Repair of Medial Meniscus Ramp Lesion Improves Knee Stability in Primary Anterior Cruciate Ligament Reconstruction

Quantitative Assessment Using an Electromagnetic Measurement System

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Ramp lesion & knee instability

ACL-injury + ramp lesion

Pivot-shift grade & Lachman test

- ACL injury < ACL injury + ramp lesion

  DePhillipo NN et al. OJSM 2020

- ACL injury = ACL injury + ramp lesion

  Albayrak K et al. KSSTA 2021

→ **No consensus**

ACLR + ramp repair

Pivot-shift test grade

- ACLR = ACLR + ramp repair

  DePhillipo NN et al. OJSM 2020

- **Improved** anterior knee laxity

  Tashiro Y et al. KSSTA 2020

→ **No quantitative evaluation**

*ACLR: ACL reconstruction

Purpose

To investigate the influence of ramp lesion on clinical outcomes focusing on **pre- and post-operative knee laxity** in primary ACL reconstruction

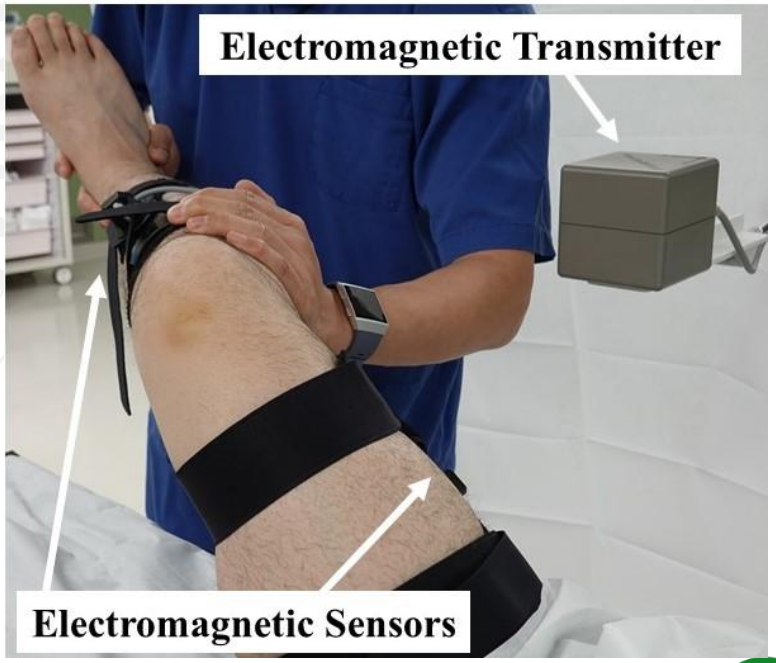
Hypotheses

- **Preoperative knee laxity** would be **greater** in patients with ramp lesion than those without
- **Postoperative knee laxity** would be **improved by ramp lesion repair**

Methods

Patients

- ✓ Retrospective analysis of prospectively collected data between 2014-2023
- ✓ **127** patients who underwent primary ACLR
  - Follow-up > 1 year
  - 2nd look arthroscopy at 1Y post-op
  - Knee laxity measurement by an electromagnetic measurement system (**EMS**) under general anesthesia

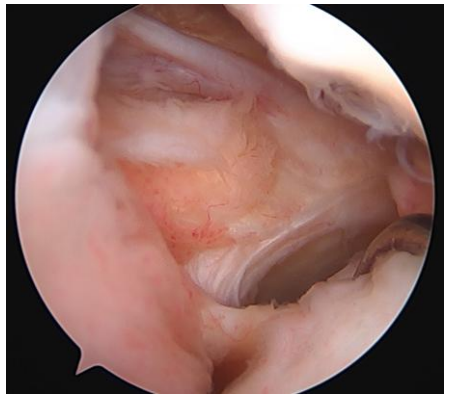


Hoshino Y et al. AJSM 2007
Nagai K et al. KSSTA 2015

Patient allocation

Primary ACLR patients (n=127)

Arthroscopy



Ramp lesion (+)

✓LM tear(n=7) included

Ramp lesion (-)

n=106

Exclusion:
Other MM tear(n=19)
LM tear(n=37)
MM &LM tear(n=5)
Multi-ligament injury(n=1)

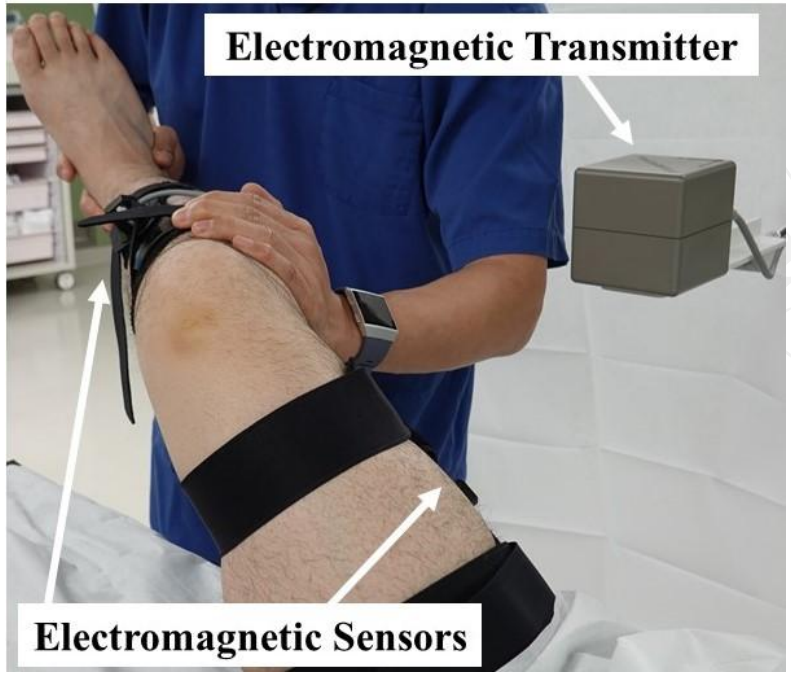
Ramp group
n=**21**
➡ **Meniscal Repair**

Control group
n=**44**
No meniscal tears

Quantitative assessment using EMS

- Non-invasive
- Precise (<1mm, <2˚)
- Femoral and tibial coordinate system configured by digitizing 7 bony landmarks

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



Evaluation & Analysis

- **Knee laxity** (pre- & post-op)
  - ✓ EMS **Lachman test**: **SSD in ATT** (mm)

    Pivot-shift test: **Posterior tibial acceleration** (m/s^2)

    Hoshino Y et al. AJSM 2007, Araki D et al. Arthroscopy 2011
    Nagai K et al. KSSTA 2015
  - ✓ KT-2000: **SSD in ATT** (mm)

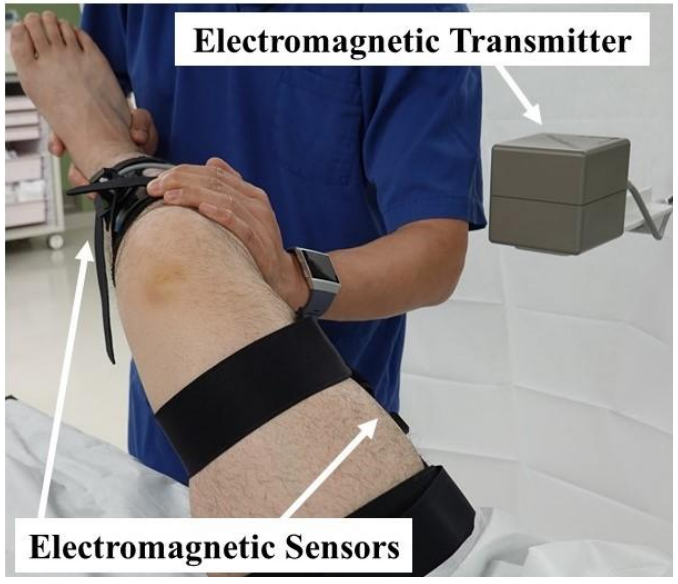
SSD, side-to-side difference
ATT, anterior tibial translation

- **IKDC-subjective knee form (SKF)**

Statistical analysis

- ✓ Unpaired t-test ($P<0.05$)

Ramp vs Control



Results

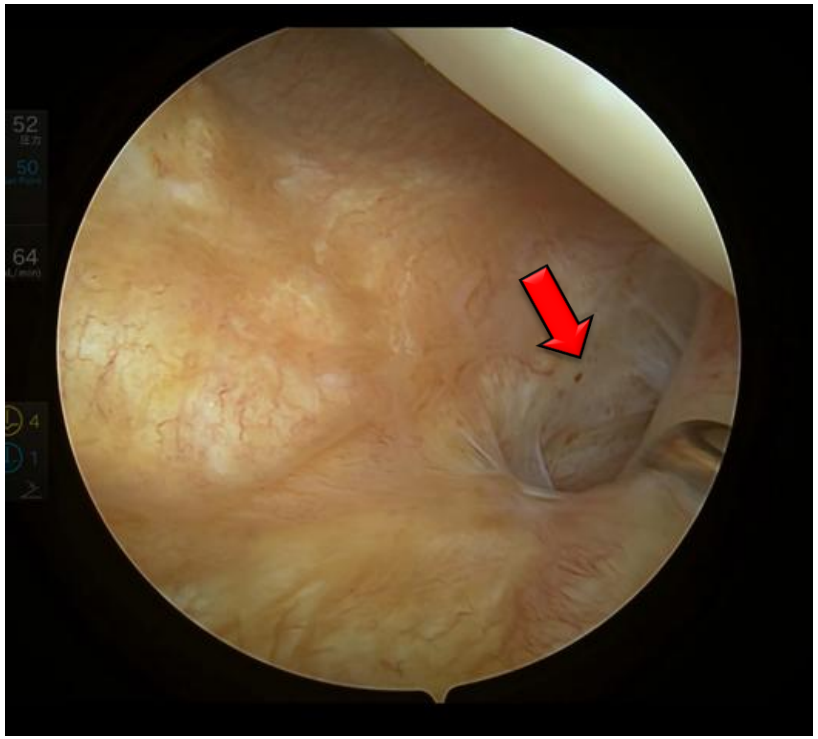
Patients demographics

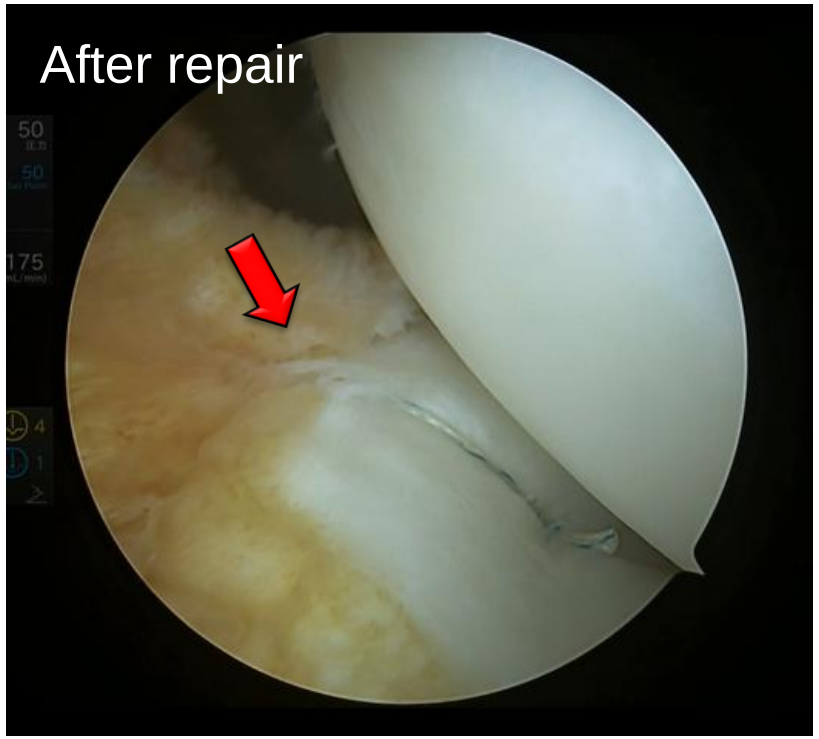
	Ramp (n=21)	Control (n=44)	P value
Sex(M/F)	10 / 11	23 / 21	0.82
Age(years)	24±8	26±13	0.35
Tegner activity scale	7.4±1.4	6.6±1.9	0.14
Period from injury to surgery (days)	153±219	138±270	0.92
Graft type	HT : 21	HT : 44	Mean±SD

Patients demographics

	Ramp (n=21)	Control (n=44)	P value

Right knee





All ramp lesions were arthroscopically confirmed **healed**

KT-2000/Lachman test

		Ramp	Control	P value
KT-2000 SSD (mm)	Pre-op	5.9±2.5	4.8±2.2	0.08
	Post-op	0.4±1.5	1.0±1.3	0.11
Lachman test SSD in ATT (mm)	Pre-op	6.3±3.7	4.0±4.5	**0.04**
	Post-op	0.8±3.9	1.4±4.1	0.57

Mean±SD

➢ **Lachman test SSD in ATT**

Preoperative

Ramp > Control

Postoperative

Ramp ≒ Control

Pivot shift test / IKDC-SKF

		Ramp	Control	P value
Pivot-shift test posterior tibial acceleration(m/s^2)	Pre-op	1.6±0.9	1.7±0.7	0.74
	Post-op	1.0±0.5	1.3±0.6	**0.03**
IKDC-SKF	Pre-op	56±15	61±13	0.23
	Post-op	83±10	87±13	0.30

Mean±SD

➢ **Pivot-shift test: tibial acceleration**

Preoperative

Ramp ≒ Control

Ramp < Control

Postoperative

Discussion

Instability in ACL-injured + ramp lesion knees

Previous studies

Ramp lesion was related to

- **Greater** KT-2000 SSD
  Tashiro Y et al. KSSTA 2020
- **High-grade** pivot-shift
  Musahl V et al. AJSM 2016
  Mouton C et al. KSSTA 2020
  Fukushima H et al. Arthroscopy 2024

No significant differences in

- ATT on stress X-ray
  Hatayama et al. OJSM 2020
- Lachman & pivot-shift tests
  Albayrak K et al. KSSTA 2021

Present study

- **Increased anterior instability** in the **ramp group**
- **No significant difference** in the **pivot shift test**

Instability in ACLR + ramp lesion knees

Previous studies

Ramp repair

Pivot-shift grade

- ACLR = ACLR +ramp repair

DePhillipo NN et al. OJSM 2020

- **Improved** anterior knee laxity

Tashiro Y et al. KSSTA 2020

Ramp non-repair

Lachman & pivot-shift test

- Repair = Non-repair

Albayrak K et al. KSSTA 2021

- Repair = Trephination

Xin Liu et al. AJSM 2017

Present study

- All cases underwent **repair** and confirmed **healing**
- Stability was **quantitatively comparable** to the control group

Strengths and Limitations

Strengths

- ✓ **Arthroscopically** confirmed ramp lesions
- ✓ Pre- and post-operative 1-year **EUA performed**
- ✓ **Quantitative evaluation** of Lachman and pivot shift test using **EMS**

Limitations

- ✓ Small sample size
- ✓ No groups of ramp lesions without repair for comparison
- ✓ Lateral meniscus injury included in the ramp group

Conclusion

- ✓ **Preoperatively**, the ramp group showed **increased anterior knee instability** compared to the control group
- ✓ **Postoperative** knee stability was **comparable** between the two groups
- ✓ The findings suggest that **ramp lesion repair** may **improve knee stability** in ACL reconstruction, and **ramp lesion repair may be recommended**

Thank you so much for your attention