

# Orthopedics Update «Reverse Total Shoulder Arthroplasty»

## Stability and Instability of RTSA

A. LÄDERMANN

Orthopaedics and Traumatology, La Tour Hospital, Meyrin, Switzerland

Orthopaedics and Traumatology, Geneva University Hospitals, Switzerland

Faculty of Medicine, Geneva, Switzerland

# Disclosures

I have no potential conflicts with this presentation

"Stability and Instability of RTSA"

# Table of Contents

- Prevalence
- Causes
- Prevention
- Treatment



# Prevalence

- 3.4%<sup>1</sup>-5%<sup>3</sup>
- Early complication 61% in the first 3 months<sup>2</sup>
  - Surgical error
- Late
  - PE wear, trauma, hematogenous infection
- Anterior, posterior, lateral

1. Molé D, Favard L. Excentered scapulohumeral osteoarthritis. Rev Chir Orthop 2007

2. Molé D. Master Shoulder Course, Berlin 2013.

3. Trappey. What Are the Instability and Infection Rates After Reverse Shoulder Arthroplasty? Clin Orthop 2011

# Causes

*The further backward you look, the further forward you can see.*

Winston Churchill

"Stability and Instability of RTSA"

# Causes

- At least 7 causes

## 1. Failure to restore intraoperatively length of humerus<sup>1</sup>



1. Lädermann A. Objective evaluation of lengthening in reverse shoulder arthroplasty. JSES 2009

# Causes

- Biomechanics changes produced by the design: secondary complications<sup>1</sup>
- Displacement in the frontal plane of the center of rotation:
  - Shortening: dislocation<sup>2</sup>  
poor function<sup>3</sup>



1. Farshad M, Gerber C. Reverse total shoulder arthroplasty: from the most to the least common complication. International Orthopaedics 2010; 34: 1075-82.
2. Lädermann A. Objective evaluation of lengthening in reverse shoulder arthroplasty. JSES 2009
3. Lädermann A et al. Influence of arm lengthening in reverse shoulder arthroplasty. JSES 2012

# Cause

- Control of lengthening is thus the key to avoid many complications.
- You really control only few factors that determine arm lengthening :
  - Position of the glenosphere in the vertical plan (you do not choose)
  - Glenosphere size (3 mm)  
arm > 300 mm, 1%
  - Eccentric glenosphere (2-4 mm) 1%
  - Humerus length (cut, spacer, poly)  
(several cm, >10%) → Key!





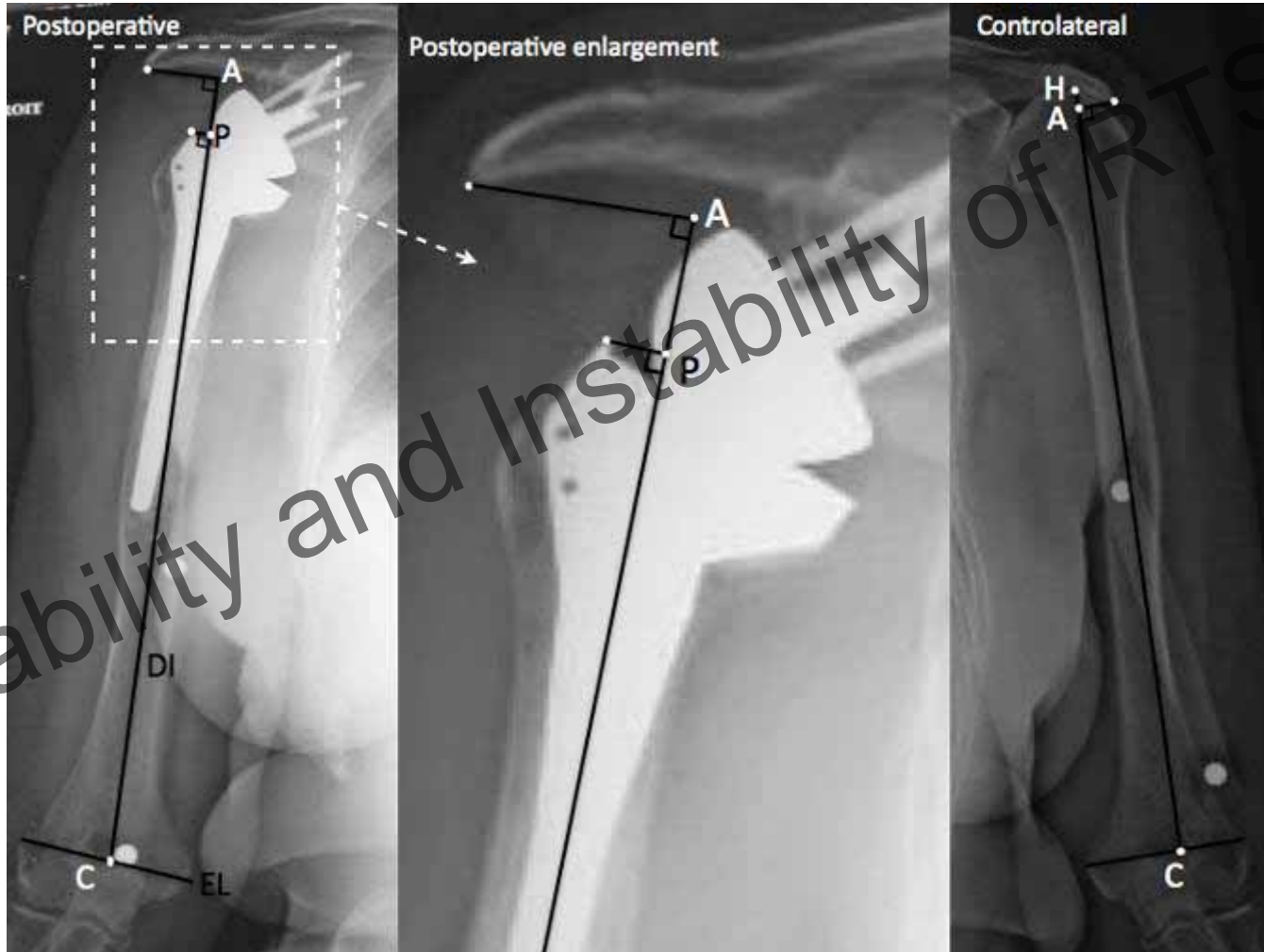
# Cause

- No standardized technique to determine deltoid tension (arm lengthening).
- Rely on intraoperative factors?:
  - Difficult reduction
  - No pistoning
  - Tight conjoint tendon
  - No asymmetric subluxation
  - Tilting during adduction...
- Safer to use «Jedi skill that involves using the force»<sup>1</sup>

1. Phipatanakul W, Norris T. In: Arthritis and Arthroplasty: The shoulder. Editors Dines DM, Laurencin CT, Williams GR. Saunders Elsevier. 2009.

# Causes

- Documentation included preoperative, postoperative and contralateral AP scaled radiographs of humeri.



# Causes

- Measure in 58 patients

## Humeral lengths:

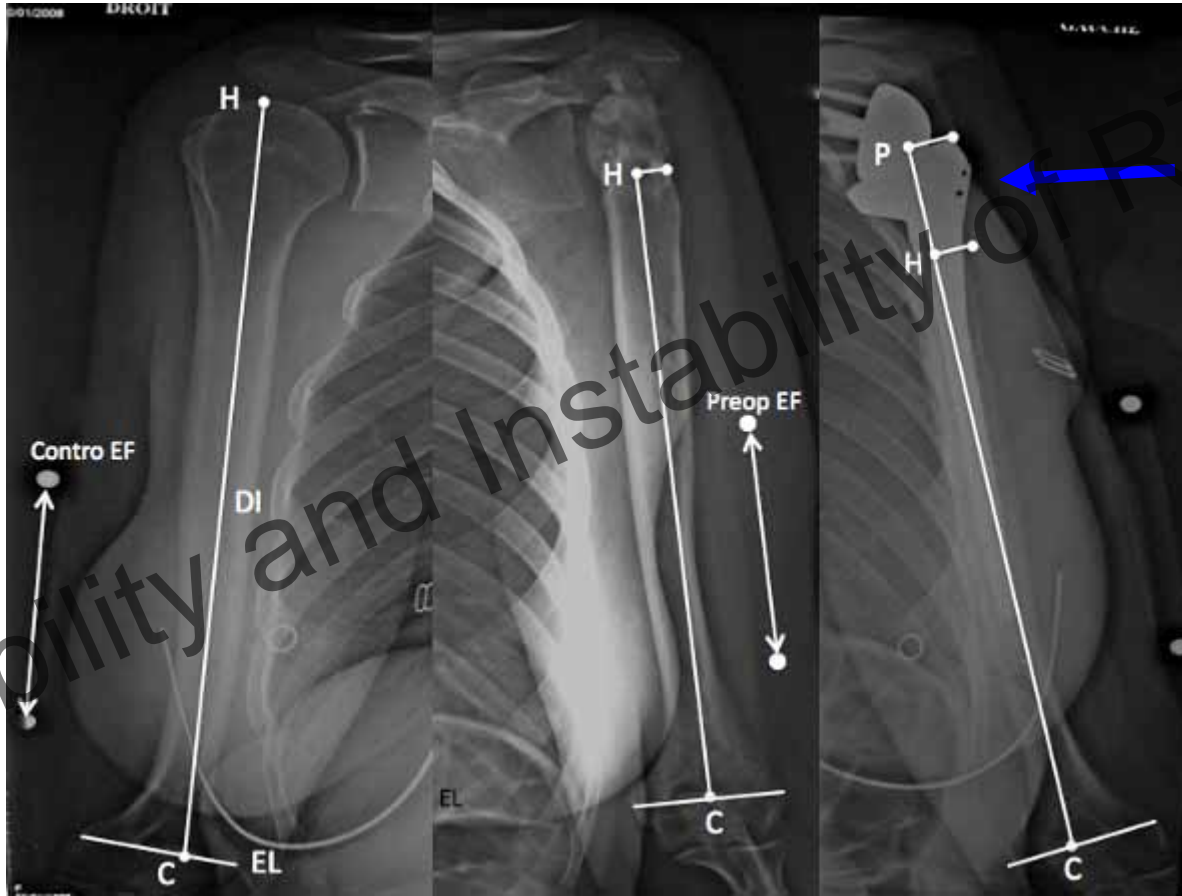
- Difference in pre-postoperative (CP-CHipsi):  
 $2 \pm 7$  mm (range: -9 to 16,  $p=0.243$ ).
- Postoperative shortening (**observed in all dislocations n=6**)  
was  $-30 \pm 18$  mm (range: -50 mm to -10 mm,  $p<0.0001$ ).

## Arm lengthening:

- Compared to preop ipsi side: arm lengthening  $23 \pm 12$  mm (range: 1 to 47,  $p<0.001$ ), correspond to deltoid re-tensioning.
- Compared to contralateral: arm lengthening  $20 \pm 11$  mm.

# Discussion

Technique of preoperative measure to objectively determine the height of RSA.



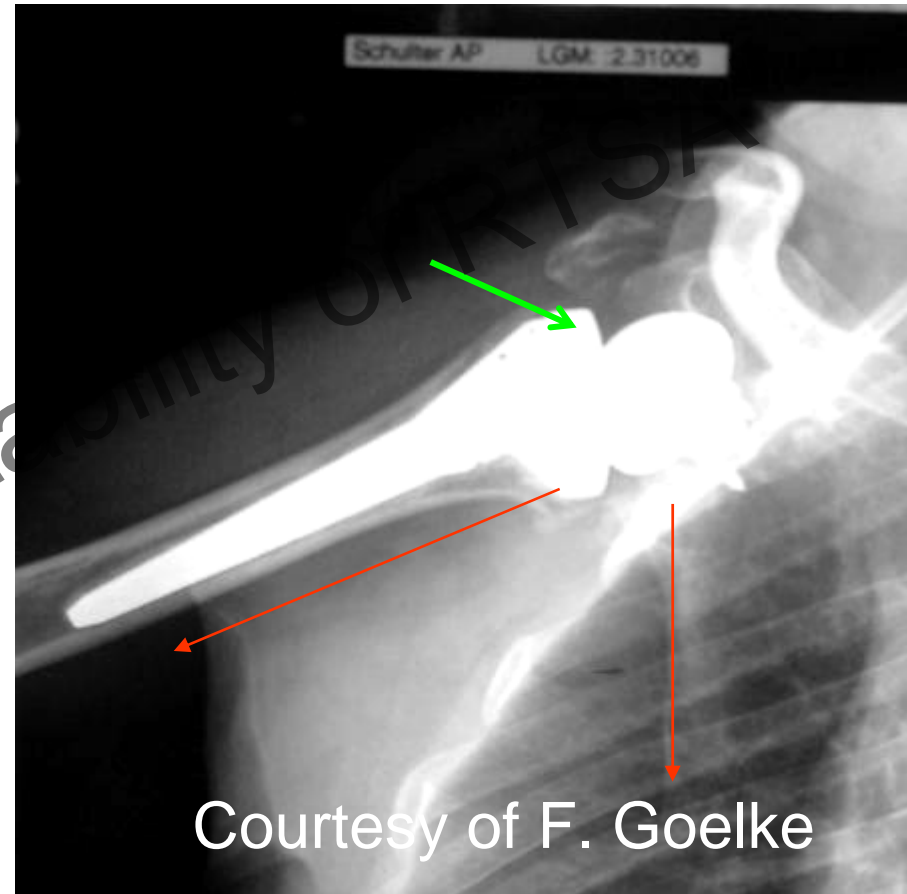
1. Lädemann A. Objective evaluation of lengthening in reverse shoulder arthroplasty. JSES 2009

# Causes

## 2. Failure to restore posterolaterally length of humerus

### Acromial/spine fractures

- Not described in series,<sup>1-2</sup> but personal communications<sup>3</sup> and case report<sup>4</sup>



1. Walch G et al. Acromial insufficiency in reverse shoulder arthroplasties. JSES 2009.
2. Wahlquist TC. Acromial base fractures after reverse total shoulder arthroplasty: report of five cases. JSES 2011.
3. Goelke F. Personal communication. Master shoulder course 2013. Berlin.
4. Levy JC. Postoperative acromion base fracture resulting in subsequent instability of reverse shoulder replacement. JSES 2012

# Causes

## 3. Impingement

- Biomechanics changes produced by the design: secondary complications<sup>1</sup>

- Medialization center of rotation:

- Notching<sup>2</sup>  
(inferior impingement)

- No neck (AP impingement)

Importance of humeral version<sup>3</sup>



- 1) Farshad M, Gerber C. Reverse total shoulder arthroplasty: from the most to the least common complication. International Orthopaedics 2010; 34: 1075-82.
- 2) Simovitch RW et al. Predictors of scapular notching in patients managed with the Delta III reverse total shoulder replacement. J Bone Joint Surg Am 2007
- 3) Favre et al. The effect of component positioning on intrinsic stability of the reverse shoulder arthroplasty. JSES 2010

# Cause

## 4. Muscle insufficiency

- Main cause of instability of the RSA is the large anteroinferior release performed through the DP approach (subscapularis and inferior GH ligament)
- Subscapularis
  - Absence or failure of repair<sup>1</sup> (1-12%)
  - Grade 3 FI<sup>2</sup>
  - Imbalance
    - LDT without subscapularis
- Deltoid?<sup>3</sup>

1) Edward et al. Subscapularis insufficiency and the risk of shoulder dislocation after reverse shoulder arthroplasty. J Shoulder Elbow Surg. 2009

2) Molé D, Favard L. Excentered scapulohumeral osteoarthritis. Rev Chir Orthop 2007

3) Lädemann A. Reverse shoulder arthroplasty with deltoid insufficiency. In press

# Cause

- **5. Humeral bone insufficiency**





# Cause

## 6. Infection

- Instability accompanied by infection in 44% cases.

"Stability and Instability of RTSA"

# Causes

## 7. Neurological lesions

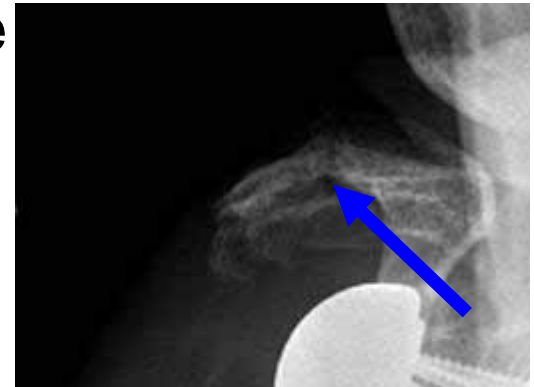
- Biomechanics changes produced by the design: secondary complications<sup>1</sup>
- Displacement in the frontal plane of the centre of rotation:

Lengthening:

–Acromial fracture

–**Neurological lesions**

–Permanent arm abduction...



1. Farshad M, Gerber C. Reverse total shoulder arthroplasty: from the most to the least common complication. International Orthopaedics 2010; 34: 1075-82.

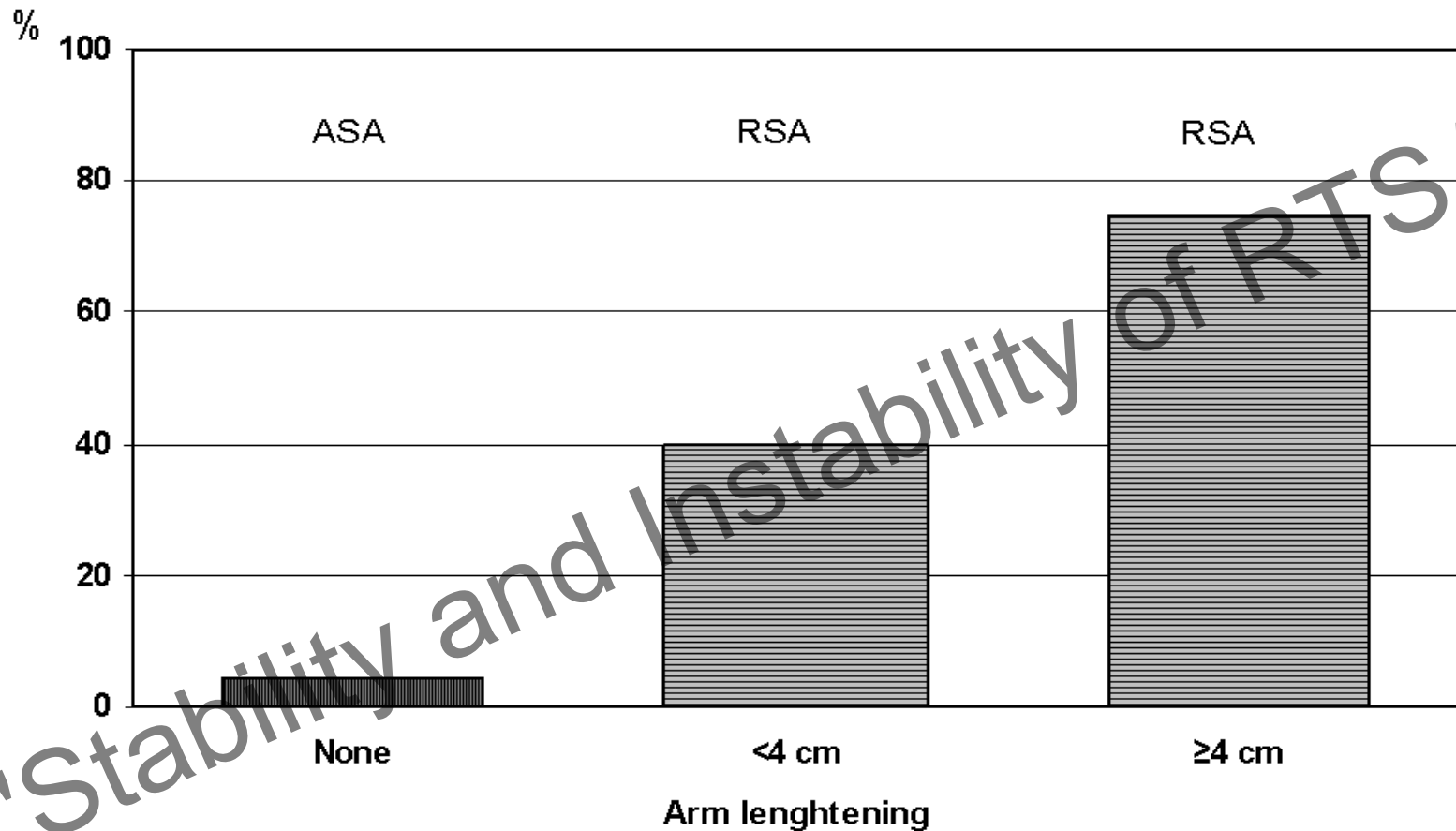
# Causes

Prospective. Same operative technique. Control EMG 3.6 weeks postoperative

Recent postoperative lesion	RSA group (n=19)	ASA group (n=23)
Axillary n.	6	0
Suprascapular n.	2	0
Musculocutaneous n.	2	0
Ulnar n.	1	0
Plexus lesion	1	1
<b>Total (patients)</b>	12 / 9 patients	1 / 1 patient

**45% acute, 18% worsening, 63% neurological impairment!**

# Results

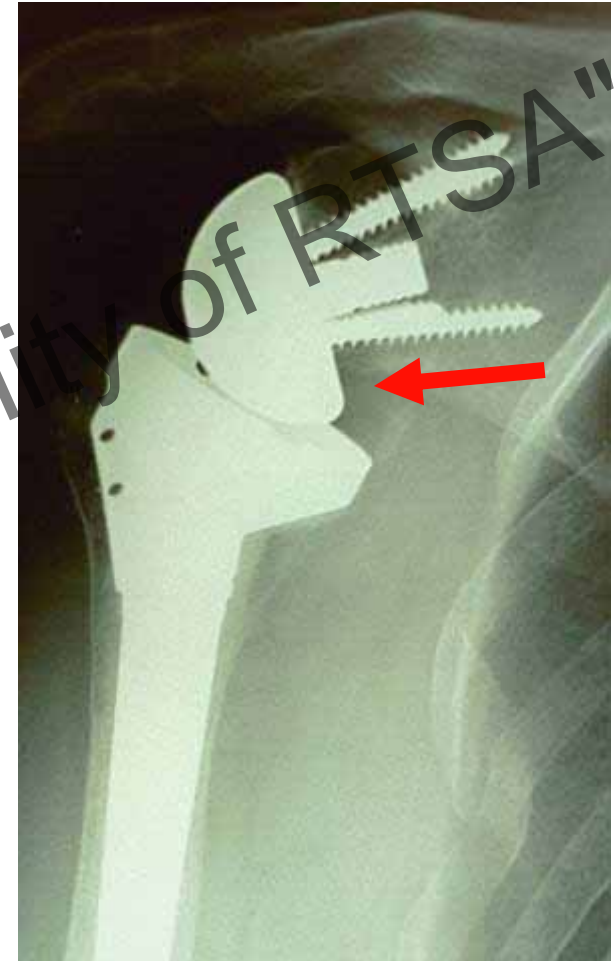


- Significantly increased risk for a neurological lesion with increasing arm lengthening ( $p < 0.001$ )

# Prevention

## 1. Baseplate positionning:

- Low position frontal plane<sup>1</sup>
- Inferior tilt?



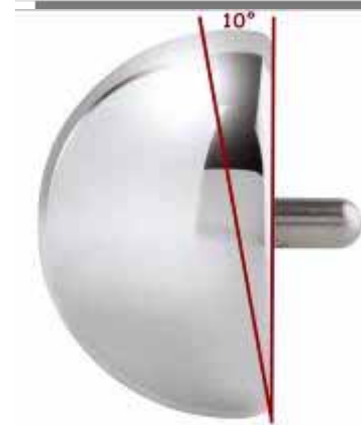
1. Nyffeler RW et al. Biomechanical relevance of glenoid component positioning in the reverse Delta III total shoulder prosthesis. J Shoulder Elbow Surg 2005
2. Edwards TB et al. Inferior tilt of the glenoid component does not decrease scapular notching in reverse shoulder arthroplasty: results of a prospective randomized study. JSES 2012

# Prevention

## 2. Glenosphere design:

- Eccentric
  - Does not prevent but decreases notching

- Tilt

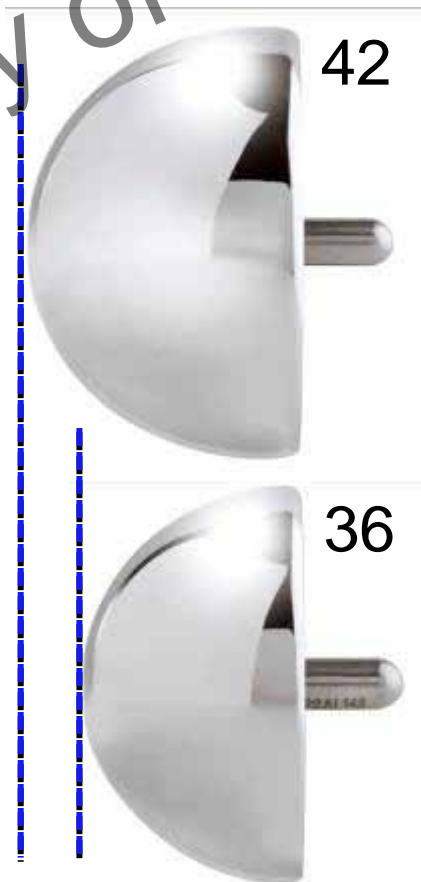


1. Mizuno. The clinical and radiographical results of reverse total shoulder arthroplasty with eccentric glenosphere. Int Orthop 2012

# Prevention

## 2. Glenosphere design:

- Eccentric
- Tilt
- Size (36 vs 42)
  - Instability rate with 42 : 0%
  - Instability rate with 36 : 4,3%

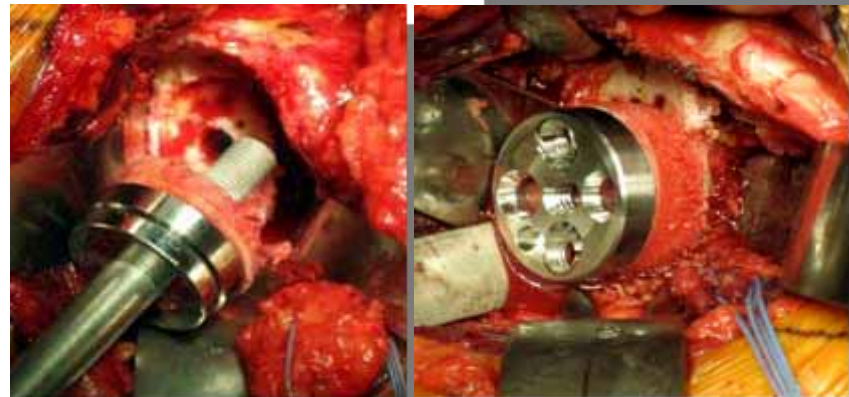
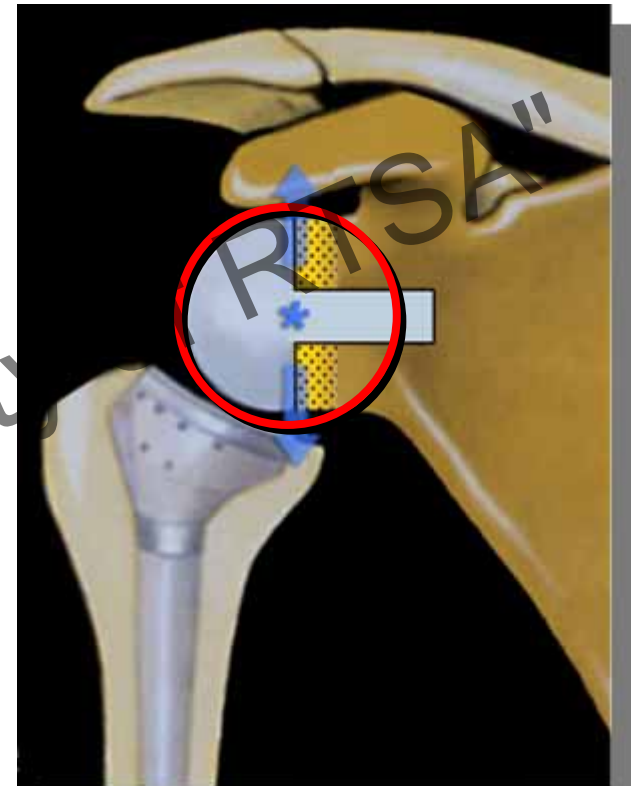


1. Molé D. RSA instability. Shoulder Master Course, Berlin, 2013.

# Prevention

## 2. Glenosphere design:

- Eccentric
- Tilt
- Size (36 vs 42)
- Glenoid lateralization (less notching/impingement? Less tension (less neurological lesion?))



1. Boileau P et al. BIO RSA. Minimizing Scapular Impingement While Maximizing Glenoid Fixation. Clin Orthop 2011.



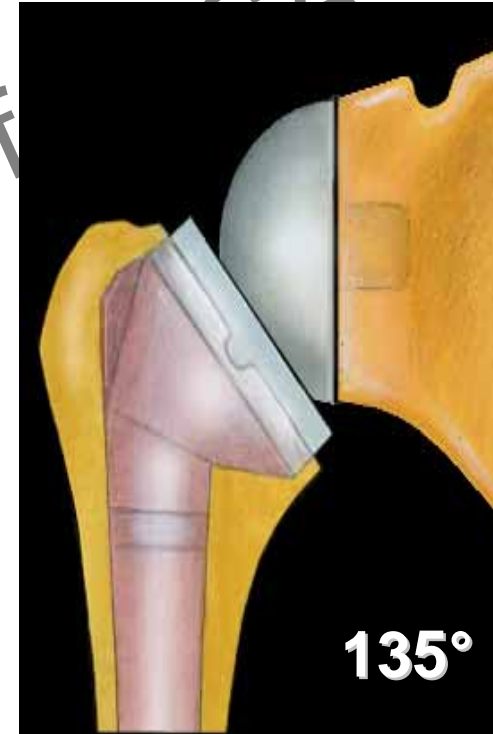
# Prevention

## 3. Humeral design:

- Lower inclination angle limits notching

but

- Easier lateral dislocation



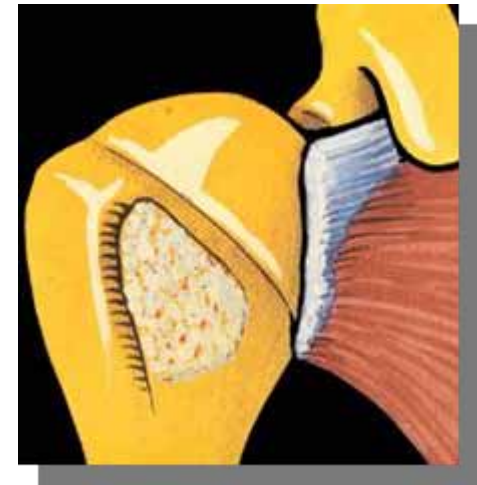
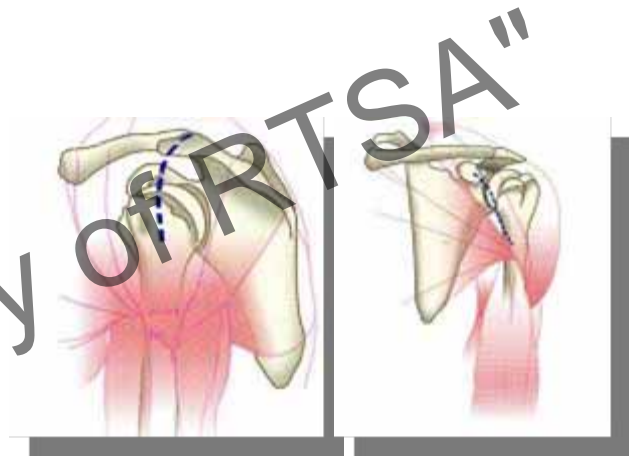
# Prevention

## 4. Approach

- Superior approach have less dislocation

- 5% with DP approach
- 1% with superior approach<sup>1</sup>

- Role of the subscapularis<sup>2</sup>

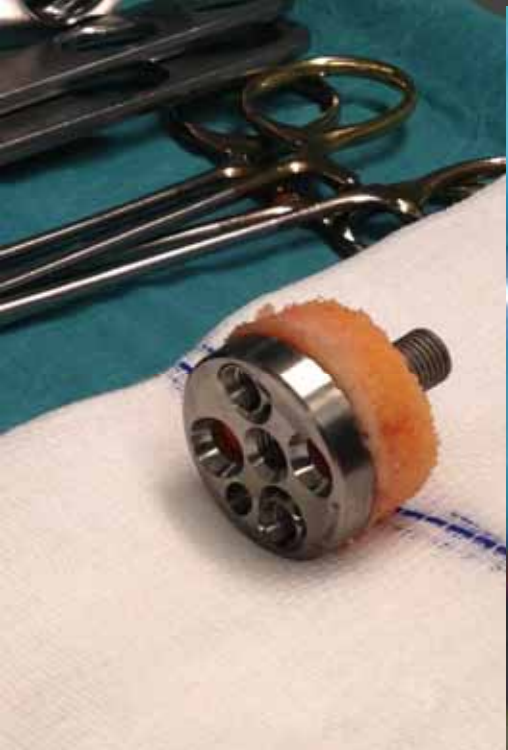


1. Molé D. RSA instability. Shoulder Master Course, Berlin, 2013.

1) Edward et al. Subscapularis insufficiency and the risk of shoulder dislocation after reverse shoulder arthroplasty. J Shoulder Elbow Surg. 2009

## My philosophy

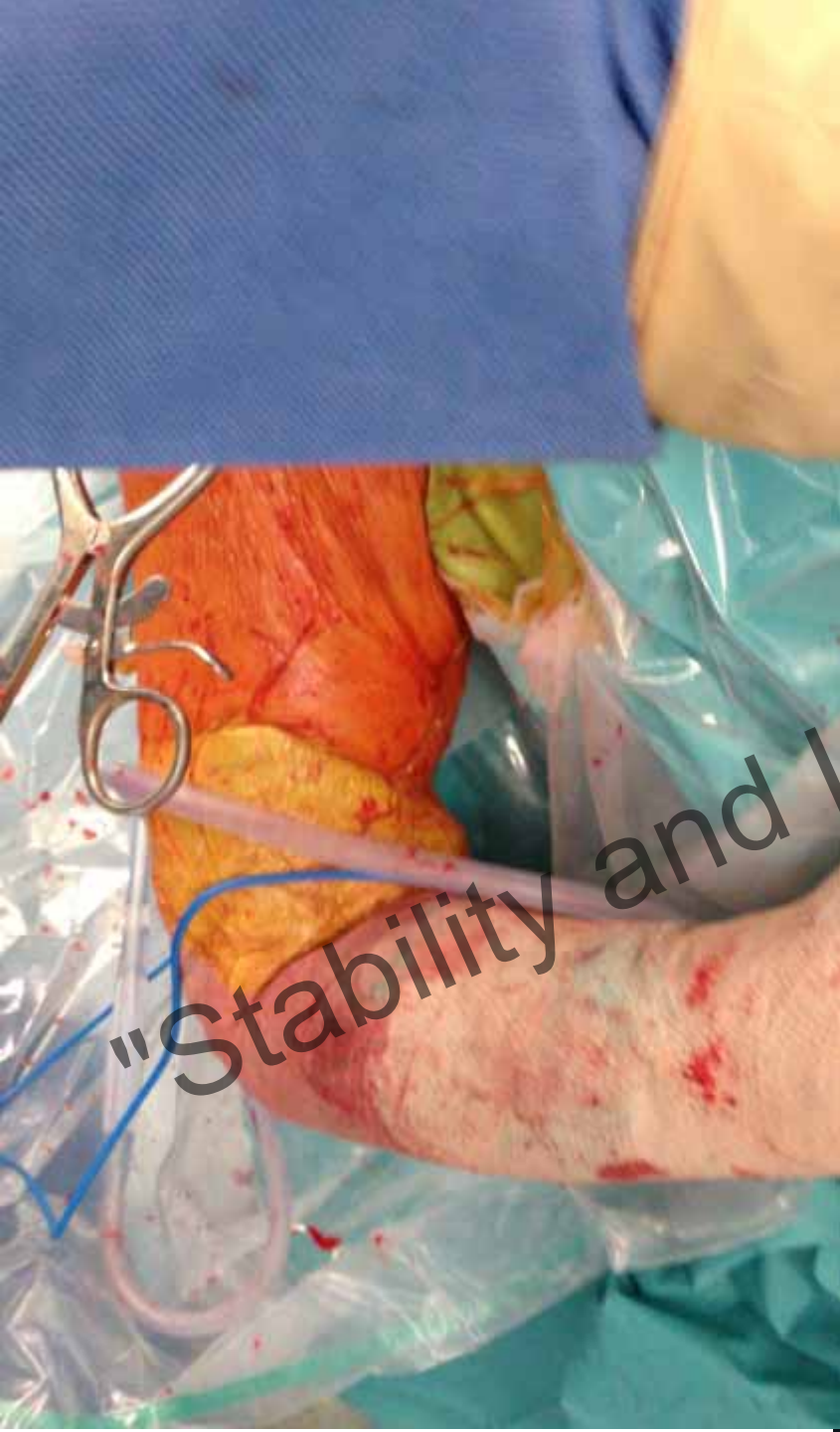
- Restore humeral length for stability
- Restore arm length for function
  - Aim 0-2 cm
- Subscapularis lesion
  - DP, repair if possible
- Intact subscapularis
  - Superior approach
- Glenoid lateralization with both approach
- Large head according to the size of the patient



"Stability and Instability of RTSA"



"Stability and Instability of RTSA"



"Stability and Instability of RTSA"

D



"Stability and Instability of RTSA"

# Treatment

- Analyze (surgical error)
- 1st episode
  - Close reduction, abduction sling 4w
  - Note efficient most of the time



- Recurrence: surgical management
  - Deltoid/soft-tissue tension is the key
  - Scaled X-ray both humeri
  - Restore humeral length (PE, spacer)
    - Think about the glenoid!



# Teamwork

- *Alone we can do so little, together we can do so much.* Helen Keller

**Thank you to Gilles Walch**



Thank you for your attention.

"Stability and Instability of RTSA"