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Does Surgical Approach Matter in Arthroplasty? A Surgeon's Perspective from Exposure to Execution

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Learning Point of the Article:

Surgical approach should not be defended as an ideology. Its value is whether it allows the surgeon to expose, mobilize, reconstruct, and – when necessary – extend the operation safely, while minimizing unnecessary soft-tissue trauma. A smaller incision is not a better approach if the surgeon has to fight the anatomy.

Abstract

Introduction: Orthopedic surgeons often debate approach as though the incision itself determines outcome: Direct anterior versus posterior total hip arthroplasty (THA), or medial parapatellar versus quadriceps-preserving total knee arthroplasty (TKA). In practice, the approach is the operating platform on which every subsequent decision is made. It determines visualization, retraction, soft-tissue release, component access, the ease of restoring biomechanics, and the surgeon's ability to manage difficulty. In direct anterior THA, the skin incision is rarely the limiting step; femoral mobilization is. In direct anterior approach THA, a reproducible supine workflow, controlled capsular and peri-femoral release, appropriate leg positioning, fluoroscopic verification, and a willingness to enlarge or extend exposure when required are more important than preserving the label of "minimally invasive." Our recent experience in younger, osteonecrosis-dominant Indian cohorts also supports a pragmatic rather than dogmatic approach to capsular management and emphasizes the importance of surgeon experience and standardized technique. In TKA, the same principle applies differently: The arthrotomy matters, but the final reconstruction is determined more by bone resection, alignment philosophy, gap balance, and soft-tissue preservation. Robotic assistance makes these variables measurable and reproducible, but it cannot rescue poor exposure or replace surgical judgment. In our robotic workflow, we favor a bounded, phenotype-respecting strategy that minimizes bone resection and soft-tissue release while balancing gaps rather than forcing every knee to neutral mechanical alignment. Current evidence suggests that such functional alignment strategies can reduce releases, although consistent superiority in patient-reported outcomes remains unproven. Surgical approach therefore matters – not because one named approach is universally best, but because it sets the biological and mechanical conditions, in which a safe, accurate, and reproducible reconstruction must be achieved.

Keywords: Arthroplasty, direct anterior approach, surgical exposure, functional alignment, robotic-assisted total knee arthroplasty, soft-tissue preservation.

Introduction

The Problem with "Approach Wars"

The most unhelpful question in modern arthroplasty is often the most common one: "Which approach is best?" It invites surgeons to defend an incision rather than analyze an operation. Comparative literature shows that different approaches can produce different patterns of early pain, mobilization, operative difficulty, instability, nerve symptoms, and soft-tissue injury, yet durable superiority of one named approach across all patients and surgeons has not been established [1,2,3,4]. This does not

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make approach irrelevant. It means that approach is only one part of a larger reconstructive strategy.

In day-to-day arthroplasty practice, an approach matters at three moments. First, it must provide controlled exposure without excessive traction or retraction. Second, it must permit the planned reconstruction – cup position, stem access, joint-line restoration, bone cuts, gap balance, and stability – to be performed reproducibly. Third, it must give the surgeon a safe way out when the case stops being routine. The best approach is therefore not the smallest incision or the most fashionable interval. It is the one that allows the surgeon to execute the operation without fighting the anatomy.

Minimal Incision is Not Minimal Trauma

A limited exposure can be biologically expensive. Forceful retraction, repeated levering, prolonged traction, uncontrolled soft-tissue stripping, or performing bone preparation through an inadequate window may create more tissue injury than a slightly larger but controlled exposure. "Minimally invasive" should therefore describe the biological effect of the operation, not the length of the skin incision.

This distinction is especially important for experienced arthroplasty surgeons because proficiency often makes an exposure look deceptively simple. What appears to be a small-incision operation is usually the result of a standardized sequence, predictable assistant positioning, deliberate releases, optimized instrumentation, and an understanding of which structure is preventing progress. The surgeon should reduce unnecessary tissue disruption, but never at the expense of visualization, fixation, stability, or the ability to manage an intraoperative complication.

The Hip: In Direct Anterior Total Hip Arthroplasty (THA), the Femur is the Rate-Limiting Step

The direct anterior approach (DAA) illustrates this principle particularly well. The theoretical attraction of the DAA is familiar: An internervous and intermuscular interval, preservation of the posterior soft tissues, supine positioning, and the ability to use fluoroscopy during reconstruction. Early functional advantages have been reported in several comparative studies, while many differences diminish with longer follow-up [1,2]. In high-volume practice, however, the practical value of the DAA is less about the incision and more about whether the surgeon can make femoral exposure predictable.

Acetabular preparation is usually straightforward once the head is removed. The femoral side is where the approach is won or lost. Inadequate mobilization encourages levering on the greater trochanter, excessive traction, varus broaching, calcar injury, perforation, or an unnecessarily long procedure. Anatomical work has identified the superior capsule, ischiofemoral ligament, and selected short external rotators as important restraints to femoral elevation, and algorithmic release strategies have been described to improve exposure while avoiding indiscriminate soft-tissue sacrifice [5,6]. The practical message is simple: Release the structure that is limiting exposure rather than increasing force.

Our own DAA workflow has evolved around this principle. Supine positioning, a dedicated leg-positioning or traction system when useful, a reproducible capsular sequence, controlled femoral release, and fluoroscopic verification of cup position, offset, and limb length make the operation more repeatable [7]. The capsule is treated as a surgical variable rather than a doctrine. If it can be preserved or repaired without compromising exposure, that is reasonable; if excision is required for safe femoral preparation, that is also reasonable. In our recent retrospective series of 168 DAA THAs, capsular excision and repair produced similar 1-year functional outcomes, supporting intraoperative judgment rather than a universal rule [8].

This becomes particularly relevant in the Indian patient population, where many primary THAs are performed for osteonecrosis in younger patients rather than for an elderly osteoarthritis-dominant population. Our experience in an osteonecrosis cohort undergoing DAA THA showed that complications were uncommon but were strongly dependent on meticulous technique, standardized protocols, and recognition of approach-specific vulnerabilities [9]. Likewise, day-care DAA THA in carefully selected younger patients has been feasible when the surgical approach is embedded within a complete enhanced-recovery pathway rather than treated as the sole reason for early discharge [10].

The learning curve should not be minimized. Registry data suggest that the DAA learning curve may extend to approximately 100 cases, with higher early revision risk during the initial phase of adoption [11]. This is an important corrective to simplistic comparisons between approaches. A DAA performed by a surgeon with experience of only 30 cases may not be directly comparable to the same approach performed by an experienced, high-volume surgical team. Surgeon experience, operating-room workflow, instrumentation, and exposure strategy are part of the intervention.

The Knee: The Arthrotomy Matters, But the Alignment Philosophy Matters More

In TKA, the debate is different. The medial parapatellar

approach remains popular because it is extensile, familiar, and reliable. Subvastus, midvastus, and other quadriceps-preserving approaches may improve selected early recovery parameters, but systematic reviews have not shown one exposure to consistently dominate across range of motion, patient-reported outcomes, and reoperation [12,13]. Again, the lesson is not that approach is irrelevant. It is that the arthrotomy is only the beginning of the reconstruction.

The biological objective in TKA is to obtain sufficient visualization while preserving the extensor mechanism, collateral ligaments, and periarticular soft tissues as far as the deformity permits. In a straightforward knee, a smaller or quadriceps-preserving exposure may be entirely appropriate. In a stiff knee, a severe varus or valgus deformity, patella baja, or difficult revision, forcing a "minimal" exposure can be counterproductive. A few additional centimeters of controlled exposure may be less traumatic than repeated patellar eversion, forceful retraction, or unplanned soft-tissue injury.

Robotic assistance has shifted our thinking further because it separates the question of exposure from the question of alignment. The robot can tell the surgeon where the femur and tibia are being cut, how much bone is being removed, and how the gaps respond to component position. It does not decide which alignment philosophy is correct. In our current robotic TKA practice, we do not treat neutral mechanical alignment as an obligatory endpoint in every knee. We use the distal femoral phenotype as an anatomical anchor, respect constitutional varus or valgus when it remains within a safe envelope, keep tibial coronal alignment within conservative bounds (typically no more than approximately 3–4° of varus and only exceptionally 5°), minimize bone resection, and adjust component position to obtain balanced gaps with the least necessary soft-tissue release.

This is best considered a pragmatic, bounded form of functional alignment rather than a claim that one set of numbers should be applied to every knee. The important concept is that personalized alignment must still be bounded. Robotics makes small, intentional departures from neutral measurable and reproducible; it should not become a justification for recreating every pre-arthritic deformity without regard to implant mechanics, fixation, or long-term survivorship.

The evolving literature supports this more nuanced interpretation. A systematic review of robotic functional alignment reported encouraging accuracy and gap-balancing results but emphasized the need for stronger long-term evidence [14]. A randomized trial by Wang et al. found fewer soft-tissue releases and better selected early patient-reported outcomes with functional alignment than with mechanical alignment [15]. Conversely, the 2026 multicenter RASKAL randomized trial found no difference in knee injury and osteoarthritis outcome score-12 or other major patient-reported outcomes between functional and mechanical alignment through 2 years, although mechanical alignment required substantially more soft-tissue release (44.8% vs. 8.1%) [16]. For the operating surgeon, that is an important finding: An alignment strategy may be worthwhile because it reduces unnecessary release and makes the reconstruction more anatomical even before superiority in long-term patient-reported outcome measures (PROMs) is proven.

Technology Does Not Rescue Poor Exposure

Fluoroscopy in THA and robotics in TKA may improve precision but cannot overcome the limitations of a surgical approach. Fluoroscopy can confirm cup inclination, anteversion, offset, and limb length, but it cannot mobilize a tight femur or prevent excessive traction. A robot can execute precise tibial cuts but cannot compensate for inadequate exposure or prevent retractor-related ligament injury.

The real value of technology is that it converts previously subjective steps into measurable ones. That should make surgeons more – not less – responsible for the choices they make. Precision is useful only when the target is sensible. The robot tells us what we are cutting; it does not tell us why we should cut it. Likewise, fluoroscopy verifies a reconstruction; it does not substitute for exposure, implant feel, or judgment.

Current randomized and meta-analytic evidence reflects this distinction. Robotic TKA consistently improves the precision and reproducibility of planned component positioning, while improvements in patient-reported outcomes are smaller and less consistent [16, 17]. Technology should therefore be judged as an execution and measurement platform rather than as a new surgical approach.

Approach Matters Most When the Case Becomes Difficult

Surgeons should judge an approach not only by how elegantly it handles the easiest primary case but also by how safely it can be extended. Muscular patients, obesity, severe stiffness, coxa vara, deformity, ankylosis, previous surgery, poor bone quality, and intraoperative fracture rapidly expose the limitations of a dogmatic minimally invasive philosophy. The same is true in the knee when fixed deformity, scarred extensor mechanism, or revision implants require more exposure.

This does not mean every case should begin with an extensile exposure. It means the surgeon must know the next step before it is needed. In DAA THA, that may mean extending the capsular release, releasing additional femoral restraints, modifying limb position, or converting to a more extensile

exposure when necessary. In TKA, it may mean lengthening the arthrotomy or using a controlled extensile maneuver rather than damaging the quadriceps or collateral ligaments through force. A good approach should be scalable.

What Should We Actually Measure When Comparing Approaches?

Long-term PROM convergence is often used to argue that surgical approach does not matter. That conclusion is too simplistic. Approach-specific effects may be expressed primarily through operative time, blood loss, soft-tissue injury, early pain, mobilization, length of stay, dislocation, nerve symptoms, intraoperative fracture, wound problems, component positioning, and ease of revision [1, 18]. These are clinically relevant even if clinical or functional scores (like Harris hip scores, oxford knee scores, and forgotten joint scores) are identical at 1 or 2 years.

At the same time, small early statistical differences should not be marketed as proof that one approach is universally superior. The clinically useful question is whether an approach produces a reproducible benefit that survives differences in surgeon experience, patient anatomy, perioperative pathways, and implant choice. For that reason, surgeon volume and learning curve should be treated as part of the exposure being studied, not as background noise.

A Practical Surgeon's Framework

1. Expose what you need to see. Do not equate a smaller incision with less tissue trauma

2. Release anatomy deliberately. In the hip, identify the structure preventing femoral mobilization; in the knee, avoid compensating for component position with unnecessary ligament release

3. Reconstruct the patient, not a textbook number. Respect anatomy and phenotype within safe implant and alignment boundaries

4. Use technology to measure and verify – not to replace judgment. Precision is valuable only when the chosen target is appropriate

5. Choose an approach you can extend. A technique is not truly reproducible if it only works when the case remains easy.

Conclusion

Surgical approach still matters in arthroplasty, but not because anterior is inherently superior to posterior, or because a quadriceps-preserving knee exposure is inherently superior to a medial parapatellar arthrotomy. It matters because the approach determines the quality of exposure, the amount of tissue trauma required to obtain that exposure, and the conditions under which the reconstruction is executed.

Our own practice has increasingly moved away from approach dogma toward reproducible principles. In DAA THA, the critical step is controlled femoral mobilization through a standardized sequence, with capsular and soft-tissue management adapted to the anatomy rather than to ideology. In robotic TKA, the incision is less important than preserving tissue, minimizing bone resection, respecting phenotype within safe boundaries, and balancing the knee without unnecessary releases. Technology can make these decisions measurable and repeatable, but it cannot make them for the surgeon.

The most useful question is therefore not "Which approach is best?" It is: "Which exposure allows me, in this patient, to perform the intended reconstruction accurately, safely, and repeatedly – and still gives me a way out if the anatomy refuses to cooperate?" That is the standard by which an orthopedic surgeon should judge an approach.

Clinical Message

A surgical approach is an execution platform, not an identity. Select and modify the exposure according to the reconstruction required, preserve tissue where it does not compromise safety, and use fluoroscopy or robotics to verify a sound surgical plan rather than compensate for an inadequate one.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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