

Evaluation of a continuous series of 969 Individualized TKA

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Background

Individualized Origin® TKA (Symbios, Switzerland) is designed from a CT scan to reproduce the native alignment, the radii of curvature, the trochlear orientation and to optimize the bone-implant fit. This technology raises concerns about the ability to restore well-balanced knees. This study reports the survivorship of a continuous series.

Material and methods

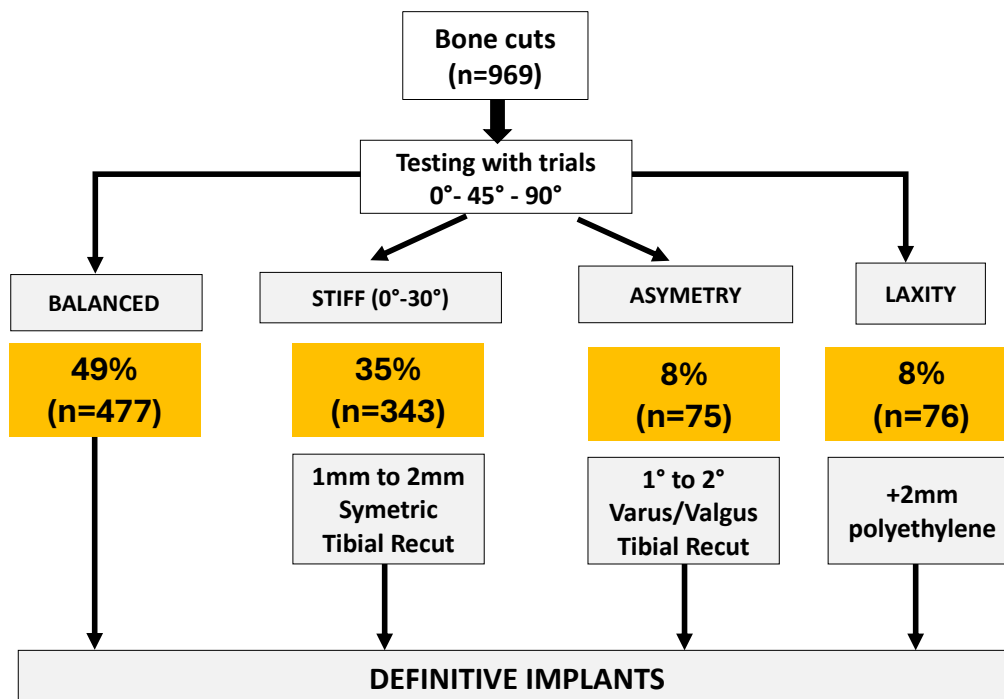
From December 2018 (CE mark) to December 2023, 969 cemented Origin-TKA (814 PS, 146 CR) were implanted: 879 unilateral, 90 bilateral, 626 in females, 504 in right knees. Mean height was 166 cm (145 to 195), weight was 77kg (45 to 180) and age was 72y (46 to 94). The patella was resurfaced in 666 knees. The indication was OA (680 medial, 191 lateral, 51 patellofemoral, 37 global), Osteonecrosis (6) and RA (4). Exclusion criteria were: coronal deformities > 15°, extension deficit > 15°, flexion range < 90°, medial laxity > 10°, or lateral laxity > 15°. The bone cuts were done with PSI, and the residual medio-lateral laxity was evaluated with the trials: in case of stiffness, tibial recuts were done with recutting guides; in case of laxity a thicker polyethylene was used. Patients were followed at 1 year and every two years.

Results

49% were well-balanced after the first cut, 43% required a tibial recut and 8% a +2mm PE. No femoral recut and no ligament or patellar retinaculum releases were done (figure). At FU 5 (0.5%) were revised for aseptic failure (1 stiffness, one loosening, one periprosthetic fracture, two patellar resurfacing) and 5 for septic complications (4 D.A.I.R. and 1 revision). Additionally, 5 (0.5%) MUA and 2 arthroscopy for debridement for stiffness were done.

Conclusion

This series demonstrates the feasibility of Individualized TKA on a large series. However, methods to predict the soft-tissue behavior of a given patient are still to be found.



The Learning Curve of a Custom Made, Individualised Total Knee Arthroplasty System

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Purpose

Custom made total knee arthroplasty (CM-TKA) is a novel system that utilizes CT imaging and a proprietary algorithm to plan and individualise the implant and alignment of the patient. The implant is produced and delivered together with patient-specific-instruments (PSI) for implantation. The purpose of the study was to analyze the learning curve for the surgeon in terms of surgical time and execution of plan as well as surgical efficiency of the surgical team.

Methods

The study is a part of an ongoing randomized controlled trial comparing CM-TKA and robotic assisted, functionally aligned TKA. Included were 10 cases prior to the trial begin as well as 16 cases in the trial itself. Recorder were surgical time, total theatre time and execution of the planned lateral distal femoral angle (LDFA), medial proximal tibial angle (MPTA), hip knee ankle angle (HKA) and posterior tibial slope (PTS), measured on anteroposterior and lateral long legged, standing x-rays at 6 weeks postoperative. The learning curve was analyzed using the cumulative sum analysis (CUSUM).

Results

Surgical time was 53.8 ± 7.0 minutes, with the inflection point after the 5th case. Total theatre time was 84.5 ± 12.0 minutes without an inflection point, indicating no learning curve. Mean LDFA error was 1.64° , MPTA 1.52° , HKA 1.88° and PTS 2.16° . The error margin was not reduced with more experience.

Conclusion

The learning curve in terms of surgical time was 5 cases for the surgeon without a learning curve for the surgical team. In terms of plan execution, the highest margin of error was observed for posterior tibial slope. There was no learning curve in terms of implant positioning and plan execution.

Do Cement Pockets Reduce the Risk of Revision for Tibial Loosening?

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Introduction

Total Knee Arthroplasty (TKA) is a highly effective treatment for end-stage osteoarthritis of the knee. A major cause of revision surgery is aseptic loosening of the tibia. Although loosening is multifactorial, there has been some suggestion that the addition of cement pockets to the undersurface of the tibia may be protective.

Materials and Methods

Using a prospectively maintained database, we identified 8345 cemented TKAs. 5431 were fixed-bearing (FB), and 2914 were rotating-platform (RP) TKAs. All implants were cemented using high viscosity cement applied to both implant and bone.

Revisions and the reason for revision were identified using our database and the National Joint Registry. Primary outcomes were all-cause revision and revision for aseptic tibial loosening.

Results

We identified 4896 FB-TKAs with cement pockets (4337 PFC Sigma, 535 Attune S+FB) and 535 FB-TKA without cement pockets (Attune FB), as well as 1816 RP-TKA without cement pockets (675 PFC Sigma, 1141 Attune RP) and 1098 RP-TKA with cement pockets (Attune S+RP).

11 PFC FB, 5 PFC RP, 1 Attune FB, 6 Attune RP, 0 Attune S+FB and 1 Attune S+RP were revised for aseptic tibial loosening.

The presence of cement pockets made no significant difference to all cause revision of the cohorts ($p=0.91$); nor was there any significant difference between the 2 groups of FB-TKAs ($p=0.08$) or RP-TKAs ($p=0.43$)

The presence of cement pockets made no significant difference to the rate of aseptic loosening ($p=0.09$); and there was no significant difference between the 2 groups of FB-TKAs ($p=0.83$) or RP-TKAs ($p=0.57$) (Fig. 1).

Conclusion

Although there is evidence that the addition of cement pockets can improve pull-out strength in cadaveric models and in-vitro studies, we have not demonstrated that these result in statistically significant differences in revision rates for aseptic tibial loosening.

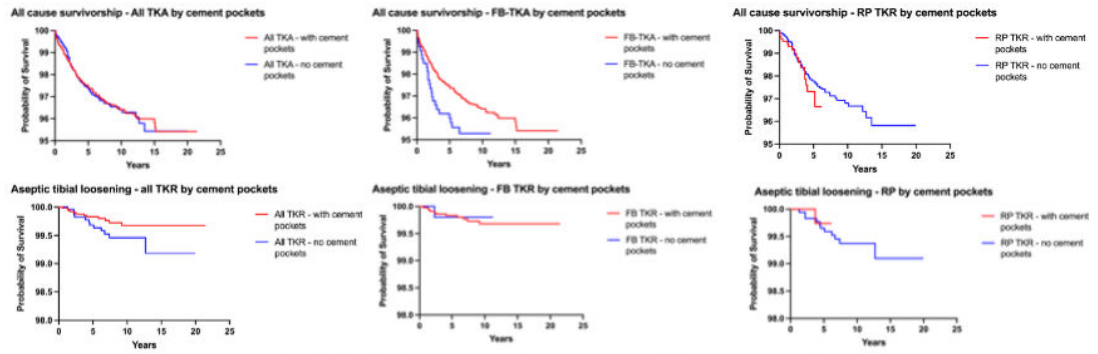


Fig 1 – Kaplan-Meier survivorship of implants with and without cement pockets:

1(a) –All cause survivorship for all TKAs ($p=0.91$); 1(b) – All cause survivorship for FB-TKA ($p=0.08$); 1(c) – All cause survivorship for RP-TKA ($p=0.43$)
 1(d) – Aseptic tibial loosening in all TKAs ($p=0.09$); 1(e) – Aseptic tibial loosening in FB-TKA ($p=0.83$); 1(f) – Aseptic tibial loosening in RP-TKA ($p=0.57$)

Title

The effects of over- and under-stuffing the anterior knee compartment in primary TKA: a systematic review

Authors

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Abstract

Background:

Up to 20% of patients remain dissatisfied following total knee arthroplasty (TKA), often due to anterior knee pain (AKP) and other patellofemoral complications. Several studies highlighted risks of over- or under-stuffing within the patellofemoral compartment, yet there are no standardized methods for their assessment, and their effects on patient-reported outcome measures (PROMs) remain unclear.

Purpose: To synthesize and critically appraise all published studies that investigated effects of over- and under-stuffing the anterior compartment on PROMs following primary TKA.

Methods: The protocol for this systematic review followed PRISMA guidelines was registered on PROSPERO on 7 July 2024, before electronic searches by two readers (CK, VG) using Medline and Scopus. The authors included clinical studies published in English, reporting a quantifiable method to assess the anterior compartment in TKA, with clinical and/or radiographic outcomes. The authors excluded in-vitro or ex-vivo studies, reviews or editorials, studies on revision TKA, and studies with follow up <1 year.

Results: The electronic search returned 156 records, of which 13 met the eligibility criteria (9 retrospective, 4 prospective), representing 4236 knees in 3550 patients. The primary outcome was over-stuffing in 4 studies, which investigated its correlation with PROMs and/or AKP, while the primary outcome was under-stuffing in 2 studies. The PROMs reported were WOMAC (8 studies), KSS (6 studies), KOOS (2 studies), as well as OKS, FJS and Kujala scores (each 1 study). Only 2 studies used dynamic assessments, while 11 used static assessments. Only 2 of the 13 studies found significant effects of over-stuffing (by >5mm) on PROMs.

Conclusions: Changes in anterior offset, particularly over-stuffing, may cause patellofemoral complications. Although it would be ideal to restore the anterior compartment, small deviations do not affect clinical outcomes. A threshold of 5mm could represent the 'safe zone' for change in anterior offset in patients undergoing TKA.

Table 1. Summary of 13 studies included

Study Name	Year	Country	Journal Name	Study Type	Patients	Knees	Age	Female	BMI
							(mean ±SD)	(%)	(Mean ±SD/range)
Kafelov et al [21]	2024	France	<i>KSSTA</i>	Retrospective	96	96	69 ±8	50	29.8 ±5
Tammachote et al [41]	2023	Thailand	<i>Eur J Orthop Surg</i>	Retrospective	220	220	19 ±8	20	26.0 ±4
Aliyev et al [2]	2022	Turkey	<i>Z Orthop Unfall</i>	Retrospective	262	372	68 ±8	50	32.7 (21–38)
Narkbunnam et al [33]	2019	USA	<i>AOTS</i>	Retrospective	138	138	71 ±10	64	NR
White et al [43]	2019	USA	<i>J Arthroplasty</i>	Prospective	90	90	70 ±7	71	29.0 (18–44)
Kemp et al [23]	2018	UK	<i>The Knee</i>	Prospective	107	107	69 ±10	NR	30.8 (15–45)
Alcerro et al [1]	2017	USA	<i>J Arthroplasty</i>	Retrospective	640	819	72	71	31.2 (19–56)
Stryker et al [40]	2017	USA	<i>Orthop Clin North Am</i>	Prospective	46	46	68	86	NR
Matz et al [27]	2017	Canada	<i>J Arthroplasty</i>	Retrospective	970	970	76 ±9	63	33.0 ±8
Beldman et al [6]	2015	Netherlands	<i>Int Orthop</i>	Prospective	193	262	71 ±8	66	29.9 ±5
Meffah et al [30]	2012	USA	<i>J Arthroplasty</i>	Retrospective	100	100	72 ±8	64	NR
Pierson et al [35]	2007	USA	<i>JBJS-Am</i>	Retrospective	556	830	69 ±9	37	NR
Daluga et al [8]	1991	USA	<i>J Arthroplasty</i>	Retrospective	88	135	68 ±8	49	NR

N^o= Number, SD= Standard Deviation, BMI= Body Mass Index kg/m², NR= Not reported

Type IIB spinopelvic imbalance is an independent risk factor for flexion contracture after knee arthroplasty

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Introduction

Sagittal imbalance leads to adjustments in the pelvis, hips, and knees to keep a level gaze with minimal energy use. People with a stiff spine adjust their posture by extending their hips, bending their knees, and tilting their pelvis back. This study hypothesises that type IIB spino-pelvic imbalance may influence the occurrence of flexion contracture after total knee arthroplasty (TKA).

Materials and methods

We retrospectively evaluated all patients who received a robotic-assisted TKA between 2018 and 2023 at a single centre. Inclusion criteria were patients with a full ROM >90°, a residual flexion contracture ≥ 0°, with a final surgery report confirming full extension (<5° of flexion). Exclusion criteria were hip osteoarthritis or replacement, the presence of a windswept knee, and pre-operative stiff knees (full ROM <70°). Patients were classified into the IA-IB-IIA-IIB categories according to the 2021 JAAOS Spinopelvic classification, and divided into two cohorts based on the residual degree of post-operative flexion contracture (cohort 1: 0-5°; cohort 2: ≥5°). Two different knee surgeons meticulously measured the residual flexion contracture with a goniometer. Fisher's test compared the prevalence of residual flexion contracture and the difference in satisfaction outcomes across cohorts. Logistic regression assessed if a type IIB independently predicted residual flexion contracture. Preoperative ROM, HKA, age, and BMI were set as potential confounders. The model's fit was assessed using the Hosmer-Lemeshow (p>0.430).

Results

A total of 112 patients were included (68 in cohort 1, and 44 in cohort 2). The mean flexion contracture was 5.8° (range 5°-16°). 27.7% were type IA patients, 19.9% IB, 7.1% IIA, 47.3% IIB. A higher incidence of residual flexion contraction was found in IIB patients (p<0.001), but the same group reported higher mean patient-reported satisfaction scoring compared to the other cohorts (p=0.014). The linear logistic regression analysis indicated that Spinopelvic classes significantly predict the degree of flexion contracture in both univariate and multivariate analyses (F=5.41 p<0.001; R2=0.19, B=1.78 [95%CI= 1.05-2.47], p < 0.001) (Table 1). Four patients required manipulation under anaesthesia, none of whom belonged to IIB.

Conclusion

Type IIB spinopelvic imbalance may predict the likelihood of residual flexion contracture following TKA with good patient-reported satisfaction.

Table 1. Univariate and Multivariate analysis predicting residual flexion contraction >5°

	B	Std. Err.	Wald	P	B	Std. Err.	Wald	P	95%CI (Wald)	
									Lower	Upper
Univariate					Multivariate					
BMI	-0.01	0.04	0.1	0.699	0.03	0.04	0.53	0.465	-39.76	29.612
AGE	-0.03	0.03	0.95	0.329	0.02	0.04	0.27	0.599	-0.05	0.132
HKA	0.03	0.02	1.57	0.209	-0.00	0.05	0.22	0.639	-0.05	0.107
LDFA	-0.16	0.08	3.95	0.047	0.10	0.14	0.29	0.586	-0.10	0.095
MPTA	0.05	0.07	0.50	0.476	-0.05	0.11	0.01	0.901	-0.16	0.385
Spinopelvic Class			15.23	0.002			-2.24	0.6223		
IB	1.50	0.70	4.56	0.033	-1.37	0.74	3.41	0.065	-3.46	-1.02
IIA	-19.29	14210.36	0	0.999	20.83	27765.43	0	0.999	-2.83	0.08
IIB	2.33	0.60	14.84	<.001	0.03	0.04	13.44	<.001	-13.95	-12.78

Mechanical evaluation of the KneeReviver device in knee joint distraction for tibiofemoral osteoarthritis treatment

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ABSTRACT

Introduction: Knee joint distraction is an innovative treatment for younger patients (ages 45-65) with tibiofemoral osteoarthritis, aimed at unloading cartilage through separation of the femur and tibia. The KneeReviver (ArthroSave, Culemborg, The Netherlands) is a device specifically developed for this kind of treatment (Figure 1). While it has proven successful for some, the results vary among patients, highlighting the need for a deeper understanding of its mechanical behavior. This study investigated the mechanical principles of the KneeReviver device under varying axial loads and the potential effects on the cartilage stresses.

Methods: An experimental study using five cadaveric knees measured tibiofemoral contact pressures, joint gap narrowing, and spring compression under axial loads with and without the KneeReviver was performed. Additionally, the impact of the device specifics (pin diameter and length) on contact parameters, including peak pressure, mean pressure, contact area, and total load on cartilage, as well as joint gap dynamics during opening and closing, was analyzed utilizing finite element simulation techniques.

Results: Experimental and finite element analyses showed that the device effectively reduced contact parameters (peak pressure, mean pressure, contact area, and load on cartilage). Smaller diameters and longer lengths of the bone pins resulted in higher contact parameters, characterized by increased contact pressures and larger contact areas. Furthermore, smaller diameters and longer pins led to smaller joint gap creation during distraction. However, these specifications also resulted in more joint gap narrowing during axial loading, suggesting a decrease in the total stiffness of the device.

Discussion: The findings underscore the potential effectiveness of the device to reduce cartilage stresses and highlight the critical role of bone pin characteristics on its mechanical functioning. Understanding how these parameters contribute to the overall mechanical working is vital for enhancing surgical placement, exploring patient-specific device options, and device design, improving overall distraction treatment outcomes.



Figure 1:
KneeReviver
(Arthrosave)

Similar Functional Results in Patients outside the Classical Criteria for Medial Unicompartmental Knee Arthroplasty

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Introduction: The indications of unicompartmental knee arthroplasty (UKA) are restricted by multiple criteria. The aim of this study is to explore the functional results of UKA in a population of patients outside the classical criteria.

Materials and methods: A population of 197 patients who underwent UKA for medial osteoarthritis were included. Two groups of patients were compared, those meeting the classical criteria and those presenting at least one contraindication: age > 75 years, BMI > 30 or coronal limb deformity >8°. The implant used was a modern fixed-bearing primary medial UKA. The minimal follow up was 3 years. The primary outcome was the functional result according to the Knee Society Score (KSS) and the secondary outcomes were the complications and revision rates.

Results: 100 patients were included in the indication group (Group 1) and 97 in the off-indication group (Group 2). No significant difference was observed between the two groups for height, sex ratio, operated side, osteoarthritis stage (p -value > 0.05). There was no significant difference between KSS in the two groups (p -value = 0.96). At 3-years follow-up, survival rate without revision was 100% in the indication group and 95.38% for the off-indication group (p = 0.57). The rate of complication was 12.9% in the indication group and 8.96% in the off-indication group (p = 0.47).

Conclusion: UKA for medial osteoarthritis allows same functional results for patient presenting at least one theoretical contraindication between BMI >30, age > 75 and coronal limb deformity >8° without altering the complication or revision rate at 3 years follow up.

Does the CPAK classification affect the results of unicompartmental knee arthroplasty? Short-term results of a retrospective series of consecutive cases.

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Introduction

Recent studies suggest that the results of mechanically aligned TKAs are not homogeneous among the preoperative CPAK categories. It is not clear if the same occurs also in unicompartmental knee arthroplasty (UKA).

This study aims to evaluate the effect of the preoperative CPAK classification on the results of UKAs in a retrospective series. Secondly, the effect of residual varus on PROMs and the distribution of UKA candidates among the different CPAK categories were analyzed.

Materials and Methods

253 consecutive UKAs in 236 patients with minimum follow-up of one year were included.

The preoperative HKA and JLO were calculated on weight bearing long-leg x-rays and patients were classified according to the CPAK. The clinical results (OKS, Likert, FJS) of the six most represented CPAK groups (I – VI) were compared. In addition, patients with a residual varus alignment of $<5^\circ$ and those with $>5^\circ$ were compared, and the correlation of aHKA and clinical results was calculated.

Results

The mean OKS was 40.5 (SD 5.3), with 97% of satisfied patients. There was no difference among the six most represented CPAK categories in all outcome measures and no difference when comparing the varus, neutral and valgus groups.

The distribution in the CPAK categories showed a significant difference according to gender, with CPAK I being the most represented in males (46%) and significantly more patients in the CPAK III (15%) and VI (10%) in females.

There was no difference in the outcome of patients based on the amount of residual varus ($<5^\circ$ vs $>5^\circ$) and no correlation between aHKA and outcome in varus patients.

4 patients were revised (2 for persistent pain, 1 for PCL instability, 1 for infection).

Conclusions

UKA is a safe and effective treatment for isolated knee OA, yielding homogenous results in all preoperative phenotypes. The entity of residual varus $>5^\circ$ does not affect the results.

ABSTRACT

UKA in morbidly obese patients with a minimal BMI of 35

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Introduction

Analyze at medium follow-up fixed-bearing UKA in morbidly obese patients (BMI > 35).

Materials and methods

Forty-eight patients with a BMI>35 undergoing UKA between 2015 and 2020 were identified for a retrospective study (42 medial UKA and 6 medial UKA combined with PFJ) and were 1:1 propensity matched (age, sex and patella resurfacing) with 48 non-obese UKA and compared to 48 obese TKA. Mean follow-up was 5 years (range, 3 to 8 years).

Results

Demographics and numerical outcome data are given in Table 1.

Length of stay (LOS) was similar for obese UKA and TKA and longer than for non-obese UKA (1 day). Especially male UKA patients had a shorter LOS.

No difference in blood loss between obese UKA and non-obese UKA, but significantly less than obese TKA (Mean Hb drop of 1.5 in UKA vs 3 for TKA). No transfusions in UKA vs 3 in TKA.

Significant difference for PE between UKA and TKA.

Mortality over time was 4% for obese UKA, 0% for non-obese UKA and 4% for obese TKA.

Re-operations in obese UKA; 2 revisions (one for aseptic loosening and one for disease progression of the lateral compartment), in non-obese UKA; 1 MUA in a multi-operated knee and in obese TKA; one revision for instability, 2 MUA for arthrofibrosis in flexion, 2 extensor mechanism repairs (one patella fracture ORIF and one patellar tendon rupture). The MUA rate was 4% for obese TKA and 1% for UKA.

Survivorship at a mean of 5 years (range, 3 to 8 years) was 96% for obese UKA, 100% for non-obese UKA and 98% for obese TKA.

Conclusion

Despite of a higher complication rate than in the non-obese, fixed-bearing UKA seems to be a safer patient solution than TKA in the morbidly obese.

Anterior knee pain is more common in obese UKA than in non-obese UKA and TKA, despite that no revision surgery was needed by these patients.

Table 1

	Obese UKA	Non-obese UKA	Obese TKA
Mean age (SD)	64 (7)	64 (7)	68 (7)
Gender (F/M)	53% / 47%	53% / 47%	70% / 30%
Side (R/L)	51% / 49%	51% / 49%	52% / 48%
BMI (SD)	38 (3.5)	26.5 (3)	38.5 (4)
PostOP Hb	11.5 (1.5)	11.5 (1.5)	10 (2)
Transfusion	0	0	3 (6%)

PostOP ROM	0°/0/122°	0°/0/125°	0°/0/118°
PostOP VAS	1.7	2.5	1.9
Arthrofibrosis	0	1 (2%)	4 (8%)
DVT/PE	0	0	1/2 (6%)
Infection	0	0	0
Re-operation	2 (4%)	1 (2%)	5 (10%)
Anterior Knee Pain	6 (12.5%)	1 (2%)	1 (2%)
PreOP HKA	173° (4)	174° (5)	176° (10)
PostOP HKA	177° (3)	178° (2)	180° (2°)
RadioLucent Lines	9 (19%)	10 (21%)	8 (17%)

The Effect of Bearing Dislocations, Tibial Periprosthetic Fractures, and Infections on Patient Reported Outcomes after Mobile-Bearing Medial Unicompartmental Knee Arthroplasty

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Introduction

The most frequent short-term complications leading to reoperation after mobile-bearing medial unicompartmental knee arthroplasty (mUKA), are bearing dislocations (BD), tibial periprosthetic fractures (PPF), and prosthetic joint infections (PJI). However, their influence on patient-reported outcome measures (PROMs) remains unclear. This study evaluates the influence of these complications on PROMs, specifically the Oxford Knee Score (OKS) and Forgotten Joint Score (FJS), compared to primary mUKA, primary total knee arthroplasty (TKA), and reoperated TKA patients.

Materials and methods

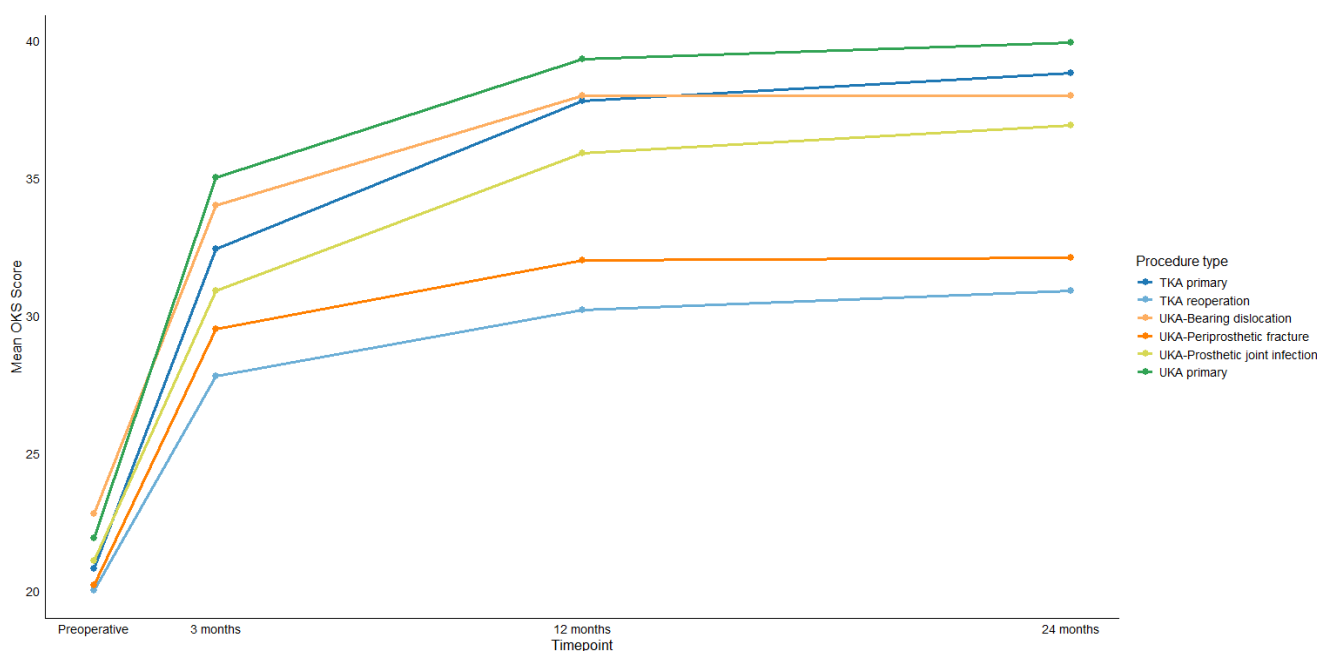
This retrospective cohort study included 74 mUKA patients reoperated for BD (n=37), PPF (n=22), or PJI (n=15) between January 2018 and January 2023 at two Danish hospitals. Comparator groups included 2158 primary mUKAs, 4310 primary TKA, and 203 reoperated TKA patients. OKS and FJS were collected preoperatively and at 3, 12, and 24 months postoperatively. Missing data was imputed based on patient characteristics. Mean scores were compared using Tobit regression to account for ceiling effects in PROMS.

Results

At 12 months, BD-mUKAs (OKS: 38.0 [35.5–40.4], FJS: 55.9 [48.2–63.6]) and PJI-mUKAs (OKS: 35.9 [32.0–39.7], FJS: 53.3 [41.2–65.4]) had outcomes closer to primary mUKAs (OKS: 39.3 [39.0–39.7], FJS: 63.4 [62.4–64.5]) and TKAs (OKS: 37.8 [37.5–38.0], FJS: 58.5 [57.8–59.2]). In contrast, PPF-mUKAs (OKS: 32.0 [28.8–35.1], FJS: 40.9 [30.9–50.9]) resembled reoperated TKAs (OKS: 30.2 [29.2–31.3], FJS: 38.4 [35.1–41.7]). Similar findings were present at 3 and 24 months (Figure 1).

Conclusion

The PROMs after mUKA reoperations vary by complication type. Reoperations after BD and PJI maintain outcomes resembling primary procedures, with PJIs achieving only slightly lower scores. Reoperations after PPF had the poorest outcomes, resembling those after reoperated TKAs. That reoperated mUKAs can achieve outcomes resembling primary procedures should be considered when comparing reoperation rates between UKAs and TKAs, and when discussing reoperation in mUKA patients.



The Use of an Imageless Robotic System in Revision of Unicompartmental Knee Arthroplasty (UKA): Surgical Technique and Outcomes

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Background: The benefits of robotic assistance in primary total knee arthroplasty (TKA) are well-documented, but its application in revision TKA, particularly from unicompartmental knee arthroplasty (UKA) to TKA, remains under-explored. The purpose of this study is to describe the surgical technique of an imageless robotic system used in the revision of UKA to TKA, and to evaluate perioperative data, and short- to mid-term clinical outcomes.

Methods: This prospective study includes 35 patients treated using the imageless robot system in the revision from UKA to TKA, during the period from May 2020 to July 2023. The demographic data of the patients were gathered and the reasons for needing revision surgery were assessed. Perioperative data were analyzed, including in-hospital complications, length of hospital stay, hemoglobin levels, any transfusions, and surgical duration. Data on the types of implants used were also collected. All patients were clinically evaluated preoperatively and at the final follow-up of 31.3 ± 12.1 months, using the Western Ontario and McMaster Universities Arthritis Index (WOMAC), Oxford Knee Score (OKS), Forgotten Joint Score (FJS-12), Numerical Rating Scale (NRS), and range of motion (ROM). Additionally, a radiographic evaluation was performed, and implant survival was assessed by analyzing complications at the final follow-up.

Results: In 88.6% of the patients included in this study, a primary prosthetic implant was used, with 11.4% of patients requiring a varus-valgus constraint implant. In 71.4% of the cases, a thinnest size liner corresponding to 10mm was used. No use of the robot was aborted during the surgical procedure. At the final follow-up, the implant survival rate was 97.14%. The average OKS was 41.5 ± 4.3 . The average FJS-12 at the final follow-up was 80.7 ± 8.9 . The average WOMAC score at the final follow-up was 17.8 ± 8.7 . Analyzing ROM, NRS, and PROMs, there were significant differences in each parameter between pre-revision surgery and the final follow-up.

Conclusions: This study highlights that in the cohort of patients undergoing robotic-assisted conversion from UKA to TKA, the use of an imageless procedure through intraoperative bone morphing combined with alignment based on functional philosophy has proven to be safe and has resulted in excellent clinical and radiographic outcomes.

Revision of UKA to TKA: not always an easy revision to a straightforward primary!

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Introduction

Unicompartmental knee arthroplasty (UKA) is an option for the treatment of isolated compartment metal osteoarthritis (OA). A commonly perceived potential advantage of UKA is that in the event of failure conversion to a standard primary total knee arthroplasty (TKA) follows. However, this is not always possible. The aim of this study was to establish what proportion of UKA to TKA revision procedures required more than a primary TKA.

Materials and Methods

A retrospective review of our departmental prospectively maintained database was undertaken to identify all UKA to TKA revisions. 47 UKA to TKA revisions for reasons other than infection were identified.

Results

The mean time to revision after primary UKA was 9.7 years (SD: 5.0 years). The most frequent indications for revision were progression of OA (n=32) and aseptic loosening (n=13,). The remaining indications including component wear, unexplained pain, and instability. 20 (43%) were revised to primary TKA components with 57% requiring additional stems, augments, or sleeves. Furthermore, of those converted to standard TKA components 4 (20%) required an insert of 15mm or more.

Conclusion

66% of UKA revisions required more than a conversion to "straightforward" primary TKA at the time of revision with either thick inserts, stems, augments, or metaphyseal fixation utilised. This highlights that tibial bone defects are frequently encountered when revising UKA. The potential complexity of revision surgery following a UKA failure should also be carefully considered by both patient and surgeon when weighing up the option of a primary UKA vs. TKA.

Is a single dose of thromboembolic prophylaxis sufficient following outpatient hip and knee arthroplasty ?

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Background:

Fast-track hip and knee arthroplasty with early mobilization has led to a reduction in thromboembolic (TE) complications. Studies have shown that in-hospital only prophylaxis in patients undergoing fast-track THA and TKA is safe, and recent European Society of Anaesthesiology guidelines on peri-operative venous TE prophylaxis suggest treatment during hospitalization only. This allows for a single dose of TE following elective hip and knee arthroplasty, however whether or not, such treatment is safe warrants further investigation.

The aim of this study was to investigate the incidence of TE complications within 30 and 90 days following hip and knee arthroplasty, with only a single dose of TE prophylactic treatment.

Methods:

A prospective multicenter study from 7 fast-track centers between September 2022 to August 2024. Patients discharged on the day of surgery or on first postoperative day received only a single dose of TE prophylaxis on the day of surgery according to protocol. Procedure type (THA, TKA and UKA) and patients demographics such as age, gender, previous TE events, preoperative TE prophylaxis treatment and comorbidities were recorded. Readmissions and complications within 90 days were identified.

Results:

12.607 received a primary THA, TKA or UKA during the study period. Patients with missing data (n=11), patients on long-term potent anticoagulants (n=1405) and patients with hospitalization >1 day (1850) were excluded, leaving 9341 patient for analysis. 46% of the patients were discharged on the day of surgery. Overall rate of TE events within 90 days was 0.3%, with only 0.1% TE events in patients discharged on the day of surgery (Table 1).

Conclusion:

Our study suggests that a single dose of TE prophylaxis on the day of surgery following elective hip and knee arthroplasty in a fast-track setup is safe for patient discharged on the day of surgery or on postoperative day one.

Met opmerkingen [ML1]: Kan man godt kalde det outpatient hvis de udskrives dagen efter? For de er jo også med jf nedenstående

Met opmerkingen [ML2]: Hvis plads ville jeg i parentes indsætte stoffet – det er jo stort set xarelto hele vejen rundt og eliquis hos Jer? NOAK

Met opmerkingen [ML3]: Styrke at det faktisk er protokollert

Met opmerkingen [ML4]: Kan udelades ved plads problemer

Met opmerkingen [ML5]: Tror vi skal skrive således for ellers lader det til at der er nogen af de her ambulante vi har givet mere end 1 tablet og det er der ikke

Table 1. Detailed analysis of VTE events and mortality within 90 days

	Overall* n = 9341	Discharged on DOS n = 2961	Discharged on 1 POD n = 6380
Overall VTE events	29 (0.3%)	4 (0.1%)	25 (0.4%)
DVT, n (%)	22 (0.2%)	4 (0.1%)	18 (0.3%)
PE, n (%)	7 (0.1%)	-	7 (0.1%)
Fatal PE, n (%)	1 (0.01%)	-	1 (0.02%)
All cause mortality, n (%)	15 (0.2%)	3 (0.1%)	12 (0.2%)

*All patients with 1 dose of postoperative tromboprophylaxis

Nocturnal Pain after Knee Arthroplasty

THIENPONT E., DELFOSSE G., DAXHELET J.

Introduction

Nocturnal pain is a specific complaint among knee osteoarthritis (OA) patients and often considered a parameter to confirm the need for surgery. Pain during the night, may persist, increase or appear after surgery, with a negative impact on sleep, overall pain experience and rehabilitation.

The aim of this study was to evaluate sleeping quality and nocturnal pain for patients undergoing UKA and TKA.

Material and method

Prospective observational study on 111 patients (79 TKAs, 32 UKAs) who completed questionnaires reporting pain at night and at rest, Brief Pain Inventory (BPI) score, Pittsburgh Sleep Quality Index (PSQI), drug consumption and were all evaluated with the Neuropathic Pain Score (DN4) until one year follow-up.

Results

Poor sleeping quality rate was 54% for the pre-operative patients and was still 53% at one year after surgery.

Prevalence of nocturnal knee pain was 38,74% before surgery and 2,9% at one year after arthroplasty. Nocturnal pain after knee surgery was associated with higher pain scores at rest, during activity and at night. Nocturnal pain was associated with higher PSQI and DN4 scores and a higher consumption of painkillers or sleeping pills at W6. The multiple variable regression showed a statistically significant correlation between preoperative and postoperative nocturnal pain at D3 and W3. Compared to TKA, UKA patients reported significantly less nocturnal pain at W3 and W6.

Conclusion

Bad sleeping quality is present in 54% of knee arthroplasty patients before and after surgery.

UKA patients stopped using sleeping pills more frequently after one year postOP than TKA patients (UKA 16%, TKA 41%).

Nocturnal pain is present in 39% of knee arthroplasty patients before surgery and this drops to 3% after one year. Nocturnal pain is associated with higher pain intensity, neuropathic symptoms, increased medication consumption and poor sleeping quality and can be a first sign of neuropathic and chronic pain developing.

Night pain disappeared significantly faster after UKA (30%) than TKA (55%), with a tipping point around 6 weeks postoperatively.

The Role of soft tissue thickness in the “good-looking but painful TKA”: a retrospective analysis based on pre-operative CTscan evaluation

Innocenti M, Leggieri F, Secci G, Akkaya M, Civinini R

Introduction

“Good-looking but painful TKA” (GLPT) describes a situation where a total knee arthroplasty (TKA) appears satisfactory on radiographic images during outpatient follow-up suggesting success, but patients experience signs and symptoms indicating issues with the knee replacement. Adipose to muscle area ratio (AMR) around the knee joint was proposed as a novel indicator for assessing fatness, in particular localized obesity. The aim of this study was to assess if an elevated AMR is a possible contributor to GLPT.

Materials and methods

We retrospectively reviewed all patients with persistent pain after a primary TKA implanted due to primary osteoarthritis of the knee. Within this group, we selected patients who matched the criteria to be identified as patients with a “good-looking but painful TKA”: preoperative bone-on-bone primary osteoarthritis with a knee preoperative CT-scan. Exclusion criteria: presence of inflammatory rheumatic disease, drug/alcohol abuse, peripheral neuropathy, psychiatric disorders or neoplasms, those been revised during the first 24 months after the primary TKA, preoperative Kellgren-Lawrence<IV, ipsilateral hip Tonnis grade>II osteoarthritis, and follow-up<24 months.

Results

A total of 33 TKA patients were finally included in the study (23 women [69.7%]). The mean age was 71.74 years (range, 48-86), with an average BMI of 28.3kg/m²(range, 21-35). The mean AMR=2.5(range, 1.8-3.3). At a mean follow-up of 28 months (range, 24-34), the average Oxford Knee Score (OKS) was 22.3 (range, 14-29), and the Forgotten Joint Score (FJS) was 27.0 (range, 19-37). Spearman's rank correlation analysis revealed significant negative correlations between AMR and OKS ($\rho = -0.5$, $p = 0.003$) and FJS ($\rho = -0.4$, $p = 0.007$). Linear regression analysis demonstrated that AMR was a significant predictor of both OKS ($B = -2.7$, $t = -2.8$, $p = 0.014$) and FJS scores ($B = -2.0$, $t = -2.3$, $p = 0.031$).

Conclusion

The AMR significantly predicts postoperative outcomes in “good-looking but painful TKA” cases, outperforming other variables, including BMI. Additionally, a clear definition for “good-looking painful TKA” was proposed.

Differences in inflammatory mediators in synovial fluid in painful total knee arthroplasty might drive unexplained pain and can be modulated by intra-articular steroid administration

Mazur K., Deehan D., Paish H., Borthwick L., Kalson N.S.

Introduction

Chronic pain is a significant problem following total knee arthroplasty (TKA), with prevalence of 10-20%. The aetiology of pain post-TKA is incompletely understood. Here we tested the hypotheses that chronic inflammation drives pain post-TKA by examining synovial fluid (SF) from pain-free and painful TKAs and investigated whether inflammation could be modulated by intra-articular steroid.

Materials and Methods

Ten patients with painful TKAs and ten with pain-free TKAs were recruited. Painful TKA, defined as an Oxford pain subscale score of <15, underwent clinical, microbiological and radiographic assessment to exclude specific pain causes. All patients had a joint aspiration performed. Painful TKAs also had intraarticular steroid administered (80 mg Kenalog) and re-aspiration two weeks later. SF samples were analysed using a panel of immunomodulatory and inflammatory mediators by electrochemiluminescence ELISA. Differences in painful versus pain-free and in pre- and post-steroid SF were tested with Mann-Whitney and paired T-tests.

Results

There was a significant difference in SF appearance; 9/10 painful SF were bloodstained compared with 1/10 pain-free aspirates. CRP was significantly elevated in painful SF (331 versus 71 ng/ml, $p=0.0281$, Figure 1). Differences in expression of 10 other inflammatory mediators (G-CSF, IFN α 2a, IL-7, IL-17E, IL-17F, IL-1a, IL-21, IL-29, IL-33, TNF-B) were also found. Expression of CRP and 14 other mediators (including VCAM-1, Eotaxin 2, IL-17C, IL-2Ra, MDC, MIP-3b, PD-1, PD-L1, TARC, TGf-B2) were significantly attenuated following steroid administration ($p=0.0256$). Pain scores were significantly reduced at two weeks post-steroid (11 v. 17, $p=0.012$), but this difference was not maintained at six months.

Conclusion

Here we report differences in levels of key inflammatory mediators in patients with unexplained pain post-TKA and demonstrate that intraarticular steroid reduces both levels of these mediators and pain. These findings have implications for our understanding of unexplained pain and offer new therapeutic opportunities to target inflammation and pain post-TKA.

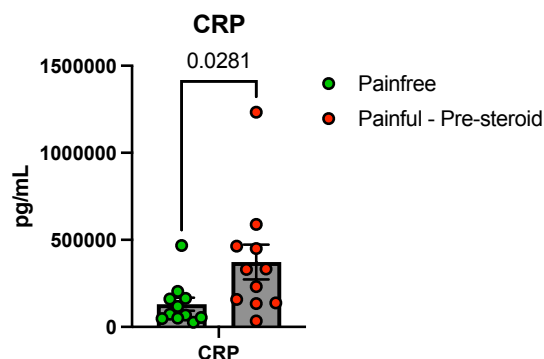


Figure 1. High inflammatory mediators in synovial fluid in painful versus pain-free TKAs.

Prophylaxis for Complex Regional Pain Syndrome Recurrence with and without Vitamin C in Total Knee Arthroplasty: A Propensity Score Matched Analysis on 1,088 Patients

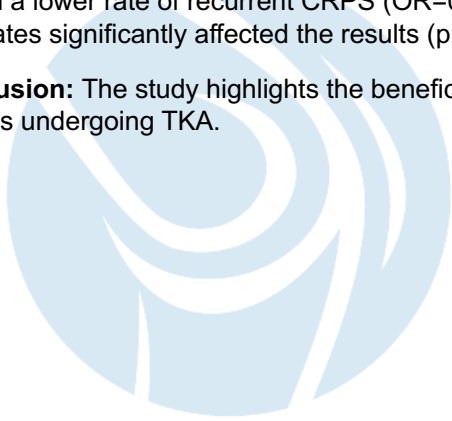
Hernigou P., Martinov S., Sabot L., Hupez A; Gamela G; Callewier A.; Bath O., Hernigou J

Introduction: Evidence regarding the effectiveness of vitamin C use for Complex Regional Pain Syndrome (CRPS) prevention of recurrence after TKA is lacking.

Materials and methods: Propensity-score-matched (PSM) cohort study from January 2017 to December 2021 at a single center, including 1,088 TKA patients, those with a history of CRPS (Group I) based on the Budapest criteria and those without. Additionally, Vitamin C was administered to a segment of patients' post-surgery, oral Vitamin C at a dosage of 1 gram daily for a period of 40 days following surgery. After 1:1 matching (baseline covariates) on the basis of gender, age, side limb, surgeon, and type of TKA, body mass index (BMI), presence of diabetes mellitus and hypertension, use of toxic (alcohol and tobacco), anesthesia modality, tourniquet, psychological context of anxiety, and the consumption of vitamin C with eating habit, the vitamin C group and the no-vitamin C group comprised 437 patients each.

Results: The prevalence of CRPS was 7% in the Vitamin C group and 15% in the no-vitamin C group, with a recurrence rate of CRPS significantly higher in patients with a previous history of CRPS (36.7% vs. 10.2%). The recurrence rate was lower among patients who received Vitamin C compared to those who did not (19% vs. 50%). Logistic regression analyses showed that vitamin C administration was associated with a lower rate of CRPS (odds ratio [OR], 0.39; CI 95%, 0.25 to 0.6; $p < 0.001$) than no vitamin C administration, as well as with a lower rate of recurrent CRPS (OR=0.19 CI 95%, 0.05 to 0.76; $p=0.018$). None of the baseline covariates significantly affected the results ($p > 0.05$ for all). Sensitivity analyses supported these findings.

Conclusion: The study highlights the beneficial role of Vitamin C in reducing the risk of CRPS recurrence in patients undergoing TKA.



European
Knee
Society

DAIR after PKA and TKA is associated with similar failure rates in the Swiss national arthroplasty registry SIRIS

Christen B., Delaloye J-R., Wahl P., Brand C.

Introduction

PKA have lower infection rates than TKA. However, DAIR is limited in PKA due to surgical approach and intact joint compartments, potentially influencing the success of implant-retaining treatment options. This study compares the rate for revision for PJI of PKA versus TKA, as well as the failure rate of DAIR for knee arthroplasties, in the Swiss national joint registry SIRIS.

Material and Methods

Retrospective analysis of the data from 1st September 2012 to 31st December 2023 available in the Swiss national joint registry SIRIS regarding first revision of primary PKA and TKA, respectively of the re-revision rate after revision of PKA and TKA for PJI treated with DAIR. Kaplan-Meier survival curves and hazard ratios (HR) were calculated.

Results

A total of 31,648 primary PKA and 167,886 primary TKA were available for analysis, and 130 (0.4%), respectively 1,362 (0.8%) of these were revised for PJI until 31.12.2023. The overall revision rate for PKA was higher than after TKA (HR 1.24, $p < 0.0001$), revision rate for PJI was only half as high (HR 0.51, $p < 0.0001$). The rate of re-revision after revision for PJI with DAIR was 36.0% (26.1-48.3%) for PKA and 27.1% (24.0-30.5%) for TKA after 3 years (HR 1.56, $p = 0.112$). Statistical precision for PKA was low due to small numbers ($n = 75$).

Conclusion

In the Swiss national joint registry SIRIS, the revision rate for PJI of primary PKA is only half as high as after primary TKA. Despite limitations in surgical options in PJI after PKA, the failure rate of revision for PJI with DAIR remains comparable to TKA, around 30%. Small numbers and lack of follow-up greatly limit any analysis of complications after PKA.

Title: Consensus statement on problematic knee replacement and revision knee replacement: A collaboration between EKS and BASK

Authors: **Porteous AJ**, Frank-Christiaan Wagenaar F-C, Price AJ, Phillips J, van Hellemond G. and the BASK/EKS Consensus Group on Problematic Knees Replacement

Introduction

This study reports consensus recommendations regarding assessment, treatment and arrangement of clinical services concerning problematic TKA and revision knee replacement (RTKA).

Materials and methods

A multiple round delphi consensus process was performed at a combined BASK/EKS meeting (London 2019) and at the EKS closed meeting (Kitzbühl 2023). The first meeting considered five statements and the second four statements.

Results

From the first meeting, 5 consensus statements with accompanying supporting evidence and text were agreed. (1) In suspected infection, a recognised diagnostic pathway and definition should be used (e.g. MSIS, ICM 1, ICM 2018, EBJIS) and documented; (2) Revision of infected knee arthroplasty should be treated in units with multidisciplinary teams; (3) Initial investigation of a problematic TKA should include a minimum of: clinical examination, X-Rays and blood tests, with further discussion with the MDT if required; (4) Units providing revision knee surgery should have surgeons with evidence of specific training or experience, and on-going minimum unit numbers; (5) National Orthopaedic/Knee Societies should develop a strategy on Revision TKA provision taking into account: workforce, revision burden, location, hospital infrastructure.

From the second meeting a further 4 consensus statements were agreed. Two statements were agreed text content answering the questions: (1) What should be included in the basic diagnostic workup of a painful TKA? and (2) Which are the key factors for surgeons to consider before offering the patient revision surgery? The other agreed statements were: (3) Pre-operative diagnosis is related to outcome in revision TKA and (4) Revision knee arthroplasty for pain, without a surgically treatable diagnosis, is unpredictable.

Conclusion

Conclusions: The agreed BASK-EKS and the EKS consensus statements on the assessment of problematic TKA and Revision TKA are recommended as the contemporary basis of optimal care for these patients and should inform future training and service developments.

Automatic detection of aseptic loosening in total knee arthroplasty using deep learning: an AI proof-of-concept study

Mills K., de Jong G., Laarhoven S.N., Maal T., Heesterbeek P.J.C.

Introduction

Implant loosening is a common indication for costly, complex revision surgeries in total knee arthroplasty. Currently, detection relies on radiological assessments through x-rays, CT scans, and bone scintigraphy, which have limitations in visibility and are time-intensive and costly. This proof-of-concept study aimed to develop a deep learning tool to detect implant loosening based on a set of 2-dimensional radiographs.

Materials and methods

A total of 307 sets (medial-lateral and anteroposterior) of x-ray images were collected, consisting of 159 loose implants and 148 non-loose primary total knee prostheses (both categories intraoperatively verified during a revision surgery). Using five-fold cross-validation with a 1:4 test-training split ratio, a deep learning algorithm was trained to predict implant loosening. The performance of the algorithm was evaluated using sensitivity, specificity, accuracy, and Receiver operating characteristic (ROC) curves, with the corresponding area under the curve (AUC).

Results

The mean \pm SD sensitivity was 61.1% \pm 12.8% and the mean \pm SD specificity was 87.9% \pm 8.1%. Accuracy was 73.9% \pm 6.2%. The overall AUC was 0.77, CI: [0.72-0.82]. (Figure 1)

Conclusion

This proof-of-concept study demonstrates that it is possible to train a deep learning algorithm using 2D x-ray images to detect implant loosening. Considering the relatively low number of sets, these results are promising. In addition to improving the algorithm itself, training the algorithm with more images and additional clinical patient- and implant-specific information could further enhance the accuracy of the tool. This tool could potentially be used in the future for patients experiencing issues after knee replacement surgery, helping to exclude implant loosening and thus saving time-consuming analyses, radiation exposure and healthcare costs.

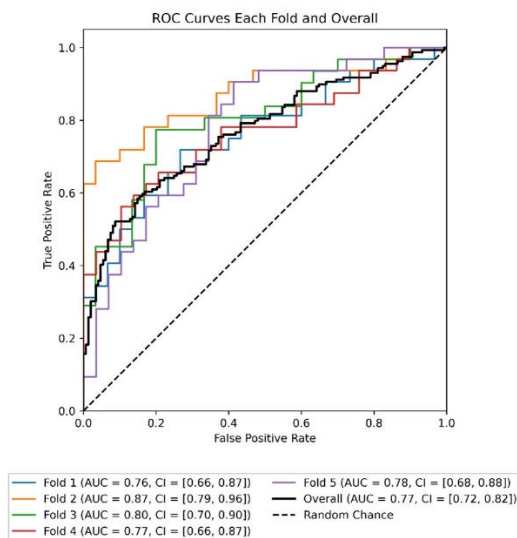


Figure 1. The ROC curves of all 5 folds separately as well as the overall ROC curve in black.

Accuracy of Digital Radiographic Preoperative Planning for Revision Total Knee Arthroplasty when using a Zonal Fixation Algorithm

Di Gennaro D, d'Amato M, Lamberti A, Salari P, **Baldini A**
From IFCA Institute, Florence Italy

Background

Aseptic loosening is one of the leading causes of failure of RTKA. Quality of implant fixation is usually judged intraoperatively and confirmed by postoperative radiographic analysis. A zonal fixation algorithm to verify intra and postoperatively the quality of implant fixation in RTKA has been developed and validated in a previous pilot study. We hypothesized that preoperative planning using a two-dimensional radiographic digital software in RTKA could obtain:

- 1) An accurate prediction of the quality of implant fixation according to a zonal fixation algorithm
- 2) A reliable and reproducible prediction of implant type, size, and fixation devices which will expedite and simplify the revision procedure

Methods

A consecutive series of preoperative planning of 77 patients who underwent RTKA at our Institute were performed using digital software (Sectra, Linköping Sweden). An algorithm for fixation developed at our institute was used to assign scores (insufficient fixation of the zone=0, partial fixation= 0.5, or full fixation=1) to each of the three fixation zones: epiphysis, metaphysis, or diaphysis. The goal of the fixation score based on a clinical pilot study is to achieve at least 1.5 points for both femur and tibia for unconstrained or varus-valgus constrained implants, and 2 points for hinged implants.

All the revision implants were then analyzed by two different observers for:

- Size (considering a margin of error of ± 1 size)
- Type of fixation (fully cemented or hybrid fixation)
- Percentage of times that a metaphyseal cone was implanted when planned
- Percentage of times that the planned fixation score was respected

Results

The final implant differed more than one size from the planning in 7% of cases for the femoral component and 10% for the tibial component. The planned type of fixation was respected in 97% of cases. The metaphyseal cone was implanted in 28% of patients in the femur and 43% in the tibia, with a planning predictability of 87% and 88%, respectively. The fixation score was predicted in the femur in 88%, 98%, and 97% of cases, in the epiphysis, metaphysis, and diaphysis respectively. Fixation score in the tibia was predicted in 91%, 99%, and 86% of cases, in the epiphysis, metaphysis, and diaphysis respectively.

Conclusion

Digital radiographic planning before RTKA allows to accurately anticipate the amount of implant fixation when using a zonal fixation algorithm.

Digital preoperative planning allows the surgeon to take strategic surgical decisions before starting the procedure. Its accuracy and reliability allow the surgical team to share the workflow of the procedure. Preoperative planning, having shown itself to be highly reliable and accurate in choosing the type of fixation, sizes, and implants to use, has become an essential tool in all RTKA procedures.

Patient reported outcome measures (PROM) from aseptic revision after total knee arthroplasty

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²Dept. of Orthopaedic Surgery, Hvidovre University Hospital

Introduction

A common cause of total knee arthroplasty (TKA) revision is infection, which has led to extensive research into the outcomes following this complication. However, outcomes after different types of aseptic revisions remain poorly understood. More specifically, little is known about changes in patient reported outcomes (PROMS) after revision TKA for different indications.

This study aimed to investigate how different indications for aseptic TKA revision impact PROMs.

Materials and methods

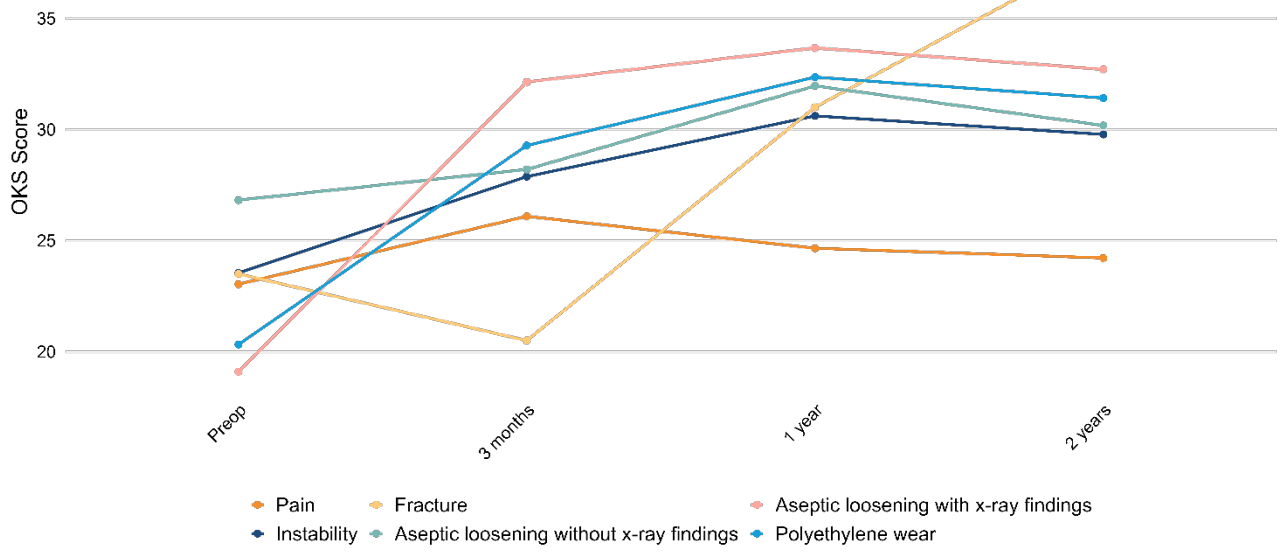
This cohort study (with prospectively collected PROM data) included 80 primary TKA patients from a single institution who underwent revision surgeries between 2018 and 2023. Patients were stratified based on the underlying cause of aseptic revision; pain, instability, periprosthetic fractures, aseptic loosening with x-ray findings, aseptic loosening without x-ray findings, and polyethylene wear. PROMs (including Oxford Knee score) were collected preoperatively and at 12 months follow-up. The response rate for OKS PROM scores was 79%. For the missing data, we performed Multiple Imputation by Chained Equations using predictive Mean Matching for the OKS scores.

Results

The delta-value (mean-difference) for the OKS-score between pre and 12 months postoperative for each aseptic revision group are described as follows; pain (1.62, CI: -3.4, 6.8), instability (7.1, CI: 3.4, 10.7), periprosthetic fractures (7.5, CI: -9.2, 24.2), aseptic loosening without x-ray findings (5.0, CI: -0.7, 11.0), aseptic loosening with x-ray findings (14.6, CI: 10.7, 18.4), and polyethylene wear (12.0, CI: 6.0, 18.0).

Conclusion

Significant improvement in PROMs (MIC > 5) was observed from preoperative to 12 months postoperatively in 4 of 6 aseptic TKA causes (instability, periprosthetic fracture, loosening with x-ray findings, and polyethylene wear). This study confirms that revision TKA with pain as indication leads to unsatisfactory results and should be avoided.



Gain in Range of Motion after Revision Total Knee Arthroplasty for Severe Stiffness with a Rotating Hinge Implant.

van Laarhoven SN, de Groot J, van Hellemond GG, Heesterbeek PJC

Introduction

Stiffness is one of the most devastating complications after total knee arthroplasty (TKA). For the severe stiff knee, $\leq 70^\circ$ range of motion (ROM) or $\geq 20^\circ$ fixed flexion contracture (FFC), revision TKA (rTKA) with a rotating hinge-knee implant (rHK) and extensive arthrolysis is an option to improve ROM. What is the functional benefit after rTKA with rHK and which factors were associated with ROM gain?

Materials and Methods

All consecutive rTKAs from 2012-2022 for severe stiffness with a rHK implant and at least 1 year follow-up were included. Patients characteristics, pre- and postoperative ROM and surgical details were collected. T-tests or non-parametric alternatives were used to investigate the association between patient parameters and ROM gain.

Results

A total of 131 rHK implants were placed in 128 patients. Median follow-up was 1.0 (1.0-1.2) years with 12.2% lost to follow up. Patients were 64.0 ± 8.7 years old, 87 (68.0%) were female and had a median BMI of $29.7(26.8-33.6)$ kg/m². Mean pre-op ROM was $48 \pm 17^\circ$ and 45.8% had an FFC $\geq 20^\circ$. Mean ROM gain was $37 \pm 22^\circ$ and 7.8% of the knees had a persistent FFC $\geq 20^\circ$. 14 knees had perioperative positive cultures (PJI). Re-revision was needed in 9 patients, eventually resulting in an amputation in 2 patients and an arthrodesis in one. Gender and smoking were not associated with ROM gain. Patients with diabetes had lower ROM gain ($p=0.040$). Although an accompanying reason for revision was associated with lower ROM gain ($p=0.026$), patients with a PJI gained significantly more ROM after rTKA ($p=0.012$). (Figure 1)

Conclusion

rTKA for severe stiffness with a rHK implant is a valuable option to gain ROM and resolve FFC. The mean ROM gain was around 37° , which is a substantial functional benefit. Diabetes and accompanying reason for revision were negatively associated, whereas patients with PJI showed higher ROM gain.

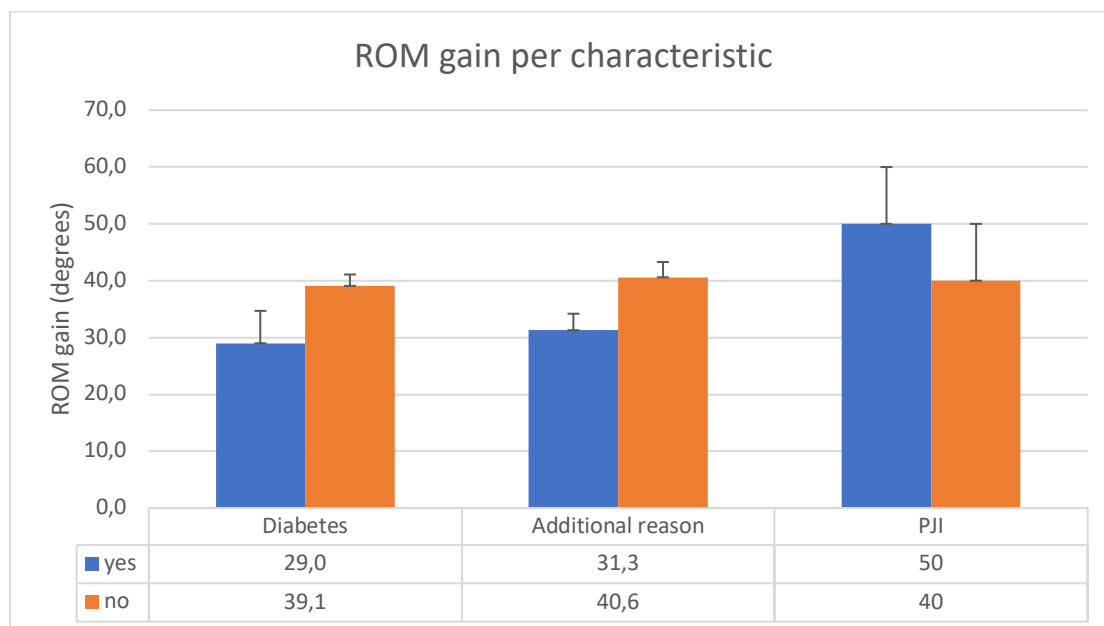


Figure 1: ROM gain per characteristic

Extensor mechanism allograft after total knee arthroplasty: an effective procedure but with a significant risk of complications.

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^b Univ Lyon, Claude Bernard Lyon 1 University, IFSTTAR, LBMC UMR_T9406, F69622, Lyon, France.

Objectives

Extensor mechanism rupture is a feared complication after total knee arthroplasty (TKA). The current trend for chronic ruptures is extensor mechanism allografts (EMA). This study aimed to evaluate EMA's survival and functional outcomes after TKA.

Methods

This retrospective, single-centre study included all patients who underwent an EMA on TKA between 2011 and 2022, with a minimum follow-up of 12 months. Exclusion criteria were allografts on native knees and partial EMA. Fifty EMA were included (50 patients). The mean age was 65.8±9 years. Most extensor mechanism ruptures were located on the patellar tendon (36.0%) and the quadriceps tendon (34.0%). Twenty-one patients underwent EMA at the same time as TKA revision (42%). Twenty-nine patients underwent isolated EMA without TKA revision (58%). The analysis focused on the rate of mechanical and septic complications, survival without revision of the allograft, and functional outcomes.

Results

The mean knee extension deficit was 17.8° (±29.5°) after a mean follow-up of 20.4 months (12-53). The complication rate was 30% (n=15), including 6% of septic complications (n=3) and 24% of mechanical complications (n=12). The most common cause of mechanical failure was quadriceps tendon rupture (n=7). The allograft revision-free survival rate was 81.5%, with a mean revision time of 11.3 months. Functional outcomes, mechanical complication rates, and allograft survival were not affected by concomitant TKA revision. In the preoperative quadriceps tendon rupture subgroup, there was a 29.4% re-rupture at the same level of the quadriceps tendon.

Conclusion

EMA on TKA was a reasonable and reliable surgical option, although considered a "last resort" procedure. This procedure was associated with significant morbidity and modest functional outcomes but with a satisfactory mid-term allograft survival rate. The quadriceps tendon was a particular area of vulnerability for these allografts. Concomitant revision of the TKA did not increase complications or compromise allograft survival.

Efficiency of implant removal in total knee arthroplasty revision

Chirico M, Meschini C, Salari P, **Baldini A**

Introduction: The complexity of total knee arthroplasty revision (rTKA) is related not only to the reconstruction phase, but very often to the explantation phase. The aim of this study is to present a standardized technique for implant removal during rTKA, emphasizing the reduction of bone loss, the limitation of intraoperative complications, the reduction of explantation time and the reproducibility with the use of a reduced set of instrumentation.

Materials and methods: Preoperative evaluations included imaging (x-rays) to analyze bone loss by the Anderson Orthopedic Research Institute (AORI) classification to categorize both preoperative and intraoperative bone defects. Intraoperative technique focused on systematic use of reciprocating saw, small osteotome and a blunt tip impactor to ensure effective removal while preserving bone integrity. Outcomes were measured based on operative time and bone loss. Descriptive analyzes of the variables and inferential analyzes were performed using the Student's t test and the Mann-Whitney test for parametric and non-parametric continuous variables, and the Chi-square test for differences in frequency distribution.

Results: The difference between expected and intraoperative AORI in the femur was statistically significant ($p=0.001$) especially for cemented small and medium sizes components. No difference between prosthesis types and prosthesis size and removal time for femur and tibia. In the femur, there is a statistically significant difference ($p<0.001$) in the removal time compared to the state of the component, with longer times observed for well fixed. Currently, 38 cases have been analyzed. Of these, 18 were well fixed. The average removal time for the femoral component was approximately 168 seconds and approximately 131 seconds for the tibia. Bone loss during implant removal was approximately 2.10 ml for the femoral component and approximately 0.42 ml for the tibial component.

Conclusion: Accurate preoperative and intraoperative assessments were essential to achieve consistent results. The proposed method reduced bone loss and did not impact on the duration of the revision procedure, reducing the risk of periprosthetic infections and operative complications. The results highlight the need for a well-defined and reproducible strategy for implant removal in order to simplify rTKA procedures. By reducing the duration of surgery and bone loss, this approach promotes better results and facilitates subsequent reconstruction phases.

Antiseptics' Concentration, Combination, and Exposure Time on Bacterial and Fungal Biofilm Eradication

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Introduction

This study aims to assess the activity of solutions containing povidone-iodine (PI) and hydrogen peroxide (H₂O₂) alone or combined on the biofilm of microbial species in the context of periprosthetic joint infection (PJI).

Materials and methods

Different antiseptic solutions were tested on 2-day-old biofilms of Gram-positive and Gram-negative bacteria and fungi at 1 and 3 minutes of exposure. The efficacy of these solutions was evaluated by measuring the biofilm metabolic activity by methoxynitro-sulfophenyltetrazolium carboxanilide (XTT) reduction assay. The anti-biofilm effect of 5% PI and 0.3% PI + 0.5% H₂O₂ was tested on a 5-day-old biofilm using colony forming unit counts and an XTT reduction assay.

Results

PI and H₂O₂ solutions showed concentration-dependent anti-biofilm activity except for *E. faecalis*. PI at 5% was the most active solution against the 2-day-old biofilm of all test microorganisms. The 0.3% PI + 0.5% H₂O₂ solution had a significant effect only at 3 minutes. The 5% PI and 0.3% PI + 0.5% H₂O₂ effect was evaluated on 5-day-old biofilms. PI at 5% produced a significant reduction in metabolic activity at both 1 and 3 minutes; 0.3% PI + 0.5% H₂O₂ caused a significant activity against all Gram-positive strains after 3 minutes, with a greater metabolic activity reduction than 5% PI.

Conclusion

In the case of PJI caused by Gram-positive bacteria, 0.3% PI + 0.5% H₂O₂ could be used for wound irrigation for 3 minutes of exposure. In the case of PJI with a different etiological agent or PJI with an unknown etiology, it is advisable to use 5% PI for 1 minute of exposure.

What Is the Most Reliable Concordance Rate of Preoperative Synovial Fluid Aspiration and Intraoperative Biopsy to Detect Periprosthetic Joint Infection in Knee, Hip and Shoulder Arthroplasty?

Akkaya M, Zanna L, Sangaletti R, Bokhari A, Gehrke T, Citak M

Introduction

The accuracy of preoperative synovial fluid microbe detection in periprosthetic joint infection (PJI) is widely reported. However, the reliability of this diagnostic modality amongst the different joints is not yet described. We aimed to compare the concordance rate between preoperative synovial fluid and intraoperative tissue cultures in shoulder, knee and hip PJIs.

Materials and methods

A total of 150 patients who met the 2018 International Consensus Meeting criteria for shoulder, hip and knee PJI were retrospectively reviewed. This cohort was divided into three groups based on the involved joint (shoulder, hip or knee), with 50 patients in each group. Cultures were collected and held for culture for 14 days.

Results

The overall concordance rate was 56.7%. Concordance rates between preoperative and intraoperative cultures were 60%, 56% and 54% for the knee, shoulder and hip joints, respectively. The analysis of high- or low-virulence and difficult- or not-difficult-to-treat germs did not reveal any significant differences between preoperative and intraoperative cultures in any of the groups.

Conclusion

In conclusion, even considering the higher concordance in knee PJI, the overall discordance between preoperative and intraoperative cultures should prompt surgeons not to rely solely on preoperative synovial fluid culture data in determining appropriate treatment and antibiotics.

Seriarte "Ad Interim" Knee Aspiration with the spacer in place. Are We Doing the Right Thing in Managing PJI?

Balato G, Ascione T, De Mauro D, Festa E, Di Gennaro D.

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Introduction

In the two-stage exchange procedure, defining the ideal time of reimplantation and monitoring the response to antibiotic treatment is very challenging. Decisions were generally made based on clinical features and serum biomarker trends. Recently, a diagnostic score based on synovial fluid cell count (WBC count > 934 cells/uL and PMN >52%) and d-dimer (> 1110 ng/mL) evaluation has been proposed to detect patients with a high risk of infection recurrence before reimplantation. This study aims to evaluate the trend over time of synovial cell count and the time patients reach the proposed cutoff.

Materials and methods

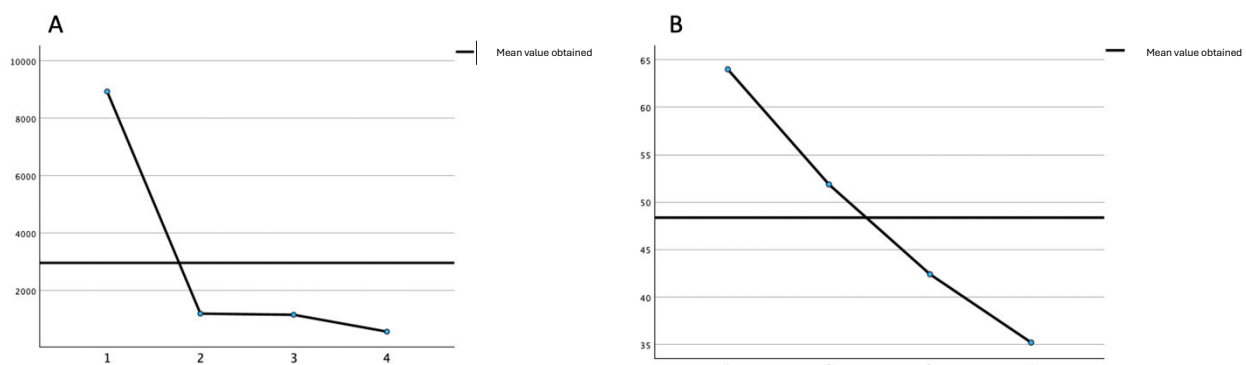
The study included 81 patients with a median age of 73 (46 to 91 years) who underwent a 2-stage revision for chronic knee PJI. After spacer placement, synovial fluid aspiration was obtained three times (four, six and 8 weeks) for cell count before proceeding to the second stage. A t-student test was used to compare mean results obtained over time, and chi-square test was used to evaluate the reaching of values below the proposed thresholds at different times.

Results

Synovial fluid cell counts and PMN percentages reduced over time, with statistical differences among evaluations (Figure 1). Patients who presented sub-threshold values (WBC count < 934 cells/uL and PMN < 52%) significantly increased at different evaluation times, reaching 89% of patients eight weeks after spacer implantation. The mean time needed to achieve the cutoff values reducing the risk of infection recurrence was 55.5 ± 22.6 days.

Conclusion

This study highlights the progressive decrease of WBC count and % PMN values in Synovial fluid between 4, 6, and 8 weeks after spacer implantation as the result of the response to surgical and antibiotic treatment. An earlier reimplantation can be imagined, considering the time needed to achieve the cutoff values proposed to reduce the infection recurrence.



Graph 1. The graph highlights WBC (a) and %PMN (b) trend over the time at T1 (pre-operative values), and T2, T3 and T4 (4, 6 and 8 weeks, respectively).

Title: Using the osteoarthritis initiative (OAI) dataset to assess the validation and interobserver reliability of the coronal plane alignment of the knee (CPAK) phenotypic classification

Wynell-Mayow W, Hall T, Hayward A, Singh A, Van Arkel R, **Gareth G Jones**

Introduction

The Coronal Plane Alignment of the Knee (CPAK) classification is increasingly used to guide alignment strategies during total knee arthroplasty (TKA). Using long-leg radiographs (LLRs) from the Osteoarthritis Initiative (OAI) database, this study assessed the impact CPAK class measurement variability might have on surgical decision making.

Material and Methods

1128 LLRs from the OAI database were included, and labelled by one orthopaedic surgeon (OS1) using the original CPAK methodology. Distribution of CPAK values were compared to the original CPAK dataset. A subset of 75 LLRs were labelled by a second orthopaedic surgeon (OS2). Mechanical HKA (mHKA) values were also compared to published ground truth OAI values. A Monte Carlo simulation was performed to understand the impact of MPTA and LDFA variability on CPAK agreement.

Results

OS1 and OS2 were in near perfect agreement for mHKA (mean absolute error [MAE]: 0.23°; ICC:1.00), and with OAI ground truth values (MAE:0.45°/0.56°; ICC:0.99/0.99). CPAK distribution was nearly identical to the original CPAK dataset (JSD:0.03). The inter-observer reliability for CPAK constituent angles (MPTA and LDFA) were less reproducible, but consistent with published values (MAE: 0.41°/0.71°; ICC: 0.96/ 0.91). Discrepancies in aHKA and JLO led to a 20% (95%CI: 10.9%-29.1%) disagreement in CPAK classification, and an 8.0% (95%CI: 1.9%-14.1%) disagreement in surgical decision making for kinematic or mechanical alignment. Monte Carlo simulations indicated that an aHKA MAE of <0.1° would be required for a CPAK disagreement rate below one in twenty (5%) and an alignment disagreement rate below one in fifty (2%).

Conclusions

Despite excellent inter-observer reliability for measurement of MPTA and LDFA, there was a significant (20%) disagreement in CPAK classification. The mean absolute error (MAE) of aHKA measurements would need to be reduced to <0.1° to achieve a 5% CPAK disagreement, which is unrealistic using LLRs. Surgeons should exercise caution when using LLRs alone to guide alignment in TKA.

Windswept deformity of the knee: prevalence and predictive factors in osteoarthritic and healthy populations

Moore J, Van de Graaf V A, Wood J A , Humburg P, **Colyn W**, Bellemans J, Chen D B, MacDessi S J

Introduction

This study examined windswept deformity (WSD) of the knee, comparing prevalence and contributing factors in healthy and osteoarthritic (OA) cohorts.

Materials and methods

A case-control radiological study was undertaken comparing 500 healthy knees with a consecutive sample of 710 OA knees undergoing bilateral total knee arthroplasty. The mechanical hip-knee-ankle angle (mHKA), medial proximal tibial angle (MPTA), and lateral distal femoral angle (LDFA) were determined for each knee, and the arithmetic hip-knee-ankle angle, joint line obliquity, and Coronal Plane Alignment of the Knee types were calculated. WSD was defined as a varus mHKA of $< -2^\circ$ in one limb and a valgus mHKA of $> 2^\circ$ in the contralateral limb. The primary outcome was the proportional difference in WSD prevalence between healthy and OA groups. Secondary outcomes were the proportional difference in WSD prevalence between constitutional varus and valgus CPAK types, and to explore associations between predefined variables and WSD within the OA group.

Results

WSD was more prevalent in the OA group compared to the healthy group (7.9% vs 0.4%; $p < 0.001$). There was a significant difference in means and variance between the mHKA of the healthy and OA groups (mean -1.3° (SD 2.3°) vs mean -3.8° (SD 6.6°) respectively; $p < 0.001$). No significant differences existed in MPTA and LDFA between the groups, with a minimal difference in aHKA (mean -0.9° healthy vs -0.5° OA; $p < 0.001$). Backwards logistic regression identified meniscectomy, rheumatoid arthritis, and osteotomy as predictors of WSD (odds ratio (OR) 4.1 , $p = 0.002$; OR 11.9 ; $p = 0.016$; OR 41.6, $p \leq 0.001$, respectively).

Conclusion

This study found a 20-fold greater prevalence of WSD in OA populations. The development of WSD is associated with meniscectomy, rheumatoid arthritis, and osteotomy. These findings support WSD being mostly an acquired condition following skeletal maturity.

CPAK type III valgus knees exhibit lateral pivot motion during squatting

Peersman G.^{1,2}, Ito J.³, Taylan O.², Peersman G.², Bellemans J.⁴, Scheys L.²

INTRODUCTION: This study aimed to perform a detailed analysis of the pivoting motion of CPAK type III knees during ex-vivo simulated squatting. Considering the more lateral weight-bearing axis in the valgus knee, it was hypothesized that weight-bearing motion is associated with lateral pivot motion.

METHODS: We retrospectively analyzed tibiofemoral kinematics of 69 native fresh-frozen cadaveric knees subjected to squatting motion (35°-100°) on a physiological knee joint simulator. 17 CPAK type III knees were isolated and anatomic reference frames were defined. For each specimen, we discerned between medial and lateral pivoting based on the Instantaneous center of rotation (ICOR). To determine the ICOR during squatting motions, the medial-lateral axis of the femur was projected onto the transverse plane of the tibia. For each consecutive pair of knee flexion angles, the intersection points of the medial-lateral axis of the femur projected onto the tibial plateau were calculated, resulting in the ICORs as a function of knee flexion angle. To further explore the respective associations of the arithmetic hip-knee-ankle angle (aHKA) and joint line obliquity (JLO) with the likelihood of lateral pivoting motion throughout knee flexion, a weighted kernel density estimation was performed. Herein, each specimen was weighted by the percent occurrence of lateral pivot throughout the flexion range and represented in the aHKA and JLO parameter space based on their respective alignment parameters.

RESULTS: Each of the 17 CPAK type III knees exhibited a lateral center of rotation (lateral pivot) during squatting, whereas for 8 of these 17 lateral pivoting was the predominant pattern, extending over more than half of the flexion range. Overall, lateral pivoting primarily occurred when flexion was $\geq 58.5^\circ$ (Fig1).

CONCLUSION: This study identified that CPAK type III knees demonstrate lateral pivot motion during squatting, primarily from mid to deep flexion.

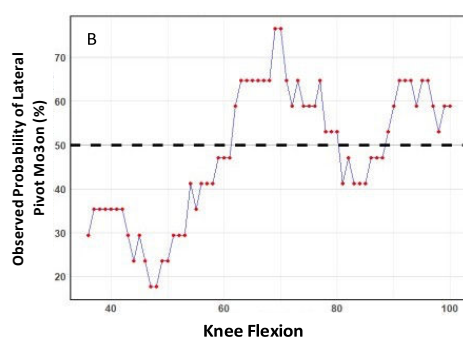


Fig1.: Probability of lateral pivoting observed during squatting within the cohort of (n=17) CPAK type 3 specimens as a function of the knee flexion angle.

Is There Really a Medial Pivot in the Normal Knee? A Robotic Cadaveric Study on 68 Human Specimens

Parratte S., Benazzo F., Siggelkow E., Blatter I., Bandi M.

Introduction

A switch from PS or CR to medially constrained bearing surfaces has been observed in total knee arthroplasty during the past years. While historical concepts are based on a rigid medial pivot, more recent designs provide some medial mobility towards flexion. The goal of this cadaveric study was to better define the behavior of the medial and lateral compartment of the normal knee in the transverse plane.

Material and Methods

Anteroposterior envelopes of motion of the medial and lateral condyle of 68 intact knee specimens were robotically measured using a previously published protocol. The knees were subjected to transverse loading (internal-external: $\pm 6\text{Nm}$, anteroposterior, mediolateral: $\pm 100\text{N}$) under 44N compression at 7 flexion angles from extension to 120° flexion. Condylar kinematics were expressed by the anteroposterior motion of the flexion facet centers (FFC).

Results

The medial and lateral condyles exhibited anteroposterior laxities in the same order of magnitude (medial: $15.3\pm 3.5\text{mm}$, lateral: $18.1\pm 3.5\text{mm}$, $p < 0.001$). The medial envelope shifted only little in the anteroposterior direction throughout the arc of flexion. Contrary, the lateral envelope shifted posteriorly with increasing flexion (net posterior shift: medial: $-0.6\pm 3.1\text{mm}$, lateral: $15.3\pm 3.7\text{mm}$, $p < 0.001$). Compartmental anteroposterior envelope of motion patterns of varus, neutral and valgus knees resembled each other closely (Figure 1).

Discussion and conclusion

This study shows that the native anteroposterior mobility of the medial condyle is more prominent than initially thought. Rather than a rigid medial pivot, the normal knee comprises a medial zone. The medial compartment is more confined throughout the arc of flexion but still exhibits mobility. Knee behavior in the transverse plane was found to be largely independent of HKA. The results support the use of medial congruent articulations that are not fully rigid in the anteroposterior constraint for both varus and valgus knees.

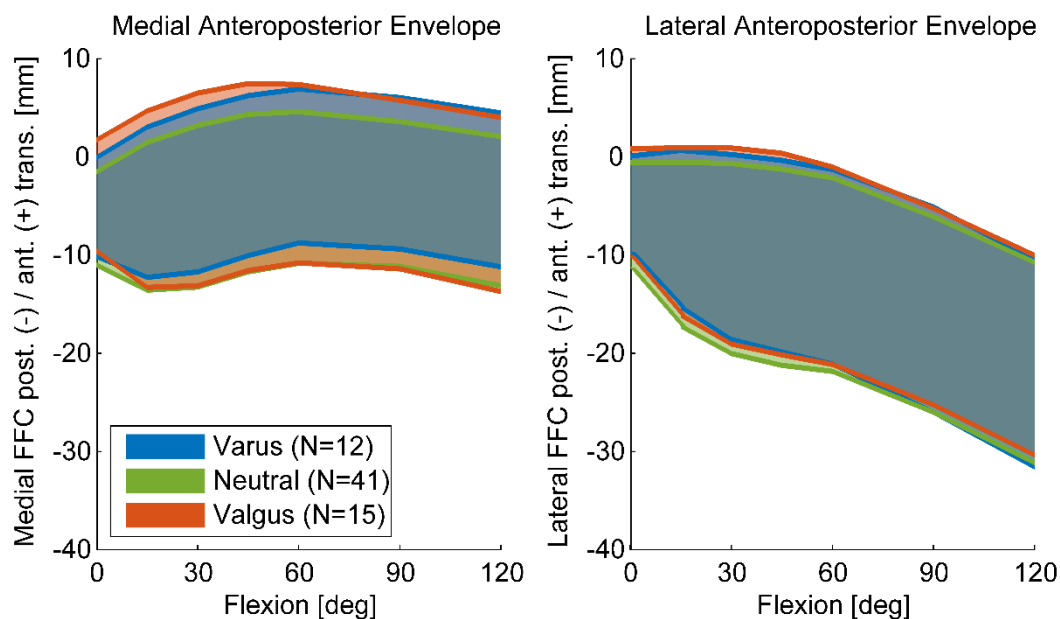


Figure 1: Average anteroposterior envelope of motion of medial and lateral condyle.

A navigation-based analysis of native knee collateral ligament elongation patterns: CPAK classification subgroups exhibit phenotype-specific ligament behaviour

Peersman G, Bellemans J, Ascani D., Taylan O., Scheys L., Pandit H., Ophoff G.

Abstract

Introduction The increasing demand for total knee arthroplasty (TKA) due to osteoarthritis has highlighted the need to enhance post-surgical outcomes, particularly for younger, active patients. Advanced technologies, including computer-assisted (CAS) and robotic-assisted (RAS) surgery, offer improved precision and personalization in ligament balancing, potentially enhancing patient satisfaction. This study investigates the elongation patterns of knee collateral ligaments across various coronal plane alignment phenotypes (CPAK classification), aiming to refine soft tissue balance in TKA.

Methodology In this cross-sectional study, 81 patients undergoing TKA at ZAS Antwerp hospitals (2023-2024) were analyzed using the CT imaging based Medacta NextAR CAS system. Pre-operative X-rays measured knee angles (LDFA and MPTA), allowing for classification into knee alignment phenotypes (CPAK). The NextAR system facilitated real-time tracking of medial (MCL) and lateral (LCL) collateral ligament elongation throughout knee motion. Data were normalized and analyzed using a linear mixed model to assess the impact of knee alignment on ligament elongation, with ANOVA and Fisher's LSD method applied at a 95% confidence level.

Results / Discussion Results showed unique ligament behaviors among the CPAK phenotypes. The MCL generally maintained near-isometric behaviour, tightening in flexion for varus-aligned knees and loosening for valgus-aligned types, particularly CPAK III, suggesting the aHKA axis as a predictor of MCL behavior. The LCL consistently loosened in flexion across all knee types, with CPAK VI exhibiting pronounced early flexion loosening, potentially due to joint line orientation or sample size limitations. These findings suggest that individualized TKA approaches based on ligament patterns could better replicate natural knee kinematics.

Conclusion By tailoring TKA to specific knee phenotypes, incorporating phenotype-specific ligament behaviour may improve soft tissue balancing, enhance patient satisfaction, and reduce revision surgeries. This study lays the groundwork for future research on personalized TKA approaches to achieve more natural knee function and improved surgical outcomes.

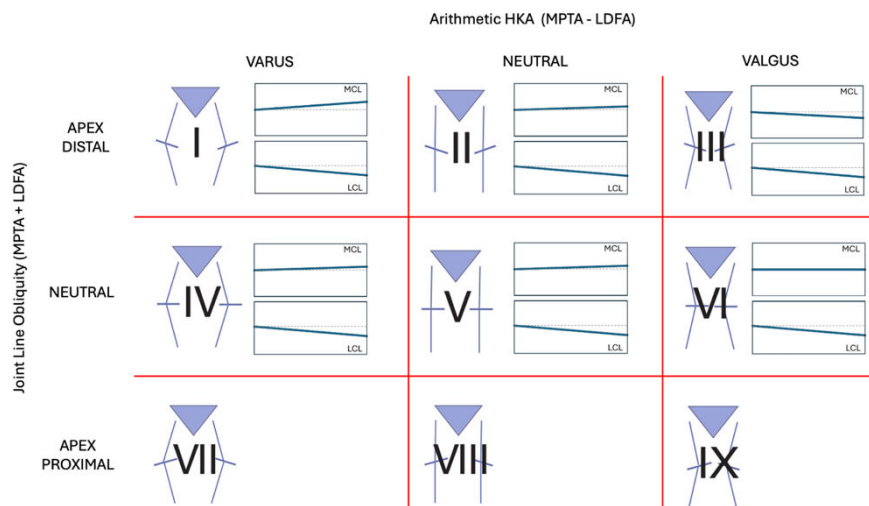


Fig. 1: The distinctive characteristics of the collateral ligaments of each knee phenotype are incorporated into the CPAK matrix of Macdessi et al.(1)

Which Configuration Restores Native Knee Kinematics and Ligament Balance: Bi-Unicompartmental, Bi-Cruciate Retaining, or Posterior-Stabilized Total Knee Prostheses?

NERI T¹, GENESTOUX V², TESTA R², PHILIPPOT R², VISTE A¹

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Orthopaedics Department, University hospital of saint Etienne, France

Introduction: We hypothesized that less invasive implants, preserving bone stock and soft tissues, would better replicate native knee kinematics and femorotibial spaces. This study aimed to compare kinematics and ligament balance among three configurations of increasing invasiveness: Bi-Unicompartmental Prostheses (Bi-Uni), Bi-Cruciate Retaining Prostheses (BCR), and Posterior-Stabilized Prostheses (PS-TKA).

Materials and Methods: A cadaveric biomechanical study was conducted on 12 knees. Exclusion criteria included prior surgery, advanced osteoarthritis, or frontal or sagittal deformities. Kinematics and femorotibial gaps were analyzed using a Brainlab® navigation system. Configurations tested included native knee, Bi-Uni, BCR, and PS-TKA (Figure 1), using Smith-Nephew® implants and the Navio® robotic system.

Results: Kinematic analysis revealed significant differences between all prosthetic configurations and the native knee. The Bi-Uni configuration most closely matched native kinematics, followed by BCR and PS-TKA.

Medial femorotibial gap increased for all prostheses compared to the native knee. The Bi-Uni showed the tightest medial gap, most similar to the native knee, followed by BCR and PS-TKA.

For lateral femorotibial gap, all configurations differed significantly from the native knee. No significant difference was found between Bi-Uni and BCR, while PS-TKA resulted in greater lateral laxity.

Discussion: No implant fully restored native knee characteristics. The Bi-Uni configuration was closest to the native knee for global kinematics and medial laxity, followed by BCR. PS-TKA produced the most divergent results. The similarity between Bi-Uni and BCR laterally likely reflects the medial condyle design of the UKA.

Conclusion: Cruciate-preserving implants better replicate native femorotibial gaps than PS-TKA, which sacrifices both cruciate ligaments. Surgeons should prioritize cruciate-preserving configurations when possible. Further clinical and survival studies are necessary to confirm these findings.

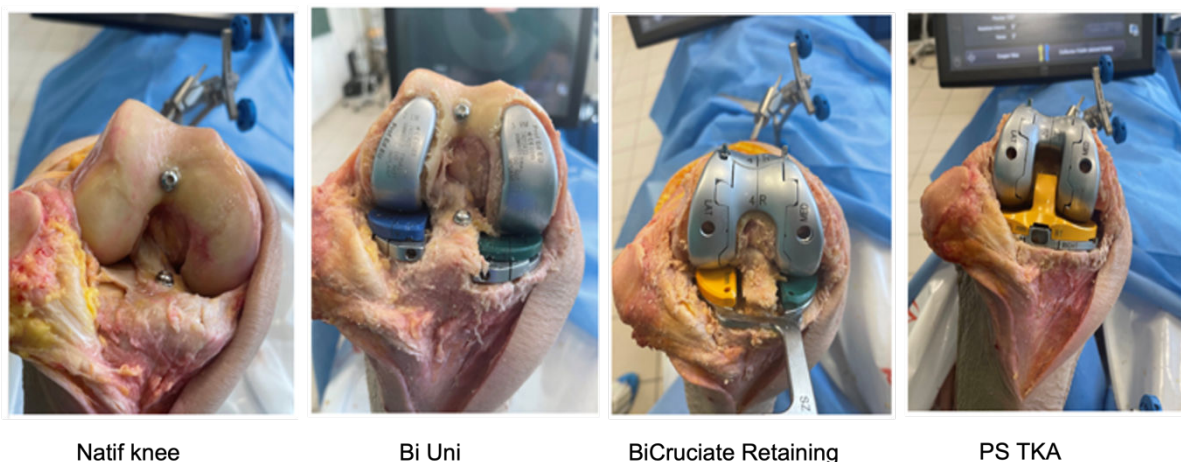


Figure 1: Configurations tested

Development of a Machine Learning Model for Determining Alignment in Knees Following Total Knee Arthroplasty

Faschingbauer, M., Chandrashekar, A.S., Suh, Y, Fox, J.A., Mika, A.P., Moyer, D.C., Polkowski G.G., Martin, J.R.

Introduction: Malalignment remains a major reason for implant failure following total knee arthroplasty (TKA). Manual analysis of images at a large scale is untenable and machine learning (ML) models may be a useful tool for determining alignment following TKA and can help identify patients who are at risk for failure. We aimed to develop a ML model that can accurately determine TKA alignment from full length hip-to-ankle films.

Methods: Long leg radiographs (LLR) from 550 patients who had undergone primary TKA were collected, of which 440 were utilized to train a ML model to identify landmarks used for alignment measurement. These landmarks included the femoral head, the intertrochanteric region, the femoral midshaft, the distal aspects of the medial and lateral implant femoral condyle, the medial third and lateral third of the superior border of the tibial base plate, the tibial midshaft, and the tibial plafond. Following identification of these landmarks, mechanical hip-knee-ankle angle (mHKA), lateral distal femur angle (LDFA), medial tibial plateau angle (MPTA), and joint line obliquity (JLO) were calculated. A separate random sample of 110 LLR were utilized to test the accuracy of the ML model.

Results: The ML model was effective in analyzing one image in less than 0.1 second. The mean angle error between human measured and ML model measured mHKA was 0.08° (standard deviation [SD= 0.84]), the mean error for LDFA was 0.7° (SD= 0.9), the mean error for MPTA was 0.39° (SD= 0.32), and the mean error for JLO was 0.7° (SD= 0.8).

Conclusions: We describe a ML model that demonstrates high accuracy in determining alignment following TKA and demonstrates the vast potential of applying artificial intelligence technology to improving clinical workflow and increasing research productivity in total joint arthroplasty.

Three-compartment phenotype concept (3D-FKP) of total knee arthroplasty alignment - Mismatch between distal femoral, posterior femoral and tibial joint lines in 83% of non-osteoarthritic and 88.8% of osteoarthritic knees

Hirschmann M.T.

Purpose: Assess whether patients with different coronal functional knee phenotypes (FKP) have distinctly different rotational alignment variations to justify an extension of the FKP concept to include rotational alignment parameters. Determine the frequency of bony congruency between the anterior, distal, and posterior femoral and proximal tibial joint lines using the extended FKP concept. Connect these findings to clinical practice by simulating the impact of different alignment concepts on the most common FKP.

Methods: The posterior condylar angle (PCA) and anterior trochlear angle (ATA) were measured in 265 non-OA knees. PCA measurements based on 3D reconstructed CT of 2,692 OA knees data were extracted from the Knee-PLAN® 3D database. The patients were categorized into phenotypes based on these parameters. One phenotype represents an alignment variation of either the posterior femoral joint line (=PCA) or the anterior femoral joint line (=ATA) in the axial plane. Each phenotype was defined by a specific mean and covered a range of $\pm 1.5^\circ$ from this mean. Distribution of coronal phenotypes among these rotational phenotypes will be presented. Rotational phenotypes (i.e. combination of alignment variations of the anterior and posterior femoral joint line) were built and combined with the previously reported coronal phenotypes of these patients. The effect of three alignment concepts (mechanical, restricted and unrestricted kinematic) on the joint line orientation of the five most common FKPs was assessed.

Results: Distribution of the five most common coronal phenotypes did not differ among the rotational phenotypes. Bony congruency between anterior (ATA) and posterior femoral (PCA) joint lines was found in 14.3% of the non-OA population. The PCA and proximal tibial joint line (TMA) were orientated parallel in 35.5% and 30.3% of all non-OA and OA patients, respectively. PCA and distal femoral joint line (FMA) were oriented parallel in 43.2 and 37.1% of all non-OA and OA patients, respectively. FMA, TMA, and PCA were aligned in parallel in 17.0 and 11.2% of the non-OA and OA populations, respectively. All four joint lines (FMA, TMA, PCA, and ATA) were aligned in 2.3% of the non-OA population.

Conclusion: It is crucial to emphasize that preoperative assessment of a patient's anatomy should include the anterior and posterior femoral joint lines. The extended 3D-FKP concept could aid in this

assessment and help identify patients at risk of complications due to malalignment or those likely to benefit from a particular alignment concept.

Abstract

Associations Between REAL Classification, CPAK Phenotypes, Alignment Severity and Surgical Management in Personalized Robotic-Assisted Total Knee Arthroplasty

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Introduction

A novel classification system (REAL) for articular laxity using robotic-assisted TKA (RA-TKA) is recently described, introducing three different phenotypes of coronal and axial gap imbalances. To assess its feasibility and impact on personalized TKA different bony alignment classifications (orientation & severity) and the amount of knee anatomy modification were compared between the coronal REAL types (R1, R2, R3).

Methods

107 RA-TKA using functional alignment were prospectively analyzed. The CPAK classification and alignment severity in degrees using the arithmetical HKA (aHKA) as well as the caliper measurement technique for the trochlea and the condyles were used.

Results

73% of all cases had a varus aHKA and only 17.6% were valgus. While caliper changes between R1 and R2 were similar, R3 showed the greatest changes on the trochlea and distal femur. Furthermore, thicker liners were used in higher REAL types.

80%, 71.9% and 33.3% of R1,2 and 3 remained after surgery within their native CPAK. However, the range of alignment undercorrections within the same CPAK ranged from 6.6° varus to -11° valgus.

4.8%, 7.1% and 0% of R1,2 and 3 were corrected by only 1xCPAK difference.

5.7%, 15.6% and 66.7% of R1, 2 and 3 with mean degree changes of 5°, 5.8° and 5.7° respectively were overcorrected changing 2xCPAK types.

Conclusion

While varus aHKA was equally distributed, valgus phenotypes were more frequent in progressed REAL imbalances more frequently associated with fixed flexion deformities requiring higher liners and a JL >2mm. REAL3 was associated with greater changes of the anterior and distal knee. CPAK as a solely orientational quality tool has limited sensitivity in assessing accuracy of a TKA technique. While R1 can be treated with an unrestricted KA and REAL 2 with a restricted KA protocol, R3 might need a combination of restricted KA and ligament releases.

The Basics about Functional Alignment in Total Knee Arthroplasty - How Does it Work?

Klasan A., Jeremic D., Nedopil A.J., Neri T., Hirschmann M.T.

Purpose

Functional alignment (FA) targets a balanced knee, defined as equal medial and lateral gaps in extension and flexion or with an increased lateral laxity in flexion. Using two different component position preservation strategies, femur or tibia, as well as two different starting positions, kinematic (KA) or mechanical (MA), the purpose of the study was to compute the frequency of balancing a TKA using the possible combinations.

Methods

Ten robotic TKAs were categorized in functional phenotypes. Based on the intraoperatively acquired data, a macro performed a post hoc analysis of the following possible combinations of achieving a balanced TKA: femur preserving, tibia preserving, KA- or MA starting position.

Results

Ten different knee phenotypes were analyzed. The tibial preserving philosophy balanced the TKA more frequent relative to the femoral preserving philosophy regardless of the starting position (80% vs. 30% when using the KA-starting position; 70% vs. 20% when using the MA-starting position, $p=0.025$). Two TKAs required both components' position to be changed, regardless of the starting position and component preserving strategy.

Conclusion

Functional alignment strategy can in theory be applied starting from MA and KA. In practice, by preserving the femur or the tibia, with or without 90° lateral flexion laxity, not all knees can be balanced. Tibial preservation strategy allows for a higher proportion of balanced knees, however, 20% of knees require a hybrid strategy, where both components need to be altered in their position. To better understand the different combinations behind functional alignment, a more detailed nomenclature is required.

Coronal plane alignment in patients undergoing total knee arthroplasty - a study based on arthroplasty registry data

Nardelli P., Pedross F., Neururer S., Koller B., Fischer M., Arora R., **Liebensteiner M.**

Objective: It was the aim of the study to determine the pre-to-postoperative change in CPAK group distributions (Coronal Plane Alignment of the Knee) in patients undergoing TKA. Another aim was to assess whether the clinical outcome (WOMAC and implant survival) would differ between those that changed the CPAK class vs. those that kept their CPAK class.

Methods: Data was taken from the Arthroplasty Registry. From 3359 primary TKAs with complete WOMAC data sets (preoperative and 1 year postoperative) cases without available whole leg radiographs were excluded. From the remaining 2059 patients the CPAK classification was determined. WOMAC data and implant survival was taken from the arthroplasty registry data base.

Results: Preoperatively, CPAK type V was the most common (n = 385, 18.7 %). slightly exceeding that of type II (n = 375, 18,2 %) and type I (n = 362, 17,6 %).

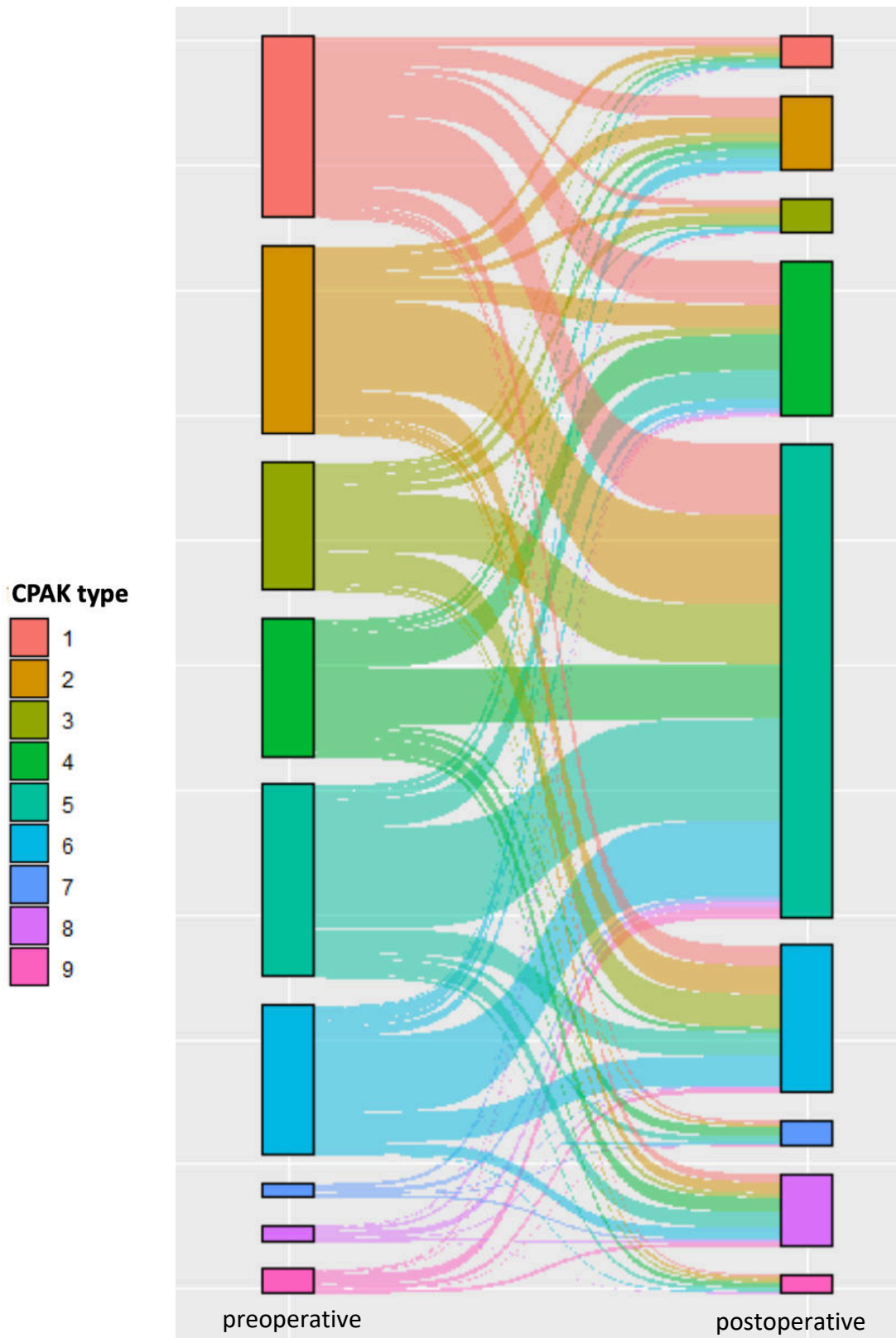
Postoperatively the most dominant CPAK type was no. V (n = 949, 46.1 %), followed by type IV (n = 309, 15.0 %) and type VI (n = 292, 14.2 %) (Fig 1.).

80.0 % (n = 1647) of patients underwent a change in CPAK type. Comparing the CPAK-class changers with the CPAK-class maintainers no significant differences in postoperative WOMAC total (p =0.399) nor subscores were found. Similarly, no differences in 10-year implant survival was determined with 91.2 % in CPAK-class changers and 92.9 % in CPAK-class maintainers (p = 0.506).

Conclusion: Based on this large cohort of TKA patients from multiple surgeons of different hospitals it seems that only in a minority of cases the preoperative type of leg alignment (CPAK type) is maintained. However, it is obvious that maintaining the CPAK type was not the goal of the many surgeons. Surprisingly, neither implant survival nor WOMAC data differed significantly between CPAK-class changers and CPAK-class maintainers.

Figures:

Fig. 1 Distribution of CPAK classes pre- and postoperatively amongst 2059 TKA patients



EFFECT OF TOTAL KNEE REPLACEMENT PERFORMED WITH MECHANICAL ALIGNMENT VERSUS KINEMATIC ALIGNMENT ON THE HIP AND ANKLE JOINT

Moya-Angeler J., León-Muñoz V.

Introduction: Total knee replacement (TKR) is a common procedure for managing advanced knee osteoarthritis. Alignment techniques, including mechanical alignment (MA) and kinematic alignment (KA), aim to optimize postoperative outcomes. However, the impact of these strategies on adjacent joints, such as the hip and ankle, remains under investigation. This study evaluates the effects of TKR with MA on hip and ankle joint alignment and compares the findings with KA.

Methods: Preliminary data from 28 patients who underwent TKR with MA were analyzed. Preoperative and postoperative parameters for the hip (femoral offset [FO], articular offset [AO], global offset [GO], vertical center of rotation [VCOR], horizontal center of rotation [HCOR], longitudinal leg length discrepancy [LLLD]), knee (mechanical and arithmetic hip-knee angles [mHKA, aHKA], medial proximal tibial angle [MPTA], lateral distal femoral angle [LDFA], knee joint line convergence angle [KJLCA], joint line orientation [JLO]), and ankle (lateral distal tibial angle [LDTA], ankle joint line convergence angle [AJLCA], ground talar dome angle [GTDA], ground plafond angle [GPA], talocrural angle [TCA]) were assessed. Statistical analyses included paired Student's t-tests and Wilcoxon tests. Data from the KA group will be included at presentation for comparative analysis.

Results: MA caused no significant changes in hip alignment. However, significant differences were observed in ankle joint parameters, including the GTDA (mean -3.006° , $p=0.006$) and the GPA (mean -3.016° , $p=0.006$).

Conclusion: TKR with MA selectively affects ankle alignment, with significant changes observed in key parameters. These findings highlight the localized impact of MA on joint biomechanics. It is hypothesized that KA, by restoring native knee alignment, will not result in these changes.

Handheld computer-navigated constrained total knee arthroplasty for complex extra-articular deformities

Pietsch M., Hochegger M., Djahani O., Mlaker G., Dampf S., Eder-Halbedl M., Hofstädter Th.

Introduction

The present study aimed to assess the postoperative alignment and clinical outcomes of patients with complex extra-articular deformities (EADs) undergoing computer-assisted surgery (CAS) for constrained total knee arthroplasty (TKA) with modular stem extensions.

Materials and methods

From May 2015 to July 2018, ten patients with EADs scheduled for constrained TKA were enrolled retrospectively. The preoperative average deviation from neutral (=180°) mechanical axis was 15.3° (range of coronal alignment: 150.9° varus to 202.9° valgus). Alignment was assessed using an accelerometer-based handheld CAS system. On long-leg films, the positions of the components and possible stems were analysed and templated preoperatively. The average follow-up was 3.3 years (range: 2.0 to 4.6 years).

Results

The postoperative mechanical axis was within $\pm 3.0^\circ$ from neutral in nine patients. In all patients, the Knee Society score (KSS) and range of motion improved significantly. A constrained condylar and a rotating hinge prosthesis were used in five patients each. In eight patients, the 100 mm cementless stem that was preferred by the authors was found to be unusable for the femur or the tibia in the planning stage. For the femur, a cementless 100 mm stem was used in three, and a cemented 30 mm stem was used in five patients; a femoral stem was not usable in two patients. For the tibia, a cementless 100 mm stem was used in six, and a cemented 30 mm stem was used in two patients; a monoblock rotating hinge tibia was used in two patients.

Conclusion

Complex EADs were excellently managed during constrained TKA implantation using the handheld CAS system. Templating allowed the possible stem lengths to be identified and prevented anatomical conflict with the CAS-configured mechanical alignment. Limb alignment and function improved significantly after surgery. No intra- or postoperative complications occurred.

Validation of Robotic Measurements for Total Knee Arthroplasty Coronal Alignment: A Radiographic Comparison

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Purpose: This study sought to validate intraoperative robotic measurements of femoral and tibial component coronal alignment in total knee arthroplasty (TKA) by comparing them with preoperative and postoperative standing double stance long leg radiographs (LLR).

Methods: This retrospective cohort study included 59 unique patients undergoing primary TKA at a single institution. The femoral and tibial coronal alignment was measured on long leg radiographs using a deep learning artificial intelligence model both preoperatively and postoperatively. The measurements obtained from the imageless robotic system were based on intra-op mapping of the bone/cartilage surface and the deep learning model were compared to evaluate the robot's accuracy and reliability utilizing paired t tests and Pearson correlation coefficients.

Results: Robotic measurements were highly correlated with measurements from preoperative LLR (Pearson $r^2=0.68$). There was no significant difference in pre-operative constitutional alignment between the two methodologies ($p=0.28$). Additionally, intraoperative and postoperative alignment of femoral and tibial implants were not significantly different ($p= 0.12$ and $p=0.95$, respectively) and strongly correlated with one another (Pearson $r^2=0.5$ and Pearson $r^2=0.6$ respectively). The mean difference in femoral alignment was 0.43° and the mean difference in tibial alignment was 0.01° .

Conclusions: The findings of this study suggest that there were no significant differences in the coronal alignment of TKA when assessed by a robotic system compared to LLR. This signifies the robotic system's high accuracy and reliability in determining coronal alignment.

Functional Alignment in Knee Arthroplasty Minimizes Impact on Ankle Alignment: Role of MPTA and LDFA Preservation

Sangaletti R., L., Rossi SMP., Benazzo F.

Background: Surgical alignment strategies in knee arthroplasty, particularly the preservation of Medial Proximal Tibial Angle (MPTA) and Lateral Distal Femoral Angle (LDFA), are known to influence knee biomechanics. This study aims to investigate whether and how maintaining CPAK classification and preserving LDFA and MPTA—affect ankle biomechanics. By examining the impact of functional alignment, which seeks to preserve native joint angles, we aim to assess its potential in minimizing postoperative biomechanical changes in the ankle.

Methods: A retrospective cohort of 300 consecutive patients who underwent robotic-assisted knee arthroplasty was analyzed, focusing on preserving MPTA and LDFA during surgery. Patients were excluded if they had previous knee surgeries and pre-existing ankle pathologies. Radiographic evaluations were conducted preoperatively and six months postoperatively, measuring Tibial Plafond Inclination (TPI), Talar Inclination (TI), and Talar Tilt (TT). Statistical analyses assessed the impact of alignment strategies, with particular attention to cases where alterations in MPTA and LDFA led to greater variations in ankle parameters.

Results: Preservation of MPTA and LDFA was associated with significantly smaller changes in ankle parameters compared to cases with greater alterations in these angles. Specifically, patients with preserved MPTA and LDFA exhibited minimal variations in TPI (mean difference = 2.4° , $p = 0.02$), TI (mean difference = 2.1° , $p = 0.03$), and TT (mean difference = 1.7° , $p = 0.04$). In contrast, cases with LDFA and MPTA deviations $\geq 2^\circ$ showed substantial shifts in TPI (mean change = 5.2° , $p = 0.02$), TI (mean change = 4.8° , $p = 0.03$), and TT (mean change = 3.6° , $p = 0.04$).

Conclusion: Preserving MPTA and LDFA during knee arthroplasty, minimizes postoperative changes in ankle biomechanics. This approach may optimize knee function while potentially reducing the risk of long-term ankle pathologies. Future research should focus on longitudinal studies to validate these benefits.

Excellent Results of Restricted kinematic alignment Total knee Arthroplasty at Minimum Ten-Year Follow-up

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Introduction

While restricted kinematic alignment (rKA) total knee arthroplasty (TKA) with cemented implants has been shown to provide a similar survivorship rate to mechanical alignment (MA) in the short term, no studies have reported on the long-term survivorship and function.

Materials and Methods

One hundred and four consecutive cemented cruciate retaining TKAs implanted using computer navigation and following the rKA principles proposed by Vendittoli were reviewed at a minimum of 10 years after surgery. Implant revisions, reoperations, and clinical outcomes were assessed using Knee Injury and Osteoarthritis Outcome Score (KOOS), Forgotten Joint Score (FJS), patients' satisfaction and joint perception questionnaires. Radiographs were analyzed to identify signs of osteolysis and implant loosening.

Results

Implant survivorship was 99.0% at a mean follow-up of 11.3 years (range 10.3 to 12.9) with one early revision for instability. Patients perceived their TKA as natural or artificial without limitation in 50.0% of cases, and 95.3% were satisfied or very satisfied with their TKA. The mean FJS was 67.6 (range 0 to 100). The mean KOOS were as follows: pain 84.7 (range 38 to 100), symptoms 85.5 (range 46 to 100), function in daily activities 82.6 (range 40 to 100), function in sport and recreation 35.2 (range 0 to 100) and quality of Life (QoL) 79.1 (range 0 to 100). No radiological evidence of implant aseptic loosening or osteolysis was identified.

Conclusion

Cemented TKA implanted with the rKA alignment protocol, demonstrated excellent long-term implant survivorship, and is a safe alternative to mechanical alignment to improve patient function and satisfaction.

Unrestricted Functional knee positioning without soft tissue release: does tibial implant with more than 3° varus result in worse outcomes?

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Introduction

Functional knee positioning (FKP) aims to restore native knee kinematics by balancing mediolateral laxities and adapting implant positioning. This study evaluates the safety and outcomes of unrestricted ($>3^\circ$ varus) functional tibial positioning in patients with varus deformity undergoing robotic-assisted TKA.

Methods

This retrospective study included 337 consecutive patients with varus deformity undergoing robotic-assisted TKA with FKP principles with a minimum of 2-year follow-up. Patients were divided into two groups based on tibial varus positioning: unrestricted ($>3^\circ$ varus) and restricted ($\leq 3^\circ$ varus). Preoperative and postoperative coronal alignment, implant positioning, and functional outcomes were assessed using the Knee Society Score (KSS). The primary outcome was implants' survivorship, and secondary outcomes included complication rates and functional scores.

Results

The unrestricted FKP group showed a 99.4% implant survivorship over a median follow-up of 30 months, with only one revision due to aseptic loosening. No significant differences were observed in overall complication rates between the restricted and unrestricted groups ($P = 0.4794$). Functional outcomes, including KSS-knee and function scores, were comparable between both groups, with no statistically significant differences in postoperative knee range of motion.

Conclusions

Unrestricted FKP in robotic-assisted TKA is safe and reliable in patients with varus deformity, demonstrating similar revision rates, implant survivorship, and functional outcomes compared to restricted FKP. This study supports expanding FKP boundaries beyond 3° varus without compromising patient outcomes in short term.

Patient-reported outcome measures following individualised TKA are not affected by the degree of preoperative coronal varus or valgus laxity

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Purpose: To determine if there is a correlation between preoperative coronal varus or valgus laxity and patient-reported outcome measures (PROMs) two years after individualised total knee arthroplasty (TKA).

Methods: Records of 150 consecutive patients who received individualised TKA were retrospectively analysed, and 126 with complete pre- and postoperative data were included. Preoperative coronal varus and valgus stress radiographs (15N load) were taken using a telos stress device with the knee in 5° to 10° of flexion. Varus stress angles were positive if the joint opened on the lateral side, and valgus stress angles were positive if the joint opened on the medial side. The sum of varus and valgus stress angles indicated total joint laxity. During surgery cases that required tibial recuts to balance the joint were recorded. Patients completed three PROMs and rated their satisfaction. Correlations between laxity and PROMs were evaluated using Pearson's correlation.

Results: Stress radiographs revealed varus stress angles of $6.3^{\circ} \pm 3.5^{\circ}$ (range, -4.5° to 14.1°), valgus stress angles of $0.1^{\circ} \pm 3.7^{\circ}$ (range, -8.0° to 10.9°), and the sum of the varus and valgus stress angle of $6.4^{\circ} \pm 3.3^{\circ}$ (range, 0.1° to 17.1°). There were no correlations between laxity and PROMs: $r < 0.160$ for varus stress angle, $r < 0.180$ for valgus stress angle and $r < 0.160$ for the sum of stress angles. There were no statistically significant or clinically relevant differences in PROMs between knees without and those with tibial recuts.

Conclusion: Preoperative coronal varus or valgus laxity was not correlated with PROMs following individualised TKA at a minimum two-year follow-up. Individualised TKA with personalised alignment enables adequate accommodation of a broad spectrum of preoperative coronal varus-valgus laxities.

Level of evidence: IV

Keywords: individualised total knee arthroplasty; coronal laxity; varus stress; valgus stress, PROMs

Is there any relationship between CPAK phenotypes and femoral rotation?

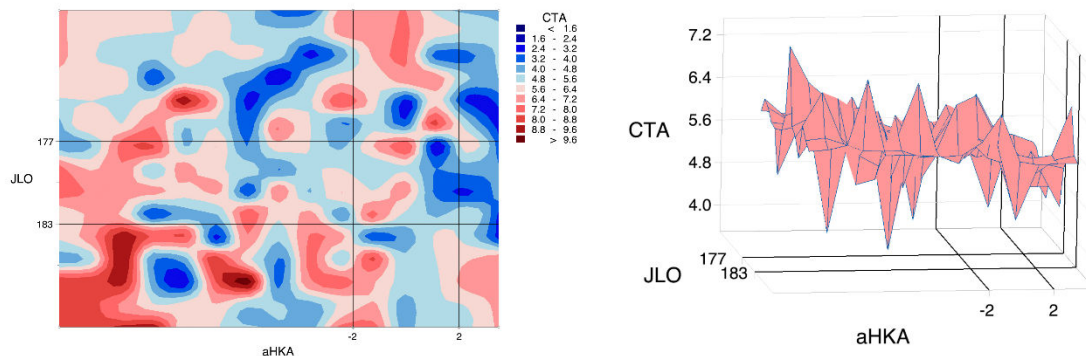
León-Muñoz, V. and Moya-Angeler J.

The Coronal Plane Alignment of the Knee (CPAK) classification categorises nine phenotypes based on constitutional limb alignment and joint line obliquity and can be used in healthy and arthritic knees. The CPAK classification is not the only classification proposed for the coronal plane of the knee. Despite criticism, knee surgeons use the CPAK classification most widely to define the coronal plane's different morphotypes, providing a common language among healthcare professionals. Our study aimed to search for relationships between phenotypes based on CPAK and femoral rotation.

Data from 622 consecutive cases in 535 osteoarthritic patients who underwent primary total knee arthroplasty have been retrospectively analysed. Computed tomography imaging was employed to ascertain the mechanical lateral distal femoral angle, the mechanical medial proximal tibial angle, and the femoral rotation quantified using the condylar twist angle (CTA: angle between the posterior condylar line and the clinical or anatomical trans-epicondylar axis, first described by Yoshioka et al.). Statistical relationships were sought.

According to the regression equations, the variables are perfectly uncorrelated ($CTA = -4.45 - 0.0897 \text{ aHKA} + 0.0540 \text{ JLO}$ ($r^2 = 0.0608$)). Upon visualising the CTA using a contour map or surface curves with low interpolation (as shown in the attached figure), it becomes evident that the data do not follow any discernible pattern. We analysed possible correlations in our series using the mHKA value and observed a significant relationship (Pearson: $r=0.249$, $p<0.001$; Spearman: $r=0.236$, $p<0.001$) between the mHKA and femoral rotation as measured by CTA, consistent with previous studies (Aglietti P, Luyckx T and León-Muñoz, V). Using ANOVA, we found some statistically significant differences between the distributions of the CPAK groups for the CTA.

Our study found no relevant relationships between coronal plane alignment, according to the CPAK classification and femoral rotation in the sample population studied.



The impact of Alignment philosophy in TKA on trochlear Anatomy restoration is strongly linked to the LDFA.

Ollivier B., Orsi A.D., Plaskos C., Vandenneucker H., Kreuzer S., **Luyckx T.**

Introduction

Most implants currently used in total knee arthroplasty (TKA) were designed based on mechanical alignment (MA) principles. Modern alignment philosophies alter the orientation of these classic designs by following each individual's knee phenotype, which may have important implications on trochlear restoration. This study aims to compare the influence of different alignment strategies on trochlear anatomy recreation within predefined LDFA groups.

Materials and methods

147 robotic-assisted, functionally aligned (FA) TKAs, performed with a digital ligament tensioner, were reviewed. Simulated femoral component positions were generated according to different alignment techniques; kinematic alignment (KA), restricted KA (rKA), restricted inverse KA (riKA), gap balancing (GB) and MA. Changes in trochlear angle (Δ TA), mediolateral sulcus offset and trochlear over/understuffing were calculated relative to native. Alignment philosophies were compared across following LDFA groups: $<84^\circ$ (n=22), 84° - 87° (n=57), 87° - 90° (n=50), $>90^\circ$ (n=18). Paired Wilcoxon-rank-sum tests were performed with Bonferroni corrections.

Results

In the $<84^\circ$, 84° - 87° and 87° - 90° LDFA groups, more significant differences in Δ TA were identified between strategies compared to the $>90^\circ$ group. The greatest range was observed in the $<84^\circ$ group, Figure 1. In the lower LDFA groups FA, KA and rKA had lower Δ TA values than riKA, GB and MA. The $>90^\circ$ LDFA group exhibited the fewest significant differences in Δ TA between techniques, with Δ TA being the lowest in FA, riKA and MA.

With MA, $>90^\circ$ LDFA sulci were less medialized compared to all other LDFA groups at 90° flexion ($p<0.01$). In FA, KA and rKA $<84^\circ$ LDFA sulci were more medialized compared to 87° - 90° at 10° flexion ($p<0.05$).

The only differences in over/understuffing were observed in MA, with $<84^\circ$ being less understuffed than all other LDFA groups ($p<0.01$).

Conclusion

Alignment strategy influences trochlear restoration more in knees with a lower LDFA. As the LDFA decreases, KA, rKA and FA most closely recreate trochlear anatomy.

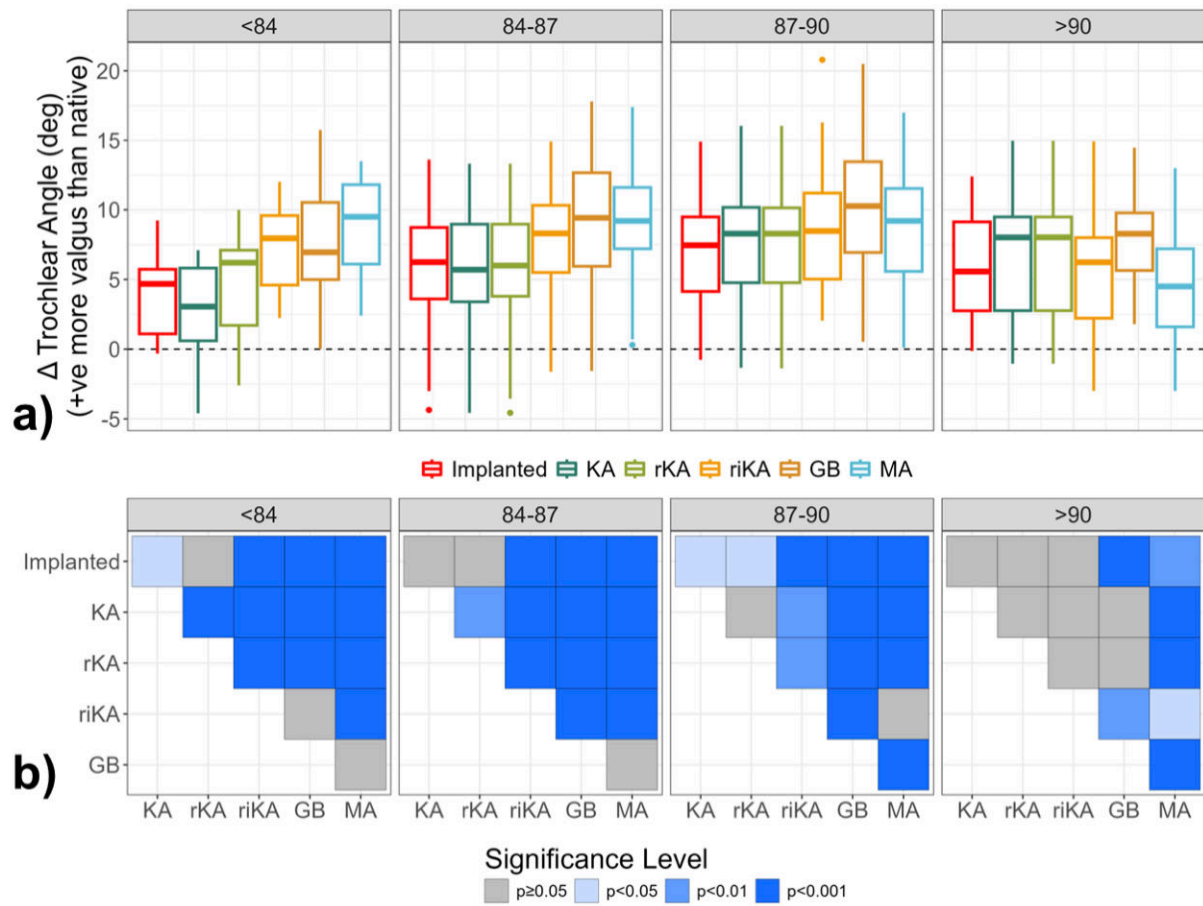


Figure 1: a) Δ Trochlear angle for all techniques, split out by LDFA group. b) Significance levels for all tests between groups.

Femoral component rotational alignment is patient-specific in robotic-assisted total knee arthroplasty performed with a tibia-based functional alignment

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Introduction

Historically, femoral component rotational malalignment in total knee arthroplasty (TKA) has been associated with poor outcomes due to patellar maltracking, knee flexion instability or stiffness. This study was designed to evaluate femoral component rotational alignment distribution among different knee phenotypes and assess the clinical relevance of femoral component rotation in a consecutive series of patients undergoing image-based robotic-arm assisted (RA)-TKA with tibia-based functional alignment (tFA).

Methods

A total of 212 subjects who underwent cruciate-retaining RA-TKA with tFA were retrospectively assessed. Tibial and femoral cuts were performed based on the patient-specific soft-tissue guided implant fine-tuning. Preoperative and postoperative robotic-derived CT data relative to tibial (MPTA) and femoral (LDFA) epiphyseal alignment and implant 3D alignment were collected. At a minimum of 2 years postoperatively, subjects were assessed with the Forgotten Joint Score-12 (FJS-12), Knee Injury and Osteoarthritis Outcome Score for Joint Replacement (KOOS-JR) and 5Level-Likert Scale (5LLS) for satisfaction. The association between femoral component rotational alignment relative to transepicondylar axis (TEA) and postoperative clinical outcome was assessed by means of logistic regression models, or nonparametric tests.

Results

A total of 218 RA-TKAs performed with tFA were included. Femoral component rotational alignment was found to be different based on the preoperative knee alignment, with a mean external rotation in varus knees and mean internal rotation in valgus knees, ranging 6.9° internal to 6.6° external rotation relative to TEA. No association was described between femoral component rotation and postoperative clinical outcome in terms of FJS-12 ($p=0.138$), KOOS-JR ($p=0.575$) and 5LLS ($p=0.063$).

Discussion

Femoral component transverse alignment in RA-TKA performed with tFA ranged from 6.9° internal to 6.6° external rotation relative to TEA, without impacting on postoperative clinical outcome. This finding supports the use of a patient-specific approach for implant positioning and a soft-tissue guided technique for femoral component rotational alignment in RA-TKA.

Medial Deviation of a 6° Prosthetic Trochlear Groove After Kinematically Aligned TKA Occurs in Four Types of Coronal Plane Alignment of the Knee (CPAK) and Decreases the Forgotten Joint Score

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Purpose: The study focused on kinematically aligned total knee arthroplasty (KA TKA). It identified which Coronal Plane Alignment of the Knee (CPAK) types are associated with a higher proportion of medial deviation of the 6° prosthetic trochlear groove (PTG) relative to the quadriceps' line of pull and whether medial deviation adversely affected the Forgotten Joint Score (FJS). The research calculated the minimum PTG angle required to prevent medial deviation by at least 2° in all patients.

Methods: The study analyzed 296 KA TKAs with a post-operative long-leg scanogram and a 2-year FJS score. Radiographic measurements were used to determine the CPAK type and to identify the deviation of the 6° PTG relative to the quadriceps' line of pull as medial (-) or lateral (+).

Results: Fifty-one percent of KA TKAs had a medial deviation of the PTG, and the proportion was higher in CPAK I, II, III, and VI than in IV and V types ($p < 0.05$). The median FJS of CPAK III was significantly lower than I and IV ($p < 0.0262$) and comparable to II, V, and VI ($p > 0.085$). The minimum PTG angle required to prevent medial deviation by at least 2° in all patients is 17°.

Conclusion: A medial deviation of the 6° PTG occurred in more than half of the KA TKAs and was observed in four of six CPAK types. Because medial deviation was associated with a lower FJS, it is suggested that the femoral component should have a minimum PTG of 17° to prevent medial deviation by at least 2° in all patients.

Keyword: total knee replacement; arthroplasty; patient outcomes; patellofemoral joint; kinematics; quadriceps vector

Level of evidence: IV

Patello-femoral kinematics in robotic-arm assisted total knee arthroplasty

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Introduction

'Third space' understuffing higher than 4mm in total knee arthroplasty (TKA) determines easy fatiguability and reduced quadriceps power, while more than 5mm of patello-femoral overstuffing can cause anterior pain, extensor mechanism dysfunction and impaired flexion. This preliminary study was designed to evaluate patello-femoral tracking and assess 'third space' modifications before and after image-based robotic-arm assisted (RA)-TKA was implanted.

Methods

Twenty-seven subjects undergoing cruciate-retaining RA-TKA with functional alignment (FA) were prospectively assessed. Patella was never resurfaced. Preoperative robotic-derived CT data relative to patellar thickness, width and distance between patellar crest and medial edge were collected. Intraoperative patellar navigation throughout full knee range of motion (ROM) was performed before and after TKA was implanted. The distance from the femoral component model displayed on the embedded robotic software to the patellar tracking depicted before and after TKA implantation was calculated at 30° and 90° of knee flexion. Difference ($\Delta_{\text{ant.offset}}$) between pre-implant and post-implant offset was extrapolated.

Results

Twenty-seven RA-TKAs were included. The mean distance between the patellar crest and the medial patellar border was 19.3mm \pm 2.3. On average, the $\Delta_{\text{ant.offset}}$ at 30° of knee flexion was reduced after RA-TKA and the mean value was -2.6mm \pm 3.2. At 90° of knee flexion the $\Delta_{\text{ant.offset}}$ was also slightly reduced, although less significantly (-0.8mm \pm 1.1).

Discussion

Patellar tracking and 'third space' modifications occurring before and after TKA can be measured with a CT based robotic-arm assisted system. In the present RA-TKA series, the post-implant anterior offset at 30° and 90° of knee flexion was on average slightly reduced in respect to pre-implant, without exceeding the cutoff value of 4 mm. Slight patello-femoral understuffing may avoid patellar tilting and result in improved patello-femoral kinematics. Present study limitations include lack of correlation between anterior offset modifications and femoral component 3D positioning.

Posterior lateral and distal lateral resections influence post-operative patellar tilt in robotic-assisted total knee arthroplasty

Pungitore M., Sangaletti R., Benazzo F.

Introduction

A retrospective observational study evaluated intraoperative factors influencing post-operative patellar tilt in patients undergoing robotic-assisted total knee arthroplasty (TKA) using the ROSA Knee System. Patients with primary robotic-assisted TKA and available post-operative radiographs were included, excluding those with severe deformities, prior knee surgeries, or incomplete data.

Materials and methods

Key intraoperative variables, including femoral component rotation, posterior and distal resections, and alignment metrics, were analyzed against post-operative patellar tilt. Pearson correlation and t-tests were employed ($p < 0.05$) to identify significant associations.

Results

Femoral rotation showed a weak, non-significant negative correlation with patellar tilt. Posterior medial resection also demonstrated weak, non-significant correlations and distal medial resections showed no meaningful association.

Significant findings emerged for posterior lateral resections > 8 mm and distal lateral resections < 6 mm. No cases of distal lateral resections > 9 mm were observed.

Conclusion

These results suggest that posterior lateral resections > 8 mm and distal lateral resection < 6 mm significantly influence post-operative patellar tilt, while other resection parameters appear less impactful.