



Extensor Digitorum Brevis tendon transfer

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- ▶ Dane Wukich, MD receives royalties from Arthrex Surgical
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- ▶ Lesser digital deformities
 - ▶ Multiplanar
 - ▶ Crossover Toe
- ▶ Surgical challenge

Technique Tip

- ▶ Level IV evidence
- ▶ EDB and biotenodesis screw
- ▶ Controlled tension
- ▶ Allows for stability for multi-planar correction





MPJ Pathology

- ▶ Instability at MPJ
 - ▶ SAGITTAL
 - ▶ TRANSVERSE
 - ▶ MULTI-PLANAR
 - ▶ Imbalance of extrinsic & intrinsic muscles
 - ▶ Disruption of ligamentous support of MPJ
 - ▶ Ligament dysfunction of plantar plate/collateral ligaments
 - ▶ Acute trauma
 - ▶ Chronic attenuation
 - ▶ Inflammatory arthropathy
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Plantar Plate Failure



Plantar
plate failure



Sagittal
deformity

Collateral Ligament Insufficiency

Collateral
ligament
insufficiency



Transverse
plane
deformity





Deformity



Subluxation/Dislocation
of MTPJ





Options....

- Corrective procedures:

- Arthroplasty
- Arthrodesis
- Metatarsal osteotomies
- FDL transfer

- Complications

- Joint stiffness
- Recurrent deformity
- Swelling
- Continued pain
- Loss of toe flexion



EDB Tendon Transfer

- ▶ Proximal tenotomy of the EDB maintaining insertion to the dorsal aspect of the proximal phalanx
- ▶ Tendon rerouted through drill holes in the base of proximal phalanx and metatarsal head/neck
- ▶ Recreates attenuated collateral ligament and reinforce the lax plantar plate

Adding the interference screw

- ▶ Utilizing the interference screw for proximal fixation of the tendon transfer
- ▶ Adds durable internal fixation with increased mobility and function
- ▶ Allows surgeon to recreate results with little technical difficulty





Materials and Methods



- ▶ Two year review of 6 surgical patients
 - ▶ 4 females
 - ▶ 2 males
 - ▶ Ages 35-62
- ▶ Painful rigid or flexible 2nd toe deformity
- ▶ Failed non-surgical treatment
 - ▶ Shoe gear modification
 - ▶ Taping
 - ▶ Splinting
 - ▶ Orthoses
- ▶ Inclusion criteria
 - ▶ Pain, digital elevatus, callus formation, crossover deformity, irritation with shoe gear
- ▶ Exclusion criteria
 - ▶ Previous surgery, compromising autoimmune disorder

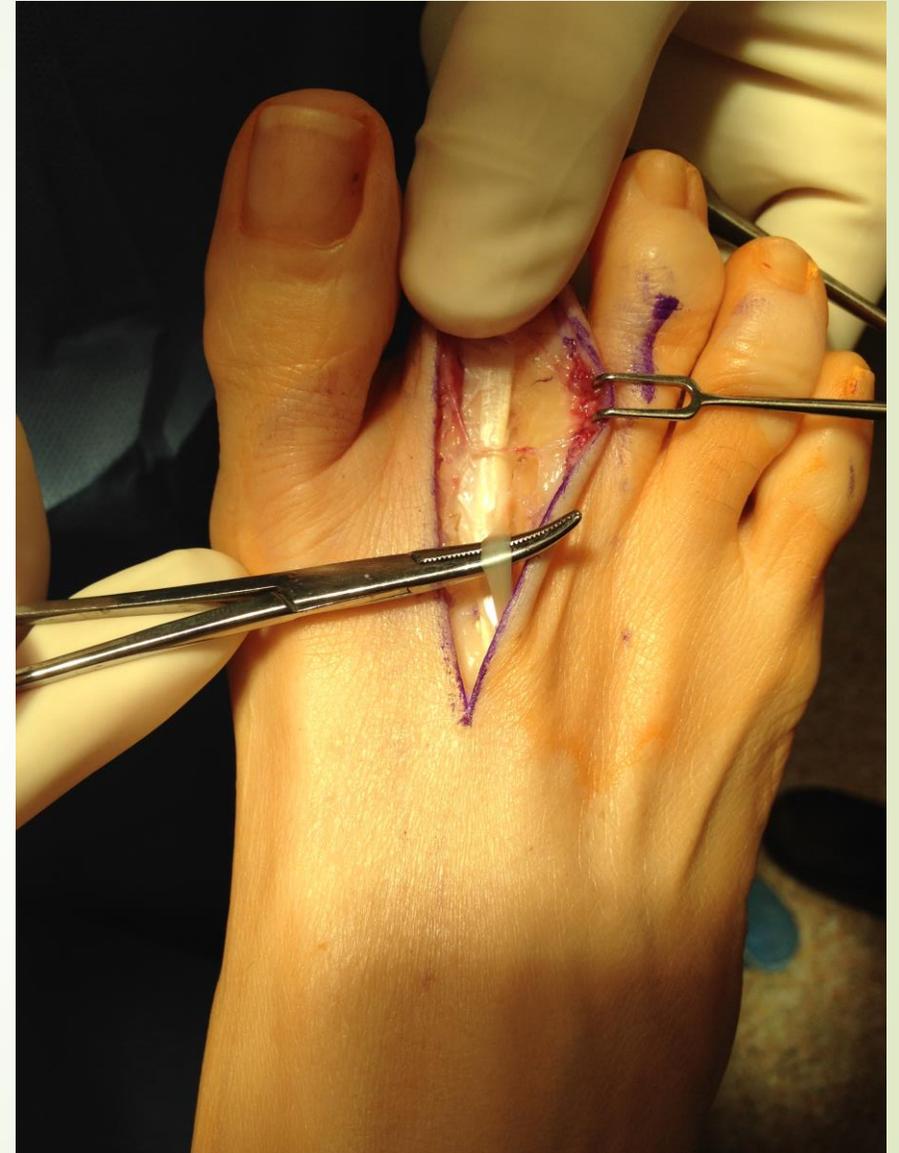
Preoperative Planning

- ▶ Three Weightbearing Radiographs
 - ▶ AP
 - ▶ MO
 - ▶ Lateral



Surgical Technique

- Dorsal longitudinal incision
 - 2nd PIPJ to proximal metatarsal head
- Possible Z-lengthening of EDL
- Identify EDB and transect PROXIMALLY
 - Distal to musculotendinous junction
 - *EDB must be left intact at its distal attachment to the dorsal aspect of proximal phalanx



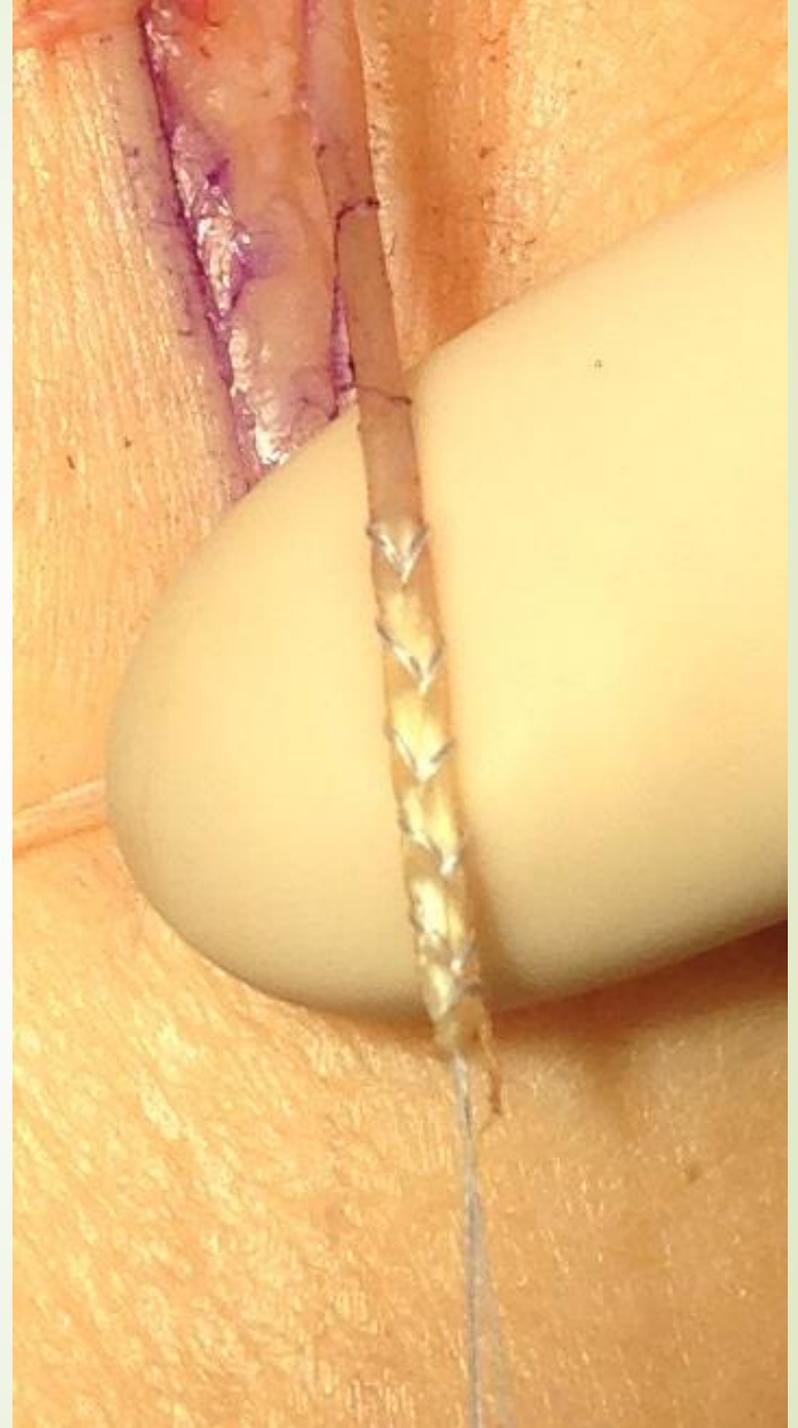
Surgical Technique

- ▶ 4-0 fiberwire whipstitch applied to EDB tendon
- ▶ 2nd MPJ capsulotomy



Surgical Technique

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- ▶ 2nd MPJ capsulotomy



Surgical Technique

VALGUS = lateral deviation
VARUS = medial deviation

- ▶ Release collateral ligament/plantar plate with McGlamry elevator
 - ▶ VALGUS deformity
 - ▶ Release contracted lateral collateral ligament
 - ▶ VARUS deformity
 - ▶ Release contracted medial collateral ligament

- ▶ Tendon routing and drill orientation dictated by type of deformity
 - ▶ VALGUS deformity
 - ▶ EDB routed to reconstruct medial collateral ligament
 - ▶ VARUS deformity
 - ▶ EDB routed to reconstruct lateral collateral ligament



Surgical Technique

- No sagittal deformity

- Drill holes oriented transversely in proximal phalanx and metatarsal head

- Parallel to WB surface

- Sagittal deformity

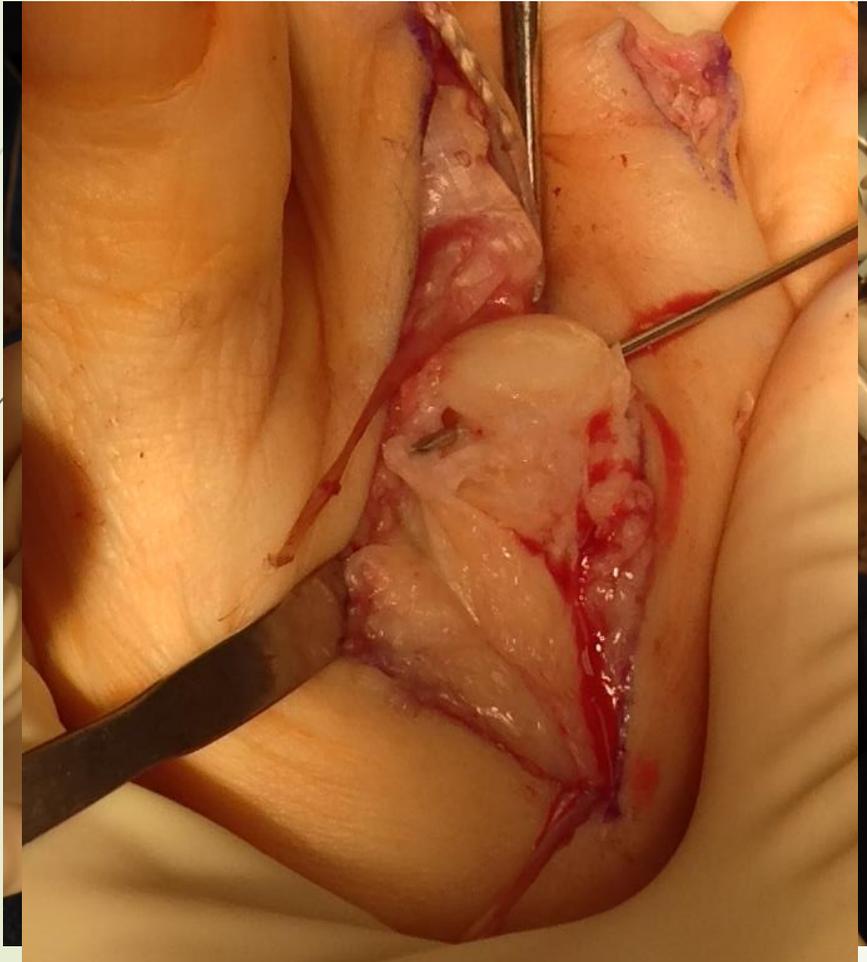
- Drill holes oriented along oblique dorsomedial to plantar lateral axis

Deformity:
Dorsiflexed Varus 2nd toe



- ▶ Medial collateral ligament, dorsal capsule and plantar capsule released
- ▶ Guidewire placed in proximal phalanx from dorsomedial to plantar lateral

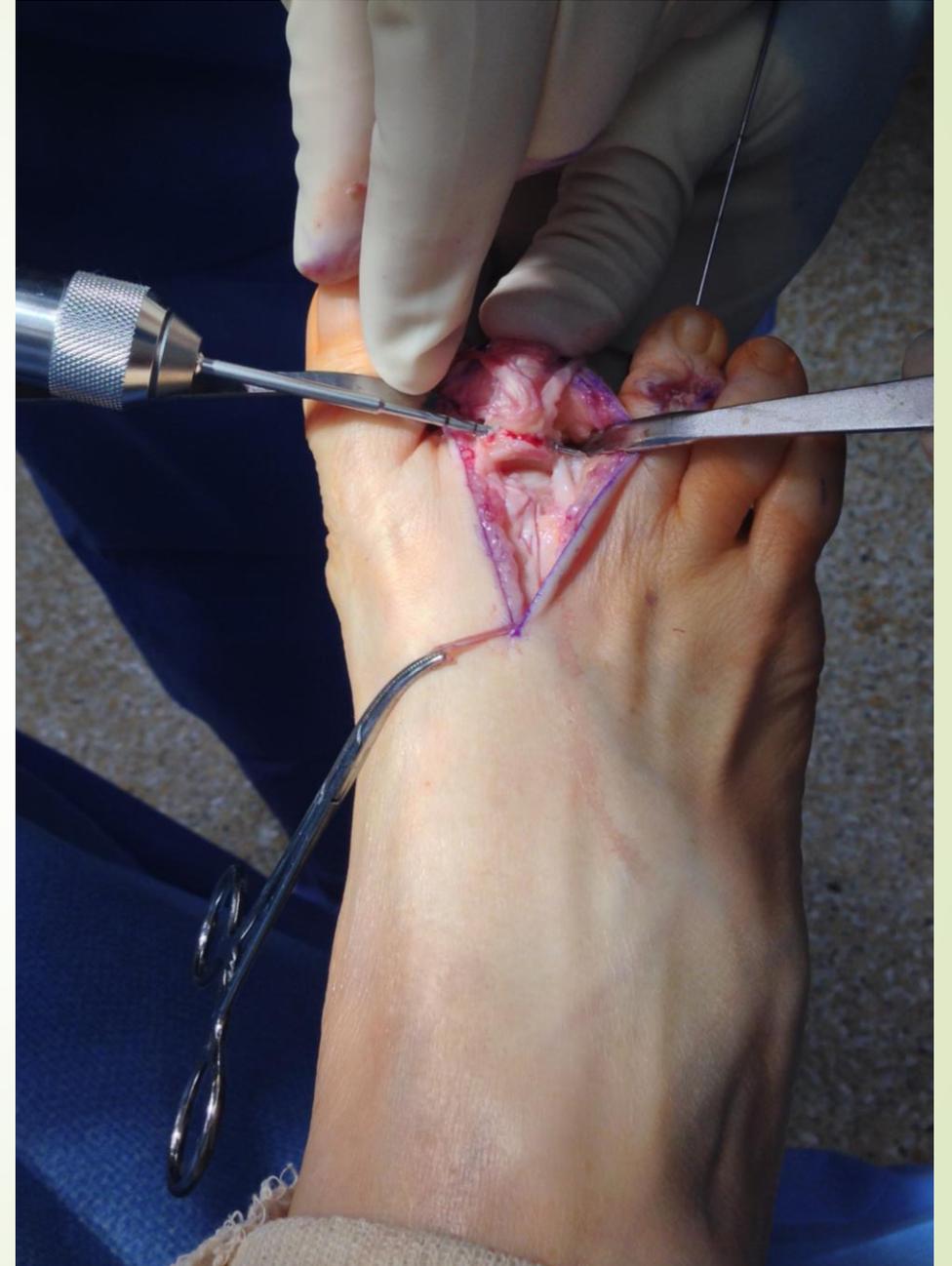
Deformity:
Dorsiflexed Varus 2nd toe



- ▶ Second guidewire placed in metatarsal head, extending from dorsomedial corner of the articular surface to the plantar lateral metatarsal neck

Surgical Technique

- ▶ Tendon diameter is measured
- ▶ Drill first with 2.0mm drill bit and then 3.0mm drill bit if needed or augmenting with fibertape
 - ▶ Drill phalanx and metatarsal
- ▶ Transfer tendon through bone tunnel with use of tendon passer



Surgical Technique



- Pass tendon through phalanx base and enter tunnel on opposite side of the phalanx from the insufficient ligament
- Tendon exits phalanx plantarly and routed from plantar to dorsal through metatarsal bone tunnel

Surgical Technique

- ▶ Whipstitch technique allows toe to be tensioned quite easily
- ▶ Verify with intraoperative fluroscopy
- ▶ Insert 3.0mm biotenodesis screw proximally
 - ▶ May add additional screw distally if using fibertape



Reassess Deformity

- ▶ Reassess hammered digit and need for additional surgery
 - ▶ Flexible deformity may no longer need addressed after transfer
- ▶ MTP may appear subluxed[%] plantarly due to dorsal capsulotomy but resolves with repair and WB.
- ▶ Reapproximate EDL and close in anatomic layers

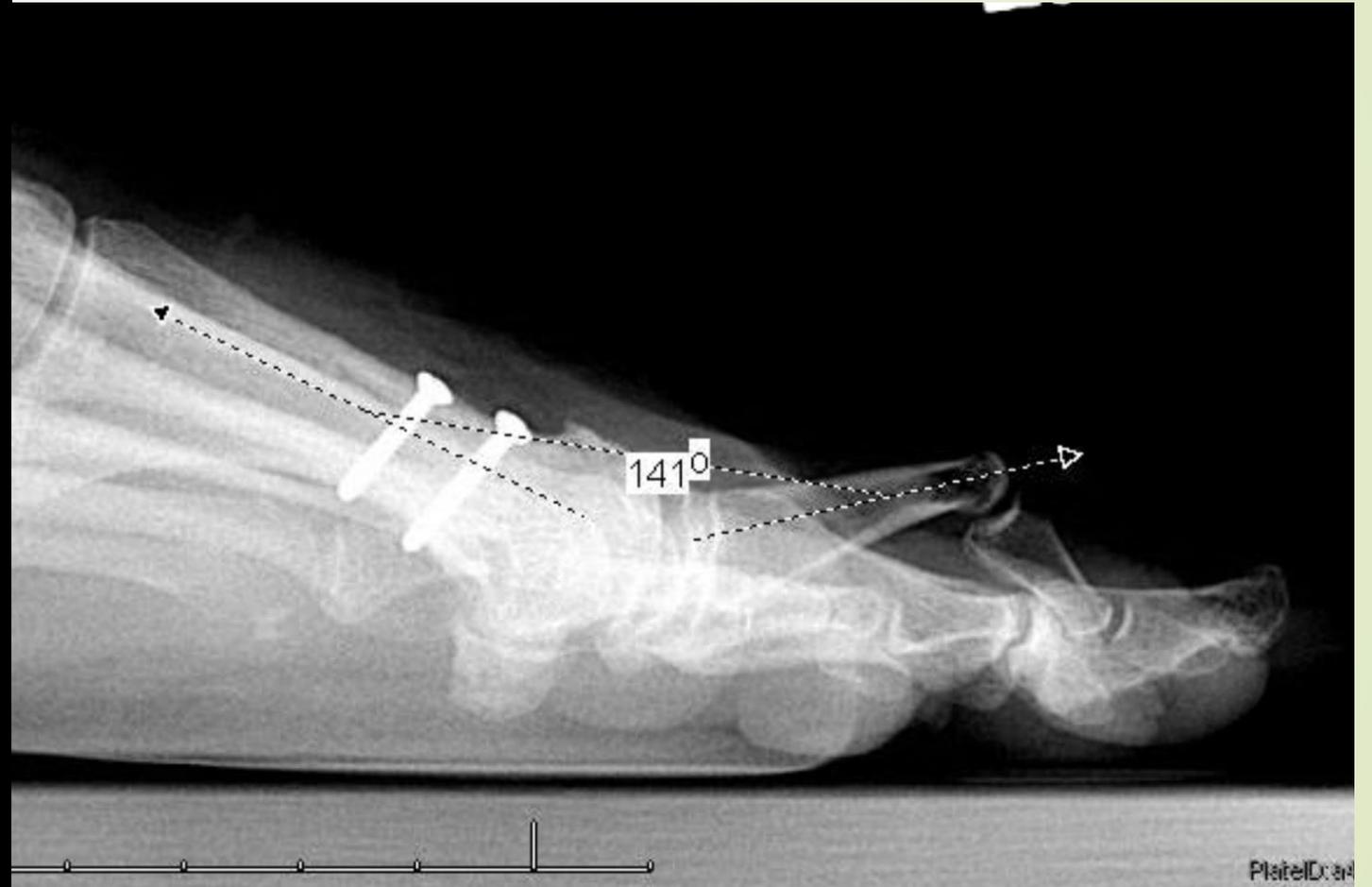




Post Operative Findings

- ▶ 120 day followup
 - ▶ WB without difficulty in normal shoe gear
- 

MTP Angle



Post Operative Findings

Preop AP°	Post op AP	% change	Pre op LAT	Post op LAT	% change	Follow Up (d)
18°	9°	50%	30°	27°	10%	80
13°	11°	15%	39°	20°	49%	94
28°	17°	39%	57°	34°	40%	189
26°	27°	-4%	50°	39°	22%	106
30°	31°	-3%	40°	41°	-3%	147
10°	8°	20%	37°	26°	30%	105



Post Operative Follow Up

- Alignment corrected in sagittal and transverse planes
- 2nd digit parallel to 3rd toe
- Purchased WB surface
 - Without PIPJ contracture or MPJ elevation, subluxation or dislocation
- 2 patients
 - Mild varus (medial drift) without hallux abutment
 - Severe deformity preoperatively
 - No pain
- Overall 100% satisfaction

Discussion

- ▶ Imbalance between extrinsic and intrinsic forces lead to lesser toe deformities
- ▶ MTP stabilized by medial and collateral ligaments, plantar plate, capsule and tendon forces
- ▶ Unopposed forces
 - ▶ Improper shoe gear, trauma, genetics, inflammatory disorder, neuromuscular disease
- ▶ Cadaveric study
 - ▶ Consistent transverse tears of plantar plate proximal to capsular insertion on proximal phalanx
 - ▶ Collateral ligament tears, complete plantar plate disruption noted in severe deformities

Extrinsic: EDL/FDL → extend MTP/flex PIP

Intrinsic: EDB/FDB/lumbricals/interossei → flex MTP/extend PIP

Their Technique

- ▶ Ellis et al.

- ▶ Static technique

- ▶ Hadded et al.

- ▶ FDL compared to EDB transfer

- ▶ EDB transfer = less pain and stiffness
 - ▶ Higher rate of recurrence with increased severity of deformity

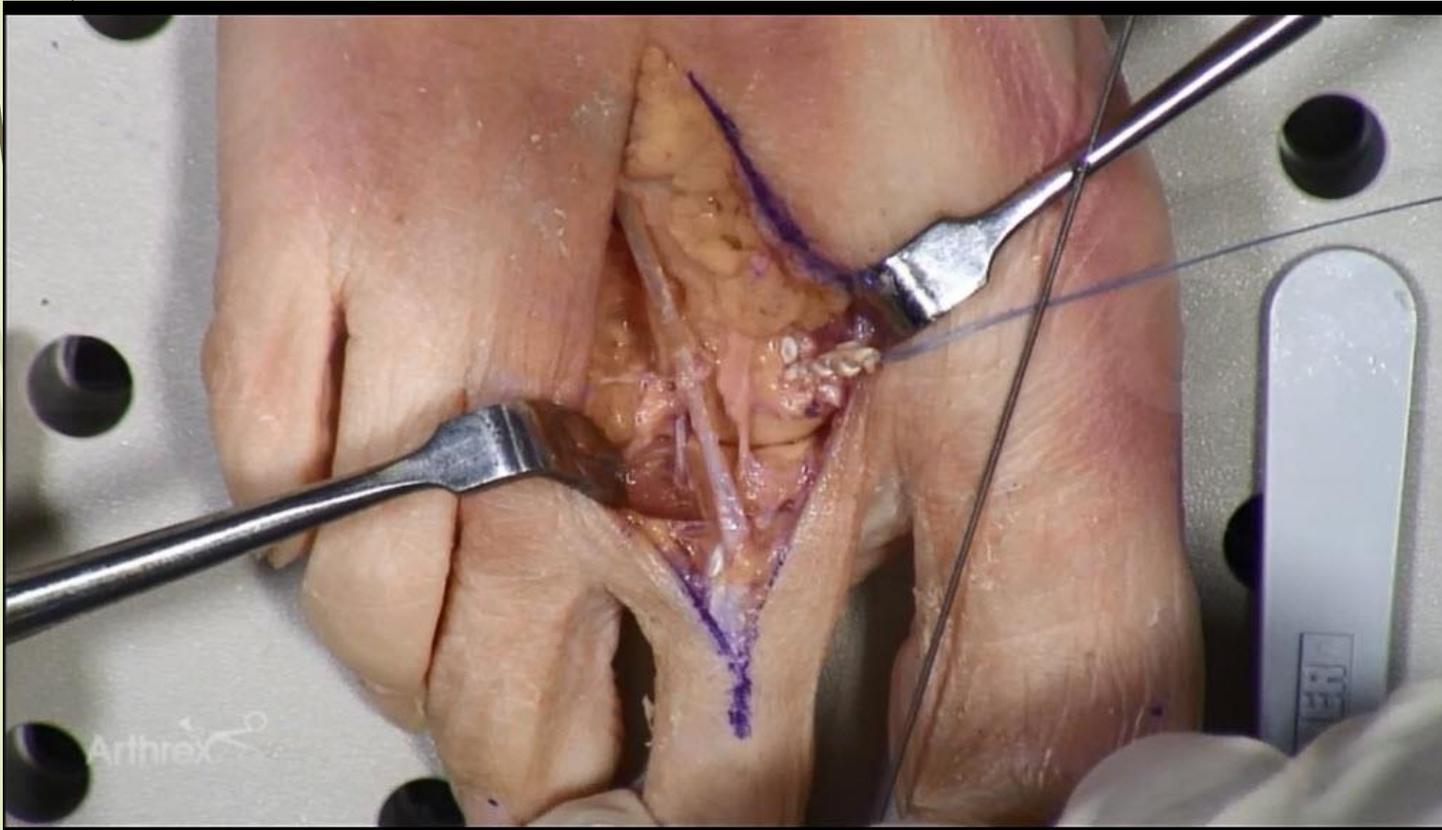
- ▶ Myers and Schon

- ▶ Mini biotenodesis screw without phalangeal tunnel
 - ▶ EDB slip with Weil osteotomy

- ▶ Lui et al.

- ▶ Secured distal stump of EDB to EDL

Our Technique



- Modified cannulated technique with biotenodesis screw for internal fixation
- To prevent frontal plane deformity seen with previous EDB transfers
- Allows for frontal plane control based upon the angle of orientation of the osseous tunnel

Results

- ▶ 2nd MTP transverse plane deformity improved by an average of 20% (AP view)
- ▶ 2nd MTP sagittal plane deformity improved by an average of 25% (LAT view)



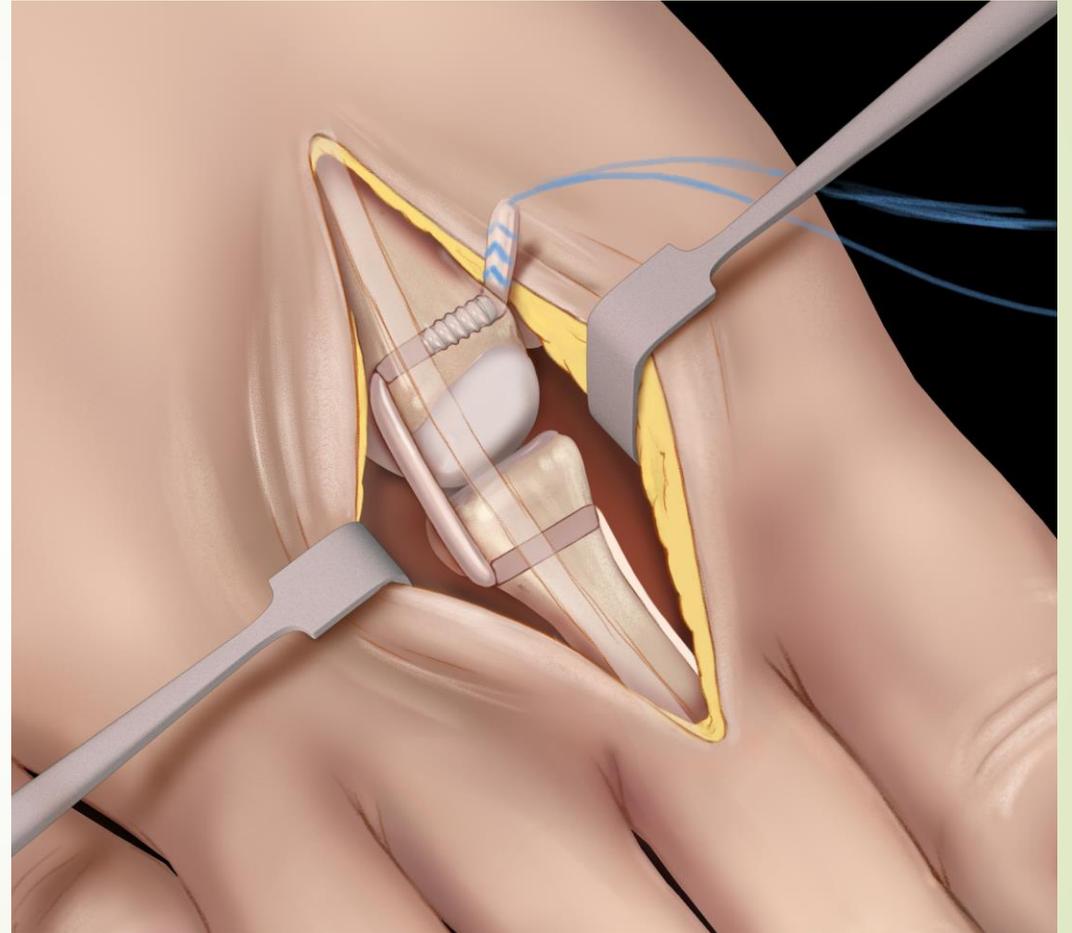


Limitations

- ▶ Small patient population
 - ▶ New study being done with 20 patients with reproducible and improved results

To be continued....

- ▶ Applicable in lesser deformities
 - ▶ Also used in 3rd and 4th MTPJ pathology
- ▶ Multiplanar deformities are difficult to treat
 - ▶ Reproducible technique to help manage a challenging problem





References



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- Unrelated procedures

- Tarsometatarsal arthrodesis
- Modified McBride bunionectomy
- Akin ostetotomy
- Proximal interphalangeal joint arthrodesis of the 3rd digit
- 1st metatarsophalangeal joint arthrodesis
- Neurolysis of the 3rd digital nerve
- Partial ostectomy of distal phalanx hallux

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