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Association between pivot-shift like phenomenon in the contralateral uninjured knee and residual pivot-shift phenomenon after anterior cruciate ligament reconstruction

Nagata N, Nagai K, Nishida K, Hoshino Y

Nakanishi Y, Yamamoto T, Kanzaki N, Matsushita T, Kuroda R

Department of Orthopaedic Surgery,
Kobe University Graduate School of Medicine, Kobe, JAPAN

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COI Disclosure

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Pivot-shift phenomenon

- ✓ **Greater** preoperative pivot-shift (PS) phenomenon in anterior cruciate ligament (ACL) injured knee is **a risk factor for residual PS** after ACL reconstruction (ACLR).

  Yamamoto Y, et al. Am J Sports Med 2018
  Kim SH, et al. Arch Orthop Trauma Surg 2020

- ✓ **PS like phenomenon** is sometimes observed in the contralateral uninjured knee

  Katakura et al, The Knee. 2020
  Sundemo et al, Knee Surg Sports Traumatol Arthrosc. 2018

- ✓ Patients with a **positive PS like phenomenon** in the **contralateral uninjured knee** had **greater preoperative PS** in the **ACL-injured knee** than those without

  Nagata N, et al. JOA annual meeting 2024

- ✓ The relationship between the PS like phenomenon in the contralateral uninjured knee and knee stability after ACL reconstruction is not clear.

Purpose

- To investigate the relationship between the PS like phenomenon in the contralateral uninjured knee and postoperative knee stability after ACLR

Hypothesis

- Patients with a positive PS like phenomenon in the contralateral uninjured knee are more likely to have residual PS phenomenon in the ACLR knee

Patients

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Primary Double-bundle ACLR using hamstring autograft,
Screw removal about 1 year after ACLR

292 cases

Evaluated both knees using an **electromagnetic measurement system (EMS)** under general anesthesia

Exclusion criteria

- Concomitant around knee osteotomy
- A history of contralateral knee surgery
- Epiphyseal sparing surgery
- No PS phenomenon in ACL injured knee
- ACL reinjured knee
- Incomplete data

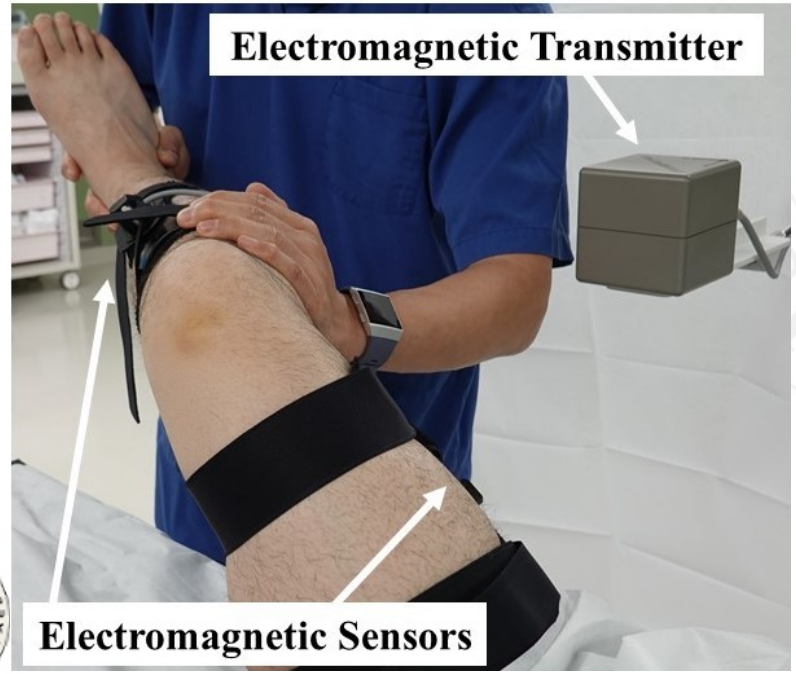
92 cases（male/female：43/49）
Age：25.7±11.8 years

Electromagnetic measurement system (EMS)

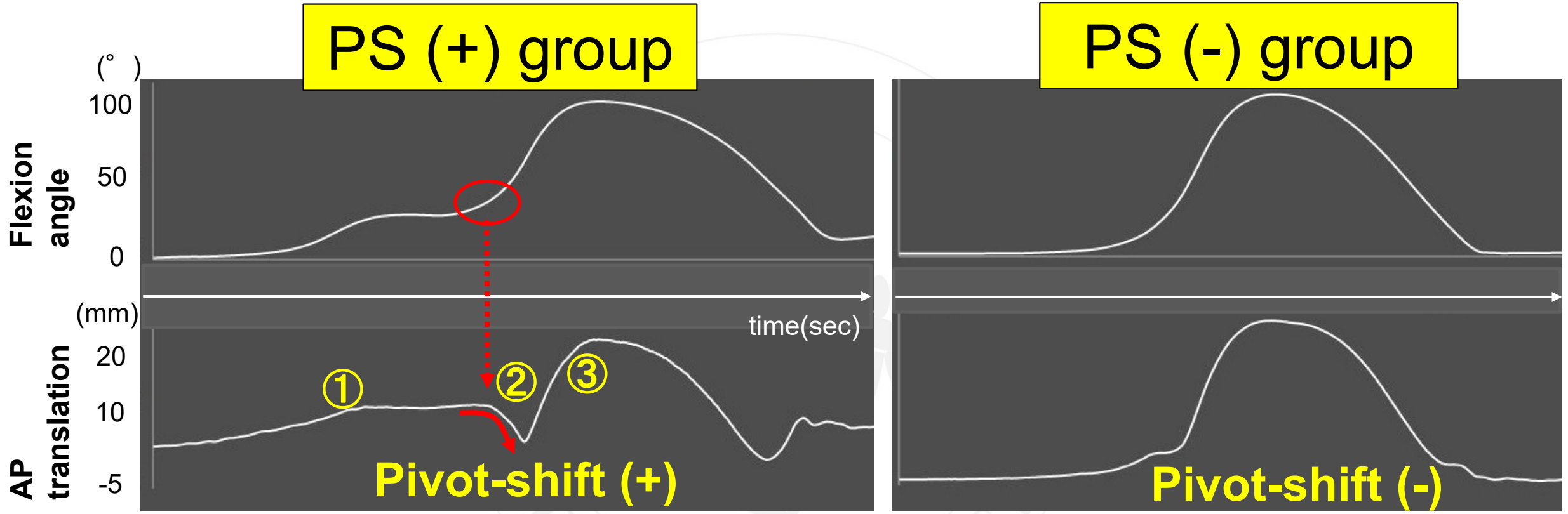
- Non-invasive
- Precise (<1mm, <2°)
- 7 bony landmarks are registered to digitize femoral and tibial positions

Hoshino Y, et al. AJSM 2007
Araki D, et al. Arthroscopy 2011
Nagai K, et al. KSSTA 2015

JIMI Kobe



PS phenomenon; EMS waveform



Definition of positive PS phenomenon

1. Anterior tibial subluxation
2. Rapid posterior translation at 30-50° knee flexion
3. Relative anterior tibial translation

Evaluations

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- **Patient's demographic data**
  - ✓ Age, sex, BMI
  - ✓ Meniscus injury, knee hyperextension
  - ✓ IKDC manual grade of PS test

Hefti F, et al. Knee Surg Sports Traumatol Arthrosc 1993

- **PS test measured by EMS measurement**

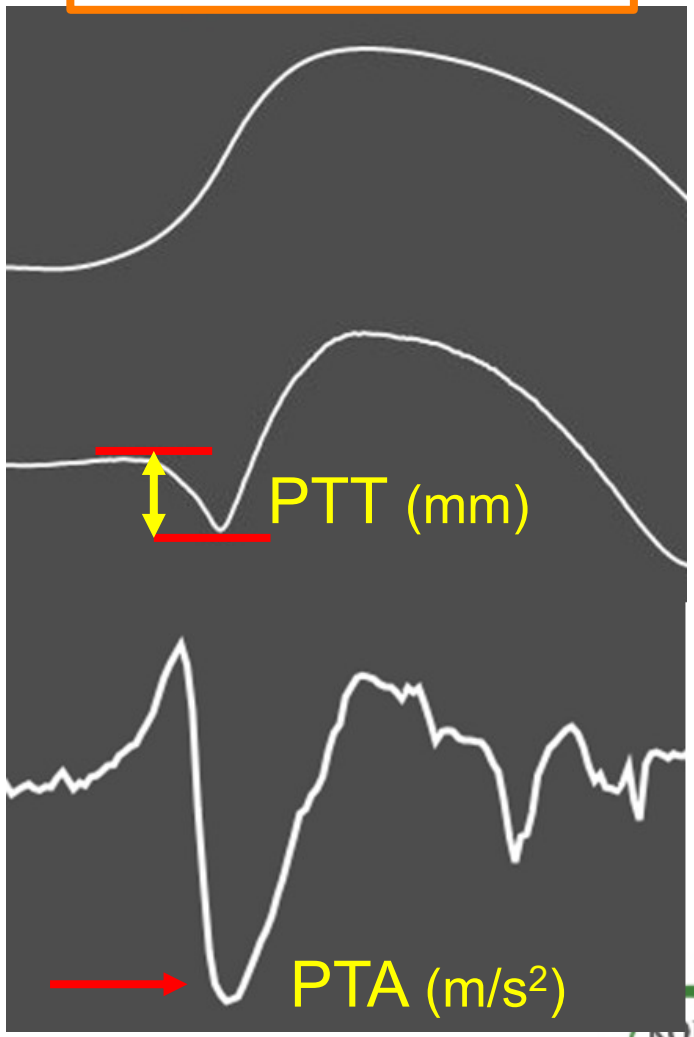
ACL-injured & ACLR knees

- ✓ Posterior tibial translation (PTT) (mm)
- ✓ Posterior tibial acceleration (PTA) (m/s^2)

ACLR knees

PTT＞3mm → Residual PS (+)

Pivot-shift test



Statistical analysis

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PS (+) vs PS (-)
in contralateral uninjured knee

- Mann-Whitney U test
  - ✓ Patient's demographic data
  - ✓ PTT & PTA in ACL-injured & ACLR knee
- Fisher's exact test
  - ✓ The ratio (%) of residual PS in ACLR knee
- Significance level: $P<0.05$

Demographic data

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	Contralateral uninjured knee		P value
	PS (+) (n=28)	PS (-) (n=64)	
Male / Female	17 / 11	26 / 38	0.11
Age	25.9 ± 12.2	25.6 ± 11.8	0.83
BMI (kg/m^2)	23.6 ± 4.9	22.9 ± 2.9	0.88
Grade; 0/1/2/3	0 /14 /11 /3	0 /33 /30 /1	0.15
Meniscus injury (+/-)	15/13	27/37	0.37
Medial (+/-)	10/18	20/44	0.81
Lateral (+/-)	6/22	12/52	0.78
Knee hyperextension	4 (14.3%)	7 (10.9%)	0.73

No significant difference in patient background

Pivot-shift analysis in ACL-injured & ACLR knees

	Contralateral uninjured knee PS(+)		Contralateral uninjured knee PS(-)	P value
ACL injured knee (pre-op)				
・PTT (mm)	7.8 ± 7.0	>	3.9 ± 3.3	0.002
・PTA (m/s^2)	1.9 ± 1.3		1.9 ± 1.1	0.71
ACLR knee (post-op)				
・PTT (mm)	2.2 ± 1.8	>	1.4 ± 2.4	0.006
・PTA (m/s^2)	1.0 ± 0.6		1.1 ± 0.7	0.74
・Residual PS phenomenon				
PTT＞3mm	11（39.3%）	>	11（17.2%）	0.03
IKDC manual grade≧1	10（35.7%）		12（18.8%）	0.11

PS like phenomenon in contralateral uninjured knee

Previous study; Accelerometer (KiRA)

Katakura M, et al. The Knee 2020

- Tibial acceleration during the PS test

  Greater PS (+) in uninjured knee

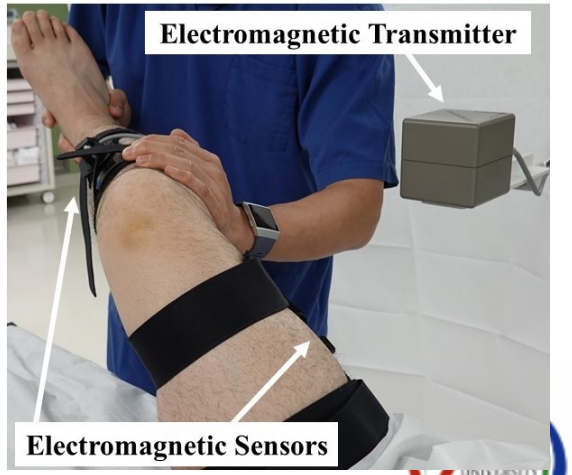
  ➡ risk factor of residual PS in ACLR knee

Di Paolo, et al. AOJ 2021

Present study; EMS

- PS (+) in contralateral uninjured knee

  ➡ **Greater PTT** & **residual PS** in ACLR knee compared to PS (-) group



Physiological anterolateral rotatory knee laxity may be associated with **residual pivot-shift** phenomenon in **ACLR knee**

Conclusion

Patients with a positive PS like phenomenon in the contralateral uninjured knee are more likely to have residual PS phenomenon in the ACLR knee