# Targeting the Gut Microbiome to Improve Outcomes in Osteoarthritis and Arthroplasty

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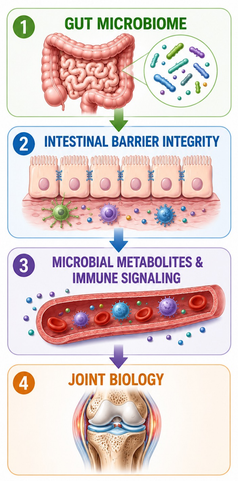
## 1. Introduction

**1- OA is a major driver of arthroplasty**
Osteoarthritis is a leading cause of pain, disability, and joint replacement worldwide.

**2- PJI remains a devastating complication**
Despite advances in surgery and perioperative care, PJI continues to cause substantial morbidity, mortality, and healthcare burden.

**3- The gut microbiome regulates host biology**
Gut microbial communities influence systemic inflammation, immune competence, metabolic homeostasis, and intestinal barrier integrity.

**4- Perioperative factors may disrupt microbial homeostasis**
Surgical stress, antibiotics, altered nutrition, and reduced mobility may perturb the gut microbiome during the perioperative period.




## 2. Aim & Methods

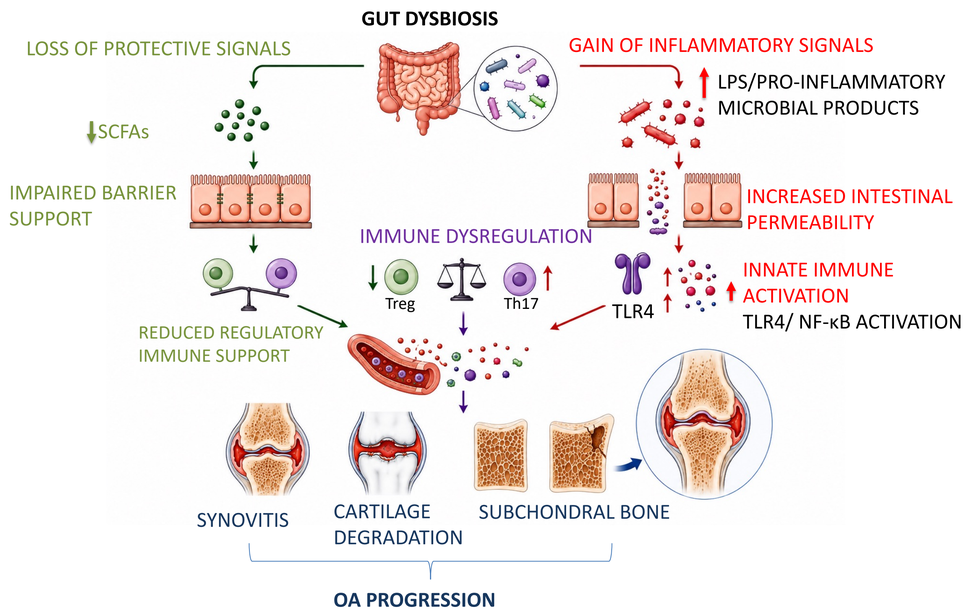
**Can targeting the gut microbiome improve outcomes across the osteoarthritis–arthroplasty continuum, including its potential relevance to PJI prevention?**

Structured narrative review
**Databases:** PubMed + Embase
**Search period:** From inception to December 2025
**Evidence:** Preclinical • Translational • Clinical
**Focus:** Gut dysbiosis • microbial metabolites • immune regulation • intestinal barrier function • OA • arthroplasty/PJI • microbiome-targeted interventions
**Additional studies:** Manual review of reference lists.

## 3. Results

### THE GUT–JOINT AXIS IN OSTEOARTHRITIS

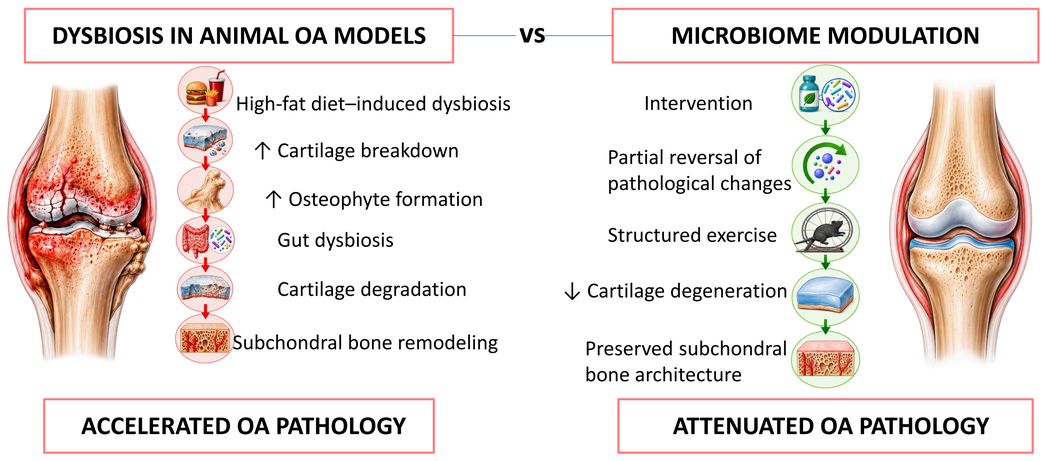
Mechanistic evidence: predominantly preclinical




Gut dysbiosis may promote OA progression by reducing protective microbial metabolites while amplifying barrier dysfunction and pro-inflammatory immune signaling.

### PRECLINICAL OA EVIDENCE

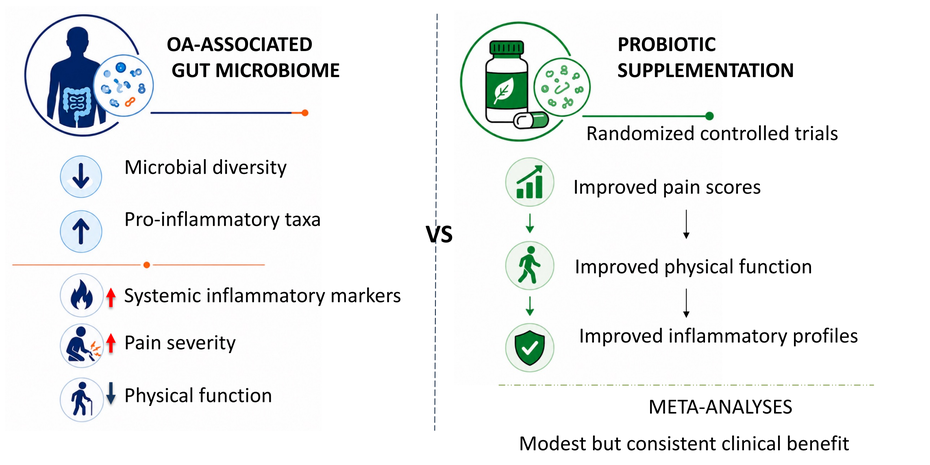
Dysbiosis accelerates OA pathology; microbiome modulation attenuates joint damage




Preclinical studies support an active role for the gut microbiome in OA pathogenesis: dysbiosis exacerbates structural joint damage, whereas microbiome-targeted modulation can partially reverse pathological changes.

### HUMAN OA EVIDENCE

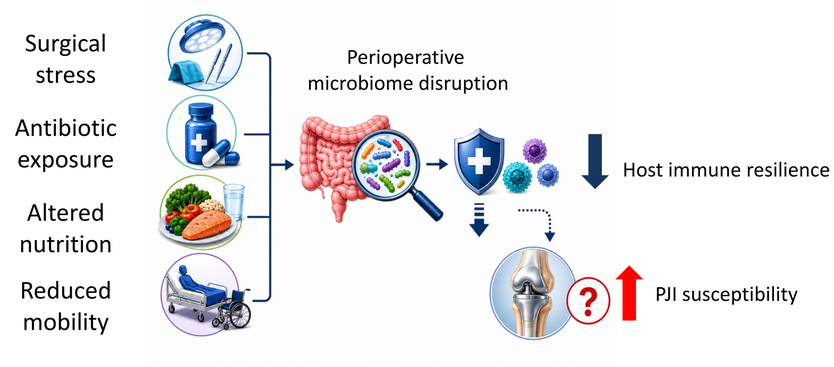
Human studies support a clinical gut–joint association and an early intervention signal




Human OA studies link gut dysbiosis with inflammation, pain, and functional impairment; probiotic trials show modest benefits, but treatment heterogeneity limits firm conclusions.

### ARTHROPLASTY & PJI RELEVANCE

Perioperative disruption of the gut microbiome may influence host immune resilience




**BIOLOGICALLY PLAUSIBLE — CAUSALITY NOT YET PROVEN**
Direct interventional evidence in orthopaedic populations remains limited.
The perioperative gut microbiome may represent a modifiable host factor, but its role in PJI prevention remains unproven.

## 4. Discussion

**BIOLOGICAL SIGNAL**
**Strong mechanistic + preclinical evidence**
Gut–joint interactions involve:
• Inflammation
• microbial metabolites
• barrier integrity
• immune regulation

**TRANSLATION GAP**
**Clinical evidence remains limited**
• Predominantly preclinical evidence
• Limited orthopaedic interventional trials
• Animal → human translation remains uncertain
• Inflammatory arthritis models ≠ direct OA equivalents

**CLINICAL CHALLENGES**
**Standardization + personalization**
• Strain/formulation
• dose • duration
• timing
• Age • diet
• comorbidities
• medications
• Baseline microbiome composition
• Perioperative antibiotics
• adherence • workflow

**NEXT STEP**
• **Prospective clinical validation**
• Adequately powered orthopaedic trials
• Microbiome + metabolomic + immunologic profiling
• Clinically meaningful outcomes
• Standardized + personalized interventions

**GOAL: CLINICALLY Validated**
MICROBIOME-INFORMED CARE
1. Reproducible
2. Personalized
3. Implementable

Promising biology must now be translated into standardized, patient-specific strategies and tested prospectively in real orthopaedic populations.

## 5. Conclusion

The gut microbiome is a promising, potentially modifiable host factor across the OA–arthroplasty continuum. Current evidence supports biological plausibility for OA modulation and perioperative immune resilience, but PJI prevention remains unproven; microbiome-targeted strategies should remain adjunctive and investigational pending prospective clinical validation.

## 6. References

**1. Ramasamy B, et al.** Role of gut microbiota disruption in prosthetic joint infection: a scoping review. *Lancet Microbe.* 2025;6:101193.

**2. Chisari E, Cho J, Wouthuyzen-Bakker M, Parvizi J.** Periprosthetic Joint Infection and the Trojan Horse Theory: Examining the Role of Gut Dysbiosis and Epithelial Integrity. *J Arthroplasty.* 2022;37:1369–1374.