Knee instability in patients with osteoarthritis after anterior cruciate ligament injury

Kyohei Nishida[1], Yuta Nakanishi[1], Kanto Nagai[1], Yuichi Hoshino[1], Takehiko Matsushita[1], Ryosuke Kuroda[1]

[1]Department of Orthopaedic Surgery, Kobe University Graduate School of Medicine, Kobe, Japan

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Kyohei Nishida

KOBE UNIVERSITY

Background

- For patients with anterior cruciate ligament deficiency (ACLD) and post-traumatic knee osteoarthritis (PTOA) , combining anterior cruciate ligament reconstruction (ACLR) with around the knee osteotomy (AKO) is a common approach. [1,2]

- However, detailed characteristics of knee instability in patients with ACLD and PTOA have not been reported, and the decision to perform ACLR alone, ACLR with AKO, or AKO alone is dependent on criteria set by individual surgeons. [3-5]

- Understanding the characteristics of knee instability in ACLD knees with PTOA may be helpful in selecting a surgical procedure.

Purpose

To investigate the characteristics of preoperative knee instability in patients who underwent ACLR with AKO

Methods

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Subjects (Inclusion) patients who underwent both ACLR with AKO
(Exclusion) contralateral ACL injuries, multi-ligament injuries

➡ 17 knees

Sex	Male 9　Female 8
Age	48.9 ± 8.0 (38-61)
Height (cm)	164.3 ± 8.0
Weight (kg)	73.5 ±18.2
BMI	27.1 ± 5.4
Tegner activity scale	4.5 ±1.6 (3-7)
ACLR	Primary:14　Revision:3
Type of AKO	MOWHTO:14　MCWDFO:3
Time from ACL injury to surgery (Y)	21.1 ±12.1　(1.2−38)

Preoperative KOOS		
	pain	62.8±22.2
	symptom	53.6 ±17.2
	ADL	73.0 ±18.8
	sports	38.8 ±29.0
	QOL	41.0 ±32.3

Methods

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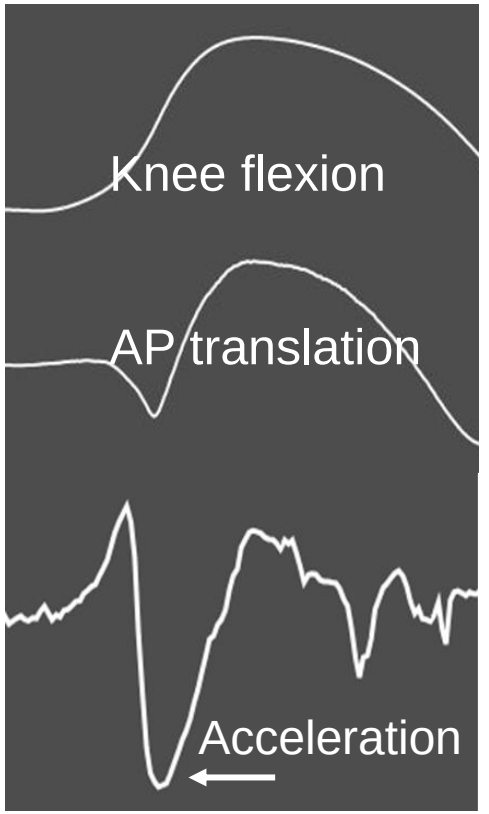
Evaluation

Posterior tibial acceleration



Stability

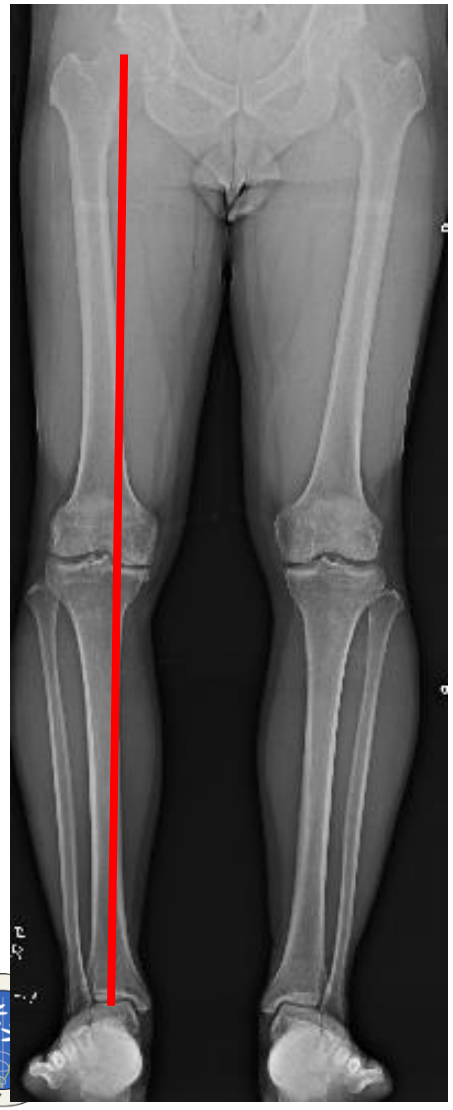
- ✓ Side-to-side difference of KT2000 (mm)
- ✓ Posterior tibial acceleration (m/s^2) during the pivot shift test [6] (Electromagnetic measurement system)

X-ray

- ✓ Kellgren-Lawrence (KL) grade
- ✓ %mechanical axis (%MA)
- ✓ Posterior tibial slope (PTS)
- ✓ Difference in anterior tibial translation between the affected and unaffected legs in a single-leg stance lateral view (ATS) [7]

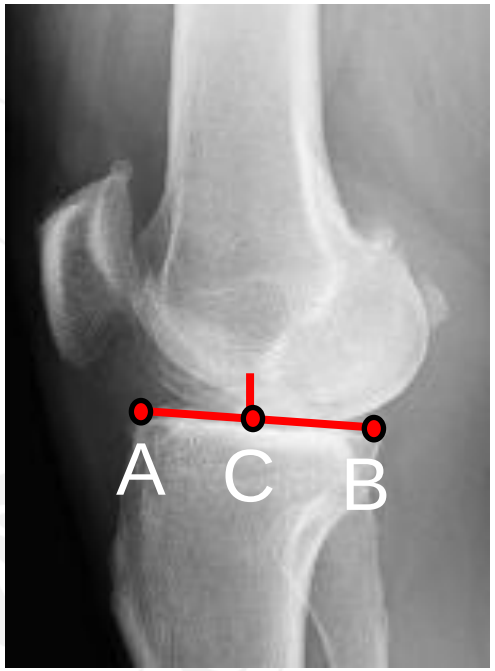
Methods

%MA



PTS

ATS [7]



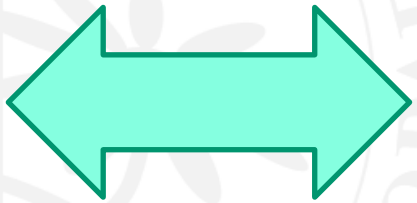
A: The peak anterior point of the medial tibial plateau.
B: The posterior point of the medial tibial plateau.
C: The point on the line A-B perpendicular from the anterior point of the Blumensaat's line.
The ratio of A-C to A-B was defined as the ratio of ATS to the femur, and the side-to-side difference was evaluated. ATS: anterior tibial subluxation.

Methods

Analysis

Stability
- KT
- Posterior tibial acceleration

Correlation

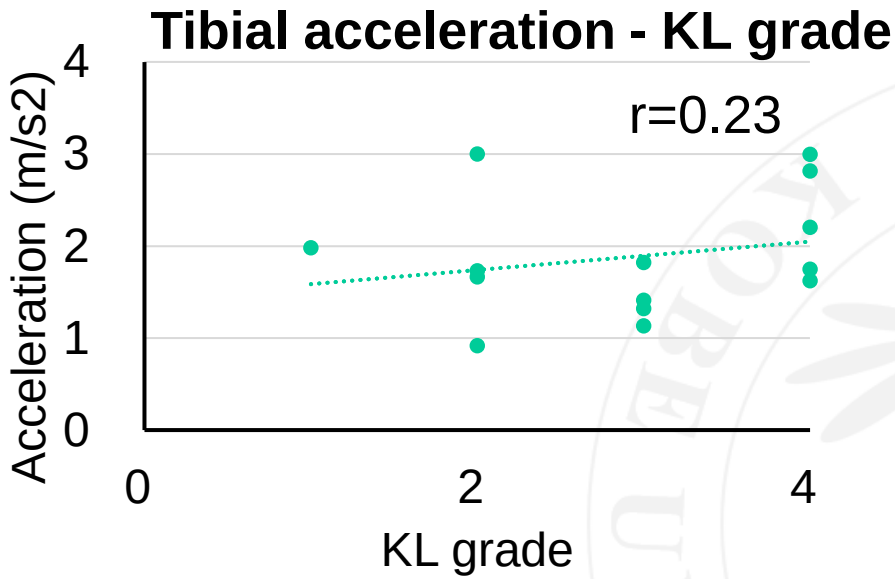


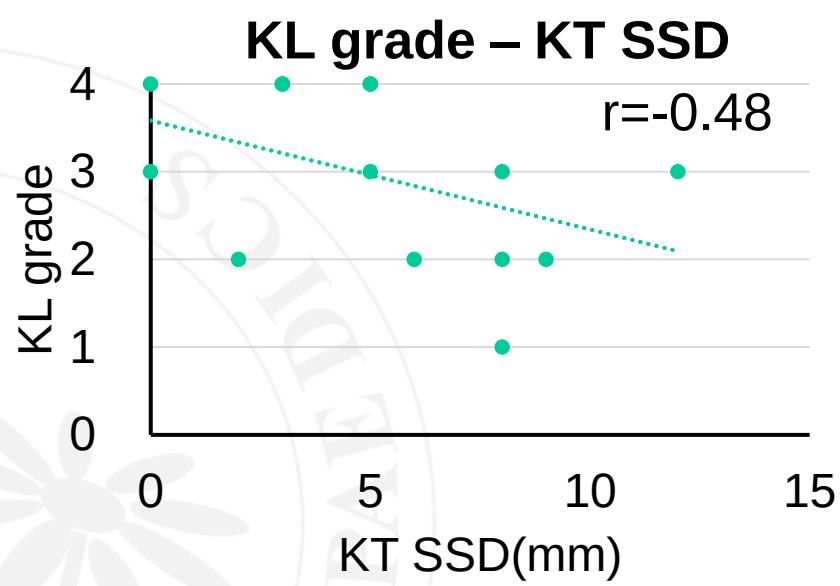
Xray
- KL grade
- %MA
- PTS
- ATS

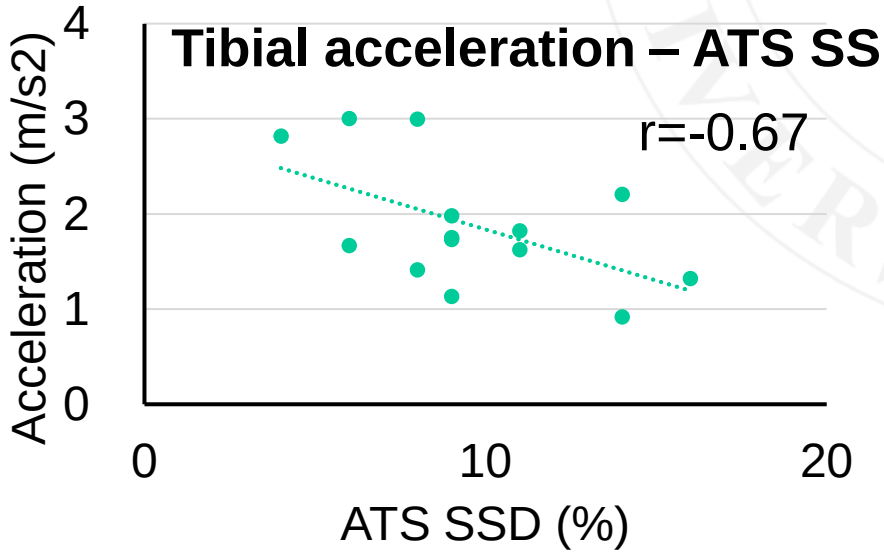
Result

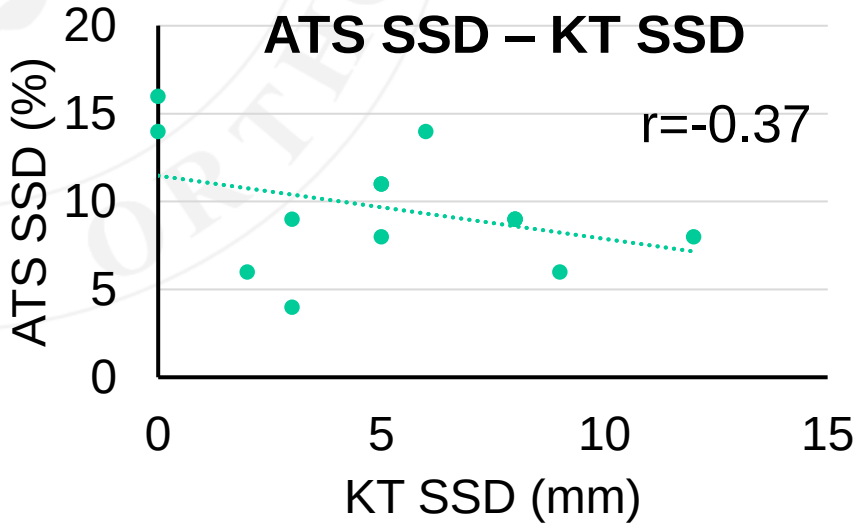
	Affected	Unaffected	SSD
Posterior tibial accerelation(m/s^2)	1.9 ± 0.7 *	1.1 ± 0.6	
KT2000 (mm)	16.8 ± 4.0*	11.2 ± 2.9	5.5 ± 3.5
%MA (%)	27.5 ± 8.6*	35.2 ±9.6	
PTS (degree)	14.4 ± 3.7	14.2 ± 2.9	
ATS (%)	47.6 ± 3.5*	38.0 ± 2.7	9.6 ± 3.4
KL grade	Ⅰ: 1 Ⅱ: 7 Ⅲ: 4 Ⅳ: 5		

Result


Tibial acceleration - KL grade
r=0.23
Acceleration (m/s2)
KL grade
0
1
2
3
4


KL grade – KT SSD
r=-0.48
KL grade
KT SSD(mm)
0
5
10
15


Tibial acceleration – ATS SSD
r=-0.67
Acceleration (m/s2)
ATS SSD (%)
0
10
20


ATS SSD – KT SSD
r=-0.37
ATS SSD (%)
KT SSD (mm)
0
5
10
15
20

Discussion

- ✓ The posterior tibial acceleration during pivot shift test prior to ACLR combined with AKO in this study (1.9 m/s²) was comparable to that observed in ACLD knees without osteoarthritis, which we have previously reported to range between 1.4 - 2.2 m/s² [8, 9].
- ✓ A negative correlation was observed between posterior tibial acceleration and ATS SSD, suggesting that preoperative single-leg standing lateral radiographs may provide an indicator of rotatory knee instability.
- ✓ The side-to-side difference in KT measurements showed a negative correlation with both the ATS SSD and KL grade, indicating that anterior instability tends to decrease with the progression of osteoarthritis and anterior tibial subluxation.
- ✓ In the present study, no correlation was found between the KT SSD and posterior tibial acceleration (r=-0.02), suggesting that surgical indications should be determined with consideration of rotatory knee instability as well [10].

Conclusion

- In cases of ACLD with PTOA, the more anteriorly the tibia was displaced on a single-leg stance lateral X-ray image, the less anterior and rotational knee instability.

- Therefore, it is suggested that for patients with ACLD with PTOA, ACLR combined with AKO should be considered if the patient has knee instability with small anterior tibial subluxation, and AKO alone may be sufficient if anterior tibial subluxation is large.

References

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