Supramalleolar Osteotomy for Coronal Deformity of the Ankle

Disclosures

- Smith & Nephew – Consultant, Design Surgeon, Royalties
- DJO Global – Consultant
- These osteotomies are probably under utilized

Goals

- To understand:
  - The deformity and how to measure it
  - The indications for Supramalleolar osteotomy
  - Introduce the concepts – planfondoplasty, mortiseplasty
  - The operative technique
  - The outcomes
Why Do We Care About Tibial Deformity?

- Deformity affects the Mechanical axis.
- It affects the way that load is transferred.
- This may lead to premature articular degeneration.
- Indications for operative correction of tibial shaft deformity:
  - Valgus >10-12 deg
  - Varus >6-10 deg
  - Ext. rotation >15-20 deg
  - Int. rotation >10-15 deg
  - Shortening >2 cm.

Does Malalignment Matter?

- Maybe
- Long term data is limited

- Miner SK, et. Al., JBJS Am, 2002
  - 164 pts, 30 to 43 years after injury
  - 29% - coronal ang > or = 5 degrees
  - No significant associations with osteoarthritis.

- Puno RM, et. Al. JOT, 1991
  - 28 tibial fractures
  - Greater degrees of ankle malalignment produce poorer clinical results (p = 0.001).

Understand the deformity

- The tibial deformity is in only 1 “true” plane (oblique).
- Varus/valgus
- Apex anterior or posterior
- Rotation
- Translation
- Shortening
- Deformity may exist at multiple levels (Tibia) (Ankle and foot).
Understand the Deformity

- Congruent -
  - Less than or equal to 4 degrees of talus tilt in the mortise
- Non-congruent -
  - Greater than 4 degrees

Measuring The Deformity

- You need:
  - Full length (if multiple levels deformity)
  - Contralateral side - “normal”
  - Scanograms – length determination
  - Saltzman View – axial alignment at multiple levels

- Draw:
  - The mechanical and anatomic axis

- Measure:
  - MAD - 10mm medial to the center of the knee
  - mLDTA approx. 90 degrees (88-95 degrees)
  - The CORA
  - The talar tilt angle
  - Tibia medial mal angle

The CORA (Center of rotation of angulation)

- Intersection of anatomic axis
- The apex of the deformity
- The transverse bisector line
- Osteotomy along the bisector - No translation
- Traumatic deformities - CORA may not be at the level of the deformity (i.e. translation may exist)

RA Fawdington, et. Al. Orthopaedics and Trauma 28:1 Elsevier 2013

Kobayashi, H, et. Al. JFAS 2016
Operative Technique - The Concept

- Knupp et. Al.
- In varus deformity - medial overload
- In valgus deformity - lateral overload
- Chen's sagittal alignment

Indications for Supramalleolar Osteotomy

- Correct tibial malalignment to "decrease the risk of arthritis and improve function"
Treating Ankle Arthritis

**Valgus Deformity**
- Must have at least 50% of the cartilage preserved
- Goal – center the talus under the tibia in all planes
- Deformities >15 degs - dome osteotomy

**Varus Deformity**
- Fluoroscopic stress
- Goal 2 – 4 degrees of valgus
- Fibular osteotomy >10 degs varus
- Congruent deformity or poor soft tissues medially –
  - Lateral closing wedge osteotomy
- Tarsal tunnel release – may be necessary

**Takakura Classification**
- To treat ankle arthritis (delaying the need for fusion or replacement)

**Things to Consider**
- Must have at least 50% of the cartilage preserved
- Goal – center the talus under the tibia in all planes
- Deformities >15 degs – dome osteotomy

**Medial Closing Wedge Osteotomy**
- Goal 2 – 4 degrees of valgus
- Fibular osteotomy >10 degs varus
- Congruent deformity or poor soft tissues medially –
  - Lateral closing wedge osteotomy
- Fibular osteotomy is often required

**Tarsal Tunnel Release** – may be necessary
To treat ankle arthritis (delaying the need for fusion or replacement)

Hintermann, B MD, et. Al. JAAOS July 2016

Plafond-plasty

Mann HA., et. Al. FAI 2012
- AOFAS - 46 to 78
- 2 Fusions, 2 TAR
- 15 - Satisfied or very satisfied

Mortiseplasty

JFA 2016 Kobayashi, H., et. Al.
- 27 cases, cases with instability
- FU - 27 mos.
- Signif decrease in pain and improved function
- Deformity improved
- No fusions or TAR
- No ligament repair
To treat ankle arthritis (delaying the need for fusion or replacement)

- 40 y.o man
- Open tibia fracture in 1980
- Pain at the medial ankle and medial knee
- Significant arthritis of the ankle with limited dorsiflexion
- Significant varus deformity on standing
- Options?

Benefits of Ex-Fix

- Complex deformities
- Poor soft tissue envelope
- Concomitant shortening can be corrected
- Total residual correction
- If you mess up you can keep correcting the program

- Horn DM, et al. FAI 2011
- TSF
- 52 pts AOFAS 40 to 71
- 3 ankle fusions
Greater than 5 years out and still no fusion or replacement

In addition

- Must assess the alignment of the foot
  - May require arthrodeals or osteotomies below the ankle
    - Calcaneal osteotomies
    - Medial column osteotomies
  - Must assess ligament balance of the ankle
    - In varus deformity – may require lateral ligament repair / reconstruction as well as a superficial deltoid release
    - In valgus deformity – may require deltoid ligament reconstruction

Bottom Line “SMO” For The Treatment of Arthritis

- Improved functional scores
- Decreased pain
- Improved alignment
- Improved arthritis grade
- Slows progression of arthritis
References

  - 294 pts., 298 ankles
  - 5-year survival rate was 88%
  - 13% Fusion or TAR
  - Younger: 38, older
  - Younger: Better

- Kim YS., et al., AJSM 2014
  - SMO with bone marrow stimulation
  - Second-look arthroscopies - Progression of degenerative arthritis in 42%

  - Both varus and valgus arthritis
  - Positive side walk sign is good

  - Lateral supramalleolar closing wedge

- Emmanouil D. Stamatis, et al., FAI 2003
  - 12 patients, AOFAS - 53.8 to 87
  - Pain decreased
  - Deformity and alignment improved
  - No progression of arthritis

- Nüesch C., et al., FAI 2015
  - Different gait biomechanics
  - Quality of life - comparable to controls

Post-op Protocol

- Immobilization depends on fixation stability and additional procedures
- Early ankle and foot motion if possible

To improve the alignment for a total ankle replacement or fusion
To improve the alignment for a total ankle replacement or fusion

Summary
- Supramalleolar osteotomies can be used to:
  - Prevent ankle arthritis
  - Treat ankle arthritis
  - Improve alignment for a fusion or replacement
- May need to combine with:
  - Other osseous realignment below the ankle
  - Soft tissue balancing
- Make the osteotomy as close to the CORA as possible
- Varus – Opening Wedge or Dome
- Valgus – Closing Wedge or Dome
- Can use internal or external fixation
- Thank you

Do We Need To Do A Fibular Osteotomy? – Maybe
- JFAS 2017 Choi GW., Et. AL.
  - Fibular osteotomy might be necessary to minimize the increase in pressure in the talofibular joint, especially when the osteotomy gap is large.
  - Varus arthritis: No significant difference – functional outcomes, better radiographic results with osteotomy

- LARS 2013 Choi GW. Et. Al.
  - Fibular osteotomy might be necessary to minimize the increase in pressure in the talofibular joint, especially when the osteotomy gap is large.
According to the present findings, lateral cortical fracture was less likely to occur when open-wedge SMO was at the plane of the proximal one-third of the intra syndesmosis.