Insights into Extension and Flexion Strength Recovery following Posterior-Stabilized Total Knee Arthroplasty and Fixed-Bearing Unicompartmental Knee Arthroplasty:

A 369-Case Prospective Cohort Study

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I (and/or my co-authors) have something to disclose.

All relevant financial relationships have been mitigated.

Co-author, Hendrik A. Zuiderbaan – paid consultant Smith&Nephew
Co-author, Andrew D. Pearle - paid consultant Smith&Nephew & Depuy Synthes

Background and Objective

Background

- The recovery of muscle strength has been minimally evaluated following total knee arthroplasty (TKA) and medial unicompartmental knee arthroplasty (UKA), which may be important for guiding rehabilitation and informing patients accurately.

Objective

- To evaluate to evaluate the recovery of extension and flexion leg strengths in comparison to the contralateral, unaffected knee following posterior-stabilized TKA and fixed-bearing medial UKA.
- To assess the change in patient-reported outcomes from pre-operative baseline, through six months to 12 months post-operatively for TKA and medial UKA.
- No comparisons were made between TKA and medial UKA.

METHODS AND MATERIALS

The study comprised 369 patients (follow-up 1 year, mean age 68.7 ± 7.9 years, 55.3% women), selected from a single-center registry.

Patient selection

- Posterior-stabilized TKA or fixed-bearing medial UKA between February 2019 and May 2023 .
- Generalized (TKA) or medial compartment (UKA) symptomatic OA (Kellgren-Lawrence ≥ 2).
- Available data on patient-reported outcomes (KOOS-PS, OKS, FJS and NRS).
- Completed post-operative physiotherapy following a three-month standardized protocol.

Strength measurements

- Pre-operative baseline, six months and 12 months post-operatively.
- Operated knee and contralateral unaffected knee.
- Measured using isokinetic dynamometry (Biodex® System 3 PRO)
  - device, used for passive measurements of joint strengths, by controlling the speed and range of motion of the exercise at a predetermined rate.
  - Maximum strength – 60 peak torque (Nm) /s normalized to body weight.[1]
  - Endurance strength – 180 peak torque (Nm) /s normalized to body weight.[2]

KOOS-PS, Knee injury and Osteoarthritis Outcome Score; OKS, Oxford Knee Score; FJS, Forgotten Joint Score; NRS, Numerical Rating Scale

SUMMARY OR RESULTS - TKA

Significant differences in baseline extension and flexion strengths between the operated and unaffected knee.

Significant improvements in extension strengths after six months post-operatively in the operated knee.

Vs.

Significant improvements in flexion strengths from pre-operative baseline throughout 12 months post-operatively in the operated knee.

Most substantial increase in extension strengths occurred between six and 12 months after surgery.

Vs.

Most substantial increase in flexion strengths occurred between pre-operative baseline and six months after surgery.

Extension strengths of the operated knee did not reach levels comparable to those of the unaffected knee at 12 months post-operatively.

Vs.

Flexion strengths of the operated knee reached equal levels of the unaffected knee at 12 months post-operatively.

Figure 1a. Extension maximal strength for TKA

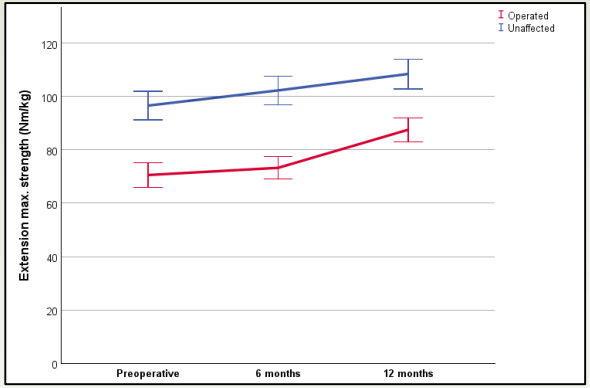


Figure 1b. Extension endurance strength for TKA

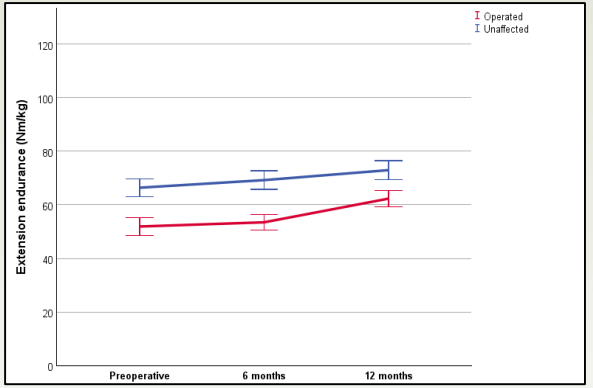


Figure 1c. Flexion maximal strength for TKA

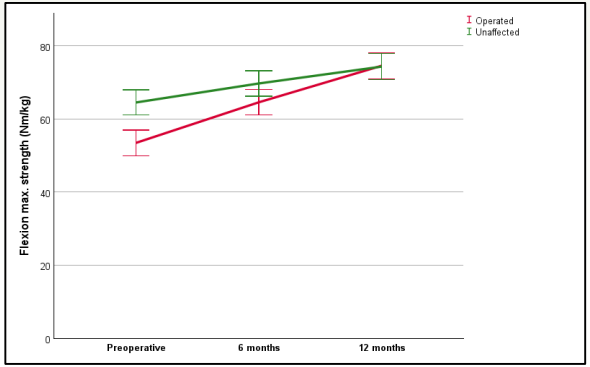
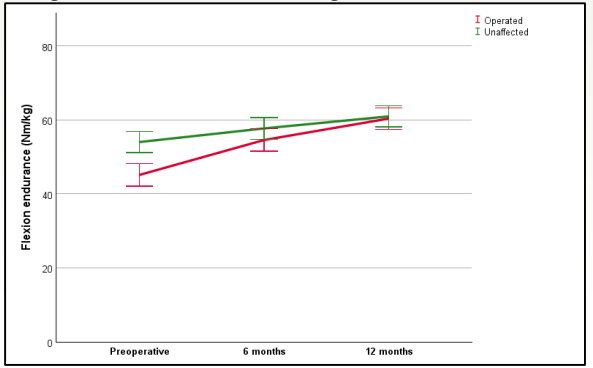


Figure 1d. Flexion endurance strength for TKA



SUMMARY OR RESULTS – MEDIAL UKA

Significant differences in baseline extension strengths , but no significant differences in baseline flexion strengths between the operated and unaffected knee.

Significant improvements in extension strengths after six months post-operatively in the operated knee.

Vs.

Significant improvements in flexion strengths from pre-operative baseline throughout 12 months post-operatively in the operated knee.

Most substantial increase in extension strengths occurred between six and 12 months after surgery.

Vs.

Most substantial increase in maximum flexion strength occurred between six and 12 months post-operatively and in flexion endurance between pre-operative and six months after surgery.

Extension strengths of the operated knee did not reach levels comparable to those of the unaffected knee at 12 months post-operatively.

Vs.

Flexion strengths of the operated knee reached equal levels of the unaffected knee at 12 months post-operatively.

Figure 2a. Extension maximal strength for UKA

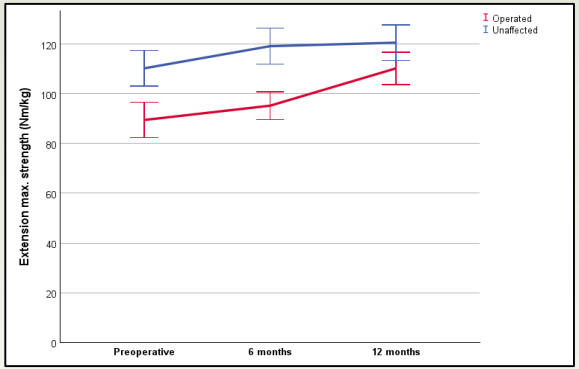


Figure 2b. Extension endurance strength for UKA

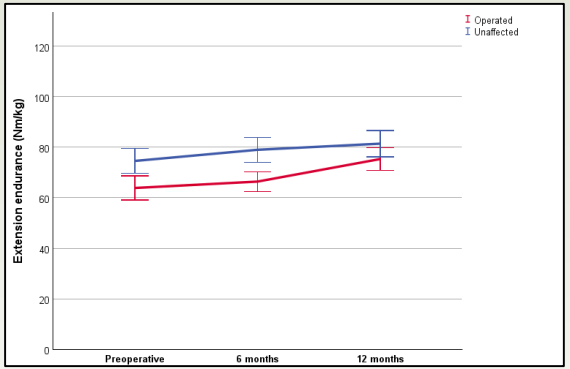


Figure 2c. Flexion maximal strength for UKA

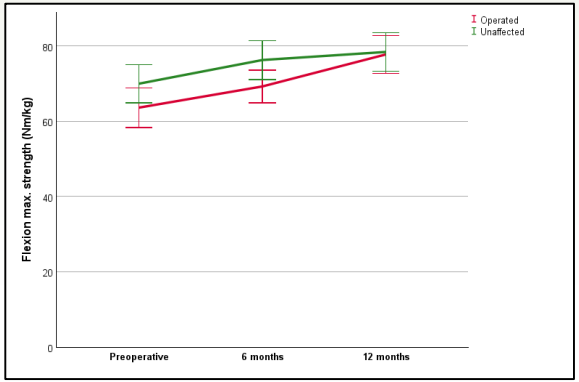
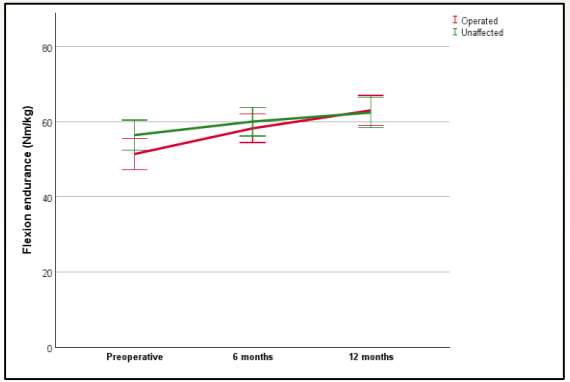


Figure 2d. Flexion endurance strength for UKA



SUMMARY OR RESULTS – PROMS

- For TKA, all improvements in pain and knee function scores significantly improved until twelve months post-operatively. Solely, the improvements from pre-operative to six months post-operative were clinically relevant, as these surpassed the MCID thresholds.

- For medial UKA, significant and clinically relevant improvements in KOOS-PS, OKS and NRS were observed between pre-operative and six months post-operative. OKS and FJS scores improved further between six and 12 months postoperatively.

Table 4. Patient-reported outcome measures stratified by arthroplasty type

		TKA (n=255)	p-value	Medial UKA (n=114)	p-value
NRS pain					
	Preoperative [s]	65 (50 – 75)		60 (45 – 75)	
	6 months [s]	20 (5 – 35)		10 (0 – 25)	
	12 months [s]	10 (0 – 30)		10 (0 – 15)	
	ΔPreop – 6 months	-40 (-55 – -25)	**<.001***	-45 (-60 – -28)	**<.001***
	Δ6 months – 12 months	-5 (-10 – 5)	**<.001***	0 (-10 – 5)	.233
KOOS-PS					
	Preoperative	51.8 ± 14.8		57.1 ± 12.4	
	6 months	68.7 ± 12.9		75.2 ± 11.1	
	12 months	71.1 ± 14.5		76.2 ± 11.5	
	ΔPreop – 6 months	16.9 ± 16.1	**<.001***	18.3 ± 14.3	**<.001***
	Δ6 months – 12 months	2.2 (-3.4 – 8.9)	**<.001***	0 (-5.5 – 6.3)	.444
Oxford Knee Score					
	Preoperative	25 ± 7		28 ± 7	
	6 months [a]	40 (35 – 44)		44 (40 – 46)	
	12 months [a]	42 (36 – 45)		44 (40 – 46)	
	ΔPreop – 6 months	13 (8 – 20)	**<.001***	13 (8 – 19)	**<.001***
	Δ6 months – 12 months	1 (-1 – 4)	**<.001***	1 (1 – 2)	**.005***
Forgotten Joint Score					
	6 months [a]	46 (21 – 73)		62 (42 – 90)	
	12 months [a]	54 (25 – 77)		73 (48 – 88)	
	Δ6 months – 12 months	4 (-5.5 – 17)	**<.001***	0 (-6 – 16)	**.038***

Patient-reported outcome measures (PROMs) were presented for the total cohort and stratified by arthroplasty type. The outcomes were presented as mean ± standard deviation in case of normal distribution or as medians with interquartile ranges in case of skewed distribution. P-value represented the increase during time period, not the difference between arthroplasty type. A positive increase over time (Δ) presented improvement of NRS, KOOS-PS and OKS, but regression of Forgotten Joint Score.

* Indicates statistical significance (p<.05).

[a] presented as median (IQR).

MCID, minimal clinically important differences;

CONCLUSION

- The greatest improvements in extension and flexion strengths occurred at different intervals; extension strengths peaked between six and 12-months, while flexion strengths mostly improved within the first six months postoperatively.
- Flexion strengths of the operated knee reached levels of the unaffected knee by 12-months, while extension strength took over 12-months.
- Irrespective of Arthroplasty type, both TKA and medial UKA patients may expect excellent improvement of subjective knee function and pain relief.
- These findings could aid in formulating clear patient expectations regarding strength recovery and guide rehabilitation protocols following TKA and medial UKA.

References

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