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Comparative Efficacy and Durability of Interventional Modalities for Chronic Knee Osteoarthritis Pain: A Comprehensive Review

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Abstract

Topic

Chronic Pain

Introduction

Knee osteoarthritis (OA) causes chronic pain and disability, necessitating effective non-surgical interventions for patients unsuitable for or averse to arthroplasty.

Materials and Methods

This review synthesized clinical data comparing intra-articular (IA) injections, genicular nerve blocks (GNB), and radiofrequency ablation (RFA), focusing on analgesic duration and functional recovery.

No IRB approval was required since no patients were involved and this study is a scientific review of literature.

Key Points

- IA corticosteroids provide rapid, short-term relief.
- Hyaluronic acid and biologics have variable longevity.
- GNB offers diagnostic utility and transient analgesia.
- RFA provides the most sustained pain reduction and functional improvement, often ≥ 6 months.
- The choice of intervention should be individualized based on patient characteristics, disease severity, and treatment goals.

Results

Table 1. Comparative Efficacy and Duration of Interventional Modalities

Modality	Mechanism of Action	Onset of Relief	Typical Duration of Analgesia	Functional Improvement	Key Considerations
Intra-articular Corticosteroids	Anti-inflammatory	Days–1 week	2–6 weeks	Minimal–moderate	Rapid relief, short duration, potential cartilage effects with repeated use
Hyaluronic Acid	Joint lubrication/ cartilage support	Weeks	3–6 months (variable)	Moderate	Variable efficacy, best in mild–moderate OA
Biologics (Platelet-rich plasma, stem cells, etc.)	Tissue regeneration/ anti-inflammatory	Weeks–months	3–12 months (variable)	Moderate–good	Heterogeneous evidence, cost, optimal preparation unclear
Genicular Nerve Block (GNB)	Nociceptive blockade	Hours–days	Days–weeks (transient)	Minimal–moderate (diagnostic utility)	Primarily diagnostic, may predict RFA response
Radiofrequency Ablation (RFA)	Neurotomy	Days–1 week	≥ 6 months (often longer)	Moderate–significant	Most durable relief, suitable for patients failing conservative care

Table 2. Summary of Key Studies

Study (Year)	Design / n	Intervention(s)	Follow-up	Key Findings
Choi et al. (2011)	RCT / 60	RFA vs control	6 months	Significant pain reduction and functional improvement with RFA (up to 6 months).
McAlindon et al. (2017)	RCT / 140	Triamcinolone vs saline	2 years	No significant long-term cartilage preservation; short-term pain relief with steroid.
McCormick et al. (2018)	RCT / 152	Cooled RFA vs steroid	12 months	RFA superior in pain relief at 3 and 12 months.
Jevsevar et al. (2015)	Systematic Review	Hyaluronic acid	Variable	Variable efficacy; modest pain relief in selected patients.
Conger et al. (2021)	Meta-analysis / 1,200+	RFA (various)	6–12 months	RFA significantly reduces pain and improves function vs conservative care (≥ 6 months).

Discussion

The therapeutic hierarchy in knee OA depends on distinct mechanisms: IA injections suppress localized joint inflammation, whereas genicular nerve interventions interrupt nociceptive transmission. While IA options provide immediate relief, their efficacy decays rapidly. Conversely, RFA offers prolonged neurotomy-driven analgesia, serving as a critical bridge for patients failing conservative care who are poor surgical candidates. Standardizing anatomical targets and patient selection criteria remains essential to optimize long-term clinical outcomes across these modalities.

Conclusions

- IA injections are effective for short-term relief, with variable durability.
- GNB is useful for diagnosis and short-term analgesia.
- RFA provides the most durable pain relief and functional improvement.
- Individualized patient selection and standardized techniques are key to optimal outcomes.

References

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