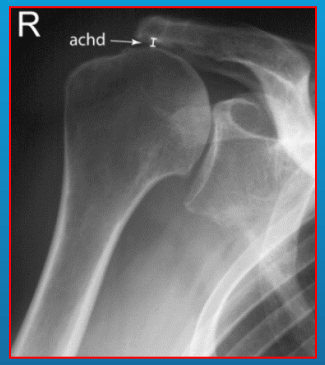
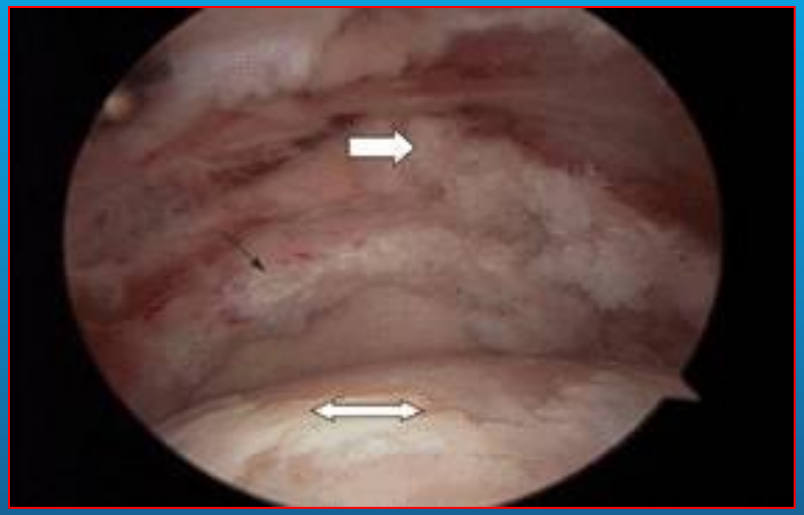
Options for the “Irreparable” Massive Rotator Cuff Tear





Craig M Ball

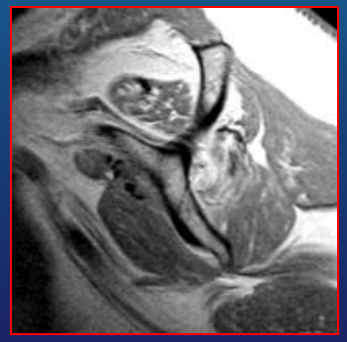
Auckland Bone and Joint Surgery

Auckland, New Zealand

Introduction

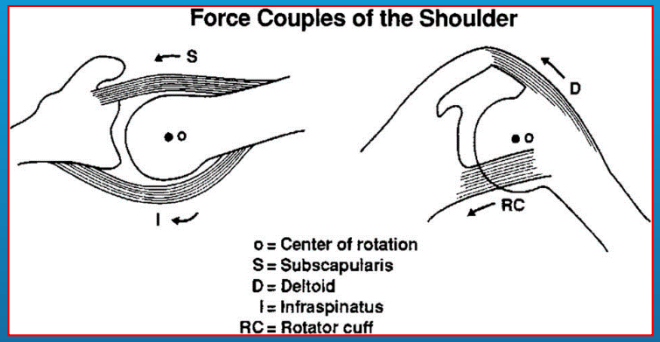
- Refers to tears in which severe atrophy and fatty infiltration of muscle prevents retracted tendon from being repaired to original footprint under appropriate tension
- No tear can be considered irreparable until a repair is attempted, even though attempted repair is not indicated in all cases

  Oh et al. Am J Sports Med 2011: 39; 1413-1420

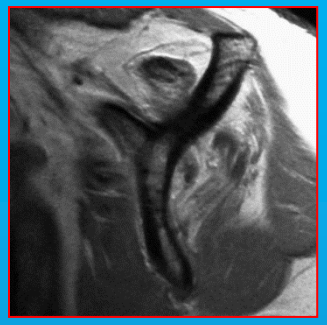


Pseudoparalysis

- With massive RC tears, uncoupling of forces across GH joint can occur, resulting in unstable shoulder kinematics and loss of shoulder function
  Burkhart. CORR 1992; 144-152



- Single most important predictor for preserved shoulder function is integrity of inferior subscapularis function
  Collin et al. JSES 2014; 23: 1195-1202
  Wieser et al. JSES 2014; In Press



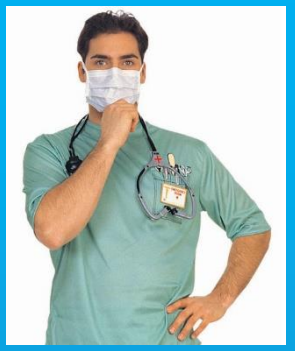
Fatty Infiltration

- Little is known about pathophysiology behind this biologic phenomenon
- Can continue to progress even after RC repair
  Gladstone et al. Am J Sports Med 2007: 35; 719-728
- Source of adipocytes is unclear – may be that loss of mechanical stretch initiates adipogenic pathways of pluripotent stem cells and precursor cell populations within the muscle
  Akimoto et al. Biochem Biophys Res Com 2005: 329; 381-385

Non-Operative Treatment

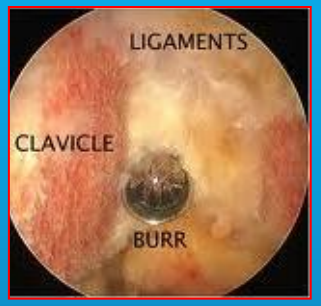
- Value of non-operative treatment using physical therapy, cortisone injections not well established, especially in patients whose symptoms have been chronic
- May lead to satisfactory clinical outcomes in selected, low-demand patients, but does not prevent inevitable joint degeneration
  Zingg et al. JBJS (Am) 2007; 89: 1928-1934
- Emphasis on anterior deltoid re-education

Operative Treatment



- Many different operative interventions
- No single guideline for treatment
- Results not dependent on delay between diagnosis and treatment
- Decision making must be individualised

Arthroscopic Debridement



- Primary goal of surgery is to remove sources of pain
  - bursa, torn RC edges, LH biceps, limited acromioplasty, tuberoplasty (RASD), AC joint)
- Satisfactory short-term results in patients with low demands and primary complaint of pain whose functional use of arm is relatively preserved (good preservation of AHI, no pseudoparalysis)
  Lee et al. Arthroscopy 2011: 27(10); 1341-1350
- Post-operative rehabilitation key to success

However

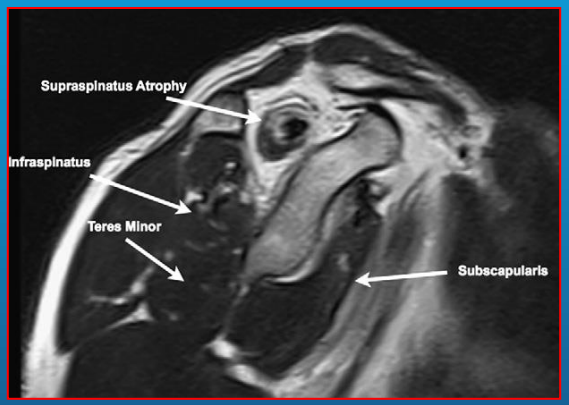
- Recovery of strength is limited
- Clinical results deteriorate with time
  Yoo et al. JSES 2013; 22: e23-24
- No evidence that debridement is superior to biceps tenotomy alone
  Boileau et al. JBJS (Am) 2007;89:747-757
- Does not prevent further radiologic deterioration
  Verhelst et al. JSES 2010;19:601-608
  Liem et al. Arthroscopy 2008: 24(7);743-748

Partial RC Repair

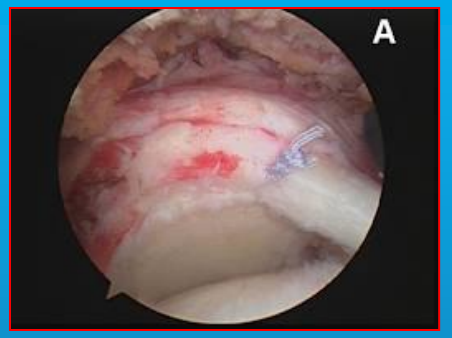
- May improve biomechanics of the shoulder while re-establishing shoulder's essential force couples
  Porcellini et al. JSES 2011; 20: 1170-1177
  Kim et al. Arthroscopy 2012: 28; 761-768
- May improve results compared to debridement alone
  Duralde et al. JSES 2005; 14: 121-127
  Berth et al. J Orthop Traum 2010: 11; 13-20
- May prevent or at least postpone prosthetic replacement in certain patients
  Verhelst et al. JSES 2010;19:601-608

However

- Does subject patient to a longer recovery
- Best results in patients without signs of complete disruption of the posterior RC and good function of the subscapularis
  al. JSES 2011; 20: 1170-1177
- Repair failure can and does occur
  Yoo et al. Arthroscopy 2009; 25: 1093-1100
  Berth et al. J Orthop Traum 2010; 11: 13-20

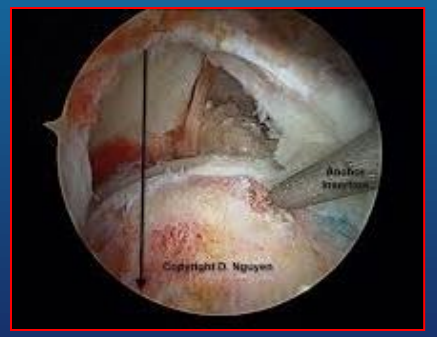


Remember



- Partial repair in appropriately selected patients may actually yield short term results comparable to complete repair
  Iagulli et al. Am J Sports Med 2012: 40; 1022-1026

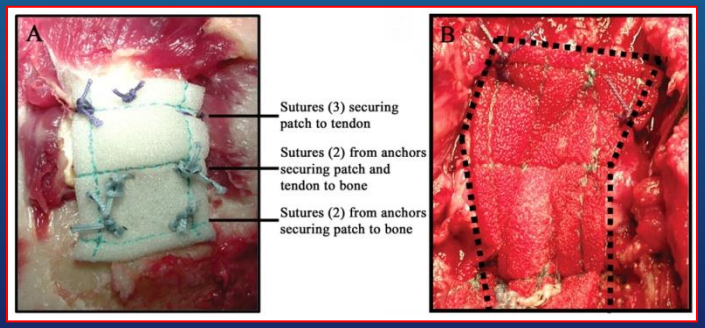
- Recognising tear pattern critical to appropriate mobilisation and re-approximation of massive RC tears in effort to maintain a low tension repair
  Burkhart and Lo. JAAOS 2006: 14; 333-346



RC Augmentation

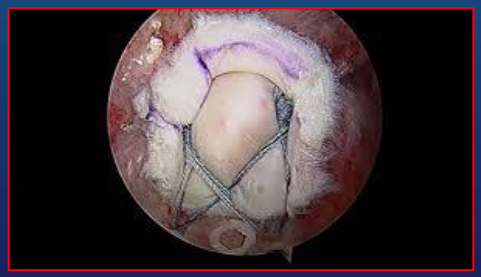
- Despite improvements in understanding RC tears and advances in surgical treatment, healing after RC repair remains a challenge
- Need for strategies that can augment repair by mechanically reinforcing it, while at the same time biologically enhancing intrinsic healing potential

Rodeo et al. JBJS (Am) 2007: 89; 2485-2497

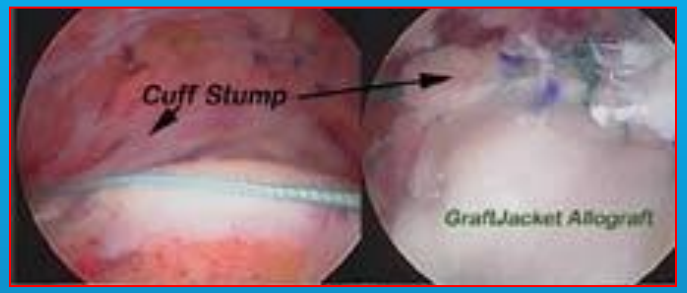


Scaffolds

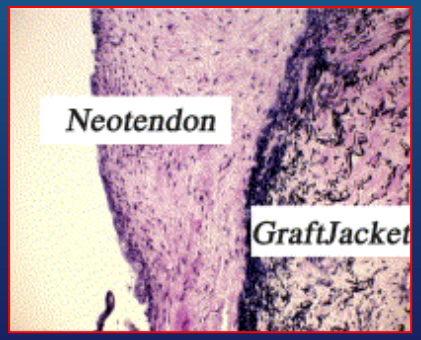
- Include mammalian extracellular matrix (ECM), synthetic polymers, or a combination of both
- A number of different options now on market
- Used for mechanical augmentation by “offloading” the repair, or biological augmentation by improving healing, or a combination of both
- Have also been used as interposition devices



Interposition



- Partial RC repair, coupled with biologic bridging (eg. Graft-Jacket allograft acellular human dermal matrix), may appear to offer alternative treatment in massive irreparable tears
  - does not burn bridges if further surgery required
  - possibility to function as regenerative tissue matrix to promote tendon healing



However

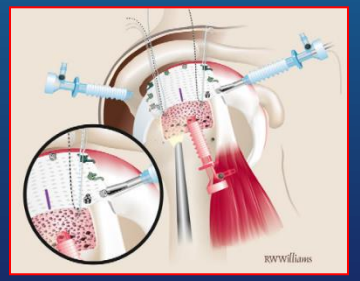
- At present scaffolds approved for use in RC augmentation only, not as an interposition graft or tendon substitute

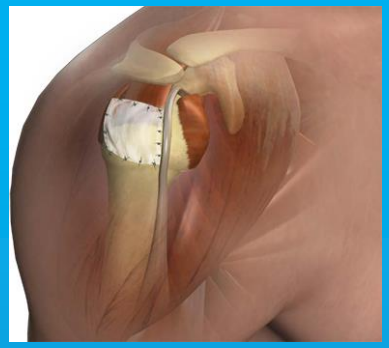
- Retrospective follow-up studies of use as an interposition have reported improved outcomes compared to pre-operative condition, but no control group comparison
  Mori et al. Arthroscopy 2013; 29: 1911-1921

Augmentation

- Current role of scaffold augmentation devices still undetermined
- Earlier reports shown mixed results for surgical outcomes and complication rates
  Iannotti et al. JBJS (Am) 2006; 88: 1238-1244
  Walton et al. JBJS (Am) 2007: 89; 786-791

- Recent success warrants further study
  Gupta et al. Am J Sports Med 2012; 40: 141-147
  Proctor. JSES 2014; 23: 1508-1513
- Now subject of review by various authors

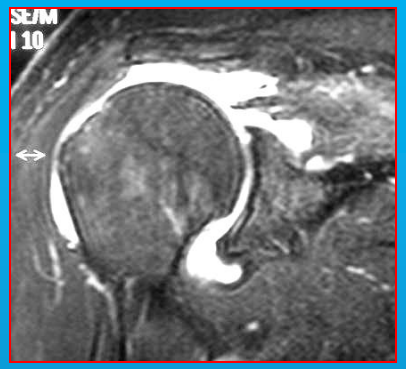




However

- No long-term or randomised data available
  - recent prospective randomised study supports potential use
    Barber et al. Arthroscopy 2012: 28; 8-15
- Numerous questions remain
  (indications, application, safety, mechanism of action, efficacy, processing, sterilisation, immunogenicity, mechanical effects)
- Temporal sequence of remodeling events, including rate and extent of scaffold degradation, incorporation, and host tissue deposition, also not well established
  Ricchetti et al. JSES 2012: 21; 251-265

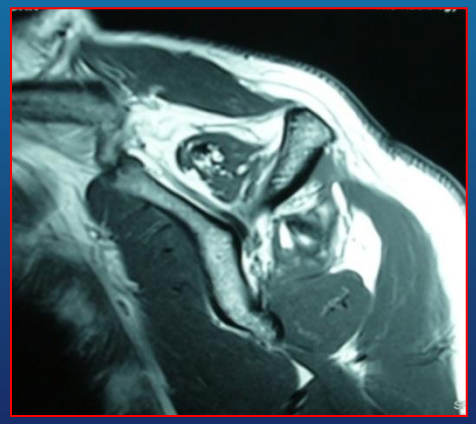
Tendon Transfer



- Alternative treatment method in select patients (too young to consider reverse TSA) in whom recovery of function and strength also a goal
  Feeley et al. JSES 2009; 18: 484-494
- Goal is to produce stable kinematics by restoring strength and force coupling about the joint (internal/external rotational balance)
- Control of elevation and ER

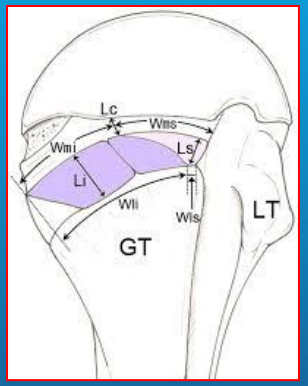
Latissimus Dorsi

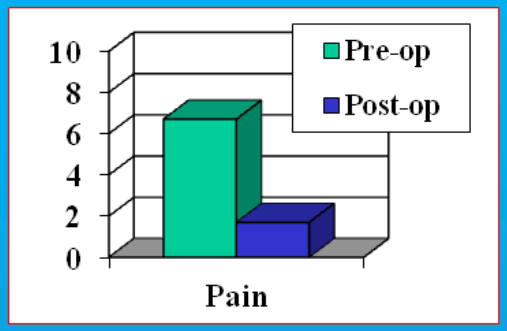
- First promising report published by Gerber
  Gerber et al. Clin Orthop 1988; 232: 51-61
- Multiple authors since concurred that it is a valuable treatment option provided that the subscapularis is intact
- Results better if no pseudo-paralysis of anterior elevation and if teres minor no fatty infiltration
  Costouros et al. JSES 2007; 16: 727-734



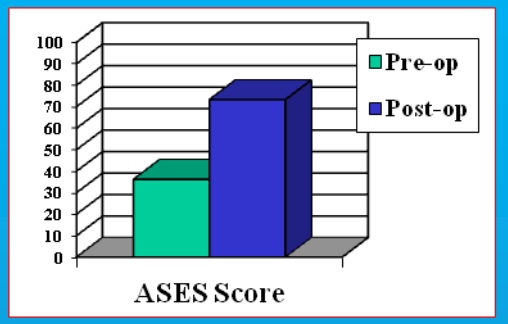
Combined Transfer

- Alternate technique taking both teres major and latissimus dorsi tendons
- Maximises surface area of tendon available for coverage of footprint
  Pearle et al. JBJS (Am) 2006; 88: 1524-1531
- May lead to increased restoration of active ER resulting from more powerful transfer
  Herzberg et al. JSES; 1999; 8: 430–437
  Habermeyer et al. JSES 2012: 21; 1499-1507





My Outcomes



- 24 patients (21 male; 3 female) reviewed at an average follow-up of 25.8 months
- Substantial improvement in pain and shoulder function in 79.2% of 24 patients
- Not insignificant complication and failure rate of 18.2% (typical for a salvage procedure)
- Results similar to other studies
  Iannotti et al. JBJS (Am) 2006; 88: 342-348
  Gerber et al. JBJS (Am) 2013; 95: 1920-1926

However

- Recovery can be prolonged and demanding
- Transfer does not provide enough strength to overcome pseudoparalysis (subscapularis)
- Inferior outcomes in patients > 60 years, especially those with failed prior RC repair (limited adaptive potential to retrain muscles)
- Does not prevent progression of osteoarthritis

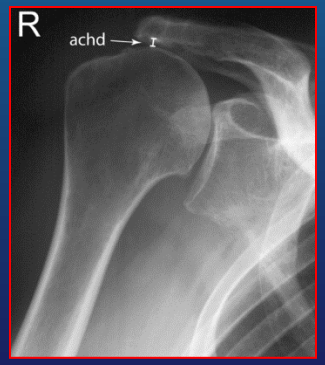
  Habermeyer et al. JSES 2012: 21; 1499-1507
  Gerber et al. JBJS (Am) 2013; 95: 1920-1926

Hemiarthroplasty

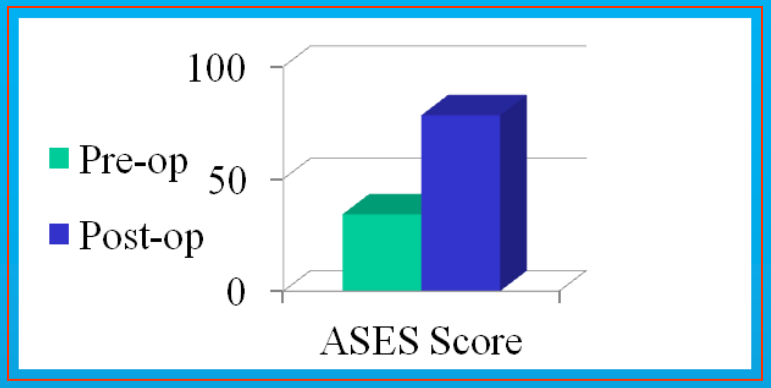
- Although some centres have reported acceptable results, most studies indicate only fair to good pain relief and poor restoration of lost function
  Field et al. JSES 1997; 6: 18-23
- If associated with pseudoparalysis, results of hemiarthroplasty so much inferior to reverse TSA that hemiarthroplasty has almost lost its role, although level I studies are lacking
  Leung et al. JSES 2012: 21; 319-323

Reverse TSA

- Best solution in elderly for treatment of disability caused by irreparable RC tearing with arthropathy
- Reliably improves function and pain
- Best solution for treatment of massive irreparable RC tear with pseudoparalysis
- Recently with increasing biomechanical knowledge and clinical confidence has become an accepted option for treatment of painful irreparable RC tears even without arthrosis



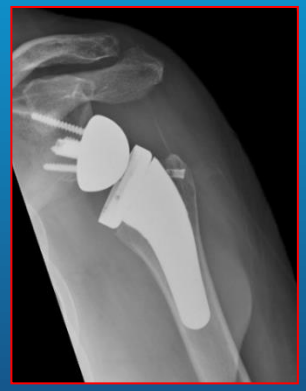
My Outcomes



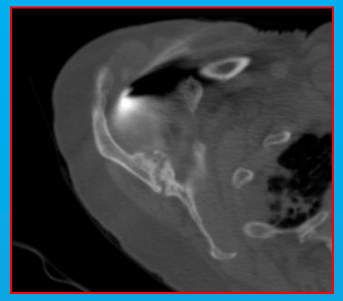
- Almost 40% of 100 cases primary reverse TSA performed for symptomatic irreparable RC tears (includes failed prior RC surgery)
- All patients significant improvement in pain
- All but 2 patients significant improvement in function
- Complication rate 12.5% but majority did not affect final clinical outcome

My Outcomes

- Results similar to other studies
  Cuff et al. JBJS (Am) 2008; 90: 1244-1251
  Naveed et al. JBJS (Br) 2011; 93: 57-61
- Good results obtained even in patients with previous failed RC repair
  Sadoghi et al. JSES 2011; 20(7): 1138-1146
  Ek et al. JSES 2013; 22: 1199-1208

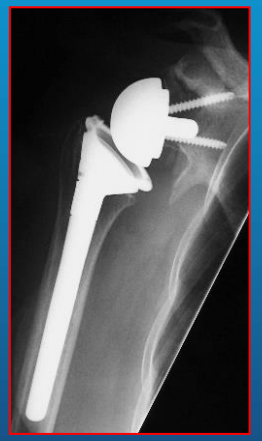


- Certainly for patients aged > 70 years it has replaced all other procedures



However

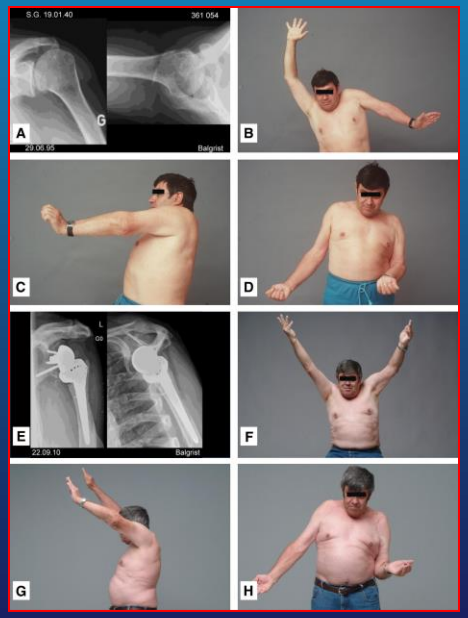
- Unsolved problems remain
  - instability
  - axillary nerve injury
  - acromial fracture
  - notching
  - infection



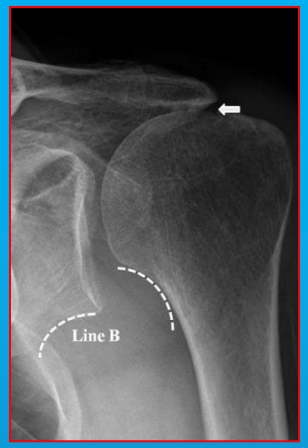
- High reported complication rates and the necessity for revision procedures remain justifiably troubling
- Difficult to correct the often subjectively important pseudoparalysis of ER
- Long-term prognosis remains guarded

Current Controversy

- Whether reverse TSA reliably yields desired improvements in relatively young and active patient (and whether increased quality of life provided outweighs risks of complications and early revision surgery)
- Recent report (mean age 60, range 46-64) showed excellent results at no less than 10 years provided that complications requiring removal (glenoid loosening, infection) can be prevented (15%)
  Ek et al. JSES 2013; 22: 1199-1208



Summary



- Massive irreparable RC tears pose a distinct clinical challenge
- Successful management relies on thorough evaluation of patients symptoms and functional demands, and precise understanding of potential of different treatment options
- Multiple different treatment options
- Choice of treatment option sometimes more difficult than execution of procedure itself

Summary

- Improvements in function can only be expected if overall kinematics about the joint can be restored
- In select younger patients combined tendon transfer can provide substantial improvements in shoulder function and pain that seem to be durable over time
  Gerber et al. JBJS (Am) 2013; 95: 1920-1926
- In older patient reverse TSA has now replaced all other options to reliably improve shoulder function and pain

Summary

- ECM and synthetic scaffolds may in the future have enormous therapeutic potential
- Will require ongoing efforts of manufacturers, clinicians, and researchers to develop and validate scaffold technology as safe and effective
- Development of adjuvant therapies also going to be necessary to obtain better outcomes, targeted at preventing progression of fatty infiltration and improving muscle regeneration
  Kang et al. JSES 2012: 21; 175-180
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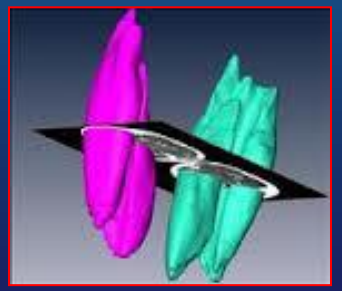

Thank You