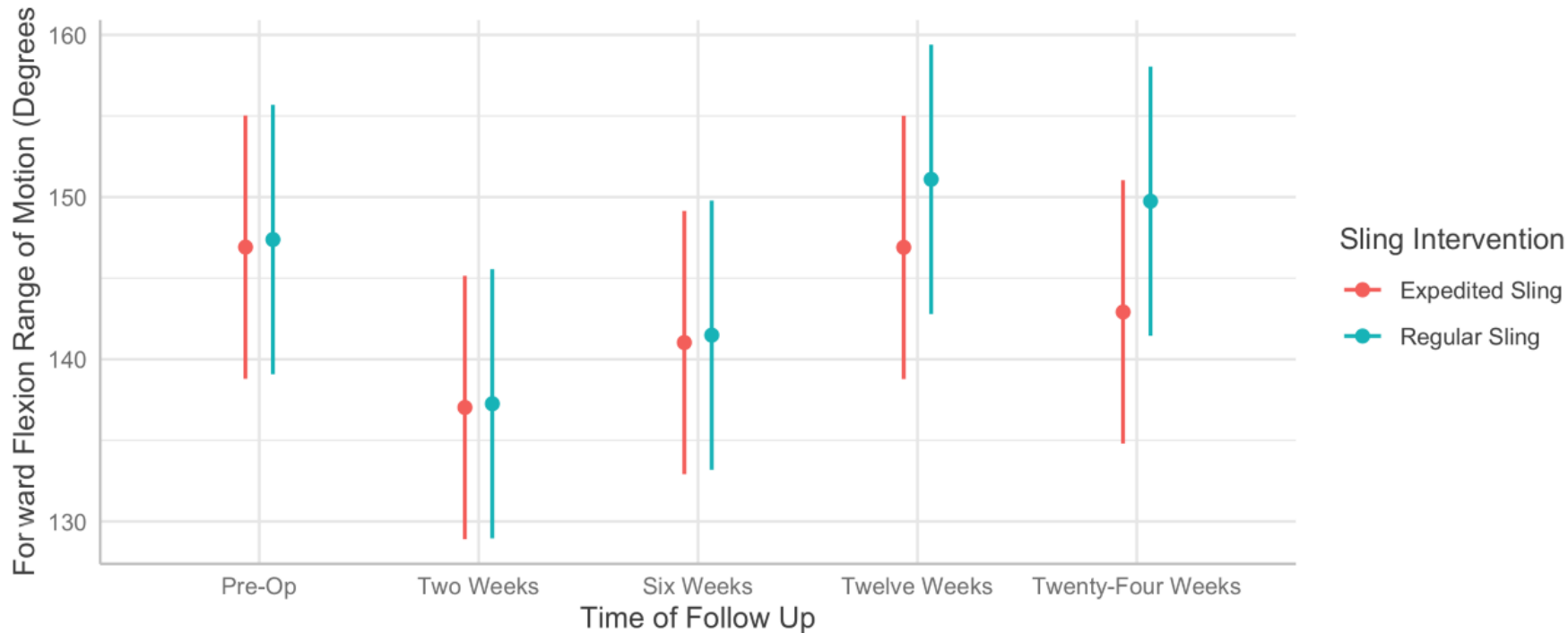
# Results: PROs

- **No differences in other patient reported outcomes** between the two sling groups over the follow up period.

Patient Reported Outcomes	
ASES Functional Score	0.14 (95% CI:-3.54, 3.52)
ASES Index Score	5.3 (95% CI: -26.3, 36.9)
SANE	5.7 (95% CI: -31.9, 43.3)
Quick DASH	-0.2 (95% CI: -28.6, 28.2)
PROMIS Physical Component Score	-0.2 (95% CI: -28.6, 28.2)
PROMIS Mental Component Score	-0.2 (95% CI: -28.6, 28.2)

# Results: ROM

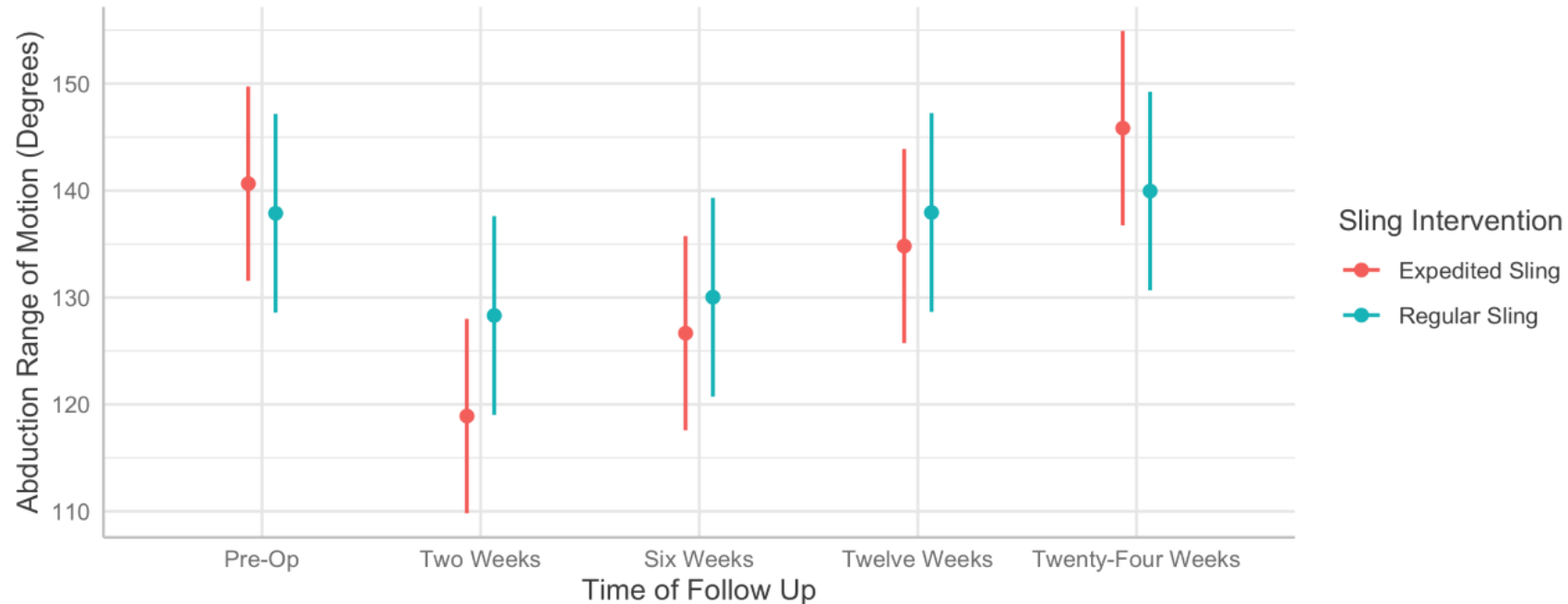
- There was no difference in range of motion observed between either sling group in **forward flexion** [-5.7 (95% CI: -69.0, 55.6)]





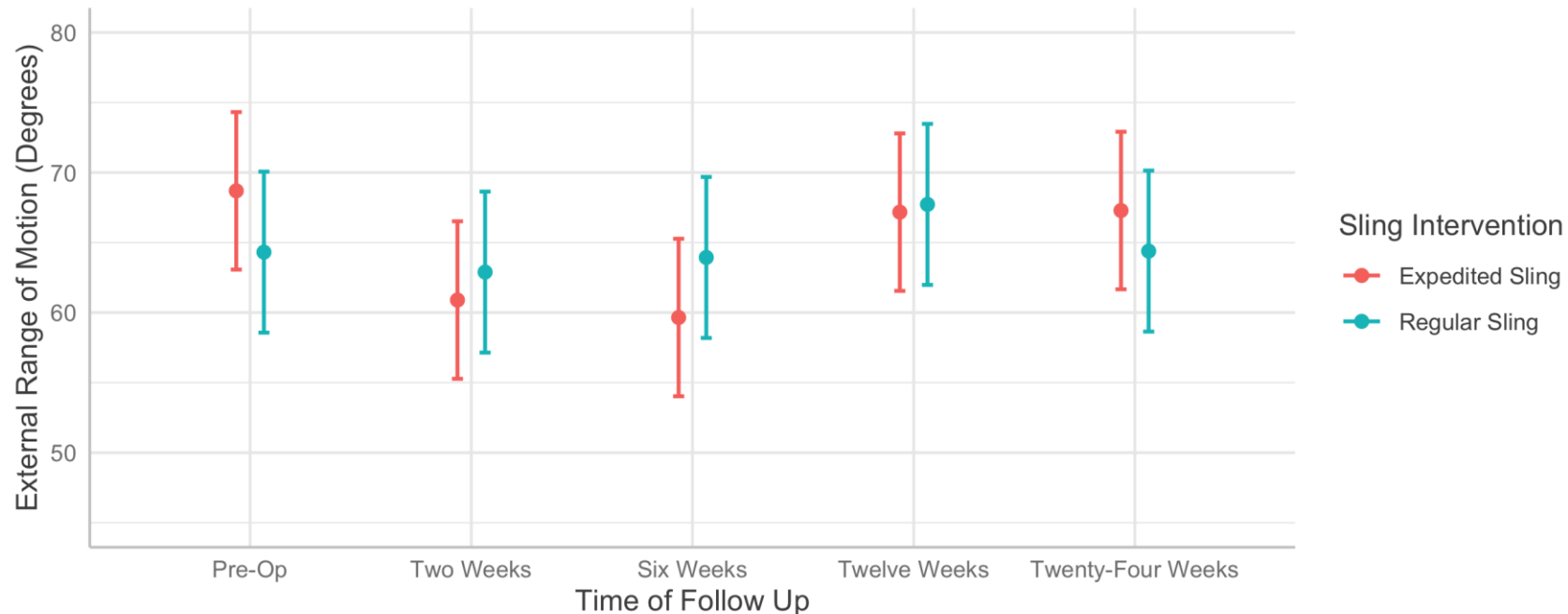
# Results: ROM

- There was no difference in range of motion observed between either sling group in abduction [-4.3 (95% CI: -93.3, 88.7)]



# Results: ROM

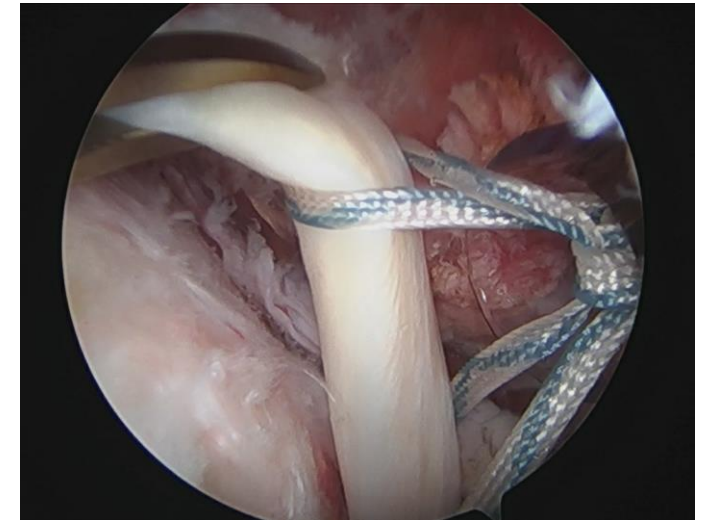
- There was no difference in range of motion observed between either sling group in **external rotation** [-6.8 (95% CI: -38.6, 25.0)]



# Discussion

---

- Early sling discontinuation permits earlier resumption of ADLs
- Expedited biceps tenodesis protocol:
  - No increased risk of Popeye deformity, surgical revision, or loss of fixation
  - Similar PROs, except for small, although clinically significant less improvement in VAS Pain



Liechti. *J Shoulder Elbow Surg.* 2018.  
Forsythe. *Am J Sports Med.* 2022.

# Limitations

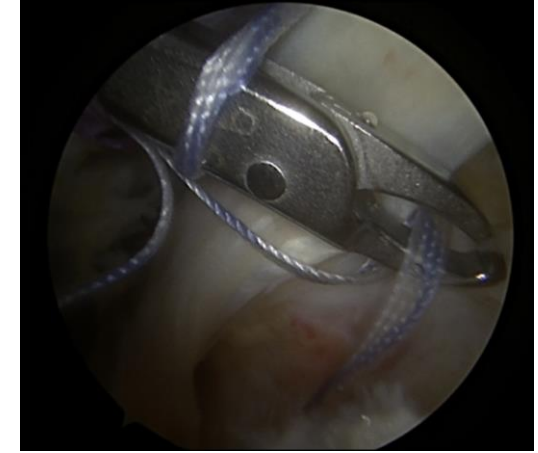
---

- Significant difference in follow-up time between groups
  - May be due to increased comfort with expedited sling rehab
- Prevalence of missing data
- All patients treated by one of three surgeons
- Heterogeneity in surgical approach
  - included both open subpectoral and arthroscopic suprapectoral BT

# Conclusion

---

- **No difference in risk of surgical complications** between standard and expedited sling rehabilitation after biceps tenodesis
- **Standard sling rehabilitation group showed small, but not clinically significant improvement** in pain relative to the expedited group
- Patients who have undergone isolated biceps tenodesis may **safely discontinue sling use within 2 weeks after surgery**



Eguia. *J Shoulder Elbow Surg.* 2020.

# Thank You

---

