



European
Knee
Society

**EKS Closed Meeting
15-17 December 2021
Courmayeur, Italy**



EKS Closed Meeting
12-13 May, 2022
Scotland

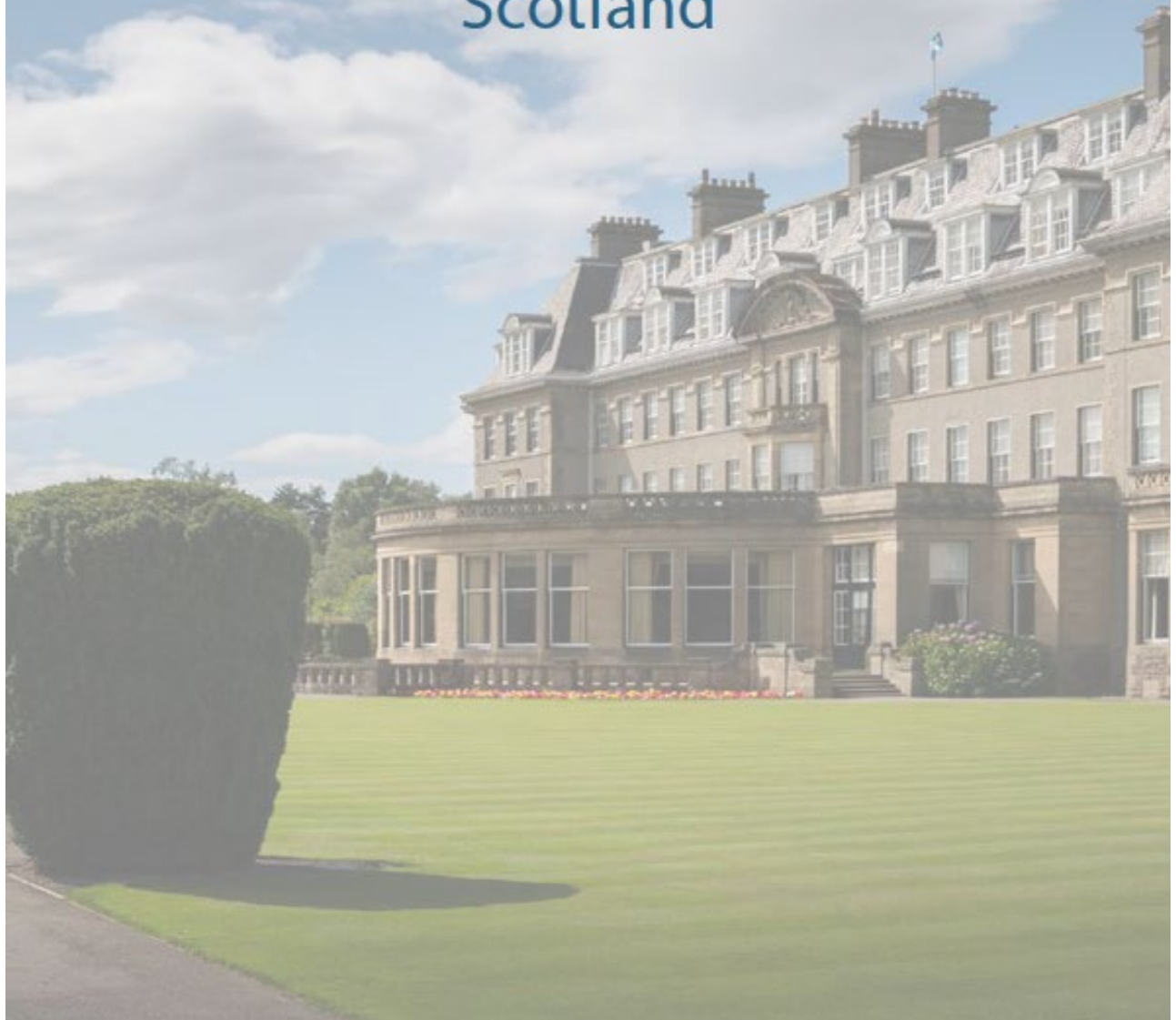




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The European Knee Society Board 2021

President: Gijs van Hellemond

Vice-President: David Barrett

Second Vice-President: Francesco Benazzo

Immediate Past- President: Fabio Catani

Past-President: Emmanuel Thienpont

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Past-Presidents of the European Knee Society

2013 Ate Wymenga

2014 Jean-Noël Argenson

2015 Johan Bellemans

2016 Jan Victor

2017 Chris Dodd

2018 Andrea Baldini

2019 Emmanuel Thienpont

2020 Fabio Catani



Welcome address

Dear Colleagues,

Welcome to the European Knee Society Closed Meeting in the beautiful mountains of Courmayeur, Italy.

You will find enclosed the final schedule of all events and accommodation information for the EKS Closed Meeting which will start on Wednesday, 15 December.

The scientific programme will start at 17.00 hrs on Wednesday, 15 December. A free afternoon is scheduled on Thursday, 16 December, followed by the Presidential Dinner.

On Friday, 17 December, the meeting will end at 13.00 hrs, allowing you to further enjoy the snow.

This Closed Meeting will again be an excellent occasion to socialise with your peers during the dinners and various activities.

We wish you a pleasant and instructive stay in Courmayeur!

With our very best regards,

Gijs van Hellemond
EKS President

Anders Troelsen
EKS General Secretary

Francesco Benazzo
Local Organiser



Wednesday, 15 December

Morning **Arrival of the EKS Members**

16.30 **Registration**

17.00 **EKS Meeting**

17.00 **Session I - Tailored knee arthroplasty**
Moderator: Gijs van Hellemond

17.05 **Effect of hybrid alignment techniques on native coronal alignment and soft tissue balance in Total Knee Arthroplasty**
Philip Winnock de Grave

17.14 **Use of condylar walls as anatomical landmarks for the kinematic alignment of the femoral component in lateral UKA**
Charles Riviere

17.23 **Predicting hip-knee-ankle and femorotibial angles from knee radiographs with deep learning**
Gareth Jones

17.32 **True kinematic alignment is applicable in 44% of patients applying restrictive indication criteria - A retrospective analysis of 111 TKA using robotic assistance**
Tilman Callies

17.41 **Variations in medial, lateral slope and medial proximal tibial angle and their possible impact on arthroplasty**
Johannes Beckmann

17.50 **Custom TKA combined with an approach for custom coronal alignment results in 88% of patients that are either satisfied or very satisfied at 24 months follow-up**
Carsten O. Tibesku

17.59 **Custom TKA enables adequate realignment with minimal ligament release and grants satisfactory outcomes in knees that had prior osteotomies or extra-articular fracture sequelae**
Mo Saffarini



- 18.08 **PCL preservation or sacrifice doesn't influence clinical outcomes and survivorship at short to mid-term follow up of a J-Curve CR – Total Knee Replacement with a Medial Congruent liner**
Stefano Rossi/ Francesco Benazzo
- 18.17 **Session II - New and old “off the shelf” implants**
Moderator: David Barrett
- 18.22 **Primary Total Knee Arthroplasty (TKA) using a Constrained Postero-Stabilized (CPS) insert: short to mid-term follow-up**
Stefano Rossi
- 18.31 **Does Anterior Cruciate Ligament (ACL) retention optimize one - year results of Total Knee Replacement (TKR)? A retrospective matched-paired comparison of bicruciate with posterior retaining (PCR) TKR**
Philippe Massin
- 18.40 **Long-term follow-up of a fixed bearing medial unicompartmental knee arthroplasty**
Stefano Rossi/Francesco Benazzo
- 18.49 **Bilateral simultaneous knee arthroplasty is as safe as a staged knee arthroplasty in a specialized clinic**
Robert Hube
- 20.00 **Welcome Dinner for Active and International Members**



Thursday, 16 December

08.00 - 13.00 EKS Meeting

- 08.00 **Session III - Robotic Surgery**
Moderator: Francesco Benazzo
- 08.05 **Evaluation of post-operative outcome with wearable sensors following robotic-assisted and conventional knee arthroplasty**
Faseeh Zaidi
- 08.14 **Impact of the diaphyseal femoral deformity on the lower limb alignment in osteoarthritic varus knees**
Sébastien Parratte
- 08.23 **Inflammatory response in robotic Total Knee Arthroplasty versus conventional Jig-based and the correlation with early functional outcomes: A pilot randomised controlled trial**
Fares Haddad
- 08.32 **Flattening the learning curve with robotic assisted knee arthroplasty**
Antonio Klasan
- 08.41 **10 year outcomes of robotic assisted medial unicompartmentals**
Martin Roche
- 08.50 **Is use of tourniquet associated to increased risk of venous thromboembolism after fast-track Total Knee Arthroplasty? A prospective multicentre cohort study of 16,267 procedures**
Kirill Gromov
- 08.59 **Equal bony resection of distal and posterior femur will lead to flexion/extension gap inequality in robot-assisted cruciate-retaining TKA**
Hannes Vermue



- 09.08 **Session IV - Patient's factors influencing outcomes**
Moderator: Anders Troelsen
- 09.13 **Robotic assisted lateral unicompartmental knee survivorship and outcomes with minimal 2 year follow up**
Martin Roche
- 09.22 **Genetic associations of knee osteoarthritis vary with the need for surgical treatment: insights from 2 large-scale genome-wide meta-analyses**
Anders Troelsen
- 09.31 **COVID-19 disruptions to postoperative care did not negatively affect elective primary Total Knee Arthroplasty (TKA) outcomes**
Alejandro Gonzalez Della Valle
- 09.40 **Femoral size and shape can improve bone fit and clinical outcomes in Total Knee Arthroplasty: Results of a prospective matched controlled study**
Jean-Noel Argenson
- 09.49 **High tibial osteotomy in young patients with constitutional deformity is an efficient strategy before a Total Knee Arthroplasty: A long-term comparative study**
Sébastien Lustig
- 09.58 **Is synovectomy necessary in Total Knee Arthroplasty with rheumatoid arthritis?**
Philippe Hernigou
- 10.07 **Considerable inter-individual variability of tibial geometric ratios renders bone-implant mismatch unavoidable using off-the-shelf Total Knee Arthroplasty: A systematic review and meta-analysis**
Mo Saffarini
- 10.16 **Patients with a high daily activity level tend to have lower Forgotten Joint Scores after knee replacement compared to sedentary patients**
Tilman Callies
- 10.25 **Coffee Break**



- 11.00 **Session V - The panorama of failures**
Moderator: Emmanuel Thienpont and Fabio Catani
- 11.05 **Comparison of different strategies in revision arthroplasty of the knee with severe bone loss: A systematic review and meta-analysis of clinical outcomes**
Jan Victor
- 11.14 **DAIR: The management of choice in infected UKA**
David Barrett
- 11.23 **Appearance and evolution of radiolucent lines in primary Total Knee Arthroplasty**
Emmanuel Thienpont
- 11.32 **Simultaneous Total Knee Arthroplasty and opening wedge high tibial osteotomy versus ligament release in knees with large tibial varus deformity (15 degrees to 25 degrees)**
Philippe Hernigou
- 11.41 **First automatic and end-to-end analysis of knee prosthesis X-ray images using artificial intelligence**
Michel Bonnin
- 11.50 **A comparative study of antibiotic resistance in periprosthetic joint infection (PJI) after Total Knee Arthroplasty between two orthopaedic centres**
Thomas Heyse
- 11.59 **The use of augmented antibiotic-loaded articulated spacers in periprosthetic knee infections in patients with massive bone defects**
Ivan De Martino
- 12.08 **Early results of bi-cruciate retaining implants**
Alessio Biazzo



- 12.17 **Session VI - Rules and perspectives with new Medical Device Regulation**
Moderator: Fabio Catani
- 12.22 **Sexual dimorphism and racial diversity renders bone-implant mismatch inevitable after off-the-shelf Total Knee Arthroplasty – A systematic review and meta-analysis**
Mo Saffarini
- 12.31 **Simultaneous bilateral Total Knee Arthroplasty in patients over 70: Are there factors that can influence safety and clinical outcome?**
Claudio Zorzi

Free afternoon for activities

- 16.00 **EKS Board Meeting**
- 18.00 **EKS General Assembly (Active and International Members only)**
- 20.00 **Presidential Dinner**



Friday, 17 December

08.00 - 13.00 **Delphi Consensus meeting**

08.00 - 10.30 **Delphi Consensus 1st part**

Please find below the full list of research questions which have been assigned to our International Expert Delegates based on their extensive experience, their published expertise and utmost interest.

1. What is the tailored alignment that we are pursuing in modern TKA with the fast progression of robotic assisted surgery?		<i>Group Coordinator</i> <u>Price A.</u>
A	Soft tissue release does still have a role in the knee balancing with robotic assisted technique?	<i>Catani F.</i> <i>Rossi S.M.P.</i>
B	Do the Kinematic Alignment (KA) technique and its variants (restricted and inverse KA) be indicated for everyone, or are there existing contra-indications?	<i>Riviere C.</i> <i>Winnock de Grave P.</i>
2. How far can we go with the external rotation of the femoral component in modern TKA?		<i>Group Coordinator</i> <u>Innocenti B.</u>
A	Do we have proper landmark or method for correct tibia rotational alignment in TKA? <i>I- What should be the correct target for correct rotational tibial alignment?</i> <i>II- Is the tibia tubercle a reliable landmark or should we use the TEA of the femur for rotational alignment?</i> <i>III- Can rotational tibia alignment be improved by using CAS (navigation, PSI or robotics)</i>	<i>Hofmann S.</i> <i>Ollivier M.</i>
B	Do we have proper landmarks or methods for correct femur rotational alignment <i>I- What should be the correct targets for correct rotational femoral alignment?</i> <i>II- Is there consensus or evidence that one technique/philosophy is superior to the other in terms of reaching the target?</i> <i>III- Can rotational femur alignment be improved by using CAS (navigation, PSI or robotics)?</i>	<i>Tsiridis E.</i> <i>Tecame A.</i>



3. Development of new materials in modern TKA		<i>Group Coordinator</i> <u>Porteous A</u>
A	Is cementless TKA gaining revival interest with new high porosity metals?	<i>Gromov K.</i> <i>De Martino I.</i>
B	When will 3-D printed TKA implants be available for daily practice? Will they decrease the percentage of dissatisfied patients?	<i>Beckmann J.</i> <i>Berger P.</i>
C	Will 3-D ultrasound or other techniques substitute CT scan for the 3-D anatomy reconstruction in preoperative templating in robotic TKA?	<i>Rosso F.</i>
D	Vit-E poly does provide a substantial improvement in wear debris and subsequent osteolysis?	<i>Heyse T.</i> <i>Skovgaard Nielsen</i> <i>C.</i>

4. The impact of robotic surgery in modern TKA		<i>Group Coordinator</i> <u>Haddad F.</u>
A	Can we compare the results of different robotic systems with different degree of autonomy? And how much do we know about unbiased results?	<i>Parratte S.</i> <i>Colombelli A.</i>
B	Can the robotic software help the surgeon to predict the functional outcomes based on the intraoperative planning and on the evaluated balancing?	<i>Lustig S.</i> <i>Luyckx T.</i>

10.30 – 11.00 **Coffee Break**



5. Telemedicine-rehabilitation in the adult reconstructive surgery perspective		<i>Group Coordinator</i> <u>Vandenneucker H.</u>
A	Will telemedicine rehabilitation substitute the inpatient physiotherapy while providing non-inferior results?	Stuyts B. Biazzo A.
B	Will home physiotherapy reduce the incidence of early infections compared with inpatient clinic rehabilitation?	Fuchs-Winkelmann S. Faschingbauer M.
C	Telemedicine follow-up controls will impact the early outcomes of TKA while providing a closer control of the patients by the surgeon?	Tibesku C. Phillips J.

6. Bidirectional barbed sutures (BBSs) are safe, time saving, and give comparable results to traditional sutures when used in primary TKA?		<i>Group Coordinator</i> <u>Pietsch M.</u>
A	Bidirectional barbed sutures (BBSs) are safe, time saving, and give comparable results to traditional sutures when used in primary TKA?	Cerciello S. Smeets K. Bistolfi A. Balato G.

7. Bicompartamental knee arthroplasty instead of TKA in case of patellofemoral osteoarthritis (PFOA).		<i>Group Coordinator</i> <u>Argenson J.N.</u>
A	Is bicompartamental knee arthroplasty (BKA) a viable alternative to Total Knee Arthroplasty (TKA) in selected patients with combined patellofemoral and tibiofemoral OA?	London N. Lunebourg A. Campi S.
B	When PFA is indicated in patients with medial UKA and progression of patellofemoral OA?	Barrett D. Jones G. Von Knoch F.

8. The patella in Total Knee Arthroplasty: to resurface or not?		<i>Group Coordinator</i> <u>Thienpont E.</u>
A	Guidelines for the 3 surgical approaches: always resurface, never resurface, selectively resurface?	Hube R. Jackson W. Van de Groes S.



9. Arthrofibrosis after TKA, what else?		<i>Group Coordinator</i> <u>van Hellemond G.</u>
A	Revision TKA after arthrofibrosis, how to prevent recurrency?	<i>Hernigou P.</i> <i>Lamberti A.</i>
B	Which are the patients at higher risk of developing arthrofibrosis after TKA? How to prevent it.	<i>Baldini A.</i> <i>Smolders J.</i>

10. Fixation in Revision TKA		<i>Group Coordinator</i> <u>Victor J.</u>
A	Is Zonal Fixation still a valid dogma?	<i>Rossi R.</i> <i>Lindberg-Larsen M.</i> <i>Liddle A.</i>
B	Is the technique of fully cemented short or mid-length stems the winning one in terms of fixation?	<i>Chapman-sheath P.</i> <i>Saffarini M.</i> <i>Petrillo S.</i>

11.00 - 13.00 **Delphi consensus 2nd part**

Free afternoon, extended stay or departure of EKS Members



Hotel Accommodation

Active and International Members

Hotel Accommodation is offered to Active and International Members.

Grand Hotel Royal e Golf

Via Roma, 87

11013 Courmayeur (Ao)

Italy

Tel. (+39) 0165 83.16.11 - www.hotelroyalegolf.com

Rates

Single Room: € 250,00 + 10% VAT/night

Double Room: + € 80,00 + 10% VAT/night (Supplement to be paid at the hotel)

This includes:

- Breakfast
- Access to the Spa (<https://www.hotelroyalegolf.com/en/luxury-hotel-and-spa-mont-blanc>)
- Access to the fitness center

Check-in time: 15.00 hrs

Check-out time: 11.00 hrs

Parking

Private car park: 40 parking places available. The car park is not monitored.

Or

Garage: 12 covered secured parking spaces at Euro 25.00 + VAT 22% / per vehicle per day.

Parking must be booked by email to info@hotelroyalegolf.com. Do not forget to mention that you will join the EKS Group.



Social Events

Wednesday, 15 December

Active and International Members are invited to attend the EKS Welcome Dinner. 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 rate of € 100,00. This must be paid to the EKS upon registration.

Thursday, 16 December

Active, International and Junior Members are invited to attend the Presidential Dinner on Thursday evening. The Gala Dinner consists of 4 courses and will be held at the Grand Royal Restaurant.

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 € 125,00. This must be paid to the EKS upon registration.



EKS Members are obliged to attend the Presidential Dinner.

Please note that the dress code for the dinner is Business Casual.

Cancellation Policy

Dinners of partners can be cancelled until 15 November 2021. No refunds will be made after this date.



Nearest Airports

There are several possibilities to reach Courmayeur by plane:

Flying into Italy – recommended

We suggest to fly to the international airport of Milan - Milan Malpensa Airport (distance: 215 km). You can also fly to or Milano Linate Airport, this one is a little bit further (distance: 235 km).

The closest airport to Courmayeur - Aosta Valley is in Turin - Caselle Aeroporto di Torino (Turin Airport) (distance: 150 km).

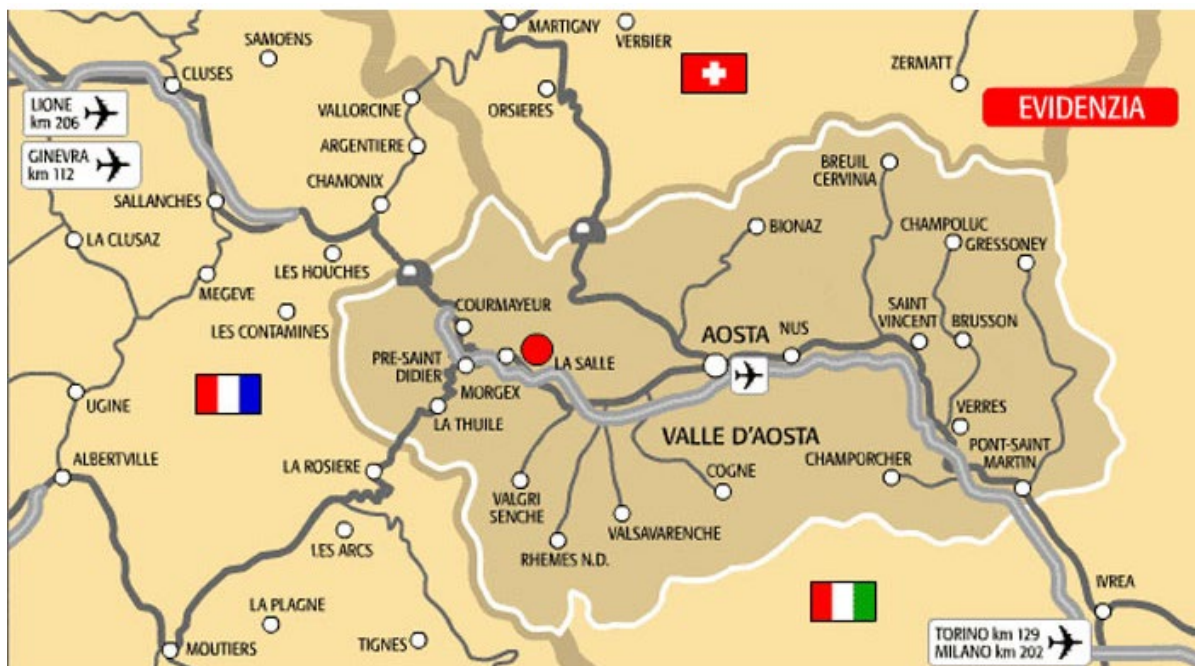
Another option is in Bergamo Orio al Serio International Airport (distance: 260 km)

Flying into **Switzerland** – discouraged!

Geneva Airport, in Geneva, Switzerland is the most convenient airport for getting to Courmayeur. Geneva Airport is closer to Courmayeur (distance: 112km) via the Mont Blanc Tunnel passing Chamonix Mont Blanc.

Flying into **France**

Another way to get to Courmayeur which is closer than some of the Italian airports is Lyon-Saint Exupéry Airport (distance: 206km)





Useful Contacts

TAXI / PRIVATE TRANSFER

Professional and reliable transfers from and to the airports of Geneva (Switzerland), Turin Caselle, Milan Malpensa, Milan Linate and Bergamo Orio al Serio Airport to the hotel.

For information: www.airporttransfers.it - Gabriele +39 338 564 8400

SKY WAY MONTE BIANCO

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https://www.courmayeur-montblanc.com/?q=tariffe_giornalieri

COURMAYEUR ALPINE GUIDE SOCIETY

Strada Villair 2, 11013 Courmayeur - (Aosta) - Italy
Telefono: +39 0165 842064
Email: info@guidecourmayeur.com



Booking Procedure and Cancellation Policy

Active and International Members

EKS Active and International Members are requested to book the room through the EKS registration form. Members booking their room through another platform (booking.com, hotel website,...) or booking another hotel will NOT be reimbursed. We have obtained competitive rates and the hotel requests a minimum number of booked rooms for our Meeting for which EKS takes the financial risk.

Availability

The hotel has a limited number of rooms and rooms are allocated on a first-come, first-served basis. We strongly advise to book your room as soon as possible.

Minimum stay

There is a minimum stay of 2 nights (15+16 December). If you wish to extend your stay before or after the proposed dates, you can contact the EKS Secretariat by email on eks@medicongress.com or by telephone on +32 (0) 9 218 85 85.

Please do not contact the hotel as they only receive the rooming list a few weeks before our arrival.

How to book?

You can book your hotel and social events through the following link:

<https://na.eventscloud.com/ekscourmayeur>

You will be asked to pay your social events for your partner by credit card or bank transfer within 30 days.

You will receive your confirmation within 3 working days by email.

What does EKS cover?

The EKS covers a total amount of **€ 815,00**:

- 2 nights at a rate of €250,00 + VAT per night.
- 2 dinners for EKS Active and International Members on Wednesday and Thursday evening.
- Access to the scientific meeting
- 2 Coffee Breaks

Please note: A credit card will be asked upon registration to serve as a guarantee for your participation into the EKS Closed Meeting in Courmayeur. See cancellation policy on page 10 for more information.



Liability

The EKS cannot be held responsible if the hotel has no availability after 1 October 2021.

Insurance

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

Covid

Participants must check the regulations regarding Covid-19 restrictions on the website of their own government.

Payment

Social events must be paid through the online registration form provided by the EKS within 30 days and before 15 November 2021.

Hotel accommodation must be booked through the online registration form, but a credit card number will be requested upon registration to serve as a guarantee for your participation and hotel booking. The cancellation policy is mentioned below.

Cancellation Policy

Cancellations are accepted until 15 November 2021. Cancellations received after this date will be charged in full. Cancellations must be done in writing to eks@medicongress.com and are valid upon confirmation by the Secretariat.

The cancellation fee is **€ 815,00** for the costs made by the EKS (hotel accommodation, dinners, meeting room rental, coffee breaks)

A credit card will be asked upon registration to serve as a guarantee for your participation into the EKS Closed Meeting in Courmayeur.

By registering to the EKS Closed Meeting in Courmayeur, Italy from 15 to 17 December 2021, you agree to the above-mentioned procedure and policies.



Abstracts

Session I - Tailored knee arthroplasty

Effect of hybrid alignment techniques on native coronal alignment and soft tissue balance in Total Knee Arthroplasty

Philip Winnock de Grave^{1,2}, Thomas Luyckx^{1,3}, Matthieu Ollivier⁴, Jacobus Hendrik Müller⁵, Kurt Claeyts²

¹AZ Delta Roeselare, Dept. Orthopaedic Surgery, Roeselare; ²KU Leuven, Dept. Rehabilitation Sciences, Brugge; ³UZ Leuven, Dept. Orthopaedic Surgery, Leuven, Belgium; ⁴Dept. of Orthopedics and Traumatology, APHM, CNRS, Sainte-Marguerite Hospital, Marseille, France; ⁵ReSurg SA, Nyon, Switzerland

Background:

Hybrid alignment techniques in TKA, such as adjusted mechanical alignment (aMA), restricted kinematic alignment (rKA) and inverse kinematic alignment (iKA), allow restoration of prearthritic knee alignment, but within defined limits or target zones. The purpose of this study was, first, to determine the proportion of native non-arthritic knees that fit within the target zones of aMA, rKA, and iKA. Second, to estimate required adjustments in native coronal alignment and soft tissue balance to bring outlier knees within the respective target zones.

Methods:

The study used measurements obtained from a computed tomography (CT) scan database of 1005 healthy knees. HKA, MPTA and LDFA were used to estimate the proportions of knees within the hybrid alignment target zones; and to estimate adjustments of MPTA, LDFA and soft tissue balance to bring outlier knees within target zones.

Results:

Of the 1005 knees, 81 (8.1%) were in the aMA target zone, 544 (54.1%) were in the rKA target zone, and 748 (74.4%) were in the iKA target zone. To bring knees within the target zones, estimated proportion of coronal alignment adjustments are, for aMA (MPTA, 90%; LDFA 91%), for rKA (MPTA, 45%; LDFA 28%), and for iKA (MPTA, 25%; LDFA 22%). Soft tissue balance adjustment would be required in 29% for aMA, 26% for rKA, and 7% for iKA.

Conclusion:

There is considerable variability in native knee alignment that correspond to hybrid alignment techniques: iKA represents the greatest proportion of knees (74.4%), followed by rKA (54.1%), whereas aMA only represents a small proportion (8.9%). Less soft tissue releases are necessary with iKA, due to its target zones which better represent the variability in native knee alignment.



Figure 2: Classification of the outlier zones (Zones I to VIII) based on the coronal alignment phenotypes. a) aMA target zone. b) rKA target zone. c) iKA target zone.

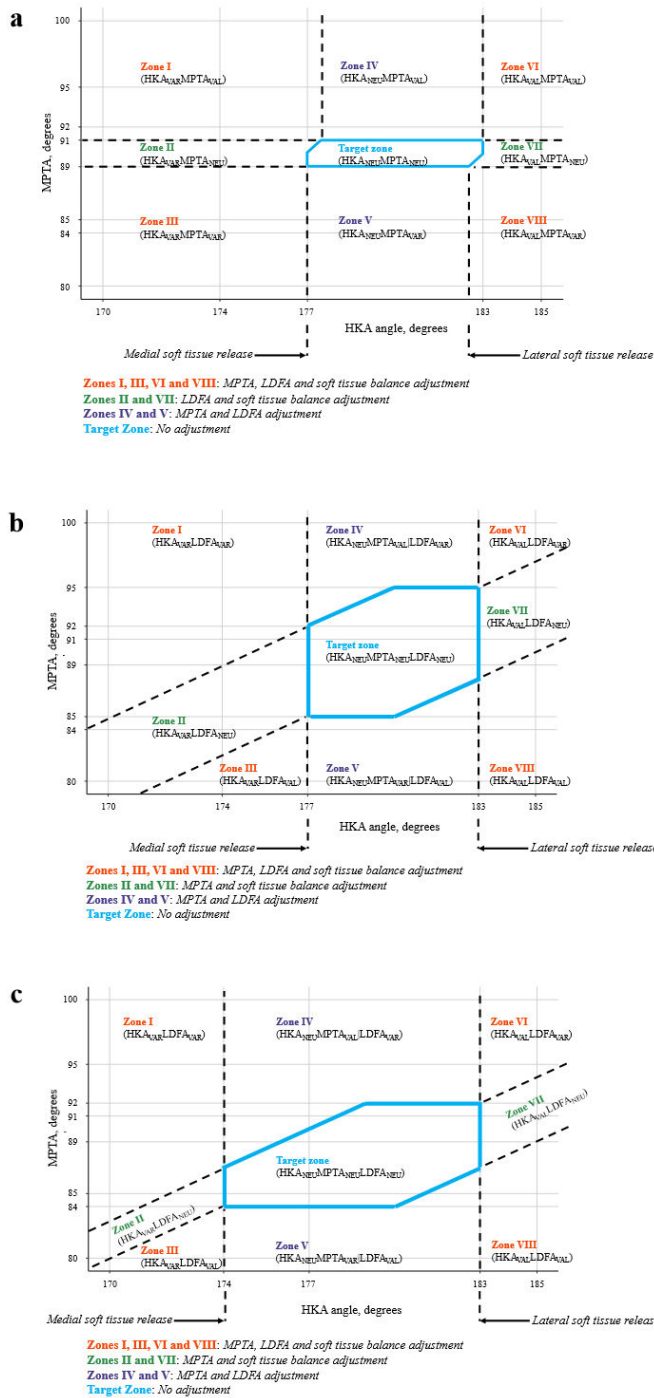
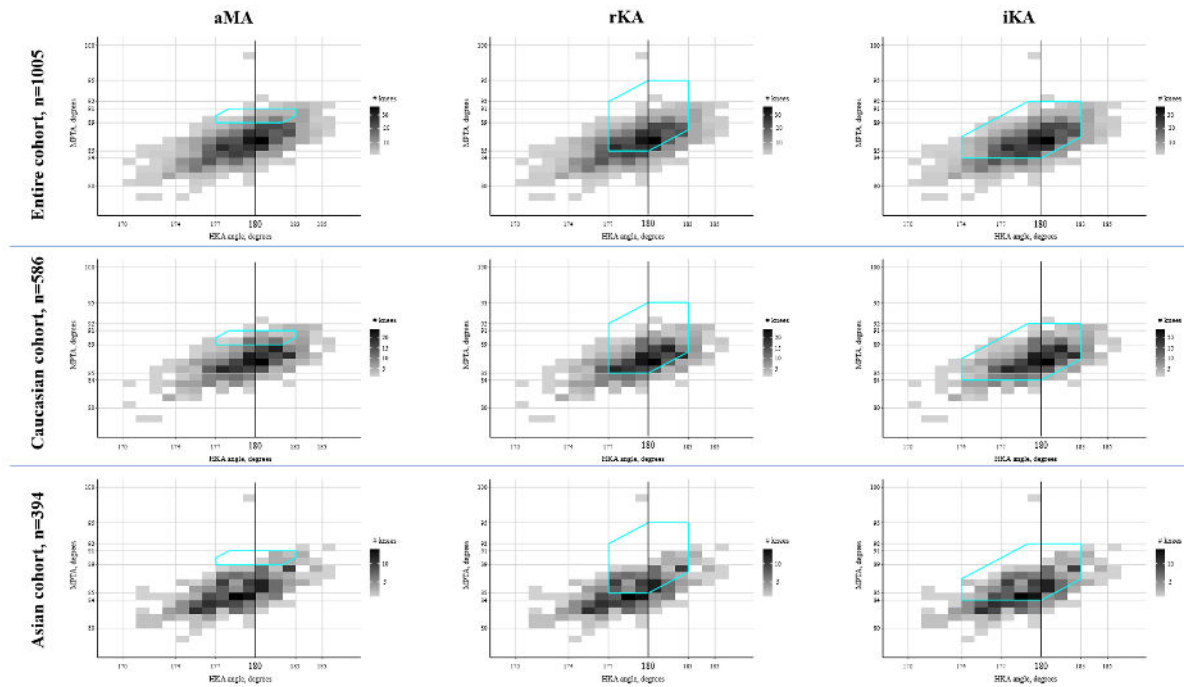




Figure 3: Heat maps illustrating the proportion of knees that are within the aMA (column 1), rKA (column 2) and iKA target zones (column 3). Row 1 represents the entire cohort of 1005 knees, row 2 the Caucasian cohort of 586 knees and row 3 the Asian cohort of 394 knees. Darker grey represents a higher density, and light grey represents a lower density.





Tables

Table 1: Cohort characteristics

Cohort	Knees, n	Age, years	BMI, kg/m ²	HKA angle, degrees		MPTA, degrees		LDFA, degrees	
		mean ±SD	mean ±SD	mean ±SD	(range)	mean ±SD	(range)	mean ±SD	(range)
Combined	1005	59,2 ±16,2	25,1 ±4,5	178,5 ±2,8	(168 – 186)	85,5 ±2,4	(78 – 98)	85,9 ±2,0	(79 – 93)
<i>Caucasian</i>	586	61,9 ±14,8	25,6 ±4,6	178,9 ±2,6	(170 – 185)	86,1 ±2,1	(78 – 92)	86,1 ±1,9	(80 – 91)
<i>Asian</i>	394	55,6 ±17,6	23,3 ±3,4	178,1 ±3,0	(168 – 186)	84,7 ±2,4	(78 – 98)	85,5 ±2,1	(79 – 93)
<i>Middle-Eastern</i>	13	46,6 ±6,4	25,7 ±2,1	178,4 ±2,7	(175 – 184)	85,5 ±2,2	(83 – 90)	85,9 ±1,9	(83 – 90)
<i>African</i>	12	54,3 ±16,4	26,9 ±6,1	175,9 ±2,0	(173 – 179)	85,4 ±1,6	(82 – 88)	87,3 ±2,3	(84 – 91)

Abbreviations: SD, standard deviation; BMI, body mass index; HKA, hip knee ankle; MPTA, medial proximal tibial angle; LDFA, lateral distal femoral angle

Table 2: Pairwise comparison of cohort and coronal alignment characteristics

Cohort		Cohort characteristics		Coronal alignment characteristics		
		Age	BMI	HKA angle	MPTA	LDFA
Caucasian	vs Asian	<0.001	<0.001	<0.001	<0.001	<0.001
	vs African	n.s.	n.s.	<0.001	n.s.	n.s.
	vs Middle-Eastern	0,002	n.s.	n.s.	n.s.	n.s.
Asian	vs Middle-Eastern	n.s.	n.s.	n.s.	n.s.	n.s.
	vs African	n.s.	n.s.	0,027	n.s.	n.s.
Middle-Eastern	vs African	n.s.	n.s.	n.s.	n.s.	n.s.

Abbreviations: BMI, body mass index; HKA, hip knee ankle; MPTA, medial proximal tibial angle; LDFA, lateral distal femoral angle;

Table 3: Comparison of estimated coronal alignment adjustment for knees of the entire cohort that are outside the target zones of aMA, rKA and iKA

	aMA			rKA			iKA			p-values		
	n (%)	mean ±SD	(range)	n (%)	mean ±SD	(range)	n (%)	mean ±SD	(range)	aMA vs rKA	aMA vs iKA	rKA vs iKA
All knees	<i>n=1005</i>			<i>n=1005</i>			<i>n=1005</i>					
MPTA adjustment, deg	903 (90%)	3,9 ±2,0	(1 – 11)	452 (45%)	2,1 ±1,4	(1 – 9)	247 (25%)	1,8 –1,2	(1 – 8)	<0.001	<0.001	<0.001
LDFA adjustment, deg	912 (91%)	3,4 ±1,6	(1 – 9)	279 (28%)	1,5 ±0,7	(1 – 4)	225 (22%)	1,6 –0,9	(1 – 6)	<0.001	<0.001	n.s.
Soft tissue release, deg	291 (29%)	2,1 ±1,5	(1 – 9)	262 (26%)	2,2 ±1,5	(1 – 9)	68 (7%)	2,0 –1,7	(1 – 9)	n.s.	n.s.	n.s.
Varus outliers¹	<i>n=236</i>			<i>n=236</i>			<i>n=42</i>					
MPTA adjustment, deg	234 (99%)	5,6 ±1,9	(1 – 11)	236 (100%)	2,7 ±1,6	(1 – 9)	42 (100%)	3,0 –1,6	(1 – 8)	<0.001	<0.001	n.s.
LDFA adjustment, deg	224 (95%)	3,4 ±1,9	(-3 – 8)	63 (27%)	1,6 ±0,9	(1 – 4)	24 (57%)	1,2 –1,4	(-2 – 4)	<0.001	<0.001	n.s.
Soft tissue release, deg	236 (100%)	2,3 ±1,6	(1 – 9)	236 (100%)	2,3 ±1,6	(1 – 9)	42 (100%)	2,4 –2,0	(1 – 9)	n.s.	n.s.	n.s.
Neutral²	<i>n=714</i>			<i>n=763</i>			<i>n=647</i>					
MPTA adjustment, deg	633 (89%)	3,3 ±1,7	(-7 – 9)	199 (27%)	1,4 ±0,8	(-4 – 4)	189 (30%)	1,5 ±1,0	(-6 – 6)	<0.001	<0.001	n.s.
LDFA adjustment, deg	633 (89%)	3,3 ±1,7	(-7 – 9)	199 (27%)	1,4 ±0,8	(-4 – 4)	189 (30%)	1,5 ±1,0	(-6 – 6)	<0.001	<0.001	n.s.
Soft tissue release, deg												
Valgus outliers³	<i>n=35</i>			<i>n=26</i>			<i>n=26</i>					
MPTA adjustment, deg	36 (65%)	1,9 ±0,8	(1 – 3)	17 (65%)	0,0 ±1,3	(-2 – 2)	16 (62%)	-0,9 –0,9	(-2 – 1)	0,024	<0,01	n.s.
LDFA adjustment, deg	55 (100%)	2,7 ±1,4	(1 – 6)	17 (65%)	2,1 ±0,9	(1 – 4)	12 (46%)	1,6 –0,7	(1 – 3)	n.s.	0,043	n.s.
Soft tissue release, deg	55 (100%)	-1,5 ±0,8	(-4 – -1)	26 (100%)	-1,5 ±0,7	(-3 – -1)	26 (100%)	-1,5 –0,7	(-3 – -1)	n.s.	n.s.	n.s.

¹ HKA angle < 177° for aMA and rKA and < 174° for iKA (Zones: I, II, III)

² HKA angle between 177° to 183° for aMA and rKA, and between 174° to 183° for iKA (Zones: IV, V, Target Zone)

³ HKA angle > 183° for aMA, rKA and iKA (Zones: VI, VII, VIII)

Abbreviations: MPTA, medial proximal tibial angle; LDFA, lateral distal femoral angle; aMA, adjusted mechanical alignment; rKA, restricted kinematic alignment; iKA, inverse kinematic alignment; SD standard deviation; n.s., not significant.



Table 4: Comparison of estimated coronal alignment adjustment for Caucasian and Asian knees that are outside the target zones of aMA, rKA and iKA

	aMA			rKA			iKA			p-values		
	n (%)	mean \pm SD	(range)	n (%)	mean \pm SD	(range)	n (%)	mean \pm SD	(range)	aMA vs rKA	aMA vs iKA	rKA vs iKA
Caucasian cohort												
All knees	n=586			n=586			n=586					
MPFA adjustment, deg	506 (86%)	3,4 \pm 1,8	(1 - 11)	199 (34%)	1,9 \pm 1,2	(1 - 7)	88 (15%)	1,6 \pm 1,0	(1 - 6)	<0.001	<0.001	0,010
LDFA adjustment, deg	514 (88%)	3,0 \pm 1,4	(1 - 7)	106 (18%)	1,4 \pm 0,6	(1 - 4)	75 (13%)	1,4 \pm 0,7	(1 - 4)	<0.001	<0.001	n.s.
Soft tissue release, deg	144 (25%)	1,9 \pm 1,3	(1 - 7)	121 (21%)	2,1 \pm 1,4	(1 - 7)	29 (5%)	1,6 \pm 0,9	(1 - 4)	n.s.	n.s.	n.s.
Varus knees¹	n=109			n=109			n=17					
MPFA adjustment, deg	107 (98%)	5,0 \pm 1,9	(1 - 11)	109 (100%)	2,4 \pm 1,5	(1 - 7)	17 (100%)	2,8 \pm 1,6	(1 - 6)	<0.001	<0.001	n.s.
LDFA adjustment, deg	102 (94%)	3,0 \pm 1,6	(-1 - 6)	18 (17%)	1,2 \pm 0,4	(1 - 2)	7 (41%)	2,4 \pm 0,8	(2 - 4)	<0.001	n.s.	<0.001
Soft tissue release, deg	109 (100%)	2,2 \pm 1,4	(1 - 7)	109 (100%)	2,2 \pm 1,4	(1 - 7)	17 (100%)	1,8 \pm 1,0	(1 - 4)	n.s.	n.s.	n.s.
Neutral knees²	n=422			n=465			n=357					
MPFA adjustment, deg	377 (89%)	2,9 \pm 1,5	(-1 - 7)	81 (17%)	1,4 \pm 0,6	(1 - 4)	65 (11%)	1,3 \pm 0,6	(1 - 3)	<0.001	<0.001	n.s.
LDFA adjustment, deg	377 (89%)	2,9 \pm 1,5	(-1 - 7)	81 (17%)	1,4 \pm 0,6	(1 - 4)	65 (11%)	1,3 \pm 0,6	(1 - 3)	<0.001	<0.001	n.s.
Soft tissue release, deg												
Valgus knees³	n=35			n=12			n=12					
MPFA adjustment, deg	22 (63%)	1,9 \pm 0,8	(1 - 3)	9 (75%)	0,0 \pm 1,2	(-1 - 2)	8 (67%)	-1,0 \pm 0,9	(-2 - 1)	0,002	<0.001	n.s.
LDFA adjustment, deg	35 (100%)	2,4 \pm 1,2	(1 - 5)	7 (58%)	1,9 \pm 0,7	(1 - 3)	5 (42%)	1,2 \pm 0,4	(1 - 2)	n.s.	n.s.	n.s.
Soft tissue release, deg	35 (100%)	-1,2 \pm 0,5	(-3 - -1)	12 (100%)	-1,3 \pm 0,5	(-2 - -1)	12 (100%)	-1,3 \pm 0,5	(-2 - -1)	n.s.	n.s.	n.s.
Asian cohort												
All knees	n=394			n=394			n=394					
MPFA adjustment, deg	374 (95%)	4,6 \pm 2,1	(1 - 11)	236 (60%)	2,3 \pm 1,5	(1 - 9)	154 (39%)	1,9 \pm 1,3	(1 - 8)	<0.001	<0.001	0,039
LDFA adjustment, deg	378 (96%)	4,0 \pm 1,7	(1 - 9)	168 (43%)	1,6 \pm 0,8	(1 - 4)	148 (38%)	1,7 \pm 0,9	(1 - 6)	<0.001	<0.001	<0.001
Soft tissue release, deg	134 (34%)	2,4 \pm 1,7	(1 - 9)	128 (32%)	2,4 \pm 1,7	(1 - 9)	36 (9%)	2,5 \pm 2,1	(1 - 9)	n.s.	n.s.	n.s.
Varus knees¹	n=116			n=116			n=24					
MPFA adjustment, deg	116 (100%)	6,3 \pm 1,7	(2 - 11)	116 (100%)	3,1 \pm 1,7	(1 - 9)	24 (100%)	3,3 \pm 1,6	(1 - 8)	<0.001	<0.001	n.s.
LDFA adjustment, deg	113 (97%)	3,9 \pm 2,0	(-3 - 8)	44 (38%)	1,7 \pm 0,9	(1 - 4)	17 (71%)	0,7 \pm 1,4	(-2 - 2)	<0.001	<0.001	0,022
Soft tissue release, deg	116 (100%)	2,5 \pm 1,7	(1 - 9)	116 (100%)	2,5 \pm 1,7	(1 - 9)	24 (100%)	2,8 \pm 2,4	(1 - 9)	n.s.	n.s.	n.s.
Neutral knees²	n=260			n=266			n=358					
MPFA adjustment, deg	244 (94%)	3,9 \pm 1,9	(-7 - 9)	114 (43%)	1,4 \pm 0,8	(-1 - 4)	124 (35%)	1,6 \pm 1,2	(-6 - 6)	<0.001	<0.001	<0.001
LDFA adjustment, deg	244 (94%)	3,9 \pm 1,9	(-7 - 9)	114 (43%)	1,4 \pm 0,8	(-1 - 4)	124 (35%)	1,6 \pm 1,2	(-6 - 6)	<0.001	<0.001	<0.001
Soft tissue release, deg												
Valgus knees³	n=18			n=12			n=12					
MPFA adjustment, deg	14 (78%)	1,9 \pm 0,9	(1 - 3)	6 (50%)	0,3 \pm 1,5	(-2 - 2)	6 (50%)	-0,8 \pm 1,0	(-2 - 1)	0,001	0,002	n.s.
LDFA adjustment, deg	18 (100%)	3,5 \pm 1,5	(1 - 6)	10 (83%)	2,3 \pm 1,1	(1 - 4)	7 (58%)	1,9 \pm 0,7	(1 - 3)	n.s.	0,045	n.s.
Soft tissue release, deg	18 (100%)	-2,1 \pm 1,1	(-4 - -1)	12 (100%)	-1,8 \pm 0,9	(-3 - -1)	12 (100%)	-1,8 \pm 0,9	(-3 - -1)	n.s.	n.s.	n.s.

¹ iKA angle < 177° for aMA and rKA and < 174° for iKA (Zones: I, II, III)

² HKA angle between 177° to 183° for aMA and rKA, and between 174° to 183° for iKA (Zones: IV, V, Target Zone)

³ iKA angle > 183° for aMA, rKA and iKA (Zones: VI, VII, VIII)

Abbreviations: MPFA, medial proximal tibial angle; LDFA, lateral distal femoral angle; aMA, adjusted mechanical alignment; rKA, restricted kinematic alignment; iKA, inverse kinematic alignment; SD, standard deviation



Use of condylar walls as anatomical landmarks for the kinematic alignment of the femoral component in lateral UKA

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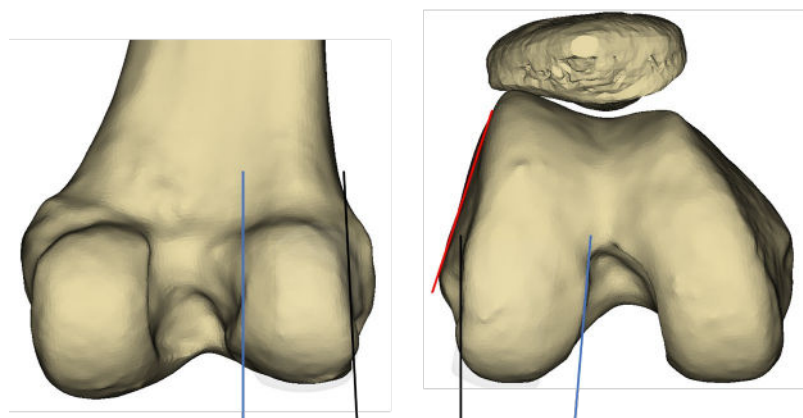
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Background:

Kinematic alignment (KA) of the femoral component in unicompartmental knee arthroplasty (UKA) aligns the implant perpendicular to the cylindrical axis in both the frontal and axial planes. When performing UKA using the mini-invasive sub-quadriceps approach, identification of this axis is challenging. This study aims to assess if the orientation of condylar walls may be suitable for use as anatomical landmarks to align the femoral component in lateral UKA. It was hypothesised that the lateral wall of the lateral condyle would prove to be a reliable anatomical landmark to set the frontal and axial alignment of the femoral component in lateral UKA.

Methods:

73 patients with medial knee osteoarthritis had pre-operative CT imaging to generate 3D models of their bony knee anatomy. Patients with osteophytes that impaired the visualisation of condylar walls were excluded. 40 patients were included in the study. The ideal KA was determined using the cylindrical axis in both the frontal and axial planes. Simulations were then performed using the medial wall of the lateral condyle (MWLC), lateral wall of the lateral condyle (LWLC) as landmarks to set the frontal alignment. For axial alignment, the MWLC, LWLC, and the lateral diagonal line (LDL) were used as anatomical landmarks. Differences between the KA values and values obtained when using landmarks were investigated.



Blue line represents the medial wall of lateral condyle, black line represents the lateral wall of the lateral condyle and red line represents lateral diagonal line.

Results:

Yet to be available

Discussion/Conclusions:

Yet to be available



Predicting hip-knee-ankle and femorotibial angles from knee radiographs with deep learning

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Background:

Knee alignment affects both the development and surgical treatment of knee osteoarthritis. Automating femorotibial angle (FTA) and hip-knee-ankle angle (HKA) measurement from radiographs could improve reliability and save time. Further, if the gold-standard HKA from full-limb radiographs could be accurately predicted from knee-only radiographs then the need for more expensive equipment and radiation exposure could be reduced. The aim of this research is to assess if deep learning methods can predict FTA and HKA angle from posteroanterior (PA) knee radiographs.

Methods:

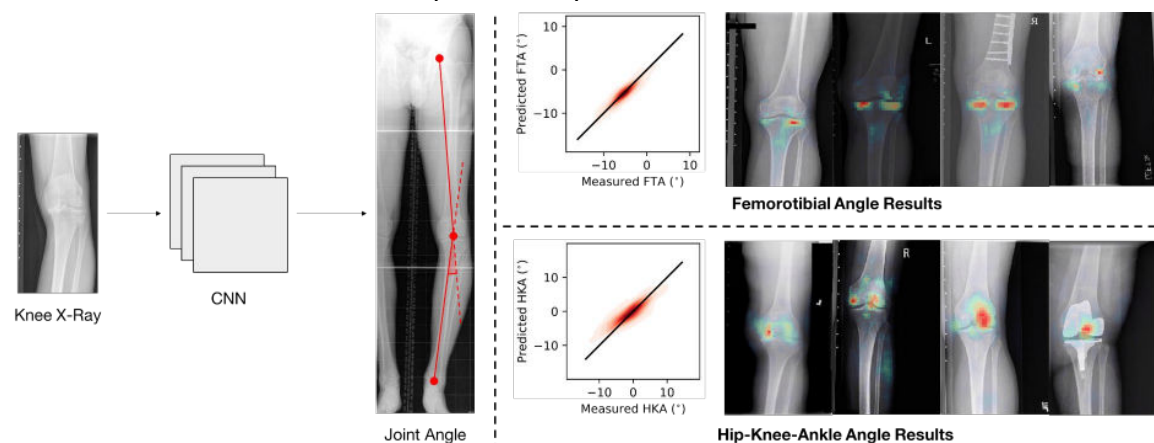
Convolutional neural networks with densely connected final layers were trained to analyse PA knee radiographs from the Osteoarthritis Initiative (OAI) database. The FTA dataset with 6149 radiographs and HKA dataset with 2351 radiographs were split into training, validation, and test datasets in a 70:15:15 ratio. Separate models were developed for the prediction of FTA and HKA and their accuracy was quantified using mean squared error as loss function. Heat maps were used to identify the anatomical features within each image that most contributed to the predicted angles.

Results:

FTA could be predicted with errors less than 3° for 98.7% of images. HKA prediction was less accurate than FTA but still high: 83.9% within 3°. Heat maps for both models were concentrated on the knee anatomy and could prove a valuable tool for assessing prediction reliability in clinical application.

Conclusion:

Deep learning techniques enable fast, reliable and accurate predictions of both FTA and HKA from plain knee radiographs and could lead to cost savings for healthcare providers and reduced radiation exposure for patients.





True kinematic alignment is applicable in 44% of patients applying restrictive indication criteria - A retrospective analysis of 111 TKA using robotic assistance

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Background:

Over the last three years, we have established a standardized workflow to implement the idea of kinematic alignment (KA) for image-based robotic-assisted TKA, and also defined limits for its safe use, when we switch to a restricted KA (rKA). The aim of the study was to evaluate (1) in what percentage of patients a true KA or an rKA is applicable, (2) whether there were differences regarding knee phenotypes, and (3) what the differences of philosophies in terms of component position, joint stability, and early patient outcome were.

Methods:

The study included a retrospective analysis of 111 robotic-assisted primary TKAs. Based on preoperative long leg standing radiographs, the patients were categorized into a varus, valgus, or neutral subgroup. Initially, all patients were planned for KA TKA. When the defined safe zone had been exceeded, adjustments to an rKA were made. Intraoperatively, the alignment of the components and joint gaps were recorded by robotic software.

Results and conclusion:

With our indication for TKA and the defined boundaries, "only" 44% of the patients were suitable for a true KA with no adjustments or soft tissue releases. In the varus group, it was about 70%, whereas it was 0% in the valgus group and 25% in the neutral alignment group. Thus, significant differences with regard to knee morphotypes were evident. In the KA group, a more physiological knee balance reconstructing the trapezoidal flexion gap (+2 mm on average laterally) was seen as well as a closer reconstruction of the surface anatomy and joint line in all dimensions compared to rKA. This resulted in a higher improvement in the collected outcome scores in favor of KA in the very early postoperative phase.



Variations in medial, lateral slope and medial proximal tibial angle and their possible impact on arthroplasty

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Purpose:

The primary objective of this study was to quantify the variations of the medial posterior tibial slope (MPTS) and the lateral posterior tibial slope (LPTS), as well as of the medial proximal tibial angle (MPTA) and to determine the fraction of patients for which standard techniques including different alignment techniques would result in alteration of the patient's individual posterior tibial slope (PTS) and MPTA. Furthermore, it was of interest if a positive correlation between a PTS and a MPTA or between medial and lateral slope exists.

Methods:

A retrospective study was performed on CT-Scans of 234 consecutively selected European patients undergoing individual total knee replacement. All measurements were done on three-dimensional CAD models, which were generated on the basis of individual CT-Scans, including the hip, knee and ankle center. Measurements included the medial and lateral PTS and the MPTA. PTS was measured as the angle between the patient's articular surface and a plane perpendicular to the mechanical axis of the tibia in the sagittal plane. MPTA was defined as the angle between the tibial mechanical axis and the proximal articular surface of the tibia in the coronal plane.

Results:

Analysis revealed a wide variation of the MPTS, LPTS and MPTA among the patients. MPTS and LPTS varied significantly both inter- and intra-individually. The range of PTS was from -4.3° to 16.8° for MPTS and -2.9 to 17.2° for the LPTS. The mean intraindividual difference between MPTS and LPTS in the same knee was 2.6° (SD 2.0) with a maximum of 9.5°. MPTA ranged from 79.8 to 92.1° with a mean of 86.6° (SD ± 2.4). Statistical analysis revealed a weak positive correlation between MPTA and MPTS.

Discussion and Conclusion:

With interindividual variations over 20° in the sagittal as well as in the coronal plane of the tibial proximal geometry and with intraindividual differences between the MPTS and LPTS up to 10°, the question arises whether the use of standard techniques is sufficient to address every single patient's individual anatomy.

This underlines findings of a recently published study of over 15000 tibiae (Meier et al. KSSTA 2019), where also tibial asymmetry was highly variable, with overall an increasing proportion of patients with high asymmetry with increasing tibial ML width. Only 14% of tibiae exhibited symmetric (<2 mm offset) lateral and medial plateaus, and 22% had an offset >5 mm. This also highlights the need for a thorough diagnostic workup to preoperatively better select the best fitting TKA, otherwise surgeons intraoperatively will often have to deal with compromises regarding fitting, sizing and rotational issues.



Custom TKA combined with an approach for custom coronal alignment results in 88% of patients that are either satisfied or very satisfied at 24 months follow-up

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Background:

To report clinical outcomes at 24 months follow-up in a series of 266 knees that received custom total knee arthroplasty (TKA).

Methods:

266 knees in 261 patients received CT based PS cemented custom TKA. Knees were aligned to preserve or restore constitutional alignment within predetermined limits of 85° to 95° for FMA and TMA, and 175° to 183° for HKA. Patients were evaluated at 12 and 24 months (KSS, Oxford Score, FJS-12, KOOS, and satisfaction. Patient acceptable state of symptoms (PASS) was used to assess the number of patients that reached satisfaction for OKS, KOOS and FJS-12.

Results:

Complete clinical records were available for 223 of 266 knees (105 men, 118 women). Four (1.8%) knees were reoperated for patellar resurfacing, 1 (0.4%) for lavage to treat infection, 1 (0.4%) to treat a problem scar and 1 (0.4%) had arthroscopy to treat a stiff knee with <90° range of motion. At 24 months follow-up, PASS thresholds were achieved in 69% (OKS), 49% (KOOS Symptoms), 56% (KOOS Pain), 57% (KOOS ADL), 62% (KOOS QOL) and 74% (FJS-12) of knees. Satisfaction revealed that 140 (63%) and 57 (26%) were either very satisfied or satisfied, whereas 5 (2%) and 2 (1%) were either dissatisfied or very dissatisfied.

Conclusion:

Using custom TKA with a strategy of custom coronal alignment, 88% of patients were either satisfied or very satisfied. These findings support the theoretical benefits of custom TKA which provides an accurate preoperative planning strategy to achieve both 'personalised alignment' and a high satisfaction rate.



Custom TKA enables adequate realignment with minimal ligament release and grants satisfactory outcomes in knees that had prior osteotomies or extra-articular fracture sequelae

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Background:

Total knee arthroplasty (TKA) in limbs with prior osteotomies and/or extra-articular metaphyseal fractures is challenging because intra-articular realignment involves asymmetric resections and ligament imbalance. The purpose is to report radiographic and clinical outcomes of custom TKA in knees with prior osteotomies and/or extra-articular fracture sequelae.

Methods:

In a consecutive series of 444 custom TKAs (2016 to 2019), 41 had prior osteotomies or fracture sequelae. Coronal alignment was planned within a 'target zone' of Femoral Mechanical Angle (FMA) and Tibial Mechanical Angle (TMA) [85° to 95°] and Hip-Knee-Ankle (HKA) angle [175° to 183°]. Agreement between planned and postoperative alignment was calculated using intra-class correlation coefficients (ICC). Pre- and post-operative (>12 months) scores were collected for Knee Society Score (KSS), Oxford Knee Score (OKS), Forgotten Joint Score (FJS) and Knee Injury and Osteoarthritis Outcome Score (KOOS).

Results:

Of the 41 knees, 3 had incomplete data and 1 was revised. Of the remaining 37 knees, 20 had prior osteotomies, 8 isolated fractures, and 9 both osteotomies and fractures. Postoperative FMA was 90.4°±2.4°, TMA was 89.3°±2.6° and HKA was 179.9°±3.0°. Agreement between planned and postoperative alignment was fair to excellent, and 29 (78%) knees were within the 'target zone'. At 15±5 months, all clinical scores had improved significantly (p<0.001).

Conclusions:

Custom TKA granted satisfactory clinical outcomes and a low complication rate in knees that had prior osteotomies and/or extra-articular fracture sequelae. Of the 37 knees, 29 (78%) were successfully aligned within the 'target zone', and 35 (95%) did not require ligament release.



PCL preservation or sacrifice doesn't influence clinical outcomes and survivorship at short to mid term follow up of a J-Curve CR total knee replacement with a Medial Congruent liner

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Background:

The MC™ liner for the Persona® CR knee has been recently introduced to improve the reproduction of the native knee kinematic using a J-curve femoral design with an adapted, “medially-congruent” polyethylene insert.

Aim of this study was to evaluate the clinical outcomes and the survivorship of this implant, with or without sparing of the PCL, at a short to midterm follow-up

Methods:

Between October 2016 and October 2019, 165 Total Knee Replacements were performed in 161 patients (69.2% females, 30.8% males) and prospectively followed; in 80 patients the PCL was preserved (PCP Group) while in 85 patients it was sacrificed with a reduction of the tibial slope (PSP Group). Mean age was 68.6 years, mean BMI 28.5. All patients were available for final follow up.

Results:

Mean follow up was 48 months (range 36-60). No implant underwent revision.

At final follow up the mean OKS was 41.2 (SD 6.6) for the PCP and 41.9 (SD 6.1) for the PSP group, while the KSS was classified as good or excellent in 92.1 % and 93% of the patients. The mean was FJS 89,6 (SD 6,9) and 90.1 (SD 7.1) respectively.

No statistical difference was found in the results between the two groups.

Conclusions:

Our first experience with the Persona® MC™ liner yielded positive results in both groups, with no statistical difference and a slightly better trend for the PSP group. Further follow up and studies are needed to evaluate results and survivorship at longer term.



Session II - New and old “off the shelf” implants

Primary Total Knee Arthroplasty (TKA) using a constrained postero-stabilized (CPS) insert: Short to mid-term follow-up

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Background:

Total knee arthroplasty (TKA) in moderate to severe deformity may require a higher constraint, with concerns about long term survivorship. Mid-level constraint inserts have been recently introduced to treat moderate deformity, but few studies described their outcomes.

Methods:

All patients who underwent TKA using a CPS insert in two centers between 2015 and 2017 were included in the study. The indications for CPS insert were: 1) valgus deformity type 2-3 partially correctable; 2) severe varus deformity with varus thrust; 3) post-traumatic deformity with ligamentous insufficiency and 4) any case of intra-operative ligament insufficiency. Patients were evaluated according to the Knee Society Scoring System (KSS), the Hospital for Special Surgery (HSS), the Western Ontario and Mc Master University (WOMAC) and the Oxford Knee score (OKS). X-rays were evaluated according to the Knee Society Roentgenographic Evaluation System.

Results:

Forty-seven TKA in 45 patients were included in the study, with 66% of female patients and an average age of 66.1 ± 10.3 years. The average follow-up was 52.4 ± 6 months. All patients demonstrated a moderate to severe pre-operative mediolateral instability. All the scores significantly improved ($p < 0.0001$). In 71.4% of cases the outcomes were excellent or very good. There were no failures due to aseptic loosening but one failure due to a traumatic ligament rupture. The cumulative survivorship was $97.9\% \pm 2.1\%$ at 60 months.

Conclusion:

The CPS insert demonstrated good outcomes at short to mid-term follow-up in a selected population with moderate to severe laxity.



Does Anterior Cruciate Ligament (ACL) retention optimize one -year results of total knee replacement (TKR)? A retrospective matched-paired comparison of bicruciate with posterior retaining (PCR) TKR

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Clinique Hartmann, Neuilly Sur Seine, France

Background:

Retaining the ACL in total knee replacement is expected to restore physiologic kinematics, thereby improving function and stability.

Methods:

We formerly reported on a technique of ACL preservation using 2 tibial half bearings combined with a conventional femoral component. Here, we compared the one-year function produced by 12 bicruciate retaining versus 12 conventional PCR arthroplasties that were matched according to age, sex, bone mass index (BMI), activity level, aetiology, preoperative deformity and Charnley class. Only non-complicated cases were included. One-year Forgotten Joint (FJS) and KOOS scores were compared using the Wilcoxon Signed-Ranks test for matched pairs.

All patients had primary osteoarthritis and were classified as Devane 3 prior to the onset of osteoarthritis. The mean age was 59 ± 7 years with a mean BMI of 30 ± 8 . Six patients (3 in each group) had valgus deformity while the other had varus deformity.

Results:

Koos scores were 95 ± 7 and 96 ± 3 ($p=0.86$) for pain, 97 ± 9 and 99 ± 2 ($p=0.42$) for other symptoms, 97 ± 6 and 98 ± 1 ($p=0.23$) for activity of daily living (ADL), and 92 ± 14 and 95 ± 8 ($p=0.49$) for quality of life, respectively. The amplitudes of active flexion were $119 \pm 11^\circ$ and $122 \pm 9^\circ$ ($p=0.47$), flexion gain were $-10 \pm 15^\circ$ and $2 \pm 19^\circ$ ($p=0.12$) and FJ scores 93 ± 7 and 79 ± 12 ($p=0.01$), respectively.

Conclusion:

The FJS score showed superior results in patients with bicruciate retaining prostheses but flexion gain and KOOS scores were similar. Thus, there might be an advantage to retaining the ACL when possible. Further research involving a more powerful comparison is needed.



Long term follow-up of a fixed bearing medial unicompartmental knee arthroplasty

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Background:

Unicompartmental Knee Arthroplasty (UKA) is a valuable solution for the treatment of medial osteoarthritis of the knee. Despite the excellent functional outcomes, revision rates reported in National Joint Registries remain concerning at long term follow up.

Aim of this study was to assess implant survival and functional outcomes at long term follow up of a fixed bearing medial UKA (ZUK previously Zimmer® Unicompartmental High Flex Knee, now Smith & Nephew and Lima Corporate) implanted in two high volume centers.

Methods:

Between 2005 and 2007 148 medial UKA were implanted in 148 patients. At last follow up, 16 patients died due to causes not related to the implant and 8 declined further follow-up. A total of 124 patients were analyzed in this retrospective study, 48 males and 76 females with mean age of 65 years (SD 10,71) and mean BMI of 27,85 (SD 3,94).

Results:

At final follow up the mean OKS was 43,02 (SD 5,1) and the mean FJS 93,6 (SD 6,9). 13 UKAs were revised. Kaplan–Meier survival estimate showed a survival rate of 97,65% at 69 months and of 89,52% at final follow up (173 months). When revisions for infection were excluded, the survivorship of the implant was 90,3% at final follow up.

Conclusions:

The ZUK unicompartmental arthroplasty implanted in two high volume centers demonstrated excellent clinical results with a satisfactory survival rate at long term follow- up. This study confirms previously presented literature data with the same implant at a shorter term and in smaller cohorts.



Bilateral simultaneous knee arthroplasty is as safe as a staged knee arthroplasty in a specialized clinic

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Purpose:

In recent years, there has been increasing interest in the use of simultaneous knee arthroplasty compared to staged procedures in patients with bilateral pathology. The aim of this study was to compare simultaneous and staged knee arthroplasty in patients with bilateral pathology by assessing the transfusion rate, postoperative hemoglobin drop, length of stay (LOS), in-hospital complications, 30-days readmissions, leg length difference and early functional outcome.

Methods:

We conducted a retrospective cohort study that included all patients who were undergoing primary total knee arthroplasty (TKA) by a single surgeon in a high-volume arthroplasty center between 2015 and 2020 as simultaneous or staged procedures. Staged bilateral arthroplasties were performed within 12 months and were stratified by the time between procedures. Data was acquired through the electronic files at the Orthopädische Chirurgie München (OCM). For functional outcome we compared the ability of the patients to walk independently on the ward and the ability to walk a set of stairs alone which was recorded daily by the attending physiotherapist.

Results:

In total n=101 patients were assessed for eligibility and included in this study. Sixty three were allocated to the staged arthroplasty group. The second staged procedure was performed within 12 months of the first procedure. Thirty eight were allocated to the simultaneous arthroplasty group. No statistical difference was found between the two groups regarding demographic data. Primary outcome measurements: In both groups the transfusion rate was actually 0%. A significant difference was found between the postoperative hemoglobin drop ($p=0.0010$ respectively $p=0,02$) comparing the simultaneous procedure to the first and second staged procedure. No significant results the functional outcome ($p=0.5959$), nor the length of stay (LOS) ($p= 0.9818$), as well as the 30 days readmission rate between both groups. Only the ability to walk stair independently showed a significant difference ($p=0.002$). No significant difference was found in the OR time comparing the simultaneous procedure to each staged procedure ($p=0.053$ and $p=0.2533$). The OR time in the simultaneous group ranged from 53min to 120min with an average of 75min (± 21). No surgery exceeded a 120min window.

Conclusion:

We observed no significant differences in transfusion rate, in hospital complications, as well as readmission rate between both groups. The early functional outcome showed no significant difference in mobility.

Simultaneous knee arthroplasty is as safe as a staged procedure, with no higher risk for the patient, in a specialized high volume center with a specialized surgeon and an adequate team.

Level of evidence: Level IV



Session III - Robotic Surgery

Evaluation of post-operative outcome with wearable sensors following robotic-assisted and conventional knee arthroplasty

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Background:

Traditional patient-reported outcome measures (PROMs) have failed to highlight differences in outcome when comparing knee replacement designs and implantation techniques. Wearable sensors, such as inertial measurement units (IMUs), provide a cost-effective, portable solution for evaluation of post-operative outcome in combination with traditional PROMs. The aims of this study were [1] to demonstrate the feasibility and reliability of using ankle-worn IMUs for remote patient monitoring (RPM); and [2] to compare IMUs and PROMs outcomes in patients with conventional total knee arthroplasty (TKA), unicompartmental knee arthroplasty (UKA), and robotic-assisted TKA (RA-TKA) in early post-operative period.

Methods:

44 patients undergoing primary knee arthroplasty (19 RA-TKA, 17 TKA, and 8 UKA) for osteoarthritis were prospectively enrolled. Community-based RPM was performed pre-operatively, then weekly from post-operative weeks 2 to 6 using IMUs and PROMs. IMU-based metrics included: cumulative impact load, bone stimulus, and impact asymmetry. PROMs scores included: Oxford Knee Score (OKS), and EuroQol Five-dimension with EuroQol visual analogue scale.

Results:

Preliminary results showed significant improvements in mean impact asymmetry by 67% ($P=0.0055$), bone stimulus by 40.9% ($P<0.0001$), and cumulative impact load by 120.9% ($P=0.0349$) between post-operative week 2 and 6. The mean change scores for OKS were 6.9 (RA-TKA), 11.4 (TKA), and 11.2 (UKA) over the early post-operative period ($P=0.144$). Interestingly, OKS did not always reflect the same trend as IMU-derived limb usage between the different implantation techniques.

Conclusions:

We present a scalable, low-maintenance RPM system using quantitative measures from IMUs that can supplement traditional PROMs to provide a more holistic overview of post-operative recovery. These data suggest a difference in the functional outcome of TKA and UKA patients that might be overlooked by using PROMs alone.



Impact of the diaphyseal femoral deformity on the lower limb alignment in osteoarthritic varus knees

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Background:

Modern positioning techniques in total knee arthroplasty consider a pure anatomical resurfacing of the knee. The impact of the non-traumatic diaphyseal femoral deformity might however have consequences on the final alignment according to its severity and localization and described as the “Wolff law”. The exact impact on the final knee alignment is unknown pre-operatively. Therefore, we aimed 1) to develop a predictive algorithm to determine the impact of the diaphyseal femoral deformity on the lower limb alignment for the varus knee (on full long leg x-ray), 2) to evaluate the reliability and the reproducibility of this method in a large cohort of osteoarthritic patients, and 3) to determine the main anatomical factors influencing the lower limb alignment and the mechanical femoral axis.

Material and methods:

All patients who underwent a knee arthroplasty from 2019 to 2021 were included. Exclusion criteria were genu valgus, flexion contracture ($>5^\circ$), previous femoral osteotomy or fracture, total hip arthroplasty and femoral rotational disorder. 205 patients met the inclusion criteria. The mean age was 62.2 ± 8.4 years. The mean body mass index (BMI) was 33.1 ± 5.5 kg/m². A computer based algorithm was developed and tested on radiological measurements performed twice by two independent reviewers and included: HKA angle (Hip Knee Ankle), mechanical Medial Distal Femoral Angle (mMDFA), anatomic Medial Distal Femoral Angle (aMDFA), femoral Neck Shaft Angle (NSA), femoral bowing angle (FBow), the distance knee center – top of FBow (DK), the C’KS angle.

Results:

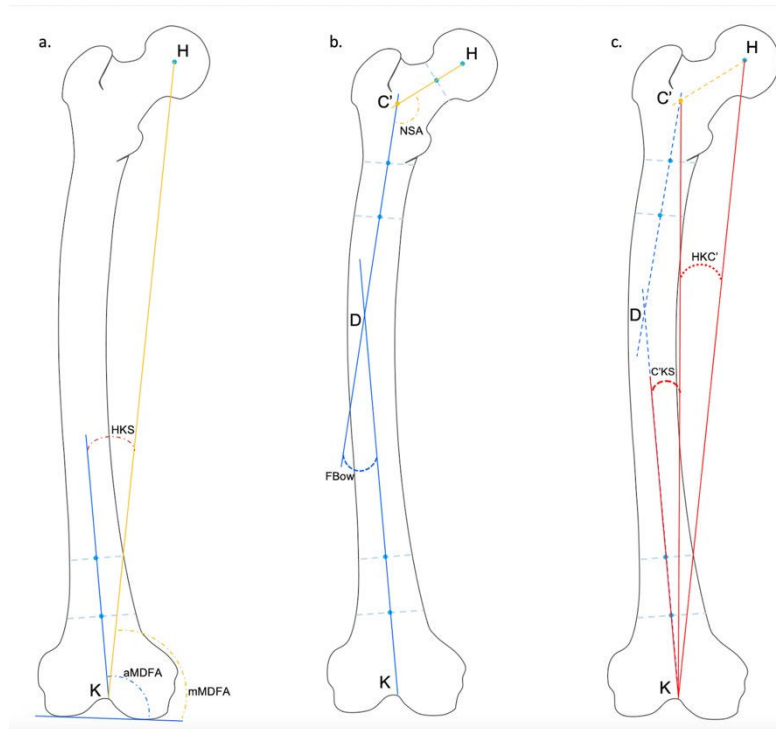
The FBow impact on the mMDFA can be materialized by the C’KS angle. The C’KS angle took the localization (length DK) and the importance (FBow angle) of the FBow into consideration. The mean FBow angle was $4.4^\circ \pm 2.4$ [0 ;12.5]. The mean C’KS angle was $1.8^\circ \pm 1.1$ [0 ;5.8]. 84 knees (41%) had a severe FBow ($>5^\circ$). The radiographic measurements showed very good to excellent intra-observer and inter-observer agreements. The C’KS increased significantly when the length DK decreased and the FBow angle increased ($p < 0.001$). The greatest contributor to mMDFA was aMDFA ($R^2 = 0.58$, $p < 0.0001$), then the C’KS angle ($R^2 = 0.13$, $p < 0.0001$). The greatest contributor to HKA angle was JLCA ($R^2 = 0.53$, $p < 0.0001$). Other contributors to HKA angle were MPTA ($R^2 = 0.35$, $p < 0.0001$), C’KS angle ($R^2 = 0.092$, $p < 0.0001$), then aMDFA ($R^2 = 0.052$, $p = 0.001$).

Conclusion:

The impact of the diaphyseal femoral deformity on the mechanical femoral axis is measured by the C’KS angle, a reliable and reproducible measurement.



The HKA and mechanical femoral axis are strongly correlated to the aMDFFA and the C'KS angle and can be used pre-operatively to determine the potential residual varus when performing kinematic or restricted kinematic alignment TKAs.





Inflammatory Response in Robotic Total Knee Arthroplasty versus conventional Jig-based and the correlation with Early Functional Outcomes: A Pilot Randomised Controlled Trial

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Background:

Robotic arm assisted TKA has been shown to result in reduced bone and soft tissue trauma. The objective of this study was to compare the inflammatory response in conventional jig-based TKA versus robotic TKA and examine the relationship with early functional outcomes.

Methods:

This pilot randomised controlled trial included 30 patients with symptomatic knee osteoarthritis undergoing conventional TKA versus robotic TKA.

Blood samples were collected for up to 7 days post-operatively and predefined markers of serum inflammation were measured. The local inflammatory response was assessed by analysing samples from the intraarticular drain fluid at 6 and 24 hours. The relationship with early functional outcomes was evaluated using Spearman's rank correlation coefficient.

Results:

A statistically significant reduction in serum inflammatory markers [interleukin-6(IL-6), tumour necrosis factor- α (TNF α), erythrocyte sedimentation rate(ESR), C-reactive protein(CRP), and creatine kinase(CK)] was evident in the robotic group on day 7. Patients in the robotic group also demonstrated reduced levels of IL-6 in the drain fluid at 6- hours [798.54 vs. 5699.2, $p=0.026$] and 24- hours and IL-8 at 6 hours.

A statistically significant correlation was observed between self-reported pain and all serum markers except IL-1 β on the 7th postoperative day; between drain IL-8 levels and pain on postoperative day 1 ($r= 0.458$), day 2 and 7; between knee flexion and extension and drain IL-6, IL-8 and TNF- α levels (6-hours).

Conclusion/Findings:

Robotic arm assisted TKA was associated with a reduction in early postoperative local and systemic inflammatory responses. We also found a moderate relationship with self-reported pain, knee flexion and knee extension.



Flattening the learning curve with robotic assisted knee arthroplasty

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Background:

Changing technique to robotic assisted surgery (RAS) in total (TKA) and unicompartmental knee arthroplasty (TKA) is associated with a learning curve, spanning from 7 to 20 cases. The switch is more difficult if there is no previous experience with computer assisted surgery (CAS).

Methods:

This is a prospective study evaluating the learning curve during RAS implementation in a clinic without previous exposure to CAS. A fellowship trained orthopedic surgeon performed 16 RAS-TKA and 9 RAS-TKA using functional alignment strategy. A dual fellowship trained orthopedic surgeon with significant exposure to RAS assisted 19 cases. CUSUM analysis was performed to identify the presence of the learning curve. Mean skin-skin times were compared, using the second surgeon's times as baseline.

Results:

Mean surgical time for UKA was 71 minutes, TKA 73 minutes. Second surgeon's mean surgical time for UKA was 63 minutes ($p=0.20$), TKA 75 minutes ($p=0.70$). A significant learning curve effect has not been observed. The first 5 UKA cases had a 3 minute difference compared to the second 4 cases ($p=0.65$), the first 8 TKAs 4 minutes difference ($p=0.45$). A slight impact on surgical time was observed in a first case by a scrub nurse.

Conclusion:

Previous RAS experience by a surgeon member of the team can bend the learning curve for the complete surgical team. RAS manufacturers should expand the support provided to departments switching to RAS, by adding a surgeon during the first cases.



10 year outcomes of robotic assisted medial unicompartmentals

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Introduction:

Recent studies have shown an increase in the utilization of robotic-assisted unicompartmental knee arthroplasty (RAUKA) for medial compartmental osteoarthritis (OA). Therefore, the purpose of this study was to analyze: 1) survivorship; 2) patient-satisfaction rates; and 3) overall revision rates at a single institution.

Methods:

A retrospective review of prospectively collected data of our institutions joint registry was performed for patients undergoing RAUKA. The inclusion criteria consisted of all patients in the registry who underwent RAUKA for medial compartmental OA, patients lost to follow-up were excluded. The final query consisted of 185 patients (left = 76; right = 109) out of 225 patients with a mean age of 64.9 years and mean body mass index (BMI) of 31.6kg/m² with a mean follow-up of 9.98 years. Outcomes analyzed included: survivorship, patient-reported satisfaction, and overall revision rates. Statistical analyses were primarily descriptive. A p-value less than 0.05 was considered statistically significant.

Results:

Ten-year survivorship of the study cohort demonstrated 99.5% survivorship 9.98 years following the index procedure. Majority of the patients stated they were either very satisfied (80.95%) or satisfied (16.19%) with the outcomes of their procedure.

Conclusion:

Robotic-assisted UKA shows high satisfaction rates with 99.5% survival 10-years following the index procedure. The study can be utilized by orthopaedists and other healthcare professionals to educate and counsel patients undergoing UKA for end-stage medial compartmental osteoarthritis.



Is use of tourniquet associated to increased risk of venous thromboembolism after fast-track total knee arthroplasty? A prospective multicentre cohort study of 16,267 procedures

Kirill Gromov², Pelle B. Petersen¹, Mette Mikkelsen², Christoffer C. Jørgensen¹, Henrik Kehlet¹, Anders Troelsen², on behalf of the Lundbeck Foundation Centre for Fast-track Hip and Knee Replacement Collaborative Group

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Background:

Data on use of tourniquet has shown conflicting results regarding risk of VTE after TKA. To date little data exist on the associated risk for VTE after TKA using tourniquet in a fast-track setup.

Purpose/Aim of the Study:

Consequently, we hypothesized that use of tourniquet in an unselected prospective multicenter fast-track TKA setting with in-hospital only thromboprophylaxis if LOS \leq 5 days were associated to increased risk of 90-day VTE.

Materials and Methods:

We used an observational cohort study design from 9 dedicated fast-track centres with prospective data collection to evaluate use of tourniquet and postoperative VTE. Risk analysis were performed using a mixed effects logistic regression model adjusting for previously identified risk-factors for 90-day VTE after fast-track THA and TKA (BMI, Age, and history of VTE as fixed effects) and hospital as a random effect.

Results:

Of the 16,267 procedures, 12,518 (77.0%) were performed using tourniquet (median duration 60 [51-70] min). The use of tourniquet varied greatly between departments from 0 % to 100% annual usage. The overall 90-day incidence of VTE was 77 (0.47%) without significant difference using tourniquet 52 (0.42%) vs 25 (0.67%) (p=0.056). This association remained insignificant with OR 0.62 (95% CI: 0.38-1.01, p=0.054) after adjustment for previously identified risk-factors.

Conclusion:

In our cohort use of tourniquet was not associated to increased 90-day VTE risk after fast-track TKA. Further identification of high-risk patients is needed to further reduce the risk of 90-day VTE.



Equal bony resection of distal and posterior femur will lead to flexion/extension gap inequality in robot-assisted cruciate-retaining TKA

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Background:

The aim of this study was to evaluate the extent of bony resection from the posterior and distal femoral joint surfaces in order to obtain an equal flexion/extension gap in robot-assisted TKA.

Methods:

A retrospective analysis was performed on all patients receiving robot-assisted TKA (Cruciate-Retaining (n=268)) by six surgeons from April 2018 to September 2019. Gap assessment, bony resections, femoral implant size and hip-knee-ankle angle were evaluated with the robot. Femoral implant size was categorized into small (Size 1-2), medium (Size 3-5) and large (Size 6-8).

Results:

To obtain equal flexion/extension gaps, a differential resection between the posterior/distal femur of 2.0mm and 1.5mm (± 2.2) was necessary for the medial and lateral compartment respectively. This difference was smaller in the large implant group compared to the small implant group ($p < .05$) and medium implant group ($p < .05$ medial). Varus knees required a larger differential resection compared to neutral and valgus knees ($p < .05$ except varus-valgus medially).

Conclusion:

Removing an equal amount of bone from the posterior/distal femur might lead to flexion/extension gap imbalance in TKA. It was required to remove 1.5-2mm more bone from the posterior femur compared to the distal femur to equalize flexion and extension gap. This effect was size dependent: in larger knees, the discrepancy between the distal and posterior resections was smaller.



Session IV - Patient's factors influencing outcomes

Is use of tourniquet associated to increased risk of venous thromboembolism after fast-track total knee arthroplasty? A prospective multicentre cohort study of 16,267 procedures

Kirill Gromov², Pelle B. Petersen¹, Mette Mikkelsen², Christoffer C. Jørgensen¹, Henrik Kehlet¹, Anders Troelsen², on behalf of the Lundbeck Foundation Centre for Fast-track Hip and Knee Replacement Collaborative Group

¹Section for Surgical Pathophysiology, Rigshospitalet, Copenhagen; ²Dept. of Orthopaedic Surgery, Clinical Orthopaedic Research Hvidovre (CORH), Copenhagen University Hospital Hvidovre, Denmark

Background:

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Purpose/Aim of the Study:

Consequently, we hypothesized that use of tourniquet in an unselected prospective multicenter fast-track TKA setting with in-hospital only thromboprophylaxis if LOS \leq 5 days were associated to increased risk of 90-day VTE.

Materials and Methods:

We used an observational cohort study design from 9 dedicated fast-track centres with prospective data collection to evaluate use of tourniquet and postoperative VTE. Risk analysis were performed using a mixed effects logistic regression model adjusting for previously identified risk-factors for 90-day VTE after fast-track THA and TKA (BMI, Age, and history of VTE as fixed effects) and hospital as a random effect.

Results:

Of the 16,267 procedures, 12,518 (77.0%) were performed using tourniquet (median duration 60 [51-70] min). The use of tourniquet varied greatly between departments from 0 % to 100% annual usage. The overall 90-day incidence of VTE was 77 (0.47%) without significant difference using tourniquet 52 (0.42%) vs 25 (0.67%) ($p=0.056$). This association remained insignificant with OR 0.62 (95% CI: 0.38-1.01, $p=0.054$) after adjustment for previously identified risk-factors.

Conclusion:

In out cohort use of tourniquet was not associated to increased 90-day VTE risk after fast-track TKA. Further identification of high-risk patients is needed to further reduce the risk of 90-day VTE.



Genetic associations of knee osteoarthritis vary with the need for surgical treatment: insights from 2 large-scale genome-wide meta-analyses

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Background:

Despite the apparent differences in personal and socio-economic consequences between different grades of OA, it is unknown whether disease severity, and thereby the need for surgical treatment, is determined by genetic factors. We aimed to investigate whether genetic associations for knee OA differ between patients who received surgical treatment (kOA-S) and patients who did not (kOA-NS).

Materials and Methods:

We defined cases as patients with primary knee OA and no known injuries or other joint diseases. As controls, we included healthy persons without any OA diagnoses (n=638,618). In each of 3 large cohorts from Denmark, Iceland and the United Kingdom, we performed 2 treatment-specific genome-wide association studies (knee OA vs healthy controls), which we subsequently joined in 2 fixed-effects inverse variance meta-analyses for kOA-S and kOA-NS, respectively.

The Danish and Icelandic cohorts were genotyped using Illumina Infinium Global Screening Array, and Affymetrix Axiom arrays were used in the UK cohort. Statistical significance was set at a familywise error rate of 0.05 (variant class-specific) determined by a weighted Holm-Bonferroni method.

Results:

The 2 meta-analyses included 61,151 knee OA cases, of which 22,525 were surgical and 38,626 were non-surgical. We identified 17 significant markers, including 3 novel ones (located on chromosomes 2 and 3). The 3 novel markers were all statistically significant in kOA-S ($p \leq 3.06 \times 10^{-9}$) and undoubtedly non-significant in kOA-NS ($p \geq 0.27$)—a pattern also seen in 2 of the replicated markers. 1 marker was only significant in the nonsurgical group (kOA-NS $p = 1.19 \times 10^{-13}$ vs kOA-S $p = 0.0047$).

Conclusion:

We have identified 3 novel markers for knee OA, all of which indicate a difference in genetic associations between surgically and non-surgically treated knee OA—a difference which we also found in replicated markers. In conclusion, our findings suggest that the genetic associations of knee OA vary with the course of treatment.



COVID-19 disruptions to postoperative care did not negatively affect elective primary Total Knee Arthroplasty (TKA) outcomes

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Introduction:

Elective orthopedic care, including post-discharge in-person office visits and physical therapy (PT), was halted on March 16, 2020 at the onset of the COVID-19 pandemic. We assessed if these interruptions in standard post-discharge care negatively affected the outcomes of patients who had just undergone TKA.

Methods:

Six hundred and twenty-four patients underwent primary, unilateral TKA for osteoarthritis and were discharged home between January-March 15, 2020 (study patients). 90-day outcomes were compared to a control of 558 patients who had undergone surgery between January-March 2019. There were no statistically significant differences in age, sex, BMI, race, ethnicity, RAPT score, Charlson Comorbidity Index, anesthesia and nerve block type. Outcomes included: unscheduled clinic visits, ER visits, hospital readmissions, CMS defined complications and PROMS. MUA was considered an essential procedure during COVID-19 and recorded up to 120 days.

Results:

Patient-reported access to PT ($p < 0.001$) and post-discharge care satisfaction ($p < 0.001$) were worse among study patients. Study patients were prescribed fewer post-discharge PT sessions than controls (19.8 vs. 23.5; $p < 0.001$), were more likely to have no in-person office visits (43.0 vs. 9.0%; $p < 0.001$) and to have had at least one telehealth visit (36.4 vs 0.9%; $p < 0.001$). There were no differences in rates of 90-day unscheduled outpatient clinic visits (12.9 vs. 10.3%; $p = 0.173$), ER visits (5.0 vs. 7.4%; $p = 0.113$), readmissions (5.8 vs. 8.5%; $p = 0.087$) and MUA (2.3 vs. 2.3%; $p = 0.999$). CMS complications were lower amongst study patients (4.0 vs. 6.8%, $p = 0.038$). Preoperative to 6-week changes in KOOS JR (15.3 vs. 11; $p = 0.003$) and VR-12 physical scores (3 vs. 0.2; $p = 0.009$) were slightly better among study patients. There were no significant differences in 6-week VR-12 mental and LEAS scores.

Conclusion:

Elective TKA surgery performed in close proximity to the cessation of elective orthopedic care in March 2020 seemed to have had no major consequences for clinical outcomes, despite shortages of postoperative services. Our findings question the usefulness of pre-pandemic, post-discharge protocols, which may over-emphasize in-person visits and PT.



Table 1: Descriptive statistics comparing pre-surgical and in-hospital patient characteristics between cohorts using Mann-Whitney U and Chi-Square Tests.

Variable	Control			Study			P-value		
	Total N	Median	IQR	Total N	Median	IQR			
Age	558	66	61.25	72	624	66	60	72	0.637
Sex:									0.799
Female	325	--	--	--	368	--	--	--	
Male	233	--	--	--	256	--	--	--	
Race:									0.394
White or Caucasian	466	--	--	--	509	--	--	--	
Not White	92	--	--	--	115	--	--	--	
Ethnicity:									0.288
Hispanic/Latino	28	--	--	--	40	--	--	--	
Not Hispanic/Latino	522	--	--	--	570	--	--	--	
BMI	558	30.5	26.72	35.5	624	30.9	27.2	35.12	0.381
CCI	558	0	0	1	624	0	0	1	0.571
RAPT Score	410	10	9	11	440	10	9	11	0.177
Anesthesia Type:									0.658
Regional	545	--	--	--	607	--	--	--	
Not Regional	13	--	--	--	17	--	--	--	
Use of Nerve Block	19	--	--	--	12	--	--	--	0.202
90-day MME's	519	315	300	315	517	315	315	336	0.133
Laterality:		--	--	--		--	--	--	0.445
Left	278				297				
Right	280				327				
In-Hospital PT	558	4	3	5	624	4	3	6	0.916
In-Hospital Comps.	28				21				0.155

Note: $*=p<0.05$; BMI = Body Mass Index; CCI = Charlson Comorbidity Index; RAPT = Risk Assessment and Prediction Tool; MME = Morphine Milligram Equivalent; PT = Physical Therapy



Table 2: Mann-Whitney U and Chi-Square analysis comparing post-discharge and surgical outcomes between cohorts.

Variable	Control		Study		P-value
	N	%	N	%	
PD PT Sessions	23.5	--	19.8	--	0.001*
PD Telehealth Only	50	9.0	268	43.0	0.001*
≥ 1 Telehealth Visit	5	0.9	227	36.4	0.001*
Unscheduled Outpatient	57	10.3	80	12.9	0.173
ER Visits	41	7.4	31	5.0	0.113
Hospital Readmission	47	8.5	36	5.8	0.087
MUA within 120 days	13	2.3	14	2.3	0.999
CMS Complications:					0.038*
Acute MI	1	0.1	0	0	0.472
Pneumonia	1	0.1	2	0.3	0.999
Sepsis	1	0.1	1	0.1	0.999
Surgical Site Bleeding	9	1.6	6	0.9	0.436
Pulmonary Embolism	1	0.1	3	0.4	0.627
Death	0	0	1	0.1	0.999
Mechanical Comps.	5	0.9	2	0.3	0.265
Infection	26	4.7	12	1.9	0.008*
Δ 6 wk. KOOS Jr.	11	--	15.3	--	0.003*
Δ 6 wk. VR-12 (Physical)	0.2	--	3	--	0.009*

Note: $*=p<0.05$; PD = Post-Discharge; PT = Physical Therapy; ER = Emergency Room; MUA = Manipulation Under Anesthesia; MI = Myocardial Infarction; Comps = Complications; Δ = Change in; wk = Week; KOOS = Knee Injury and Osteoarthritis Outcome Score; VR-12 = Veterans RAND 12 Item Health Survey



Femoral size and shape can improve bone fit and clinical outcomes in Total Knee Arthroplasty: Results of a prospective matched controlled study

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Background:

Accurate fit between femoral component and bony cut is essential in total knee arthroplasty (TKA). We hypothesized that using contemporary morphometric knee (MK) implants would improve femoral component fit as compared to conventional implants and have a positive impact on clinical outcomes.

Methods:

Thirty Patients who received morphometric TKA were included prospectively according to the following criteria: TKA performed for primary tricompartmental arthritis, deformity less than 15°, age between 18 and 85 years. Patients were matched on age, BMI, gender, and preoperative KSS and KOOS score, in a 1:1 fashion with patients receiving a non-morphometric TKA from a prospectively collected database. Clinical outcomes were measured preoperatively and at an average follow up of 4 years. Post-operative CT-scan included for each patient analysis of: femoral implant rotation, overhang, undersized and cortical-fit status.

Results:

Functional scores were superior in the MK group (KSS mean difference 21 points for MK group, $p < 0.05$). Overhang rate (23% vs 27%) was similar between the two groups and was most frequently found on lateral distal zone and medial anterior chamfer. Better cortical fit was found in the MK group with thinner component/cortical (MK group 2.71 mm vs non-MK group 4.98 mm, $p < 0.001$). Overhang of more than 2 mm was associated with worse outcomes whereas thinner bone margin had a benefic impact on clinical scores (KOOS, KSS, $p < 0.05$)

Conclusion:

The use of a morphometric femoral component design can optimize bone fit and improves clinical outcomes at midterm follow up compared to non-morphometric implants. Closer femoral fit and reduced overhang allow better clinical results.



High tibial osteotomy in young patients with constitutional deformity is an efficient strategy before a Total Knee Arthroplasty: a long-term comparative study

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Introduction:

The management strategy of knee osteoarthritis (OA) in young patients remains a challenge. Total Knee Arthroplasty (TKA) after High Tibial Osteotomy (HTO) is technically demanding and has a higher complication rate than TKA without HTO. The utilisation of HTO to delay TKA in young patients with unicompartmental OA and associated constitutional deformity is still debated. The aim of this study was to compare the long-term survivorship and clinical outcomes of TKA with a previous HTO compared to TKA without HTO using the time from the first OA surgery (HTO timing for the study group versus TKA timing for the control group) as reference.

Methods:

This retrospective monocentric case-control study included all patients who underwent primary posterior-stabilized TKA for OA between 1996 and 2010 with a previous HTO. Exclusion criteria were inflammatory and post-traumatic OA, revision of tibial osteotomy, and previous tibial tubercle osteotomy. The minimum follow-up was 10 years after TKA. 144 TKA following HTO were performed during this period. Fifty-nine patients were excluded, 12 were lost to follow-up. A total of 73 TKA after HTO were included. Each case was matched with a primary TKA without previous HTO (1:1) based on BMI, gender, and age at the time of HTO in the study group, to compare the management algorithm of OA management in a young patient: HTO first with later TKA versus TKA as the index procedure. All re-operations and revisions were recorded. Kaplan Meier survivorship analysis was performed using revision with metal component removal as the endpoint. Clinical follow-up was performed using the Knee Society Score (KSS), range of motion, and patient satisfaction.

Results:

Mean follow-up was 13 years ± 3.3 [10; 22] after TKA in both groups. In the TKA post HTO group, follow-up since HTO was 24.4 years ± 6.9 [12; 41], with a mean delay between HTO and TKA of 11.1 years ± 5.2 [2; 25]. The survival rate free from any revision was 91.8% at the last follow-up in the TKA post HTO group and 94.5% in the control group. The 20-year Kaplan Meier survival estimate was 98.6% (95% CI, 90.4% to 99.8%) in the TKA post HTO group (HTO as timing reference) and 81.4% (95% CI, 45.1% to 94.8%) in the control group (TKA as timing reference) ($p=0.03$). There was no significant difference in clinical, radiological outcomes, and complications between groups at the last follow-up. Mean postoperative knee and function KSS were respectively 88.8 ± 11.9 [49 ; 100] and 73.9 ± 24.8 [0 ; 100] in the TKA post HTO group versus 89.8 ± 10 [58 ; 100] and 78.6 ± 22.8 [0 ; 100] in the control group ($p=0.36$ and $p=0.17$, resp.).

Conclusion:

At the same delay from the index surgery (HTO or TKA), a strategy of HTO with later TKA had superior survivorship compared to primary TKA without HTO at long term in young patients with unicompartmental OA and constitutional deformity. Therefore, HTO should continue to be part of OA treatment strategy in this population group.



Level of Evidence: III

Table 1

Postoperative clinical and radiological outcomes in both groups (TKA with and without prior HTO).

Analyzed cohort	TKA / HTO Group n=67	Primary TKA Group n=69	p-value
Improvement knee score (mean ±SD) [Min; Max]	30.3 ±17.4 [-16 ; 68]	34.4 ±14.5 [6 ; 69]	n.s.
Improvement function score (mean ±SD) [Min; Max]	10.8 ±28.4 [-80 ; 60]	14.9 ±30.1 [-80 ; 80]	n.s.
Improvement global KSS (mean ±SD) [Min; Max]	41.1 ±35.0 [-70 ; 107]	49.2 ±35.7 [-60 ; 120]	n.s.
Satisfaction score			n.s.
Very satisfied	45 (67.2%)	38 (55.1%)	
Satisfied	17 (25.4%)	25 (36.2%)	
Disappointed	5 (7.5%)	5 (7.2%)	
Dissatisfied	0	1 (1.4%)	
Postoperative flexion (°) (mean ±SD) [Min; Max]	117.6 ±11.6 [70 ; 140]	117.3 ±12.0 [90 ; 140]	n.s.
Radiolucent lines	11 (16.4%)	14 (20.8%)	n.s.
Postoperative Black Burn index (mean ±SD) [Min; Max]	0.69 ±0.2 [0.3 – 1.25]	0.65 ±0.2 [0.3 – 1.2]	n.s.

KSS : Knee Society Score ; SD : Standard Deviation ; Min : Minimum ; Max : Maximum ; n.s. : non-significant.



Table 2

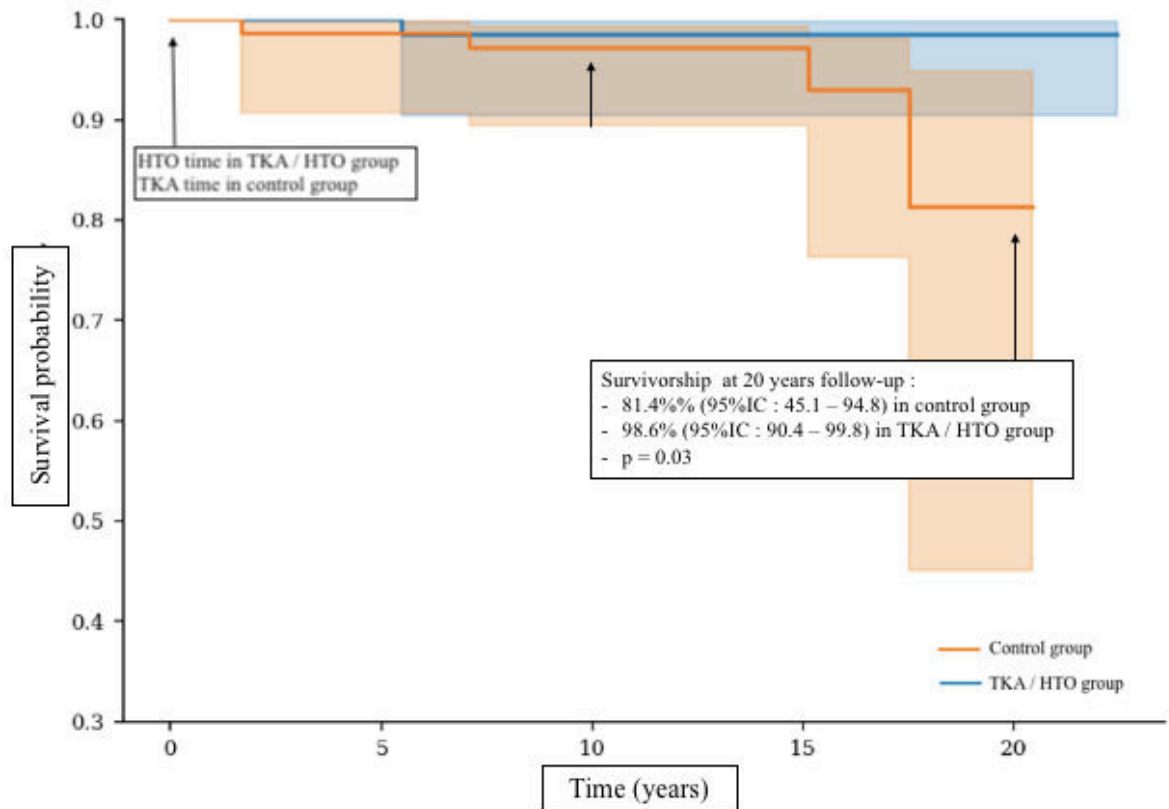
Survivorship free from any revision and causes of revision in both groups (TKA with and without prior HTO).

	TKA / HTO Group n=73	Primary TKA Group n=73	p-value
Revision TKA	6 (8.2%)	4 (5.5%)	n.s.
Deep infection	1 (1.4%)	2 (2.7%)	
Aseptic loosening	1 (1.4%)	0	
Fracture	1 (1.4%)	0	
Coronal instability	2 (2.7%)	0	
Unexplained pains	1 (1.4%)	2 (2.7%)	
Reintervention	8 (11.0%)	15 (20.5%)	n.s.
Stiffness	2 (2.7%)	4 (5.5%)	
Deep infection	1 (1.4%)	2 (2.7%)	
Aseptic loosening	1 (1.4%)	0	
Fracture	1 (1.4%)	1 (1.4%)	
Clunk syndrome	0	1 (1.4%)	
Coronal instability	2 (2.7%)	0	
Patellar complications	0	4 (5.5%)	
Unexplained pains	1 (1.4%)	2 (2.7%)	
Dislocation	0	1 (1.4%)	



Figure 1

10 and 20-year Kaplan Meier survival estimate in the TKA after HTO group (HTO time as reference) and in the TKA group (TKA time as reference).





Is Synovectomy Necessary in Total Knee Arthroplasty with rheumatoid arthritis?

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Background:

To our knowledge, there is no report with long-term FU results on the advantage of synovectomy when TKA in the presence of rheumatoid arthritis (RA). The study evaluates whether synovectomy changes results of a TKA as compared with the implantation of the contralateral implant without synovectomy in the same patient and a similar follow-up.

Methods:

Consecutive series of 65 bilateral staged PS fixed-bearing TKA (28 men, 37 women) in RA patients reviewed at 16 years FU (15 to 22 years): one knee with synovectomy; The contralateral without synovectomy and same implant.

Results:

Knees in the synovectomy group received blood product transfusions significantly more frequently (23.3% versus 16.6%; $P < 0.01$), had longer mean lengths of hospitalization (9.60 (95 % C.I. =6.56; 13.63) days versus: 6.51 (95 % C.I. =5.50; 9.52) days; $P < 0.001$) as well as higher hospital cost. The Knee Score of the KSS (89.1 versus 80.2 points; $p = 0.02$) and the ROM for flexion (130 versus 102 degrees; $p = 0.01$) were significantly better in the group without synovectomy. Knee alignment and stability, femoral and tibial component alignment, were similar in both groups. The Insall-Salvati ratio showed six patients with patella baja in the group with synovectomy. There were 4 severe hematoma and deep infections after synovectomy. The Kaplan-Meier survivorship for revision at 15 years of follow-up was 84% (95% confidence interval, 78 to 95) for TKA with synovectomy, and 97% (95% confidence interval, 93 to 100) for TKA without synovectomy.

Conclusion:

Synovectomy resulted in lower knee flexion and lower pain scores with more complications in our series. The absence of synovectomy in rheumatoid arthritis did not increase the risk of loosening.



Considerable inter-individual variability of tibial geometric ratios renders bone–implant mismatch unavoidable using off-the-shelf Total Knee Arthroplasty: A systematic review and meta-analysis

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Background:

Tibial prosthetic overhang can lead to persistent pain due to soft tissue impingement, while bone under-coverage can lead to subsidence and aseptic loosening. The purpose of this meta-analysis was to investigate variability in tibial geometric ratios as a function of sexual dimorphism and racial diversity to determine if commercial tibial baseplates accommodate the morphologic diversity.

Methods:

This meta-analysis was performed according to the PRISMA criteria. Two authors independently conducted an electronic search using MEDLINE® and Embase® (28701/2021) for studies that report tibial geometric ratios. The tibial geometric ratios were graphically presented as their means with 2 standard deviations for comparison to 2 symmetric and 2 asymmetric commercial tibial baseplates.

Results:

Data were extracted from 27 articles reporting on a combined total of 20944 knees. Variation in tibial aspect ratios was equal among sexes. Aspect ratio varied most among East Asians, followed by Caucasians, African-Americans, Indians and Middle Eastern. Variation in tibial asymmetry ratio was larger among men. Asymmetry ratio varied most among African-Americans, followed by Caucasians, East Asians, Indian and Middle Eastern. Implant overhang (>3 mm) or under-coverage (>4 mm) of 4 commercial tibial baseplates occurred in 17% to 100% (variations in aspect ratio) and 7% to 100% (variations in asymmetry ratio).

Conclusion:

Studies reported considerable inter-individual variability of tibial geometric ratios, which exceeded effects of sexual dimorphism and racial diversity. Bone–implant mismatch may be unavoidable in a large proportion of knees, which support the drive towards personalized medicine, such as customisation of implants for accurate bone-implant fit.



Patients with a high daily activity level tend to have lower Forgotten Joint Scores after knee replacement compared to sedentary patients

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Background:

The Forgotten Joint Score (FJS) is increasingly being used in outcome measurement after knee replacement, as it is known for a low “ceiling effect”. However, the meaningfulness of the FJS in the short postoperative course has already been questioned, as also a high “floor effect” is described. Yet, no specific influencing parameters to the patients’ self-assessment with the FJS are known.

The hypothesis of our study was that the individual level of activity has a higher impact on the FJS than the objective joint function in the early postoperative course.

Methods:

100 patients with the indication for TKA (n = 52) or medial UKA (n = 48) were prospectively included in the study. All patients underwent roboticarm-assisted knee replacement according to their indication. The KSS, OKS and FJS were recorded preoperatively and 2 months and postoperatively. All patients were also equipped with an activity tracker that recorded their daily step count for 2-4 weeks preoperatively and in the first 2 postoperative months. Based on their average daily activity preOP and in the 8th postoperative week, the patients were divided into activity categories and these were then compared with objective functional scores and the FJS.

Results:

Both groups (UKA/TKA) had similar demographic parameters and preOP activity levels (5114 vs. 5357 steps per day on average). Also, the OKS and FJS had the same average outcome at 2 month in both groups (OKS: 34 vs. 34; FJS: 48 vs. 49). Only differences were seen for knee function measured with KSS (165 vs. 157) and a faster recovery to the preoperative activity level after 8 weeks (99.8% vs. 84.1%) on average.

In the total collective, a negative correlation between the number of daily steps and the FJS was seen, with the highest score in sedentary UKA patients (<5000 steps / day, FJS = 52 points) and lowest in active UKA patients (10,000-12,500 steps/day, FJS = 36 points). This dependency was not seen for KSS or OKS.

Conclusion:

In the early postoperative phase after knee replacement, the FJS does not necessarily correlate with the objective knee function or rehabilitation progress and should be interpreted with caution. In our study, the functionally best and most active patients showed the lowest FJS scores. It will be interesting to consider this relationship further over time with further follow-up.



Session V - The panorama of failures

Comparison of different strategies in revision arthroplasty of the knee with severe bone loss: Asystematic review and meta-analysis of clinical outcomes

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Introduction:

Revision total knee arthroplasty is frequently complicated by bone defects. These lesions can jeopardize correct implant orientation and fixation. Larger defects extending into the metaphysis, can be especially problematic. Several different strategies addressing these lesions have been explored such as morselized and structural allografts. The more recently developed porous cones and porous coated sleeves, have now been used for over a decade. Doubts remained over their longer term follow up results. The purpose of this review and meta-analysis was to compare the clinical and survivorship results of these implants with those for grafting.

Methods:

We performed a systematic review of the literature on these different strategies targeting moderate to large metaphyseal bone defects defined as Anderson orthopedic research society classification type 2 or 3. The literature was evaluated for methodological quality. We analyzed results on survivorship using logistic regression correcting for follow-up time and number of knees. We compared these results using Forest plots with a distinction between early (2 to 5 years) and midterm (more than 5 years) follow up. Clinical outcome was evaluated by comparing standardized mean difference (SMD) of KSS, OKS, HSS, VAS and ROM.

Results:

A total of 85 articles analyzing 4767 knees, were included. The logistic regression curve showed an odds ratio of 1,08 (95%CI 0,84-1,39; p-value 0,56) for failure comparing all grafting procedures with all porous implants. The available clinical reports show a bigger SMD increase for tantalum cones 3,04 (95%CI 1,71-4,37) than for porous sleeves 1,72 (95%CI 0,88-2,57).

Conclusion:

Our analysis shows that the quality of the literature on metaphyseal bone defects is progressively improving. It also shows that within the span of a few years, the literature has been dominated by porous implants. The survivorship results of these implants, although not inferior to existing strategies, do not support this dramatic shift.



DAIR: the management of choice in infected UKA

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Background:

Infection after Unicompartmental Knee Arthroplasty (UKA) is an uncommon but severe complication with a lower incidence compared to a Total Knee Arthroplasty (TKA). Little data is available regarding the modern treatment of periprosthetic joint infection (PJI) specifically after UKA. We present the results of the largest multicenter clinical study of UKA PJI treated with DAIR with over 3 years follow up.

Methods:

In this retrospective study, clinical data was collated between January 2016 and December 2019. Nineteen patients had early infections and were submitted to Debridement, Irrigation, polyethylene liner exchange with Implant Retention (DAIR) and intravenous antibiotic therapy followed by oral treatment.

Results:

DAIR procedure with an overall survivorship free from septic reoperation of 84.2%. The overall survivorship free from all-cause reoperation was 78,9%. The usage of DAIR procedure had a higher than expected success against earlier published data for UKA (60%) and significantly better than the same procedure in TKR (50-60% success)

Analysis of UKA infected cases reveals the most common bacteria are coagulase-negative Staphylococcus, Staphylococcus aureus, and group B Streptococcus. Three patients underwent a second DAIR procedure successfully: one of these patients had a TKA for progression of osteoarthritis. All cases had no recurrence at last review, minimum three year follow up.

Conclusion:

This largest study to date reveals the modern technique of DAIR in infected UKA is more effective than first thought, and significantly more effective than DAIR for TKA. Surgeons might wish to adopt a different strategy in UKA than in TKA infection, with more emphasis on the less invasive and potentially more successful DAIR procedure.



Appearance and evolution of radiolucent lines in primary Total Knee Arthroplasty

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Background:

Aseptic loosening (AL) is the most common reason for revision. The aim of this study was to describe different types of radiolucent lines (RLL) that are not necessary signs of aseptic loosening.

Methods:

Retrospective study on 774 Vanguard TKA (Zimmer Biomet) implanted between 2007 and 2015. RLLs were described in 2020 according to their radiological aspect, localization, time of apparition, their progression and eventual evolution to AL. Pre- and post-operative HKA angles, amount of postoperative HKA correction, surgical, clinical and demographic data were collected.

Results:

Isolated RLL are most frequent (43%) and appear (70%) medially for varus knees and laterally for valgus knees after about 3 months. For 2/3 RLLs they are osteosclerotic and for 1/3 osteolytic. Fifty % of these RLLs disappear at two years FU. They are in fact a postoperative radiological observation of the preoperative sclerotic bone at the concave side of the disease.

Combined RLLs account for 39% of the RLLs and appear a little before the 3 month postoperative period. They are always osteolytic and 50% disappear after two years. They can evolve to aseptic loosening.

Evolutive RLLs are the least frequent (18%) and appear sequentially with first an osteolytic RLL and in a second stage an osteosclerotic RLL on the opposite side. They rarely disappear and are most at risk for aseptic loosening.

Aseptic loosening is defined as an evolutive RLL that shows signs of macro-mobility with a reaction around the tibial keel, bone apposition on the concave side and increased deformity measured as HKA-angles over time.

Patients at risk are younger females with big deformities and medical co-morbidities leading to osteoporosis undergoing more important tibial cuts with smaller size trays.

Conclusion:

Not all radiolucent lines are signs of aseptic loosening and consensus should be obtained on the criteria for revision for loose components. Prevention should be considered for patients at risk.



Simultaneous Total Knee Arthroplasty and opening wedge high tibial osteotomy versus ligament release in knees with large tibial varus deformity (15 degrees to 25 degrees)

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Background:

Orthogonal cuts result in asymmetric bone resection and subsequent difficult release in large varus knees: opening wedge high tibial osteotomy (HTO) and TKA in the same sitting address such significant deformities. We analyzed the assumption that the results of this combined procedure could be better than the conventional surgery with release at a long-time follow-up.

Methods:

The precision of surgery, complications, clinical results and risk of laxity and deformity recurrence in the long term were analyzed. Between 2005 and 2010, HTO and TKA in one sitting was performed on 25 knees with an average pre-operative 18° varus (range: 15–25°) measured on hip-knee-ankle (HKA) radiographs. A group of 27 knees (mean varus 17°, range: 16–23°) operated at the same period with the same posterior-stabilized TKA had conventional surgery with ligament release.

Results:

Better postoperative alignment measured with HKA radiographs was observed with a combined procedure (HTO and TKA): average 1.5° varus (range: 0° to +5° varus), versus 3° varus (range: -3° to +10° varus). Better knee scores and alignment of implants were obtained in the combined group than in the release Group. No instability and no complication were noted during the first five years of FU in both groups. In the long term (ten years FU), laxity or recurrent varus remained absent in knees treated with HTO and TKA. However, instability associated with laxity and increased recurrent varus (mean 6°, range 3° to 10° measured with HKA radiographs) was observed in release knees, with four revisions for instability.

Conclusions:

Combined total knee arthroplasty and opening wedge high tibial osteotomy offer better results.



First Automatic and End-to-End Analysis of Knee Prosthesis X-ray images using Artificial Intelligence

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Objectives:

Assessing the condition of a total knee prostheses (TKA) is a complex task that requires time and expertise.

The goal of this study was to use artificial intelligence algorithms to assist physicians by detecting, locating, measuring and comparing XR abnormalities/complications after TKA.

In this study, we evaluated an end-to-end approach to the analysis of TKA x-rays using deep learning. We concentrated our study on two challenging problems: the automatic calculation of knee and prosthesis alignment angles and the detection of interface abnormalities at the implant-cement, bone-cement or bone-implant interfaces.

Methods:

Our database for this retrospective study contains 103,630 X-ray images of 19,560 adult patients.

We developed six pre-processing steps to ensure the quality of our curated database. These steps were performed by training specific deep learning models, using the annotations produced by medical experts. They include removing other joints than the knee, poor quality images, incorrect acquisition protocol, other material than a prosthesis and retaining lateral and coronal views of TKA.

We trained two neural networks for angle calculation and anomaly detection using the resulting subset of 16,482 images from 3,859 patients.

Algorithms' performance is accessed on a separate test set of 769 examinations reviewed by senior arthroplasty surgeons and compared to the radiologists' reports, using Area Under the Curve (AUC) values for anomaly detection and statistics for angle calculation.

We are working on an external clinical validation to demonstrate our algorithms' capacities to generalize on unseen data.

Results:

Our end-to-end analysis pipeline performs on all quality-assurance tasks with a mean AUC value of 0.98. For the interface anomaly detection we obtain AUC values of 0.91 for both the AP and lateral views. The predicted key points used for the calculation of the angles are shown in figures A. Concerning the predicted angles, 70% of them have an error inferior to 2 degrees.



Conclusion:

Our deep learning pipeline allows for a complete analysis of the state of the knee prosthesis and defines a new standard in the automatic assessment of post-op X-ray knee images.

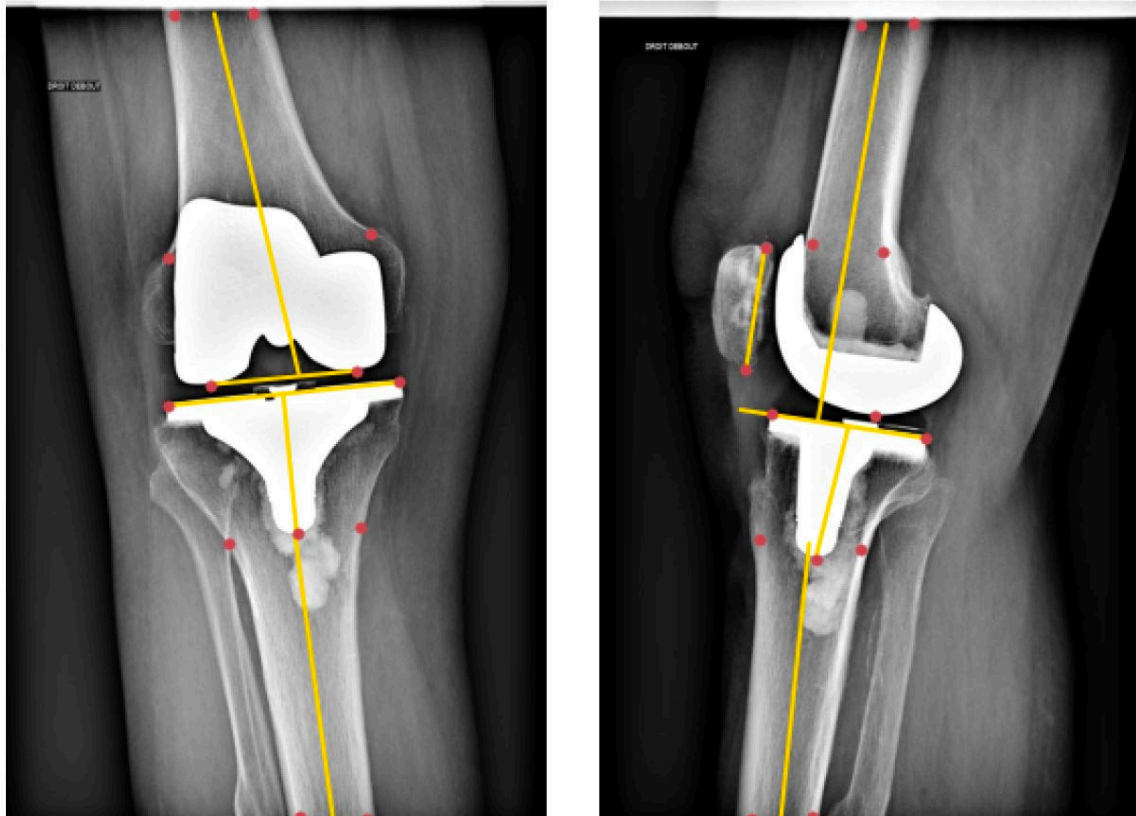


Figure A

Predicted keypoints (red) used for the calculation of angles based on the anatomic lines (yellow).
From left to right : frontal and lateral views.



A comparative study of antibiotic resistance in periprosthetic joint infection (PJI) after Total Knee Arthroplasty between two orthopaedic centres

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Introduction:

Antibiotic resistance is recognized as a major public health problem affecting humans worldwide. It occurs naturally, however an excessive antibiotic use and misuse of antibiotics accelerates the process. It is crucial to analyse the bacterial strains causing PJI. The aim of this study was to compare the resistance of the most common cause of PJI, coagulase-negative staphylococci (CNS), to antibiotics identified after revision TKAs between the two major orthopaedic centres.

Methods:

A review of all revision TKAs which were undertaken between 2006 and 2018 in two orthopaedic centres (University Hospital Marburg, Germany and Kepler University Hospital, Linz, Austria) was performed, meeting consensus criteria for PJI, in which CNS were identified. There were no major differences in surgical management and tissue sampling between both centres. Thirteen commonly used antibiotics were tested at both centres. A p-value of < 0.05 was considered statistically significant.

Results:

There were 132 PJIs in which CNS were identified. *Staphylococcus epidermidis* was identified in 70.5% cultures, followed by *Staphylococcus capitis* in 8.3% cultures. The difference in antibiotic resistance between two centres was statistically significant for penicillin (p=0.001), oxacillin (p= 0.011), cefuroxime (p= 0.044), levofloxacin (p= 0.006), moxifloxacin (p= 0.008), tetracycline (p<0.001), rifampicin (p<0.001) and vancomycin (p<0.001). The difference of resistance of CNS was not statistically significant to fosfomycin, clindamycin, teicoplanin, erythromycin and ampicillin. Neither of the centers had predominantly more CNS resistant strains.

Conclusion:

The resistance to antibiotics differs significantly between these two orthopaedic centres, even though there are merely 635 km apart. A monitoring of bacteriological analyses in each referral centre should be continuously performed. Close monitoring, additionally to smarter antibiotic use, should relevantly contribute to more efficient antibiotic treatment of PJI.



The use of augmented antibiotic-loaded articulated spacers in periprosthetic knee infections in patients with massive bone defects

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Background:

Two-stage reimplantation has been considered the “gold standard” for the treatment of chronic periprosthetic knee infections. However, in the setting of massive bone loss a static spacer is usually preferred. The purpose of this study was to report our results using preformed, articulating spacers, loaded with gentamicin (Spacer K® knee, Tecres, Italy) in patients with massive bone defects with a minimum 10-year follow-up.

Methods:

We performed a retrospective analysis of prospectively collected data for all patients treated for chronic knee periprosthetic infection at our institution in which a preformed articulating spacer was used to address massive bone defects. Fifteen preformed articulating augmented spacers were implanted between 2004 and 2009 at our institution. The bone defects were all AORI 2B and 3. Mean age of patients was 65 years (female 66%). A stem extension was added to each preformed spacer component.

Results:

After a minimum follow-up of 10 years, infection had reoccurred in 4 (27%) patients. Mean Knee Society Score improved from 34 preoperatively to 74. Flexion contracture decreased from 8° to 1° at time of second procedure and to 3°, except for a patient that underwent extensor mechanism transplantation. In 3 cases a second spacer was necessary to eradicate the infection (20%). An increased number of preformed spacer exchanges and bad local extremity grade also had a negative impact on the outcome. One knee spacer dislocation was observed.

Conclusion:

Augmented antibiotic-loaded articulating spacers could achieve satisfactory clinical outcomes in periprosthetic knee infections in patients with massive bone defects.



Early results of bi-cruciate retaining implants

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Introduction:

About 15% of patients with total knee arthroplasty are still clinically dissatisfied and the causes are often unknown. According to some, one reason could be that of the sacrifice of the cruciate ligaments, especially the anterior cruciate ligament, which is responsible for the proprioception of our knee. The goal of our study is to evaluate the functional results of 3 groups of implants: total knee arthroplasty with preservation of both cruciate ligaments, bicompartmental and bi-unicompartamental knee arthroplasty.

Materials and methods:

The first group consists of 33 patients suffering from osteoarthritis of the medial and patellofemoral compartment and treated with bicompartmental knee arthroplasty. The Persona Partial Knee plus patello-femoral joint (Zimmer-Biomet, Warsaw, USA) was used in this patient group.

The second group is made up of 17 patients suffering from osteoarthritis of the medial and lateral compartment and treated with bi-unicompartamental knee arthroplasty: in this case the Sigma Partial Knee (DePuy-Synthes) was used.

The third group consists of 31 patients suffering from three-compartmental knee osteoarthritis and treated with the Vanguard XP (Zimmer-Biomet, Warsaw, USA) and the Journey XR (Smith and Nephew).

The functional results were evaluated using the VAS and WOMAC scale at the last follow-up. Patients with a follow-up of less than 12 months were excluded.

Results:

All groups reported a statistically significant difference on the VAS and WOMAC scales compared to preoperative values ($p < 0.05$). The first group reported a preoperative VAS of 7.7 and a post-operative VAS of 3.09; as regards WOMAC, the preoperative value was 44 and the post-operative score was 15.6. In the second group the preoperative VAS was 6.8 compared to the post-operative score of 2.1; as regards WOMAC, the preoperative value was 49, the post-operative value was 10.7. In the third group the preoperative VAS was 7.3, the final one was 1.7; as regards the WOMAC scale, the preoperative value was 54.3, the post-operative value 10.2.

Conclusions:

Total knee arthroplasty with preservation of both cruciate ligaments have been shown to give high functional results; theoretically they should guarantee greater proprioception and stability of the knee. They are particularly indicated in young patients who will have to undergo a second revision surgery.

However, prospective studies are needed to compare them with conventional cruciate-retaining or postero-stabilized total knee arthroplasty.



Session VI - Rules and perspectives with new Medical Device Regulation

Sexual dimorphism and racial diversity renders bone-implant mismatch inevitable after off-the-shelf Total Knee Arthroplasty – a systematic review and meta-analysis

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Background:

Femoral geometry can be quantified in terms of aspect, asymmetry and trapezoidicity ratios, which enable comparison among sexes and races, regardless of size. The purpose of this meta-analysis was to investigate the variability in femoral geometric ratios as a function of sexual dimorphism and racial diversity to determine if commercial femoral components of total knee arthroplasty (TKA) accommodate the observed variability.

Methods:

This meta-analysis was performed according to PRISMA criteria. Two authors independently conducted an electronic search using MEDLINE® and Embase® (6/07/2020) for studies reporting on femoral geometric ratios. Femoral geometric ratios were graphically presented as their means with 2 standard deviations for comparison to 13 commercial femoral components.

Results:

Data were extracted from 15 articles reporting on a combined total of 2627 knees. Men had wider knees than women, and compared to Caucasian knees, Arabian and Indian knees were wider, while East Asian were narrower. There were no differences in asymmetry ratio between men and women, nor among Caucasian and East Asian knees. Men had more trapezoidal knees than women, and East Asian knees were more trapezoidal than Caucasian knees. Commercial femoral components accommodated less than a quarter of the variability observed among sexes and races.

Conclusion:

Studies reported considerable sexual dimorphism and racial diversity of femoral geometric ratios. Bone-implant mismatch remains unavoidable in a large proportion of knees. These findings support the drive towards personalized medicine, and accurate bone-implant fit may only be achievable through customisation of implants.



Simultaneous bilateral Total Knee Arthroplasty in patients over 70: are there factors that can influence safety and clinical outcome

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Introduction:

Approximately 20% of patients have severe pain on both knees and 10% of patients undergo contralateral TKA within 1 year after the first procedure (3).. One approach to this pathology may be simultaneous bilateral total knee arthroplasty (SBTKA), where both joints are operated on simultaneously by two teams of surgeons under a single anaesthetic.

Due to increased comorbidity and reduced healing ability, the risk of complications in patients over 70 years of age is even higher. However, with recent advances in the medical field, important surgical interventions such as total knee arthroplasty can also be performed safely in elderly patients. Most of the studies published in the literature on these patients concern unilateral and bilateral total knee arthroplasty in two stages (15-23), while only a few are related to SBTKA (24-27). Even less data are available on patients over 70.

The purpose of this study is to demonstrate that the SBTKA is safe and effective in patients over 70 years old by evaluating the short and long term and research factors that may influence clinical outcome and or safety.

Materials and Methods:

Between 2014 and 2017, 110 consecutive patients (220 knees) with an age greater or equal to seventy years underwent simultaneous total bilateral knee arthroplasty operations in our institute. All patients suffered from severe bilateral gonarthrosis and were operated on both knees simultaneously by two surgical teams and none had intraoperative complications. Medial subvastus approach was used in all patients.

Postoperative complications during hospitalization were recorded, such as lipothymia, bradycardia, atrial fibrillation, tachyarrhythmia, hypotension, asthenia, deep vein thrombosis, confusion and delirium, renal indexes and surgical wound dehiscences. For all patients, long-term complications such as the need for revision of the intervention due to infections or fractures following traumas and algic syndromes were evaluated and recorded.

Two questionnaires were administered to patients to measure the outcomes of the intervention: the Italian version of the Knee Injury and Osteoarthritis Outcome Score (KOOS-I) and the Oxford Knee Score (OKS) (30, 39). The data collected was used in a descriptive analysis and all continuous values were expressed as mean and standard deviation. The results of each postoperative questionnaire were compared with the results obtained in the preoperative.

Results:

A total of 110 patients who underwent simultaneous bilateral TKA were included in this study, of which 40 were male and 70 were female. The average age of the patients is 75.05 ± 3.83 . Mean BMI is $27 \pm 4,1$.

The study included 34 patients (30%) who had no comorbidity at the time of surgery and 76 (70%) who had at least one disease at the anamnestic analysis. Patients with grade ASA I were 8 (7.3%), ASA II 82 (74.5%), ASA III 20 (18.2%) and no patients with ASA IV. The mean preoperative haemoglobin was 13.4 ± 1.29 g/dL and the mean postoperative haemoglobin was $12,0 \pm 1,28$ g/dL and 46 patients needed blood transfusions in the postoperative.



Postoperative intra-hospital complications appeared in 32 patients (29,0%) and the most represented were fever (10 patients) and hypotension (8 patients), 6 patients had confusion, 4 patients had acute renal failure, only 2 patients had cardiological complications occurred, with atrial fibrillation was found requiring electrical cardioversion and amiodarone therapy. The average length of stay in the department of Orthopaedics and Traumatology was $9.8 \pm 3,73$ days. Comparison of preoperative and post-operative long-term questionnaires (KOOS-I, Oxford Knee Score) reveals significant improvement in joint function and significant pain relief.

Conclusions:

Although numerous investigations show that the risk between unilateral prosthesis and sbtka is similar. The latter turns out to be a practice that is avoided in "elderly" patients. most of the investigations conducted did not isolate patient populations in old age. As a result, much less is known regarding the relative risk of undergoing bilateral TKA in an older age population. As highlighted by this study, comparing the data obtained by the patients examined with the results reported in the literature referring to single knee surgery, the simultaneous bilateral total knee arthroplasty operation is safe and effective even in this age group, demonstrating a low incidence of mortality and serious post-operative complications in the short and long term and resulting in a significant increase in function with all the economic, health and social benefits that follow.

The factors capable of influencing the final clinical result are age and preoperative functionality. So in the preoperative period it is necessary to evaluate these factors in addition to the patient's comorbidity, in order to offer a better treatment tailored to the patient than to the age group.



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