

EKS CLOSED MEETING

29 NOVEMBER – 1 DECEMBER 2023

BORDEAUX, FRANCE



**European
Knee
Society**



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WELCOME

Dear Colleagues and Friends,

It is our pleasure to welcome you to the closed EKS meeting in Bordeaux. This event will take place from Wednesday 29th November to Friday 01st December in the beautiful Intercontinental Grand Hotel, located in the heart of the city.

This meeting will be the opportunity to present cutting-edge evidence related to knee arthroplasty, whilst discovering the elegant city of Bordeaux. We have planned 7 scientific sessions over the 3 days. Of the 57 abstracts we received, 45 were selected to be presented.

The meeting will start on Wednesday, with a welcome drinks reception and dinner to be held in the Intercontinental Grand Hotel in the evening for Active and International members. On Thursday afternoon, we have planned a visit to the picturesque village of St. Emilion with, of course, a wine tasting in the monolithic caves of the Manoir Galhaud. We will then proceed to Chateau Pavie for the President's dinner, known to be one of the best producers of premier Grand Cru wine in St Emilion.

We hope this will be an excellent opportunity to promote and strengthen friendships among members. We are looking forward to meeting you all here in Bordeaux!

Amicalement,

Charles Rivière (Local Organizer)

Francesco Benazzo (President)

DAY 1 - 29 NOVEMBER 2023

- 14:30 - 16:00 Registration
 16:00 - 16:40 Welcome Coffee reception
 16:40 - 16:50 Welcome and Introduction
F. Benazzo / C. Riviere
 16:50 - 17:00 Results of the EKS survey
C. Riviere

Session 1 (85 min) - Alignment & Implant Design

Moderators: F. Benazzo / S. Lustig

- 17:00 - 17:10 Keynote lecture - Defining the framework: concept of 'physiological arthroplasty'
C. Riviere
 17:10 - 17:20 Keynote lecture - Balancing the third space of a 'physiological TKA'
M. Hirschmann
Q&A (5 min)
 17:25 - 18:21 Free papers session - 8 presenters (5'+2')
 17:25 Why we need CPAK (or other) phenotyping, and how this contributes to our understanding of the OA knee
J. Bellemans
 17:32 Toward functional reconstruction of the pre-diseased state in robotic total knee arthroplasty: defining the target in a patient cohort
N. Verdonchot
 17:39 Personalized 'blended' alignment in total knee arthroplasty with the use of mechanical instruments and angulated wedges
A. Baldini
 17:46 Kinematic alignment using the Sphere TKA – clinical outcome and survival at 4-years
A. Pice
 18:53 Management of preoperative extension deficit in robotic assisted kinematically aligned TKA
J. Moya-Angeler
 18:00 Which method for Femoral Component Sizing when performing a Kinematically Aligned TKA? An in-silico study
C. Riviere
 18:07 Trochlea morphology demonstrates variability but no gender differences in patients undergoing robotically assisted TKA
A. Klasan
 18:14 Off-the-shelf TKA fails to restore the native patellofemoral alignment regardless of the alignment strategy
A. Klasan
 18:21 - 18:25 Session's wrap up
T. Calliess
 18:25 Coffee break (20 min)

DAY 1 - 29 NOVEMBER 2023

18:45 **Session 2 (75 min) - Alignment & Implant Design** **Moderators: S. Campi / S. Parratte**

18:45 - 18:55 *Keynote lecture - Custom TKA: for complex situations or for everyday TKA?*

M. Bonnin

Q&A (5 min)

19:00 - 19:56 *Free papers session - 8 presenters (5'+2')*

19:00 *Achieving Better Clinical Outcomes after Total Knee Arthroplasty in valgus knee deformity: The Role of Alignment Strategies.*

C. Batailler

19:07 *Better Motor Control during the Forward Lunge after inverse Kinematic Aligned TKA Compared to adjusted Mechanical Aligned TKA - a Comparative, Blinded Analysis of 45 Subjects at 2 Years Postop*

P. Winnock de Grave

19:14 *Impact of tibial component alignment boundaries on femoral component orientation in functionally aligned TKA*

T. Luyckx

19:21 *The Oxford Partial Surgical Technique – pre-disease physiological joint line reconstruction*

W. Jackson

19:28 *How Reproducible is the Callipered KA Technique for Aligning the Tibial Component of a Medial OXFORD® UKA?*

C. Riviere

19:35 *Similar Survivorship for Uncemented Mobile-Bearing and Cemented Fixed-Bearing Medial Unicompartmental Knee Arthroplasty but Different Reasons for Revision*

P. Monk

19:42 *Does Alignment Technique in Medially Stabilised Total Knee Arthroplasty Affect the Patello-Femoral Joint? Clinical and Radiological Outcomes at 1 year*

H. Pandit

19:49 - 20:00 *Session's wrap up*

T. Heyse

20:00 - 21:00 *Welcome drink in Grand Hôtel (Salon Margaux)*

21:00 *Welcome Dinner for Active and International Members in Restaurant Bordeaux*

DAY 2 - 30 NOVEMBER 2023

Session 3 - Knee replacement for Young (Under 55) Active Patient Moderators: J. Cobb / J. Bellemans

09:00 - 09:10 Keynote lecture 1 - Alignment techniques (MA Vs KA Vs rKA Vs FA) for TKA: Does it matter in the young and active patient?

E. Thienpont

Q&A (5 min)

09:15 - 09:25 Keynote lecture 2 - Influence of sporting activities on TKA and UKA outcomes: what should we advise ?

A. Price

Q&A (5 min)

09:30 - 10:26 Free papers session - 9 presenters (5'+2')

09:30 Long-Term Results of Primary Total Knee Arthroplasty Performed in Patients 35 Years of Age and Younger

T. Heyse

09:37 Lateral UKA can be a safe solution in a young patients' population: 10 years follow up report

S. Rossi

09:44 Fifteen Year Results of Cementless Medial Oxford Unicompartmental Knee Replacement

C. Dodd

09:51 High rates of return to sport following image-based robo6c-arm assisted unicompartmental knee arthroplasty

F. Catani

09:58 The Added Utility of Magnetic Resonance Imaging in Pre-operative Assessment for Patients Undergoing Medial Unicompartmental Knee Arthroplasty

P. Monk

10:05 The knee arthroplasty usage profile of orthopaedic surgeons and the association with patient-reported outcome: A cohort study of 2045 patients.

A. Troelsen

10:12 A Second PKA behaves more like a primary PKA than a primary TKA

J. Cobb

10:19 The outcome of revision knee surgery in patients who had their primary arthroplasty aged 55 years or less.

C. Esler

10:26 CPAK classification cannot determinate segmental extra-articular knee deformity

M. Ollivier

10:33 - 10:38 Session's wrap up

G. Jones

10:38 Coffee break (30 min)

DAY 2 - 30 NOVEMBER 2023

Session 4 - Revision

Moderators: A. Porteous / G. van Hellemond

- 11:08 - 11:18 *Keynote lectures - The use of biomarkers/molecular (DNA-based and RNA-based quantitative PCR) diagnostic tools for diagnostic of PJI*
V. León-Muñoz
Q&A (5mn)
- 11:23 - 12:33 *Free papers session - 10 presenters (5'+2')*
- 11:23 *Post-operative Continuous Passive Motion does not improve Range of Motion achieved after Manipulation Under Anaesthesia for stiffness in Total Knee Arthroplasty*
B.V. Bloch
- 11:30 *Does CT Imaging Improve Tibial Defect Prediction for Zonal Fixation?*
F. Boettner
- 11:37 *Association between postoperative fixation and later aseptic loosening in revision total knee arthroplasty with hybrid fixated tibial components*
SN. Van Laarhoven
- 11:44 *Construct stability of revision Total Knee Arthroplasty with tibial cones: preliminary results of a radiostereometric analysis (RSA)*
PJC. Heesterbeek
- 11:51 *Clinical and biomechanical evaluation of custom methaphyseal cones for complex revision total knee implants with major bone loss*
B. Innocenti
- 11:58 *Nutritional status and mortality rate of patients who have undergone revision TKR: a retrospective analysis of 234 patients*
J. Palan
- 12:05 *Knee function and QoL with an articulating spacer. Can we identify an ideal candidate for the 1.5-stage?*
G. Balato
- 12:12 *A comparison between stemmed, cementless and unstemmed tibial components in Total Knee Arthroplasty in obese patients*
B. von Bloch
- 12:19 *Low Rate of Tibial Debonding in a Popular Knee Replacement Analysis of a Single Specialist Knee Surgeon Survival Data for the NexGen LPS Flex Femur using Option Tibia Compared to the Precoat Tibia : a 14 year Follow-up Study*
P. Chapman-Sheath
- 12:26 *Individual Phenotype does not impact the Outcome of Mechanical Aligned Total Knee Arthroplasties for Valgus Osteoarthritis*
F. Boettner
- 12:33 - 12:37 *Session's wrap up*
S. Rossi

DAY 2 - 30 NOVEMBER 2023

Afternoon program **with** visit to St-Émilion

- 12:30 - 15:00 Lunch - Pick up your restaurant in Bordeaux (see the list of recommended addresses)
- 15:00 First departure to St-Émilion by coach (pick up in front of the Hotel)
- 15:50 - 17:50 Visit of the village of St-Émilion. Optional and based on registration:
wine degustation at Manoir Galhaud (duration 45 min) at 16.00 and 17.20;
max 45 pax per degustation
- 17:50 Transfer to Château Pavie (Premier Grand Cru St Émilion Classé A): by coach
(pick up in front of Manoir Galhaud) or by foot (20min - 1,8km away)
- 18:00 - 19:00 Arrival and Visit to the Cellars of Château Pavie
- 19:00 - 19:20 Inauguration ceremony by the Jurade
- 19.20 - 20:00 EKS Champagne Reception at Château Pavie
- 20:30 - 23:30 Presidential EKS diner (4 courses menu) at Château Pavie
- 23:30 Departure to Grand Hotel Intercontinental Bordeaux

Afternoon program **without** visit to St-Émilion

- 12:30 - 15:00 Lunch - Pick up your restaurant in Bordeaux (see the list of recommended addresses)
- 17:00 Second departure: directly to Château Pavie by coach (pick up in front of the Hotel)
- 18:00 - 19:00 Arrival and Visit to the Cellars of Château Pavie
- 19:00 - 19:20 Inauguration ceremony by the Jurade
- 19.20 - 20:00 EKS Champagne Reception at Château Pavie
- 20:30 - 23:30 Presidential EKS diner (4 courses menu) at Château Pavie
- 23:30 Departure to Grand Hotel Intercontinental Bordeaux

DAY 3 - 1 DECEMBER 2023

09:00 - 10:00 General Assembly

Session 5 - Technology and Efficiency

Moderators: A. Baldini / H. Vandenuecker

10:00 - 10:10 Keynote lectures - OR efficiency: The rationale? Improving the quality of care? Key concepts? How to implement it?

T. Ait Si Selmi

Q&A (5 min)

10:15 - 11:11 Free papers session - 8 presenters (5'+2')

10:15 An untrained open-source natural language processing tool (ChatGPT) can make complex surgical decisions with confidence similar to experienced surgeons: a comparative analysis

G. Jones

10:22 Radiographic assessment of Unicompartmental Knee replacement: A comparison between machine learning and an experienced surgeon

D. Murray

10:29 Accuracy of the ROSA robotic system for targeted resection thickness in Total Knee Arthroplasty

E. Tsiridis

10:36 Is your robot telling the truth? In-vivo accuracy of a new robotically-assisted system for total knee arthroplasty: a prospective cohort study

P. Monk

10:43 Ligament balance in image-based robotic-assisted TKA with functional implant positioning: an objective assessment using intraoperative sensor technology

S. Lustig

10:50 Robotic-assisted total knee Arthroplasty (TKA) implemented with a tensor: Mechanical versus functional alignment and effect on femoral component external rotation

F. Rosso

10:57 Less costs for image-based robotic TKA 2023 compared to 2018

T. Calliess

11:04 Incidental findings on planning CT scans for robotic surgery. Are your scans routinely reported? If they are not, then maybe they should be

J. Philips

11:11 - 11:15 Session's wrap up

T. Luyckx

11:15 Coffee break (30 min)

DAY 3 - 1 DECEMBER 2023

Session 6 - Miscellaneous

Moderators: J-N. Argenson / D. Barrett

11:45 - 11:55 Keynote lecture - Knee replacement and extreme osteoporosis

A. Klasan

Q&A (5 min)

12:00 - 12:10 Keynote lecture - Which alignment techniques for UKA (MA Vs KA Vs rKA Vs FA) ?
Does it matter in the young and active patient?

W. Jackson

Q&A (5 min)

12:15 - 12:25 Very young active patients with unicompartmental bone on bone knee OA: does knee osteotomy play a role?

M. Ollivier

Q&A (5 min)

Session 7 - Best papers award

Moderators: T.Heyse / P. Adravanti

12:30 Robotic-assisted total knee arthroplasty is associated with earlier return of symmetrical limb function compared to conventional techniques using wearable sensors: a prospective cohort study

P. Monk

12:37 The Impact of Image-Based Robotic-Assisted Total Knee Arthroplasty with Functional Positioning Principles: Anterior Compartment Restoration and One-Year Follow-Up Results

S. Lustig

12:44 Favorable early outcomes of Medial Unicompartmental Knee Arthroplasty as primary treatment for medial meniscus root tears (MMRT) with meniscal extrusion and early phase radiographic osteoarthritis

N. Innocenti

12:51 - 12:55 Session's wrap up

M. Liebensteiner

12:55 Closing Remarks – Meeting Chair

C. Riviere

13:00 Closing Remarks – President

F. Benazzo

13:05 Departure or extended stay

HOTEL ACCOMMODATION ACTIVE AND INTERNATIONAL MEMBERS

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HOTEL ACCOMMODATION ACTIVE AND INTERNATIONAL MEMBERS

BOOKING PROCEDURE AND CANCELLATION POLICY ACTIVE AND INTERNATIONAL MEMBERS

Minimum stay

There is a minimum stay of 2 nights (29 – 30 November 2023).

What does EKS cover?

The EKS covers a total amount of € 860,00:

- *2 nights*
- *2 dinners for EKS Active and International Members on Wednesday and Thursday evening.*
- *Access to the scientific meeting*
- *2 Coffee Breaks*

Insurance

Participants should organise their own health, travel and personal insurances.

Payment

Social events must be paid through the online registration.

Hotel accommodation must be booked through the online registration for your hotel booking.

The cancellation policy is mentioned below.

Cancellation Policy

Cancellations shall be charged in full.

Cancellations must be done in writing to europankneesociety.secretariat@gmail.com.

The cancellation fee is € 860,00 for the costs made by the EKS (hotel accommodation, dinners, meeting room rental, coffee breaks)

By registering to the EKS Closed Meeting in Bordeaux on 29 November – 01 December 2023, you agree to the above-mentioned procedure and policies.

WEDNESDAY 29 NOVEMBER

Active and International Members arriving in the afternoon are invited to attend the EKS Welcome drink at the Grand Hotel at the Salon Margaux, as well as to join the Welcome dinner at Restaurant Bordeaux

This dinner is offered free of charge to EKS Active and International Members.

EKS Active and International Members are most welcome to register their partner for this dinner at a price of € 125,00. This must be paid to the EKS upon registration.

Please note that the dress code for the dinner is business casual

THURSDAY 30 NOVEMBER

Visit St-Émilion

Active, International and Junior Members are invited to attend the EKS Presidential Dinner on Thursday evening. The Presidential Dinner will be held at Château Pavie near St. Emillion.

This dinner is offered free of charge to EKS Active, International and Junior Members.

EKS Members can register their partner for this dinner at a rate of € 165,00. This must be paid to the EKS upon registration.

ALL EKS Members are obliged to attend the Presidential Dinner.

Please note that the dress code for the dinner is formal attire (no tuxedo required).

Session 1 - 29 November 2023 - 17.25

Title: Why we need CPAK- (or other) phenotyping, and how this contributes to our understanding of the OA knee.

J. Bellemans, MD, PhD (presenting author)

K. Smeets MD, PhD

W. Colyn, MD, PhD

Background:

There is growing consensus amongst TKA surgeons that restoring neutral mechanical alignment and perpendicular joint line orientation is no longer the most logical option for a significant number of patients.

Instead, restoring the knee to its pre-arthritic state seems much more reasonable, especially since contemporary surgical techniques, implant materials and fixation options have made this technically possible. The question remains however how a surgeon can retrograde determine the pre-arthritic geometry and status of the knee, especially in end-stage OA, when the joint is altered by chondral, ligamentous and osseous erosion or deformity.

For this purpose, and also in order to be able to compare different pre-arthritic joint constellations, CPAK, as well as other knee phenotyping matrices or formula's have been developed. The purpose of this presentation is to provide an overview on knee phenotyping using the CPAK system, its methodology and results in terms of prevalence and decision making, and its influence on future comparative clinical outcome studies.

Methods:

3 different patient cohorts including 1100 knees were analysed; one with 500 knees analysed prior to any osteoarthritic degeneration, one with 500 knees immediately prior to TKA, and one with 100 knees that were followed longitudinally until end-stage OA.

All knees were subjected to full leg standing coronal X-Rays, on which all relevant alignment parameters were measured, using previously validated methodology.

Results:

A 9-box phenotype matrix (CPAK-matrix) was developed, discerning on HKA alignment (varus-neutral-valgus) and joint line orientation (apex distal, apex neutral, apex proximal). Knee phenotypes remained consistent during the process of the OA-disease, as result of reciprocal increase/decrease of MPTA (medial proximal tibial angle) and LDFA (lateral distal femoral angle), combined with a gradual increase in JLO (joint line opening).

Conclusion:

Knee phenotyping using the CPAK-matrix is an easy and intuitive tool to guide the surgeon towards understanding and quantifying the pre-arthritic status of the knee.

It thereby provides a visual as well as mathematical framework during surgery on how to restore the knee towards its pre-arthritic overall alignment, joint line obliquity, tibial articular joint line and femoral joint line geometry.

In view of the significant differences and prevalences between phenotypes, this study also suggests that phenotype-specific reporting should be considered for future outcome studies.

Session 1 - 29 November 2023 - 17.32

Title: Toward functional reconstruction of the pre-diseased state in robotic total knee arthroplasty; defining the target in a patient cohort

Periklis Tzanetis¹, René Fluit^{2,3}, Kevin de Souza⁴, Seonaid Robertson⁴, Bart Koopman¹, Nico Verdon-schot^{1,3}

¹Department of Biomechanical Engineering, University of Twente, Enschede, The Netherlands, ²Faculty of Science and Engineering, University of Groningen, Groningen, The Netherlands, ³Orthopaedic Research Laboratory, Radboud Institute for Health Sciences, Radboud University Medical Center, Nijmegen, The Netherlands, ⁴Stryker, Manchester, United Kingdom

Background:

The surgical target for optimal positioning in robotic-assisted total knee arthroplasty remains a subject of ongoing discussion. One of the proposed targets is to recreate the knee's functional behavior to its pre-diseased state. The aim of this study was to optimize implant positioning, starting from mechanical alignment (MA), toward restoring the pre-diseased status, including ligament strain and kinematic patterns, in a patient population.

Methods:

We utilized a statistical shape and appearance model-based approach to segment the pre-operative computed tomography of 20 osteoarthritic patients that identified the subchondral osteophyte-free surfaces and estimated cartilage from the segmented bones; these geometries were used to construct patient-specific musculoskeletal models of the pre-diseased knee. Subsequently, implantations were simulated using the MA method, and a previously developed optimization technique was employed to find the optimal implant position that minimized the root-mean-square deviation between pre-diseased and post-operative ligament strains and kinematics.

Results:

There were evident biomechanical differences among the simulated patient models, but also trends that appeared reproducible at the population level. Optimizing the implant position significantly reduced the observed peak strain deviations from 22.8% to below 5.3% for all but the anterolateral ligament across the population; and concomitantly reduced the kinematic deviations from 3.6 ± 1.5 mm and $4.5 \pm 1.7^\circ$ with MA to 2.6 ± 1.4 mm and $3.5 \pm 1.9^\circ$ relative to the pre-diseased state. To achieve this, the femoral component consistently required translational adjustments in the anterior, lateral, and proximal directions, while the tibial component required a more posterior slope and varus rotation in most cases.

Conclusion:

These findings confirm that MA-induced biomechanical alterations relative to the pre-diseased state can be reduced by optimizing the implant position and may have implications to further advance pre-planning in robotic-assisted surgery that strives to restore the pre-diseased knee function.

Session 1 - 29 November 2023 - 17.39

Title: Personalized "blended" alignment in total knee arthroplasty with the use of mechanical instruments and angulated wedges.

Authors and affiliations:

Leonardo Venzo, Giuseppe Polizzotti, Paolo Salari, Rosario Sagliocco, Andrea Baldini
From IFCA Institute, Florence Italy

Background:

Personalized alignment according to the patient's morphotype in total knee arthroplasty (TKA) is showing promising results. Pure kinematic alignment has shown high accuracy with the so-called "calipered" manual technique using mechanical instruments. When restrictions from the original deformity are adopted, the scientific community is prone to use assistive technology to titrate the bone resections as desired. Our hypothesis was that employing mechanical instruments positioned according to the preoperative digital radiographic planning, and double checking with a series of angulated wedges, accuracy could be comparable to those reported using assistive technology.

Methods:

Sixty-seven consecutive patients with a varus or neutral morphotype (CPAK 1 in 52%, 2 in 36%, 4 12%) underwent TKA with "Restricted Inverse Kinematics" criteria on the tibial side (MPTA within 5° varus, and final HKA within 5° of varus) and blended with "Pure Kinematic" alignment on the femur when LDFA was neutral or valgus and blended with the "Functional" alignment for the final rotation alignment of the femoral component according to the flexion gap configuration and to the trochlear sulcus position. All bone resections were conducted using classic mechanical extramedullary tibial and intramedullary femoral instruments positioned accordingly to the adjusted values of the preoperative planning for each bone. Intraoperative double-check of the accuracy of the femoral and tibial resections was performed using extramedullary rods mounted on angulated wedges from 1° to 5° and referring to the femoral head and to the distal tibial crest.

Results:

The percentage of error compared to the aimed resection plan for both tibial and femoral cuts $\pm 2^\circ$ was 9% (6 outliers on 67 cuts for each bone). Errors were mostly in the direction towards neutral alignment. A post-operative Hip Knee Ankle Angle (HKA) within $180 \pm 2^\circ$ was obtained in 40 patients (60%) and HKA within $180 \pm 3^\circ$ in 54 patients (81%), and HKA within $180 \pm 5^\circ$ in 65 patients (97%). Final CPAK alignment was 1 in 30%, 2 in 48%, 3 in 4%, 4 in 8%, 5 in 9% and 6 in 2%. To achieve alignment restrictions, in 7 patients we changed the morphotype, more specifically from neutral to valgus in 6%, from varus to neutral in 3%, from neutral to varus in 1.5%.

Conclusion:

Our surgical technique demonstrated a satisfactory degree of accuracy in the execution of bone cuts comparable to most of the series with assistive technology. Further studies should be performed to understand the overall accuracy of mechanical instruments with personalized alignments technique performed by different surgeons.

Session 1 - 29 November 2023 - 17.46

Title: Kinematic alignment using the Sphere TKA – clinical outcome and survival at 4-years

Authors:

Mr Will Jackson Professor Andrew Price

Nuffield Orthopaedic Centre
Oxford
UK

Background:

Kinematic alignment is growing in popularity in arthroplasty care. The combination of this technique and a medially stabilised total knee replacement theoretically offers patients advantages in clinical outcome. We have adopted this philosophy and have undertaken the procedure using calipered KA technique modified using a linked femoral jig. Our indications for the procedure are any patient with primary OA, who has a contraindication for partial knee replacement and who had normal collateral ligaments. The surgical aim was to reproduce the patients pre-disease physiological alignment in each case. The aim of this study was to report the clinical and all-cause survival at 3-years, to assess for early treatment failure.

Methods:

We report the outcome of 279 case prospectively followed up with no loss to follow-up. The mean age was 71 (46-88 range), with 56% females. The pre-operative deformity distribution was: Varus 70.6%, Valgus 23.5% and Neutral 6.9%, with a mean HKA of -1.4 degrees.

Results:

There were 2 revisions within the group; 1) DAIR for infection and (2) washout and bearing exchange for haematoma. One patient had an MUA at 6 weeks. All cause revision at 4- years was 99% (12.5 at risk). The pre-operative Oxford Knee Score was 20.1 and at 1- year had increased to 41.0. The distribution of OKS scores showed a high level of excellent results where patients felt they were much better, at a greater level than seen for our historical outcomes for mechanically aligned total knee replacement.

Conclusion:

Kinematically aligned total knee replacement using the Sphere components provide patients with safe reconstruction that obtains excellent resolution of their symptoms and 4-year survival.

Session 1 - 29 November 2023 - 17.53

Title: Management of preoperative extension deficit in the robotic Assisted TKA with kinematic alignment.

Authors and affiliations:

J. Moya-Angeler^{1,2}, V.J. León-Muñoz^{1,2}, K. Huber³, C. Jimenez-Soto⁴, B. Christen³, T. Calliess³

¹ Hospital Universitario Reina Sofia, Murcia, Spain,

² Instituto de Cirugia Avanzada de la Rodilla (ICAR), Murcia, Spain,

³ Articon Spezialpraxis für Gelenkchirurgie, Bern, Switzerland.

⁴ Universidad de Murcia Medical School, Murcia, Spain

Background:

In traditional mechanical aligned (MA) TKA, proximalising the joint line (JL) in case of fixed flexion contracture is an established method to address this issue. This contrasts with more modern philosophies like kinematic alignment (KA) or restricted (rKA) in which the goal is to reconstruct the femoral JL. This study aimed to evaluate whether a fixed flexion deformity can be reliably addressed in robotic assisted (RA) KA or rKA TKA without raising the JL.

Methods:

One hundred forty-seven patients in whom an RA-TKA with KA or rKA and a minimum one-year follow-up were reviewed. Baseline demographics, preoperative clinical scores, intraoperative resection levels and postoperative scores were compared (SPSS). Patients were divided into three groups based on their preoperative extension deficit: group 1 (0-4°) (n= 64), group 2 (5-11°) (n= 56), and group 3 (>11°) (n= 27).

Results:

No differences in femoral distal and posterior resection levels ($p>0.05$) were observed, but tibial resection levels tended to be greater in group 3 (less than 1 mm on average) ($p<0.05$). There was a slightly increased risk for postoperative extension deficit in group 3, ranging from -17.22° (SD 3.49) preoperatively to -2.41° (SD 4.46) postoperatively ($p<0.05$).

Conclusion:

There is no need to proximalise the JL to address extension deficits up to 20° in a KA or rKA RA-TKA. Only a slight increase in tibial resection levels were observed. The higher risk for persistent flexion contracture is also described in the literature for MA, but still, we observed a significant improvement compared to preoperative.

Session 1 - 29 November 2023 - 18.00

Title: Which Method For Femoral Component Sizing When Performing A Kinematically Aligned TKA? An In-Silico Study

Authors:

Charles Rivière, Fasen Huang, Loic Villet, Ben Preston, Simon Harris, Justin Cobb

Introduction:

The Kinematically Alignment (KA) technique for TKA aims to reproduce the pre-arthritis knee anatomy, including both the femoro-tibial and femoro-patellar joints. An in-silico study was conducted to compare 3 different femoral component sizing techniques to identify the anatomical landmark which allows closest restoration of the native trochlear anatomy. Our study's question is: What is the best method for sizing the femoral component when performing KA-TKA?

Methods:

GMK sphere® (Medacta) femoral component 3D models were virtually kinematically aligned on 30 tri-dimensional (3D) bony OA knee models. The femoral component was mediolaterally positioned to match distal native and prosthetic grooves. Three methods were used to size the femoral component: (Figure 1): a conventional method with the anterior femoral cut flush to the femoral cortex (C-KATKA), and two alternative personalized methods aiming to recreate either the medial facet's height (ATM-KATKA), or the groove's height (ATG-KATKA). In-house analysis software was used to compare native and prosthetic trochlear articular surfaces and mediolateral implant overhangs.

Results:

Compared with the C-KATKA, ATG-KATKA and ATM-KATKA techniques increased the component size by a mean of 0.90 (SD 0.31, min 0.5 to max 1.5) ($P < 0.001$) and 1.02 (SD 0.31, min 0.5 to max 1.5) ($P < 0.001$), respectively. C-KATKA technique substantially understuffed the trochlea with maximum values of 7.11mm (SD 1.39, min 3.93mm to max 10.57mm) in the medial facet, 4.72mm (SD 1.27, min 1.46mm to max 6.86mm) in the lateral facet and 4.51mm (SD 1.40, min 1.92mm to max 7.30mm) in the groove, respectively. Alternative techniques understuffed medial facet with maximum values of 5.07mm (SD 1.29, min 2.83mm to max 8.34mm) and 4.70mm (SD 1.52, min 0.83mm to max 8.04mm) for ATG-KATKA and ATM-KATKA techniques, respectively. There was no significant understuffing of the groove or lateral facet for alternative techniques (ATM and ATG). The ATM-KATKA and ATG-KATKA techniques generated mediolateral implant overhang, mainly postero-lateral, with a rate of 90.0% and 86.7%, respectively. In this study, no mediolateral implant overhang was found for C-KATKA.

Discussion / Conclusion:

The C-KATKA technique substantially understuffs the native trochlear articular surfaces in medial, lateral and groove parts. Alternative techniques (ATM-KATKA and ATG-KATKA) for sizing the femoral component better restore the native trochlear anatomy but also generate a high rate of postero-lateral implant overhangs. Would this posterolateral implant overhang be clinically deleterious remains unknown. The aspect ratio of contemporary femoral TKA implants can probably be optimised to allow a better anatomical restoration of the anterior femoral compartment.

Session 1 - 29 November 2023 - 18.07

Title: Trochlea morphology demonstrates variability but no gender difference in patients undergoing robotically assisted TKA

Antonio Klasan^{1,2}, Victoria Anelli-Monti¹, Angelika Schwarz¹, Maximilian Zacherl¹,
Christian Kammerlander¹

1-AUVA UKH Steiermark, Graz, Austria

2-Johannes Kepler University, Linz, Austria

Background:

In recent years, coronal lower leg alignment has received significant attention. Two classifications recently described the variability in both femoral and tibial morphology, resulting in differing native lower limb alignment.

The native trochlea and the variability in morphology has received less attention.

Methods:

This is a prospective cohort study of 170 patients undergoing robotically assisted TKA. Preoperative transverse CT scans were used to determine the posterior condylar axis (PCA), transepicondylar axis (TEA), lateral trochlear inclination (LTI), the sulcus angle (SA) and the anterior trochlear line (ATL). Outliers were defined as values >1.5 IQR from median value. Trochlea dysplasia was defined as LTI<11°. Gender differences were compared.

Results:

In total, 84 patients were female (49.4%). LTI and SA were normally distributed ($p=0.151$; $p=0.228$). SA had a median of 136.5° (IQR 13°), ATL 4° (IQR 4), LTI 18° (IQR 6°). Median TEA-PCA was 5° external (IQR 3°). There were 4.11% outliers in SA, 2.9% of outliers in ATL, 7.6% outliers in LTI and 4.11% outliers in the TEA-PCA. Trochlear dysplasia was present in 9.4% of the measurements. There was no difference in any of the angles between the genders.

Conclusion:

The present study demonstrates a significant number of outliers in trochlear morphology in all measured angles. Larger cohorts but also, more investigations, are needed to better understand the trochlear morphology of patients undergoing total knee arthroplasty. The personalized alignment strategies and implants need to account for this variability in the population.

Session 1 - 29 November 2023 - 18.14

Title: Off-the-shelf TKA fails to restore the native patellofemoral alignment regardless of the alignment strategy

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1-AUVA UKH Steiermark, Graz, Austria

2-Johannes Kepler University, Linz, Austria

Background:

Alternatives to mechanical alignment (MA) in total knee arthroplasty (TKA) have gained popularity, especially kinematic alignment (KA). Whereas MA restores the neutral leg axis, KA aims to restore the native kinematics of the knee. Some data on variability of native trochlea morphology exists, however, the alteration in morphology after TKA remains unknown. Off-the-shelf implants have a single trochlear design, anchored to accommodate the flexion gap.

Methods:

This is a prospective cohort study of 170 patients undergoing robotically assisted TKA. Preoperative CT scans were used to determine the posterior condylar axis (PCA), transepicondylar axis (TEA), lateral trochlear inclination (LTI), sulcus angle (SA) and anterior trochlear line (ATL). Due to the lack of the manufacturer data, LTI, SA and ATL angles of the planned TKA implant for all sizes were measured digitally and in real-time. LTI, SA and ATL were measured after digital implantation with MA (3° external to PCA) and KA

Results:

TKA implant's SA was 143°, TAL 2° and LTI 18°. SA was restored in 24.7% of patients. LTI was restored in 45.3% for MA and 48.2% for KA ($p=0.59$). TAL was restored in 34.1% for MA and 60.0% for KA ($p<0.001$). In 5.3%, none of the parameters could be restored, regardless of the alignment.

Conclusions:

As a consequence of a unified design of off-the-shelf implants, restoring patellofemoral alignment can be achieved in 25-60% of patients. Further studies investigating clinical relevance are needed.

Session 2 - 29 November 2023 - 19.00

Title: TKA alignment & implant design

Achieving Better Clinical Outcomes after Total Knee Arthroplasty in valgus knee deformity: The Role of Alignment Strategies.

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

Background:

This study aimed to assess the impact of postoperative knee alignment on functional outcomes and satisfaction in a population with preoperative valgus knee.

Methods:

This retrospective study included primary total knee arthroplasty (TKA) for osteoarthritis with a preoperative hip-knee-ankle (HKA) angle $\geq 180^\circ$. 460 knees were included, divided into three groups: preoperative neutral alignment (180° to 183°) ($n=162$), preoperative mild valgus (184° to 190°) ($n=204$), and preoperative severe valgus ($>190^\circ$) ($n=94$). The demographic parameters were similar in the three groups. A standardized surgical technique was employed to achieve neutral postoperative alignment. Radiographs, Knee Society Scores (KSS), range of motion, and satisfaction rates were collected at the last follow-up.

Results:

The mean follow-up was 68.3 months ± 12.4 . In mild valgus group, postoperatively, 10.8% of patients had $HKA < 176^\circ$, 81.4% had HKA between $177-183^\circ$, and 7.8% had $HKA > 184^\circ$. In severe valgus group, postoperatively, 4.3% had $HKA < 176^\circ$, 83.0% had HKA between $177-183^\circ$, and 12.8% had $HKA > 184^\circ$. In the preoperative mild valgus group, patients with postoperative neutral alignment had significantly higher satisfaction ($p=0.0004$) and KSS function score ($p=0.031$) at the last follow-up compared to patients with postoperative valgus alignment. Patients with preoperative mild or severe valgus demonstrated higher rates of dissatisfaction ($p=0.005$) and lower KSS function score ($p=0.014$) if they had postoperative varus alignment.

Conclusion:

When dealing with preoperative valgus deformity, it is crucial to avoid overcorrection into varus, which is associated with poorer functional outcomes. For mild valgus, correction to neutral alignment achieved better outcomes than leaving a residual valgus.

Session 2 - 29 November 2023 - 19.07

Title: Better Motor Control during the Forward Lunge after inverse Kinematic Aligned TKA Compared to adjusted Mechanical Aligned TKA - a Comparative, Blinded Analysis of 45 Subjects at 2 Years Postop

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Background:

Patients who undergo total knee arthroplasty (TKA) with inverse kinematic alignment (iKA) tend to report higher satisfaction levels compared to those with adjusted mechanical alignment (aMA). However, these observations require validation through biomechanical studies that examine gait and everyday functional movements. This study aimed to compare the performance of bipodal squats between a group of patients who received iKA and a group who received aMA.

Methods:

The investigation involved a cohort of 15 patients with aMA and 15 patients with iKA, both evaluated two years after their surgeries. All patients underwent robotically assisted procedures following an identical perioperative protocol. A control group consisting of 15 healthy individuals, matched for age and sex, was also included for comparison. The forward lunge motion was analyzed using a 3D Vicon motion analysis system, focusing on spatiotemporal and kinematic parameters. Data collection was performed by an investigator who was blinded to the group assignments.

Results.

The duration of the loading phase of the forward lunge with iKA (39,6%) was close to the healthy controls (43,2%). With aMA, the loading phase was shorter (34,2%). The duration of the push back was longest with aMA (43,0%), when compared to iKA (39,1%) and the healthy controls (33,0%). (Table 1) The range of motion of the knee flexion during forward lunge was 49,8° with iKA, 38,8° with aMA and 68,3° with the healthy controls. Maximal hip flexion angle was 73,6° with iKA, 63,1° with aMA and 76,9° with the healthy controls.

(Table 2 and Figure 1)

Conclusion.

At two years postoperative, performance of the forward lunge with iKA is better compared to aMA. Better preservation of the native anatomy and native joint line obliquity might r

Table 1: Temporal performance of forward lunge

Spatiotemp parameters	iKA (n=15) mean \pm SD	aMA (n=15) mean \pm SD	Controls (n=15) mean \pm SD	iKA vs. aMA	iKA vs. CONTROL	aMA vs. CONTROL
Lunge total duration (s)	6.44 \pm 1.69	6.37 \pm 1.25	6.33 \pm 1.26	0,98	0,96	0,99
Forward swing phase (%)	14.61 \pm 3.24	14.43 \pm 3.98	14.37 \pm 2.78	0,98	0,96	0,99
Loading phase (%)	39.6 \pm 12.03	34.18 \pm 12.1	43.21 \pm 11.37	0,35	0,53	0,02
Push back phase (%)	39.12 \pm 12.83	42.97 \pm 16.7	32.96 \pm 13.64	0,70	0,28	0,04
Step back phase (%)	14.76 \pm 5.04	15.51 \pm 5.72	13.76 \pm 3.55	0,87	0,71	0,37

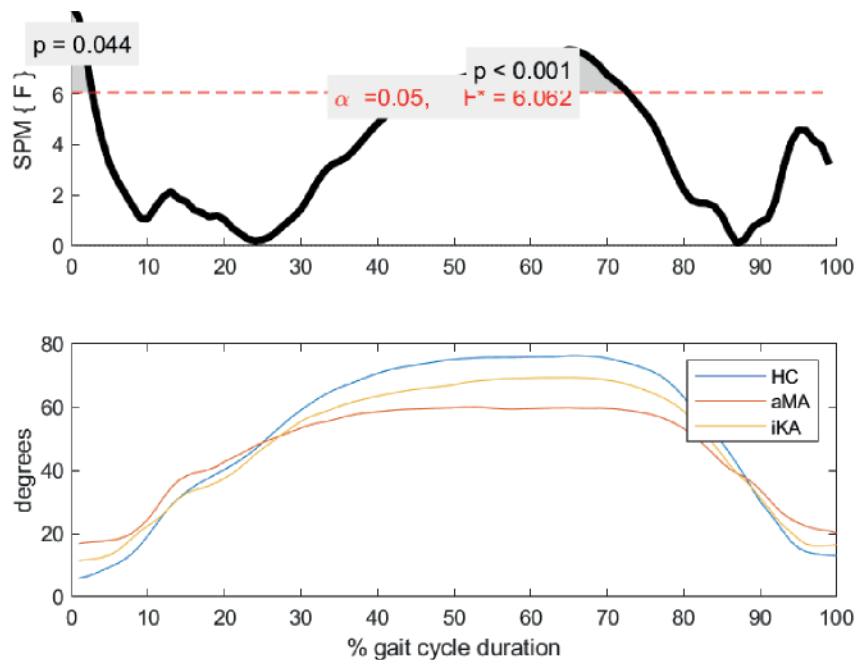
iKA= inverse kinematic alignment total knee arthroplasty; aMA= mechanical alignment total knee arthroplasty; SD= standard deviation. statistical significance was set at $p < 0.05$;

Table 2: Maximal angle and range of motion of sagittal kinematics of the hip, knee and ankle.

Kinematic parameters	iKA (n=15) mean \pm SD	aMA (n=15) mean \pm SD	Controls (n=15) mean \pm SD	iKA vs. aMA	iKA vs. CONTROL	aMA vs. CONTROL
Maximal hip flexion (°)	73.57 \pm 7.37	63.08 \pm 13.1	76.87 \pm 14.05	0,04	0,63	0,005
Maximal knee flexion (°)	61.58 \pm 20.52	59.27 \pm 19.8	87.05 \pm 21.75	0,94	0,001	0,000
Maximal ankle dorsiflexion (°)	19.07 \pm 8.02	15.15 \pm 7.41	23.02 \pm 5.97	0,92	0,11	0,004
ROM sagittal hip (°)	64.51 \pm 10.46	45.54 \pm 14.5	71.17 \pm 14.44	0,00	0,23	0,000
ROM sagittal knee (°)	49.78 \pm 23.93	38.79 \pm 17.8	68.26 \pm 27.29	0,38	0,26	0,000
ROM sagittal ankle(°)	31.53 \pm 12.99	30.21 \pm 20.8	37.64 \pm 17	0,97	0,42	0,28

iKA= inverse kinematic alignment total knee arthroplasty; aMA= mechanical alignment total knee arthroplasty; SD= standard deviation; statistical significance was set at $p < 0.05$;

Figure 1: Hip sagittal flexion angle of forward lunge – ANOVA



iKA= inverse kinematic alignment total knee arthroplasty; aMA= mechanical alignment total knee arthroplasty.
HC: healthy controls

Session 2 - 29 November 2023 - 19.14

Title: Impact of tibial component alignment boundaries on femoral component orientation in functionally aligned TKA.

Britt Ollivier, Edgar Wakelin, Chris Plaskos, Thomas Luyckx

Introduction:

Modern total knee arthroplasty (TKA) alignment strategies often accept some degree of tibial varus to balance the knee without ligament releases, which impacts femoral component orientation in a tibia-first balancing technique. This study aimed to investigate the influence of increasing the tibial boundaries in functional alignment on femoral component orientation.

Methods:

A retrospective review of a prospective database of robot-assisted TKAs using a digital joint tensioning device was performed (BalanceBot®, Corin, UK). 692 TKAs with correctable deformity were included. Functional alignment with a tibia-first balancing technique was simulated by performing an anatomical tibial varus resection to recreate the native tibial joint line within certain boundaries (A. 0–3°, B. 0–4°, C. –2–6°) while accounting for wear. After balancing the knee, the resulting amount of femoral component outliers in the coronal and axial plane was calculated for each group and correlated to the CPAK classification.

Results:

The proportion of knees with high varus (>6°) or valgus alignment (>3°) increased from 21.5% in group A to 26.5% in group B and 34.2% in group C ($p \leq 0.0348$). Similarly, more knees with high external rotation (>6°) or internal rotation (>3°) were identified in group C (33.4%) than group B (23.7%) and group A (18.4%) ($p \leq 0.0184$). There was a statistically significant ($p \leq 0.0051$) overall increase in knees with both femoral component valgus >3° and internal rotation >3° from group A (4.0%) to B (7.7%) and C (15.8%), with CPAK group I and II showing a 12.7 fold and 2.9 fold increase, respectively.

Conclusion:

Extending the tibial boundaries when using functional alignment with a tibia-first balancing technique in TKA leads to a statistically significant higher percentage of knees with more than 3° of valgus and internal rotation of the femoral component, especially in CPAK group I and II.

Session 2 - 29 November 2023 - 19.21

Title: The Oxford Partial Surgical Technique – pre-disease physiological joint line reconstruction

Authors:

Professor Andrew Price Mr Abtin Alvand
Mr Will Jackson

Nuffield Orthopaedic Centre Oxford
UK

Background:

The Oxford partial knee replacement was designed 48 years ago. During this time it has maintained the same key geometries of the components; a spherical femur, a flat tibia and a fully congruous polyethylene bearing. The implantation technique uses manual instruments to firstly create a flexion gap with a bone sparing tibial cut and a femoral component sized and positioned to anatomically reconstructs posterior femoral condyle. Secondly 1mm increments of bone are milled in extension to create physiological tension in the medial collateral ligament, to recreate the patients pre-disease distal femoral articular angle and therefore create the patients pre-disease physiological joint line. The aim of this study was to measure how accurately the Oxford Partial Surgical technique reconstructs the joint line.

Methods:

30 patients were studied who all had anterior medial osteoarthritis and underwent medial Oxford Partial knee replacement using the Oxford partial surgical technique with microplasty manual instruments. In each case we measured from pre-operative and post-operative radiographs the pre-operative; Distal femoral articular angle (DFAA) (degrees), the posterior condylar offset (PCO) (mm), and the tibial posterior slope (TPS) (degrees). We established the intra and inter observer repeatability of the measurement techniques. pre and post-operation Oxford Knee scores were recorded for the patients.

Results:

Intra and inter user variation calculations were: DFAA 0.07 and -0.01, PCO 0.11 and 0.22 and TPS -0.06 and 0.05. Comparing pre-operation to post-operation: the DFAA showed a mean difference of -1.2 degrees (SD 2.7), the PCO showed a mean difference of 0.8mm (SD 1.6) and the PTS -3.51 degrees (SD 4.3). The patients all had significant improvement in OKS pre to post operation with a mean final score of 42.

Conclusion:

The Oxford Partial Surgical Technique accurately reconstructs the patients pre-disease joint line by recreating the distal femoral articular angle and posterior condylar offset. This accurate reconstruction of the joint line restores pre-disease alignment, physiological joint motion and creates excellent clinical outcomes for patients.

Session 2 - 29 November 2023 - 19.28

Title: How Reproducible is the Callipered KA Technique for Aligning the Tibial Component of a Medial OXFORD® UKA?

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Introduction:

The kinematic alignment (KA) technique for medial noncompartmental knee arthroplasty (UKA) aims at preserving the anatomy, laxity, and biomechanics of the medial compartment as well as maintaining a good implants interaction throughout the knee range of motion (ROM). However, the precision of the manual implantation of a medial KA UKA (i.e., callipered technique) has never been assessed. The goal of this study is to assess the precision of tibial component implantation.

Methods:

The operative notes and preoperative, as well as 6-week postoperative, radiographs from a series of 90 consecutive callipered medial KA UKAs performed by one of the authors (CR) were reviewed. To establish the orientation of the tibial cut in both the frontal and sagittal planes, as well as its thickness, specific anatomical landmarks were used. Frontal alignment was achieved relying on the 'medial wall of the medial femoral condyle'. Sagittal alignment was achieved using a 2.5mm K-wire inserted in the joint line and lying on the anterior and posterior rims of the medial tibial plateau. The 'deep MCL line' served as a reference for determining the tibial cut thickness. The precision of the technique for coronal alignment was assessed by measuring on post-operative frontal knee radiograph the 'Joint line to Tibial line Angle' (JTA), which is the angle between a line parallel to the distal femoral joint line and a line parallel to the tibial component. To evaluate sagittal alignment precision, the Medial Plateau Slope Difference (MPSD) was assessed, representing the difference between the prosthetic and native medial tibial plateau posterior slopes. The thickness of the polyethylene insert was retrieved from the operative notes, providing a metric for the tibial cut thickness precision.

Results:

The mean JTA was -0.2° (SD = 2.6; range -9° to $+6.8^\circ$), with 56%, 83% and 93,1% of cases falling within the range of $\pm 1^\circ$, $\pm 3^\circ$ and $\pm 5^\circ$, respectively. The mean MPSD was -0.7° (SD = 1,9; min = -6.6° ; max = $+3.7^\circ$), with 66%, 85% and 97% of cases falling within the range of $\pm 1^\circ$, $\pm 3^\circ$ and $\pm 5^\circ$, respectively. The mean insert thickness was 3.78 mm (SD = 0.83, range 3 to 6 mm), with 97% of the cases falling within the 4 ± 1 mm range and 44% of the cases having the minimum insert thickness available of 3 mm.

Conclusions:

The native orientation of the medial condylar wall proved to be a reliable anatomical landmark for achieving frontal alignment of the tibial component in medial KA UKA, with 93,1% of cases falling within the $\pm 5^\circ$ "safe zone" relative to the native frontal alignment. Similarly, the K-wire technique resulted in only 3% of patients falling outside the $\pm 5^\circ$ range from the native sagittal alignment. The deep MCL line proved to be an excellent anatomical landmark for determining tibial cut thickness, with a mere 3% of patients exhibiting an insert thickness greater than 2 mm compared to the minimum available.

Session 2 - 29 November 2023 -19.35

Title: Similar Survivorship for Uncemented Mobile-Bearing and Cemented Fixed-Bearing Medial Unicompartmental Knee Arthroplasty but Different Reasons for Revision

Mei Lin Tay, Scott M Bolam, A Paul Monk, Gary J Hooper, Simon W Young

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North Shore Hospital, Auckland, New Zealand
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Middlemore Hospital, Auckland, New Zealand

Introduction:

Unicompartmental knee arthroplasty (UKA) is an effective treatment for patients with isolated compartment osteoarthritis, however the procedure has higher revision rates and debate around patient selection remains. Long-term survivorship and accurate characterisation of revision reasons are typically limited by a lack of long-term data and standardised revision definitions. We aimed to identify the survivorship, risk factors and revision reasons in a large UKA cohort with long-term follow-up (up to 20 years).

Method:

Patient, implant and revision details were recorded through clinical and radiological review for 2,137 consecutive patients undergoing primary medial UKA across four tertiary referral hospitals between 2000 and 2017. Revision reasons were determined from review of clinical, laboratory, and radiological records for each patient using a standardised protocol. To ensure complete follow-up data was cross-referenced with the New Zealand Joint Registry to identify patients undergoing subsequent revision at outside hospitals. Implant survival, revision risk and revision reasons were analysed using Cox proportional-hazards and competing risk analyses.

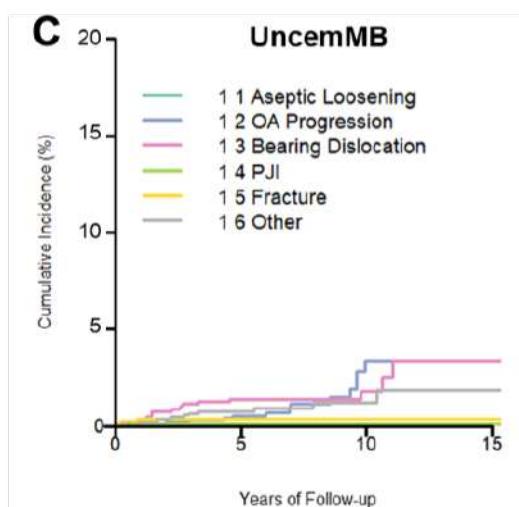
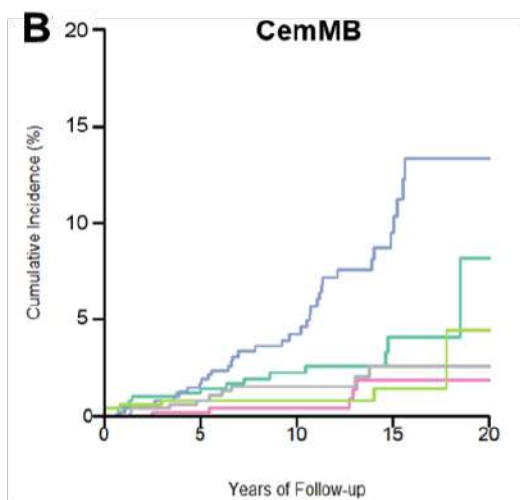
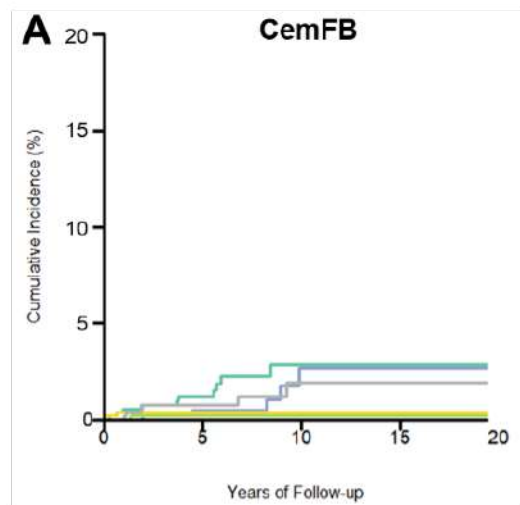
Results and Discussion:

Implant survivorship at 15 years was comparable for cemented fixed-bearing (cemFB; 91%) and uncemented mobile-bearing (uncemMB; 91%), but lower for cemented mobile-bearing (cemMB; 80%) implants. There was higher incidence of aseptic loosening with cemented implants (3-4% vs. 0.4% uncemented, $p<0.01$), osteoarthritis (OA) progression with cemMB implants (9% vs. 3% cemFB/uncemMB; $p<0.05$) and bearing dislocations with uncemMB implants (3% vs. 2% cemMB, $p=0.02$). Compared with the oldest patients (≥ 75 years), there was a nearly two-fold increase in risk for those aged 55-64 (hazard ratio 1.9; confidence interval 1.1-3.3, $p=0.03$), associated with higher incidence of bearing dislocation (2% vs. 1%; $p<0.05$) and disease progression (8% vs. 5%; $p=0.03$) but lower incidence of aseptic loosening (2% vs. 4%, $p=0.048$). No association was found with gender, BMI or ASA.

Conclusions:

Cemented mobile-bearing implants and younger age were linked to lower implant survivorship. These were associated with disease progression and bearing dislocations. The use of cemented fixed-bearing and uncemented mobile-bearing designs have superior comparable long-term survivorship.

ABSTRACTS



Cemented mobile-bearing implants and younger age were linked to lower unicompartmental knee implant survivorship, and these were associated with disease progression and bearing dislocations

Session 2 - 29 November 2023 - 19.42

Title: Does Alignment Technique in Medially Stabilised Total Knee Arthroplasty Affect the Patello-Femoral Joint? Clinical and Radiological Outcomes at 1 year.

Authors:

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2: Leeds Teaching Hospitals NHS Trust and University of Leeds, Leeds, UK

Presenting Author: Hemant Pandit (h.pandit@leeds.ac.uk)

Category:

TKA Alignment and Implant Design

Background:

Mechanical (MA) and kinematic alignment (KA) are two philosophies in TKA alignment. MA aims to create 180° HKA angle in the coronal plane and a perpendicular tibiofemoral joint line. KA aims to restore the pre-arthritis joint obliquity and limb alignment. Unlike MA, in KA no external rotation of femoral component is implemented, which can adversely impact the PFJ biomechanics. This study compares effects of alignment on patellar tilt and clinical outcomes in medially-stabilised (MS) TKA.

Methods:

Hospital-based arthroplasty registry prospective cohort study including all MA or KA primary MS-TKA patients with patella resurfacing were included. Radiographic data reviewed (pre-operatively, at 6-weeks and at 1-year post-surgery) included patellar tilt, patellar height, hip-knee-ankle angle and tibial slope. Clinical outcomes were recorded pre- and 1-year post-surgery (WOMAC pain and function).

Results:

There were 129 TKAs; 51 MA and 78KA. Mean age 67.7 years (± 8.3) and mean BMI 29.8 (± 5.5). No difference in patellar tilt was noted pre-operatively or at 6-weeks. At 1-year, patellar tilt was significantly less in the MA group 3.98° (SD 3.2) vs KA group 5.88° (SD 4.8). Pre-operative and 1-year clinical outcomes not statistically different between groups. Patellar tilt at 1-year did not correlate with 1-year WOMAC.

Conclusions:

A 2° difference in the patellar tilt for MA vs KA TKA at 1-year post-surgery, although statistically significant, is not clinically relevant (no correlation of patellar tilt with 1-year WOMAC). This study confirms that MS-TKA implanted using KA philosophy does not adversely impact the PFJ biomechanics and achieves equivalent clinical outcomes.

Session 3 - 30 November 2023 - 9.30

Title: Long-Term Results of Primary Total Knee Arthroplasty Performed in Patients 35 Years of Age and Younger

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⁴ Mayo Clinic, Department of Orthopedic Surgery, Rochester, MN, United States Topic: General Topics-

Objectives:

Total knee arthroplasties (TKA) for patients 35 years of age and younger are rare but necessary for patients with diseases such as juvenile idiopathic arthritis, avascular necrosis, osteoarthritis, and rheumatoid arthritis. Few studies have examined the long-term survivorship and clinical outcomes of TKAs in a large cohort of young patients.

Methods:

A retrospective registry review identified 185 TKAs in 119 patients younger than 35 years between 1985 and 2010 performed at a single institution. The primary outcome was failure, defined as reoperation for any reason. Patient-reported outcomes were assessed at two time points: 2011-2012 and 2018-2019, with response rates of 89% and 65%, respectively.

Results:

The average age was 26 (12-35) years. Mean follow-up was at 17 (8-33) years. Survivorship decreased from 84% (95% CI: 79-90) at 5 years to 70% (95% CI: 64-77) at 10 years to 37% (95% CI: 29-45) at 20 years. Risk factors for failure included increasing age at the time of surgery (HR = 1.3) and the use of constrained (HR = 1.7) or hinged prostheses (HR = 4.3). Eighty-six percent of patients reported that their surgery resulted in "a great improvement," or better. Seventy-six percent of patients achieved PASS on KOOS JR at 20 years post-TKA.

Conclusion:

Survivorship of total knee arthroplasties in young patients is less favorable than expected, but patient-reported functional outcomes were excellent. Revision risk increased with older age and higher levels of constraint.

Session 3 - 30 November 2023 - 9.37

Title: Lateral UKA can be a safe solution in a young patients' population: 10 years follow up report

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2. Università Cattolica del Sacro Cuore, Roma, Italy.
3. Clinica Ortopedica e Traumatologica, Fondazione IRCCS Policlinico San Matteo, Pavia, Italy
4. IUSS Pavia, Italy

Background:

This study aimed to assess the long-term survivorship and functional outcomes of fixed-bearing lateral unicompartmental knee arthroplasty (UKA) in a young patients' population with osteoarthritis limited to the lateral compartment.

Methods:

The study included a cohort of consecutive patients who underwent lateral UKA between January 2008 and December 2014 at a single high-volume surgical center. The surgical procedures were performed by experienced surgeons using a lateral parapatellar approach and fixed-bearing implants. Patient follow-up included a retrospective re-evaluation, clinical assessments, patient-reported outcome measures (PROMs), and X-ray analysis.

Results:

A total of 40 lateral UKAs were analyzed, with 19 performed on the left and 21 on the right knee. The mean age of the patients at the time of surgery was 57.6 years, and the mean BMI was 24.8. At the final follow-up, 80% of patients achieved excellent outcomes (OKS > 41), and 20% had good outcomes (OKS: 34 - 41). No patients exhibited fair or poor outcomes. The mean FJS at the final follow-up was 82.8. The mean WOMAC was 10.5. Kaplan-Meier survival analysis revealed a survivorship rate higher than 90% at 10 years, considering revision for any reason as endpoint.

Conclusions:

Lateral UKA proved to be an effective treatment option for primary, post-traumatic osteoarthritis or osteonecrosis affecting the lateral compartment of the knee. The study demonstrated a high survivorship rate and favorable functional outcomes at a mean follow-up of 132.7 months. These findings highlight the potential benefits of fixed-bearing lateral UKA in selected patients with lateral compartment knee pathology.

Session 3 - 30 November 2023 - 9.44

Title: Fifteen Year Results of Cementless Medial Oxford Unicompartmental Knee Replacement.

N Widari, S Mellon, C Dodd, D Murray
University of Oxford

The cementless Oxford Unicompartmental Knee replacement (OUKR) was introduced to minimise the risk of aseptic loosening. The study aim was to determine its survival and functional outcomes at 15 years.

1000 cementless medial OUKR were implanted by two surgeons between 2004 and 2017 for antero-medial osteoarthritis (982) or avascular necrosis (18) were prospectively and independently followed-up. The mean follow-up was nine years and maximum 18 years. Survival was assessed using various endpoints and the primary outcome measure was the Oxford Knee Score (OKS, range 0–48).

The 15-year survival rate was 89% (CI 81.7-96.8) for all re-operations, 90% (CI 82.6-97.4) for revision, 99.8% (CI 99.5-100) for major revision needing revision total knee replacement components and 99.9% (CI 99.7-100) for failure of tibial or femoral components. There were 47 re-operations at a mean of 5.1 years (SD 4.3). The most common causes for revision were lateral compartment arthritis (1.3%), pain (1.0%) and bearing dislocation (0.8%). There were two fractures, both of the lateral tibial condyle following trauma. There was one aseptic loosening. The mean OKS was 41.8 (SD 7.7) at 10 years and 40.7 (SD 8.4) at 15 years.

The cementless OUKR has good long-term functional outcomes and survival. The aim, to minimise the risk of aseptic loosening, appears to have been achieved: The only case of loosening (0.1%) was a femoral component that loosened in the first year, probably because the femoral fixation hole was damaged at surgery. resulting in a failure of primary fixation.

Session 3 - 30 November 2023 - 9.51

Title: High rates of return to sport following image-based robotic-arm assisted unicompartmental knee arthroplasty

*Fabio Catani, Francesco Zambianchi, Valerio Daffara, Enrico Festa, Riccardo Cuoghi Costantini
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Background:

This study was aimed to assess the return to sport (RTS) rate in patients who underwent CT-based robotic-assisted unicompartmental knee arthroplasty (RA-UKA) and to evaluate the clinical performance and the association between patients' sport activity levels and Patient Reported Outcome Measures (PROMs) after surgery.

Methods:

This retrospective study included 218 patients undergoing medial RA-UKA with fixed-bearing implants, performed at a single center between 2014 and 2019. Patients were allocated into two groups based on sport's practice and were administered the University of California, Los Angeles (UCLA) activity scale score, the ForgoYen Joint Score-12 (FJS-12), the Knee Injury and Osteoarthritis Outcome Score for Joint Replacement (KOOS-JR) and the 5-Level Likert Scale (5-LLS).

Results:

A total of 136 patients (148 RA-UKAs) were included for assessment. The overall RTS rate after surgery was 93.1%. Six subjects who did not practice sport preoperatively were able to start after surgery and all patients performing sports preoperatively, returned to the same activity level. The mean UCLA and FJS-12 scores in the group of patients practicing sports were significantly higher than in the no-sport group ($p < 0.001$ and $p < 0.05$, respectively). Patients who practiced sports were more likely to attain higher FJS-12 and UCLA scores than those who were not performing physical activity.

Conclusions:

Patients undergoing RA-UKA showed a 93.1% RTS rate after surgery. Differences were detected in terms of postoperative UCLA and FJS-12 scores between patients who performed and who did not practice sport activities after surgery. High levels of postoperative UCLA scores were associated with higher KOOS-JR and patients' satisfaction.

Session 3 - 30 November 2023 - 09.58

Title: The Added Utility of Magnetic Resonance Imaging in Pre-operative Assessment for Patients Undergoing Medial Unicompartmental Knee Arthroplasty

Mei Lin Tay¹, Scott Matthew Bolam, Tyler Campbell, Laura Hill, Hayley Hai-Lin Wong, David Campbell McDonald Dow, Jacob Munro, Simon Young, Andrew P Monk
¹University of Auckland

Introduction:

For unicompartmental knee arthroplasty (UKA), patient selection using optimal indications can optimise success and longevity of the implants. The current gold standard for assessing eligibility is with radiographs, however magnetic resonance imaging (MRI) may allow for more accurate assessments of cartilage thickness loss. We aimed to evaluate the utility of MRI for pre-operative assessment of medial UKA patients by: 1) comparing OA severity of the medial, lateral and patellofemoral (PF) compartments when assessed using MRI compared with standard radiographs, and 2) investigating associations of these two assessments with post-operative clinical outcomes.

Methods:

Retrospective review was performed for 84 cases (81 patients) of primary medial UKA between 1 January 2017 and 31 December 2021. The main outcomes measures were pre-operative cartilage loss and patient-reported clinical outcomes. Pre-operative cartilage loss was recorded using the International Cartilage Repair Society (ICRS) classification using MRI, and Kellgren-Lawrence (K-L) scores from radiographs. Patient-reported clinical outcomes were measured using early (6- week) or late (1- or 2-year) Oxford Knee Score (OKS) 'change' scores. Differences were tested using t-tests or 1-way ANOVA (normally-distributed) or Mann-Whitney (non-parametric).

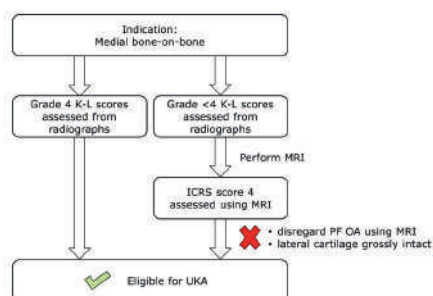
Results:

Use of MRI had improved accuracy over radiographs. In the medial compartment, 37 (44%) patients had less severe radiographic K-L scores (1 to 3), however all patients had the most severe MRI ICRS scores (4). For patients with mild K- L scores (0 and 1), 20 (43%) and 5 (71%) patients had more severe ICRS scores (3 and 4) within their lateral and PF compartments, respectively. Higher pre-operative ICRS scores for the PF compartment was associated with higher OKS at late follow-up ($p=0.03$), but no associations were found between ICRS scores and OKS for the medial and lateral compartments.

Discussion and conclusion:

Overall, accuracy in the assessment of cartilage thickness loss was improved with use of MRI, however patients with more severe pre-operative PF disease reported better post-operative outcomes. The findings of this study suggest that MRI has utility for pre-operative assessment of the medial compartment for UKA patient selection, however evidence of disease in the PF compartment assessed using MRI is not considered a contraindication for UKA.

Figure: Proposed additional MRI assessment step for improved UKA patient selection.



ICRS, International Cartilage Repair Society; K-L, Kellgren-Lawrence; MRI, magnetic resonance imaging; OA, osteoarthritis; PF, patellofemoral; UKA, unicompartmental knee arthroplasty.

Session 3 - 30 November 2023 - 10.05

Title: The knee arthroplasty usage profile of orthopaedic surgeons and the association with patient-reported outcome: A cohort study of 2045 patients.

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Clinical Orthopaedic Research Hvidovre (CORH), Department of Orthopaedic Surgery, Copenhagen University Hospital Hvidovre, Kettegård Alle 30, 2650 Hvidovre, Copenhagen, Denmark

Background:

Using medial unicompartmental knee arthroplasty (UKA) in more than 20% of primary knee arthroplasties is associated with low revisions rates. However, it remains unknown how a surgeon's knee arthroplasty usage profile (the mix of total and unicompartmental surgeries) relates to postoperative improvements in patient reported outcomes.

Design:

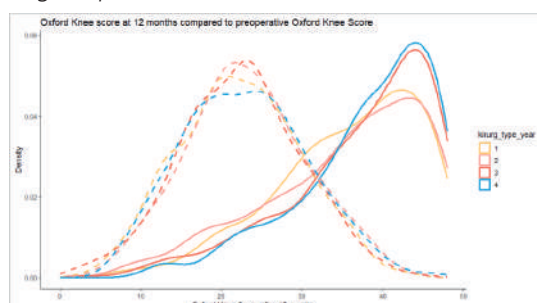
We included 2045 knee arthroplasty patients operated between August 2016 and August 2021 with 1 year follow-up. The Oxford Knee Score (OKS), the Forgotten Joint Score (FJS) and the Activity and Participation Questionnaire (APQ) were assessed preoperatively and after 3 and 12 months. Yearly arthroplasty usage profiles were defined based on the surgeries performed by each surgeon: 1) only TKA 2) TKA +<20% medial UKA 3) TKA +>20% medial UKA and 4) TKA +>20% medial UKA + lateral UKA + patellofemoral UKA. Changes in mean PROM scores were analysed using linear regression models adjusted for demographics and preoperative PROM scores.

Results:

Profile 3 and 4 had a higher change in mean scores in both OKS, FJS, and APQ at 3 and 12-month follow-up compared to profile 1 (12 months; OKS: 1.6 points (CI 0.63-2.6), FJS: 7.1 points (CI 4.0-10.2), APQ: 7.2 points (CI 3.5-10.6)). There were no significant differences between profile 1 and 2 at any follow-up. Nor were there significant differences between type 3 and 4.

Conclusion:

We found that knee arthroplasty surgeons performing >20% medial UKAs produce higher postoperative increase in PROM scores among all their knee arthroplasty patients. Our findings further support that eligible patient should be offered UKA.



Density plot showing the pre- and 12 months post-operative OKS scores for each surgeon profile. The difference between profiles 3+4 (> 20 % UKA) vs. profiles 1+2 is apparent.

Session 3 - 30 November 2023 - 10.12

Title: A Second PKA behaves more like a primary PKA than a primary TKA

Cobb, Liddle, Jones, Garner

Background:

For over 15 years we have adopted the "philosophie d'Aubaniac et Cartier" in our group, trying never to resect the 'pivot centrale' and thus preserving the biomechanical integrity of the knee. Adding a second partial knee replacement is an alternative to a total knee arthroplasty (TKA). We wondered how patients who receive a second partial knee replacement(2ndPKA) behave?

Methods:

23 Patients who had undergone a second second partial knee (2nd PKA) were identified from our database. These were matched for age, gender and procedure with patients who had undergone the same procedure as a primary operation (1st PKA), and those who had undergone a primary total knee arthroplasty (TKA).

Results:

2ndPKA patients walked better than TKA patients in all gait parameters. At top walking speed 2nd PKA patients walked faster, with more normal stride length and weight acceptance. 1st PKA patients walked faster, but in other characteristics were similar to 2ndPKA patients.

In the OKS questions 3, 7 and 10, the 2nd PKA and 1st PKA were statistically superior to TKA. In EQ5D, the domains of mobility, pain and usual activities were also significantly superior.

Conclusions:

This case controlled study of partial knee arthroplasty suggests that the 'second uni' approach is a clinically effective approach that may give comfort to those considering a primary uka. This raises the question whether it should be considered a revision arthroplasty in national registries.

Session 3 - 30 November 2023 - 10.19

Title: The outcome of revision knee surgery in patients who had their primary arthroplasty aged 55 years or less.

Colin Esler, Associate Professor / Consultant Orthopaedic Surgeon
Martin Hughes, Extended Scope Practitioner
Azhar Din, Knee Fellow
Dept. of Orthopaedic Surgery, University Hospitals of Leicester NHS Trust.

Background:

In the UK around 11% of primary knee arthroplasties are performed in patients aged 55 years or less. The 10 year survivorship is 93% (NJR). Our aim was to determine the outcome of the revision surgery from patient reported outcome scores.

Methods:

We analysed prospectively collected data from our institution's arthroplasty database. This includes patient demographics, surgical details, findings at revision surgery and PROMS (OKS, AKSS, EQ5D). We identified 91 revision procedures in 87 patients (4 bilateral revisions), 48 female. The age at primary knee arthroplasty was from 32 to 55 years and 48-81 years for their revision procedure.

Results:

The time from primary to revision surgery ranged from 1 month to 34 years (median 8 years). BMI ranged from 19 to 47 (median 32). 14 were revised for infection, 10 for progression of osteoarthritis, 10 for malalignment / instability, but a majority for aseptic loosening +/- lysis. The BASK Complexity Grade was R1 in 24, R2 in 43 and R3 in 23. The 1 year Oxford Knee Score ranged from 4 to 47 out of 48, median 19. The change in Oxford Knee Score from pre-op to 1 year ranged from -2 to 33 (Mean + Median 13 points). The complexity of the surgery did not appear to have an effect on the change of score

Conclusion:

Patients who have arthroplasties aged less than 55 years frequently have co-morbidities which make failure of the implant more likely and increase the complexity of their revision surgery and lead to disappointing PROMS.

Session 3 - 30 November 2023 - 10.26

Title: CPAK classification cannot determinate segmental extra-articular knee deformity

Authors:

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Introduction:

Coronal Plane Alignment of the Knee (CPAK) classification allowing the surgeon to measure the pre-ar-thritic coronal limb alignment.

Even if CPAK classification is helpful for align total knee arthroplasty is still not clear if there is a correlation between CPAK-matrix-groups and segmental extraarticular knee deformity. The purpose of this study is to find a correlation between CPAK-matrix-groups and segmental extraarticular deformity in the pre-ar-thritic knee.

Materials and methods:

Radiological lower limb evaluation of 1240 pre-ar-thritic knees was carried out through lower limb analysis according to Paley then all the knees were classified into CPAK-matrix-groups.

To find a correlation between CPAK-matrix-groups and segmental extraarticular deformity nine potential coronal extraarticular deformity phenotype groups (CEDP) were identified based on CPAK classification, MPTA and mL DFA neutral values were firstly fixed at $90^{\circ} \pm 2^{\circ}$ and then at $87^{\circ} \pm 2^{\circ}$.

In conclusion each CPAK-matrix-group were analysed itself and segmental extraarticular deformity was assessed through comparison with CEDP groups.

Results:

Mean HKA was $178,6^{\circ} \pm 4,4^{\circ}$; LDFA was $86,9^{\circ} \pm 2,5^{\circ}$; MPTA was $85,4^{\circ} \pm 2,4^{\circ}$, aHKA was $-1,4^{\circ} \pm 3,2^{\circ}$ and JLO was $172,5^{\circ} \pm 3,7^{\circ}$.

Varus CPAK groups (I/IV/VII) comprising 435 patients, Neutral Groups (II/V/VIII) 630 patients and Valgus groups (III/VI/IX) 175 patients.

CPAK-matrix-groups are not uniquely related to a specific CEDP group. More common the CPAK-matrix group is (I/II/III/IV/V) weaker the correlation to a unique segmental extraarticular deformity pattern is. Furthermore, if neutral MPTA/mL DFA value is set on $87^{\circ} \pm 2^{\circ}$, the CPAK-matrix-groups show even more extraarticular deformity variability.

Conclusion:

CPAK-matrix-groups do not correlate to a unique extraarticular deformity pattern so they cannot determine the segmental extraarticular knee deformity.

Session 4 - 30 November 2023 - 11.23

Title: Post-operative Continuous Passive Motion does not improve Range of Motion achieved after Manipulation Under Anaesthesia for stiffness in Total Knee Arthroplasty.

Authors:

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Author Affiliations:

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Background:

Stiffness is reported in up to 16% of patients after TKA, and MUA accounts for between 6-36% of readmissions. The use of post-operative CPM remains the subject of debate. We report a retrospective study comparing MUA with and without CPM.

Methods:

In our institution patients undergoing MUA usually receive CPM post-operatively. Owing to the COVID-19 pandemic hospital admissions were limited. During this period MUA procedures were undertaken without CPM. Two cohorts of were included: 1) MUA + CPM 2) Day-case MUA.

Results:

Between 2017-2022 126 patients underwent MUA and were admitted for CPM; 42 had day-case MUA. Median age was 66.5 and 64% were female. 57% had extension deficit ($>5^\circ$), 70% had flexion deficit ($<90^\circ$), and 37% had both. The mean Pre-operative ROM was 72.3° vs. 68.5° , ROM at MUA was 95.5° vs 108.3° [$p < 0.01$], and at final follow-up 87.4° vs. 92.1° for day-case and CPM groups respectively. At final follow-up for the day-case and CPM groups respectively 10% vs. 7% improved, 29% vs. 13% maintained, and 57% vs. 79% regressed from the ROM achieved at MUA. The mean percentage of ROM gained at MUA maintained at final follow-up was 92% and 85% [$p=0.03$] for day-case and CPM groups respectively.

Conclusion:

There was no significant difference in ROM achieved at final follow-up despite the significantly greater improvement in ROM achieved at MUA for the CPM group. The CPM group lost a greater ROM after MUA (15% vs 8%). We conclude that CPM after MUA does not improve ROM.

Session 4 - 30 November 2023 - 11.30

Title: Does CT Imaging Improve Tibial Defect Prediction For Zonal Fixation?

Authors & Affiliation:

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Background:

Improvements in metal artifact reduction protocols for Computer Tomography (CT) allow for improved assessment of bone loss around tibial components prior to revision total knee arthroplasty (rTKA). The purpose of this study was to evaluate the accuracy of preoperative CT-based AORI grading and to correlate CT-based volumetric defect measurements with intraoperative AORI findings.

Methods:

99 patients undergoing rTKA with preoperative CT-images were identified in a institutional revision registry. CT-image segmentation with 3D-Slicer Software was used to create 3D tibial bone defects which were then graded according to the AORI classification. These 3D-CT gradings were compared to preoperative X-ray and intraoperative AORI grading. Volumetric 3D-bone defect measurements were used to investigate the relationship between AORI classification and volumetric defect size in the three anatomic zones of the tibia.

Results:

Substantial agreements between preoperative 3D-CT AORI and intraoperative AORI ($\kappa=0.663; P<0.01$) and fair agreements between preoperative X-ray AORI and intraoperative AORI grading ($\kappa=0.304; P<0.01$) were found. Moderate correlations between volume of remaining bone and intraoperative AORI grading were found in epiphysis ($rS=-0.529; P<0.001$), metaphysis ($rS=-0.557; P<0.001$) and diaphysis ($rS=-0.421; P<0.001$). Small volumetric differences between AORI I vs. AORI II defects and relatively large differences between AORI II and AORI III defects in each zone were detected.

Conclusion:

3D-imaging of bone defects improved the prediction of intraoperative tibial bone loss. CT-imaging appears to be an accurate tool for revision planning based on the concept of zonal fixation. The relatively small difference in defect volume between AORI I, IIa and IIb suggests that updated CT-based classifications might hold benefits for the planning of rTKA.

Session 4 - 30 November 2023 - 11.37

Title: Association between postoperative fixation and later aseptic loosening in revision total knee arthroplasty with hybrid fixated tibial components

Authors and affiliations:

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Department of Orthopaedic Surgery, Sint Maartenskliniek, Nijmegen, the Netherlands

Background:

Implant fixation in revision total knee arthroplasty (rTKA) is a challenge. It is recommended to get appropriate fixation in at least 2 of the 3 anatomic zones (epi-, meta-, diaphysis). But is there an association between fixation of rTKA and later re-revision for aseptic loosening (rrTKA-AL)?

Methods:

All consecutive hybrid fixated tibial component rTKA were screened for rrTKA-AL and 1:2 matched with a control group (patients without rrTKA-AL and sufficient follow-up). Post-operative X-rays were scored by 3 blinded observers on zonal fixation in the epiphysis (bone cut below, at or above fibular head, 0-2), metaphysis (number of sufficiently cemented zones, 0-4) and diaphysis (canal filling ratio, CFR). Interclass correlation coefficient (ICC) was calculated to quantify the agreement between observers. Chi2 and t-tests, or non-parametric alternatives were used to compare the two groups.

Results:

33 of 1174 patients with hybrid fixated tibial components had a rrTKA-AL (2.8N%). Patients with rrTKA-AL had significantly lower epiphyseal cuts ($p=0.02$), lower number of sufficiently cemented zones ($p=0.03$), but no difference in CFR ($p=0.73$). Furthermore, patients with rrTKA-AL had more previous revisions ($p=0.047$) and previously stemmed components ($p=0.01$). Age, gender, ASA, BMI and reason for revision were not different. Agreements of zonal fixation between observers were good (ICC 0.79-0.87).

Conclusion:

A lower epiphyseal bone cut and less sufficiently cemented metaphyseal zones were associated with a higher risk of rrTKA-AL.

Session 4 - 30 November 2023 - 11.44

Title: Construct stability of revision Total Knee Arthroplasty with tibial cones: preliminary results of a radiostereometric analysis (RSA)

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Background:

In (re-)revision total knee arthroplasty (TKA), cones can be used to ensure sufficient fixation of the prosthesis in the bone in case of suboptimal metaphyseal bone stock. The aim was to investigate the stability of a revision TKA with tibial cones.

Methods:

Twenty five patients with a revision TKA with a tibial cone (Smith+Nephew) were included. During surgery, tantalum markers were inserted in the tibia which formed a 3D-model. The stability of the implant was assessed by measuring micromotion (total translation (TT) and total rotation (TR)) of the tibial component with respect to the 3D bone model using model-based radiostereometric analysis (MB-RSA). Radiographs were made post-operative (baseline), after 6 weeks, 3 months, 6 months, 1, 2, and 5 years. Clinical results were evaluated using the OKS, KOOS-PS, KSS, VAS pain and VAS satisfaction.

Results:

Currently, all 25 patients were included and 19 completed the 1-year follow-up and 11 the 2-year follow-up. Median TT at 1 year was 0.43 mm (IQR 0.29-1.06), median TR was 0.63° (IQR 0.33-1.23). One patient had re-revision after 1 year for loosening. Clinical scores at 1 year were: VAS pain 4 (IQR 2-6), VAS satisfaction 6 (IQR 3-8), OKS 30.5 (IQR 27.3-39), KSS-clinical 92 (IQR 70-95) and functional 60 (IQR 45-70), and KOOS-PS was 39.45 (35.3-43.5).

Conclusion:

So far, results on group level show a stable fixation, although there are outliers with more micromotion. One patient had a repeat revision TKA for loosening, not evidently related to migration as measured with MB-RSA. At the time of the conference, we expect to share 24/25 1-year migration results and 16/25 2-year.

Figure 1: Cones for tibia and femur (Smith+Nephew), left image, and placement in the tibia bone of a patient with a revision TKA, middle and right images.

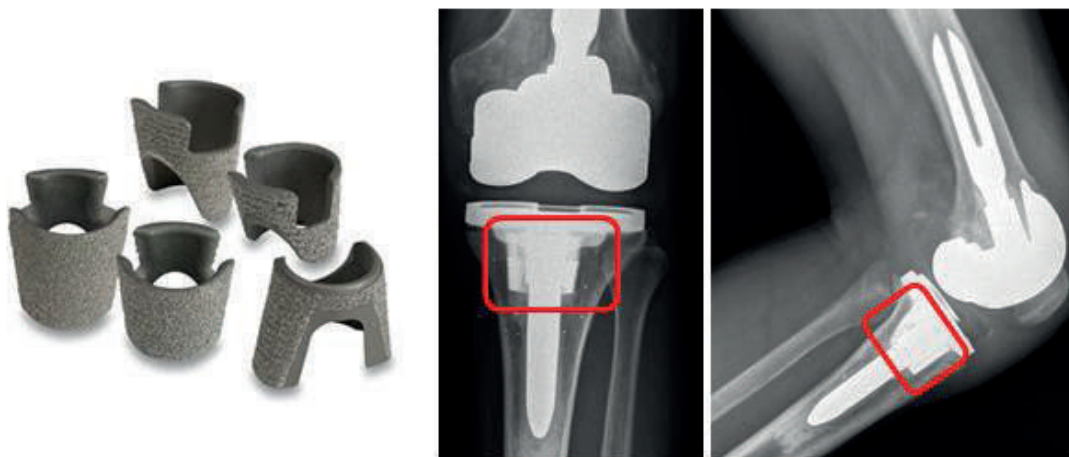


Figure 2: Median translation values in x, y and z directions and total translation in mm up until 2 years post-operative. The striped lines present all separate patients.

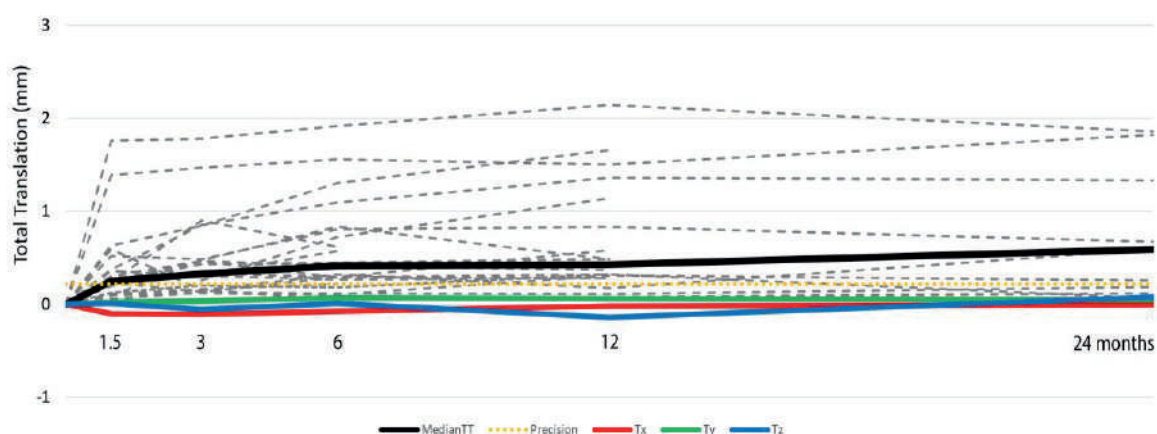
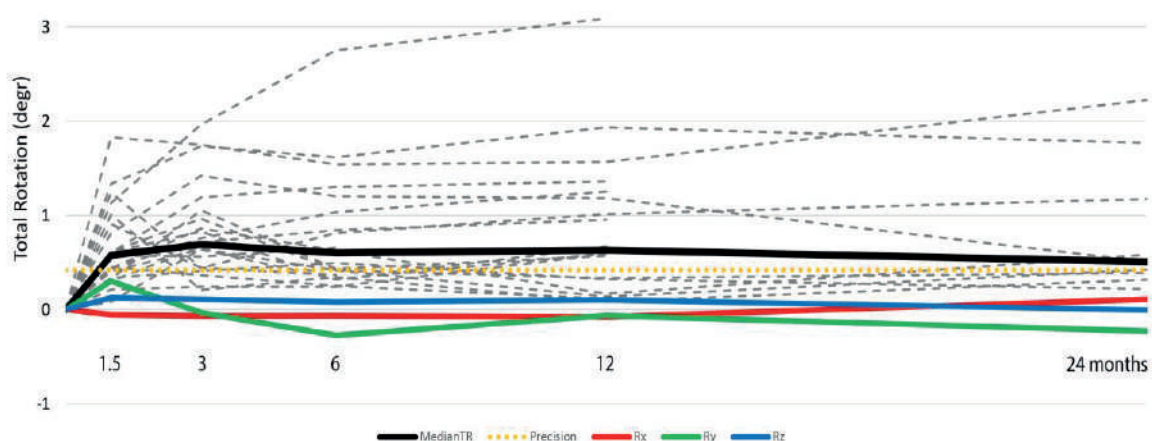


Figure 3: Median rotation values in x, y and z directions and total rotation in degrees up until 2 years post-operative. The striped lines present all separate patients.



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Session 4 - 30 November 2023 - 11.51

Title: Clinical and biomechanical evaluation of custom metaphyseal cones for complex revision total knee implants with major bone loss

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Background:

In revision total knee arthroplasty (TKA), addressing significant bone loss often involves the use of cemented or press-fit stems to ensure implant stability and long-term fixation. This study introduces an innovative approach utilizing custom-made porous metaphyseal cones, designed to reconstruct tibial and femoral geometries. Early clinical and radiological assessments have shown promising results. The objective of this research was to biomechanically evaluate the performance of these custom-made cones.

Methods:

Over the period from 2013-2020, a female patient underwent four knee revisions due to infection and periprosthetic fracture, resulting in substantial metaphyseal bone loss. Custom-made 3D-printed metaphyseal cones were employed to stabilize the Distal Femoral Replacement implant (DFR) and the tibial component. After a two-year follow-up, the patient reported minimal pain and excellent clinical scores. To support these findings, a biomechanical study was conducted using a validated finite element model. Three revision scenarios were examined: A) custom-made cementless metaphyseal cones; B) cemented stems; C) press-fit stems. Analyses were performed at 0° and 90° of flexion, simulating different motor tasks. performance of these custom-made cones.

Results:

The use of custom-made 3D-printed cones exhibited the most favourable stress distribution within the bones. Tibial bone stress was evenly distributed in custom-made cone configurations, while stress concentration was observed in distal regions for the other scenarios. Additionally, custom-made cones displayed lower stress levels and homogeneity, potentially contributing to reduced pain. Symmetrical stress distribution was observed between the lateral and medial proximal tibia in custom-made cone cases, whereas other scenarios exhibited uneven stress, particularly in the anterior tibial bone. performance of these custom-made cones.

Conclusions:

Biomechanical analysis of porous custom-made metaphyseal cones in re-revision arthroplasties aligns with positive clinical and radiological outcomes. These findings provide valuable insights into the potential benefits of using custom-made cones, which offer more uniform stress distribution and may contribute to improved patient outcomes in revision TKA procedures. Further studies in this direction are warranted to validate these biomechanical findings.

Session 4 - 30 November 2023 - 11.58

Title: Nutritional status and mortality rate of patients who have undergone revision TKR: a retrospective analysis of 234 patients

Authors:

Panos Souroullas, Neesha Jenkins, Sameer Jain, Hemant Pandit, Jeya Palan

Institution: Leeds Teaching Hospitals NHS Trust

Background:

Malnutrition has been shown to be an independent risk factor for postsurgical complications such as periprosthetic joint infections. Malnutrition can be defined by the following serum markers: an albumin <3.5 g/dL, a total lymphocyte count <1,500 cells/mm³, and/or a ferritin level <30 ng/ml in men and <13ng/ml in women. Very few studies have reported the prevalence of malnourishment in patients having revision knee replacements and if malnutrition was associated with poorer outcomes such as mortality rates.

Methods:

Data on 231 consecutive cases of revision total knee replacements (TKRs) was collected over a four-year period. The cohort was split into malnourished and non-malnourished according to one or more of three of the above parameters: hypo-albuminaemia, low ferritin, lymphopenia. The primary outcome measure was mortality rate at one year. Secondary outcome measure was length of stay (LOS) in hospital.

Results:

Of 231 cases, 31% (n=71) were malnourished, of which, 48% were female. Mean age: 72 years, median LOS: 8 days, mean BMI: 30.7 and median ASA grade: 2. Overall mean CCI score: 1.11 and mortality rate: 15.5%. Of the non-malnourished group (n= 160), 46% were female. Mean age: 69 years, median LOS: 4 days ($p<0.001$), mean BMI: 31.7 and median ASA grade: 2. Overall mean CCI score: 0.86 and mortality rate: 3.13% ($p<0.001$).

Conclusions:

Pre-operative malnourishment in revision TKR patients is associated with a longer inpatient stay and a significantly higher mortality rate at one year. Optimizing their nutritional status may help reduce mortality rates and improve patient outcomes.

Session 4 - 30 November 2023 - 12.05

Title: Knee function and QoL with an articulating spacer. Can we identify an ideal candidate for the 1.5-stage?

Topic:

Revision TKA

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Background:

The two-stage approach for treating chronic periprosthetic knee infection profoundly affects patients' Quality of Life (QoL), psychological status, and knee function. The study aims to (i) assess QoL and joint function before reimplantation and (ii) identify the ideal candidate for 1.5-stage by evaluating outcome predictors of patients' QoL.

Methods:

All the patients treated with a metal-on-poly spacer for chronic PJI were included. The EQ-5D-5L Index Value, WOMAC, and KSS were assessed preoperatively and before scheduling the reimplantation. The infection eradication was defined as the disappearance of all evidence of PJI during the 96-week follow-up period.

Results:

The study included 108 patients with a median age of 73 (46–91) years. The KSS, WOMAC, and QoL scores, before scheduling the revision, were improved than preoperative ones ($p < 0.001$). A lower Anxiety level was also retrieved after spacer placement. Gram-negative infections and infections affecting revision knee arthroplasty were negative predictors for pre-reimplantation QoL. Thirteen patients (12%) experienced an infection recurrence. Thirty-six patients retained the spacer (1.5 stage). Age over 73 years, Charlson comorbidity index > 5 , and revision implant infection were the most important determinants of choosing 1.5-stage revision. The Womac score registered before scheduling the reimplantation was inversely correlated to the spacer retaining.

Conclusion:

The choice of a mobile spacer guarantees good patient QoL and knee function. Retaining the spacer (1.5 stage) should be reserved for elderly patients (> 73 years) with severe comorbidities (CCI > 5) and with revision prostheses infection that reported a good function with the spacer in place.

Session 4 - 30 November 2023 - 12.12

Title: A comparison between stemmed, cementless and unstemmed tibial components in Total Knee Arthroplasty in obese patients.

Authors:

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Background:

TKA is an effective treatment option for high BMI patients, achieving similar outcomes to non-obese patients. However, increased rates of aseptic loosening in patients with a high BMI have been reported. Component fixation is a potential concern when performing TKA in obese patients, and extended cemented tibial stems, or cementless fixation have been advocated. We compared the outcome of extended tibial stems and cementless implants to conventional cemented implants in high BMI patients.

Methods:

We retrospectively reviewed a prospectively maintained database of 3239 primary Attune TKAs (Depuy, Warsaw, Indiana). All obese patients (BMI >30kg/m²) with >1 year follow-up were included in our analysis. Those who underwent cemented TKA using a Qbial stem extension (Group 1) [n=145] and those where cementless implants were used (Group 2) [n=100] were compared to a control group [n=1243] using a standard cemented implant. Primary outcome measures were all-cause revision, revision for aseptic loosening, and revision for tibial loosening.

Results:

1,488 knees met the inclusion criteria. Mean follow-up was 5.4, 3.7, and 3.7 years for cemented, stemmed, and cementless groups. 22 all-cause revisions were identified. 6 were for aseptic loosening; all of these were in the standard cemented group. There were no revisions in the stemmed or cementless implants. There were no significant differences between groups for all-cause revision or aseptic loosening.

Conclusion:

No implants were revised for aseptic loosening when either a cemented stemmed or cementless implant were used in obese patients. Cementless fixation and extended cemented stems are reasonable options in obese patients.

Session 4 - 30 November 2023 - 12.19

Title: Low Rate of Tibial Debonding in a Popular Knee Replacement Analysis of a Single Specialist Knee Surgeon Survival Data for the NexGen LPS Flex Femur using Option Tibia Compared to the Precoat Tibia : a 14 year Follow-up Study

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Background:

The Zimmer-Biomet NexGen LPS Flex & LPS Flex Gender femoral component when combined with the OPTION (5 degree fluted) cemented tibial tray has been the subject of recent criticism in the literature (1,2,5). The higher than expected revision rate (specifically for early aseptic tibial loosening up to 16.7% at 5 years (x)) has prompted a detailed implant based analysis from the UK NJR (7% revision rate at 10 years) & the issuing of a field safety notice from the UK Medicines & Healthcare Regulatory Agency (DSI/2023/002) leading to a voluntary withdrawal of the Option tibial implant worldwide - as it has been implicated as an isolated causative factor in this failure analysis.

Methods:

A survival analysis of 366 cases using this specific combination of implants performed personally by the senior author was undertaken (with 54 deaths recorded on NJR as not revised)

Results confirm a satisfactory survival, with a lower revision rate than the recent NJR analysis. Specifically, for the OPTION tibia, at an average follow-up of 7.1 years (range 0.8 to 14.2 years) only 3.8% (14 knees) had been revised for all causes – detailed analysis confirms a rate of aseptic tibial loosening of 0.55% (2 knees). Analysis of post-operative radiographic coronal & sagittal plane alignment was undertaken showing an overall average tibial varus of 1.30 (surgical target of 00 = mechanical alignment) & an average posterior tibial slope of 7.10 (surgical target 70)

This data was directly compared to the results from the same surgeon in a further 149 knees using exactly the same surgical technique with the same NexGen LPS Flex Femur but with the alternative PRECOAT tibial tray (with 19 deaths recorded on NJR as not revised).

At an average follow-up of 6.6 years (range 1 to 14.2 years) only 2% (3 knees) had been revised for all causes – again with a low rate of revision specifically for aseptic loosening of the PRECOAT tibial tray of 0.68% (1 knee).

Conclusion:

The data confirm acceptable survival rates using this combination of implant & does not support the reported high early increased failure rate related to catastrophic aseptic tibial loosening - reported by the NJR & recent literature.

This study may further suggest that the OPTION tibial implant is NOT the sole source of increased early failure rate reported in the UK. This study suggests that (like most revision cases) there may be other (as yet undocumented) multifactorial causes to explain the reported higher aseptic loosening of this specific tibial implant such as surgical technique and patient based factors - requiring further study to prevent a repeat with alternative implant systems.

	Option tibia with flex femur		Precoat tibia with flex femur	
	Number	%	Number	%
Outcome type				
Unrevised	298	81.4	124	85.0
Revised	14	3.8	3	2.0
Death (No NJR revision)	54	14.8	19	13.0
Overall Implant Survival		96.2		98.0
Average time to follow-up				
Unrevised	7.1 years (0.8 - 14.2)		6.6 years (1 - 14.2)	
Revised	3.9 years (0.1 - 10.1)		4.2 years (3.2 - 4.3)	
Death (No NJR revision)	6.3 years (0.7 - 11)		3.8 years (0.3 - 8.1)	
Reason for revision				
Infection	5	1.4	1	0.68
Trauma	5	1.4	0	0
Aseptic loosening tibia	2	0.55	1	0.68
Aseptic loosening femur	1	0.3	0	0
Instability	0	0	1	0.68
Unknown	1	0.3	0	0

- Results confirm satisfactory survival :
 - 3.8 % revised for all causes using the Option tibia @ average 7.1 years
 - 2.0 % revised for all causes for the Precoat tibia @ average 6.6 years
- Revision for Aseptic Tibial Loosening is rare :
 - 0.55 % Option tibia revised
 - 0.68 % Precoat tibia revised

Session 4 - 30 November 2023 - 12.26

Title: Individual Phenotype does not impact the Outcome of Mechanical Aligned Total Knee Arthroplasties for Valgus Osteoarthritis

Authors & Affiliation:

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Background:

There is an ongoing discussion about the best alignment targets in total knee arthroplasty (TKA). While mechanical alignment has been the standard in TKA for years, kinematic alignment restoring the individual phenotype of the knee has been advocated more recently.

Methods:

The study retrospectively evaluated 158 knees in 135 patients who underwent TKA with a mechanical alignment target for valgus osteoarthritis. Pre- and postoperative hip knee angle, lateral distal femur angle, and medial proximal tibial angle/ tibial plate angle (pre-/postoperative) were measured on standing hip to ankle radiographs. Knees were grouped according to the coronal plane alignment of the knee (CPAK) classification as published by MacDessi et al. Pre- and postoperative range of motion and patient related outcome measures (WOMAC, UCLA, SF-12, pain) were assessed.

Results:

There was no difference in outcome for mechanically aligned TKA between the different phenotypes, suggesting that mechanical alignment is an appropriate target for the different phenotypes analyzed in the study. Kinematic alignment was associated with decreased postoperative UCLA scores and decreased improvement in SF-12 scores ($p=0.011$ / $p=0.028$). Within CPAK III, mechanical aligned TKA showed better postoperative UCLA Scores than TKA with valgus alignment ($p=0.015$).

Conclusion:

The individual knee phenotype in patients with valgus osteoarthritis does not influence the outcome of mechanical aligned TKA operated with a standardized soft tissue release. Kinematic alignment targets might be associated with worse outcome scores.

Session 5 - 1 December 2023 - 10.15

Title : An untrained open-source natural language processing tool (ChatGPT) can make complex surgical decisions with confidence similar to experienced surgeons: a comparative analysis

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Key Words: Natural Language Processing, Knee Arthroplasty, Decision Making, Artificial Intelligence

Abstract

Introduction

Unicompartmental knee replacements (UKR) have become an increasingly attractive option for end-stage single-compartment knee osteoarthritis(OA). However, there remains controversy in patient selection. Natural language processing (NLP) is a form of artificial intelligence. Recently, there has been increasing interest in open access NLP models with the release of ChatGPT (OpenAI).

We aimed to determine whether an 'untrained' open-source natural language program (ChatGPT) can make complex decisions regarding a patient's suitability for a total knee replacement (TKR) or a UKR.

Method

We conducted a case-based cohort study using data from a separate study, where participants (73 surgeons and ChatGPT) were presented with 32 fictitious clinical case scenarios that simulated patients with knee OA who would require surgery. The surgeons and ChatGPT program decided between UKR and TKR and indicated their degree of confidence in the decision (-5 = "Definitely TKR" and +5= "Definitely UKR"). The sensitivity, specificity, and positive predictive value of ChatGPT was calculated to accurately decide that the correct procedure was a UKR using the 73 experienced knee surgeons as the gold standard reference. Cohen's kappa coefficient was used to assess the difference between the surgeon cohort and ChatGPT in deciding between UKR versus TKR.

Results:

There was disagreement between the two groups in five scenarios (15.6%). With the 73 surgeons' decision as the gold standard, the sensitivity of ChatGPT in determining if a patient should undergo UKR was 0.91 (95% CI: 0.71 to 0.98), and the specificity was 0.7 (95% CI: 0.39 to 0.93). The positive predictive value for ChatGPT was 0.87 (95% CI: 0.72 to 0.94). ChatGPT was more confident in its UKR decision making (Surgeon mean confidence =1.7, ChatGPT mean confidence=2.4). The Cohen's kappa coefficient was 0.63 (95% CI: 0.33 to 0.92, $p<0.05$) for determining 'UKR' or 'TKR'.

Conclusion:

ChatGPT had high positive predictive value in deciding between UKR and TKR for participants with surgery-indicated knee osteoarthritis. This untrained open-source NLP program approximated the decision making, and exceeded the confidence, of experienced knee surgeons with substantial inter-rater agreement when deciding if a patient was most appropriate for a UKR.

Session 5 - 1 December 2023 - 10.22

Title: Radiographic assessment of Unicompartmental Knee replacement: A comparison between machine learning and an experienced surgeon.

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University of Oxford

Poor results occasionally occur after Unicompartmental Replacement (UKR). It is often difficult, even for experienced surgeons, to determine from radiographs why patients have poor outcomes. The aim was to compare the ability of an experienced surgeon and a machine learning model (MLM) to predict from radiographs whether patients had a poor or good outcome.

Antero-posterior radiographs taken one-year following UKR were cropped and rescaled. 924 were used to train a MLM (ResNet50-V2) based on their one-year Oxford Knee Score categories. Seventy, not used for training, were assessed by an experienced surgeon and the MLM and categorised according to whether their expected one-year outcome was poor/fair (poor) or good/excellent (good).

In the testing set, 14 patients had a poor score and 56 a good score. The MLM correctly identified 43% (n=6) of the patients with a poor score and 88% (n=49) of those with a good score. The surgeon did not identify any (0%) of those with a poor score and 91% (n=51) of those with a good score.

The MLM performed much better than the surgeon, as it correctly identified nearly half the patients with a poor outcome, whereas the surgeon identified none. Those not identified by the MLM may have had an extra-articular cause for their poor outcome. Further analysis of the MLM should help identify previously unrecognized features associated with a poor outcome. This could lead to improvem

Session 5 - 1 December 2023 - 10.29

Title: Accuracy of the ROSA robotic system for targeted resection thickness in Total Knee Arthroplasty

Authors:

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Background:

The high level of accuracy of robotic systems has been demonstrated in cadaveric studies, we sought to investigate the accuracy of the targeted resection thickness in patients undergoing Total Knee Arthroplasty (TKA) using the ROSA robotic system.

Methods:

We investigated 18 patients undergoing ROSA robotic TKA from 27/06/23 to 28/09/23 using a single implant design and carried out by a single surgeon. Caliper measurements were undertaken by 2 observers of the resected bone, which included the distal femur (DF), proximal tibia (PT), posterior condyles (PC) and any recut bone. This was compared to the intraoperative planned resection amount and the validated measurements post-resection.

Results:

Mean age \pm SD = 55yrs \pm 9yrs, M:F = 7:11, Operative side (R:L) = 14:4. The difference between mean planned, validated and the caliper measurements were calculated and compared and found to be as follows (mean \pm SD Planned vs caliper, Validated vs caliper: DF medial = 0.42mm \pm 0.96mm, 0.82mm \pm 0.72mm; DF lateral = 0.16mm \pm 1.65mm, 0.53mm \pm 1.47mm; Proximal tibia medial -0.59mm, \pm 1.81mm, 0.4mm \pm 2.43mm; Proximal tibia lateral = 0.06mm \pm 2.67mm, 1.19mm \pm 2.49mm; medial PC caliper vs planned = 0.84mm \pm 1.41mm, lateral PC caliper vs planned = 0.77mm \pm 1.46mm.

The proximal tibia was recut in 5 cases and the difference between planned resection and the caliper measurements were proximal tibia mean \pm SD: medial 0.2mm \pm 0.6mm, proximal tibia lateral - mean \pm SD: 0.1mm \pm 1mm.

Conclusion:

The ROSA robotic system can achieve the planned resection thickness with high degree of accuracy of 1mm or less mean difference compared to initial planned values and when planning a recut. Error between the measurements can be due to kerf thickness of the blade (1.25mm), bone density/quality, tilting of the blade and additional adjustment by the surgeon. Further study can include angle measurements and accuracy achieving desired alignment.

Session 5 - 1 December 2023 - 10.36

Title: Is your robot telling the truth? In-vivo accuracy of a new robotically-assisted system for total knee arthroplasty: a prospective cohort study

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Background:

Recent technological advancements have led to the introduction of robotic-assisted total knee arthroplasty to improve the accuracy and precision of bony resections and implant position. However, the in vivo accuracy is not widely reported. The primary objective of this study is to determine the accuracy and precision of a cut block positioning robotic arm.

Methods:

Seventy-seven patients underwent total knee arthroplasty with various workflows and alignment targets by three arthroplasty-trained surgeons with previous experience using the ROSA® Knee System. Accuracy and precision were determined by measuring the difference between various workflow time points, including the final pre-operative plan, validated resection angle, and post-operative radiographs. The mean difference between the measurements determined accuracy, and the standard deviation represented precision.

Results:

The accuracy and precision for all angles comparing the final planned resection and validated resection angles was $0.90^\circ \pm 0.76^\circ$. The proportion within 3° ranged from 97.9% to 100%. The accuracy and precision for all angles comparing the final intra-operative plan and post-operative radiographs was $1.95 \pm 1.48^\circ$. The proportion of patients within 3° was 93.2%, 95.3%, 96.6%, and 71.4% for the distal femur, proximal tibia, femoral flexion, and tibial slope angles when the final intra-operative plan was compared to post-operative radiographs. No patients had a postoperative complication requiring revision at the final follow-up.

Conclusions:

This study demonstrates that the ROSA Knee System has accurate and precise coronal plane resections with few outliers. However, the tibial slope demonstrated decreased accuracy and precision when measured on post-operative short-leg lateral radiographs with this platform.

Session 5 - 1 December 2023 - 10.43

Title: Ligament balance in image-based robotic-assisted TKA with functional implant positioning: an objective assessment using intraoperative sensor technology

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Background:

Functional implant positioning (FIP) for total knee arthroplasty (TKA) is an evolution of kinematic alignment as enabling technology has progressed. This study aimed to assess the ligament balancing of robotic-assisted TKA in extension, mid-flexion, and flexion with a FIP using intraoperative sensor-guided technology.

Methods:

This prospective monocentric study included 43 consecutive patients undergoing image-based robotic-assisted TKA performed with FIP. After robotic-assisted bone cuts, soft-tissue balance (measured in pound-force (lbf)) was assessed with trial components using sensor-guided technology (VERASENSE; OrthoSensor, USA) at 10°, 45°, and 90° of knee flexion. A mediolateral balanced knee was defined by an inter-compartmental pressure difference (ICPD) ≤ 15 lbf and both medial and lateral compartment pressure ≤ 60 lbf. The mean age was 71.7 years old ± 6.4 , the mean body mass index was 28.9 kg/m² ± 5.0 , and the mean preoperative HKA was 173° $\pm 5.0^\circ$.

Results:

There was 95.3% of balanced knees ($n=41$) at 10° and 90° versus 74.4% ($n=32$) at 45° ($p=0.002$). Median ICPD at 10°, 45° and 90° of knee flexion were respectively 6.0 (IQR 8.5), 11.0 (IQR 12.0), and 8.0 (IQR 8.0) ($p<0.001$). Pairwise analyses revealed differences for ICPD at 45° vs ICPD at 10° ($p = 0.001$), and ICPD at 90° vs ICPD at 45° ($p = 0.002$). The mean postoperative knee alignment was 177.0 ± 2.1 .

Conclusion:

Functional implant positioning with an image-based robotic-assisted system allowed the restoration of a well-balanced knee at 10° and 90° of flexion. Nevertheless, this robotic-assisted system was less efficient in restoring a balanced TKA in midflexion.

Session 5 - 1 December 2023 - 10.50

Title: Robotic-assisted total knee arthroplasty (tka) implemented with a tensor: mechanical versus functional alignment and effect on femoral component external rotation

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Category:

Technology/Efficiency

Background:

Aim of this study is to evaluate differences in femoral component rotation in R-TKA associated to a tensor in mechanical or functional aligned TKA.

Methods:

All cemented primary R-TKA (pre-operative HKA<185°) performed in two institutions were considered for the study. Two matched-paired groups were created based on the type of alignment: mechanical alignment (MA) and functional alignment (FA). All cases were performed with the ROSA® Robotic Imageless system in association with the Fuzion® tensor system (Zimmer Warsaw).

Chi-squared test and T test were used to evaluate differences between groups. Correlation coefficient was used to evaluate the association between femoral component rotational alignment and implant positioning or gaps.

Results:

26 patients were included in each group. There were no differences between groups in gender, age and pre-operative HKA. Total average external rotation of the femoral component (ER) was 4° (SD ,2°). In MA there was a significant increased ER compared to FA (respectively 5,1° and 3° P=0,0205). 76,9% of cases were ER more than 3° in MA compared to 53,8% in FA (p<0,05). In MA increased ER was correlated to increased lateral distraction ($\rho=0,632$, $p=0,0005$). Similarly in FA it was related to both increase lateral distraction ($r=0,6882$, $p=,0001$) and decrease medial distraction ($r=-0,755$, $p=,0001$), but also to increase distal medial and lateral resection (respectively $r=0,404$ and $p=,0407$ and $r=0,4081$ and $p=,0385$).

Conclusion:

R-TKA in association with a tensor confirmed the difference in femoral component ER based on the type of alignment, with significative increased ER in MA compared to FA.

Session 5 - 1 December 2023 - 10.57

Title: Less costs for image-based robotic TKA 2023 compared to 2018

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Background:

We published in 2020 on additional costs for technological support for TKA compared to conventional TKA set as baseline with a mean procedure time of 59 min. Additional costs for material, additional OR time or time spearing respectively were calculated for conventional computer navigation, PSI, image-less and image-based robotics. Image-based robotics did lead to the highest additional costs of 2600 USD per case. In the meantime, the method has become the new gold standard for TKA in our unit. After 4 years a new contract with the company was negotiated for the next 4 years.

Aim of this study was to evaluate any changes in costs for the image-based robotic technology applying the same calculation algorithm as in 2018.

Methods:

All the additional costs for image-based robotic compared to conventional TKA were re-evaluated for calculation. Some were deriving from the new contract with the company in 2023, some were collected in the OR and compared to the costs in 2018. Costs for OR time were set to 15 USD per minute, an additional tray to 210 USD, a CT scan to 420 USD as in 2018. Since 2018 we changed to cementless fixation in 95% of the TKA cases which reduced OR time by 15 minutes in mean (-225 USD) and such equalized OR time of a conventional TKA.

Results:

Additional costs for one tray with specific instruments (+160 USD), additional OR time of 14 min for computer navigation, calibration, registration, adjusting the preset surgical plan (+210 USD) and the costs for the preoperative CT scan (+420 USD) remained the same.

The costs for disposables were 600 USD in 2018 and increased to 766 USD in 2023 (+166 USD). Due to the new contract the costs for the technology itself (leasing contract, costs for the technician) could be reduced from 1210 USD in 2018 to 770 USD in 2023 (-440 USD or minus 36%).

By merging from cemented TKA in 2018 to mainly cementless in 2023 OR time could be reduced by 15 min (-225 USD) equalizing mean OR time for a conventional TKA.

Additional costs for image-based robotic TKA could be reduced from in mean 2180 USD in 2018 to 1681 USD in 2023 (minus 23%) in the OR itself or from totally 2600 USD in 2018 to 2101 USD in average when including costs for the preoperative CT scan.

Conclusion:

Total additional costs for image-based robotic TKA could be reduced by 19% in 5 years' time due to negotiation after doubling the cases and increasing efficiency in OR by declaring the technology to the new gold standard and converting to mainly cementless fixation although costs for disposables increased by 28% during the same period.

Session 5 - 1 December 2023 - 11.04

Title: Incidental findings on planning CT scans for robotic surgery. Are your scans routinely reported? If they are not, then maybe they should be?

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Robin Jones, Registrar, Royal Devon and Exeter Hospital

Michalis Pantelli, Consultant Orthopaedic Surgeon, Royal Devon and Exeter Hospital

Background:

Computed Tomography (CT) is part of the routine planning for Mako robotic assisted joint replacement for the assessment of positioning, alignment and rotation. The scans are routinely reported by Consultant Radiologists at our institution.

The aim of this study was to quantify and characterise incidental CT findings, their clinical significance, and their effect on planned joint arthroplasty.

Methodology:

All consecutive patients undergoing an elective TJR (hip or knee arthroplasty) were retrospectively identified, over a 3-year period (December 2019 and December 2022). Data documented and analysed included patient demographics, type of joint arthroplasty, CT findings, their clinical significance, as well as potential delays to the planned arthroplasty because of these findings and subsequent further investigation.

Results:

A total of 624 patients (637 studies, 323 (51.8%) female, 301 (48.2%) male) were identified of which 163 (25.6%) showed incidental findings within the long bones or pelvis. Of these 52 (8.2%) were significant, potentially requiring further management, 32 (5.0%) represented potential malignancy and 4 (0.6%) resulted in a new cancer diagnosis.

Conclusions:

It is not currently standard practice to report planning CT imaging as it is deemed an unnecessary expense and burden on radiology services. Within the study cohort 52 (8.2%) of patients had a significant incidental finding that required further investigation or management and 4 (0.6%) had a previously undiagnosed malignancy. In order to avoid the inevitability of a missed malignancy on a planning CT and potential medicolegal implications, we advocate formal reporting in all cases.

Session 7 - 1 December 2023 - 12.30

Title: Robotic-assisted total knee arthroplasty is associated with earlier return of symmetrical limb function compared to conventional techniques using wearable sensors: a prospective cohort study

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Background:

The purpose of this study was to compare outcomes of patients undergoing robotic-assisted total knee arthroplasty (RA-TKA) to conventional jig-based techniques in the early post-operative period using traditional patient-reported outcome measures (PROMs) and wearable sensors.

Methods:

This was a prospective, matched, parallel cohort study of 100 patients with symptomatic end-stage knee osteoarthritis undergoing primary TKA (44 RA-TKA and 56 conventional TKA). Functional outcomes were assessed using ankle-worn inertial measurement units (IMU) and PROMs. IMU-based outcomes included impact load, impact asymmetry, maximum knee flexion angle, and bone stimulus. PROMs, including Oxford Knee Score (OKS), EuroQol-Five Dimension, EuroQol Visual Analogue Scale, and Forgotten Joint Score, were evaluated at pre-operative baseline, weeks 2 to 6 post-operatively, and at 3-month follow-up.

Results:

By post-operative week 6, RA-TKA was associated with significant improvements in maximum knee flexion angle compared to conventional TKA ($118.0 \pm 6.6^\circ$ vs $113.0 \pm 5.4^\circ$; $p=0.04$), symmetrical limb loading (82.3% vs 22.4%; $p<0.01$), cumulative impact load (146.6% vs 37%; $p<0.01$), and bone stimulus (25.1% vs 13.6%; $p<0.01$). Of note, RA-TKA demonstrated an earlier return to symmetrical limb loading, with operative limb IMU-based function reaching 80% of the non-operative limb by post-operative week 3. There were no significant differences in PROMs between the two groups, however, significantly more RA-TKA patients achieved an 'excellent' outcome at 6 weeks compared to conventional TKA using OKS subscales (47% vs 41%, $p=0.013$).

Conclusion:

RA-TKAs were associated with functional improvements when assessed using IMUs compared to conventional TKA, which were not detected by traditional PROMs during the early post-operative period.

Session 7 - 1 December 2023 - 12.37

Title: The Impact of Image-Based Robotic-Assisted Total Knee Arthroplasty with Functional Positioning Principles: Anterior Compartment Restoration and One-Year Follow-Up Results.

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Background:

This study aimed to assess the functional outcomes based on the restoration of the anterior compartment at 12 months after robotic-assisted total knee arthroplasty (TKA).

Methods:

This retrospective study included 96 primary TKAs performed for varus osteoarthritis. Functional positioning principles were applied using an image-based robotic-assisted system. The mean age was 69.2 years old ± 7.9 . Kujala score, Forgotten joint score (FJS), Knee society score (KSS) knee, KSS function, and patient satisfaction were collected 12 months postoperatively. The depth difference between native and prosthetic trochlea was measured to assess anterior compartment restoration at four sequential flexion positions: at full extension, at 30°, 70°, and 90° flexion.

Results:

The trochlear offset was mostly understuffed after TKA compared to the native anatomy, mainly for the medial and lateral condyles at 30° and 70° of flexion. The global anterior compartment restoration was understuffed in full extension ($-0.7\text{mm} \pm 2$), at 30° ($-4.4\text{mm} \pm 2$) and 70° of flexion ($-3.6\text{mm} \pm 2.5$). At 90°, the global anterior compartment restoration was overstuffed ($2.2\text{mm} \pm 1.8$). Functional scores and patient satisfaction were not significantly influenced by the anterior compartment stuffing at 0° and 30° of knee flexion. The anterior compartment overstuffing at 70° and 90° tended to decrease the KSS function score ($p=0.009$) and the flexion ($p=0.04$).

Conclusion:

Moderate anterior understuffing was frequently observed after TKA performed with functional positioning and an image-based robotic-assisted system. This understuffing did not influence the functional outcomes. The overstuffing tended to reduce KSS function score and knee flexion at one year.

Session 7 - 1 December 2023 - 12.44

Title: Favorable early outcomes of Medial Unicompartmental Knee Arthroplasty as primary treatment for medial meniscus root tears (MMRT) with meniscal extrusion and early phase radiographic osteoarthritis

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Background:

The aim of this study was to evaluate early outcomes of mUKA as the primary treatment in active patients presenting an MMRT with meniscal extrusion and only mild radiographic OA of the knee. To prove this claim we hypothesized that (1) patients with a MMRT with initial grade 1-3 KL OA of the medial compartment of the knee present the same pre-operative symptoms as patients with an end-stage grade 4 K-L OA, and that (2) the mUKA in patients with MMRT and low-grade OA provides the same early clinical and functional outcomes than patients with end-stage medial OA.

Methods:

We reviewed the prospectively collected data of 218 patients undergoing robotic- assisted image-based mUKA from January 2021 to July 2022 at a single Institution. We identified two different cohorts: mUKA implanted for MMRT combined with K-L grades 1-3 OA (group 1), and mUKA for end-stage bone-on-bone K-L grade 4 OA (group 2). Preoperative and postoperative clinical assessments included the KSS, KOOS, OKS, EQ-5D-5L score, VAS, active and passive ROM, and a standard weight-bearing X-ray protocol. The follow-up period was 1 year postoperative for all cases. All MMRT were additionally identified with MRI, which was not standard in K-L grade 4 OA. The paired t-test was used to compare preoperative and postoperative clinical outcomes of the two cohorts and preoperative and postoperative clinical outcomes in-between the two cohorts. Statistical significance was set at $p < 0.05$.

Results:

Clinical outcomes showed a statistically significant improvement postoperatively in both groups. The mean postoperative HKA, coronal femoral component angle, coronal tibial component angle, and sagittal tibial component angle were $179,1 \pm 2,6$, $87,2 \pm 2,3$, $87,2 \pm 3,3$, and $85,5 \pm 2,4$ respectively. No difference was found between preoperative age, BMI, OKS, and EQ-5D-5L scores and postoperative OKS and EQ-5D-5L scores between the two cohorts.

Conclusion:

Favorable early clinical outcomes were obtained after mUKA in active patients presenting with MMRT and only mild isolated medial OA. Patients with mild no bone-on-bone OA but with MMRT and MME presented the same pre-operative symptoms as patients with end-stage medial OA and benefit the same from mUKA.

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