

Greater iatrogenic soft tissue damage in conventional approach when compared with the robotic-arm assisted approach for total knee arthroplasty

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Introduction

- Manual TKA (MTKA) procedures have demonstrated excellent clinical success. Occasionally intraoperative damage to soft tissues can occur.
- Robotic-arm assisted technology is designed to constrain a sawblade in a haptic zone to help ensure that only the desired bone cuts are made.
- Aim: Quantify the extent of soft tissue damage sustained during TKA through a robotic assisted (RATKA) haptically guided approach and conventional manual TKA (MTKA) approach in cadaveric model.

Materials and methods

- Sample size: 24 paired cadaveric knees (12 RATKA and 12 MTKA) prepared by 4 surgeons.
- 2 surgeons blinded to method of preparation graded 14 structures (**Table 1**), according to the damage percentages (**Table 2**). Direct visual grading and arthroscopic imaging used to assess extent of damage (tissue fibers that were visibly torn, cut, frayed, or macerated over the total cross-sectional area).
- Percent damage averaged between evaluators, and grades assigned.

Acronym	Full name	Acronym	Full name
dMCL	Deep medial collateral ligament	LR	Lateral retinacular
sMCL	Superficial medial collateral ligament	LCL	Lateral collateral ligament
POL	Posterior oblique ligament	PoT	Popliteus tendon
SMT	Semi-membranosus muscle tendon	GML	Gastrocnemius muscle lateral head
GMM	Gastrocnemius muscle medial head	PaT	Patellar tendon
PCL	Posterior cruciate ligament	QT	Quadriceps tendon
ITB	Iliotibial band	EM	Extensor mechanism

Table 1. List of ligaments evaluated

Grade	1	2	3	4
Damage	≤5%	6-25%	26-75%	76-100%

Table 2. Tissue damage scale

Results

- Significantly less damage occurred to the PCL in the haptic- controlled RATKA than MTKA specimens (p=0.004).
- RATKA specimens had less damage to the dMCL (p=.186), ITB (p=0.5), popliteus (p=0.137), and patellar ligament (p=0.5).
- sMCL, POL, SMT, GMM, GML, LR, LCL, QT, and EM were grade 1 in all MTKA and RATKA specimens.

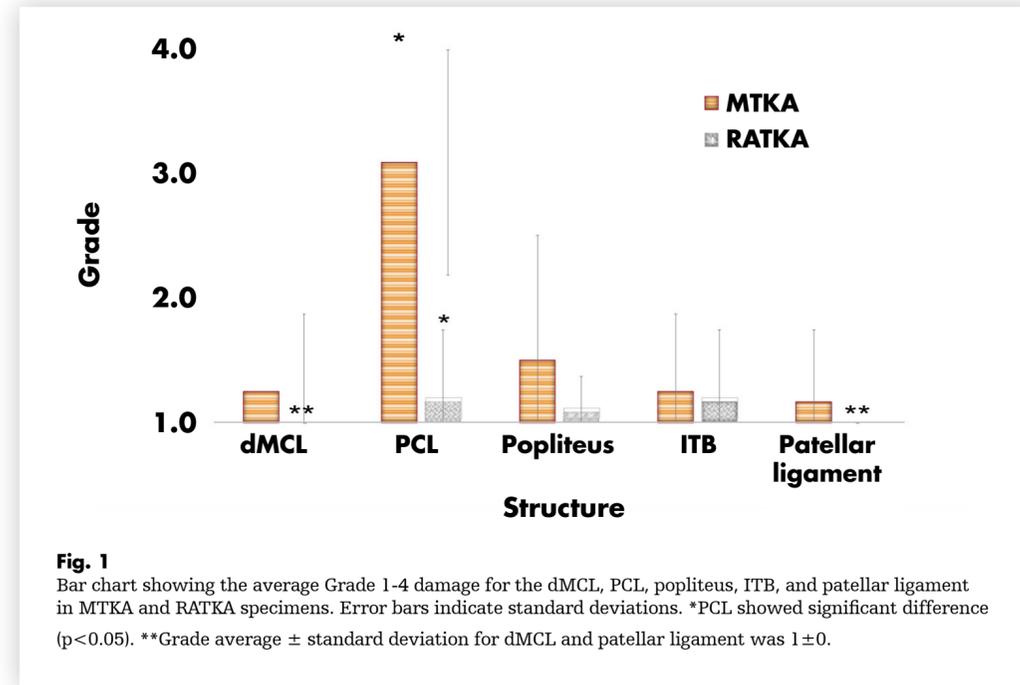


Fig. 1 Bar chart showing the average Grade 1-4 damage for the dMCL, PCL, popliteus, ITB, and patellar ligament in MTKA and RATKA specimens. Error bars indicate standard deviations. *PCL showed significant difference (p<0.05). **Grade average ± standard deviation for dMCL and patellar ligament was 1±0.

- No intentional soft tissue releases were performed in either group to balance the knee.
- **Fig. 1** shows the PCL less damaged in RATKA than MTKA specimens. In MTKA specimens, 4 PCLs were 100% severed (grade 4). **Fig. 2a** shows example arthroscopic images of PCLs in MTKA and RATKA specimens. 9/12 RATKA specimens had a posterior bone bridge protecting the PCL (examples indicated by probe tip in **Fig. 2b**).

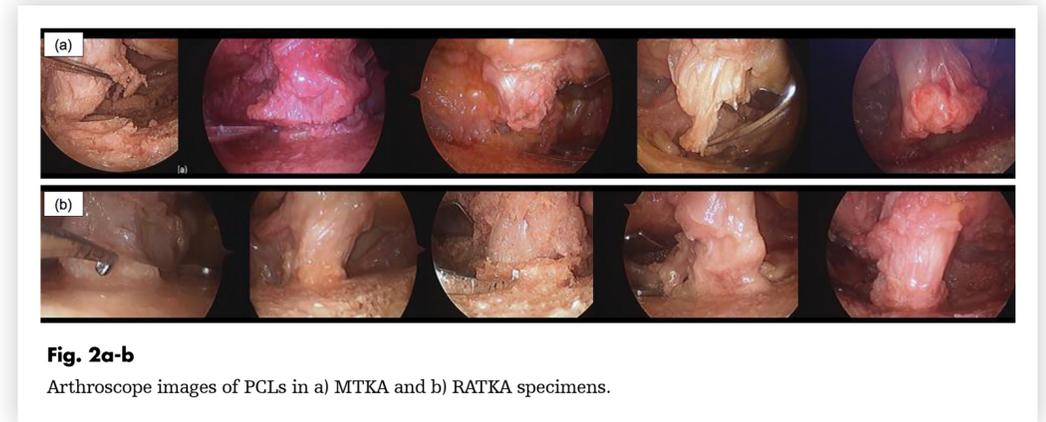


Fig. 2a-b Arthroscopic images of PCLs in a) MTKA and b) RATKA specimens.

Discussion

The results of this study indicate that RATKA may result in less soft-tissue damage than MTKA, especially for the PCL. These findings can potentially be attributed to RATKA using a stereotactic boundary to constrain the sawblade, which can prevent unwanted soft-tissue damage. However, since any damage was post-operatively assessed and in a cadaveric model, further investigations on soft-tissue damage from patients with clinical outcomes should be performed.

References:
 Hampp, E.L., Scholl, L.Y., Faizan, A., Westrich, G., Mont, M.A. Great iatrogenic soft tissue damage in conventional approach when compared with the robotic-arm assisted approach for total knee arthroplasty. EPFOT 2018 Annual Meeting, Barcelona, Spain. Poster No. 1582, May 30-June 1, 2018.

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