

Blumensaat's Line Morphology Does Not Influence the Femoral Tunnel Position in Anatomical Double-Bundle ACL Reconstruction

Yoshiyuki Yahagi¹, Takanori Iriuchishima², Keinosuke Ryu¹, Kazuyoshi Nakanishi¹

¹Department of Orthopaedic Surgery, Nihon University
Itabashi Hospital, Tokyo, Japan

²Department of Orthopaedic Surgery, Kamimoku Hot Springs Hospital, Minakami, Japan



ISAKOS
CONGRESS
2023



Boston
Massachusetts
June 18–June 21



ISAKOS CONGRESS 2023 COI disclosure

The author has no financial conflicts of interest regarding the presentation.

Presenting author: Yoshiyuki Yahagi



ISAKOS
CONGRESS
2023



Boston
Massachusetts
June 18–June 21

Introduction

The quadrant method¹⁾ is a popular femoral ACL tunnel placement measurement method.

The roof of the grid's baseline is mainly determined using Blumensaat's line. Some reported morphological variations about Blumensaat's line^{2,3)}, and the center position of the ACL footprint exhibited significant differences according to the morphology of Blumensaat's line⁴⁾.

Iriuchishima et al. reported⁵⁾ single-bundle femoral ACL tunnel position was significantly influenced by the morphological variations of the Blumensaat's line. But there are still no reports on the double-bundle ACL reconstruction.



Purpose

To reveal the influence of the morphological variations of Blumensaat's line on antero-medial(AM), postero-lateral(PL) femoral tunnel placement in anatomical double-bundle ACL reconstruction.



ISAKOS
CONGRESS
2023



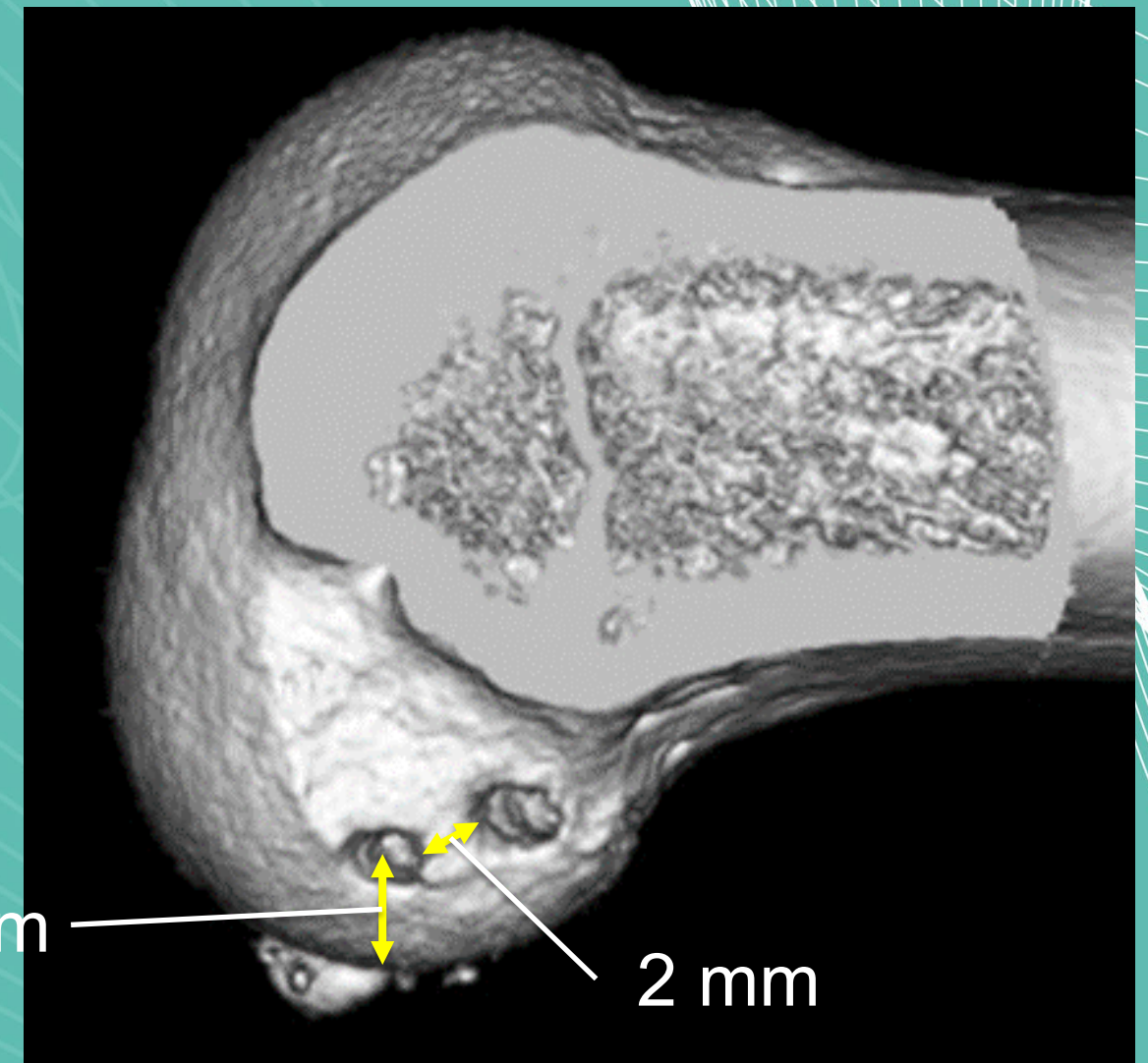
Boston
Massachusetts
June 18–June 21

Materials

Fifty-three subjects undergoing anatomical double-bundle ACL reconstruction (**22** male, **26** female: median age 26.9 y.o.)

How to position the AM, PL femoral tunnels

- Using inside-out trans-portal technique
- PL tunnel placement : made on a line drawn vertically from the bottommost point of the lateral condyle at 90° of knee flexion, spanning a distance of 5 to 8 mm, to the edge of the joint cartilage.
- AM tunnel placement : made 2 mm distal to the PL bundle tunnel placement.



Methods

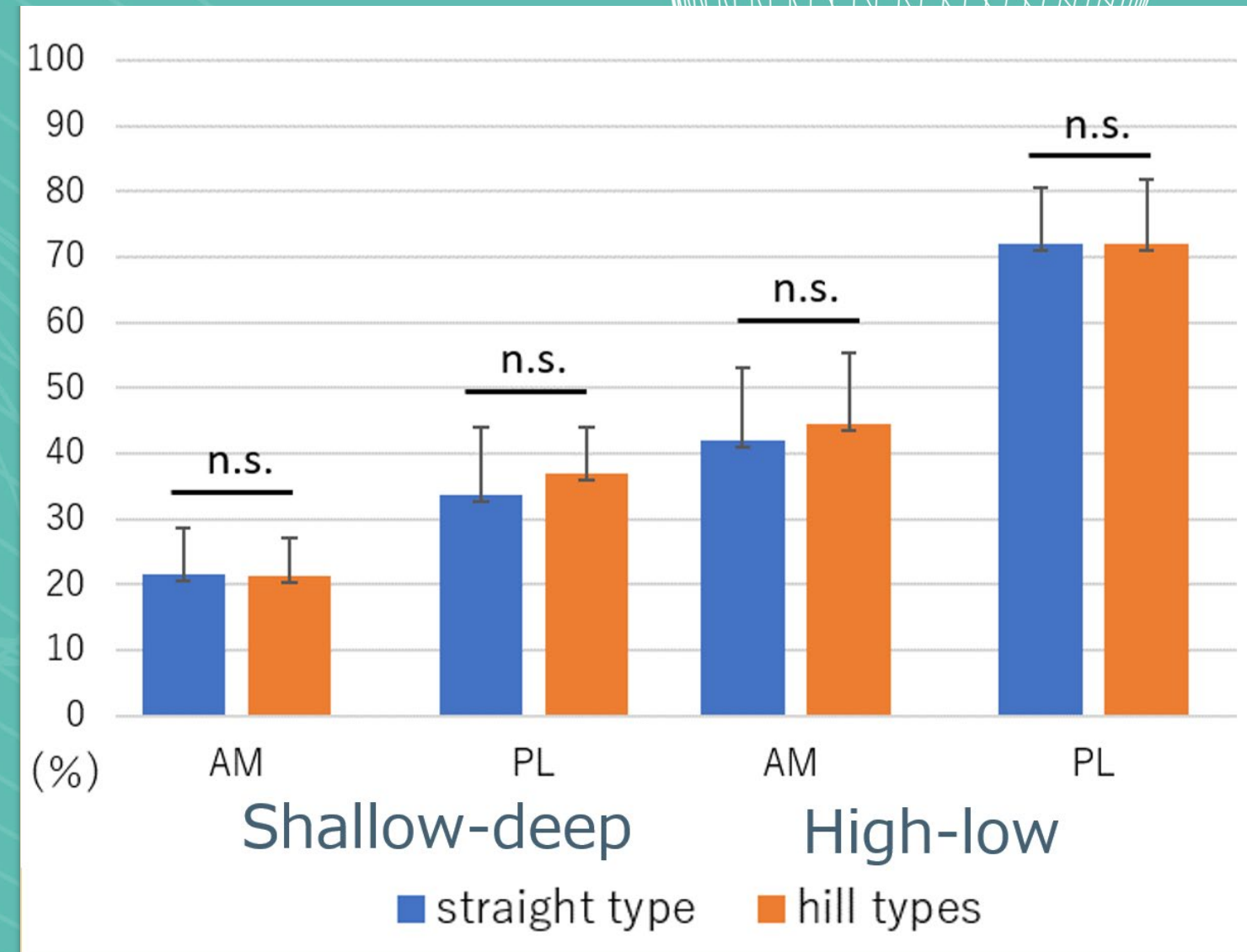
- Following Iriuchishima's classification³⁾, the morphology of Blumensaat's line was classified into straight and hill types (large and small).
- Straight and hill type knees. AM, PL femoral ACL tunnel position was evaluated using the quadrant method.
- The roof of the grid's baseline was matched to the anterior part of Blumensaat's line without considering the existence of a hill.
- Compared the straight and hill types AM, PL femoral tunnel positions. (Mann-Whitney's *U* test)



Results

AM, PL femoral tunnel position

		AM	PL	AM	PL
		shallow-deep		high-low	
Straight type	17 knees	22.4 ± 6.9	34.3 ± 10.3	41.6 ± 11.2	71.9 ± 8.7
Hill types	31 knees (11 small, 20 large)	20.8 ± 5.0	36.7 ± 6.3	44.7 ± 10.7	72.5 ± 9.9



No significant difference in AM, PL femoral tunnel position was observed between straight and hill type knees.

Discussion Previous report

Iriuchishima et al⁵⁾ reported in hill type knees were placed more shallow and lower rather than straight type in anatomical single-bundle ACL reconstruction.

- The femoral tunnel placement was that resident's ridge and bifurcate ridge were indicated to ensure the correct anatomical position of the tunnel.
- In hill type knees, due to the existence of the hills placed in the proximal lesion of Blumensaat's line, the femoral tunnel might be unintentionally induced to a shallow and low position.
- To prevent the misplacement due to misjudgment of hill existence, surgeons should evaluate Blumensaat's line morphology pre-operatively using radiograph or CT.
- When hills are present, surgeons should be careful to avoid making the femoral tunnels too shallow or too low in the intercondylar notch.



Discussion Our report

- No significant difference in AM, PL femoral tunnel position was observed between straight and hill type knees in anatomical double-bundle ACL reconstruction.
- In this study, the reason for no difference may be that the operative method was to determine the AM, PL femoral tunnel position not indicated by the resident's ridge and bifurcate ridge, but indicated by the index from the bottommost point of the lateral condyle to the edge of the joint cartilage.



Conclusion

- AM, PL femoral tunnel position in anatomical double-bundle ACL reconstruction was not influenced by the morphological variations of Blumensaat's line.
- The surgery may not be affected by Blumensaat's line if the AM, PL femoral tunnel position is indicated from the bottommost point of the lateral condyle.



References

- 1) Bernard M, Hertel P et al. Am J Knee Surg. 1997
- 2) Farrow LD et al. Arthroscopy. 2008
- 3) Iriuchishima T et al. Knee Surg Sports Traumatol Arthrosc. 2016
- 4) Yahagi Y et al. Knee Surg Sports Traumatol Arthrosc. 2018
- 5) Iriuchishima T et al. Knee Surg Sports Traumatol Arthrosc. 2019



ISAKOS
CONGRESS
2023



Boston
Massachusetts
June 18–June 21

