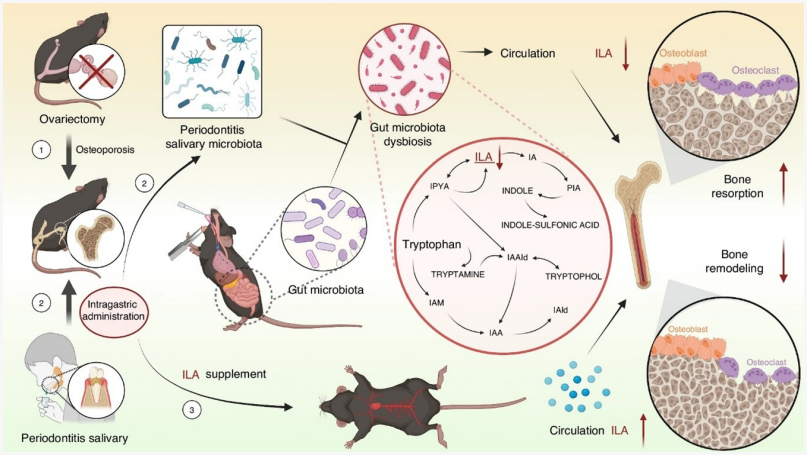
How Periodontitis-Linked Bacteria Accelerate Osteoporosis-Like Bone Loss Through the Gut

Researchers reveal that salivary bacteria from gum disease alter gut metabolism, driving osteoclast activity and systemic bone loss



Schematic illustration of the experimental design and mechanism showing how periodontitis-associated salivary microbiota disrupt gut metabolism, suppress tryptophan-derived ILA, and promote osteoclast-mediated bone loss.

CHINA, March 4, 2026 /EINPresswire.com/ -- Periodontitis-related bone loss is often considered a localized condition, leaving systemic consequences unclear. A new study shows that salivary microbiota from periodontitis patients can accelerate osteoporosis-like bone loss in ovariectomized mice by reshaping the gut microbiota and suppressing tryptophan metabolism. Using microbiota transfer, metabolomics, and cellular assays, the researchers identified indole-3-lactic acid as a protective metabolite that inhibits osteoclast formation, revealing a gut-mediated link between oral disease and systemic bone loss.

Periodontitis, a chronic inflammatory disease of the gums, affects hundreds of millions of people worldwide and is increasingly linked to systemic disorders beyond the oral cavity. Epidemiological studies have long suggested an association between periodontitis and osteoporosis, particularly in postmenopausal women, yet the biological mechanisms connecting these conditions have remained unclear. Growing evidence indicates that microbial communities play a central role in regulating immune responses and metabolism across distant organs, raising the possibility that oral microbes may influence bone health through indirect pathways.

To investigate this possibility, a research team was formed, led by Professor Fuhua Yan and researcher Dr. Fangfang Sun from Nanjing Stomatological Hospital, the Affiliated Hospital of the Medical School, Institute of Stomatology, Nanjing University, China. The researchers analyzed salivary microbiota from individuals with advanced periodontitis and compared them with samples from periodontally healthy donors. They then administered this microbiota to

ovariectomized mice, a well-established model of postmenopausal osteoporosis. This approach allowed the team to isolate the effects of oral microbial communities without confounding inflammatory factors. Their findings were published in Volume 18, Issue 1 of the International Journal of Oral Science on January 27, 2026.

Using high-resolution micro-CT imaging and histological analysis, the researchers observed that mice receiving salivary microbiota from periodontitis patients developed significantly reduced bone mineral density and deteriorated trabecular architecture compared with controls. These skeletal changes were accompanied by a marked increase in osteoclast numbers, indicating enhanced bone resorption.

Further investigation revealed that these bone effects were mediated through the gut. Although periodontal pathogens themselves did not dominantly colonize the intestine, the salivary microbiota from periodontitis patients reshaped the gut microbial ecosystem. Fecal microbiota transplantation experiments confirmed that gut dysbiosis alone was sufficient to reproduce bone loss in recipient mice. Metabolomic analyses of intestinal contents and serum showed that tryptophan metabolism was significantly suppressed, drawing attention to microbial metabolites as key signaling molecules in the oral–gut–bone axis.

Among the altered metabolites, indole-3-lactic acid (ILA) emerged as a critical protective factor. ILA levels were markedly reduced in mice exposed to periodontitis-associated microbiota. In cell-based experiments, ILA directly inhibited the differentiation and activity of osteoclasts, the cells responsible for bone resorption. When ILA was administered orally to affected mice, it restored bone density, improved trabecular structure, and significantly reduced osteoclast numbers, effectively reversing the skeletal damage.

“This study shows that oral health cannot be viewed in isolation from systemic physiology,” said Prof. Yan. “We were motivated by the clinical reality that many patients suffer simultaneously from periodontal disease and osteoporosis, yet treatment strategies rarely consider their biological connection.”

Dr. Sun added, “Our findings suggest that targeting gut microbial metabolism could open new preventive and therapeutic avenues in the future, not only for osteoporosis but also for other systemic diseases influenced by chronic oral inflammation.”

In the short term, this research highlights the importance of maintaining oral health as part of osteoporosis risk management and suggests that microbial metabolites could serve as early biomarkers or intervention targets. In the longer term, understanding how oral microbes modulate gut metabolism may enable microbiome-based therapies that reduce fracture risk and improve quality of life for aging populations. The work also paves the way for interdisciplinary collaborations among dentistry, microbiology, metabolomics, and bone biology, potentially reshaping how systemic diseases linked to chronic inflammation are prevented and treated.

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Reference
Title of original paper: Periodontitis-associated salivary microbiota exacerbates systemic osteoclastogenesis via gut modulation and tryptophan metabolism suppression in ovariectomized mice
Journal: International Journal of Oral Science
DOI: 10.1038/s41368-025-00415-2

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About Professor Fuhua Yan
Prof. Fuhua Yan is a Professor, PhD Supervisor at Nanjing Stomatological Hospital, Affiliated Hospital of the Medical School, Institute of Stomatology, Nanjing University, China. He serves as President-elect of the Society of Periodontology, Chinese Stomatological Association, and Vice President of the Chinese Stomatological Doctor Association. His research focuses on periodontal tissue engineering and regeneration, links between periodontal and systemic diseases, and implant restoration in periodontal conditions. He has completed 16 funded projects, including five National Natural Science Foundation grants, published over 100 papers, edited 18 monographs, received two major awards, supervised 66 graduates, and currently leads ten postgraduate researchers, earning him worldwide recognition.

About Dr. Fangfang Sun
Dr. Fangfang Sun is a researcher affiliated with Nanjing University, Nanjing, China, and a graduate of Hangzhou Dianzi University. She has authored numerous peer-reviewed publications, accumulating 1,466 citations and an h-index of 22. Her research focuses on biocomposite nanotechnology, advanced drug-delivery systems, virus detection technologies, and tissue engineering applications. Dr. Sun's interdisciplinary work bridges materials science, biomedical engineering, and translational research, enabling innovative strategies for disease

diagnosis, therapeutic development, and biomedical technology advancement across diverse clinical and experimental fields. Her contributions support collaborative research initiatives and promote the translation of nanotechnology-based solutions into practical medical and healthcare applications worldwide.

Funding Information
Financial support was provided by the National Natural Sciences Foundation of China (82270979), High-Level Hospital Construction Project (0224C001, 0224C050), and Cultivation Program for Reserve Talents for Academic Leaders (2023A208) of Nanjing Stomatological Hospital, Affiliated Hospital of Medical School, Institute of Stomatology, Nanjing University. The authors also thank BioRender for providing drawing elements.

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