

Dr. Tom Lootens
Dienst orthopedie – AZ Maria Middelaers – Gent



Gezondheidszorg met een Ziel

Pathophysiology

- Passive structures
 - Capsule
 - Plantar plate
- Active structures
 - Extensors
 - Flexors
 - Intrinsic
 - Interossei
 - Lumbricals

Extensor digitorum longus tendons

Lateral strand of anterior bundle of deep flexor (FDP)

Common digital branches of superficial flexor nerve (S1-S2)

Deep flexor nerve

Extensor hallucis brevis muscle

Extensor hallucis longus tendon

Insertions of anterior, posterior, and distal phosphors

Extensor expansion

Copyright © 2006 Wolters Kluwer Health | Lippincott Williams & Wilkins

RMC Division of the Post-Operative Research Unit

-



GezondheidsZorg met een Ziel

Pathophysiology

- Passive structures
 - Capsule
 - Plantar plate
 - Most stabilizing factor of MTP joint
 - Plantar aponeurosis + plantar capsule



The diagram shows a lateral view of the first metatarsophalangeal (MTP) joint. The metatarsal bone is on the left, and the proximal phalanx is on the right. The plantar plate, a thick, fibrocartilaginous structure, is shown as a horizontal band between the two bones. The plantar capsule is the joint capsule located on the plantar (bottom) aspect of the joint. A label 'Plantar plate and capsule' points to these structures.

Plantar plate and capsule

AZ Maria Middelares

-
- Plantar plate and capsule



Pathophysiology

- Active structures
 - Extensors
 - **Extensor Digitorum Longus**
 - divides into 3 slips over prox phalanx
 - middle slip on base of middle phalanx
 - 2 lateral slips converge to base of distal phalanx
 - **Extensor Sling**
 - Fibroaponeurotic sling
 - Anchors EDL to plantar aspect MTP and base of prox phalanx
 - **Function**
 - dorsiflex prox phalanx
 - with prox phalanx neutral or flex: extension of PIP joint
 - Hammer toe: no extension in PIP due to extension of prox phalanx

The image contains two anatomical diagrams. The top diagram shows a lateral view of the foot and ankle, highlighting the Extensor Digitorum Longus (EDL) muscle. Labels include: Ext. longus, Interosseal, Ext. brevis, Transverse metatarsal ligament, and Extensor hood. The bottom diagram shows a lateral view of the foot and ankle, highlighting the Extensor Sling. Labels include: Ext. digitorum longus, Extensor sling, and Ext. digitorum brevis. A red arrow points from the 'Function' section of the text to the Extensor Sling diagram.

Gezondheidszorg met een Ziel

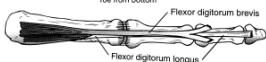
AZ Maria Mediscap

-
- phalanx



Pathophysiology

- Active structures
 - Flexors
 - **Flexor Digitorum Longus**
 - Inserts on distal phalanx
 - Flexion of DIP joint
 - **Flexor Digitorum Brevis**
 - Inserts into middle phalanx
 - Flexing PIP joint
 - **Function**
 - No flexion of MTP joint (no insertion on proximal phalanx)
 - With MTP joint in extension, no antagonist to flexors → flexion DIP and PIP



→ over time **hammer toe**

 AZ Maria Middelares

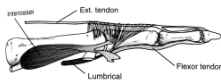
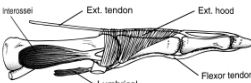
-
- Diagram illustrating the deep muscles of the foot (plantar view). The diagram shows the following structures:
- Toe from bottom
 - Flexor digitorum brevis
 - Flexor digitorum longus



Gezondheidszorg met een Ziel

Pathophysiology

- **Active structures**
 - **Interossei**
 - Dorsal to transverse MT ligament
 - Flexing MTP joint; extension of PIP and DIP (weak)
 - **Lumbricals**
 - Plantar to transverse MT ligament
 - Flexing MTP joint; extension of DIP and PIP (strong)
 - **Function**
 - Dorsiflexion of MTP joint
→ lumbrical flexion limited



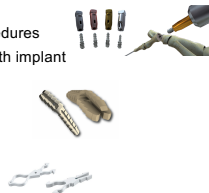
AZ Maria Medelare

-



Surgical treatment

- Open vs Percutaneous
- Bony procedure – Soft tissue procedures
- Fixation with dressing – Fixation with implant
- Implants:
 - K-wire
 - Resorbable implants
 - Peek implants
 - Metal implants (static – dynamic)
 - ...
- Rehab



Literature

Hammertoe correction with k-wire fixation.

Kramer WC¹, Parman M¹, Marks RMP.
[Foot Ankle Int.](#) 2015 May;36(5):494-502. doi: 10.1177/1071100714568013. Epub 2015 Feb 12.

- Retrospective case series, Level IV
- 2698 hammertoes; 709 female & 167 male
- Complications:
 - 94 pin migrations (3,5%); 9 pin-tract infections (0,3%)
 - 2 pin breakages (0,1%)
- 150 recurrent deformities (5,6%)
- 94 revision hammertoe surgery (3,5%)
- 55 malalignment (2,1%)

K-wire fixation led to good maintenance of correction and relative low complication rate

Literature

Correction of Hammertoe Deformity With Novel Intramedullary PIP Fusion Device Versus K-Wire Fixation

Richman SH¹, Siqueira MB¹, McCullough KA², Berkowitz MJ¹.
[Foot Ankle Int.](#) 2017 Feb;38(2):174-180. doi: 10.1177/1071100716671883. Epub 2016 Oct 22.

95 toes K-Wire fixation; 54 toes CannuLink implant

	K-WIRE	IM DEVICE
Recurrence	9,5%	2,5%
Complications	15%	7,7%
Pain after surgery	27%	7,7%
Revision surgery	5,3%	0%

IM device less complications, recurrence and no revision surgery

Literature

Hammertoe Correction With K-Wire Fixation Compared With Percutaneous Correction

Yassin M^{1,2}, Garti A^{1,2}, Heller E^{1,2}, Robinson D^{1,2}.
[Foot Ankle Spec.](#) 2017 Oct;10(5):421-427. doi: 10.1177/1938640016681069. Epub 2016 Dec 4.

454 toes open, K-Wire fixation; 221 toes percutaneous

	OPEN	PERCUTANEOUS
Recurrence	3,3%	2,3%
Infection (per toe)	5,3%	2,2%
VAS score (pre-post)	4,1 – 3,5	3,9 – 1,9
Revision surgery	2,6%	0%

Similar results; lower infection rate percutaneous

Own series

Comparison of two IM devices for hammertoe surgery

Donadoni P, Lootens I.

- DuaFit®
 - Peek; barbed
 - 0° ; 10° ; 17°
 - 4 sizes (length)
- SmartToe®
 - One piece memory Nitinol
 - Dynamic compression
 - 0° and 10°
 - 6 sizes



Own series

Comparison of two IM devices for hammertoe surgery

Donadoni P, Lootens I.

- 35 patients; 42 toes
- 13 DuaFit implants; 29 SmartToe implants
- 24 right; 18 left

Toe	Number
2nd	35
3rd	6
4th	1

Own series

Comparison of two IM devices for hammertoe surgery

Donadoni P, Looftens I

- No infections;
- 1 solo; 40 combined procedure (HV; hammertoe; flatfoot corr)

	DuaFit	SmartToe
Angle	3 – 0° / 10 – 10°	All 10°
Xray	1 diastasis ≥ 2mm	3 diastasis ≥ 2mm distal migration through P2 (4th toe!)
Pain after surgery	7,7%	3,5%
Recurrence	0%	0%

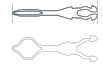
Own series

Comparison of two IM devices for hammertoe surgery

Donadoni P, Looftens I

Conclusions

- Both good results
- SmartToe
 - more sizes and better fixation in osteoporotic bone (dynamic compression)
 - technique: reaction time (temperature); size P2
- DuaFit
 - less sizes; all same diameter
 - technique: static (no rush); instrumentation (drill)



Case reports

- HammerFix IM device 2nd toe



Case reports

- SmartToe 2nd toe (10°)



Case reports

- SmartToe 3rd toe



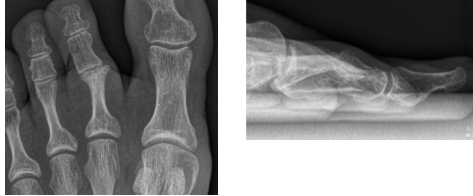
Case reports

- SmartToe 3rd toe problem P2



Case reports

- Non union PIP with K wire
- Recurrence; malalignment



Case reports

- Non union PIP with K wire
- Recurrence; malalignment



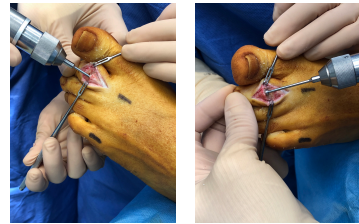
Case reports

- Non union PIP with K wire



Case reports

- Non union PIP with K wire



Case reports

- Non union PIP with K wire



Case reports

- Non union PIP with K wire



Case reports

- Non union PIP with K wire



AZ Maria Middelaars

Case Report

- Non union 4th toe



AZ Maria Middelaars

Case Report

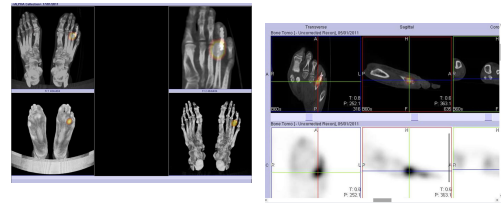
- Non union 4th toe



AZ Maria Middelaars

Case Report

- Non union 4th toe



AZ Maria Middelaars

Conclusions

- 'All Roads Lead To Rome'
 - Open
 - Percutaneous
- Learning curve
- Tendency: IM implant
 - Less recurrence
 - Less revision surgery
 - Problem in case of infection

AZ Maria Middelaars

THANK YOU FOR YOUR ATTENTION



AZ Maria Middelaars