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Deformity Correction in Total Ankle Arthroplasty 2014:  
Making the Unpredictable Predictable  
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NOTES

Introduction
Short Term Results
Haskell and Mann (CORR 2004 7(24) 98-103  
86 consecutive total ankle replacements  
35 had coronal plan malalignment of >10 degrees  
Ligament balance procedures  
Divided their cohort into congruent and incongruent deformities  
In congruent deformities were 10 times more likely to develop edge loading due to failure

Long Term Results
Reddy and Mann (FAI 2011 32(7): 659-664  
130 consecutive TAA (41 month ave. f/u)  
25 had 10-19 degrees preoperative coronal plane deformity  
18 had 20 degrees or greater  
Average initial postop deformity 3.5 degrees  
Average final postop deformity 4.7 degrees  
Recurrent of deformity in 6/43 (14%)  
All three with >25 degrees preop developed recurrence  
Conclusion: Deformity correction predictable if preoperative alignment <25°

The Agility Days
Haddad (AAOS, 2007)  
Regardless of initial deformity, all groups demonstrated a significant (but not perfect) improvement in intraoperative neutral alignment  
Valgus Failures  
Preoperative Valgus>15° or Varus>20° demonstrated a significant (p<0.035) prevalence of talar alignment change in the postoperative period
Prosthesis Mismatch??
But the inability to maintain the corrected deformity may hinge on an inherently unstable prosthesis.
Better talus to polyethylene coverage has introduced better stability into total ankle replacement systems improving our ability to correct deformity.

Still...
The driving principle behind ALL deformity correction is a perfectly balanced foot beneath the prosthesis.
Ignoring this principle always results in implant failure....

Two Stage Theory
Deformity correction that includes adjacent joint arthritis requiring fusion of the subtalar or talonavicular joint(s).
Screw placement may interfere with prosthesis placement.
Differing post-operative protocols
- Fusion requires immobilization
- Replacement requires early motion.
May lessen dysvascularity to talus from simultaneous superior and inferior dissection.
This newer recognized phenomenon may be critical to long-term survival of prostheses.
Working with posterior approach subtalar fusions to limit vascular insult to sinus tarsi.

More Consideration
Deformity correction that includes severe ankle instability.
Secondary ligament reconstruction procedures beyond simpler modified Brostrom or deltoid reefing.
Early range of motion may disrupt stability achieved through tendon transfers.

And Most Important...
Deformity correction that includes the potential for unpredictable deformity recurrence.
This depends on your comfort level with more severe deformity.
Two stages allow surgeon to make adjustments in alignment during second stage.
Note residual deformity during weight bearing assessment between procedures.
Improved predictability of correction by making adjustments at 2nd stage (minor).
Lessons Learned: Assessment
Assess clinical deformity for reducibility of mal-alignment
Assess radiographic deformity for blocking osteophytes or abnormal anatomy
Assess CT scans for adjacent joint arthritis and structural deformity

Reconstruction
Part I
Critical to align every component of the deformity within the foot
If there is any question as to a potential present or future deformity, correct it at the index procedure
Apply cement in liquid form to the ankle sulcus if varus or valgus wear has been significant and longstanding
Cement allows weight-bearing between procedures to limit disuse osteopenia

Part II
Cement Left in Place
Keeps ankle stable during saw cuts.
Replace ankle and add any additional simple deformity correction of required (calcaneal osteotomy, Cotton osteotomy, 1st ray dorsiflexion)

Extremes Become Possible in Two Stages: Clinical Examples

Is All Of This Supported?
Newer Literature
Comparative Ankle Arthroplasty Outcomes with Preoperative Talar Varus Deformity of 20 Degrees or Greater (Daniels, et.al. 2012)

Premise
Limited evidence to support greater than 15 degrees varus relative contraindication and 20 degrees varus absolute contraindication to total ankle replacement

Investigation
Prospective Trial
36 TAA with >20º varus vs. 36 neutral
Follow-up average 27 months (9 to 54)
Multiple validated and unvalidated scoring systems
AOFAS, AOS, SF-36
Additional procedures in both (heavier in varus group)

What They Found
Coronal plane alignment improved from 20º to 1.4º (p<0.001)
no statistically significant difference in post-operative alignment between varus and neutral groups
Improvement in scoring systems all statistically significant
AOFAS (p<0.0001), AOS (p<0.0001), SF-36 (p<0.0001)
Caveat

Secondary procedures were required in 16 varus group patients. Which essentially makes this a two stage procedure for a majority of the group!

Avoiding Incision Problems: Haddad Pearl

How do we get the swelling out to make the first and second surgeries safe? Postoperative protocols have changed for both stages.

- No longer cast within operating room
- Begin compression wrap protocol for 2 to 3 weeks postoperative until all edema absent
- Utilize a wound care center for wraps, or teach PA or physical therapist
- Cast after all edema gone following fusion OR begin PT for TAA after all edema gone

Summary

Complex varus and valgus ankle joint deformities certainly HAVE to potential to undergo total ankle arthroplasty. A structured plan involves the following:

- Clinical assessment: reducibility of joint and/or hypermobility
- Radiographic assessment: blocking osteophytes or anatomy
- CT scan: adjacent joint arthritis requiring fusion rather than osteotomy

Two stage procedures are more effective for complex deformities. Be more rather than less aggressive in corrective measures. Use cement to strut out joint and allow earlier weight bearing to prevent disuse osteopenia prior to replacement.