Total Ankle Replacement for Ankle Arthritis with Deformity

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Disclosures

- Consultant, speaker bureau
  - Wright Medical
  - Integra

Successful TAR

- Patient selection
  - Surgeon experience
  - Prosthesis design
  - Alignment
  - Ligament stability
  - Rehabilitation
TAR and Deformity

- Most end-stage arthritic ankles
  - Post-traumatic
  - Instability
  - Deformity (33-44% >10°)
  - Soft tissue contracture
- Asymmetric loss of articular cartilage
- Neighboring joint arthritis and deformity

TAR with Persistent Angular Deformity

- Progressive edge loading
- Polyethylene wear, subluxation
- Osteolysis
- Premature failure
- Neutrally aligned prosthesis components have the best clinical outcomes including ROM and pain relief (Barg et al, JBJS 2011)

TAR with Coronal Plane Deformity

Challenge to Regain Anatomical Alignment

- Joint replacement is a soft tissue procedure
- Ligament balancing needs to be predictable and has to be done before patient leaves OR to ensure component parallelism
- Need to achieve a plantigrade foot and ankle
TAR with Coronal Plane Deformity  
Challenge to Regain Anatomical Alignment

• Release contracted tissues on concave side

• Reinforce tissues on convex side

TAR with Coronal Plane Deformity  
Challenge to Regain Anatomical Alignment

• Controversy on limits:
  – Coetzee: >20° contraindication
  – Hobson: 30° can be managed
  – Kim, Queen, Sung: no difference

• Must achieve neutral alignment & stability intra-op to reduce subsequent wear

TAR with Deformity  
Pre-op

• Ankle ROM, contractures
• Scars from previous operations
• Neurovascular status
• Examine gait, alignment, instability
  – Coleman block testing
  – Test deltoid competence!
TAR with Deformity
Radiographic Analysis

• Standing foot, ankle XR
• Alignment b/w tibia anatomic axis and perpendicular to talar dome
  – >10° = varus/valgus
• Talar tilt angle is the tibial and talar articular surfaces
  – >10° = incongruent joint

Kim et al, JBJS Br 2010

Joint Congruity

• Congruent:
  <10° difference between talar and tibial joint lines
• Incongruent:
  >10° difference between talar and tibia joint lines

TAR with Deformity
Radiographic Analysis

• 3 joint standing film with large deformity
• HF alignment view
• MRI helpful for soft-tissue pathology, vascularity
• CT: deformity, bone loss, cysts, impingement
  – Use for patient-specific blocks
Radiographic Analysis

- Location of deformity determines procedure(s)
- At the joint
  - Bony cuts, soft tissue
- Proximal to the joint
  - Corrective osteotomy
- Distal to joint
  - Osteotomy, fusion, soft tissue

Balance Above or Below the Ankle Joint

Goals

- In patients with early OA (not TAR)
- Osteotomy to alter WB axis of LE to offload areas of asymmetric wear
- Concomitant intra-articular procedures
  - Osteophyte debridement
  - ? Chondral resurfacing
  - Injection
  - Otherwise ineffective w/o proper mechanical alignment!

Balance Above or Below the Ankle Joint

Goals

- In patients who need TAR
  - Adjuvant procedures to produce a neutral alignment

- Correct deformity
  - Especially with focal wear changes

- Simultaneous vs staged

Burg et al. Foot Ankle Clin N Am, 2012
**Balance Above or Below the Ankle Joint**

**Goals**
- Proximal tibia osteotomy (rotational)
- Distal tibia +/- fibular osteotomy
  - Oblique, opening/closing, dome
- Calcaneus osteotomy
- Tendon releases, transfers
- Ligament reconstruction

**TAR with Deformity**

**Technique**
- Anterior incision
- Adequate length (10-12 cm)
- Avoid self-retaining retractors that crush skin edges
- Avoid subcutaneous dissection to preserve skin vascularity

**TAR with Deformity**

**Technique**
- Debride osteophytes
- Assess intra-articular deformity
  - Ability to correct
TAR with Deformity Technique
- Balance the ankle, restore mortise
  - Laminar spreaders into joint
  - Pin distractor
  - Gutter debridement
  - Ligament releases

Balance the Joint: Etiology of Varus Deformity
- Medial tibial plafond erosion
- Post-traumatic arthritis
  - Congruent deformity
- Chronic ankle instability
  - Extra-articular at level of the joint
  - Incongruent joint
  - Talar tilt, tight medial ligaments, flat MM
- Cavovarus hindfoot malalignment

Balance the Joint: Varus
- Removal of periarticular osteophytes
- Debride gutters (M, L, posterior)
  - +/- separate lateral incision
Balancing the Joint:
Congruent Varus
- Parallel joint lines
- Bony>soft tissue pathology
- Stiff subtalar joints
- Address deformity before cuts are made
- Often just adjust TAR cut
  - Slightly higher tibial cut

Coetzee, Foot Ankle Int 2010

Balancing the Joint:
Incongruent Varus
- Greater than 10° difference in tibial and talar joint lines
- Obvious soft tissue imbalance
- Cannot be corrected by bony cuts alone
- Deltoid ligament release (deep +/- sup)

Easley, Advanced Reconstruction Foot and Ankle 2, 2015

Balance the Joint: Varus
- Laminar spreader into medial joint
- Posterior capsule release
- Medial malleolar osteotomy
  - When deltoid lengthening is not enough
  - With severe intra-articular varus deformity
Varus Correction
Medial Malleolar Osteotomy

- Doets et al, FAI 2008
- Medial gutter debridement
- Osteotomy is done halfway down the malleolus
- Medial to shoulder
- Hindfoot deformity correction

60 yo male, history of instability

Trincat et al, Orth & Traum, 2012
Balance the Joint: Varus

- Talonavicular capsule release
- Posterior tibial tendon recession at m-t
- Flexor retinaculum release

TAR, deltoid release, FTT/PL → PB, cavovarus correction, ST/TN fusion

Beware Persistent Instability, Malalignment
60 yo male, history of instability

**Balancing the Joint: Varus**

- Severe pes planovalgus
  - Deltoid insufficiency
  - PTT insufficiency
  - Correct the foot to prevent implant valgus tilt
- Osseous deformities
  - Fibular fracture malunion (short, ER)
  - Posterior distal tibia, plafond fracture
- Identify medial ligament incompetence pre-op

**Balancing the Joint: Etiology of Valgus Deformity**

- Severe pes planovalgus
  - Deltoid insufficiency
  - PTT insufficiency
  - Correct the foot to prevent implant valgus tilt
- Osseous deformities
  - Fibular fracture malunion (short, ER)
  - Posterior distal tibia, plafond fracture

**Balance the Joint: Mild Valgus (<10°)**

- Removal of periarticular osteophytes
- Debride gutters (M, L, posterior)
  - Modify bone cuts
  - Fibular lengthening/rotational osteotomy
  - Medializing calcaneus osteotomy or LCL
  - Possible corrective subtalar/triple if rigid
  - Reconstruction/repair of medial ligaments
  - Reconstruction of lateral ligaments
Balance the Joint:
Mild Valgus (<10°)

Balance the Joint:
Severe Valgus (>10°), supramalleolar
- Supramalleolar osteotomy
- TAR
- Hindfoot still in valgus?
  - Fibula lengthening/rotational osteotomy
  - Medializing calc osteotomy or HF fusion
  - Cotton osteotomy
  - Reconstruction of medial ligaments
  - Reconstruction of lateral ligaments


Balance the Joint:
Severe valgus (>10°) inframalleolar
- (PTTD)
  - Reconstruction vs arthrodesis
    - PF osteotomy medial cuneiform
    - PB→PL
  - TAR
  - Fibula lengthening/rotational osteotomy
  - Reconstruction of medial ligaments
  - Reconstruction of lateral ligaments
TAR with Deformity Technique

- Once joint is balanced, can make cuts
  - +/- place in jig
  - Heel cord lengthening
  - Deformity correction in jig
  - Maintain correction with IM rod
  - Precise tibial, talar cuts
  - If anything, *under* resect bone!
  - Posterior capsulectomy

TAR with Deformity Technique

- Implant components
  - Maximize cortical support, stems?
  - Stability

- Test ankle stability with trial components in place
  - Favor fixed bearing implants

TAR with Deformity Technique

- Peri-articular bony procedures
  - Hindfoot
- Ligament reconstruction
- Foot alignment correction
TAR with Deformity
Technique
• Hindfoot/midfoot deformity?
  – Reconstruction, osteotomy
• If peroneals, eversion weak
  • PTT/FDL/FHL → PB
• AT transfer to middle cuneiform
  – With severe varus

Easley, Advanced Reconstruction Foot and Ankle 2. 2015

TAR with Deformity
Technique
• Test full ROM with final components, trial poly
• Layered closure over Hemovac drain

Balanced TAR with Varus Deformity
TAR with Deformity
Patient-Specific Total Ankle Arthroplasty

- Goal is to restore mechanical, kinematic joint axes
- Improved implant alignment
  - Neutral coronal and sagittal alignments obtained for all TAR cases regardless of preoperative deformity (Hsu et al, FAI 2015)
- Improved accuracy, reproducibility
- Decreased surgical time
- Decreased fluoro time (12 min)

Patient-Specific Total Ankle Arthroplasty: Cannot Blindly Rely on Technology

- MRI: avascular necrosis 50% talus, plafond
- Erosion anterior tibial plafond
My Preference With Deformity

- With severe foot deformity I prefer to stage
- With moderate HF arthritis with minimal symptoms, I prefer TAR by itself
  - Provides good pain relief and function
  - TAR usually markedly improves foot alignment
- Always try to protect the talar blood supply
  - Limit ST preparation to the posterior facet avoids inferior talar neck blood supply
  - Also avoid inferior talar head w/TN preparation

With severe foot deformity I prefer to stage
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Conclusions

• Tibiotalar coronal malalignment is not uncommon in end-stage arthritis and should not be a contraindication to TAR
• But still a challenge to correct
• Balancing is vital to outcomes
  – Surgeon experience is important
  – Different constraints with different prostheses
  – More refined techniques of ligament balancing

Conclusions

• Figure out pre-operatively where the deformity is coming from
  – Above the ankle
  – The ankle joint itself
  – Below the ankle
• Address deformities systematically either concurrently or staged
  – Soft-tissue, bony, fusion
• Beware of an incompetent deltoid!

Conclusions

• Stable neutral alignment
• Achieve a plantigrade, balanced foot & ankle
• Restore component parallelism
  – Reduce eccentric wear
  – Reduce component loosening
  – Reduce subsidence
  – Reduce reoperation and failure