MENTORS IN ORTHOPEDICS

CUTTING THROUGH THE HYPE TO ACHIEVE TRUE MILESTONES IN TOTAL KNEE ARTHROPLASTY

https://doi.org/10.71165/grss-7sbi

AUTHORS

Andrea Baldini - Istituto Clinico Humanitas IRCCS, Milan, Italy
Flavio Trapani - Università degli Studi di Roma Tor Vergata, Roma, Italy
Filippo Leggieri - University of Florence, A.O.U. Careggi CTO, Florence, Italy

SUMMARY

Background: Despite advancements in implant technology and surgical techniques, achieving consistently successful outcomes in total knee arthroplasty (TKA) remains a clinical challenge. Identifying perioperative interventions that provide sustained functional improvements is essential to distinguish evidence-based practices from those with limited clinical utility.

Objective: This narrative review aims to evaluate the preoperative, intraoperative, and postoperative factors that meaningfully influence TKA outcomes and to identify interventions that lack demonstrated clinical efficacy.

Key Points: Preoperative success is driven by appropriate patient selection, specifically targeting Kellgren-Lawrence Grade 4 disease, and comprehensive medical optimization of anemia and diabetes. The administration of high-dose corticosteroids and cryocompression therapy further enhances early recovery. Intraoperatively, reducing surgical time to under 60 minutes, utilizing personalized alignment for specific phenotypes (CPAK 1, 2, and 4), and employing cementless fixation in young or obese patients are critical. Technical refinements, including the use of tranexamic acid, watertight capsular closure, and anatomical local infiltration anesthesia, contribute to reduced complications. Postoperatively, early mobilization within 12 hours and the use of low-dose aspirin for thromboprophylaxis are fundamental to optimizing functional restoration. Conversely, several modern techniques, such as robotic-assisted surgery, computer navigation, and specific surgical approaches, have not demonstrated superior clinical outcomes compared to conventional methods.

Conclusion: Superior TKA results are achieved through the systematic implementation of validated perioperative protocols. Surgeons should prioritize evidence-supported interventions, such as rigorous patient selection and optimized fixation strategies, while remaining critical of high-cost technological innovations that do not offer clear clinical advantages.

KEYWORDS

Arthroplasty, Replacement, Knee; Osteoarthritis, Knee; Patient Selection; Recovery of Function; Postoperative Care

INTRODUCTION

Despite significant advances in surgical techniques and implant technology, achieving consistently successful outcomes after total knee arthroplasty (TKA) remains challenging [1]. Selecting interventions that deliver clinically meaningful improvements may present uncertainties for arthroplasty surgeons [2].

The orthopaedic community actively seeks interventions that could fundamentally transform TKA outcomes—true "game changers" in the field. Identifying genuine game changers requires distinguishing between interventions that provide sustained clinical improvements and those that generate initial enthusiasm but fail to deliver lasting benefits in practice.

We present a narrative review examining the key factors that meaningfully influence TKA outcomes, integrating evidence-based medicine with clinical experience. The analysis progresses chronologically through the perioperative phases: preoperative, intraoperative, and postoperative management.

Appropriate Patient Selection

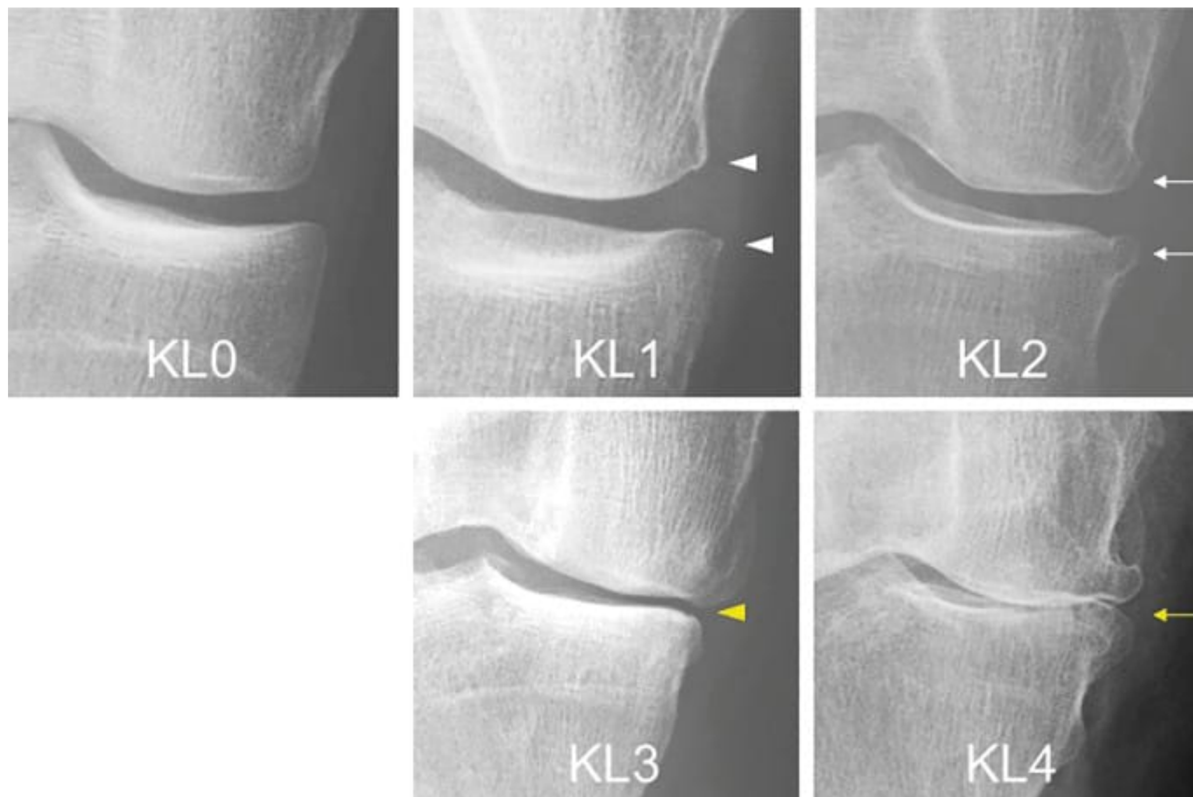


Figure 1 - Osteoarthritis (OA) progression of the knee joint medial compartiment assessed via KL grading. KL grade 4 shows the bone-to-bone end-stage OA (Adapted from Sekiya, I., Katano, H., Guermazi, A. et al. Association of AI-determined Kellgren–Lawrence grade with medial meniscus extrusion and cartilage thickness by AI-based 3D MRI analysis in early knee osteoarthritis. Sci Rep 13, 20093 (2023). https://doi.org/10.1038/s41598-023-46953-9, Creative Commons Attribution License CC-BY 4.0.)

Appropriate patient selection represents a fundamental determinant of TKA success [3] **(Figure 1)**. Evidence demonstrates that patients with severe Kellgren-Lawrence Grade 4 bone-on-bone osteoarthritis (AO) consistently achieve superior outcomes compared to those with early-stage disease [4],[5]. This pattern is reported in treatment failure analyses following TKA, where it has been demonstrated that up to 50% of patients experiencing unexplained post-TKA pain without identifiable diagnosis had mild preoperative osteoarthritis (KL 1-2) [4]. These findings translate to a 4.2-fold increase in dissatisfaction rates and persistent pain among patients with minimal radiographic OA disease [5].

Functional outcomes further support this relationship, as patients with severe OA show superior improvement, exceeding those with mild disease [6]. Additionally, KL Grade 4 patients report significantly lower pain levels at 12-month follow-up compared to the lower-grade counterparts [7].

TKA performed on minimally damaged knees may result in persistent implant awareness. These findings underscore that evidence-based patient selection according to disease severity constitutes a critical factor in optimizing TKA outcomes and surgical success rates.

Cryocompression therapy

Figure 2 - Cryocompression therapy combines controlled cooling (cryotherapy) with pneumatic compression to reduce inflammation, pain, and swelling. The devices circulate cold water or coolant through wraps or sleeves while simultaneously applying intermittent pneumatic compression to the targeted area.

Cryotherapy (Figure 2) represents a well-known therapeutic intervention in TKA management, with solid evidence supporting its efficacy limiting vasoconstriction, inflammation, oedema, and pain transmission [14],[15]. The addition of compression enhances cold penetration into deeper tissue layers and prevents fluid accumulation by reducing vascular-tissue pressure differentials [16]. The physiological benefits translate into accelerated rehabilitation progress and quantifiable clinical improvements, including reduced pain intensity and decreased opioid requirements during the recovery period [17].

Recent innovations in preoperative cryocompression protocols demonstrated significant potential for outcome enhancement beyond conventional only postoperative applications. A recent randomized controlled trial (RCT) investigated preoperative cryocompression administered for 1.5 hours prior to surgery, showing a bone temperature reduction to 21°C following arthrotomy. This preoperative intervention yielded decreased early inflammatory markers, accelerated rehabilitation milestone achievement, and superior flexion range of motion at 20 days postoperatively compared to patients receiving standard postoperative cryocompression alone.

Preoperative corticosteroids

The use of intravenous perioperative corticosteroids in arthroplasty has undergone a paradigm shift from traditional concerns regarding immunosuppression and infection to evidence-based acceptance as a beneficial therapeutic intervention. High-dosage preoperative dexamethasone, particularly at elevated doses of 24 mg before skin incision, enhances multiple patient outcomes [19], following the potential to attenuate the inflammatory, reduced postoperative nausea and vomiting, decrease pain and opioid consumption, and accelerate functional recovery including extended ambulation distances and expedited rehabilitation milestone achievement [20].

Large RCTs confirm that high-dose systemic corticosteroid protocols outperform low-dose alternatives, with dual-dose 8mg regimens providing superior benefits compared to single-dose strategies [21],[22],[23]. Furthermore, corticosteroid therapy demonstrated strong association with reduced endothelial injury markers, indicating possible vascular protective effects during the perioperative phase [24]. Perioperative corticosteroids represent a "must-go" element of modern fast recovery protocols, delivering enhanced patient experience, improved functional outcomes, and superior early-term surgical success, while maintaining an acceptable safety profile.

Preoperative medical optimization

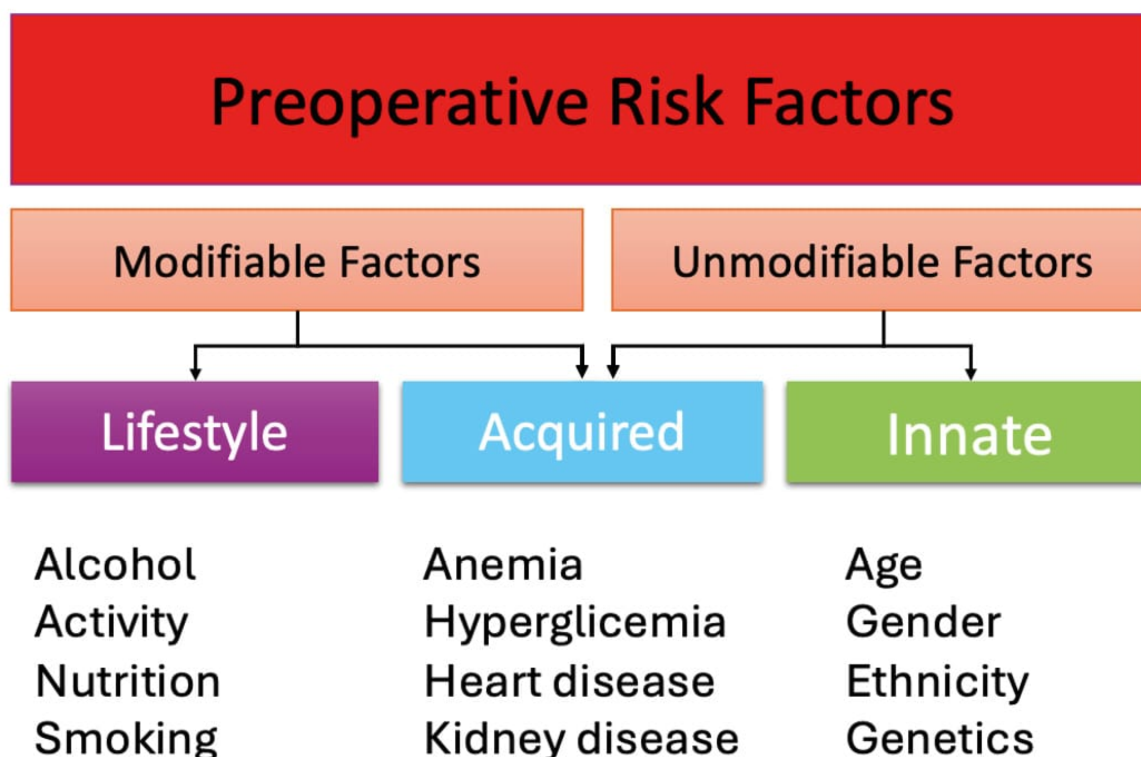


Figure 3. Classification of modifiable and unmodifiable preoperative risk factors.

Systematic preoperative medical optimization (Figure 3) has become a critical intervention for significantly improving surgical outcomes, emphasizing the transition from accepting patients' current medical conditions to pursuing evidence-based comprehensive preparation.

Patients with moderate to severe anaemia face substantially elevated complication risks, with haemoglobin concentrations below 11.0 g/dL and conferring a five-fold increase in all-complication risk compared to medically optimized patients [8]. Likewise, inadequately managed diabetes poses significant perioperative risks, with hyperglycaemia correlating with higher periprosthetic joint infection rates, hospital 90-days readmissions rates, and revisions TKA rates [9],[10].

Structured optimization frameworks demonstrated measurable improvements across multiple outcome parameters [10]. Optimized patients exhibit reduced readmission frequencies at 30 and 90-day intervals, decreased transfers to post-acute care facilities, and lower healthcare costs, with non-optimized patients incurring episode-of-care costs exceeding optimized patients by 15-33% based on baseline risk stratification [11].

The financial advantages extend beyond immediate perioperative savings, with optimization protocols achieving overall cost reductions of up to 7.6% among arthroplasty patients, while simultaneously improving clinical results [12]. Specialized geriatric assessment further increases the optimization strategy, with preoperative geriatrician engagement contributing to reduced early term emergency department admission rates and increased home discharge rates [13].

Preoperative medical optimization is an important element of modern arthroplasty practice, providing a clinically effective intervention that simultaneously enhances patient outcomes and healthcare system efficiency [11]. This framework became critical and essential during preoperative assessment of octogenarians [13].

INTRAOPERATIVE GAME CHANGERS

Reduced surgical time

Figure 4 - Excessive surgical instrumentation demonstrating factors that compromise operative efficiency. True surgical efficiency requires optimization of instrument selection, elimination of unnecessary steps, effective team communication, and coordinated workflow beyond technical surgical skill alone.

Reduced surgical time represents a significant factor influencing TKA outcomes, with procedures completed within 60 minutes demonstrating favourable results across multiple clinical parameters. The correlation between operative time and clinical success extends beyond infection risk mitigation to encompass various perioperative benefits that enhance patient experience. Efficient surgical execution allows the use of shorter-acting spinal anesthetics, enabling patients to regain complete visceral and motor function within 2 hours postoperatively, thereby reducing complications such as urinary retention commonly associated with prolonged procedures [25].

The advantages of the reduced surgical time include decreased anesthetic requirements, reduced medical complications, diminished sedation, enhanced postoperative patient vigor, and simplified fluid and electrolyte management for anesthesiologists and nursing staff [26]. Complication rates positively correlate with shorter operative time, while procedures exceeding 90 minutes carry elevated risks of infection and thromboembolic

events [27],[28]. Surgery completed within 60 minutes establish optimal conditions for enhanced recovery protocols, with patients experiencing reduced systemic stress and accelerated anesthetic recovery [29].

This evidence underscores the significance of efficient surgical technique as an integral component of a comprehensive perioperative optimization, contributing to improved patient safety, comfort, and functional recovery trajectories.

Personalized alignment for CPAK 1, 2 and 4

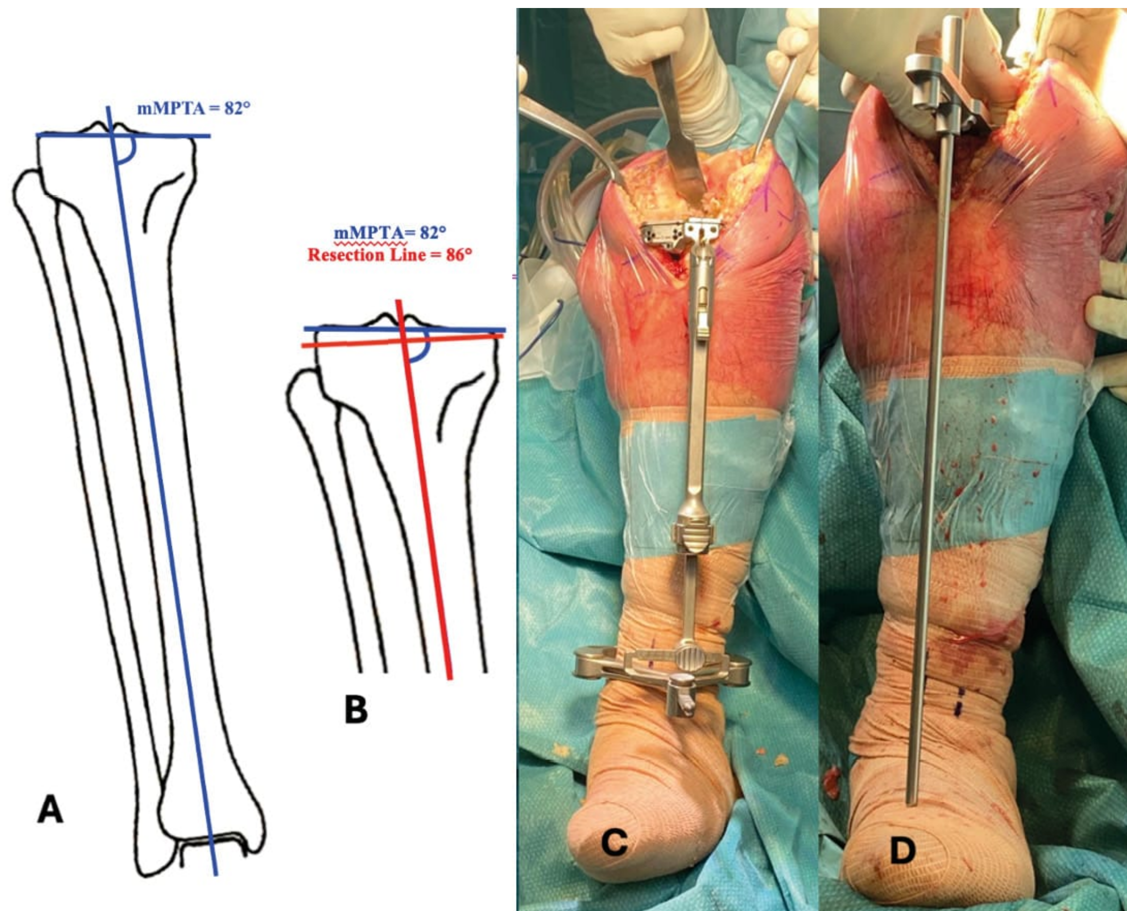


Figure 5 - Example of achieving a personalized tibial cut during knee replacement surgery. - A. Preoperative mechanical medial proximal tibial angle (mMPTA) can be calculated on plain radiographs using digital software. - B. The preferred tibial cut is planned preoperatively according to the chosen alignment philosophy. - C. In this example, the extramedullary guide was lateralized to achieve the desired varus cut. - D. Fine incremental adjustments using a varus wedge positioned on the previously cut tibial plateau allow for the final verification that the preferred tibial varus cut angle has been accomplished.

The ongoing debate between personalized and one-fits-all approaches continues to evolve with emerging evidence. Different response patterns has been described among different Coronal Plane Alignment of the Knee (CPAK) phenotypes, identifying types 1 and 4 classes as optimal candidates for personalized alignment strategies achieving better functional and performance outcomes [30].

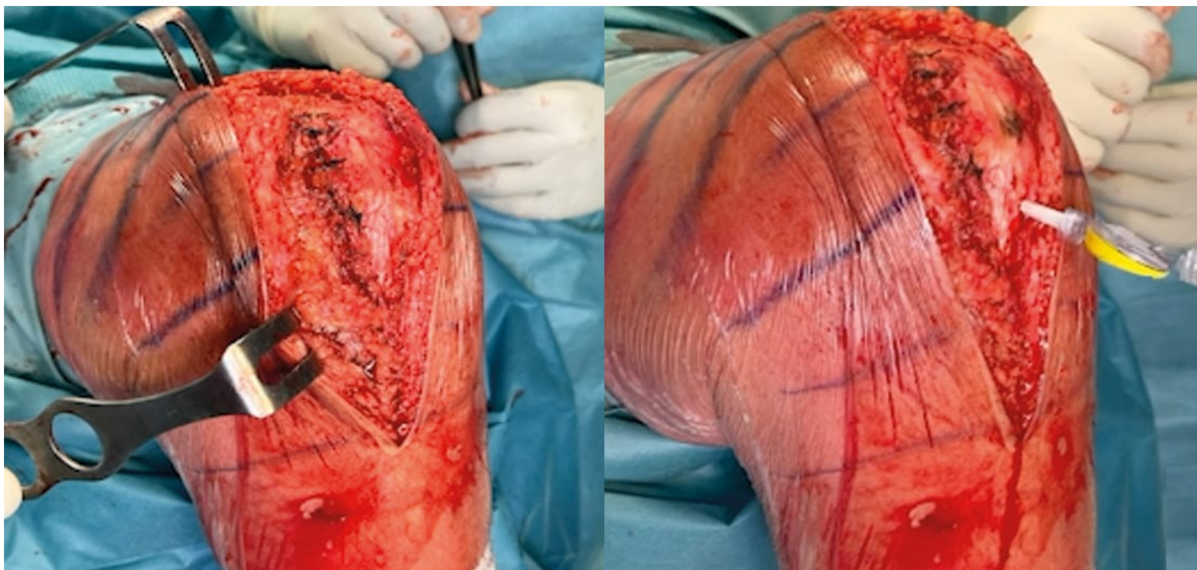
Individual joint and surgeon experience responses to complex ligamentous balancing procedures may vary, producing inconsistent results with mechanical alignment methods [2]. Mechanical alignment in varus morphotypes necessitates trapezoidal resection gaps requiring soft tissue releases which leading to outcomes dependent on surgeon skill and unpredictable tissue responses. Conversely, performing preserving bone cuts that

maintain the native deformity, completely or partially through morphotype-specific alignment, avoids the inherent uncertainties following complex release procedures and achieving knees with improved lacity gaps and soft tissue laxity patterns [31]. This approach can improve clinical outcomes by avoiding extensive soft tissue manipulation.

CPAK type 2 patients, despite exhibiting very little or no deviation from neutral alignment, still benefit from personalized strategies, indicating that following the native joint line orientation provides clinical advantages even among neutrally aligned limbs [32]. For neutral alignment patterns, particularly CPAK type 5 patients, personalized approaches may not demonstrate significant differences compared to mechanical alignment techniques.

Evidence remains insufficient among valgus morphotypes and severe varus deformities - severe CPAK types 1 and 4 - where neutral restoration may surpass the compensatory capabilities of personalized approaches among valgus and very high degrees of varus deformities or distortion.

Tranexamic acid, watertight closure, and postoperative knee flexion position



Tranexamic acid has expanded beyond its conventional systemic antifibrinolytic function to become a multifaceted therapeutic tool, with evidence supporting preoperative i.v. administration, postoperative i.v or oral dose doubling, and intra-articular injection [46].

Intra-articular administration of 30-40ml tranexamic acid serves dual therapeutic purposes: achieving effective local hemostasis while providing a diagnostic method for assessing watertight capsular closure integrity, ensuring that fast recovery and rehabilitation protocols do not jeopardize wound healing [47]. This technique facilitates systematic layer-by-layer “running” sutures, preventing articular fluid extravasation during early mobilization compromising healing or bacteria infiltration increasing infection risk [48].

Moreover, early “forced” knee flexion position maintained for few hours postoperatively promotes sustained intra-articular haemostasis and prevents hemarthrosis development, directly enhancing clinical outcomes through reduced pain, swelling, and functional impairment [49].

Modern wound closure sutures have been improving in materials and techniques that optimize both procedural efficiency and patient outcomes [50]. Barbed sutures have achieved strong expert consensus endorsement, with widespread agreement regarding operative time reduction and resource allocation, alongside decreased complications and enhanced cosmetic results [51]. Closure time reductions averaging 4-7 minutes, lower wound

complication rates, reduced overall costs despite higher material expenses, and abbreviated hospital stays with increased early discharge rates have been demonstrated using “running” sutures in large systematic reviews [50], [52].

Cementless fixation in young or obese patients

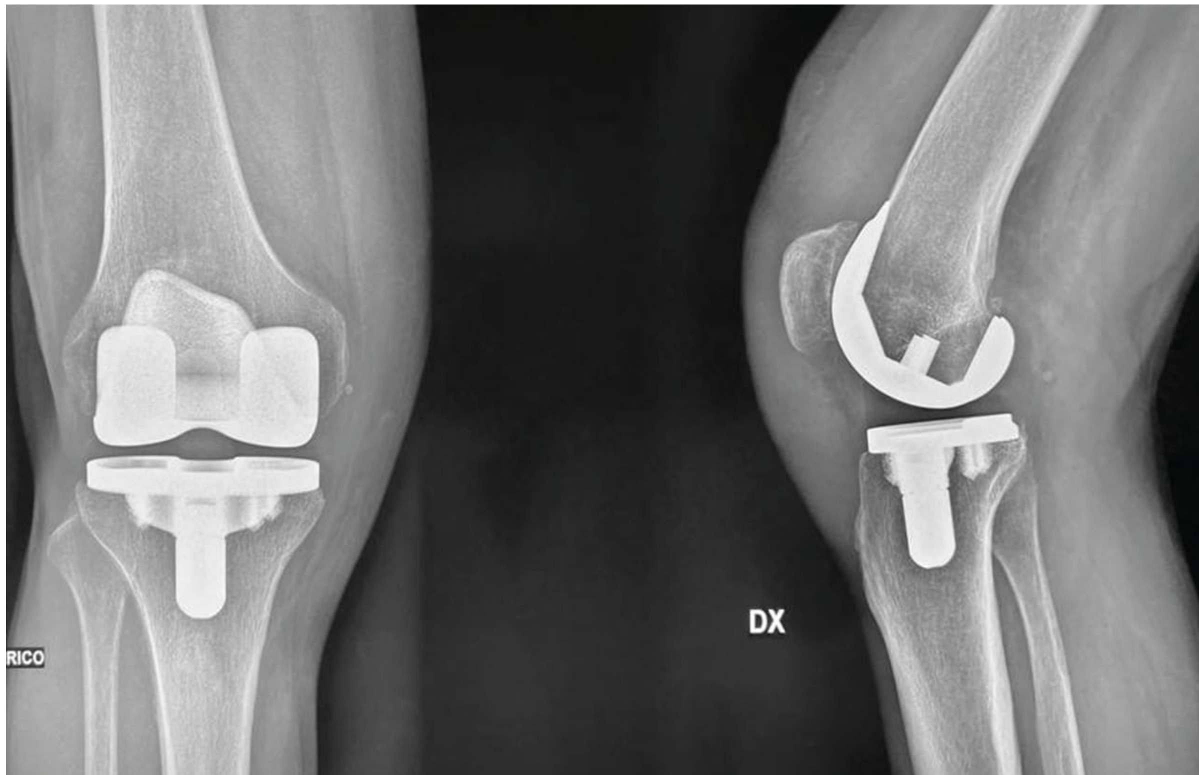


Figure 7. Total knee arthroplasty with cementless femoral and tibial component configuration. The ideal design features a central keel with four surrounding pegs, providing enhanced primary stability and optimal load distribution for a successful osseointegration.

Cementless components represent a significant evolution in modern TKA practice, supported by evidence demonstrating superior performance particularly in specific patient populations alongside advancing implant technologies. Registry data revealed consistent annual increases in cementless utilization, achieving 22% adoption in 2023 with continued growth projected as clinical evidence expands [40]. This trend reflects the increasing recognition that cemented fixation may be inadequate for high-demand demographics, particularly young, active patients, males, and obese individuals where mechanical stresses may surpass cement-bone interface durability.

Registry analyses demonstrated higher aseptic loosening rates in males under 65 years with cemented implants compared to cementless ones, while patients with BMI exceeding 35-40 exhibited higher failure rates cemented implants compared to cementless alternatives [40],[41]. Enhanced cementless prosthetic performance has been enabled by advanced implant designs featuring the four-peg-one-keel configuration that establishes reliable primary stability, addressing historical concerns regarding initial fixation adequacy [42].

Meta-analyses in younger patient cohorts revealed multiple advantages favouring cementless over cemented fixation, including superior patient-reported outcome measures, reduced pain scores, improved range of motion, and decreased component radiolucency rates [42],[43]. In high-BMI populations, the evidence proved particularly compelling, with cementless implants demonstrating aseptic loosening rates of only 0.9% compared to 18.8% in cemented groups, yielding survivorship rates of 99.1% versus 88.2% at eight-year follow-up [44].

Pooled analyses indicated substantial benefits of cementless implants among high BMI patients, with odds ratios of 0.17 for all-cause revisions and 0.15 for aseptic loosening, representing considerable risk reductions that support expanding cementless fixation adoption [45].

Anatomical local infiltration anesthesia and anterolateral Skin Incision

Anatomical Local Infiltration Anesthesia (LIA) and "curved-line" anterolateral skin incision represent sophisticated intraoperative techniques addressing the detailed knee neuroanatomy to optimize postoperative comfort and functional outcomes. Anatomical LIA advances beyond conventional infiltration approaches by precisely targeting specific neural structures rather than employing broad tissue saturation, with primary emphasizing the saphenous nerve complex. Current understanding of saphenous nerve anatomy has facilitated the development of reproducible intraoperative procedures that achieve effective neural blockade without requiring specialized ultrasound guidance.

The technique involves nerve access approximately 8 cm deep at a 30° angle parallel to the bone surface, utilizing the femoral artery as a consistent anatomical landmark confirmed through aspiration bleeding (Figure 8.A). This approach enables effective adductor canal blockade comparable to formal regional anesthetic techniques while preserving surgical workflow efficiency. Precision targeting may deliver superior pain control compared to traditional infiltration methods while minimizing systemic absorption and potential toxicity associated with high-volume local anesthetic administration.

The complementary anterolateral skin incision, though not universally employed, may benefit specific patient subgroups including those requiring kneeling needs, patients with hypertrophic subcutaneous tissue in the saphenous distribution, women, and individuals at elevated risk for postoperative pain syndromes. This incision extends lateral to the extensor mechanism followed by standard anteromedial capsulotomy, strategically avoiding saphenous nerve branches that contribute to persistent anterior knee discomfort, numbness, and functional impairment. Furthermore, this technique may prevent autonomic denervation reactions manifesting as unexplained lateral herpetic-like skin changes (Figure 8.B)

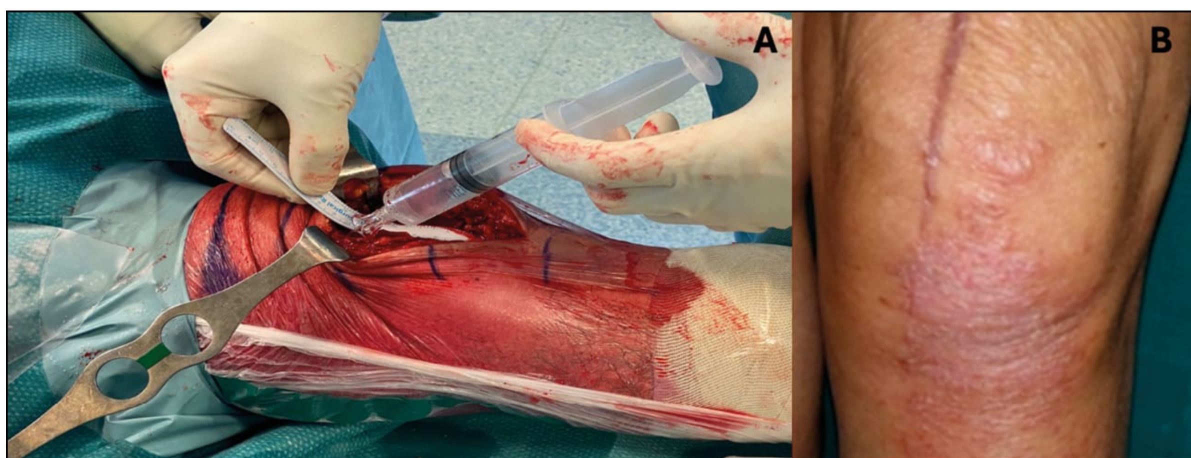


Figure 8 - A. Intraoperative adductor canal block technique using the proximal margin of the medial femoral condyle as an anatomical landmark. B. Lateral herpetic-like skin changes following an autonomic denervation reaction.

Medial congruent or central congruent inserts

Consistent equivalence or superiority across multiple outcome parameters has been reported for medial congruent, central congruent, and medial pivot designs over posterior-stabilised (PS) designs [33],[34]. For

patients requiring high-speed ambulation, navigation of uneven terrain, stair climbing, and incline walking, the enhanced stability provided by these articulating surfaces may yield even better outcomes [35],[36],[37].

Biomechanical investigations demonstrated higher anteroposterior stability, particularly at 45° flexion where medial stabilized designs exhibit only 3.6mm translation versus 16.5mm in PS implants [38]. Functional outcome data indicates faster and higher return to sports rates in medial or central stabilized patients compared to PS cohorts [39]. Registry analysis supports this trend, with PS bearings showing elevated hazard ratios for all-cause revision compared to pivot bearing designs [40].

This evidence establishes medial or central congruent designs beneficial for high demanding patients seeking optimized performance, potentially providing superior long-term survivorship compared to traditional alternatives.

Optimized tourniquet management

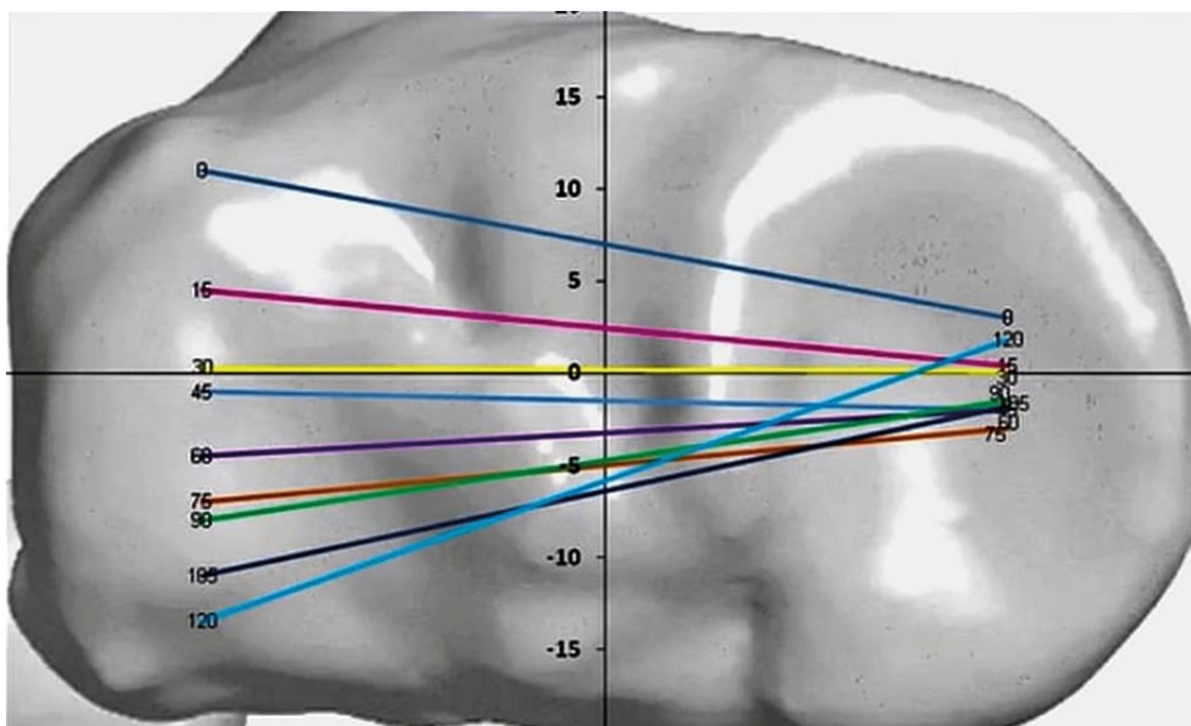


Figure 9. Transverse view of the tibial plateau demonstrating femoral rotation during knee flexion. The femur exhibits a motion pattern that is more constrained on the medial side compared to the lateral side, representing a modified pivot mechanism rather than pure medial pivot kinematics. (Adapted from Cretu B, Costache M, Cursaru A, et al. Restoring Anatomical Features in Primary Total Knee Arthroplasty. Cureus 15(6): e40616, 2023. Creative Commons Attribution License CC-BY 4.0.)

While full-duration tourniquet use provides minimal intraoperative advantages, it significantly increases overall complication risk (risk ratio 1.73), elevates postoperative pain scores by 1.25 NRS points on the first day, and prolongs hospital stays by 0.34 days without meaningful benefits in blood loss management or functional outcomes [53]. Personalised tourniquet inflation pressures (PTIP) based on individual systolic blood pressure achieve superior results compared to standardized inflation protocols, with patients experiencing significantly reduced pain scores at rest and during activity in the early postoperative period, enhanced range of motion, higher early-term patient-reported outcome measures, and decreased thigh complications including reduced ecchymosis rates and venous thromboembolism events [54].

The paradigm shift toward optimized tourniquet protocols involves either implementation of tourniquetless or short-duration, low-pressure strategies that maintain surgical visibility while minimizing physiological disruption. A recent RCT comparing no-tourniquet versus optimized tourniquet techniques (inflation before skin incision, deflation after cementing, with pressure 100mmHg above systolic blood pressure) demonstrate equivalent outcomes across all measured parameters including operative time, blood loss, pain levels, edema, range of motion, functional scores, and complication rates [55].

When tourniquet use is necessary, short-duration protocols under 10 minutes achieve comparable pain control and functional outcomes while significantly reducing 24-hour opioid consumption compared to extended tourniquet times, without compromising haemoglobin levels, creatine kinase markers, or knee society scores [55],[56],[57].

Fine increment femoral components and asymmetric tibial designs

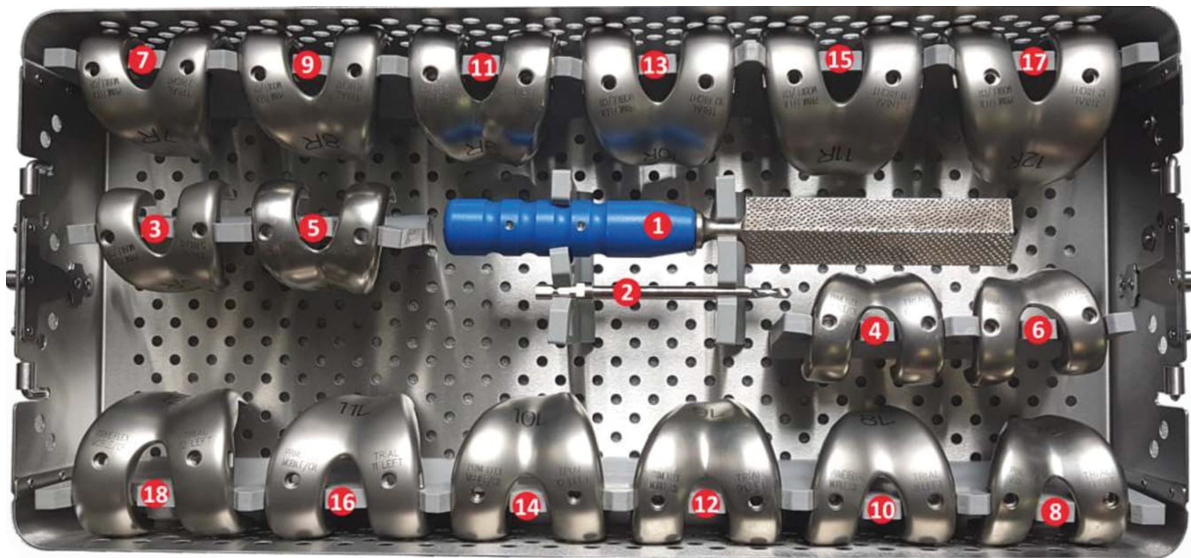


Figure 10. Modern component sizing utilizes 2mm incremental femoral sizing with multiple medial-lateral options per anteroposterior size to achieve superior bone-implant interface fit. This precision sizing approach, combined with asymmetric tibial designs, addresses anatomical variability across patient populations.

Femoral component systems offering 2mm incremental sizing with multiple medial-lateral options achieves superior component-to-bone fit compared to traditional designs with larger sizing intervals [58],[59]. The clinical significance of this precision becomes apparent when considering that overhang ≥3mm approximately doubles knee pain incidence at two years post-TKA, while decreased posterior condylar offset of 2mm reduces postoperative flexion by 12.2° [60]. Femoral component providing 9-12 anteroposterior sizes with multiple medial-lateral options achieve optimal coverage rates of 76-78% compared to only 61% for limited-size systems, with anatomical designs showing particularly superior medial-posterior coverage (48% optimal fit versus 0-4% for symmetrical designs) and enhanced medial-lateral coverage (42% versus 32-38%) [61]. Additionally, properly sized components reduce femoral notching, preserve bone stock, and achieve better posterior condylar offset restoration [86].

These technical improvements translate directly to reduced periprosthetic fracture risk through minimized anterior femoral notching, decreased soft tissue impingement from reduced component overhang, and enhanced postoperative range of motion through optimized posterior condylar offset maintenance.

At the same time, asymmetric tibial components achieve significantly superior tibial coverage, reduce stress risers, minimizes subsidence rates, and enhances long-term fixation stability while preserving maximal bone stock for potential future revision procedures compared to symmetric designs, regardless of the positioning reference [59],[62],[63],[65].

POSTOPERATIVE GAME CHANGERS

Pain and swelling control

The complex pathophysiological response to surgical trauma involving extensive bone resection and soft tissue manipulation generates inflammatory cascades that perpetuate persistent pain and swelling without targeted therapeutic intervention [79]. Effective pain management serves as a critical determinant of successful rehabilitation engagement, facilitating accelerated achievement of physical therapy milestones [79]. Pain control results in significantly reduced difficulty with daily activities, decreased gait abnormalities, fewer medication-related adverse effects, and reduced complication incidence that compromises therapeutic participation [80].

The underlying mechanism reflects the principle that inadequately controlled pain and inflammation create a self-perpetuating cycle where inflammatory responses impair tissue repair processes, restrict mobility, delay functional recovery, and compromise patient engagement in essential rehabilitation protocols [81]. This evidence framework establishes comprehensive pain and inflammation management not merely as comfort measures but as fundamental therapeutic modalities that directly influence surgical success, functional restoration, and patient satisfaction.

Early mobilization

Early mobilization within 12 hours following TKA has emerged as a fundamental component of modern perioperative care, dramatically transforming patient recovery trajectories and clinical outcomes [66]. Reduced hospital stays, improved knee flexion mobility, decreased pain scores, lower healthcare costs, reduced thromboembolic complications and pulmonary morbidity, diminished opioid requirements, enhanced rehabilitation performance, and increased direct home discharge rates compared to institutional care facilities all represent the therapeutic advantages of early mobilization [67].

However, successful early mobilization implementation requires comprehensive fast recovery protocols that systematically address all perioperative management domains, including thorough preoperative patient optimization, multimodal analgesic strategies, effective hemostatic control, and adequate infrastructure supporting operative day physical therapy interventions [68]. Conventional barriers such as excessive drainage systems, indwelling urinary catheters, and preventive measures against urinary retention need to be eliminated to achieve early mobilization [69]. It also demands consistent collaboration among anaesthesiologists, nursing staff, rehabilitation specialists, and surgical teams.

Quantifiable clinical benefits for ultra-early mobilization have been demonstrated, with patients receiving physical therapy within 12 hours achieving reduced hospital stay compared to those mobilized between 12-24 hours, and striking results compared to delayed mobilization at 24-48 hours [70]. Although three-month functional assessment scores show equivalent outcomes between ultra-early and early mobilization cohorts, the immediate perioperative benefits of ultra-early mobilization contribute to patient satisfaction and reduced healthcare [71].

Appropriate anticoagulation

Current evidence, notably from the 2022 VTE International Consensus Meeting, establishes that heparins, direct oral anticoagulants, and warfarin substantially increase postoperative complication rates, with wound-related complications serving as the most important predictor of excessive bleeding risk [72]. Low-dose aspirin (81-100mg twice daily) has been validated as the most efficacious and safe thromboprophylaxis, receiving endorsement from both the American Academy of Orthopaedic Surgeons for patients with standard thromboembolic risk profiles and the American College of Chest Physicians since 2012. This recommendation is substantiated by Level I-IV evidence confirming that low-dose aspirin achieves optimal equilibrium between thromboembolic protection and hemorrhage risk mitigation.

The clinical relevancy are substantial, with hematoma development ranking among the third through seventh most frequent causes of hospital readmission following arthroplasty procedures [73]. Comparative analyses between direct oral anticoagulants and aspirin demonstrate notable differences in wound complication incidence, with aspirin demonstrating superior outcomes and emphasizing the significant impact of anticoagulant selection on surgical site healing [74],[75],[76]. The pathophysiology underlying these complications extends beyond simple haemorrhage, as hemarthrosis establishes an inflammatory microenvironment that impairs tissue repair mechanisms, delays mobilization protocols, compromises range of motion restoration, and predisposes patients to periprosthetic joint infection through compromised local immune response [77],[78]. This framework positions anticoagulant selection not simply as a pharmacological consideration but as a critical surgical outcome modifier, where aspirin selection over more potent alternatives can differentiate between uncomplicated recovery and complex postoperative trajectories characterized by wound complications, hospital readmissions, and suboptimal functional restoration.

FAKE GAME CHANGERS

Multiple modern techniques have gained popularity without demonstrating clear clinical advantages, constituting procedures that drain healthcare budgets while failing to provide substantial patient benefits (Table 1).

Intervention	Evidence Against Clinical Benefits	Key Findings	Reference
Prehabilitation Programs	Limited evidence for transformative outcomes	No specific exercise-based rehabilitation modality shows superiority for typical patients Home-based rehabilitation equally effective as supervised outpatient programs Elaborate protocols do not warrant complexity and costs	[82]
Alternative Surgical Approaches	No any-time-point clinically meaningful differences	Quadriceps-sparing shows no significant advantages Prolongs surgical and tourniquet times	[83]
Fat Pad Preservation vs Resection	No clinical advantages	No significant clinical benefit from preservation	[84]
Synovectomy	Potentially detrimental intervention	Significantly increased blood loss and hemoglobin reduction No compensatory benefits in pain relief, functional improvement, or ROM Pooled RCT results show net negative impact	[85]
Patellar Denervation	No clinical advantages	No differences in pain levels, ROM, reoperation rates, or patient satisfaction Comparable outcomes to preservation techniques	[86]
Patient-Specific Instrumentation	No clinical superiority despite theoretical precision	No functional outcome improvements at any postoperative interval Comparable results to conventional instrumentation systems	[87]
Sensor-Embedded Polyethylene	No clinical benefit from technological advancement	No significant differences in patient-reported outcomes No ROM improvements between sensor-guided and manually balanced techniques No benefits at meaningful follow-up periods	[88]
Computer-Assisted Navigation	No clinical superiority despite theoretical precision	No significant differences in patient-reported outcomes or pain measures Improved component positioning accuracy does not translate to clinical benefits Comprehensive meta-analyses show lack of meaningful patient improvement	[89]

Table 1. Fake game changer

CONCLUSION

Optimal TKA outcomes are achieved through systematic implementation of evidence-supported interventions across the entire perioperative spectrum while eliminating practices that lack demonstrated clinical efficacy. The evolution of TKA should prioritize systematic adoption of validated interventions rather than pursuing technological innovations indiscriminately, ensuring that surgical progress results in meaningful patient outcome improvements rather than simply increasing procedural complexity without corresponding clinical advantages. g

REFERENCES

1. Oussedik S, Haddad FS. Is shifting the goal posts a game-changer in total knee arthroplasty? The Bone & Joint Journal 2025;107-B:664–5. https://doi.org/10.1302/0301-620X.107B7.BJJ-2025-0620.

2. Rak D, Klann L, Heinz T, Anderson P, Stratos I, Nedopil AJ, et al. Influence of Mechanical Alignment on Functional Knee Phenotypes and Clinical Outcomes in Primary TKA: A 1-Year Prospective Analysis. J Pers Med 2023;13:778. https://doi.org/10.3390/jpm13050778.

3. Connelly JW, Galea VP, Rojanasopondist P, Nielsen CS, Bragdon CR, Kappel A, et al. Which Preoperative Factors are Associated with Not Attaining Acceptable Levels of Pain and Function After TKA? Findings from an International Multicenter Study. Clin Orthop Relat Res 2020;478:1019–28. https://doi.org/10.1097/CORR.0000000000001162.

4.
Polkowski GG, Ruh EL, Barrack TN, Nunley RM, Barrack RL. Is pain and dissatisfaction after TKA related to early-grade preoperative osteoarthritis? Clin Orthop Relat Res 2013;471:162–8. https://doi.org/10.1007/s11999-012-2465-6.

5. Leppänen S, Niemeläinen M, Huhtala H, Eskelinen A. Mild knee osteoarthritis predicts dissatisfaction after total knee arthroplasty: a prospective study of 186 patients aged 65 years or less with 2-year follow-up. BMC Musculoskelet Disord 2021;22:657. https://doi.org/10.1186/s12891-021-04543-8.

6. Meding JB, Ritter MA, Faris PM, Keating EM, Harris W. Does the preoperative radiographic degree of osteoarthritis correlate to results in primary total knee arthroplasty? J Arthroplasty 2001;16:13–6. https://doi.org/10.1054/arth.2001.16501.

7. Riis A, Rathleff MS, Jensen MB, Simonsen O. Low grading of the severity of knee osteoarthritis pre-operatively is associated with a lower functional level after total knee replacement: a prospective cohort study with 12 months' follow-up. Bone Joint J 2014;96-B:1498–502. https://doi.org/10.1302/0301-620X.96B11.33726.

8. Gu A, Malahias M-A, Selemon NA, Wei C, Gerhard EF, Cohen JS, et al. Increased severity of anaemia is associated with 30-day complications following total joint replacement. Bone Joint J 2020;102-B:485–94. https://doi.org/10.1302/0301-620X.102B4.BJJ-2018-0991.R3.

9. Shohat N, Tarabichi M, Tan TL, Goswami K, Kheir M, Malkani AL, et al. 2019 John Insall Award: Fructosamine is a better glycaemic marker compared with glycated haemoglobin (HbA1C) in predicting adverse outcomes following total knee arthroplasty: a prospective multicentre study. Bone Joint J 2019;101-B:3–9. https://doi.org/10.1302/0301-620X.101B7.BJJ-2018-1418.R1.

10. Kim KY, Anoushiravani AA, Chen KK, Li R, Bosco JA, Slover JD, et al. Perioperative Orthopedic Surgical Home: Optimizing Total Joint Arthroplasty Candidates and Preventing Readmission. J Arthroplasty 2019;34:S91–6. https://doi.org/10.1016/j.arth.2019.01.020.

11. Bernstein DN, Liu TC, Winegar AL, Jackson LW, Darnutzer JL, Wulf KM, et al. Evaluation of a Preoperative Optimization Protocol for Primary Hip and Knee Arthroplasty Patients. J Arthroplasty 2018;33:3642–8. https://doi.org/10.1016/j.arth.2018.08.018.

12. Schroer WC, LeMarr AR, Mills K, Childress AL, Morton DJ, Reedy ME. 2019 Chitranjan S. Ranawat Award: Elective joint arthroplasty outcomes improve in malnourished patients with nutritional intervention: a prospective population analysis demonstrates a modifiable risk factor. Bone Joint J 2019;101-B:17–21. https://doi.org/10.1302/0301-620X.101B7.BJJ-2018-1510.R1.

13. Liimakka AP, Farid AR, Zhu L, Monette PJ, Varady NH, Lange JK, et al. Perioperative Geriatrician Assessment Is Associated with a Lower Risk of Emergency Department Visits After Total Joint Arthroplasty. J Bone Joint Surg Am 2025;107:372–80. https://doi.org/10.2106/JBJS.23.01157.

14. Morsi E. Continuous-flow cold therapy after total knee arthroplasty. J Arthroplasty 2002;17:718–22. https://doi.org/10.1054/arth.2002.33562.

15. Guillot X, Tordi N, Laheurte C, Pazart L, Prati C, Saas P, et al. Local ice cryotherapy decreases synovial interleukin 6, interleukin 1β, vascular endothelial growth factor, prostaglandin-E2, and nuclear factor kappa B p65 in human knee arthritis: a controlled study. Arthritis Res Ther 2019;21:180. https://doi.org/10.1186/s13075-019-1965-0.

16. de Vries AJ, Aksakal HK, Brouwer RW. Effects of 6 weeks of cryotherapy plus compression therapy after total or unicompartmental knee arthroplasty: protocol for a single-centre, single-blind randomised controlled trial. BMJ Open 2024;14:e077614. https://doi.org/10.1136/bmjopen-2023-077614.

17. Hohenauer E, Clarys P, Baeyens J-P, Clijsen R. The effect of local cryotherapy on subjective and objective recovery characteristics following an exhaustive jump protocol. Open Access J Sports Med 2016;7:89–97. https://doi.org/10.2147/OAJSM.S110991.

18. Pieri L, Leggieri F, Bartoli D, Ponti M, Caparrini C, Baldini A. Preoperative knee joint hypothermia reduces inflammation and recovery time and increases range of motion after total knee arthroplasty: A randomized controlled trial. Knee Surg Sports Traumatol Arthrosc 2025. https://doi.org/10.1002/ksa.12756.

19. Gasbjerg KS, Hägi-Pedersen D, Lunn TH, Laursen CC, Holmqvist M, Vinstrup LØ, et al. Effect of dexamethasone as an analgesic adjuvant to multimodal pain treatment after total knee arthroplasty: randomised clinical trial. BMJ 2022;376:e067325. https://doi.org/10.1136/bmj-2021-067325.

20. Xu B, Ma J, Huang Q, Huang Z-Y, Zhang S-Y, Pei F-X. Two doses of low-dose perioperative dexamethasone improve the clinical outcome after total knee arthroplasty: a randomized controlled study. Knee Surg Sports Traumatol Arthrosc 2018;26:1549–56. https://doi.org/10.1007/s00167-017-4506-x.

21. Chia SK, Wernecke GC, Harris IA, Bohm MT, Chen DB, Macdessi SJ. Peri-articular steroid injection in total knee arthroplasty: a prospective, double blinded, randomized controlled trial. J Arthroplasty 2013;28:620–3. https://doi.org/10.1016/j.arth.2012.07.034.

22. Lunn TH, Kristensen BB, Andersen LØ, Husted H, Otte KS, Gaarn-Larsen L, et al. Effect of high-dose preoperative methylprednisolone on pain and recovery after total knee arthroplasty: a randomized, placebo-controlled trial. Br J Anaesth 2011;106:230–8. https://doi.org/10.1093/bja/aeq333.

23. Yue C, Wei R, Liu Y. Perioperative systemic steroid for rapid recovery in total knee and hip arthroplasty: a systematic review and meta-analysis of randomized trials. J Orthop Surg Res 2017;12:100. https://doi.org/10.1186/s13018-017-0601-4.

24. Lindberg-Larsen V, Ostrowski SR, Lindberg-Larsen M, Rovsing ML, Johansson PI, Kehlet H. The effect of pre-operative methylprednisolone on early endothelial damage after total knee arthroplasty: a randomised, double-blind, placebo-controlled trial. Anaesthesia 2017;72:1217–24. https://doi.org/10.1111/anae.13983.

25. Duchman KR, Pugely AJ, Martin CT, Gao Y, Bedard NA, Callaghan JJ. Operative Time Affects Short-Term Complications in Total Joint Arthroplasty. J Arthroplasty 2017;32:1285–91. https://doi.org/10.1016/j.arth.2016.12.003.

26. Schroer WC, Calvert GT, Diesfeld PJ, Reedy ME, LeMarr AR. Effects of increased surgical volume on total knee arthroplasty complications. J Arthroplasty 2008;23:61–7. https://doi.org/10.1016/j.arth.2008.03.013.

27. Pulido L, Ghanem E, Joshi A, Purtill JJ, Parvizi J. Periprosthetic joint infection: the incidence, timing, and predisposing factors. Clin Orthop Relat Res 2008;466:1710–5. https://doi.org/10.1007/s11999-008-0209-4.

28. Frisch NB, Darrith B, Hansen DC, Wells A, Sanders S, Berger RA. Single-dose lidocaine spinal anesthesia in hip and knee arthroplasty. Arthroplast Today 2018;4:236–9. https://doi.org/10.1016/j.artd.2018.02.011.

29. Pugely AJ, Martin CT, Gao Y, Mendoza-Lattes S, Callaghan JJ. Differences in short-term complications between spinal and general anesthesia for primary total knee arthroplasty. J Bone Joint Surg Am 2013;95:193–9. https://doi.org/10.2106/JBJS.K.01682.

30. MacDessi SJ, Griffiths-Jones W, Harris IA, Bellemans J, Chen DB. Coronal Plane Alignment of the Knee (CPAK) classification. Bone Joint J 2021;103-B:329–37. https://doi.org/10.1302/0301-620X.103B2.BJJ-2020-1050.R1.

31. Franceschetti E, Campi S, Giurazza G, Tanzilli A, Gregori P, Laudisio A, et al. Mechanically aligned total knee arthroplasty does not yield uniform outcomes across all coronal plane alignment of the knee (CPAK) phenotypes. Knee Surg Sports Traumatol Arthrosc 2024;32:3261–71. https://doi.org/10.1002/ksa.12349.

32. Yang H, Park C, Cheon J, Hwang J, Seon J. Comparison of Outcomes Between Functionally and Mechanically Aligned Total Knee Arthroplasty: Analysis of Parallelism to the Ground and Weight-Bearing Position of the Knee Using Hip-to-Calcaneus Radiographs. J Pers Med 2025;15:91. https://doi.org/10.3390/jpm15030091.

33. Shi W, Jiang Y, Wang Y, Zhao X, Yu T, Li T. Medial pivot prosthesis has a better functional score and lower complication rate than posterior-stabilized prosthesis: a systematic review and meta-analysis. J Orthop Surg Res 2022;17:395. https://doi.org/10.1186/s13018-022-03285-0.

34. Liu X, Liu Y, Li B, Wang L, Wang Y, Liu J. Comparison of the clinical and patient-reported outcomes between medial stabilized and posterior stabilized total knee arthroplasty: A systematic review and meta-analysis. The Knee 2022;36:9–19. https://doi.org/10.1016/j.knee.2022.03.010.

35. Obada B, Iliescu MG, Costea DO, Petcu L, Popescu AI. Comparative study of outcomes with total knee arthroplasty: medial pivot prosthesis vs posterior stabilized implant. Prospective randomized control. International Orthopaedics (SICOT) 2025;49:629–39. https://doi.org/10.1007/s00264-025-06420-8.

36. Elbardesy H, Salamah HM, McLeod A, Thada PK, Mohammed ER, Hanifa FA, et al. Medial pivot versus (cam post) posterior stabilised total knee arthroplasty, systematic review and meta-analysis of 3837 knees. Acta Orthop Belg 2021;87:665–80. https://doi.org/10.52628/87.4.12.

37. Scott DF, Gray CG. Outcomes are Better With a Medial-Stabilized vs a Posterior-Stabilized Total Knee Implanted With Kinematic Alignment. J Arthroplasty 2022;37:S852–8. https://doi.org/10.1016/j.arth.2022.02.059.

38. Scott DF, Hellie AA. Mid-Flexion, Anteroposterior Stability of Total Knee Replacement Implanted with Kinematic Alignment. The Journal of Bone and Joint Surgery 2022;105:9–19. https://doi.org/10.2106/JBJS.22.00549.

39. Kendall J, Pelt CE, Imlay B, Yep P, Mullen K, Kagan R. Revision Risk for Total Knee Arthroplasty Polyethylene Designs in Patients 65 Years of Age or Older: An Analysis from the American Joint Replacement Registry. J Bone Joint Surg Am 2022;104:1548–53. https://doi.org/10.2106/JBJS.21.01251.

40. American Academy of Orthopaedic Surgeons (AAOS). American Joint Replacement Registry (AJRR): 2024 Annual Report. Rosemont, IL: 2024.

41. Australian Orthopaedic Association National Joint Replacement Registry (AOANJRR). Hip, knee and shoulder arthroplasty: 2024 Annual Report. Adelaide: Australian Orthopaedic Association; n.d.

42. Wang K, Sun H, Zhang K, Li S, Wu G, Zhou J, et al. Better outcomes are associated with cementless fixation in primary total knee arthroplasty in young patients: A systematic review and meta-analysis of randomized controlled trials. Medicine (Baltimore) 2020;99:e18750. https://doi.org/10.1097/MD.0000000000018750.

43. Chen C, Li R. Cementless versus cemented total knee arthroplasty in young patients: a meta-analysis of randomized controlled trials. J Orthop Surg Res 2019;14:262. https://doi.org/10.1186/s13018-019-1293-8.

44. Sinicrope BJ, Feher AW, Bhimani SJ, Smith LS, Harwin SF, Yakkanti MR, et al. Increased Survivorship of Cementless versus Cemented TKA in the Morbidly Obese. A Minimum 5-Year Follow-Up. J Arthroplasty 2019;34:309–14. https://doi.org/10.1016/j.arth.2018.10.016.

45. Goh GS, Fillingham YA, Sutton RM, Small I, Courtney PM, Hozack WJ. Cemented Versus Cementless Total Knee Arthroplasty in Obese Patients With Body Mass Index ≥35 kg/m2: A Contemporary Analysis of 812 Patients. The Journal of Arthroplasty 2022;37:688-693.e1. https://doi.org/10.1016/j.arth.2021.12.038.

46. Fillingham YA, Darrith B, Calkins TE, Abdel MP, Malkani AL, Schwarzkopf R, et al. 2019 Mark Coventry Award: A multicentre randomized clinical trial of tranexamic acid in revision total knee arthroplasty: does the dosing regimen matter? Bone Joint J 2019;101-B:10–6. https://doi.org/10.1302/0301-620X.101B7.BJJ-2018-1451.R1.

47. Elmenawi KA, Mohamed FAE, Poilvache H, Prokop LJ, Abdel MP, Bedard NA. Association Between Tranexamic Acid and Decreased Periprosthetic Joint Infection Risk in Patients Undergoing Total Hip and Knee Arthroplasty: A Systematic Review and Meta-Analysis of Over 2 Million Patients. J Arthroplasty 2024;39:2389-2394.e2. https://doi.org/10.1016/j.arth.2024.04.033.

48. Zhang Q, Chen Y, Li Y, Liu R, Rai S, Li J, et al. Enhanced recovery after surgery in patients after hip and knee arthroplasty: a systematic review and meta-analysis. Postgrad Med J 2024;100:159–73. https://doi.org/10.1093/postmj/qgad125.

49. Chen Z, Bains SS, Sax OC, Sodhi N, Mont MA. Optimal Method of Skin Wound Management for Total Knee Arthroplasty: A Systematic Review and Meta-Analysis. J Knee Surg 2024;37:238–47. https://doi.org/10.1055/s-0043-1768248.

50. Ainslie-Garcia M, Anderson LA, Bloch BV, Board TN, Chen AF, Craigie S, et al. International Delphi Study on Wound Closure and Incision Management in Joint Arthroplasty Part 2: Total Hip Arthroplasty. The Journal of Arthroplasty 2024;39:1524–9. https://doi.org/10.1016/j.arth.2024.01.047.

51. Romanini E, Zanoli GA, Ascione T, Balato G, Baldini A, Foglia E, et al. Barbed sutures and skin adhesives improve wound closure in hip and knee arthroplasty. Knee Surgery, Sports Traumatology, Arthroscopy 2024;32:303–10. https://doi.org/10.1002/ksa.12055.

52. Tan Z, Tomaszewski J, Chen BP-H, Gunja NJ, Etter K. Use of interrupted time-series analyses in evaluating health economic outcomes following implementation of multilayer water-tight wound closure in a primary total joint arthroplasty population. Journal of Comparative Effectiveness Research 2024;13:e230110. https://doi.org/10.57264/cer-2023-0110.

53. Cai DF, Fan QH, Zhong HH, Peng S, Song H. The effects of tourniquet use on blood loss in primary total knee arthroplasty for patients with osteoarthritis: a meta-analysis. J Orthop Surg Res 2019;14:348. https://doi.org/10.1186/s13018-019-1422-4.

54. Pavão DM, Pires eAlbuquerque RS, de Faria JLR, Sampaio YD, de Sousa EB, Fogagnolo F. Optimized Tourniquet Use in Primary Total Knee Arthroplasty: A Comparative, Prospective, and Randomized Study. The Journal of Arthroplasty 2023;38:685–90. https://doi.org/10.1016/j.arth.2022.10.026.

55. Zak SG, Yeroushalmi D, Long WJ, Meftah M, Schnaser E, Schwarzkopf R. Does the Use of a Tourniquet Influence Outcomes in Total Knee Arthroplasty: A Randomized Controlled Trial. The Journal of Arthroplasty 2021;36:2492–6. https://doi.org/10.1016/j.arth.2021.02.068.

56. Ahmed I, Chawla A, Underwood M, Price AJ, Metcalfe A, Hutchinson CE, et al. Time to reconsider the routine use of tourniquets in total knee arthroplasty surgery. Bone Joint J 2021;103-B:830–9. https://doi.org/10.1302/0301-620X.103B.BJJ-2020-1926.R1.

57. Ahmed I, Chawla A, Underwood M, Price AJ, Metcalfe A, Hutchinson C, et al. Tourniquet use for knee replacement surgery. Cochrane Database Syst Rev 2020;2020:CD012874. https://doi.org/10.1002/14651858.CD012874.pub2.

58. Cheng FB, Ji XF, Lai Y, Feng JC, Zheng WX, Sun YF, et al. Three dimensional morphometry of the knee to design the total knee arthroplasty for Chinese population. Knee 2009;16:341–7. https://doi.org/10.1016/j.knee.2008.12.019.

59. Dai Y, Scuderi GR, Bischoff JE, Bertin K, Tarabichi S, Rajgopal A. Anatomic tibial component design can increase tibial coverage and rotational alignment accuracy: a comparison of six contemporary designs. Knee Surg Sports Traumatol Arthrosc 2014;22:2911–23. https://doi.org/10.1007/s00167-014-3282-0.

60. Hitt K, Shurman JR, Greene K, McCarthy J, Moskal J, Hoeman T, et al. Anthropometric measurements of the human knee: correlation to the sizing of current knee arthroplasty systems. J Bone Joint Surg Am 2003;85-A Suppl 4:115–22.

61. Maciąg BM, Stolarczyk A, Maciąg GJ, Dorocińska M, Stępiński P, Szymczak J, et al. Does the anatomic design of total knee prosthesis allow for a better component fit than its nonanatomic predecessor? A matched cohort Study. Arthroplast Today 2021;12:62–7. https://doi.org/10.1016/j.artd.2021.09.001.

62. Mahoney OM, Kinsey T. Overhang of the femoral component in total knee arthroplasty: risk factors and clinical consequences. J Bone Joint Surg Am 2010;92:1115–21. https://doi.org/10.2106/JBJS.H.00434.

63. Hsu RW, Himeno S, Coventry MB, Chao EY. Normal axial alignment of the lower extremity and load-bearing distribution at the knee. Clin Orthop Relat Res 1990:215–27.

64. Zhang Z, Zhang T, Zhang L, Chen Z, Zhao H, Kuang J, et al. Comparison of the coverage and rotation of asymmetrical and symmetrical tibial components: a systematic review and meta-analysis. BMC Musculoskeletal Disorders 2024;25:336. https://doi.org/10.1186/s12891-024-07466-2.

65. Shekhar A, Chandra Krishna C, Patil S, Tapasvi S. Does increased femoral component size options reduce anterior femoral notching in total knee replacement? J Clin Orthop Trauma 2020;11:S223–7. https://doi.org/10.1016/j.jcot.2019.03.006.

66. Alsiri N, Alshatti SA, Al-Saffar M, Bhatia RS, Fairouz F, Palmer S. EMMATKA trial: the effects of mobilization with movement following total knee arthroplasty in women: a single-blind randomized controlled trial. Journal of Orthopaedic Surgery and Research 2025;20:181. https://doi.org/10.1186/s13018-025-05568-8.

67. Ripoll S-Melchor J, Aldecoa CS, Fern Índez-Garc A R, Varela-Dur Ín M, Aracil-Escoda N, Garc A-Rodr Guez D, et al. Early mobilization after total hip or knee arthroplasty: a substudy of the POWER.2 study. Braz J Anesthesiol 2023;73:54–71. https://doi.org/10.1016/j.bjane.2021.05.008.

68. Lei Y-T, Xie J-W, Huang Q, Huang W, Pei F-X. Benefits of early ambulation within 24 h after total knee arthroplasty: a multicenter retrospective cohort study in China. Mil Med Res 2021;8:17. https://doi.org/10.1186/s40779-021-00310-x.

69. Thwin L, Chee BRK, Yap YM, Tan KG. Total knee arthroplasty: does ultra-early physical therapy improve functional outcomes and reduce length of stay? A retrospective cohort study. J Orthop Surg Res 2024;19:288. https://doi.org/10.1186/s13018-024-04776-y.

70. Bohl DD, Li J, Calkins TE, Darrith B, Edmiston TA, Nam D, et al. Physical Therapy on Postoperative Day Zero Following Total Knee Arthroplasty: A Randomized, Controlled Trial of 394 Patients. J Arthroplasty 2019;34:S173-S177.e1. https://doi.org/10.1016/j.arth.2019.02.010.

71. Sarpong NO, Boddapati V, Herndon CL, Shah RP, Cooper HJ, Geller JA. Trends in Length of Stay and 30-Day Complications After Total Knee Arthroplasty: An Analysis From 2006 to 2016. J Arthroplasty 2019;34:1575–80. https://doi.org/10.1016/j.arth.2019.04.027.

72. Mont MA, Abdeen A, Abdel MP, Al Mutani MN, Amin MS, Arish A, et al. Recommendations from the ICM-VTE: Hip & Knee. Journal of Bone and Joint Surgery 2022;104:180–231. https://doi.org/10.2106/JBJS.21.01529.

73. Mirghaderi P, Pahlevan-Fallahy M-T, Rahimzadeh P, Habibi MA, Pourjoula F, Azarboo A, et al. Low-versus high-dose aspirin for venous thromboembolic prophylaxis after total joint arthroplasty: a systematic review and meta-analysis. J Orthop Surg Res 2024;19:848. https://doi.org/10.1186/s13018-024-05356-w.

74. Warren JA, Sundaram K, Anis HK, Kamath AF, Higuera CA, Piuzzi NS. Have Venous Thromboembolism Rates Decreased in Total Hip and Knee Arthroplasty? J Arthroplasty 2020;35:259–64. https://doi.org/10.1016/j.arth.2019.08.049.

75. Migliorini F, Maffulli N, Velaj E, Bell A, Kämmer D, Eschweiler J, et al. Antithrombotic prophylaxis following total knee arthroplasty: a level I Bayesian network meta-analysis. Eur J Orthop Surg Traumatol 2024;34:2881–90. https://doi.org/10.1007/s00590-024-04071-w.

76. Jiang W, Yan Y, Huang T, Lin Z, Yang X, Luo Z, et al. Efficacy and safety of aspirin in venous thromboembolism prevention after total hip arthroplasty, total knee arthroplasty or fracture. Vasa 2024;53:314–25. https://doi.org/10.1024/0301-1526/a001129.

77. Guo X, Zheng S, Zhi Y. Comment on “The role of aspirin versus low-molecular-weight heparin for venous thromboembolism prophylaxis after total knee arthroplasty: a meta-analysis of randomized controlled trials”. Int J Surg 2024;110:621–2. https://doi.org/10.1097/JS9.0000000000000825.

78. Ding K, Yan W, Zhang Y, Li J, Li C, Liang C. The safety and efficacy of NOACs versus LMWH for thromboprophylaxis after THA or TKA: A systemic review and meta-analysis. Asian J Surg 2024;47:4260–70. https://doi.org/10.1016/j.asjsur.2024.02.113.

79. Lamplot JD, Wagner ER, Manning DW. Multimodal pain management in total knee arthroplasty: a prospective randomized controlled trial. J Arthroplasty 2014;29:329–34. https://doi.org/10.1016/j.arth.2013.06.005.

80. Qiu H, Yu L, Wang Q, Liu Z, Li L. Clinical Efficacy, Analgesic Efficacy, and Effects of Cocktail Analgesic Regimens in Patients Undergoing Total Knee Arthroplasty: A Systematic Review and Meta-Analysis. Altern Ther Health Med 2024;30:279–85.

81. Jiang J, Teng Y, Fan Z, Khan MS, Cui Z, Xia Y. The efficacy of periarticular multimodal drug injection for postoperative pain management in total knee or hip arthroplasty. J Arthroplasty 2013;28:1882–7. https://doi.org/10.1016/j.arth.2013.06.031.

82. Bandholm T, Wainwright TW, Kehlet H. Rehabilitation strategies for optimisation of functional recovery after major joint replacement. J Exp Orthop 2018;5:44. https://doi.org/10.1186/s40634-018-0156-2.

83. Bouché P-A, Corsia S, Nizard R, Resche-Rigon M. Comparative Efficacy of the Different Surgical Approaches in Total Knee Arthroplasty: A Systematic-Review and Network Meta-Analysis. The Journal of Arthroplasty 2021;36:1187-1194.e1. https://doi.org/10.1016/j.arth.2020.09.052.

84. Walker H, Rao A, Tsimiklis J, Smitham P. Are short term outcomes superior following total knee arthroplasty when infra-patellar fat pad is resected? A systematic review and meta-analysis. ANZ J Surg 2024;94:1234–9. https://doi.org/10.1111/ans.19148.

85. Liu P, Lu F, Chen J, Xia Z, Yu H, Zhang Q, et al. Should synovectomy be performed in primary total knee arthroplasty for osteoarthritis? A meta-analysis of randomized controlled trials. J Orthop Surg Res 2019;14:283. https://doi.org/10.1186/s13018-019-1332-5.

86. Liu L, Li J, Wang Y, Li X, Han P, Li X. Different modalities of patellar management in primary total knee arthroplasty: a Bayesian network meta-analysis of randomized controlled trials. J Orthop Surg Res 2024;19:74. https://doi.org/10.1186/s13018-024-04546-w.

87. Burnett R, Barrack R. Computer-assisted Total Knee Arthroplasty Is Currently of No Proven Clinical Benefit: A Systematic Review. CLINICAL ORTHOPAEDICS AND RELATED RESEARCH 2013;471:264–76. https://doi.org/10.1007/s11999-012-2528-8.

88. Sava M-P, Hara H, Alexandra L, Hügli RW, Hirschmann MT. Verasense sensor-assisted total knee arthroplasty showed no difference in range of motion, reoperation rate or functional outcomes when compared to manually balanced total knee arthroplasty: a systematic review. Knee Surg Sports Traumatol Arthrosc 2023;31:1851–8. https://doi.org/10.1007/s00167-023-07352-9.

89. Namireddy SR, Gill SS, Yaqub Y, Ramkumar P. Computerized Versus Traditional Approaches for Total Knee Arthroplasty: A Quantitative Analysis of Knee Society Score and Western Ontario and McMaster Universities Osteoarthritis Index. Orthop Surg 2024;16:1530–7. https://doi.org/10.1111/os.14103.