HALLUX RIGIDUS

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DÉFINITION

- Arthrose métatarso-phalangienne et métatarso-sésamoïdienne
- douleur et raideur variables.
- Contrairement à l'hallux valgus, on retrouve plutôt une prédominance masculine,
- autour de 50 ans
- Traitement médical au début
- à un stade plus avancé, TTT chirurgical conservateur ou radical (arthrodèse)

22% of these men cannot be held responsible for the crimes which they have committed. They are feeble-minded, even to the point, in some cases, of being imbeciles, and to turn them again loose into the community to associate with the depraved class that lead them into trouble, is a crime for which Massachusetts ought not to assume the responsibility.

The present Board is encouraging more out-of-door life and more open wards. There are in some of our State hospitals wards and buildings which are not locked, neither the doors nor the windows—and the patients come and go as they please. There should be more of this. A majority of the people now confined in our State hospitals should be allowed the freedom of the grounds without the slightest fear of their running away or doing harm to themselves or others. Only about 8% are really violent and dangerous. Our superintendents, who have appreciated this fact, are today encouraging out-of-door sports and games and work.

One of the results is the formation of baseball nines in the different hospitals, and now there is an interchange of games between the nines of some of the hospitals. The nine of one hospital visits another hospital and plays one afternoon, and later on the latter nine returns the visit and plays the first hospital's nine. This interchange between teams is going to be more frequent, and brings much interest to the patients who can watch these games. At one of the last games of the autumn, 50 patients of the Medfield State Hospital were allowed to accompany the baseball nine to Taunton the afternoon that Medfield played Taunton. This, and the privilege of attending the dances in the evening, and private theatricals and moving picture shows, are great incentives to patients to get hold of themselves, to control themselves, and to coöperate with the physicians in the work of getting them back into the community.

Original Articles.

HALLUX RIGIDUS.

BY CHARLES F. PAINTER, M.D., F.A.C.S., BOSTON.

IN a paper recently published by the writer, upon Hallux Valgus, reference was made to the possible influence of anatomic variations of the bones of the tarsus upon the causation of that deformity. My belief that such might be the case was derived from studies that were made some years ago concerning the matter. There are a number of anatomic variations in the bones of the tarsus, as has been pointed out by the late Prof. Thomas Dwight of the anatomical department of Harvard. At the Harvard Medical School there are now a large number of radiograms of dissected feet, prepared under Dr. Dwight's direction. They were practically all adults and sufficient data was available in reference to them for the purposes of this discussion.

The theory which had been suggested to me from the clinical observation of a number of cases of hallux rigidus was this: anatomical variations in the size or conformation of the bones of the tarsus seems the only reasonable explanation for the fact that the great toes of certain individuals gradually acquire incapacity for dorsiflexion when these individuals have experienced no traumatism and are not the subject of any arthritic diathesis. Furthermore, in practically every instance, these patients are so shod that the metatarso-phalangeal joints of the first toes are situated immediately beneath the points of juncture of the vamps with the uppers. Sometimes in the same patient this will be true on one foot, whereas the other will show no tendency to rigidity of the toe and at this joint the juncture of the vamp and the upper will not be related, as they are on the side of the rigid toe. Inasmuch as hallux rigidus is caused by an hypertrophy of the bone on the dorsum of the distal end of the first metatarsal, it would seem that under the conditions present when the seam of a shoe presses continuously against this point while the foot is in action, and the "break" in the shoe, which necessarily comes opposite the point of flexure of the foot, will increase this pressure, the factors needful to produce such an hypertrophy as that which characterizes hallux rigidus are all present.

Long before these patients have any idea of the beginning rigidity of their great toe joints they often have had the skin rub off on the top of this joint while "breaking" in new shoes, and they are obliged to exercise great care in getting their feet fitted to shoes. More often than not this difficulty will occur with only one foot. Sometimes, I presume, where the patient feels that he can afford it and these difficulties arise in purchasing ready made shoes, he resorts to the custom-made shoe and, if he does so sufficiently early, possibly saves himself from any noticeable rigidity.

If, as I shall try to show, the anatomic variations in the lengths of the various tarsal bones are the cause of hallux rigidus, the question naturally arises, why do these not occur more often in women in whom these same variations must occur. I think the answer to this must be that the stock out of which men's shoes are made is so much heavier than that from which women's shoes are made that it offers more chance for traumatism. In addition to this, men use their feet more and harder than women, as a rule.

In looking over the series of radiograms which Prof. Dwight has taken of the bones of the feet, which I was permitted to see through the courtesy of the anatomical department at Harvard, there was seen by actual measurement to be variations in the comparative lengths of the bones of the feet, possessed of the same total length, amounting in

ETIOLOGIES

- L'hallux rigidus peut s'intégrer à une maladie arthrosique générale
- Le + souvent il apparaît **primitif**
- HR secondaires : extrinsèques et intrinsèques
  - Certains ont évoqué une élévation excessive du premier métatarsien, mais ceci est controversé.
  - Cause ou conséquence?

  - ZammitG.V., MenzH.B., MunteanuS.E. Structural factorsassociatedwithhallux limitus/rigidus: a systematicreviewof case control studies*J OrthopSports PhysTher2009 ; 39 : 733-742*

ETIOLOGIES (2)

- **L'excès de longueur du 1er rayon** par une prédisposition anatomique du pied (pied égyptien),
  - Hallomégalie P1 long (Davies-Colley 1887)
  - M1 long (Botek 2011)

  - pouvant entraîner des microtraumatismes ++ répétés lors du chaussage,
  - pourra justifier certaines indications de raccourcissement du premier rayon.

ETIOLOGIES (3)

- Il existe d'autres causes de dégradation articulaire plus rares : infection, rhumatisme, séquelles traumatiques…
- En principe, il n'y a pas de déformation associée du premier rayon, type hallux valgus
- si un hallux valgus est associé à de l'arthrose, on parle d'hallux valgus arthrosique, et non d'hallux rigidus

CLINIQUE

- L'hallux rigidus comporte 3 stades cliniques.
  - **Le stade I** est caractérisé par une douleur intermittente lors du déroulement du pas notamment lors de la flexion dorsale du 1er orteil. La mobilité est bien conservée à ce stade.
  - **Le stade II** est celui de l'arthrose constituée. Il existe une raideur articulaire et un aspect caractéristique en « barquette » du gros orteil. Il existe une hypertrophie osseuse à prédominance dorsale.
  - **Le stade III** est celui de l'ankylose articulaire. La marche s'effectue en supination. Le conflit dorsal au chaussage est souvent invalidant accompagné de douleurs névralgiques inconstantes du 1er rayon.

LA DOULEUR

- 3 types:
  - en regard de l'hypertrophie osseuse entraînant un conflit au chaussage avec une bursite plus ou moins marquée.
  - D'autre part une douleur + diffuse, évoluant par crises, plus ou moins associée à une inflammation, liée à l'arthrose proprement dite.
  - Dysesthésies, brûlures dorsales (irritation du nerf collatéral dorsomédial)

IMAGERIE

- Des <u>clichés radiographiques de face et de profil en charge</u> de l'avant-pied sont nécessaires qui apprécieront :
  - l'état de l'interligne articulaire métatarso-phalangien
  - Le degré de pincement articulaire
  - la longueur du 1er rayon,
  - l'importance de l'ostéophytose dorsale (plus ou moins prononcée).
  - Classification +

CLASSIFICATION DE REGNAULT

Classification radiographique de l'hallux rigidus

Regnault B. le pied. Paris. Springer Verlag 1986.

stade 1 – pas de pincement de l'interligne et condensation sous chondrale. Pas d'ostéophyte

stade 2 – Pincement modéré de l'interligne < 50%

stade 3- pincement marqué de l'interligne articulaire > 50%, ostéophytose

Stade 4- Pincement total de l'interligne, qui est élargi, CE

CLASSIFICATION DE COUGHLIN

CLASSIFICATION

Coughlin and Shurnas Classification		
	Exam Findings	**Radiographic Findings**
Grade 0	Stiffness	Normal
Grade 1	mild pain at extremes of motion	mild dorsal osteophyte, normal joint space
Grade 2	moderate pain with range of motion increasingly more constant	moderate dorsal osteophyte, <50% joint space narrowing
Grade 3	significant stiffness, pain at extreme ROM, no pain at mid-range	severe dorsal osteophyte, >50% joint space narrowing
Grade 4	significant stiffness, pain at extreme ROM, pain at mid-range of motion	same as grade III

TRAITEMENT MEDICAL

- traitement symptomatique (antalgiques, anti-inflammatoires …)

- mesures « mécaniques » :
  - chaussures larges et plates (pour éviter les contraintes articulaires, limiter le conflit dorsal au chaussage),
  - voire semelles avec une barre de roulement antérieur (pour faciliter le déroulé du pas).

- Infiltrations :
  - Corticoïdes
  - Acide hyaluronique

VISCOSUPPLEMENTATION

- L’efficacité de la viscosupplémentation dans l’hallux rigidus est controversée et les études peu nombreuses (produits différents, nombre d'injections, technique de guidage).

Kon Kam King C, Loh Sy J, Zheng Q, Mehta KV .
Comprehensive Review of Non-Operative Management of Hallux Rigidus
Cureus. 2017 .

MunteanuS.E.,etal. Effectivenessof intra-articularhyaluronan(Synvisc, hylanG-F 20) for the treatmentof first metatarsophalangealjoint osteoarthritis: a randomisedplacebo-controlledtrial *Ann RheumDis2011 ; 70 : 1838-1841)*

VISCOSUPPLEMENTATION

Observational, single-arm, prospective multicentre pilot-trial, with a 3-month follow-up

Inclusion criteria:
Patients with symptomatic hallux rigidus, not relieved by analgesics and/or non-steroidal anti-inflammatory drugs (NSAIDs) and/or foot orthotic, with radiological evidence of FMP-OA (joint space narrowing and/or osteophyte).

Main exclusion criteria:
Patients with hallux valgus, microcrystalline or inflammatory arthritis, hyaluronic acid injection in the target joint within the last 3 months, intra-articular corticosteroids in the previous month, planned surgery within the 3 months of follow-up.

Safety, efficacy and predictive factors of short term efficacy of a single intra-articular injection of mannitol-modified cross-linked hyaluronic acid (HANOX-M-XL) in patients with hallux rigidus**. T Conrozier, L. Galois, JY Collard**

Patients and methods-2

Intervention

All patients received a single, imaging-guided (ultrasonography or fluoroscopy), intra-articular injection of 1 ml of HANOX-M-XL, in the FMP joint. HANOX-M-XL is a cross-linked HA (16 mg/ml) combined with mannitol (35 mg/ml) supplied in a 1 ml syringe.

Data at baseline:

Age, sex, weight, height, symptoms duration, bilaterality, previous and current treatments for FMP OA, concomitant therapies, patient's self-assessment of pain (11-point numeric scale: 0-10), Menz radiological classification (stage 0 to 3).

Menz et al. Osteoarthritis Cartilage 2007 15, 1333-38

Outcome measures:

Primary endpoint: assessment of the pain variation on a 11-point numeric scale (0-10) between the date of injection and month 3.

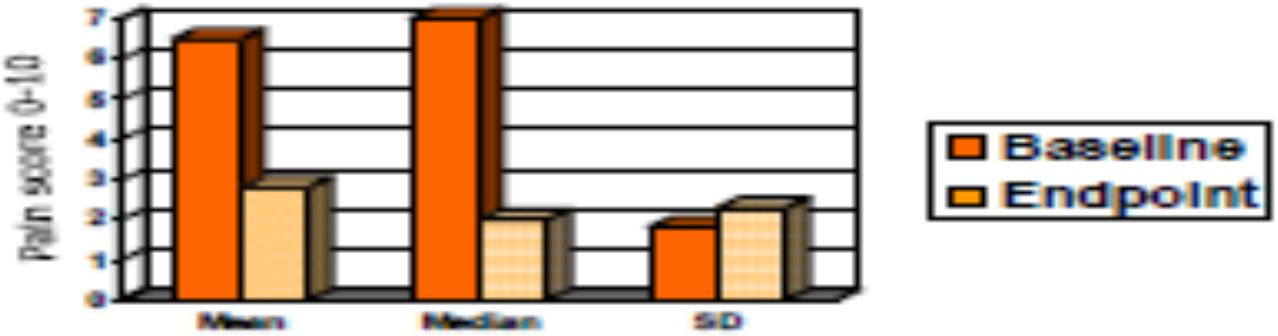
- ✓Secondary outcomes: Patient's self assessment of effectiveness at month 3, decrease in analgesic/NSAIDs use, safety.
- ✓Predictors of efficacy were studied in univariate and multivariate analysis from the Intent-To-Treat (ITT) population.

Results-1

65 patients (72.3% women, mean age: 60, mean symptom duration: 24.9 months) were included in the trial. 9 patients (13.5%) were lost to follow-up.

X-ray grade was 1 in 30 patients, 2 in 29 patients, 3 in 6 patients. There was no statistically significant correlation between the radiological stage and the pain score at baseline ($p = 0.69$).

At baseline and end-point, the average pain score was respectively 6.5 ± 1.8 and 2.8 ± 2.3. The mean difference of the pain score between baseline and endpoint was highly significant (-3.1 ± 2.9 ; $p < 0.0001$).



The average pain score at end-point was 2.0 ± 1.9 in X-ray stage 1, 3.1 ± 2.3 in stage 2 and 3.3 ± 2.4 in stage 3.

The average pain score difference between groups was statistically significant ($p = 0.001$).

Results-2

In multivariate analysis, pain decrease was unrelated to age, gender, disease duration, pain score at baseline, bilaterality, and imaging guidance but remained related to X-ray stage ($p = 0.02$).

Adverse Events (AEs) were reported by 15 patients (22.7%). All were a transient increase of the big toe pain that occurred within the very next hours after injection and lasted few days later. All AEs have been resolved in 3 to 7 days.

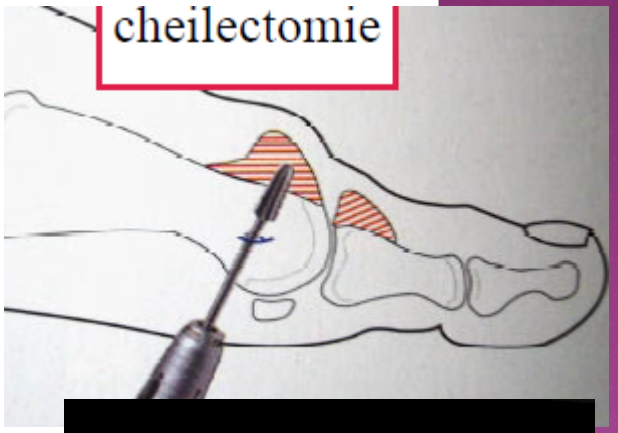
Conclusion

This prospective study showed that, in patients suffering from FMP-OA, a single injection of 1 ml of HANOX-M-XL, performed under imaging guidance, reduced dramatically the first toe pain.

The clinical outcome was significantly better in patients with mild joint space narrowing than in moderate/severe one. However, the majority of patients with more advanced OA were also significantly improved.

TRAITEMENT CHIRURGICAL

- Le traitement chirurgical sera conservateur ou radical.
- Il convient de distinguer 4 gestes principaux :
  - l'émondage articulaire qui consiste à retirer les ostéophytes pour supprimer le conflit au chaussage (cheilectomie)
  - les ostéotomies d'accourcissement phalangienne et/ou métatarsienne indiquées en cas d'excès de longueur du 1er rayon (généralement associées à l'émondage),

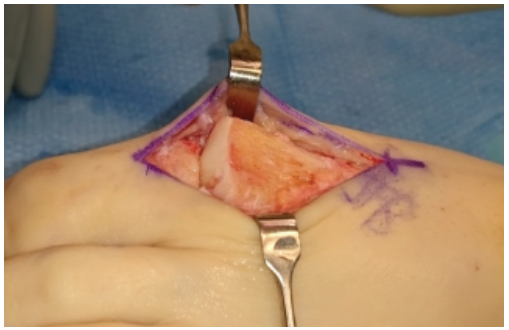


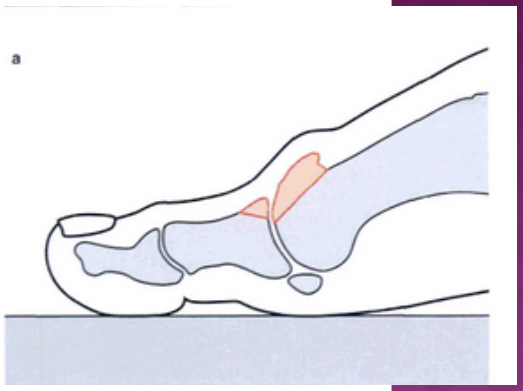
TRAITEMENT CHIRURGICAL

- l’arthrodèse métatarso-phalangienne

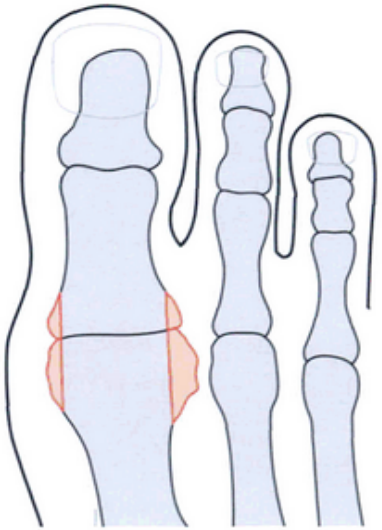
- l’arthroplastie métatarsophalangienne pour certains en cas d’arthrose évoluée.

CHEILECTOMIE





- Conservateur
- EMONDAGE = résection simple des ostéophytes

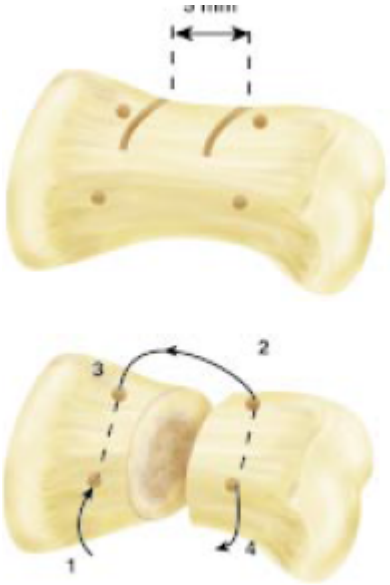


- CHEILECTOMIE ++
  - Résection tiers dorsal M1
  - MackayD.C., et al. The role of cheilectomy in the treatment of hallux rigidus *J Foot AnkleSurg1997*

- **STADES 1 et 2 (3)**

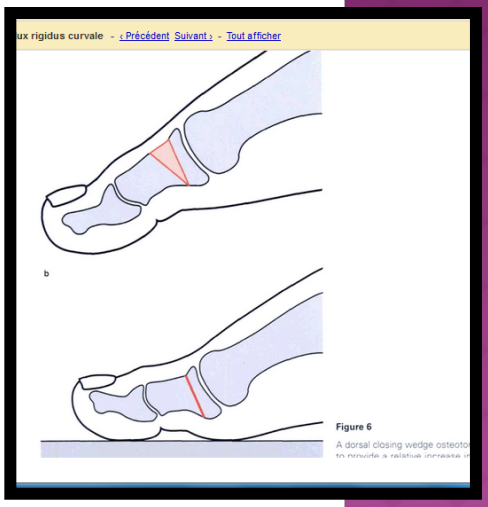
OSTÉOTOMIES PHALANGIENNES : SOUSTRACTION

- Décompression articulaire
- Détente muscles fléchisseurs et extenseurs
- Indic : hallomégalie



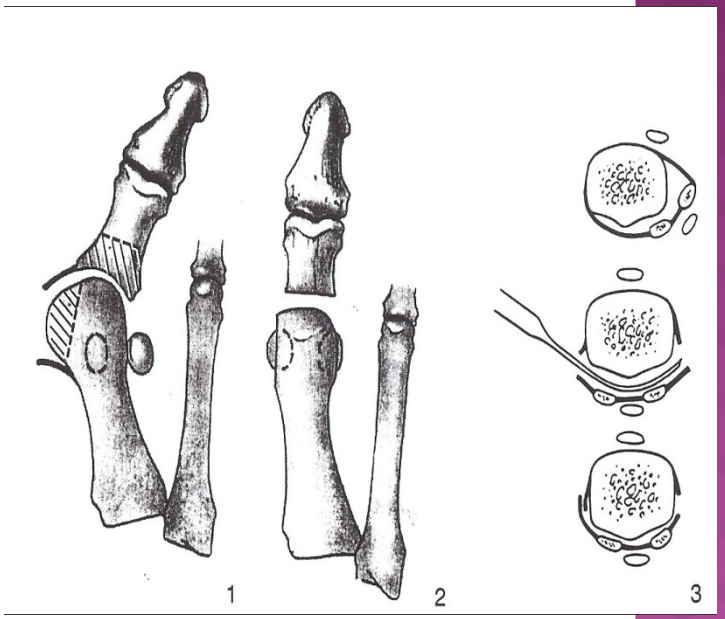
OSTEOTOMIES PHALANGIENNES :
OSTÉOTOMIE DE MOBERG

- Décrite en 1952 (Bonney et Macnab)
- Flexion dorsale
- ↑ flexion dorsale ↓flexion plantaire
- Isolée ou Combinée avec cheilectomie
- Indic : grade I à III
- 99% et 85% satisfaction
- Thomas FAI 1999 § O'Malley JBJSa 2013



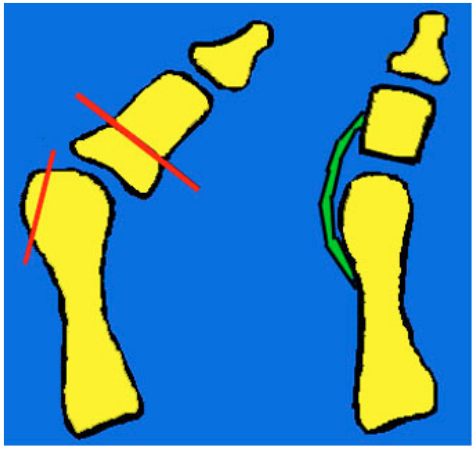
KELLER

- Résection base P1



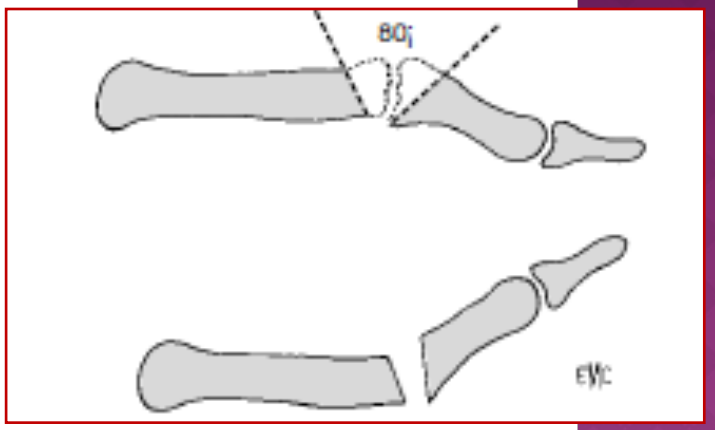
- Création néo-articulation fibro-cartilagineuse

- Complications :
  - métatarsalgies de transfert,raideur,arthrose,
  - raccourcissement,hallux varus



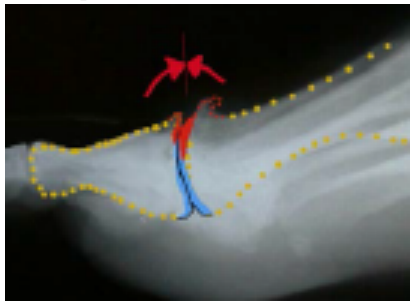
- A éviter

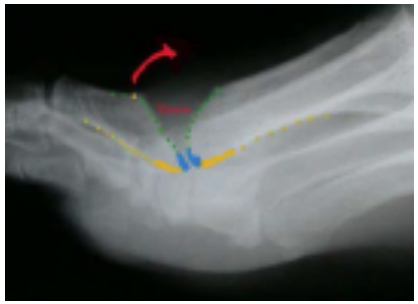
VALENTI



- Arthrectomie à charnière
  - Controversée

- Résection en V des surfaces
  - Lever le bloc osseux limitant la flexion dorsale
  - Mobilisation quotidienne en post-opératoire

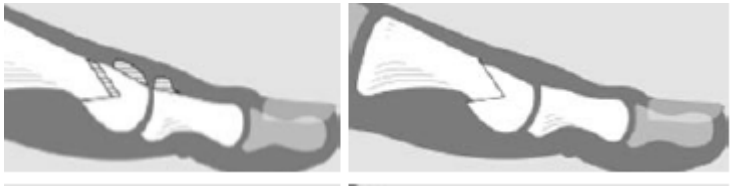




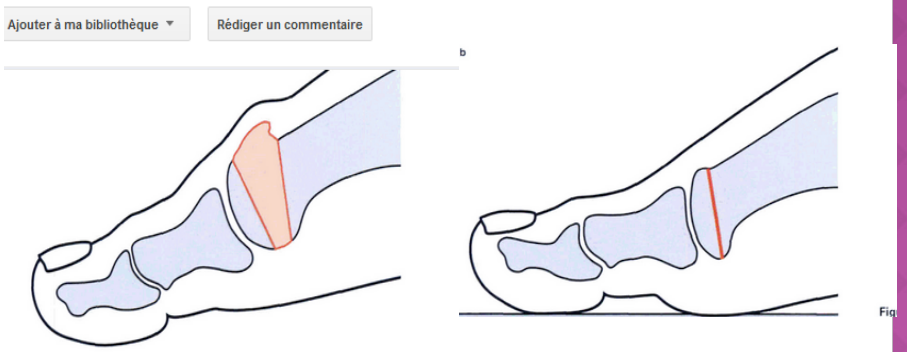
Harisboure A et al . L'intervention de Valenti dans le traitement de l'hallux rigidus : à propos de 41 cas. RCO 2009

OSTEOTOMIES METATARSIENNES

- Austin (chevron)
  - Modifiée Youngswick
  - Décompression articulaire
  - Amélioration fonction, douleur



- Waterman : fermeture dorsale
  - ↑ flexion dorsale
  - Relève cartilage plantaire
  - Décompression articulaire

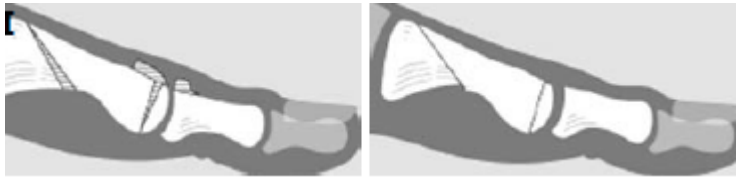


OSTEOTOMIES METATARSIENNES (2)

- Weil :
  - Recul tête métatarsienne
  - Décompression articulaire

- Scarf
  - Sagittal Z ostéotomie

- Ostéotomie de Drago



PLASTIE D'INTERPOSITION

- (Keller) + espaceur biologique
- coughlin FAI 2003 : gracilis
  - ↓ douleur ↑ fonction à 3.5 ans recul
- Mackey JBJS 2010 : suture capsule dorsale et court extenseur avec plaque plantaire

INTERFACAGE

- Implant pyrocarbone (maestro)
  - Économie stock osseux
  - Action antalgique
  - Maintien mobilité
  - + grand recul nécessaire

ARTHROPLASTIE

- Implants silastic : 1ere 2ème génération
  - échecs
  - ostéolyse +++
  - Pertes de substance importantes
  - Reprises difficiles

Sebold EJ, Cracchiolo A 3rd. Use of titanium grommets in silicone implant arthroplasty of the hallux metatarsophalangeal. **Foot Ankle Int. 1996**

Cracchiolo A 3rd, Weltmer JB Jr, Lian G, Dalseth T, Dorey F. Arthroplasty of the first metatarsophalangeal joint with a double-stem silicone implant. Results in patients who have degenerative joint disease failure of previous operations, or rheumatoid arthritis. **J Bone Joint Surg Am. 1992**

ARTHROPLASTIE (2)

- Implants métalliques (PTG-PTH) :

  - ChromeCobalt (M1)
  - PE et Titane (P1)

  - Efficacité antalgique +
  - Ostéolyse, descellement, enfoncement ++

  - *Gibson § Thomson FAI 2005*
    - 49% descellement 1an
    - 15 % révision à 2 ans

ARTHROPLASTIES (3)

- Hémiarthroplasties
  - Implant métallique M1 ou P1
  - Townley FAI 1994
    - 279 cas
    - Bons résultats
  - Konkel FAI 2006
    - 10 cas
    - 100% descellement
  - Raikin jbjs 2007
    - 21 cas
    - 24% révision à 6 ans
  - Kline and hasselman FAC 2015
    - 30 cas
    - 87% survie à 5 ans

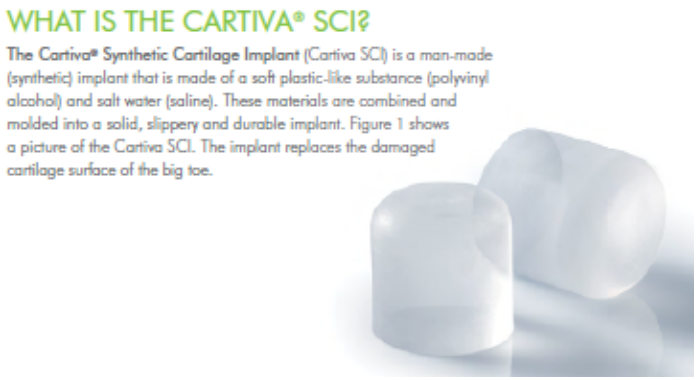
ARTHROPLASTIE (4)

- Prothèses Céramiques :

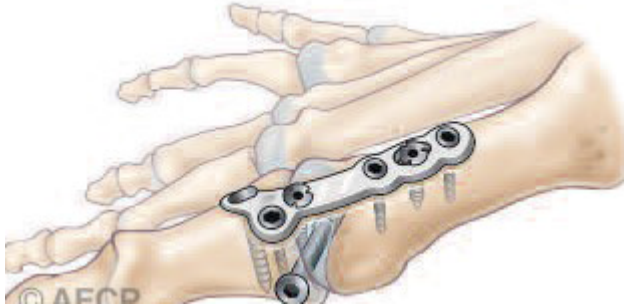
  - Alternative au métal
  - Résultats modestes
  - *Nagy FAI 2014*
    - 31 cas
    - Survie 68% à 9 ans
  - *Dawson-bowling FAI 2012*
    - 32 cas
    - 26% révision à 8 ans
    - 52% descellement

ARTHROPLASTIE (5)

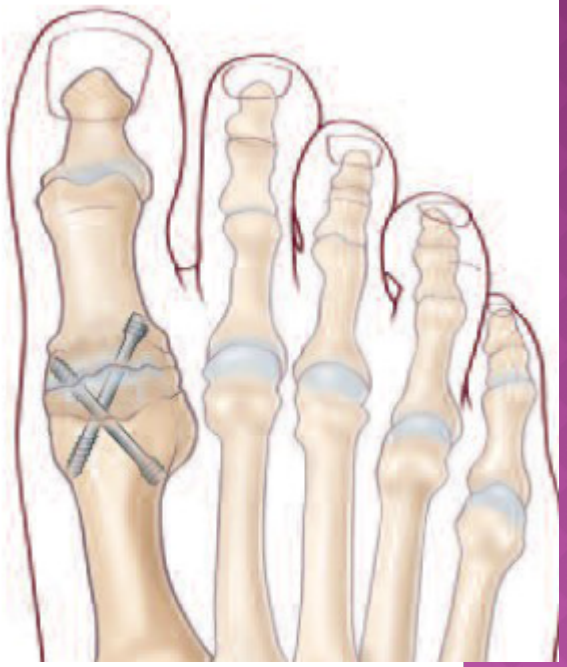
- Substitut cartilagineux
  - Substitut CARTIVA
    - 8-10 mm
  - Baumhauer FAI 2016
    - 202 cas
    - étude prospective randomisée /arthrodèse
    - Score douleur = arthrodèse
    - 9.2% reprise



ARTHRODESE



- Gold standard
  - Arthrose évoluée 3-4



- Nombreuses techniques
  - Ostéosynthèse « légère »
    - Broches
    - Agrafes
  - Ostéosynthèse rigide
    - Plaque vissée à vis verrouillées ou non

POSITIONNEMENT § TECHNIQUE

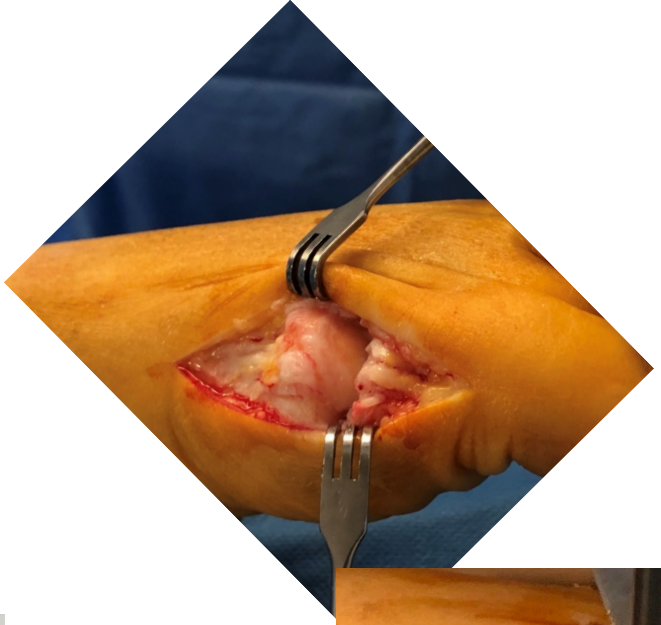
- Rotation neutre
- 5-10° valgus
- 10-15° flexion dorsale parfois + chez femme (hauts talons)

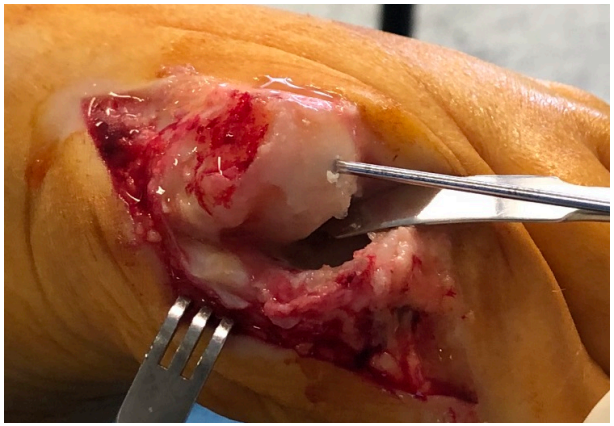
- Coupes ou fraises convexes/concaves

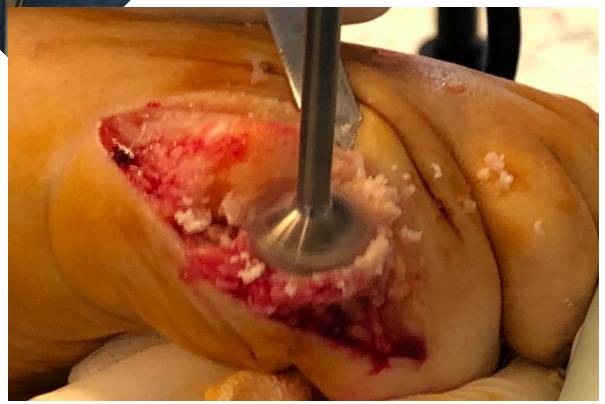
- Vissage isolé ou en croix
- Brochage en croix
- Plaque + vis (résistance mécanique +++)

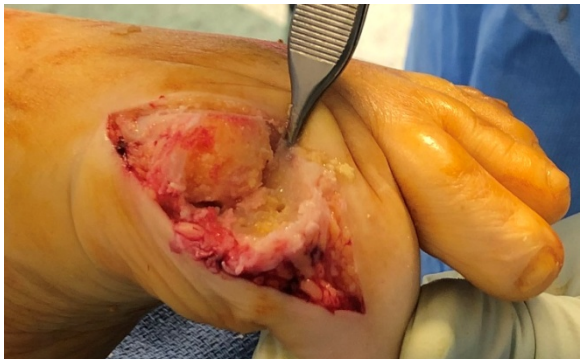
ARTHRODESE : LITÉRATURE

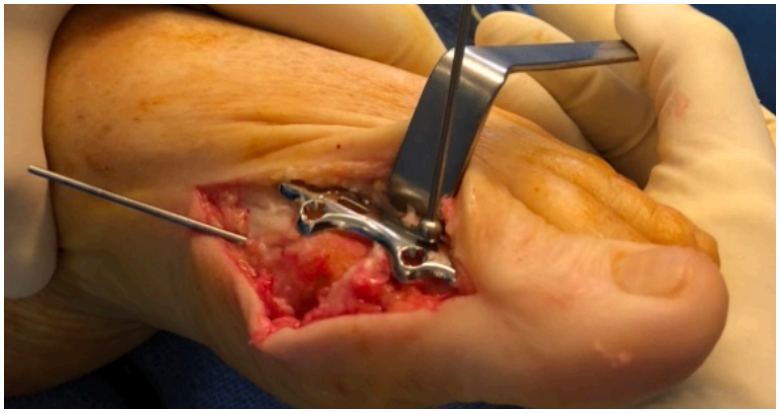
- Goucher § Coughlin FAI 2006
  - Prospective 50 cas
  - Vis + plaque vissée
  - 96% satisfaction
  - 92% fusion
  - 4% révision
- Doty FAI 2013
  - 49 cas
  - 89% bons excellents résultats
  - 98% fusion
  - …….
- Nombreuses études comparatives arthrodèse vs arthroplastie
  - Meilleurs scores douleur, fonction, avec l'arthrodèse
  - Moins de révision







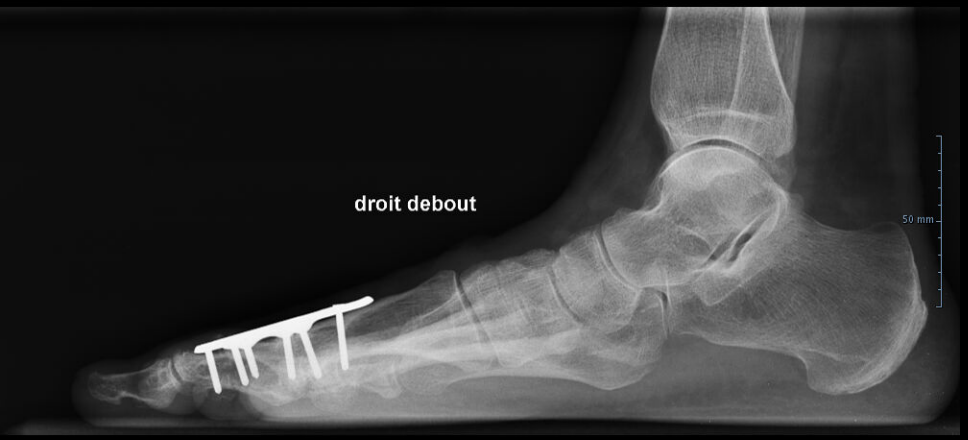




EXEMPLE

Femme 80 ans
Polyarthrite rhumatoïde
Amputation 2e rayon 2010

1 an



INDICATIONS

- L’indication dépendra
  - Du stade d’arthrose
  - des doléances et souhaits du patient, d’une part
  - et des possibilités techniques et convictions de l’opérateur, d’autre part

CONCLUSION

- Traitement conservateur premier
- Cheilectomie : bons résultats stades 1 et 2
- Arthrodèse à partir stade 3 : **gold standard**, bons résultats >> arthroplasties
- Interposition, cartilage synthétique : *résultats prometteurs à court terme, évaluations à + long terme nécessaires*

MERCI DE VOTRE ATTENTION