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What Are the Indications for Hinged Implants in Revision Total Knee Arthroplasty?

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What are the indications for a hinged implants in revision total knee arthroplasty?

Response/Recommendation: The three most commonly reported indications for using hinged-design implants in revision total knee arthroplasty (rTKA) are infection, instability, and aseptic loosening. However, these conditions rarely present in isolation and are often accompanied by additional factors such as pain, stiffness/arthrofibrosis, periprosthetic fracture, dislocation/subluxation, malalignment/malposition, mechanical failure, bone loss, patellar complications, and the need for revision of a previously implanted hinged prosthesis. Therefore, hinged implants should be considered in cases where major bone loss or compromised soft tissue and ligamentous integrity renders semiconstrained devices prone to failure.

Strength of Recommendation: Moderate.

Delegate vote: agree: 69%, disagree: 21%, abstain: 10%

Rationale

A systematic review was conducted to analyze the indications for hinged knee implants in revision total knee arthroplasty (rTKA). PubMed, Web of Science, and Scopus were searched from inception till March 27, 2024, for original articles on hinged implant indications in rTKA. Exclusion criteria were non-English language, case reports, sample size < 10, review articles, registry-based studies, studies with oncology cases, distal femur replacements, technique articles, nonhuman studies, and studies not reporting implant use indications. The Preferred Reporting Items for Systematic Review and Meta-Analysis guidelines were strictly followed [1]. Of the 2,349 articles identified, 58 met the inclusion criteria [2–59], representing 2,803 revision TKAs. Most studies were retrospective, providing level IV evidence. Table 1 summarizes the indications for hinged designs in rTKA. Table 1 shows the

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Table 1
Indications of Hinged Implant Designs in rTKA.

Indication	n	%
Infection	781	27.86
Instability	671	23.94
Aseptic loosening	665	23.72
Stiffness/Arthrofibrosis	228	8.13
Multiple reasons	128	4.57
Periprosthetic fracture	110	3.92
Dislocation/Subluxation	41	1.46
Malalignment/Malposition	40	1.43
Mechanical Failure	32	1.14
Bone loss	27	0.96
Patellar complications	24	0.86
Pain	17	0.61
Others	17	0.61
Revision of hinged as only indication	15	0.54
Not specified	7	0.25

rTKA, revision total knee arthroplasty.

list of indications with their share for the use of hinged designs in rTKA.

Hinged implants are increasingly used in complex rTKA cases involving substantial instability and bone loss, which compromise the performance and longevity of standard implant designs [60]. The three most commonly reported indications for considering hinged-implants in rTKA are infection, instability, and aseptic loosening. Although rTKA for infection could be done in a single-stage or two-stage revision, hinged design can be considered to compensate for the lack of stability after extensive debridement of bone and soft tissue. Apart from infection, instability—whether from direct ligamentous insufficiency or as a result of revision procedures that cannot be managed by less-constrained implants—is the next common indication, followed by aseptic loosening. From a clinical perspective, the above-mentioned indications are not usually as distinctive; rather, they present in a combined fashion, thereby making a case for the use of hinged knee designs. These high-risk scenarios are associated with an increased risk of reoperations and revisions. The common reasons for reoperation and revision following rTKA with hinged knee prosthesis are listed below in Table 2. The overall reported reoperation and revision rate in the included studies was 28.1%.

With the increase in modularity and next-generation rotating designs, hinged implants are now becoming an essential component in the arsenal of not only rTKA, but also in complex primary scenarios.

Table 2
The Common Reasons for Reoperation and Revision Following rTKA With hinged Knee Prosthesis.

Revision/Reoperation Causes	n	%
Infection	188	34.4
Aseptic Loosening	85	15.5
Patellar Complications	52	9.5
Wound complication	48	8.8
Arthrofibrosis	40	7.3
Implant Failure	24	4.4
Periprosthetic Fracture	50	9.1
Chronic Pain	12	2.2
Dislocation	15	2.7
Extensor Mechanism Failure	14	2.6
Instability	8	1.5
Polyethylene wear	7	1.3
Others	4	0.7
Total	547	100.00

rTKA, revision total knee arthroplasty.

Like all systematic reviews, this study had potential limitations. Significant heterogeneity and selection bias were present, and only English-language articles were included. Additionally, the inconsistency in reporting outcomes impeded a comprehensive quantitative analysis, and some studies lacked detailed patient demographics and comorbidity data, key factors influencing outcomes. Additionally, variations in the follow-up durations across studies may have affected long-term assessment of outcomes and mortality rates. Moreover, the diversity of implant designs and indications likely influenced the observed outcomes, reoperation/revision rates, and complication rates. Also, inconsistent differentiation between revisions and reoperations prevented definitive conclusions on these rates.

To conclude, in rTKA, the main reasons reported in the literature for considering hinged-design implants are infection, instability, and aseptic loosening. These indications, however, are rarely encountered in isolation. More often, they are combined or accompanied by additional factors such as pain, stiffness/arthrofibrosis, periprosthetic fracture, dislocation/subluxation, malalignment/malposition, mechanical failure, bone loss, patellar issues, and the need to revise an existing hinged prosthesis. Therefore, hinged implants should be considered in cases where major bone loss or compromised soft tissue and ligamentous integrity renders semiconstrained devices prone to failure.

CRediT authorship contribution statement

Ashraf T. Hantouly: Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Data curation, Conceptualization. **Sathish Muthu:** Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Mahmood Shahab:** Writing – review & editing, Writing – original draft, Supervision, Conceptualization. **Maritin Sarungi:** Writing – review & editing, Supervision, Conceptualization. **Aasis Unnanuntana:** Writing – review & editing, Conceptualization. **Brian Debeaubien:** Writing – review & editing, Writing – original draft, Supervision, Conceptualization. **Jacobus D. Jordaan:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. **Thorsten Gehrke:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. **Javad Parvizi:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. **Mustafa Citak:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization.

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