Section: Orthopaedics

Original Research Article

COMPARISON OF OUTCOMES BETWEEN SUBVASTUS AND PARAPATELLAR APPROACHES IN KNEE REPLACEMENT: A COMPARATIVE STUDY

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ABSTRACT

Background: The surgical approach in total knee arthroplasty (TKA) influences early recovery, pain, and functional outcomes. The subvastus approach preserves the extensor mechanism, while the parapatellar approach offers wider exposure but may delay quadriceps recovery. **Objectives:** To compare early and mid-term outcomes between subvastus and parapatellar approaches in primary TKA.
Materials and Methods: In this prospective, randomized comparative study, 120 patients with primary osteoarthritis of the knee were allocated to either the subvastus (n=60) or parapatellar (n=60) approach. Outcomes assessed included Knee Society Score (KSS), Visual Analog Scale (VAS) for pain, range of motion (ROM), and complication rates at 2 weeks, 6 weeks, and 6 months.
Results: The subvastus group demonstrated significantly lower VAS scores on postoperative day 3 (3.2 ± 0.8 vs. 4.6 ± 1.1, $p<0.05$), greater ROM at 2 weeks (95° ± 10° vs. 82° ± 12°, $p<0.05$), and earlier straight leg raise (78% vs. 52% by day 2). At 6 months, KSS was comparable between groups (85 ± 6 vs. 83 ± 7, $p>0.05$). Anterior knee pain was more frequent in the parapatellar group (22% vs. 10%).
Conclusion: The subvastus approach offers superior early recovery and reduced pain without compromising mid-term outcomes. Surgical expertise and patient selection remain key determinants of approach choice.
Keywords: Total knee arthroplasty, Subvastus approach, Parapatellar approach, Knee Society Score, Quadriceps recovery.

INTRODUCTION

Total knee arthroplasty (TKA) is a definitive treatment for advanced knee osteoarthritis. The surgical approach impacts postoperative pain, rehabilitation, and patient satisfaction. The medial parapatellar approach is widely used for its simplicity and exposure, but it involves splitting the quadriceps tendon.[1,2] The subvastus approach spares the extensor mechanism, potentially enhancing early recovery.[4,7] Several studies have compared these approaches, with some reporting faster functional recovery and less pain in the subvastus group,[4-6,8-12] while others found no significant long term differences.[5,6] This study compares functional and clinical outcomes between these two approaches in an Indian tertiary care setting.

MATERIALS AND METHODS

Design: Prospective, randomized comparative study
Setting: Pacific Institute of Medical Sciences, Udaipur
Sample Size: 120 patients (60 per group)
Inclusion Criteria: Age 50–75, primary OA, unilateral TKA
Exclusion Criteria: Prior knee surgery, inflammatory arthritis, BMI >35, deformity >20°
Randomization: Computer-generated sequence
Surgical Technique:

- *Subvastus:* Vastus medialis retracted, no tendon split

Parapatellar: Midline incision, patellar eversion
Post-op Protocol: Standard analgesia, early mobilization

Outcomes: KSS, VAS, ROM, complications
Statistics: t-test, chi-square, $p<0.05$ significant.

RESULTS

Table 1: Baseline Demographics

Parameter	Subvastus (n=60)	Parapatellar (n=60)	p-value
Age (years)	64.2 ± 5.8	63.7 ± 6.1	0.62
Male/Female	28/32	30/30	0.71
BMI (kg/m²)	27.4 ± 2.9	27.8 ± 3.1	0.48
Pre-op KSS	42 ± 8	43 ± 7	0.55

Table 2: Perioperative Metrics

Metric	Subvastus	Parapatellar	p-value
Operative time (min)	78 ± 12	74 ± 10	0.08
Blood loss (ml)	320 ± 50	340 ± 55	0.09
Hospital stay (days)	5.2 ± 0.9	5.4 ± 1.0	0.21

Table 3: Post-op Outcomes

Outcome	Subvastus	Parapatellar	p-value
VAS Day 3	3.2 ± 0.8	4.6 ± 1.1	<0.05
ROM at 2 weeks	95 ± 10°	82 ± 12°	<0.05
KSS at 6 months	85 ± 6	83 ± 7	>0.05

Table 4: Complications

Complication	Subvastus (%)	Parapatellar (%)	p-value
Anterior knee pain	10	22	<0.05
Infection	0	2	0.31
Lateral release	2	8	0.09

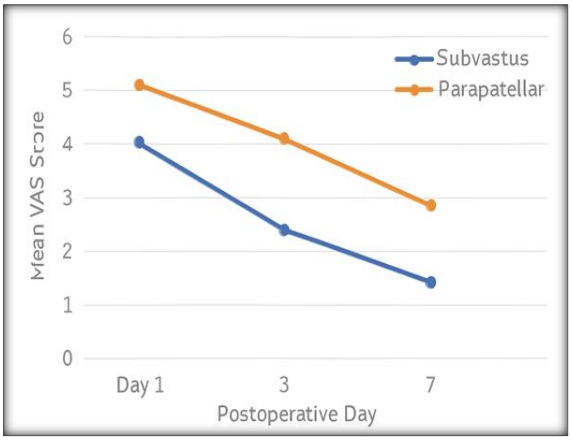

Figure 1: VAS Pain Scores Over Time

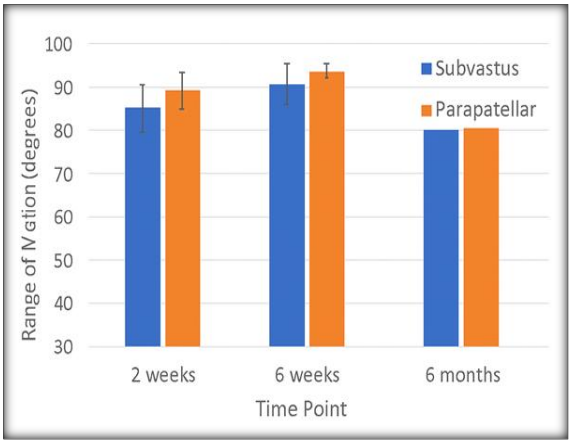

Figure 2: Range of Motion (ROM) Progression

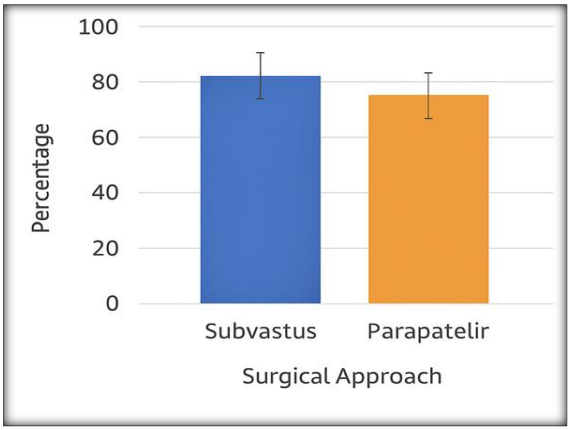

Figure 3: SLR Achievement Figures

Figure 1: VAS Pain Scores Over Time — Mean Visual Analog Scale (VAS) pain scores for subvastus and parapatellar groups on postoperative Days 1, 3, and 7. The subvastus group demonstrated consistently lower pain scores, with the greatest difference observed on Day 3 ($p<0.05$). Error bars represent standard deviation.

Figure 2: Range of Motion (ROM) Progression — Mean knee range of motion at 2 weeks, 6 weeks, and 6 months postoperatively. The subvastus group achieved significantly greater ROM at 2 weeks ($p<0.05$), with differences narrowing by 6 months. Error bars represent standard deviation.

Figure 3: Straight Leg Raise (SLR) Achievement by Day 2 — Percentage of patients in each group able to perform a straight leg raise by postoperative Day 2. The subvastus group demonstrated a significantly

higher proportion of early SLR achievement ($p<0.05$).

DISCUSSION

This study demonstrates that the subvastus approach in total knee arthroplasty (TKA) offers distinct advantages in the early postoperative period, particularly in terms of pain control, range of motion (ROM), and quadriceps recovery. These findings are consistent with the anatomical rationale behind the subvastus technique, which preserves the extensor mechanism by avoiding disruption of the quadriceps tendon and patellar eversion. As a result, patients in the subvastus group achieved straight leg raise (SLR) earlier and reported lower Visual Analog Scale (VAS) pain scores in the first postoperative week.

The improved early ROM observed in the subvastus group at two weeks aligns with prior studies by Hofmann et al. and Engh et al,[7,8] who emphasized the biomechanical benefits of muscle-sparing approaches. Although the parapatellar approach provides superior exposure, especially in complex or obese cases, it may contribute to delayed quadriceps activation due to tendon splitting and patellar manipulation.

Our findings are further supported by recent comparative trials. Fahim et al,[4] and Hosseini-Monfared et al,[5] reported similar trends in early functional recovery, with subvastus patients demonstrating faster mobilization and reduced analgesic requirements. Sukeik et al,[6] in a meta-analysis of short-term outcomes, concluded that subvastus TKA is associated with reduced pain, earlier SLR, and fewer lateral releases, although long-term functional scores converge between approaches.

At six months, both groups in our study achieved comparable Knee Society Scores (KSS), suggesting that while the subvastus approach accelerates early rehabilitation, it does not confer a significant long-term functional advantage. This echoes the conclusions of Matsueda et al,[2] and Cho et al,[12] who found no sustained differences in KSS or patient satisfaction beyond the early recovery phase.

Interestingly, the incidence of anterior knee pain was higher in the parapatellar group, which may be attributed to patellar eversion and altered patellofemoral mechanics. While this did not affect overall KSS, it could influence patient-reported outcomes and long-term comfort during activities such as stair climbing or kneeling. These findings are consistent with reports by Scuderi et al,[9] and Laskin,[10] who noted that patellar handling during surgery can impact anterior knee symptoms.

From a surgical standpoint, the subvastus approach requires greater technical expertise and may be challenging in patients with limited joint mobility, obesity, or severe deformity. However, in appropriately selected cases, it offers a less invasive alternative that promotes faster recovery, reduced analgesic requirements, and earlier discharge. Jung et al,[11] emphasized that surgeon experience is a key determinant of success with minimally invasive techniques, and our findings support this view.

In the context of enhanced recovery after surgery (ERAS) protocols, the subvastus approach aligns well with goals of early mobilization, reduced pain, and shorter hospital stay. As healthcare systems increasingly prioritize patient-centered outcomes and cost-effectiveness, approaches that facilitate early rehabilitation without increasing complication rates are highly valuable.

Overall, our study reinforces the growing body of evidence favoring the subvastus approach for improved early outcomes in TKA. While long-term functional results remain similar between techniques, the early benefits may translate into better patient satisfaction, faster return to activity, and reduced healthcare utilization. Future research should explore the impact of surgical approach on patient-reported outcome measures (PROMs), long-term patellofemoral function, and cost-effectiveness in diverse clinical settings.

CONCLUSION

The subvastus approach in total knee arthroplasty provides measurable advantages in the early postoperative period, including reduced pain, faster quadriceps recovery, and improved range of motion. These benefits, while most prominent within the first few weeks, do not compromise long-term functional outcomes when compared to the conventional parapatellar approach.

Although both techniques yield comparable Knee Society Scores at six months, the subvastus approach may enhance patient comfort, rehabilitation efficiency, and satisfaction during early recovery. Given its technical demands, this approach should be considered in patients with favorable anatomy and when performed by experienced surgeons.

As enhanced recovery protocols become increasingly central to joint replacement care, the subvastus approach offers a valuable option for optimizing short-term outcomes without sacrificing long-term success. Individualized surgical planning remains essential to ensure safe and effective implementation.

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