



Pre- and postoperative changes in alignment of the ankle and subtalar joint in patients undergoing high tibial osteotomy for knee osteoarthritis

Yuki Nishimura, MD

Munehiro Ogawa, MD, PhD

Kensuke Okamura, MD, PhD

Yusuke Inagaki, MD, PhD

Yasuhito Tanaka, MD, PhD

***Department of Orthopedic Surgery
Nara Medical University, Kashihara, Nara, JAPAN***



Conflict of interest

**Yuki Nishimura, Munehiro Ogawa, Kensuke Okamura,
Yusuke Inagaki, Yasuhito Tanaka**

I have no conflicts of interest to declare.

Background

- ✓ High tibial osteotomy (HTO) enables redistribution of weight loading and correction of varus alignment through lateral translation of the mechanical axis.
- ✓ Several studies reported that excessive correction of severe varus deformity with total knee arthroplasty or HTO could result in ankle joint pain and osteoarthritis progression.[1][2]
- ✓ Few studies have investigated the coronal alignment changes of the ankle and subtalar joint after HTO.[3]

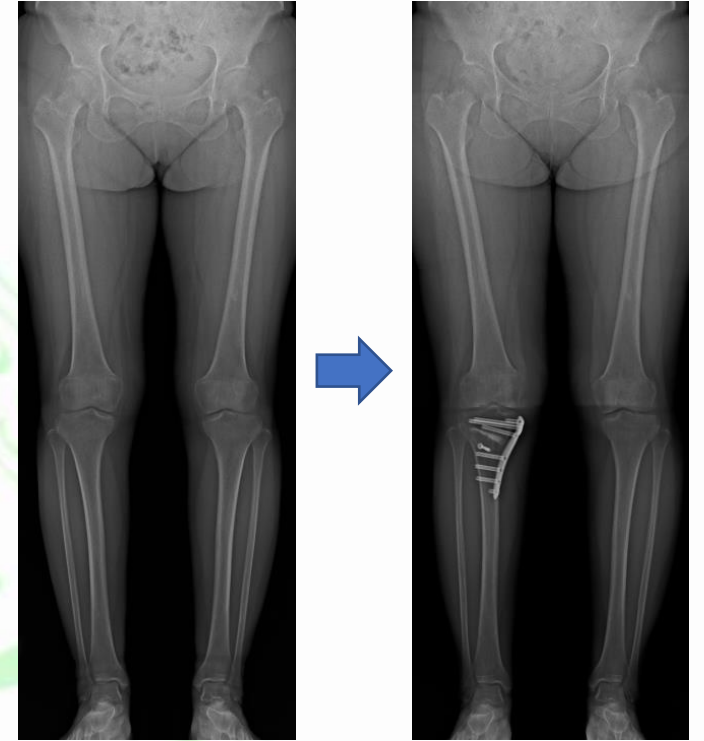
Objectives

- ✓ The purpose of this study was to investigate how the ankle joint and hindfoot alignment changes after HTO surgery.



Study Design & Methods

- Open wedge HTO (OWHTO)
32 knees of 31 patients
 - medial knee osteoarthritis (OA)
 - sex : 22men / 10 women
 - mean age : 60.0 y.o. (range 47 – 72 y.o.)
- Preoperative and 1 month postoperative whole-leg radiographs were taken.

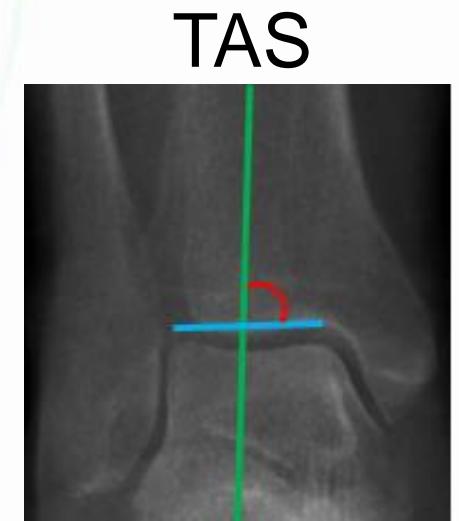
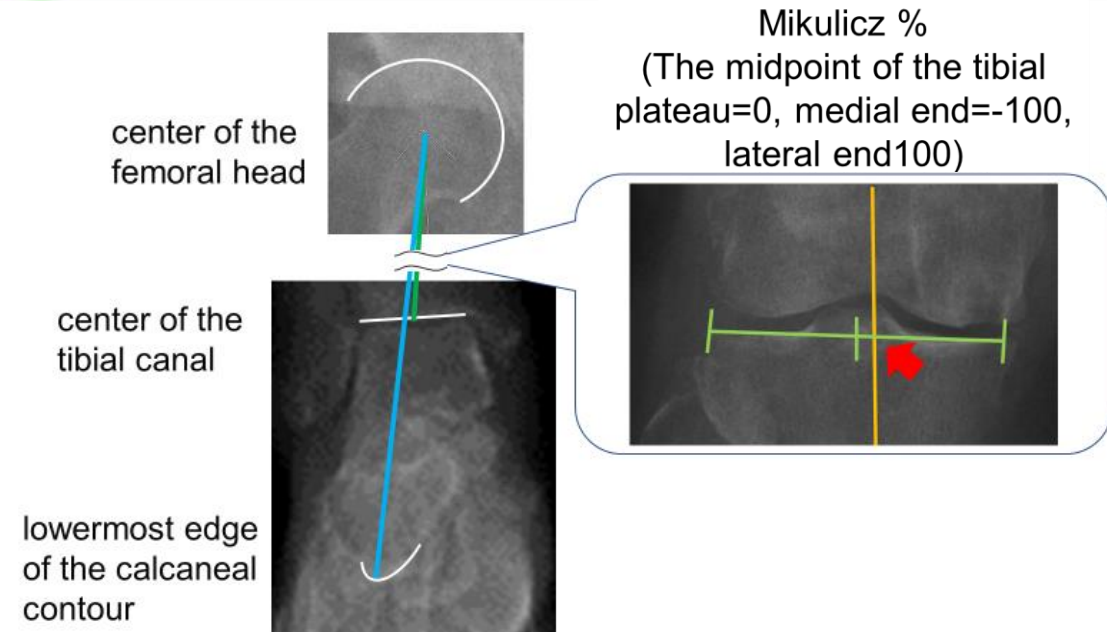


Study Design & Methods

- Mikulicz line from the center of the femoral head to
 - the center of the tibial canal
 - the lowermost edge of the calcaneal contour
 - ✓ The migration of the line at the level of the tibial plateau before and after surgery
- Femoral Tibial Angle (FTA)
- Tibial Anterior Surface angle (TAS)
 - the angle between the tibial bone axis and the tangent of the tibial plafond

Measured before and after the surgery

Wilcoxon signed-rank test



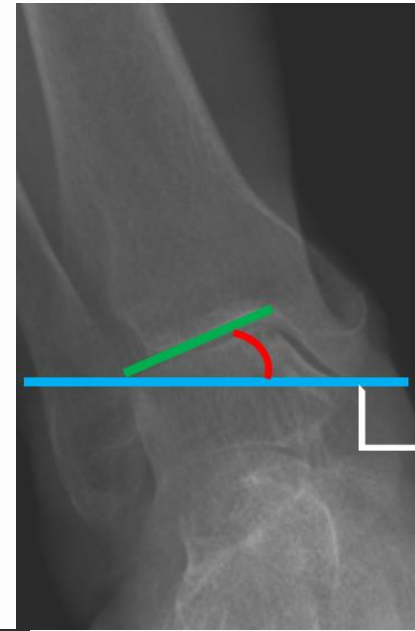
Study Design & Methods

- Tibial-Calcarneus Angle (TCA)
 - the angle between the tibial bone axis and line connecting the center of the tibial canal and the lowermost edge of the calcaneal contour
- Tibial Tilt Angle (TTA)
 - the angle between the tibial bone axis and perpendicular to the ground
- Tibial Plafond Inclination (TPI)
 - the angle between the tangent of the tibial plafond and the horizontal line

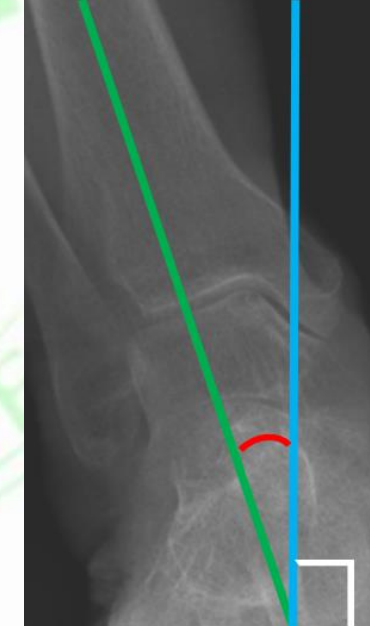


TCA

TTA



TPI



Measured before and after the surgery

Wilcoxon signed-rank test

Results

- Mikulicz line

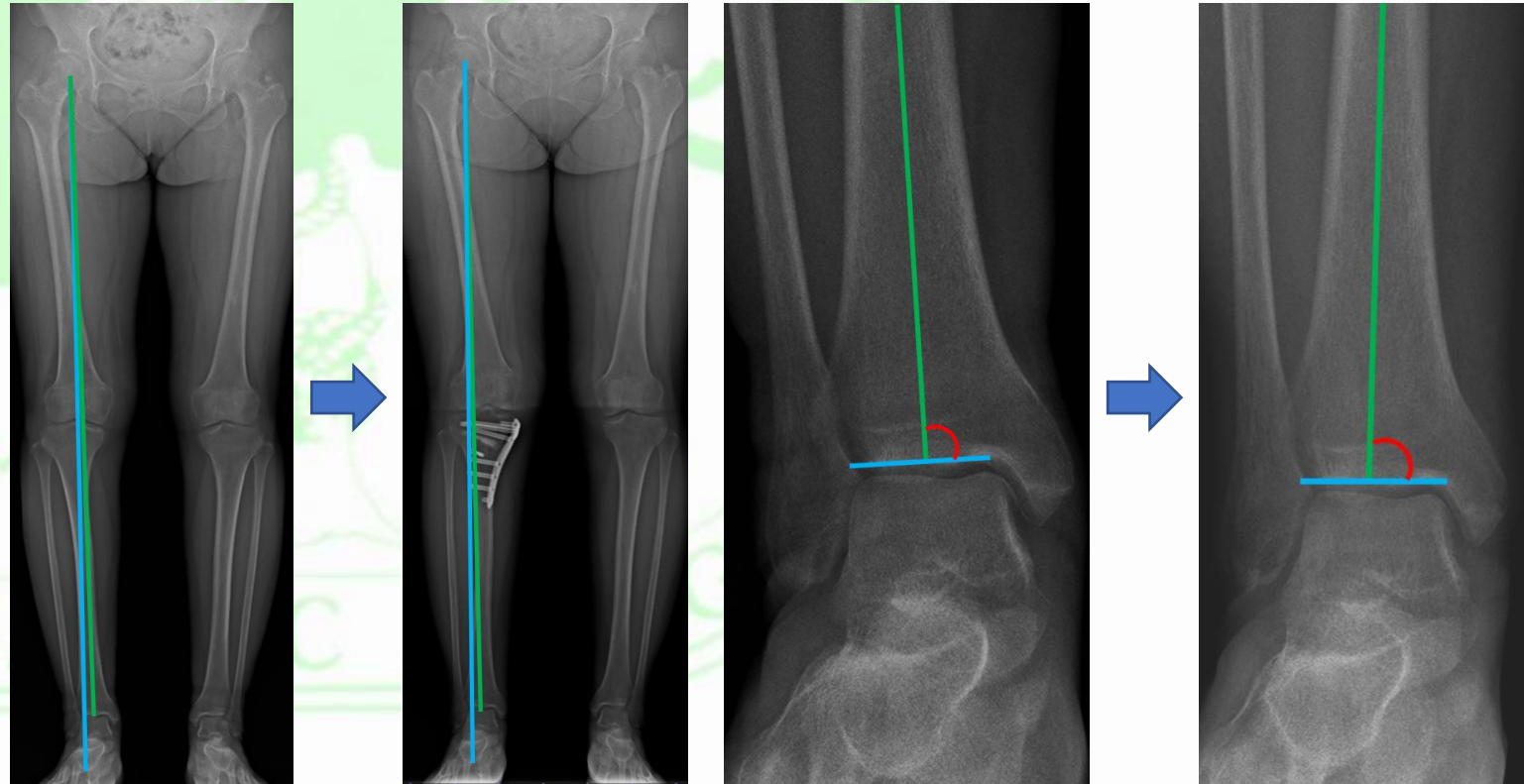
- pre -46 (SD 21) % → post 22 (SD 22) % (the center of the tibial canal)
- pre -35 (SD 25) % → post 38 (SD 25) % (the lowermost edge of the calcaneal contour)
 - $p < 0.05$

- FTA

- pre 178 (SD 2.6) °
 - post 171 (SD 3.4) °
 - $p < 0.05$

- TAS

- pre 90 (SD 3.6) °
 - = post 90 (SD 2.6) °



Results

- Tibial-Calcanus Angle (TCA)

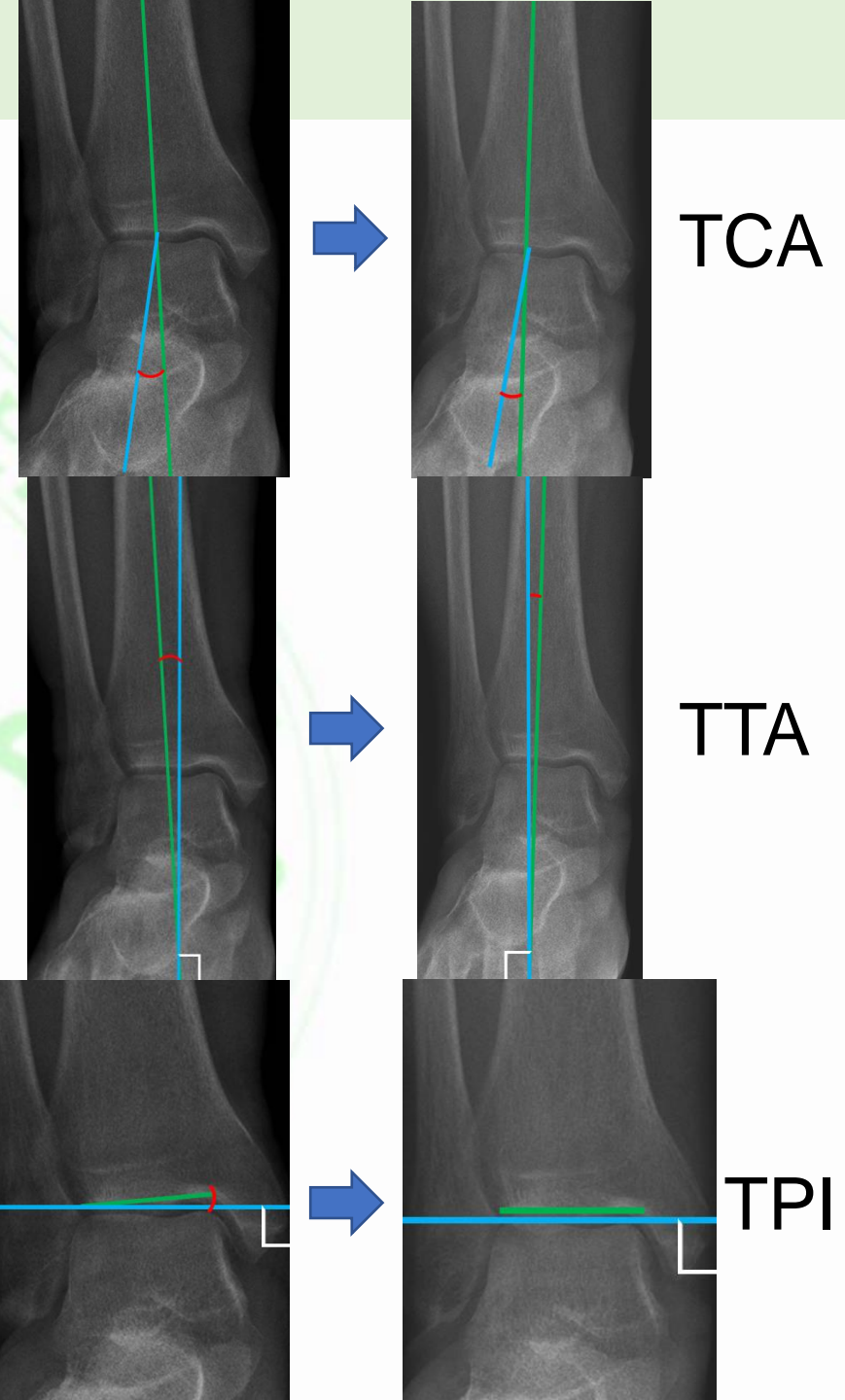
- pre 11.6 (SD 3.5) ° valgus
- ➔ post 9.6 (SD 3.4) ° valgus
- $p < 0.05$

- Tibial Tilt Angle (TTA)

- pre 4.4 (SD 2.1) ° varus
- ➔ post 0.2 (SD 2.3) ° varus
- $p < 0.05$

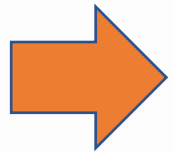
- Tibial Plafond Inclination (TPI)

- pre 3.9 (SD 4.7) ° varus
- ➔ post 1.3 (SD 3.8) ° valgus
- $p < 0.05$

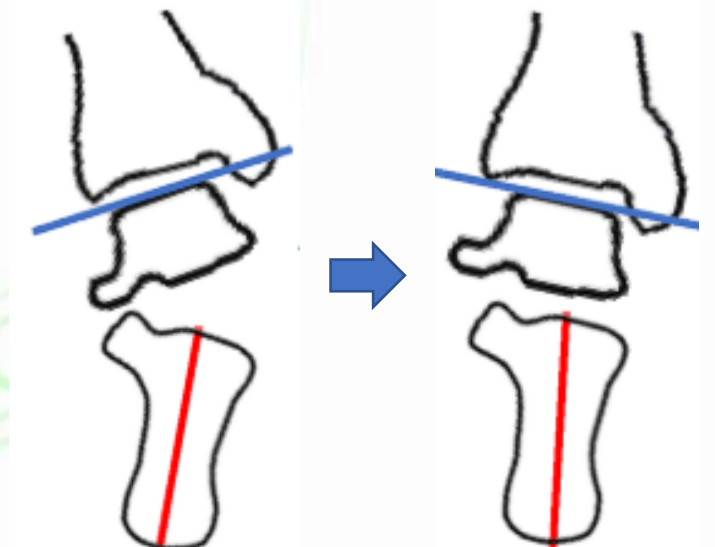


Discussion

- ✓ The hindfoot alignment (TCA) becomes valgus to compensate for varus knee OA.[4]
 - In this study, the compensation of hindfoot valgus was attenuated by the correction of the knee varus deformity after HTO.
 - Choi et al. reported that after OWHTO for varus OA, the talus joint surface becomes horizontal to the ground. [5]



Consistent with previous reports.



Discussion

- ✓ Many cases were corrected to **neutral** from **varus**, but there were also a few cases corrected to excessive **valgus** in **TTA** and **TPI**.
 - Postoperatively in this study, TTA became up to 6.7° valgus in one case and TPI up to 11° valgus in two cases.
 - The lowermost edge of the calcaneal contour of the Mikulicz line was shifted **more outward** than the center of the tibial canal of the Mikulicz line.
 - ✓ post 22 % < post 38%
- ◆ Possibility of compensatory function failure of subtalar joint
- ◆ It may be necessary to consider the assessment of lower extremity **alignment including hindfoot alignment**.
- ◆ Limitation : Not enough cases to analyze
- ◆ Factors that predict postoperative ankle or hindfoot alignment and symptoms should be investigated in a larger number of cases.



Conclusions

- ✓ Alignment changes in the knee and ankle joint and subtalar joint were investigated after HTO.
- ✓ HTO was found to alter not only femoral and tibial alignment, but also ankle and subtalar joint alignment.
- ✓ It is necessary to investigate whether changes in the ankle and subtalar joints after HTO are related to postoperative outcomes.

References

- [1]Lee JH, Jeong BO. Radiologic changes of ankle joint after total knee arthroplasty. Foot Ankle Int. 2012 Dec;33(12):1087-92.
- [2]Jeong BO, SooHoo NF. Ankle Deformity After High Tibial Osteotomy for Correction of Varus Knee: A Case Report. Foot Ankle Int. 2014 Jul;35(7):725-9.
- [3]Miyazaki K, Maeyama A, Yoshimura I, Kobayashi T, Ishimatsu T, Yamamoto T. Influence of hindfoot alignment on postoperative lower limb alignment in medial opening wedge high tibial osteotomy. Arch Orthop Trauma Surg. 2021 Jun 19.
- [4]Norton AA, Callaghan JJ, Amendola A, Phisitkul P, Wongsak S, Liu SS, et al. Correlation of Knee and Hindfoot Deformities in Advanced Knee OA: Compensatory Hindfoot Alignment and Where It Occurs. Clinical Orthopaedics & Related Research. 2015;473(1):166-74.
- [5]Choi GW, Yang JH, Park JH, Yun HH, Lee YI, Chae JE, et al. Changes in coronal alignment of the ankle joint after high tibial osteotomy. Knee Surgery, Sports Traumatology, Arthroscopy. 2017;25(3):838-45.