Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2024 Sep 15; 12(3):443-447.
https://doi.org/10.3889/oamjms.2024.11943
eISSN: 1857-9655
Category: *C - Case Reports*
Section: *Case Report in Surgery*

Revision Surgery due to Patient Dissatisfaction with Remaining Valgus leg Alignment after Kinematically Aligned Total Knee Arthroplasty: A Case Report

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Edited by: Igor Spiroski
Citation: Jerele E, Mirt PK. Revision Surgery due to Patient Dissatisfaction with Remaining Valgus leg Alignment after Kinematically Aligned Total Knee Arthroplasty: A Case Report. Open Access Maced J Med Sci. 2024 Sep 15; 12(3):443-447. https://doi.org/10.3889/oamjms.2024.11943
Keywords: Total knee arthroplasty; Kinematic alignment; Restricted kinematic alignment; Valgus alignment; Revision surgery
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Received: 06-Jul-2024
Revised: 30-Jul-2024
Accepted: 02-Sep-2024
Ahead of print: 10-Sep-2024

Funding: This research did not receive any financial support
Competing Interests: The authors have declared that no competing interests exist

Abstract

BACKGROUND: The kinematic alignment (KA) technique aims to achieve true resurfacing of the knee joint and recreate prearthritic anatomy while preserving soft tissues. However, it remains uncertain whether all prearthritic anatomies are biomechanically equivalent and if KA is suitable for cases with extreme anatomical variations.

CASE PRESENTATION: The case of a 75-year-old female patient with a moderate valgus deformity who underwent kinematically aligned total knee arthroplasty (TKA) was reported. The patient required early revision surgery due to persistent pain in the medial collateral ligament area and dissatisfaction with the postoperative leg alignment.

CONCLUSION: There is a paucity of studies addressing the outcomes of kinematically aligned TKA in patients with valgus knees. Concerns persist regarding the suitability of unrestricted KA for all anatomical variations, particularly extreme ones. This case underscores the importance of considering restricted KA as a potentially safer alternative. In addition, patient perception of limb alignment and appearance significantly impacts the success of total knee arthroplasty, particularly in cases with valgus deformities.

Introduction

The kinematic alignment (KA) technique aims to achieve true resurfacing of the knee joint and restore the prearthritic anatomy while preserving the surrounding soft tissues [1], [2]. This approach contrasts with the mechanical alignment technique, which focuses on aligning the knee components to a neutral mechanical axis. KA strives to personalize the alignment to each patient's unique anatomical features, theoretically providing a more natural joint movement and improved functional outcomes.

Despite its advantages, there are concerns regarding the biomechanical equality of all prearthritic anatomies and the suitability of KA for patients with extreme anatomical variations. Specifically, the variability in knee anatomy among patients poses a challenge. While some knees may respond well to KA, others with significant deformities or unusual anatomy may experience suboptimal results. In such cases, restricted KA (rKA) might be a more reasonable approach. rKA modifies the principles of KA to impose certain restrictions, potentially leading to better outcomes for patients with complex anatomical deviations [3], [4].

A critical consideration in total knee arthroplasty (TKA) is patient satisfaction, which is influenced not only by the functional outcomes but also by the esthetic appearance of the lower limb. Esthetic concerns can significantly affect a patient's perception of the surgery's success, particularly in cases of noticeable deformities. Therefore, it is crucial to address both functional and aesthetic expectations during preoperative planning and patient consultations.

In this context, we present a case of a 75-year-old female patient with a moderate valgus deformity. The patient experienced knee pain due to advanced osteoarthritis and was also disturbed by the esthetic appearance of her lower limb. She underwent kinematically aligned TKA (KA-TKA) but required early revision surgery due to persistent pain in the medial collateral ligament area and dissatisfaction with the postoperative leg alignment. This case highlights the complexities of applying KA in patients with significant anatomical variations and underscores the importance of considering rKA and thorough preoperative discussions about patient expectations.

Case Presentation

A 75-year-old female with advanced degenerative osteoarthritis in the lateral compartment and moderate valgus deformity underwent TKA of the right knee using a calipered unrestricted KA protocol. She had pain in the lateral and medial compartments and had difficulty walking due to valgus leg alignment. The preoperative range of motion was 0 to 115°. Five years ago, she underwent mechanically aligned TKA (MA-TKA) on her left knee, and she was satisfied with the result, although she had a prolonged rehabilitation period (she used crutches for more than 3 months). On the right knee, we decided to use KA-TKA to accelerate the recovery process. The preoperative hip-knee-ankle angle (HKAA) of 8° was measured in the long leg X-ray. The implants were all cemented medially stabilized (GMK® Sphere, Medacta International SA, Castel San Pietro, Switzerland). A midline skin incision with medial parapatellar arthrotomy was used. The postoperative HKAA was 7°. The postoperative course was uneventful, and she underwent a course of standard physiotherapy. At the 4-month follow-up visit, she complained about remaining pain at the medial site of the knee and in the right ankle due to planovalgus foot deformity. She also expressed dissatisfaction with remaining valgus alignment of the leg and difficulty walking (feeling of stumbling), which was even worse than before surgery. Physical examination of the right knee revealed full range of motion from 0° to 130° and no pain during movement. Patella tracking was good. There was a swollen area at the medial site of the knee, the palpation of which resulted in pain. The postoperative wound healed well. Collateral ligaments were stable. There was planovalgus deformity of both feet, but the pain was only on the medial arch of the right foot. The long leg X-ray of both legs showed intact TKA with remaining valgus alignment of both legs with HKAA of the right leg 7° and HKAA of the left leg 2° (Figure 1). The patient agreed to minor surgery, but she refused exchange of all components. Because she was satisfied with left TKA (with minor residual valgus alignment), we chose 2° valgus limb alignment as a goal. The author performed revision surgery with release of the iliotibial band, posterolateral capsule, and tibial recut in a more varus position. The primary tibial component was changed for one size smaller, short-stemmed revision component. The femoral component was left intact. A primary fixed-bearing implant of 10 mm was changed to a primary fixed-bearing implant of 17 mm. At the 1-month follow-up visit, the patient was almost pain-free and was able to walk without crutches, which she could not have performed before. Physical examination revealed a range of motion from 0° to 115° with minimal pain in extreme flexion. Collateral ligaments were stable. The postoperative wound healed well. The long leg X-ray revealed intact TKA and HKAA of 2° (Figure 2). 1 year after surgery, the patient is satisfied with the result, and physical examination revealed painless range of motion from 0° to 130°.

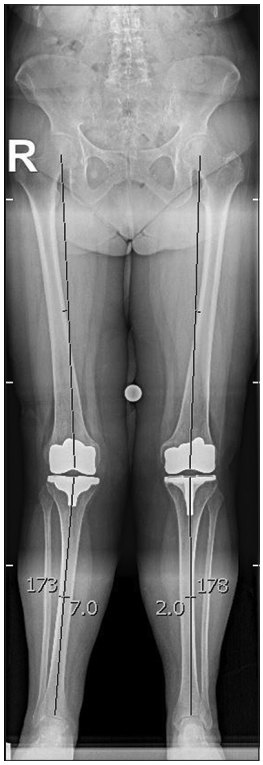

Figure 1: Standing long leg anteroposterior view X-ray of both legs, before revision surgery

Discussion

The primary goal of KA in TKA is to recreate the knee's prearthritic anatomy, preserving soft tissues and aiming for a more natural joint movement. However, not all prearthritic anatomies are biomechanically equivalent. Extremes in anatomical variation, often influenced by factors such as trauma, tumors, childhood deformities, or previous surgeries, may present biomechanical challenges. Replicating these altered anatomies could negatively impact TKA biomechanics and longevity [2], [4]. For instance, significant valgus or varus angulations in component alignment could lead to early loosening [5], [6].

In such cases, rKA, which reproduces the patient's native anatomy within a safe range, might be more suitable. This approach limits overall lower limb coronal orientation within ±3° of neutral and femoral and tibial components coronal alignment to within ±5° of neutral [2], [3], [4]. Our case involved a patient with an 8° valgus deformity, for whom true KA was achieved without complications during the primary surgery, and the wound and soft tissue healed favorably.

Howell *et al*. found no correlation between postoperative limb alignment (0.8° varus, ranging from 10° valgus to 8.5° varus) or tibial component alignment (mean 1.9° varus, ranging from −7° valgus to 7° varus) and clinical outcomes at midterm (mean 6.3 years). Notably, all five revisions in their study involved patients with neutrally aligned KA-TKA [7].

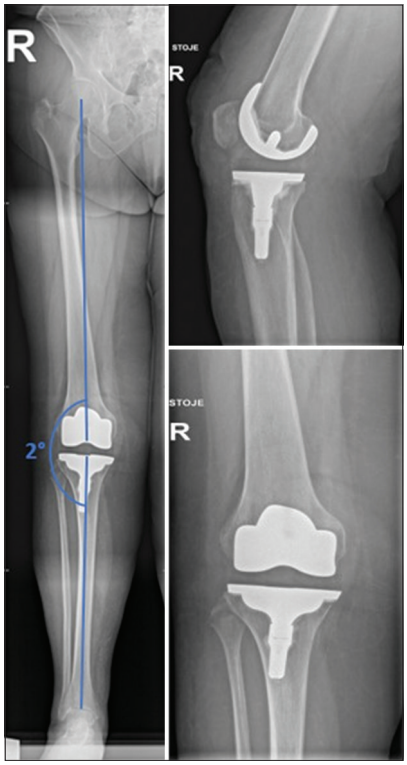

Figure 2: Standing right leg long leg anteroposterior view X-ray and right knee X-ray in anteroposterior and lateral view

Extra-articular deformities, which lead to pathological joint line angles, are limitations for KA. Patients with extreme alignments often have extra-articular deformities, such as tibia valga deformity in extreme valgus or a bowed femur in extreme varus. KA preserves ligaments but does not address limb deviation from extra-articular pathology. In contrast, rKA corrects extra-articular pathology with intra-articular cuts, though it may require ligamentous release to avoid secondary instability. MA would necessitate even larger corrections [4], [8].

Our patient had a flexible planovalgus deformity in both feet, which worsened on the right foot after KA-TKA. Post-revision TKA with HKAA correction alleviated the foot pain.

Studies demonstrate that a significant proportion of patients are within the safe range for pure KA or with minimal corrections. Almaawi *et al*. reported 51% of patients were suitable for pure KA and 83% for KA with minimal corrections [9]. Huber *et al*. found 44% suitable for true KA and 56% for rKA, with 10% of all patients receiving soft tissue release [5]. In our practice, using an unrestricted KA protocol for 3 years, this was the first case necessitating systematic soft tissue release during primary surgery.

Approximately 10% of TKA patients have valgus deformity, presenting surgical challenges that KA-TKA can often mitigate [10]. However, while the surgical technique in KA-TKA does not differ between valgus or varus knees, valgus deformity remains critical for KA. There is a paucity of studies specifically reporting clinical outcomes for KA-TKA in valgus knees. Bar-Ziv *et al*. observed that while significant improvements in pain and function were recorded in both varus and valgus groups, the varus group had better extension and overall scores [10].

Howell *et al*. reported rare reoperations after unrestricted KA-TKA, with all revisions occurring in patients with an extreme valgus phenotype [11]. Our minor revision surgery was straightforward, with no issues removing the polyethylene and tibial component.

Shelton *et al*. found higher satisfaction rates in patients with KA-TKA compared to those with MA-TKA on the contralateral leg, highlighting patient preference for KA-TKA outcomes and recovery [12]. Our patient's dissatisfaction with the physical appearance and walking difficulty post-surgery underscores the importance of addressing patient expectations during preoperative planning.

Gandhi *et al*. emphasized that patient perception of alignment and appearance significantly impacts TKA outcomes. Their study found that dissatisfaction with postoperative leg alignment correlated with poorer perceptions of pain and range of motion, despite no significant differences in clinical scores [13]. This reinforces the necessity of considering patient perceptions and expectations to optimize TKA outcomes.

Implication

This case study highlights critical implications for the practice of KA in TKA, particularly concerning patient expectations and the suitability of KA in valgus knees. The patient's dissatisfaction with the esthetic outcome and persistent pain post-surgery underscore the importance of aligning surgical goals with patient expectations through thorough preoperative discussions. The case also emphasizes that while KA aims to recreate prearthritic anatomy, its application in patients with significant anatomical variations, such as moderate-to-severe valgus deformities, may require careful consideration. The use of rKA could be a safer alternative in these instances, potentially reducing complications and enhancing long-term outcomes.

Limitation

The limitations of this case study are noteworthy, particularly its focus on a single patient, which restricts the generalizability of the findings. The absence of long-term follow-up data post-revision surgery limits the understanding of the durability and effectiveness of both the initial KA-TKA and the subsequent revision procedure. In addition, the patient's unique anatomical features, such as the planovalgus foot deformity, may not be representative of the broader population undergoing KA-TKA, although most patients with valgus knee osteoarthritis have a mild planovalgus foot deformity at least. The reliance on subjective

measures of satisfaction, such as esthetic outcomes and pain, highlights the need for objective, standardized assessments in future studies. Consequently, further research with larger patient cohorts and extended follow-up is essential to validate these observations and develop comprehensive guidelines for the use of KA and rKA in patients with complex anatomical variations.

Conclusion

The use of KA in TKA can address many challenges associated with valgus knee deformity. However, there is a notable paucity of studies specifically examining the outcomes of KA-TKA in valgus knees. Concerns persist about whether all anatomical variations, particularly extreme ones, are suitable for unrestricted KA or if rKA may provide a safer alternative. This case underscores the significant impact of patient perception regarding limb alignment and appearance on the overall success of TKA, particularly in valgus knees.

The report highlights the first revision case at our institution due to patient dissatisfaction with postoperative leg alignment following KA-TKA. This case serves as an important reminder for practitioners to consider and discuss patients' expectations and esthetic concerns during preoperative planning, especially for those with valgus deformities. It emphasizes the need for further research to develop comprehensive guidelines that ensure both functional and patient satisfaction outcomes in KA-TKA procedures.

Declarations

Ethics approval and consent to participate

Not applicable

Consent for Publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Availability of Data and Material

The data used and analyzed during the current study are not openly available due to reasons of sensitivity and are available from the corresponding author on reasonable request. Data are located in controlled access data storage at General Hospital Novo mesto.

Authors' Contributions

PKM performed all examinations and surgeries, analyzed, and interpreted the patient's data. EJ collected the data. Both authors contributed equally in writing the manuscript. All authors read and approved the final manuscript.

Acknowledgments

The authors would like to thank Prof. Dr. Karmen Erjavec for her expert advice and encouragement throughout writing this article.

References

1. Lustig S, Sappey-Marinier E, Fary C, Servien E, Parratte S, Batailler C. Personalized alignment in total knee arthroplasty: Current concepts. SICOT J. 2021;7:19. https://doi.org/10.1051/sicotj/2021021
   PMid:33812467
2. Rivière C, Iranpour F, Auvinet E, Howell S, Vendittoli PA, Cobb J, *et al*. Alignment options for total knee arthroplasty: A systematic review. Orthop Traumatol Surg Res. 2017;103(7):1047-6. https://doi.org/10.1016/j.otsr.2017.07.010
   PMid:28864235
3. Rivière C, Lazic S, Boughton O, Wiart Y, Vïllet L, Cobb J. Current concepts for aligning knee implants: Patient-specific or systematic? EFORT Open Rev. 2017;3(1):1-6. https://doi.org/10.1302/2058-5241.3.170021
   PMid:29657839
4. Blakeney WG, Vendittoli PA, editors. Restricted Kinematic Alignment: The Ideal Compromise? In: Personalized Hip and Knee Joint Replacement. Cham: Springer; 2020. https://doi.org/10.1007/978-3-030-24243-5_17
5. Huber K, Christen B, Calliess S, Calliess T. True kinematic alignment is applicable in 44% of patients applying restrictive indication criteria-a retrospective analysis of 111 TKA using robotic assistance. J Pers Med. 2021;11:662.
6. Hsu CE, Huang JT, Tong KM, Huang KC. Total knee arthroplasty according to the original knee phenotypes with kinematic alignment surgical technique-early clinical and functional outcomes. BMC Musculoskelet Disord. 2020;21(1):839. https://doi.org/10.1186/s12891-020-03862-6
   PMid: 33308196
7. Howell SM, Papadopoulos S, Kuznik K, Ghaly LR, Hull ML. Does varus alignment adversely affect implant survival and function

six years after kinematically aligned total knee arthroplasty? Int Orthop. 2015;39(11):2117-24. https://doi.org/10.1007/s00264-015-2743-5

PMid:25823516

8. Calliess T, Ettinger M. Limits of kinematic alignment and recommendations for its safe application. Orthopade. 2020;49(7):617-24. https://doi.org/10.1007/s00132-020-03931-7

PMid:32494904

9. Almaawi AM, Hutt JR, Masse V, Lavigne M, Vendittoli PA. The impact of mechanical and restricted kinematic alignment on knee anatomy in total knee arthroplasty. J Arthroplasty. 2017;32(7):2133-40. https://doi.org/10.1016/j.arth.2017.02.028

PMid:28302462

10. Bar-Ziv Y, Beit Ner E, Lamykin K, Essa A, Gilat R, Livshits G, *et al*. Minimum 2-year radiographic and clinical outcomes of kinematic alignment total knee arthroplasty in the valgus knee. J Pers Med. 2022;12(7):1164. https://doi.org/10.3390/jpm12071164

PMid: 35887663

11. Howell SM, Gill M, Shelton TJ, Nedopil AJ. Reoperations are few and confined to the most valgus phenotypes 4 years after unrestricted calipered kinematically aligned TKA. Knee Surg Sports Traumatol Arthrosc. 2022;30(3):948-57. https://doi.org/10.1007/s00167-021-06473-3

PMid:33582829

12. Shelton TJ, Gill M, Athwal G, Howell SM, Hull ML. Outcomes in patients with a calipered kinematically aligned TKA that already had a contralateral mechanically aligned TKA. J Knee Surg. 2021;34(1):87-93. https://doi.org/10.1055/s-0039-1693000

13. Gandhi R, De Beer J, Petruccelli D, Winemaker M. Does patient perception of alignment affect total knee arthroplasty outcome? Can J Surg. 2007;50(3):181-6.