

# Analysis of Effective Risk Factors and Comparison of Treatment Methods in Instabilities Following Total Knee Arthroplasty

Atakan Telatar<sup>1</sup>, Yusuf Öztürkmen<sup>2</sup>, Ahmet Şenel<sup>2</sup>, Ziya Demirci<sup>3</sup>, Murat Eren<sup>4</sup>, Asiye Zuhul Baltacı<sup>5</sup>

<sup>1</sup>Medical Park Hospital, Clinic of Orthopaedics and Traumatology, Samsun, Türkiye

<sup>2</sup>University of Health Sciences Türkiye, İstanbul Training and Research Hospital, Clinic of Orthopaedics and Traumatology, İstanbul, Türkiye

<sup>3</sup>NHS Lanarkshire University Hospitals, Clinic of Orthopaedics and Traumatology, Wishaw, United Kingdom

<sup>4</sup>Örebro University Hospital, Clinic of Orthopaedics and Traumatology, Örebro, Sweden

<sup>5</sup>Rectorate, Big Data Coordination Office, Yalova University, Yalova, Türkiye

## ABSTRACT

**Introduction:** This study aimed to investigate the significant risk factors for instabilities following total knee arthroplasty (TKA) and to develop a treatment algorithm by evaluating the efficacy of treatments described in the literature.

**Methods:** Seventeen patients diagnosed with instability after TKA performed in University of Health Sciences Türkiye, İstanbul Training and Research Hospital, Clinic of Orthopaedics and Traumatology, between 2012 and 2017 were retrospectively evaluated. Preoperative data and radiological examinations were obtained from the hospital database, while postoperative data were recorded through direct outpatient follow-ups. Factors causing instability were identified from radiological examinations, physical findings, and intraoperative observations. Patients were classified into three groups: flexion instability, extension instability, and global instability. Ten patients received a total condylar constrained prosthesis, four received a hinged knee prosthesis, two underwent polyethylene (PE) insert exchange, and one patient was managed conservatively. Postoperative outcomes were assessed using the American Knee Society Clinical and Functional Scores, Lysholm score, pre- and post-treatment pain scores, and range-of-motion measurements.

**Results:** Obesity and age were found to be the most significant risk factors for post-TKA instability. Patients who underwent revision of all components showed statistically significant improvements in all scores postoperatively. No significant improvement was observed in patients treated with PE insert exchange or conservative management. There were no statistically significant differences in treatment outcomes among the different instability groups.

**Conclusion:** Early primary knee arthroplasty and obesity are risk factors for postoperative instability. Identifying the underlying cause and selecting an appropriate implant are crucial for successful treatment. The best outcomes were observed in patients who underwent revision of all components.

**Keywords:** tibiofemoral instability, total knee arthroplasty, revision knee arthroplasty

## Introduction

Total knee arthroplasty (TKA) is a surgical procedure that provides good or excellent outcomes in 92–97% of patients at 10–15 years of follow-up (1). Revisions of TKA are most commonly performed due to septic or aseptic loosening. However, instability has emerged as an important cause of early revisions. Among revision arthroplasty procedures performed within the first four years after TKA, those due to instability account for 10–22% of all cases (2).

Instability can be defined as excessive or abnormal motion of the structures forming the joint (2). It may occur immediately after TKA or develop progressively due to soft tissue deficiency, inadequate soft tissue or joint space balance, malalignment of components, or the use of

implants with inappropriate size or type (3). Various approaches, ranging from conservative methods to surgical techniques, are available for the treatment of instability following TKA. In this study, we aimed to identify risk factors contributing to instability following TKA. Additionally, we sought to evaluate the effectiveness of various surgical techniques employed in the treatment of this condition.

## Methods

Between 2012 and 2018, 978 primary TKAs were performed in our clinic; of these, 60 patients who underwent revision TKA were evaluated. Of these, 17 patients required revision surgery due to instability. One patient was excluded from the study due to the development of periprosthetic infection during follow-up.



**Address for Correspondence:** Atakan Telatar, MD, Medical Park Hospital, Clinic of Orthopaedics and Traumatology, Samsun, Türkiye

**E-mail:** atakantelatar@gmail.com **ORCID ID:** orcid.org/0000-0003-2993-6630

**Cite this article as:** Telatar A, Öztürkmen Y, Şenel A, Demirci Z, Eren M, Baltacı AZ. Analysis of effective risk factors and comparison of treatment methods in instabilities following total knee arthroplasty. İstanbul Med J. 2026; 27(4): 294-298

**Received:** 14.11.2025

**Accepted:** 22.07.2026

**Publication Date:** 30.10.2026



©Copyright 2026 by the University of Health Sciences Türkiye, İstanbul Training and Research Hospital/İstanbul Medical Journal published by Galenos Publishing House. Licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND) International License

All patients were followed for a minimum of six months. Preoperative data for revision surgery were obtained retrospectively from hospital archives, while postoperative data were collected through direct outpatient follow-up visits. Informed consent regarding the study process was obtained from all patients included in the study. The study was approved by the Clinical Research Ethics Committee of University of Health Sciences Türkiye, İstanbul Training and Research Hospital (approval number: 1107, date: 09.11.2017). Patients with septic or aseptic loosening; those with signs of periprosthetic infection without loosening; patients with neuromuscular diseases, extra-articular deformities, or patellofemoral instability were excluded from the study.

Patient age, sex, comorbidities, medical history, and smoking habits were recorded. Symptoms recorded in the patients' histories included anterior knee pain, a sensation of sliding or instability, catching or locking, difficulty going up or down stairs, weakness, and recurrent effusions. The type of implant used in the primary surgery and the indication for the primary procedure were noted. The presence of instability was assessed using anterior and posterior drawer tests, as well as varus/valgus stress tests at 15°, 30°, and 90° of knee flexion. Hyperextension instability was evaluated by forcibly extending the knee. Range of motion (ROM) and the presence of contractures were recorded. Gait was observed for varus/valgus drift, sagittal plane translation and hyperextension. Patellar tracking in the trochlear groove was examined. The integrity of the extensor mechanism was assessed by evaluating knee extension strength against resistance. Hip joint movements were assessed to investigate possible joint pathologies. The presence of foot and ankle deformities was noted. Patient height and weight were measured to calculate body mass index (BMI).

In all patients, C-reactive protein, erythrocyte sedimentation rate, and complete blood count were measured to rule out infection. Joint fluid was aspirated and cultured in patients with effusion or suspected infection. Radiological evaluation included weight-bearing anteroposterior (AP) and lateral knee radiographs. All patients underwent full-length orthoroentgenograms to assess the mechanical alignment of the lower extremities and to rule out additional deformities. Radiographs were evaluated using the American Knee Society Radiographic Evaluation and Scoring System (4).

The type of instability was determined based on physical examination and radiological evaluation. Patients were categorized into three groups: extension instability, flexion instability, and global instability. Patient histories and physical examination data, both preoperative and postoperative were assessed using the Knee Society Score (KSS) for knee and functional evaluations. Additionally, the Lysholm Scoring System (LSS) was used to evaluate knee stability. The visual analog scale (VAS) was employed to assess pain. ROM measurements were recorded.

The treatment methods applied to the patients were as follows: isolated polyethylene (PE) insert exchange in 2 patients; revision surgery with a rotating hinge knee prosthesis (RT-Plus Modular Rotating Hinged, Smith & Nephew, USA) in 4 patients; and revision with a total condylar constrained prosthesis (Vanguard SSK 360, Biomet, Inc., Warsaw, IN, USA) in 10 patients. In some patients, offset options were used to achieve proper alignment. In cases of bone defects, cement, allograft,

or metal augments were used depending on the size of the defect. No patients received a patellar component. All patients were discharged on postoperative day 4 or 5, after stabilization of vital signs and achievement of a 90° ROM. During outpatient follow-up, infection parameters were monitored and weight-bearing AP/lateral knee radiographs were obtained.

### Statistical Analysis

The Shapiro-Wilk test indicated that the data did not follow a normal distribution; therefore, non-parametric tests were used in the analysis. Results were presented as median (range) values. The Wilcoxon signed-rank test was used to compare preoperative and postoperative outcomes across all groups, while the Mann-Whitney U test was used to evaluate the relative success among different implant types. Statistical analyses were performed using IBM SPSS version 20.0 (IBM Corp, New York, NY, USA), with a significance level set at  $p < 0.05$ .

### Results

Between 2012 and 2017, our clinic performed 978 primary TKA and 60 revision knee arthroplasties. Among all surgeries, the 17 patients included in our study represented a 1.7% incidence of instability following primary TKA; among all revision surgeries, 28.3% were performed due to instability. All patients included in the study were female. The mean age at the time of revision surgery was 70.1 years (range, 57–84), while the mean age at the time of primary surgery was 62.9 years (range, 55–80). Five patients (31.25%) underwent right knee surgery, while 11 patients (68.75%) underwent left knee surgery. Twelve patients (75%) had undergone TKA in the contralateral knee. The mean BMI was  $36.7 \pm 5.1$  kg/m<sup>2</sup> (range, 31–47). The mean follow-up duration was  $16.4 \pm 10.1$  months. None of the patients had a history of smoking. No hip, foot, or extra-articular deformities were observed in any patient. The indications for primary surgery were primary osteoarthritis in 14 patients (87.5%), post-traumatic arthritis and rheumatoid arthritis in one patient each. Regarding the primary implant type, 14 patients (87.5%) received cruciate-retaining (CR) implants, while the remaining two patients received a posterior-stabilized (PS) implant and a constrained condylar implant, respectively.

Postoperative evaluations in all patients demonstrated significant improvements in all scores and in ROM values compared with the preoperative period (Table 1). The mean increase in KSS was 60 points; the mean increase in KSS functional scores was 40 points; and the mean increase in LSS was 60 points. An average reduction of 5 points was observed in VAS pain scores. The mean increase in ROM was 20 degrees.

In the group that underwent PE insert exchange, KSS clinical scores increased from 38.5 to 58.5, functional scores increased from 12.5 to 25, Lysholm scores increased from 16 to 19.5, and ROM increased from 95° to 100°. When the preoperative and postoperative values of the patients in this group were compared, no statistically significant differences were observed. When evaluated by implant type, the group that received a total condylar constrained knee prosthesis had higher KSS clinical and functional scores than the hinged knee prosthesis group, whereas the hinged knee prosthesis group had better Lysholm scores, VAS values, and ROM. However, the differences between the two groups were not

statistically significant ( $p>0.05$ , Table 2). No postoperative complications were encountered in any of the patients.

## Discussion

The findings of the study can be summarized as follows: All patients who developed instability after TKA were obese, underwent primary surgery under the age of 65, and had primary implants that were CR prostheses. Successful outcomes in the treatment of instabilities following TKA can be achieved with surgical techniques. The benefits of isolated PE-insert exchange are limited. There is no difference in postoperative success between constrained condylar knee prostheses and hinged prostheses for the treatment of tibiofemoral instabilities after TKA.

Obesity is one of the most prevalent problems of our time and is considered a risk factor for the development of osteoarthritis. In studies by Vazquez-Vela Johnson (6) and Kerkhoffs (5), the presence of obesity was associated with poor clinical scores and early loosening following TKA. In a study by Can et al. (7) focusing on patients who developed instability after TKA, obesity was suggested as a risk factor for the development of instability. According to the World Health Organization classification, among the patients in our study, one was overweight, seven were class 1 obese, five were class 2 obese, and four were class 3 obese (8). The distribution of patients in our study supports the hypothesis suggested in the literature that obesity may act as a risk factor for instability.

TKA is becoming increasingly common and is now also being sought by younger patients. In a study by Khan et al. (9) investigating causes of TKA failure and revision, younger age was identified as a major risk factor for early revision. Other studies have reported higher TKA failure rates in younger patients, likely due to their higher expectations for daily activity levels (6,10). The age distribution of patients in our study supports the finding in the literature that being under 65 years of age is a major risk factor for revision knee surgery.

Gender is considered a major risk factor for early knee revisions. In our study, however, all patients were female. In this respect, our study presents data that are inconsistent with the existing literature.

The relationship between factors causing osteoarthritis and surgical outcomes has been investigated in multiple studies. El-Galaly et al. (11) found that surgical outcomes for post-traumatic osteoarthritis were less successful compared to those for primary osteoarthritis, with higher rates of early revision in these patients. When comparing revision causes between the two groups, revision due to instability was higher in the post-traumatic osteoarthritis group (23%) compared to the primary osteoarthritis group (17%). In our study, the majority of patients had primary osteoarthritis. Our contribution to the literature on this point is limited because of the small sample size and unequal distribution.

Implant design in TKA affects postoperative outcomes. In Can et al. (7)'s study, all patients who developed instability had received CR

**Table 1. Results of the statistical analysis including all groups**

| Group                                                  | Score                | Preoperative |      |       |       | Postoperative |      |       |      | p      |
|--------------------------------------------------------|----------------------|--------------|------|-------|-------|---------------|------|-------|------|--------|
|                                                        |                      | n            | Med  | Range |       | n             | Med  | Range |      |        |
|                                                        |                      |              |      | Min   | Max   |               |      | Min   | Max  |        |
| All groups (patients undergoing revision knee surgery) | KSS knee score       | 16           | 21.0 | -13.0 | 49.0  | 16            | 79.0 | 48.0  | 95.0 | 0.000* |
|                                                        | KSS functional score | 16           | 27.5 | -20.0 | 60.0  | 16            | 70.0 | -10.0 | 90.0 | 0.000* |
|                                                        | Lysholm score        | 16           | 21.5 | 10.0  | 59.0  | 16            | 80.5 | 19.0  | 95.0 | 0.001* |
|                                                        | VAS                  | 16           | 7.0  | 5.0   | 9.0   | 16            | 2.0  | 0.0   | 7.0  | 0.001* |
|                                                        | Range of motion      | 16           | 75.0 | 45.0  | 120.0 | 16            | 95.0 | 70.0  | 120  | 0.002* |

\* $p<0.05$  indicates a statistically significant difference between groups. Med: Median, Min: Minimum, Max: Maximum, KSS: Knee Society Score, VAS: visual analog scale

**Table 2. Results of the statistical analysis according to implant types**

| Group                                | Score                | Preoperative |      |       |       | Postoperative |      |       |       | p     |
|--------------------------------------|----------------------|--------------|------|-------|-------|---------------|------|-------|-------|-------|
|                                      |                      | n            | Med  | Range |       | n             | Med  | Range |       |       |
|                                      |                      |              |      | Min   | Max   |               |      | Min   | Max   |       |
| Constrained condylar knee prosthesis | KSS knee score       | 10           | 21.0 | 1     | 46.0  | 10            | 86.5 | 63.0  | 95.0  | 0.831 |
|                                      | KSS functional score | 10           | 27.5 | -20.0 | 60.0  | 10            | 70.0 | -10.0 | 90.0  | 0.615 |
|                                      | Lysholm score        | 10           | 21.5 | 10.0  | 59.0  | 10            | 79.5 | 60.0  | 95.0  | 0.553 |
|                                      | VAS                  | 10           | 7.0  | 5.0   | 9.0   | 10            | 2.0  | 0.0   | 4.0   | 0.257 |
|                                      | Range of motion      | 10           | 75.0 | 45.0  | 120.0 | 10            | 92.5 | 70.0  | 120.0 | 0.660 |
| Hinged knee prosthesis               | KSS knee score       | 4            | 0.0  | -13.0 | 34.0  | 4             | 81.5 | 56.0  | 94.0  | -     |
|                                      | KSS functional score | 4            | 27.5 | -10.0 | 45.0  | 4             | 67.5 | 50.0  | 80.0  | -     |
|                                      | Lysholm score        | 4            | 7.5  | 19    | 37.0  | 4             | 1.5  | 80.0  | 90.0  | -     |
|                                      | VAS                  | 4            | 25.0 | 6     | 9.0   | 4             | 88.0 | 1.0   | 2.0   | -     |
|                                      | Range of motion      | 4            | 57.5 | 55    | 120.0 | 4             | 95.0 | 70.0  | 120.0 | -     |

\* $p<0.05$  indicates a statistically significant difference between groups. Med: Median, Min: Minimum, Max: Maximum, KSS: Knee Society Score, VAS: visual analog scale

prostheses during their primary surgery, and successful outcomes were reported after revision with PS prostheses. Another study by Hao et al. (12) observed that among patients with instability, more were in the PS prosthesis group compared to the CR system group. In our study, the majority of patients had CR systems implanted. Due to the small sample size and unequal distribution, our contribution to the literature on this point is limited.

Various surgical approaches exist to treat instability following TKA. PE insert exchange is one of the revision options and is a low-morbidity, technically simple procedure. Patel et al. (13) performed only PE insert exchanges in 93 revision surgeries for post-TKA instability and reported that 10% of patients required early component revision during follow-up. In another study by Tetreault et al. (14) reported a 15.5% risk of rerevision in 143 unstable knees treated with PE exchange. In our study, two patients underwent PE-insert exchange. Neither patient showed significant improvement in KSS knee scores, KSS functional scores, or Lysholm scores. VAS scores also did not show a meaningful improvement. We consider PE insert exchange alone insufficient to eliminate the underlying factor causing the instability.

The appropriate level of constraint for the implant used to treat post-TKA instability is another topic of debate. In a study by Luttjeboer et al. (15), KSS functional scores were significantly lower in the hinged group compared to the condylar knee prosthesis group. No significant differences were observed in KSS clinical scores or VAS scores. In this study, the condylar constrained group experienced more frequent postoperative complications and required reoperations due to recurrent instability compared to the hinged group (15). Houfani et al. (16) reported that, at five years of follow-up, hinged knee prosthesis revisions achieved good clinical outcomes in 77% of patients, whereas postoperative complications were observed in 29% of cases. In our study, total condylar constrained systems demonstrated higher clinical and functional KSS scores than the hinged group. The hinged group showed a minimal positive difference in VAS scores. Unlike other studies, we included the Lysholm score in our evaluation. The hinged knee prosthesis group had a higher mean Lysholm score than the condylar constrained system group. Similarly, compared with preoperative values, hinged systems were associated with greater postoperative improvements in ROM. However, no statistically significant differences were found between the two groups in any of these scores or values. In our study, two patients had complete loss of the LCL, and two had complete loss of the MCL. All four patients underwent revision with a hinged knee prosthesis and achieved successful outcomes. Clinical evaluations indicated that hinged systems provided better stability, although no difference in patient satisfaction was observed between the two groups. We recommend hinged-knee prostheses for patients whose advanced bone loss or ligamentous instability cannot be corrected with condylar-constrained systems. Although no significant differences were observed between the two groups in clinical and functional scores, we believe that condylar-constrained systems may be a better primary choice because they require less bone resection than revisions with hinged systems.

### Study Limitations

Our study has several limitations. First, because this was a retrospective study, we encountered challenges in accessing historical data. The demographic characteristics of our patients were largely homogeneous: all were female and obese. Therefore, we could not compare groups with different demographic characteristics. When determining risk factors, we had to interpret our data in the context of the literature rather than by directly comparing two groups. Additionally, the presence of greater instability in the hinged prosthesis group may have introduced a bias against this group. No inconsistencies between our results and the literature were observed.

### Conclusion

In this study, patients who developed instability after TKA were predominantly in the obese category and had undergone primary surgery before age 65 years. The effectiveness of isolated PE insert exchange in revisions for instability was limited. In cases of tibiofemoral instability, no significant difference in postoperative success was observed between total condylar constrained systems and hinged knee prostheses. Therefore, except when the use of a hinged knee prosthesis is indicated, such as in cases of excessive bone or soft-tissue loss, less-constrained systems are more appropriate.

### Ethics

**Ethics Committee Approval:** The study was approved by the Clinical Research Ethics Committee of University of Health Sciences Türkiye, İstanbul Training and Research Hospital (approval number: 1107, date: 09.11.2017).

**Informed Consent:** The patients were first informed about the study, and their consent to participate was obtained.

### Footnotes

**Authorship Contributions:** Surgical and Medical Practices - A.T., Y.Ö.; Concept - A.T., Y.Ö.; Design - A.T., A.Ş., Z.D., A.Z.B.; Data Collection or Processing - Z.D., M.E., A.Z.B.; Analysis or Interpretation - A.Ş., M.E., A.Z.B.; Literature Search - A.Ş., Z.D., M.E.; Writing - A.T., Y.Ö.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study received no financial support.

### References

1. Scott CEH, Snowden GT, Cawley W, Bell KR, MacDonald DJ, Macpherson GJ, et al. Fifteen-year prospective longitudinal cohort study of outcomes following single radius total knee arthroplasty. *Bone Jt Open*. 2023; 4: 808-16.
2. Al-Jabri T, Brivio A, Maffulli N, Barrett D. Management of instability after primary total knee arthroplasty: an evidence-based review. *J Orthop Surg Res*. 2021; 16: 729.
3. Athwal KK, Hunt NC, Davies AJ, Deehan DJ, Amis AA. Clinical biomechanics of instability related to total knee arthroplasty. *Clin Biomech (Bristol)*. 2014; 29: 119-28.

4. Ewald FC. The Knee Society total knee arthroplasty roentgenographic evaluation and scoring system. *Clin Orthop Relat Res.* 1989; (248): 9-12.
5. Kerkhoffs GM, Servien E, Dunn W, Dahm D, Bramer JA, Haverkamp D. The influence of obesity on the complication rate and outcome of total knee arthroplasty: a meta-analysis and systematic literature review. *J Bone Joint Surg Am.* 2012; 94: 1839-44.
6. Vazquez-Vela Johnson G, Worland RL, Keenan J, Norambuena N. Patient demographics as a predictor of the ten-year survival rate in primary total knee replacement. *J Bone Joint Surg Br.* 2003; 85: 52-6.
7. Can A, Erdogan F, Erdogan AO. Tibiofemoral instability after primary total knee arthroplasty: posterior-stabilized implants for obese patients. *Orthopedics.* 2017; 40: e812-9.
8. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *World Health Organ Tech Rep Ser.* 2000; 894: i-xii, 1-253.
9. Khan M, Osman K, Green G, Haddad FS. The epidemiology of failure in total knee arthroplasty: avoiding your next revision. *Bone Joint J.* 2016; 98-B: 105-12.
10. Anatone AJ, Richardson SS, Kahlenberg CA, Gausden EB, Figgie MP, Blevins JL. Decreased implant survival is associated with younger patients undergoing total knee arthroplasty. *HSS J.* 2022; 18: 290-6.
11. El-Galaly A, Haldrup S, Pedersen AB, Kappel A, Jensen MU, Nielsen PT. Increased risk of early and medium-term revision after post-fracture total knee arthroplasty. *Acta Orthop.* 2017; 88: 263-8.
12. Hao K, Niu Y, Feng A, Wang F. Coronal laxity at flexion is larger after posterior-stabilized total knee arthroplasty than with cruciate-retaining procedures. *J Arthroplasty.* 2023; 38: 1267-72.
13. Patel A, Egbulefu F, Berger RA, Gerlinger TL. Reevaluating isolated polyethylene revision for instability after total knee arthroplasty. *Knee.* 2023; 42: 186-92.
14. Tetreault MW, Hines JT, Berry DJ, Pagnano MW, Trousdale RT, Abdel MP. Isolated tibial insert exchange in revision total knee arthroplasty: reliable and durable for wear; less so for instability, insert fracture/dissociation, or stiffness. *Bone Joint J.* 2021; 103-B: 1103-10.
15. Luttjeboer JS, Bénard MR, Defoort KC, van Hellemond GG, Wymenga AB. Revision total knee arthroplasty for instability-outcome for different types of instability and implants. *J Arthroplasty.* 2016; 31: 2672-6.
16. Houfani F, Mainard D, Rubens-Duval B, Papin PE, Pasquier G, Ehlinger M; French Society for Orthopaedic, Trauma Surgery (SoFCOT). Rotating-hinge prosthesis for aseptic revision knee arthroplasty: a multicentre retrospective study of 127 cases with a mean follow-up of five years. *Orthop Traumatol Surg Res.* 2021; 107: 102855.