

Introduction

Osteoarthritis (OA) is increasingly viewed as a whole-joint disease involving subchondral bone.

Intraosseous (IO) injections, calcium phosphate (CaP), platelet-rich plasma (PRP), and mesenchymal stem cells (MSCs), have emerged as joint-preserving treatments for knee OA with bone marrow lesions (BMLs). This study aims to update and critically appraise clinical evidence on their safety, functional outcomes, retreatment rates, and conversion to total knee arthroplasty (TKA).

Methods

A systematic review of PubMed, Embase, and Google Scholar was conducted up to February 2025. Clinical studies reporting outcomes of IO injections with CaP, PRP, or MSCs for knee OA with ≥ 5 patients and ≥ 6 months of follow-up were included. Methodological quality was assessed using the modified Coleman Methodology Score and Cochrane Risk of Bias 2.0 tool.

Results

Twenty-four studies involving 1,109 patients (mean age 55 years; mean follow-up 38 months) met inclusion criteria: 10 on CaP, 6 on PRP, and 8 on MSCs. Five were randomized controlled trials (RCTs). Most studies reported significant improvements in pain and function. CaP injection outcomes were variable, with TKA conversion rates ranging from 1.3% to 45%. PRP and MSC studies showed favorable safety profiles and lower conversion rates. Long-term data from MSC studies, indicated sustained symptom relief and delayed TKA over up to 15 years. However, overall study quality was modest, with only one RCT rated as low risk of bias.

Conclusion

Intraosseous injections for knee OA, especially those involving MSCs, show promise in improving symptoms and delaying arthroplasty in selected patients. PRP offers a safer, less invasive alternative, while CaP may benefit specific populations but with more variable results. Standardized protocols and high-quality RCTs with long-term follow-up are needed to optimize patient selection and treatment efficacy.

