Geometrical Analysis of the Wolf Osteotomy

Emilio Wagner, MD
Cristian Ortiz, MD
Andres Keller, MD
Geometric Analysis of the Wolf Osteotomy
Emilio Wagner MD

My disclosure is in the Final AOFAS Program Book.
I have no potential conflicts with this presentation.
• Metatarsalgia is defined as pain under the lesser metatarsals, mainly 2nd to the 4th.

• It is associated with gait, and depending on which moment of gait it presents, is classified in 1st rocker metatarsalgia, 2nd or 3rd rocker metatarsalgia.
• 2nd rocker metatarsalgia (20%) is seen in the following cases:
  – Ankle equinus
  – Pes cavus
  – Long metatarsals
  – Rheumatoid arthritis

• Calluses are seen just under the metatarsal heads
• 3rd rocker metatarsalgia (30%) is seen in the following cases:
  – MC Instability
  – Hallux valgus
  – Braquimetatarsal
  – Hallux rigidus

• Calluses extend from the area under the metatarsal heads distally up to the base of the toe
• If pain is present under the metatarsal head (2nd rocker metatarsalgia), we should elevate the metatarsal head:
  • Modified Weil
  • Maceira´s Osteotomy
  • Wolf Osteotomy
• If pain is present under the metatarsal head and projects distally to the toe (3rd rocker), we should shorten the metatarsal bone:
  • Weil osteotomy
  • Maceira´s Osteotomy
• About the Wolf Osteotomy:
  • Simple, minimal soft tissue dissection
  • No need for fixation
  • Can be loaded without restriction
  • No information is available relative to its capacity of shortening or elevating the metatarsal head

• Objective: perform a geometrical analysis of the Wolf Osteotomy, and estimate its shortening and elevating capacity of the metatarsal head
Methods

- A geometrical model of the second metatarsal bone was designed, head diameter of 16 mm, total length of 75 mm, plantar declination angle of 15 degrees.
- The amount of shortening and elevation was calculated removing either a 2 or 3 mm dorsally based wedge, leaving the plantar cortex intact.
A partial osteotomy, with a dorsal wedge leaving the plantar cortex intact is planned. Either a 2 or 3 mm base dorsal wedge was removed in the planning.
Final effect achieved, with a plantar hinge intact, is an elevation and a shortening of the metatarsal bone, as seen in the figure.
Results

- With a dorsal wedge resection, the Wolf osteotomy:
  - 2 mm wedge: Elevates 1.3 mm, Shortens 1 mm
  - 3 mm wedge: Elevates 2.1 mm, Shortens 1.5 mm
Discussion

• The results show the capacity of the Wolf osteotomy to both shorten and elevate the metatarsal head.
• The elevation capacity equals to 66% to the size of the wedge removed.
• The shortening capacity equals to 50% of the size of the wedge.
• As the Wolf osteotomy can shorten and elevate, it could be used for both 2nd and 3rd rocker metatarsalgia.
• Normally it doesn’t need fixation, although this fact may render this procedure less reliable compared to a classic subcapital osteotomy with screw fixation.
• Our main indication for this osteotomy is a 2nd rocker metatarsalgia, where mainly elevation has to be achieved. Our preference of use is in patients where we want to avoid soft tissue dissection, as this procedure is extraarticular, and can be done through a small dorsal approach.
References

- Espinosa, N; Brodsky, J; Maceira, E. Metatarsalgia. JAAOS 18(8): 474-485, 2010
- Novotny, M; Klimecky, P; Pochop, J. Wolf and Helal Metatarsal Osteotomies in Metatarsalgia Treatment. Scripta Medica 82(2): 100-107, 2009