

# An *in vivo* 3D-CT Analysis of Femoral Tunnel Geometry and Aperture Morphology between Rigid and Flexible Systems in Double Bundle Anterior Cruciate Ligament Reconstruction Using the Transportal Technique

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# Disclosure

Jae Gyoon Kim, MD, Ph.D

Joon Ho Wang, MD, Ph.D

We have no financial conflicts to disclose

# Introduction

- Transportal technique using rigid system
  - Anatomic tunnel placement
  - Short femoral tunnel
  - Posterior wall breakage
  - Poor visual field
  - Iatrogenic damage of MFC

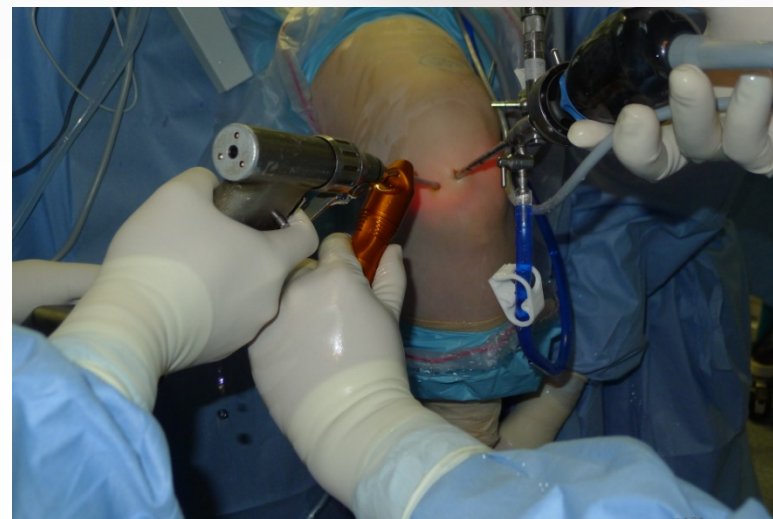
*Need high flexion to prevent complications!!*

- Lubowitz et al., arthroscopy, 2009



# Intoduction

- Transportal technique using flexible system
  - Less knee flexion
  - Longer femoral tunnel
  - Avoiding posterior wall breakage
  - Avoiding injury of LCL, peroneal nerve
  - Less MFC damage



- Cain and Clancy, Orthop Clin North Am, 2002

# Introduction

- Purpose
  - To compare the **femoral tunnel geometry**
    - ✓ Tunnel length, graft bending angle, posterior wall breakage
  - To compare the **femoral tunnel aperture morphology and position** after DB ACL reconstruction using TP technique with rigid or flexible system
    - ✓ Aperture shape, aperture axis angle, tunnel position

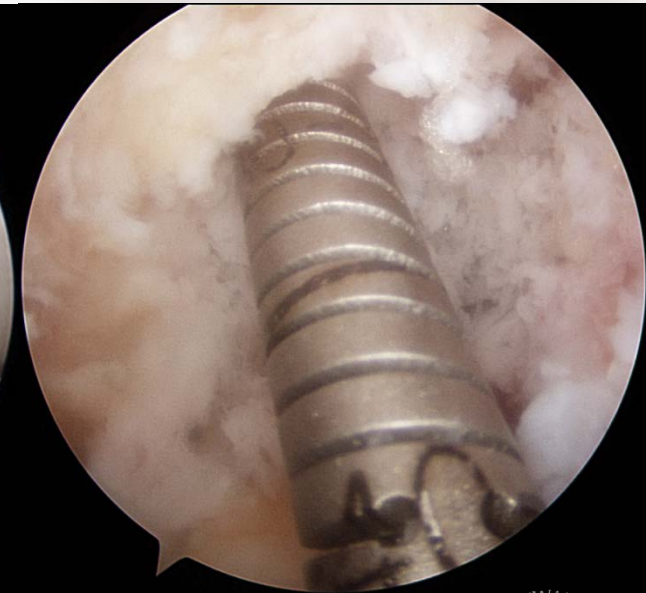
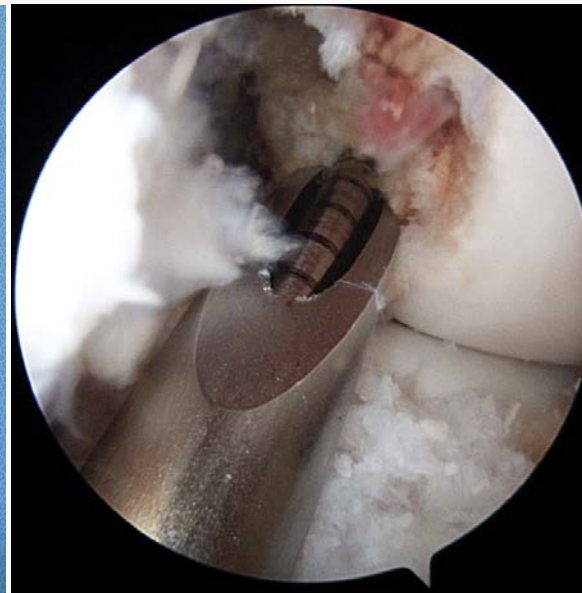
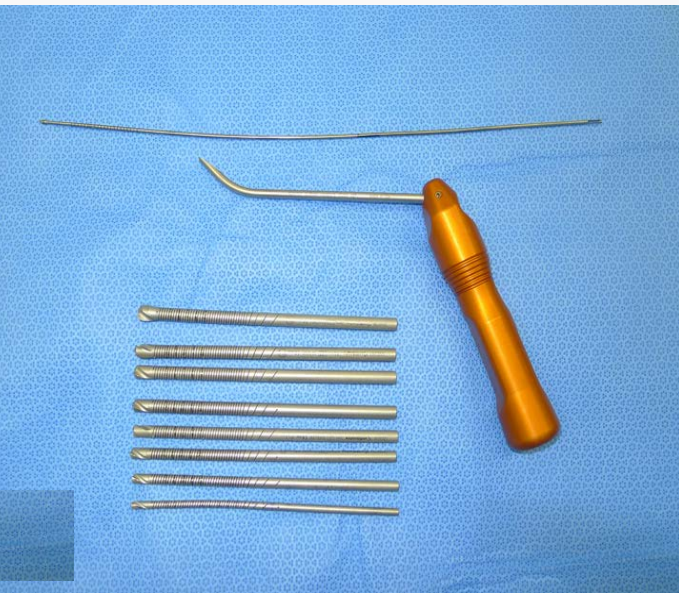
# Material and methods

- Retrospective study
- Rigid group : 2010.11 – 2011. 11
  - 27 DB ACLR using rigid system
  - Bullseye guide, cannulated reamer (ConMed Linvatec)
  - Full flexion of knee joint



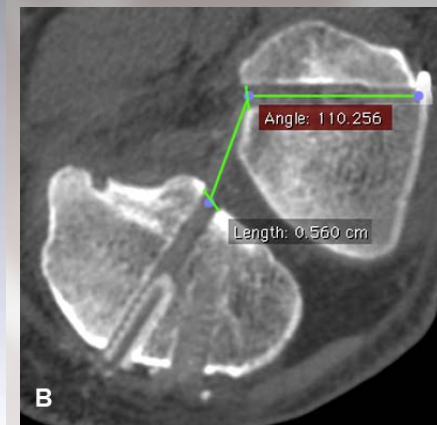
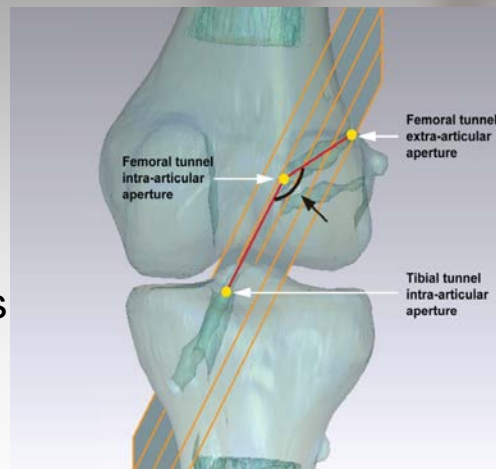
# Material and methods

- Flexible group : 2013. 6 – 2013. 10
  - 27 DB ACLR using flexible system
  - Clancy anatomical Cruciate Guide System (Smith & Nephew)
  - 110 degree of knee flexion

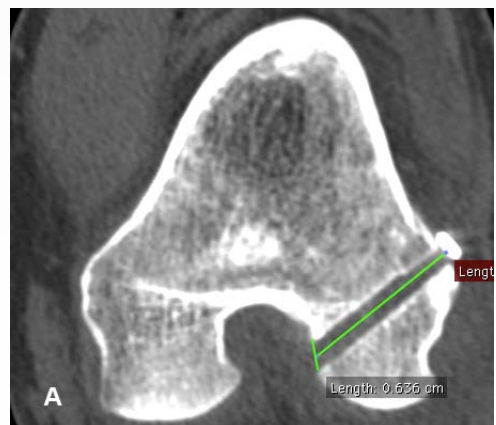
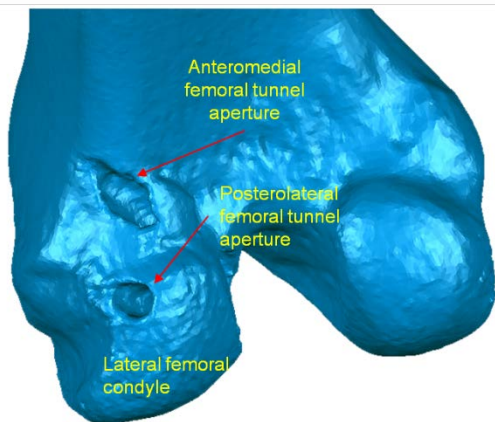


# Material and methods

- 3D-CT
- OsiriX imaging software
  - Femoral graft bending angle
    - ✓ Correlated with bending stress
    - ✓ Graft damage
    - ✓ Tunnel expansion
  - Femoral tunnel length
  - Posterior wall breakage



- Natsu-ume et al, JBJS Br ,2001,  
- Segawa et al, KSSTA, 2001



- Wang et al., Arthroscopy, 2012  
- Wang et al., KSSTA, 2012  
Kim et al. Arthroscopy, 2012  
Kim et al., KSSTA, 2013





# Results

- Femoral tunnel aperture geometry

		Rigid group (n=27)	Flexible group (n=21)	P
<b>Femoral tunnel length, mm</b>	AM	31.4 ± 3.1	35.8 ± 6.4	0.009
	PL	34.1 ± 4.3	35.8 ± 3.9	0.14
<b>Femoral graft bending angle, °</b>	AM	108.4 ± 7.4	115.5 ± 5.5	< 0.001
	PL	109.3 ± 9.2	117.3 ± 9.7	0.003
<b>Posterior wall breakage</b>		4	4	

Values are expressed as mean ± SD (range), except posterior wall breakage.

AM, anteromedial; PL, posterolateral

- Femoral tunnel length < 30mm (**P=0.05, 0.10**)
  - Rigid : 7/6 (AM/PL)
  - Flexible : 1/1 (AM/PL)

# Results

- Femoral tunnel aperture morphology / tunnel position

		Rigid group (n=27)	Flexible group (n=27)	P
AM femoral tunnel	Height/width ratio	1.35 ± 0.16	1.18 ± 0.12	<0.001
	Aperture axis angle, °	17.5 ± 17.3	26.3 ± 22.5	0.22
PL femoral tunnel	Height/width ratio	1.32 ± 0.23	1.18 ± 0.10	0.006
	Aperture axis angle, °	8.09 ± 7.70	30.3 ± 19.0	<0.001

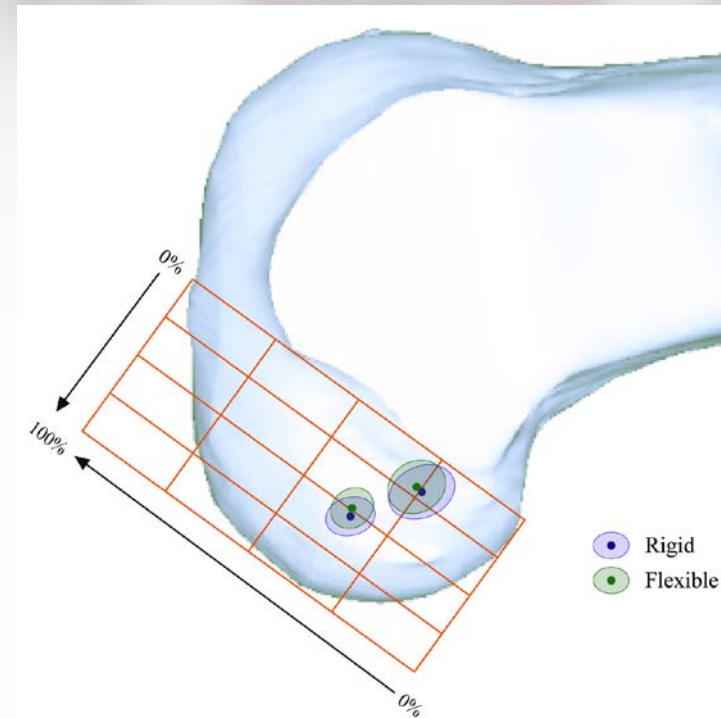
Values are expressed as mean ± SD (range), except posterior wall breakage. AM, anteromedial; PL, posterolateral

		Rigid group (n=27)	Flexible group (n=27)	P
Parallel to Blumensaat line (%)	AM	24.5 ± 3.6 (18-33)	25.4 ± 3.6 (20.1-34.2)	0.36
	PL	35.0 ± 6.1 (24-51)	36.4 ± 4.6 (27.5-46.2)	0.33
Pependicular to Blumensaat line (%)	AM	21.0 ± 7.9 (2-35)	19.1 ± 5.3 (12.2-32.7)	0.31
	PL	51.9 ± 5.8 (39-64)	49.5 ± 4.1 (41.3-57.0)	0.15

Values are expressed as mean ± SD (range), except posterior wall breakage. AM, anteromedial; PL, posterolateral

# Conclusion

- No difference in tunnel position
- Flexible system : Graft fixation and bending stress
  - AM femoral tunnel length
  - Less acute AM/PL femoral graft bending angle
- Rigid system : Footprint coverage
  - Ellipsoidal femoral tunnel aperture
  - Horizontal aperture axis angle



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