Short-Term Outcomes of Dome-Shaped High Tibial Osteotomy Combined with All-inside Anterior Cruciate Ligament Reconstruction

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COI disclosure information

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Purpose

This study aimed to evaluate short-term outcomes at least 2 years after dome-shaped high tibial osteotomy (HTO) combined with all-inside anterior cruciate ligament reconstruction (ACL) in patients with persistent ACL insufficiency accompanied by pain due to varus deformity.

Subjects and evaluation

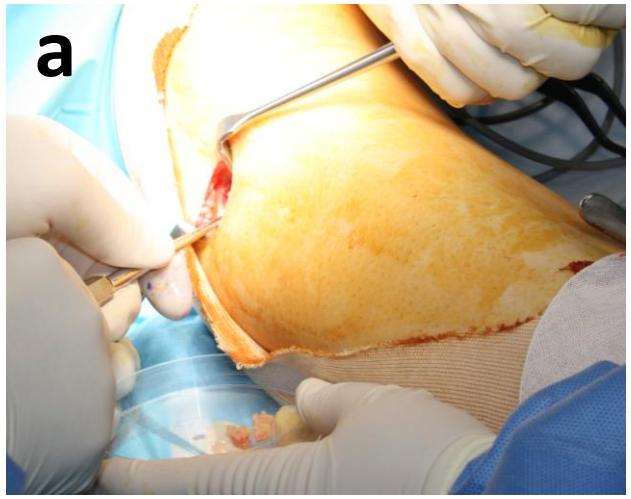
19 knees of 18 patients (9 men, 9 women)

Mean age: 58 years (41~70 years old)

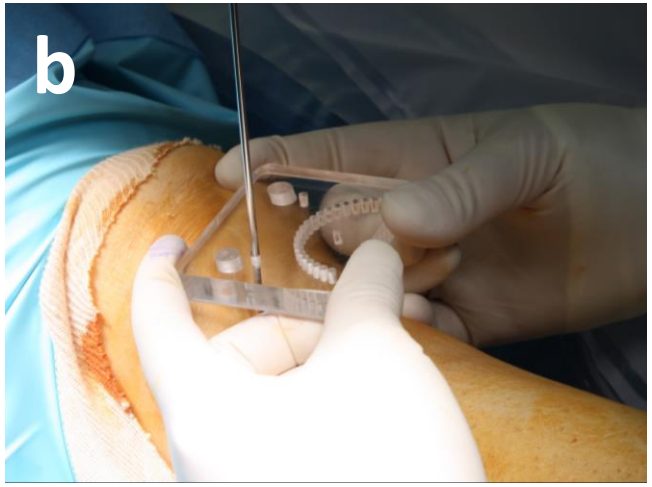
Mean postoperative follow-up period: 31 months (24–49 months)

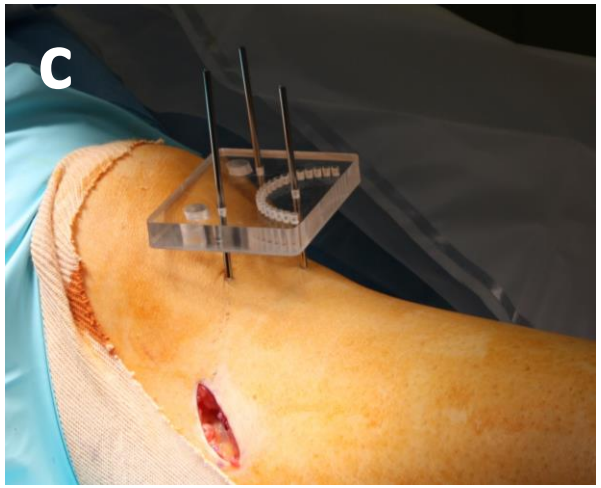
- JOA (Japanese Orthopaedic Association)-OA scores
- Lysholm score
- KT-1000: side to side difference (mm)
- X-ray images (Femoro tibial angle (FTA), MPTA, Posterior slope angle, Insall-Salvati ratio, Carton-Deschamps (C-D) index)
- Arthroscopic findings during the HTO plate-removal procedure

Methods of Dome shaped HTO

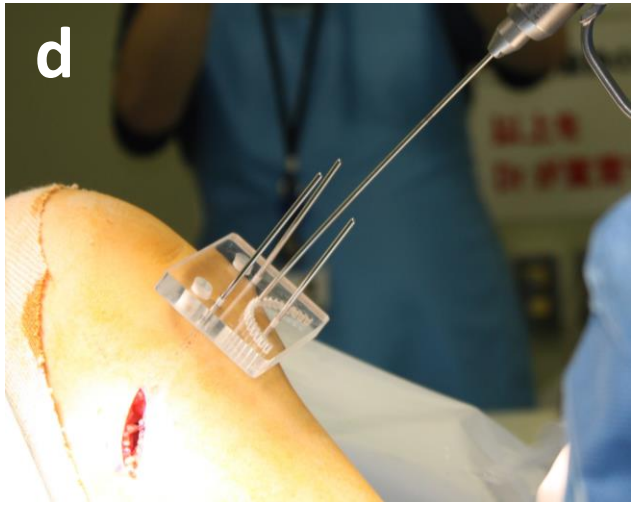


Fibular head was excised with 7mm height.





A custom-designed drill guide plate was fixed with three Kirschner wires of 2.4 mm diameter under fluoroscopic control in the extension of the knee.



A Kirschner wire of 2.4 mm- diameter was used to create holes percutaneously

Dome shaped osteotomy was confirmed by a fluoroscopy

Two trapezoid-shaped HA blocks were inserted into the medial gap.

Clinical results

	Pre op.	Post op.	t-test
JOA-OA score (points)			
	65.0±13.5	93.1±6.0	P<0.00001
Lysholm score (points)			
	47.2±16.2	94.2±5.8	P<0.00001
KT-1000: side to side difference (mm)			
	4.1±1.3	- 0.2±0.8	P<0.00001
	(3~7)	(-2~1)	

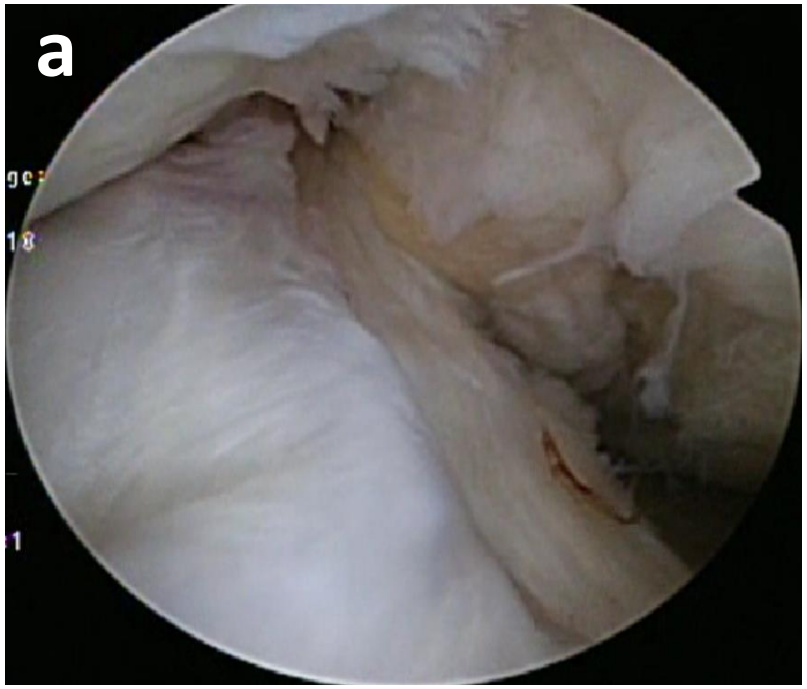
One patient showed non-union at the osteotomy site and underwent additional surgery.

Radiographic findings

	Pre op.	Post op.	t-test
FTA	183.8±3.4° (180~190°)	168.0±3.3° (164~173°)	P<0.00001
MPTA	81.5±2.9°	94.7±3.4°	P<0.00001
Posterior slope angle	6.9±2.6°	5.0±3.6°	P=0.024
Insall-Salvati ratio	1.03±0.20	0.94±0.18	P=0.033
Carton-Deschamps (C-D) index	0.94±0.19	0.82±0.16	P=0.008

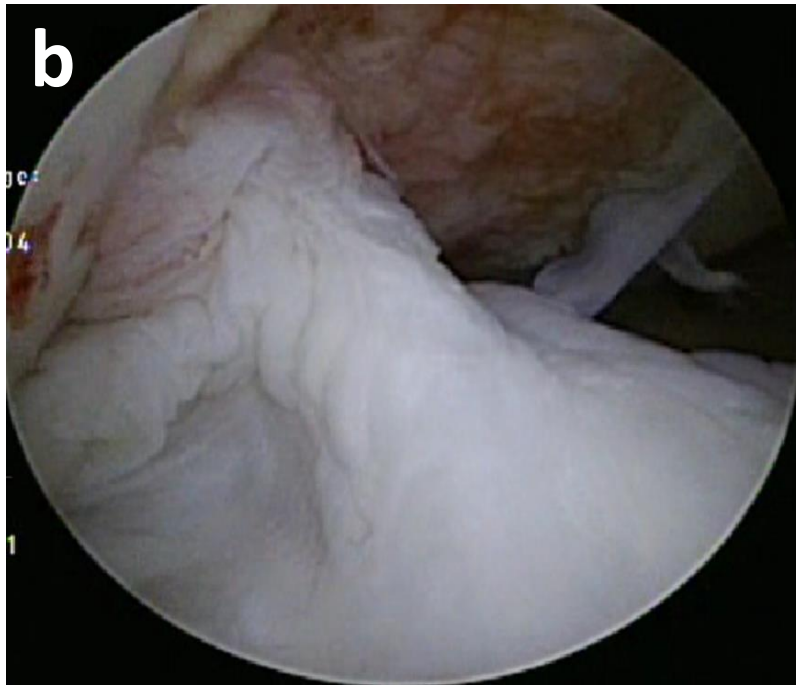
Arthroscopic findings after ACL reconstruction（N＝17）

Good



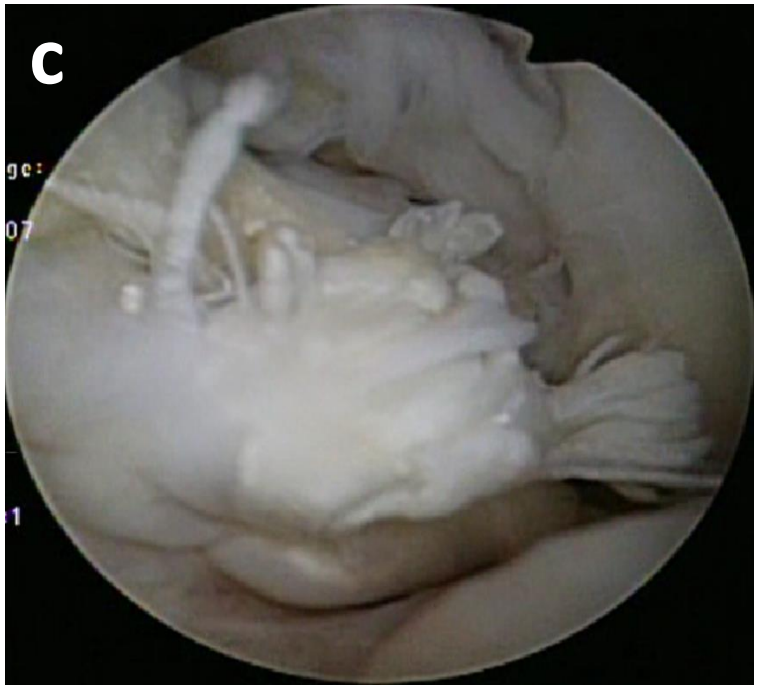
13 knees（76.4%）

Looseness or tear
of anterior fibers



3 knees（17.6%）

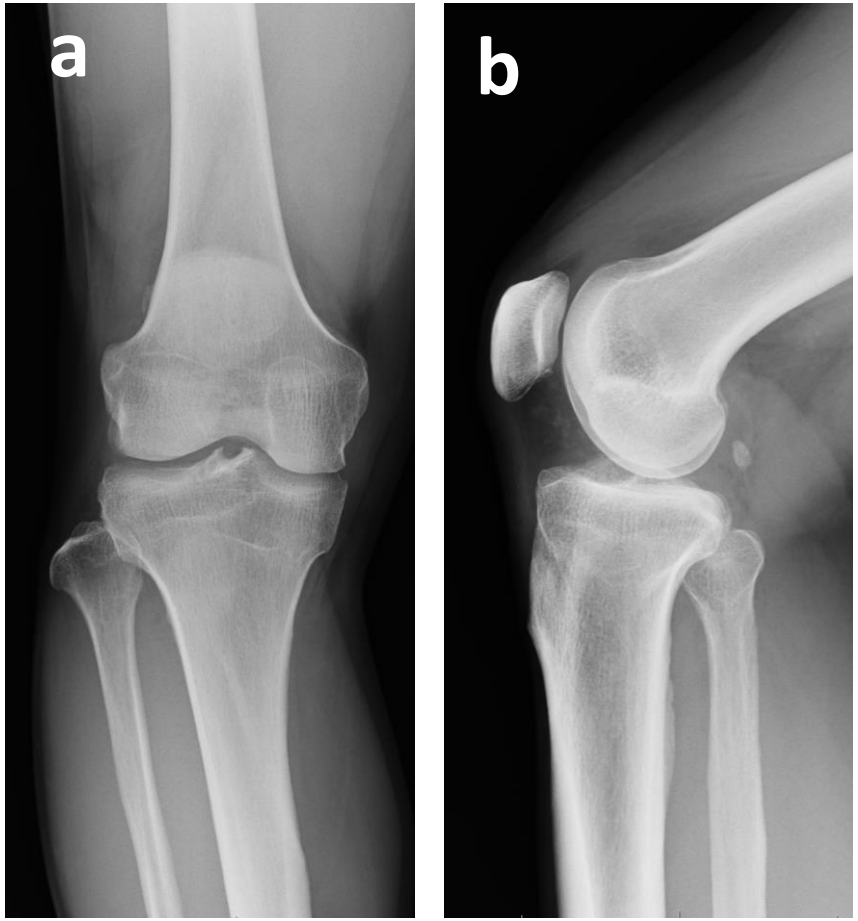
Cyclops



1 knee（5.9%）

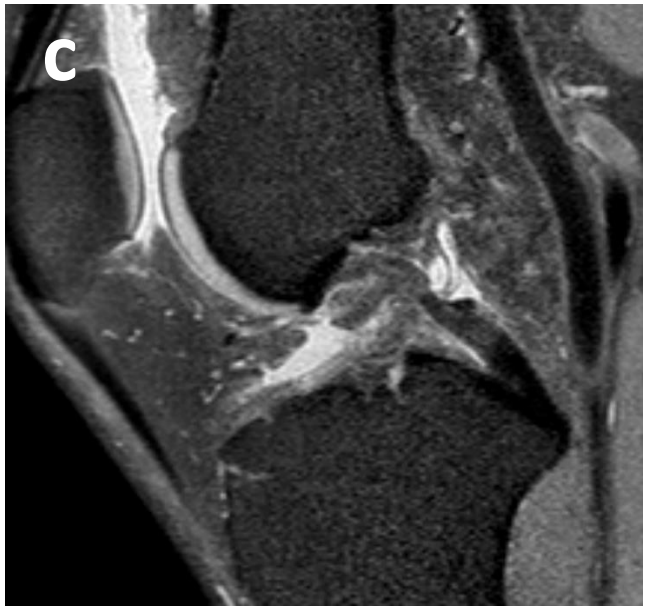
Representative case

A 41 year old, man suffered right ACL rupture during basketball at 19 years ago



Standing FTA: 185 °
MPTA: 79 °
Posterior slope angle: 9 °
Insall-Salvati ratio: 1.35
C-D index: 1.13

Side to side difference: 7mm
Lysholm score: 60 points
JOA-OA score: 90 points

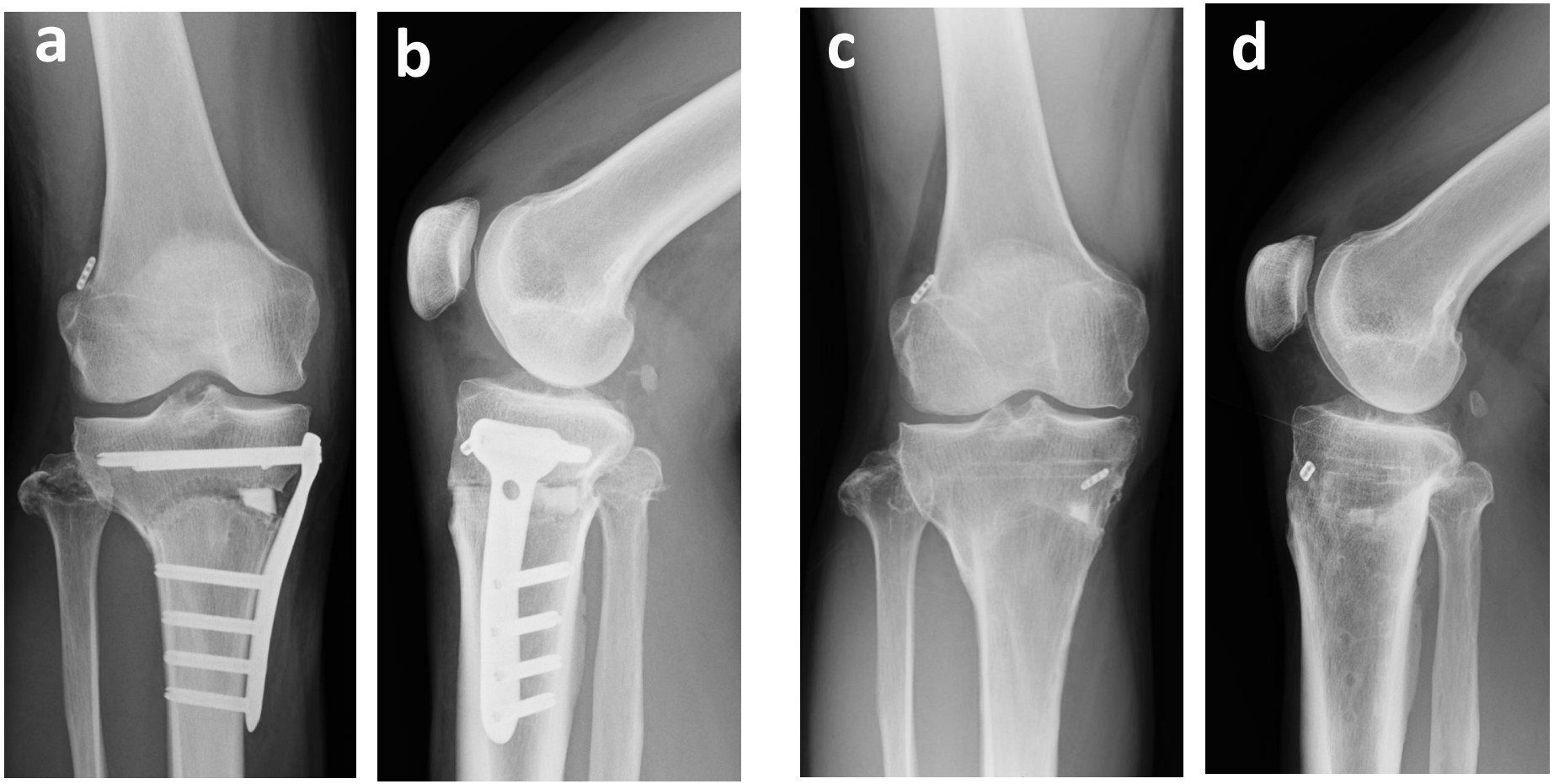


Disappear of ACL shadow

Dome-shaped high tibial osteotomy combined with all-inside anterior cruciate ligament reconstruction using semitendinosus tendon and partial resection of medial meniscus simultaneously

Post op 3 weeks

Post op 3 years

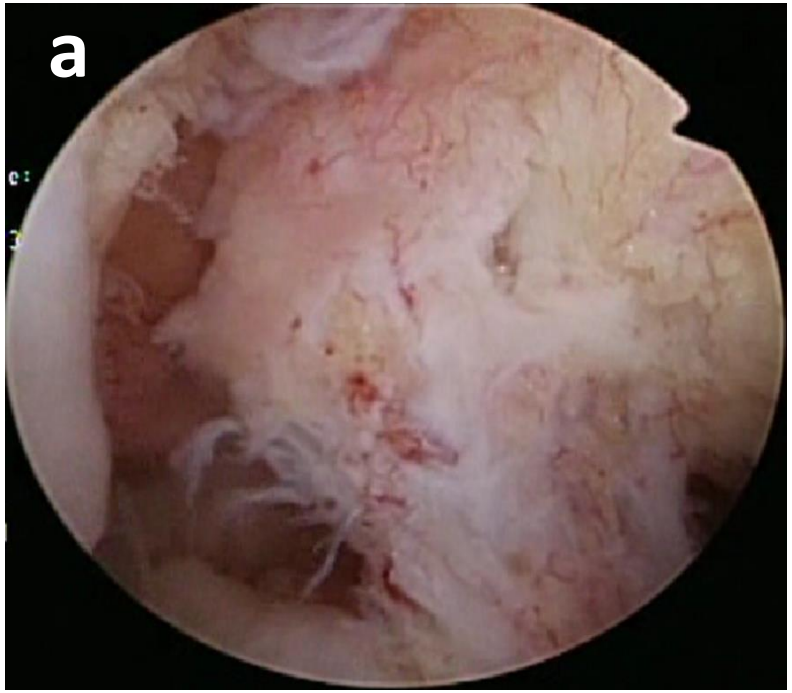


Standing FTA: 170 °
MPTA: 95 °
Posterior slope angle: 6.5°
Insall-Salvati ratio: 1.21
C-D index: 0.92

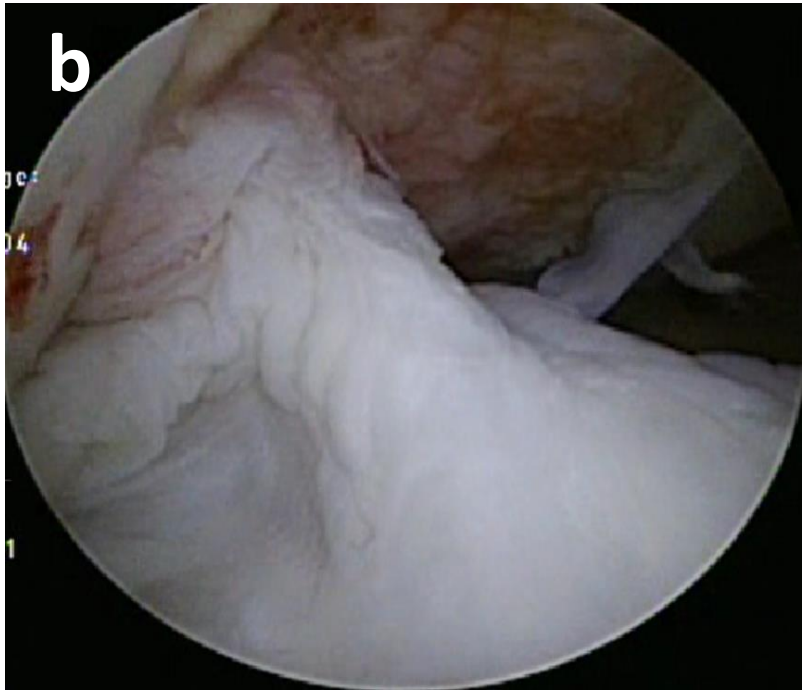
Side to side difference: 0mm
Lysholm score: 100 points
JOA-OA score: 100 points

Arthroscopic findings of ACL

During ACL reconstruction



Post op 1 years 4months.



Looseness of anterior fibers

Discussion

- Recently, increasing numbers of studies reported the clinical results of the combination of HTO and ACL reconstruction.
- Risks of opening-wedge HTO include increasing of posterior tibial slope, knee instability. Increased posterior tibial slope following opening-wedge HTO may result in correction loss and degenerative ACL changes and increase of posterolateral bundle strain.
- In contrast, dome-shaped HTO has a low risk of increasing the posterior tibial slope. We have developed a method to use percutaneous drilling for easy and accurate dome-shaped osteotomy [1].
- In this series, average of posterior tibial slope was slightly decreased. Increased posterior tibial slope is strongly associated with increased force on the ACL graft. Graft insufficiency was strongly dependent on tibial slope in combined HTO and ACL reconstruction [2].
- There were small number of cases of this procedure. We must perform this case series furthermore, evaluate the usefulness and the indication of this procedure.
- Further research is required to better understand the effects of combined HTO and ACL reconstruction compared to ACLR or HTO alone

Conclusions

Dome-shaped HTO allows for a relatively high degree of valgus correction and decreases the steep posterior tibial slope that causes excessive load on the ACL. Moreover, it facilitated tibial socket placement and graft fixation in a minimally invasive manner.

With all-inside ACL reconstruction, there was a low risk of HTO fixation screws interfering with tibial drilling since tibial sockets were created from inside the joint cavity. Our combination surgery was relatively easy to perform, and provided good clinical short-term results.

References

1. Takahashi T, et al. (2000)
Dome-shaped proximal tibial osteotomy using percutaneous drilling for osteoarthritis of the knee. Arch Orthop Trauma Surg.

2. Schuster P, et al. (2018)
The influence of tibial slope on the graft in combined high tibial osteotomy and anterior cruciate ligament reconstruction. Knee.