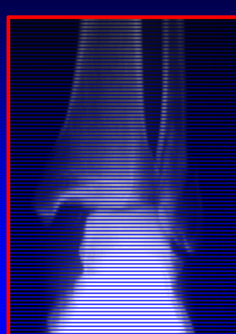
Syndesmosis: How and When to Reduce

Disclosures!

- Publications:
  - Rockwood and Green, Tornetta and Einhorn; Subspecialty series, Court-Brown, Tornetta; Trauma, AAOS; OKU Trauma, ICL Trauma 1,2, Tornetta; Op Techn in Ortho Surg, OTA Slide project,
  - Journals:; JOT; Deputy editor, CORR, JAAOS, JBJS; Reviewer
- Research:
  - OTA, FOT, AIOD, DOD
- Consultant / Designer
  - Smith and Nephew, Exploramed

The Syndesmosis

- Indications
  - Subluxation
  - Instability
- Technique
  - Fluoroscopic
  - Open



Does Perfection Matter?

The Functional Consequence of Syndesmotic Joint Malreduction at a Minimum 2-Year Follow-Up

H. Claude Sagi, MD, Anjan R. Shah, MD, and Roy W. Sanders, MD

- 78 Patients
- CT scan at 2 yrs
- Functional outcomes

The Functional Consequence of Syndesmotic Joint Malreduction at a Minimum 2-Year Follow-Up

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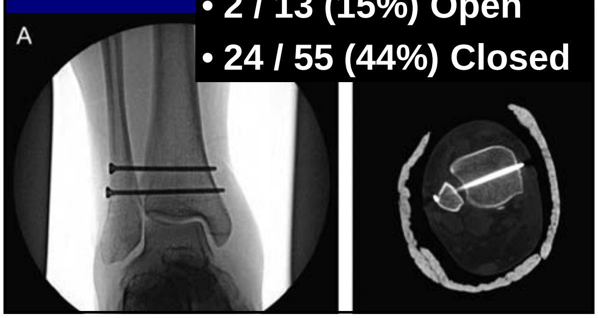
- 2 / 13 (15%) Open
- 24 / 55 (44%) Closed



The Functional Consequence of Syndesmotic Joint Malreduction at a Minimum 2-Year Follow-Up

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TABLE 2. Outcome Scores as a Function of Quality of Reduction of Syndesmosis

	Anatomic Reduction	Malreduction	Significance
SMFA (functional)	12.0	27.0	<0.05
SMFA (bothersome)	18.3	30.8	NS
SMFA (emotional)	19.7	32.0	NS
Olerud/Molander	46.3	72.7	<0.05

SMFA, Short Form Musculoskeletal Assessment; NS, nonsignificant.

The Functional Consequence of Syndesmotic Joint Malreduction at a Minimum 2-Year Follow-Up

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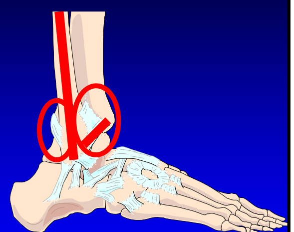
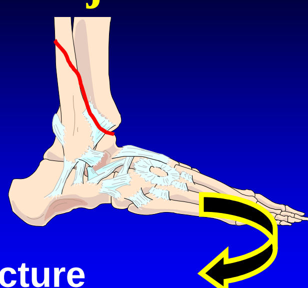
Syndesmosis

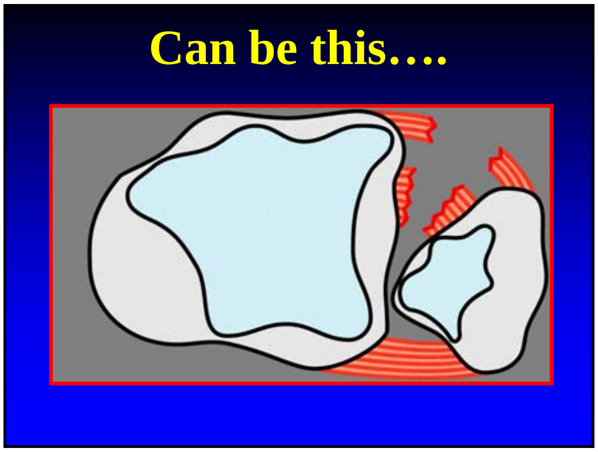
- Anterior TF
- Posterior TF
- Interosseous
  - Location varies
    - Snedden 2000
- Anterior inferior

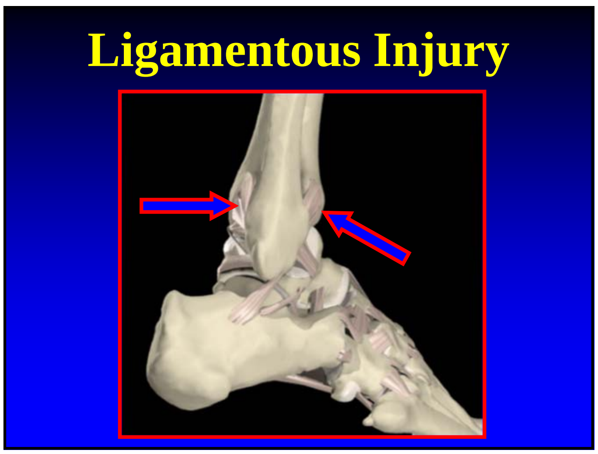


Indirect Injuries

- Rotation
  - PE
  - SE
- Abduction
  - PA
- Level of fracture
  - At or above the syndesmosis

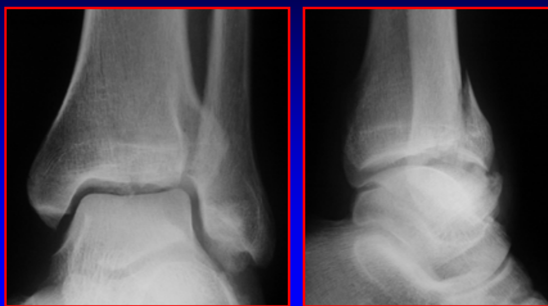



Can be this….

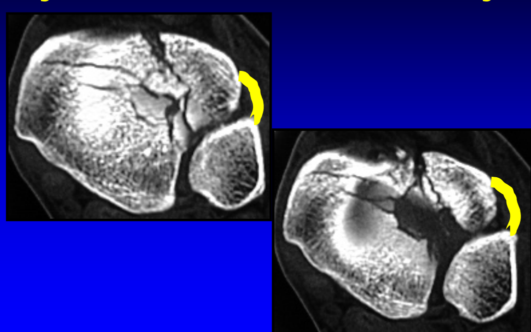

Ligamentous Injury


Avulsions vs Tears

23 year old man

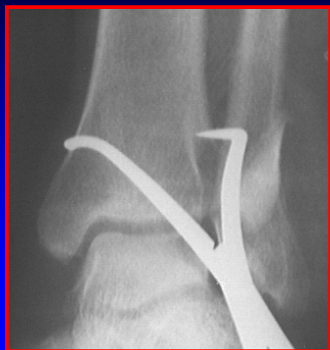


Syndesmotic Instability

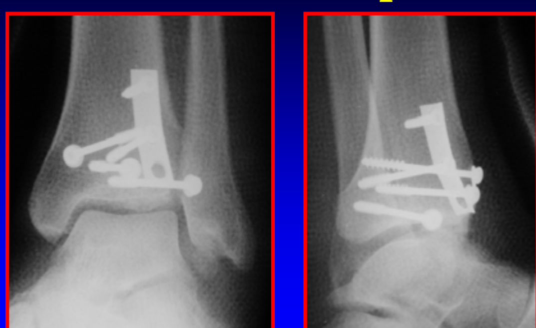


Marginal Impaction

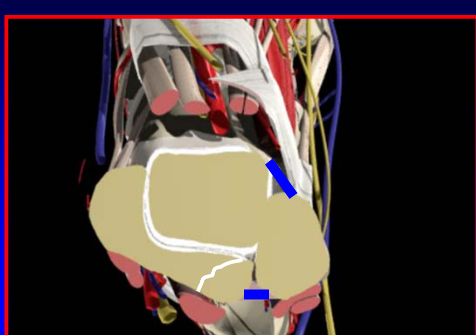
Treatment

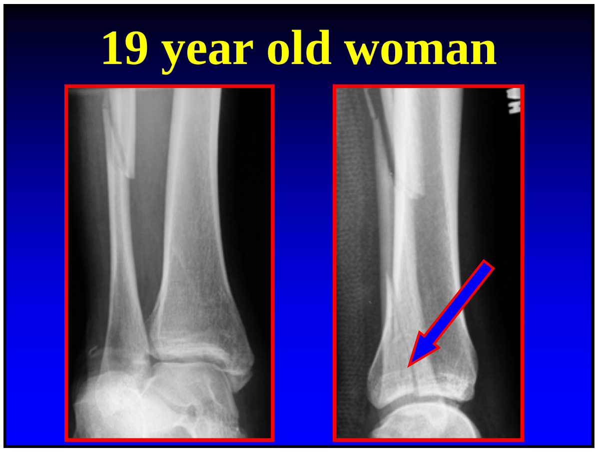


Final Postop

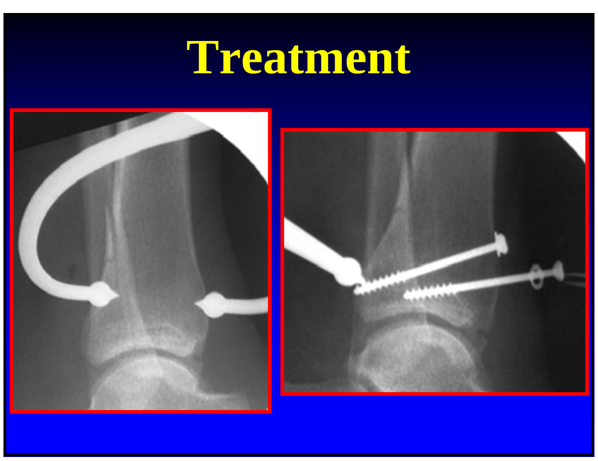


Avulsions vs Tears

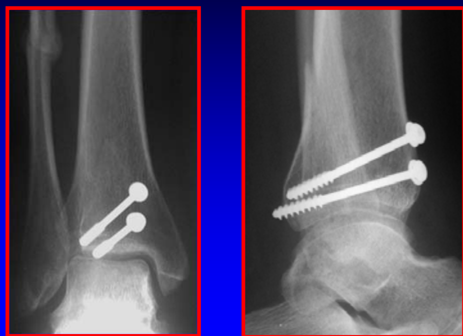



19 year old woman


Posterior Syndesmosis


Treatment

Healed



Instability

- Weber B injuries
  - Incidence
  - Indications for fixation
- Weber C injuries
  - Almost all
  - Posterior malleolus?

Weber B, SE Pattern

- General Criteria
- Instability after bony fixation
  - Bimalleolar
    - Type of medial fracture
    - Cotton test
  - Lateral malleolar
    - Stress test

Boden

- Recommendations
  - Height of fibula above joint
  - Medial injury
    - Malleolar fracture
    - Deltoid injury
  - Design flaws
  - Clinical failures
  - Time to healing

Stress Examination

- Syndesmotic instability
- 104 / 291 (36%) ankles
- Bimalleolar fractures
  - 30%
- Lateral malleolar fractures
  - 40%

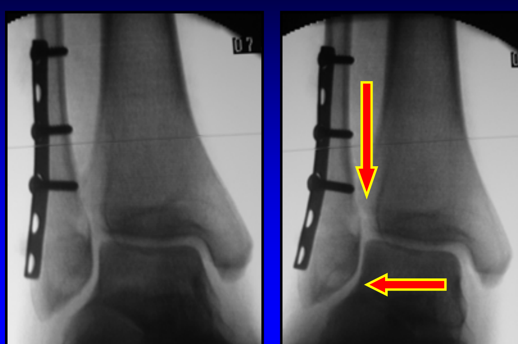
Stress (+) SE4

- 41% Syndesmotic Injury

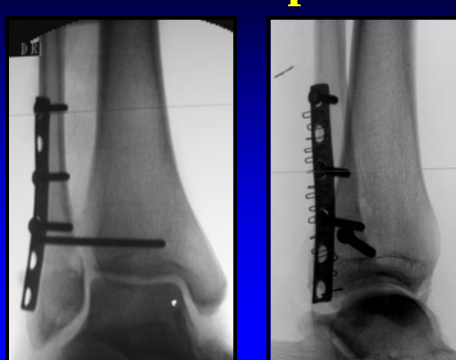
	Presentation MCS (mm)	Stress MCS (mm)	United MCS (mm)
Casted (43)	2.51±.3	5.01± .6	2.55±.4
ORIF fibula (32)	2.66±.4	6.09± .9	2.41±.3
ORIF fibula + syndesmosis (24)	2.80±.4	7.51± 2	2.50±.3

32 Year Old Woman

S/P ORIF



Post-op

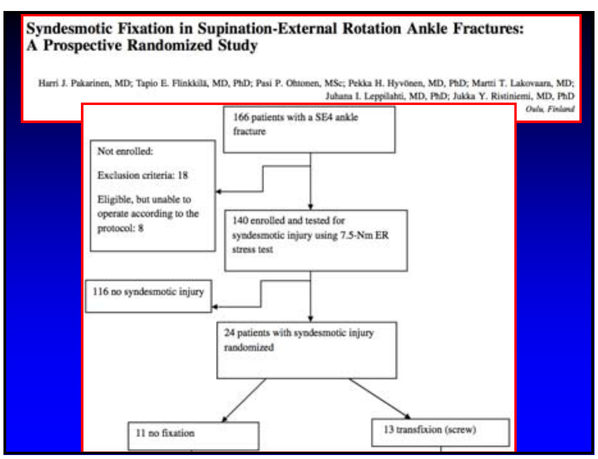


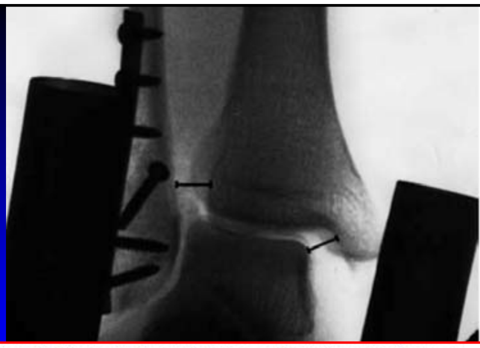
Weber B Injuries

- Associated with syndesmotic instability
- General criteria abandoned
- Individual evaluation of all cases intraoperatively

Does it Matter?

- Must we fix them?
- What happens if we don't?





Syndesmotic Fixation in Supination-External Rotation Ankle Fractures: A Prospective Randomized Study

Harri J. Pakarinen, MD; Tapio E. Flinkkilä, MD, PhD; Pasi P. Ohtonen, MSc; Pekka H. Hyvönen, MD, PhD; Martti T. Lakovaara, MD; Juhana I. Leppilahti, MD, PhD; Jukka Y. Ristiniemi, MD, PhD
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Table 2: Syndesmotic Fixation and Self-Reported Disability at 1 Year.

	[illegible]	[illegible]	[illegible]	[illegible]	Upper	*p*
[illegible]	[illegible]	[illegible]	4.0	−8.2	16.3	0.50
[illegible]	[illegible]	11.3 (12.5)	−14.2	−31.2	3.3	0.38
[illegible]	22.6 (24.6)	14.9 (15.0)	−7.8	−25.5	9.9	0.37
[illegible] function	0.9 (0.2)	1.0 (0.2)	0.1	−0.1	0.3	0.23
[illegible] pain	0.9 (0.4)	1.1 (0.2)	0.2	−0.1	0.5	0.32

NO DIFFERENCE!!

My Take

- Surprised
  - Have done many revisions when injuries are missed
  - No difference found if screws used
  - Why take the risk…
- But…*VERY* interesting study

Does Syndesmotic Injury Have a Negative Effect on Functional Outcome? A Multicenter Prospective Evaluation

Jody Litrenta, MD, David Saper, MD,* Paul Tornetta III, MD,* Laura Phieffer, MD,† Clifford B. Jones, MD,‡ Brian H. Mullis, MD,§ Kenneth Egol, MD,‖ Cory Collinge, MD,¶ Ross K. Leighton, MD,** William Ertl, MD,†† William M. Ricci, MD,‡‡ David Teague, MD,†† and Janos P. Ertl, MD§*

TABLE 3. SMFA—Mixed Linear Regression

	Syndesmotic Injury	Adjusted Mean	P
Week 6	Yes	36.49	0.76
	No	35.86	
Week 12	Yes	28.83	0.02
	No	22.68	
Week 26	Yes	15.66	0.73
	No	14.79	
Week 52	Yes	13.51	0.32
	No	10.96	

	Adjusted Mean	P
Gender		
Female	24.77	0.002
Male	19.35	

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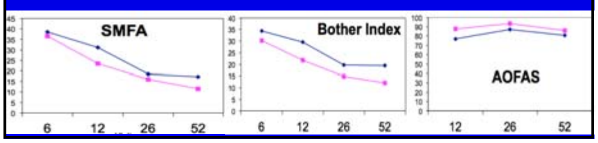
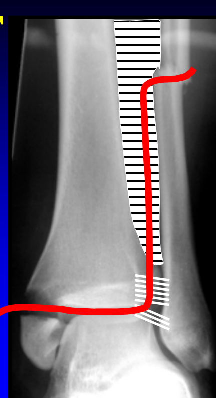
Group	SMFA*	Bother*	AOFAS
Syndesmosis injury	17.19	19.36	80.58
No Syndesmotic injury	11.60	12.06	85.89
P Value	0.04	0.05	0.21



Weber

- Type "C"
- Above the syndesmosis
- Assumes tib - fib dissociation

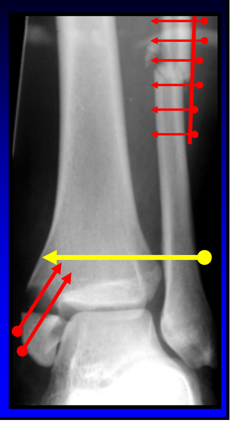


Operative Indications

- Instability after bony fixation
  - Bimalleolar
    - Type of medial fracture
    - Cotton test
  - Lateral malleolar
    - Stress test
- In liu of fibular fixation
  - Stabilizes fibula as well

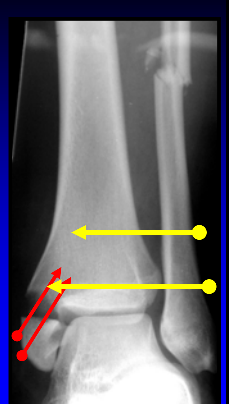
Fixation

- After fixation
- Instead of fibular fixation



Fixation

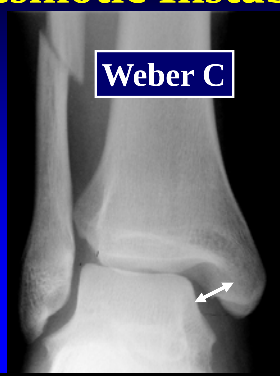
- After fixation
- Instead of fibular fixation



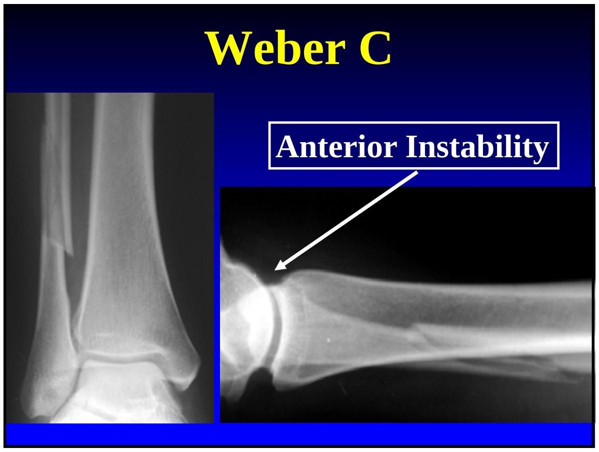
Syndesmotic Injury

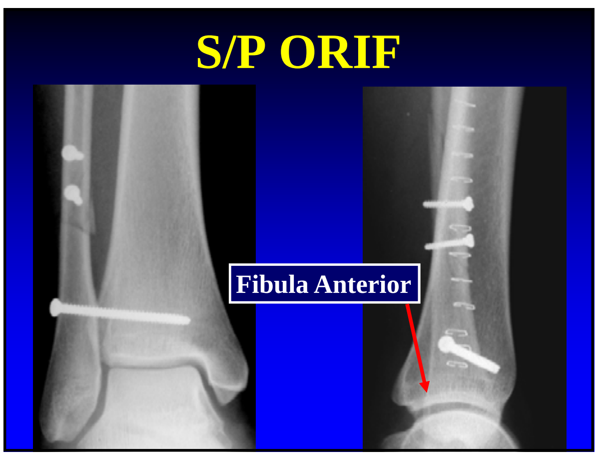
- Instability is NOT just posterior
- Rest ankle, not heel on bolster
  - Avoids anterior subluxation
- Don't forget the lateral radiograph

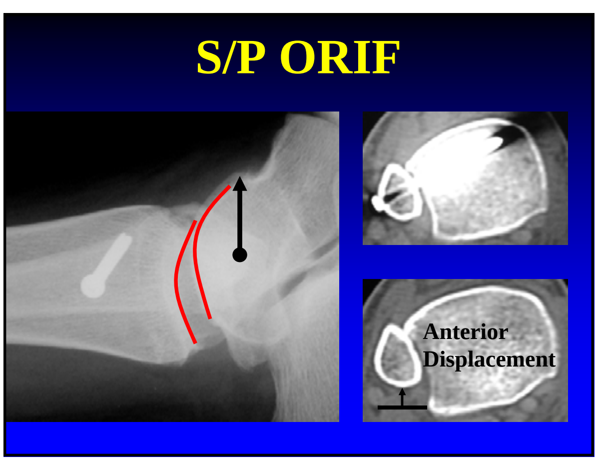
Syndesmotic Instability



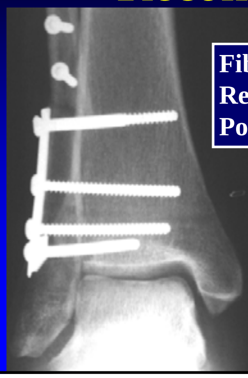
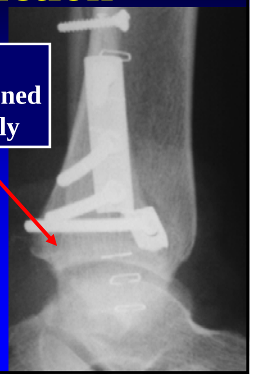
Syndesmotic Instability


Weber C
Anterior Instability


S/P ORIF
Fibula Anterior


S/P ORIF
Anterior
Displacement

Reconstruction

Syndesmotic Reduction

- Periarticular clamp


Reduction Techniques

- Ankle position
- Fluoroscopy
- Open methods

Reduction

- Position of ankle
  - Dorsiflexion ➡ lateral subluxation
- Can cause malunion

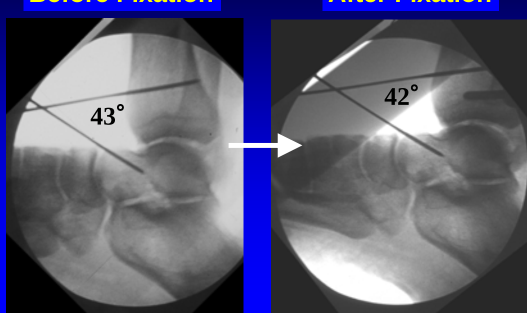
Ankle Position

- Dorsiflexion ➡ malreduction
- Dorsiflexion not necessary
- Position of the foot irrelevant
- ***Make sure syndesmosis is anatomic***

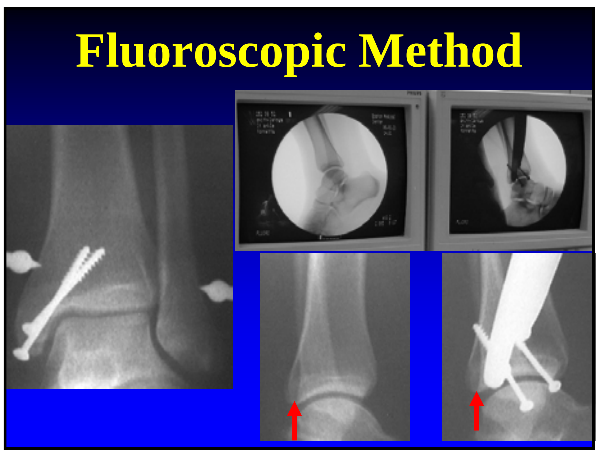
Cadaveric Study

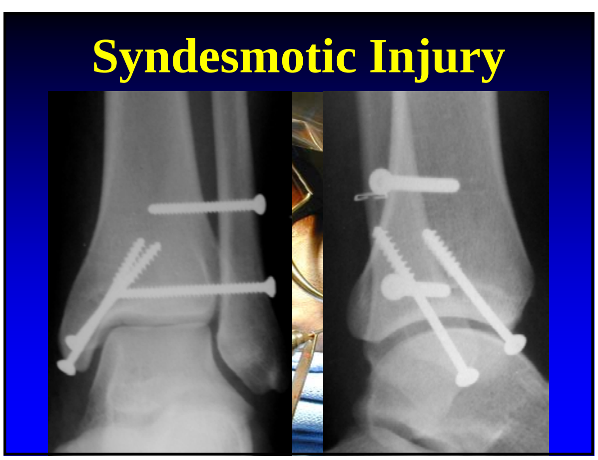
Before Fixation

After Fixation

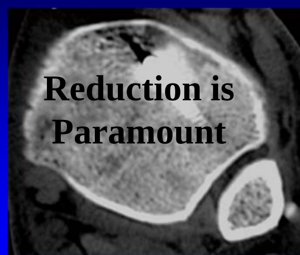



Syndesmotic Injury


Fluoroscopic Method


Syndesmotic Injury

Syndesmotic Injury

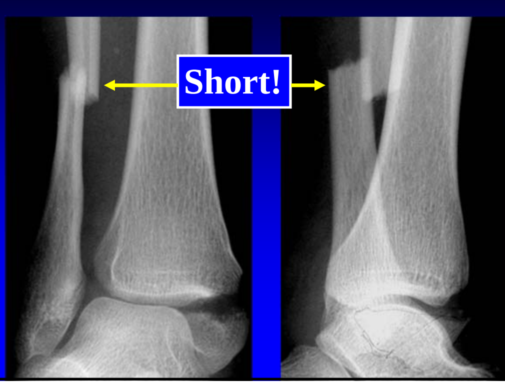


How Do We Do

- Lateral radiograph
- 90% NPV for unreduced
- 4 Traumatologists
- Varied (best was 100%)

	Reduced	Anterior	Posterior	2.5mm displaced	5.0 mm displaced
PPV	70%	90%	75%	74%	92%
NPV	90%	83%	77%	78%	83%

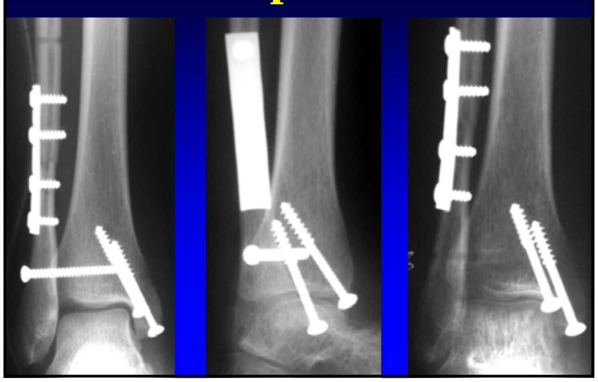
Weber C

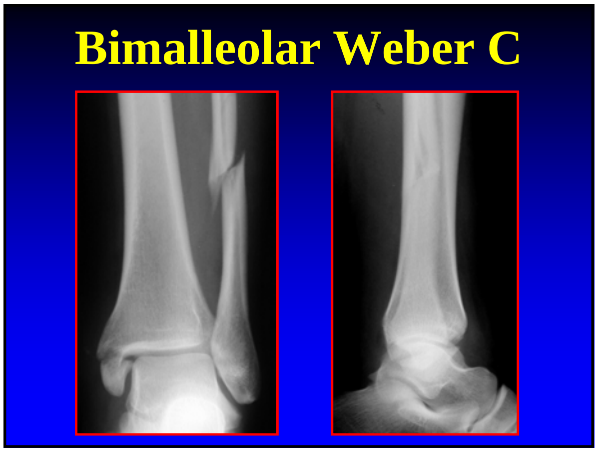


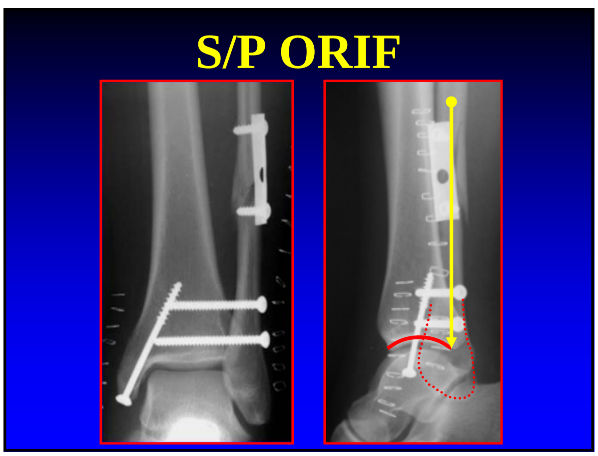
Maintain Length

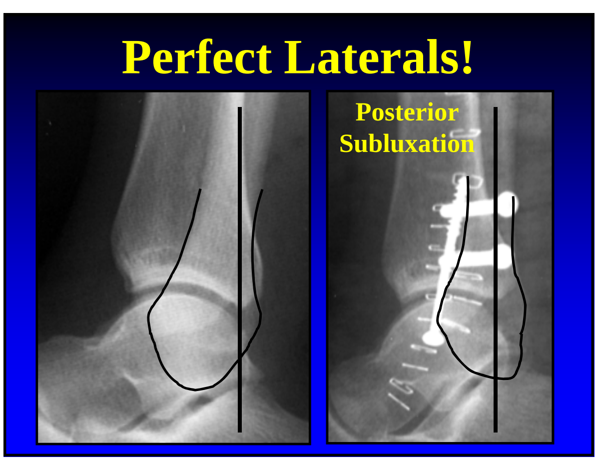
Maintain Length

Postop & F/U




Bimalleolar Weber C

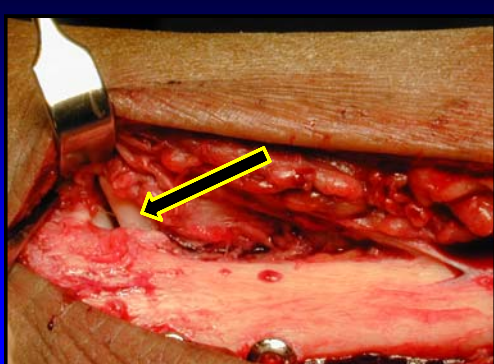

S/P ORIF

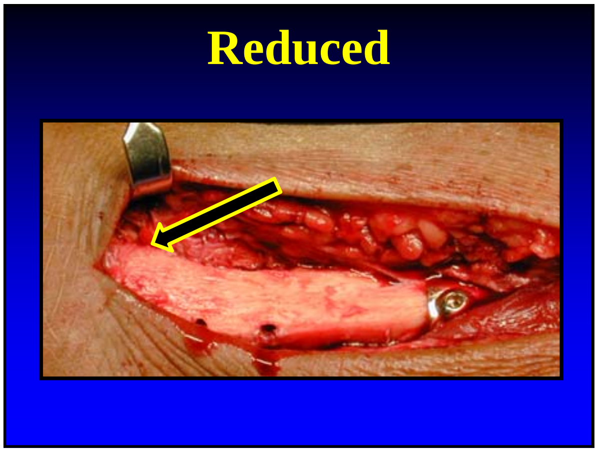

Perfect Laterals!
Posterior
Subluxation

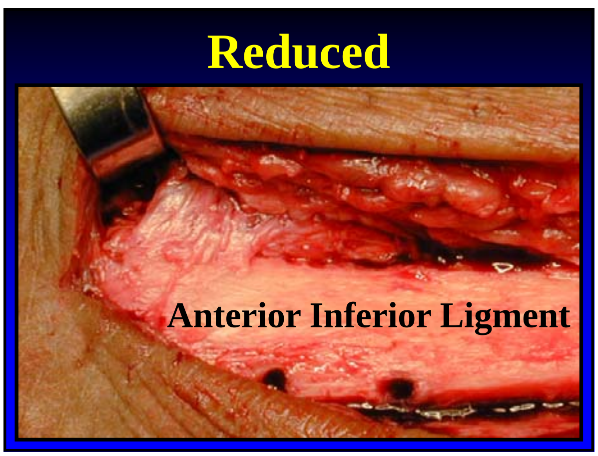
Re-opened

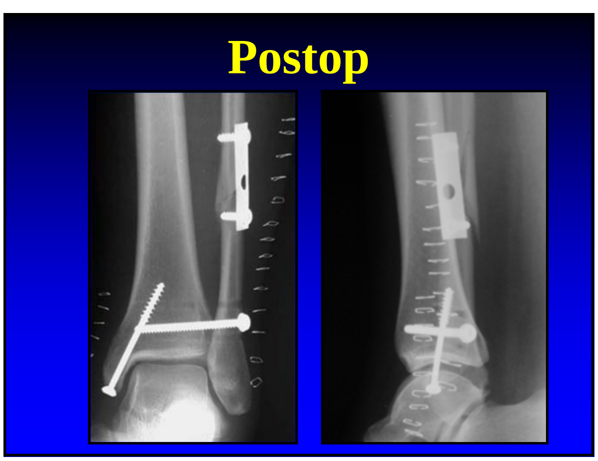
Malreduced

Malreduced

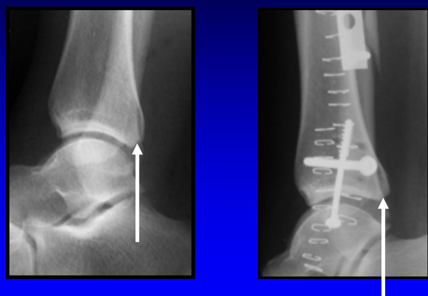



Reduced

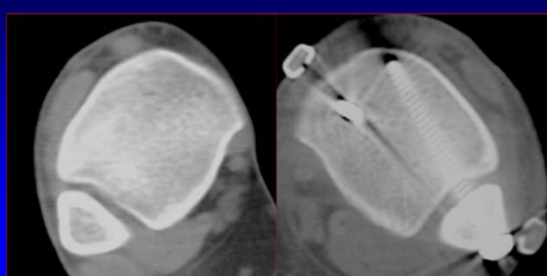

Reduced
Anterior Inferior Ligment


Postop

Postop



CT Confirmation



Long-Term Outcome of Pronation-External Rotation Ankle Fractures Treated with Syndesmotic Screws Only

Kaj T.A. Lambers, MSc, Michel P.J. van den Bekerom, MD, Job N. Doornberg, MD, PhD, Sjoerd A.S. Stufkens, MD, C. Niek van Dijk, MD, PhD, and Peter Kloen, MD, PhD

- 50 Patients
- Average F/U = 21 yrs!
- OA in 49%
  - 2 Fused
- 92% G/E AOFAS scores
  - Pain explained variation

My Take

- One evaluator “not anatomic”
  - No strict criteria for measurement
- No fracture types (B vs. C)
- No method of closed reduction
- Fellows….
- *Stresses need for reduction!*

How Do We Do

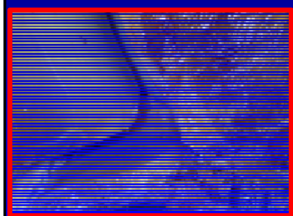
- Lateral radiograph
- 90% NPV for unreduced
- 4 Traumatologists
- Varied (best was 100%)

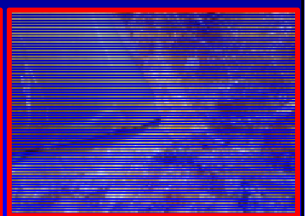
	Reduced	Anterior	Posterior	2.5mm displaced	5.0 mm displaced
PPV	70%	90%	75%	74%	92%
NPV	90%	83%	77%	78%	83%

If Not Sure…OPEN!

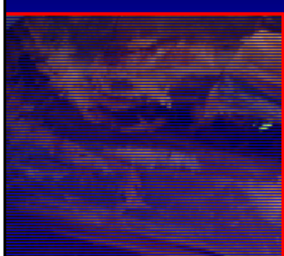
- Where do you look?
- Incisura?
- Shapes very
  - Very curved
  - Very flat
- Joint!!!

Joint Reduction



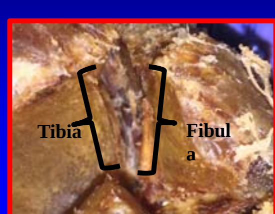


Incisura



Why is the Joint Better?

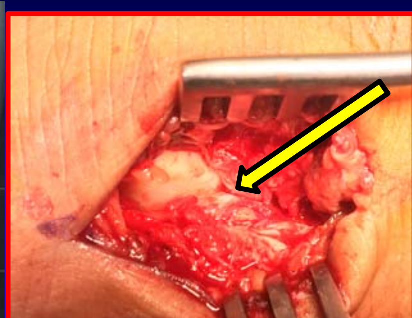
- 10 cadaveric ankles
- AP depth
  - At Joint
  - 1cm above Joint



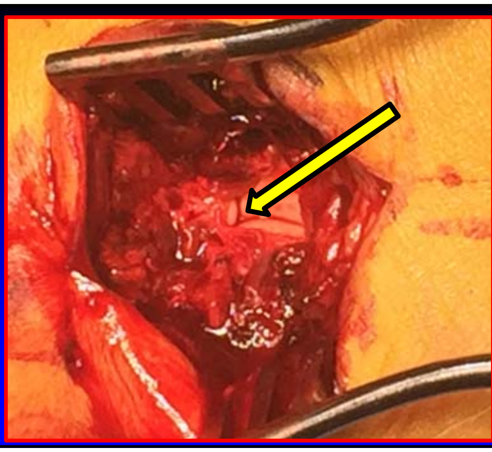
Answer…

- At joint corner vs incisura
- Joint better p = 0.0001
  - 0.7 ± 0.7
- Fibula to incisura difference
  - 2mm at joint
  - 6mm at 1 cm

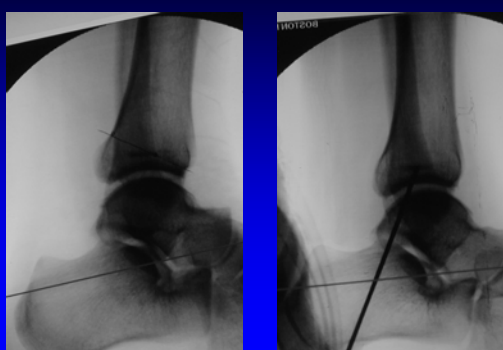
Case



Clinical View



Laterals



The Radiographic Fate of the Syndesmosis after Trans-syndesmotic Screw Removal in Displaced Ankle Fractures

Thomas H. Jordan, DPM [1], Ross H. Talarico, DPM [2], John M. Schuberth, DPM [3]

1. (A) Injury film with clear diastasis of the tibiofibular joint. (B) Immediate postoperative view with restoration of the tibiofibular relationship. (C) Radiograph immediately af
w removal. Note the separation of the fibula from the tibia and loss of reduction.

Fate Over Time

Koenig, Tornetta, et al

- 166 Patients
  - 35% Removed (patient choice)
  - 84% Remaining loose or broken
  - Did NOT lose reduction at all!
  - 0.5mm difference if removed

Tibia-Fibula OL			Tibio-Talar MCS		
Preop	Postop	Final	Preop	Postop	Final
4.78	6.89	7.35	4.24	2.31	2.05
-0.41	3.29	3.02	4.73	2.19	2.21

Song, et al AAOS '12

- 15 Patients
- CT of syndesmosis
  - Postop and 30D after removal
- 6 (40%) malaligned
  - 5/6 (83%) too posterior
- *5/6 (83%) Aligned at 30 days*
- *Self center!!*

My Take

- Initial reduction is not final
- Fibula settles without ankle subluxation
- Minimal translation probably ok
- Screw removal?
  - Two studies with different criteria

Screw Removal?

- Sanders, et al
  - Broken, loose or removed > intact
- Egol, et al
  - Syndesmotic fixation = worse outcome
- Wikeroy, et al
  - 3 vs 4 Corticies not different
    - Obese, PM worse
- Miller, et al
  - Removing increased ROM + outcome

Locked!!!

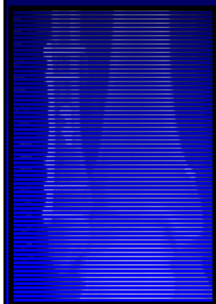
Syndesmotic Screws

- Leave in a long time
- Minimum 12 wks
- Removal?

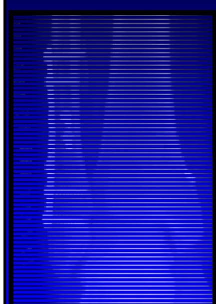
"Flexible Fixation"

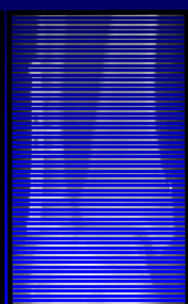
- Not as strong
- Forsythe, et al '08
  - More displacement at all loads
- Multiple trials
  - Seemigly good results

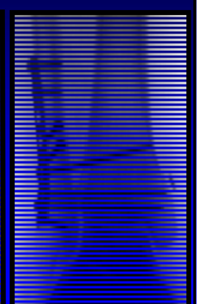
Technical Issues



Have Seen Failures







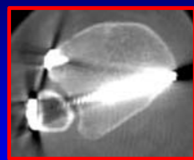
A Prospective Randomized Multicenter Trial Comparing Clinical Outcomes of Patients Treated Surgically With a Static or Dynamic Implant for Acute Ankle Syndesmosis Rupture

Mélissa Laflamme, MD, Etienne L. Belzile, MD,† Luc Bédard, MD,‡ Michel P. J. van den Bekerom, MD,§ Mark Glazebrook, MD,|| and Stéphane Pelet, MD, PhD, FRCSC‡¶*

- Only one screw or Tightrope
- Even for high type C (n?)
  - No way to maintain length!
- No relevant difference at any time point
- Reduction? Radiographic?

Summary

- Fix for subluxation, instability
- Reduce the talus
  - Avoid clamps
- Fluoroscopy
  - Beware posterior malleolus
- If any question, open the joint



Controversies

- Remove screws?
- Flexible fixation?
- Timing of weightbearing?
- Weber B SE pattern mild instability
  - Fix or not?

Boston Medical Center

Thank You