

Why Oral Biology Belongs in Women's Health

A systems-based case for bringing oral biology into women's health research, policy and care

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Summary

Oral biology belongs in women's health because it responds to the same hormonal transitions that reshape the rest of the body. Yet it is largely absent from whole-body research on the menopause transition.

- **The claim.** Oral biology is a whole biological system, including saliva, the oral microbiome, the oral mucosa, gums, teeth, and supporting bone, not simply cavities or gum disease. It responds to hormonal change and is interconnected with inflammatory, immune, microbial, and bone-remodeling processes throughout the body.
- **Menopause.** The menopause transition is associated with changes across this system, including dry mouth, burning sensations, changes in the oral mucosa, shifts in the microbiome, and changes in periodontal tissues and bone. These occur alongside broader changes in inflammation, immunity, metabolism, and bone remodeling. Oral inflammation and microbial changes may, in turn, interact with systemic health. Periodontitis (gum disease) is one part of this broader, interconnected biology.
- **The evidence.** Oral inflammation, periodontal disease, and changes in the oral microbiome are associated with diabetes, cardiovascular disease, depression, and other conditions that affect women only, differently, or disproportionately. Treating periodontitis can improve some markers of systemic inflammation and metabolic health, although how treatment changes long-term disease outcomes remains under investigation.
- **The gap.** Despite this interconnected biology, oral measures are largely missing from the symptom scales, research frameworks, major cohorts, and research priorities shaping our understanding of menopause and midlife women's health.
- **The ask.** Include oral measures in women's health research. Name oral biology in research priorities. And ask women about oral symptoms as part of midlife care.

Why now

Menopause is being re-evaluated at the national level, in research, at the FDA and in Congress, and decisions about what it encompasses are being made *now*. The National Academies called for a broader vision of women's health research in 2025,¹ an October 2026 *Science* special issue reframed menopause as a whole-body transition,² and the American Heart Association updated its statement on periodontal disease and cardiovascular disease in December 2025, calling for closer medical–dental integration and more research.³ This momentum is now moving from research and policy discussion into concrete federal action:

- **First congressional hearing.** On September 16, 2026, the Senate Special Committee on Aging held the first congressional hearing on menopause. Senators Rick Scott and Kirsten Gillibrand asked the Government Accountability Office to review how the federal government funds and coordinates menopause research, training and care.⁴
- **Pending legislation.** The bipartisan Advancing Menopause Care and Mid-Life Women's Health Act (S 4503 in the Senate, HR 9090 in the House) would direct NIH to coordinate and expand menopause and midlife research across all of its institutes, fund clinician training and public education, and create Centers of Excellence.^{5,6} A separate Senate bill would direct the Defense Department and the Department of Veterans Affairs to evaluate menopause research among servicewomen and veterans.⁷
- **Hormone therapy.** In February 2026, the FDA approved revised labeling for six menopausal hormone therapy products, removing cardiovascular disease, breast cancer and probable dementia risk statements from the boxed warning, with more labels expected.⁸

These efforts will shape federal menopause research measures and funding. There is an opportunity to bring oral biology into the conversation now, before the priorities and the measures are established.

What is oral biology?

The term “oral health” is often discussed in terms of cavities, gum disease and tooth loss. Oral biology is the broader biological system of the mouth, including its tissues, saliva, microbes, immune activity and hormonal influences, and how these interact with the rest of the body.

- **Saliva and the salivary glands:** a fluid that lubricates, defends against microbes, buffers acid and protects teeth and tissue, made by glands that can be affected by hormones, autoimmune disease and medications.
- **The oral microbiome:** the community of microorganisms in the mouth, in constant exchange with host tissue and the immune system.
- **Oral mucosa:** the lining of the mouth, which acts as both a barrier and an immune interface.
- **Gums and supporting bone:** tissues that respond to inflammation and are remodeled continuously.
- **Hormonal and immune signaling:** estrogen and other hormonal signals, together with inflammatory and immune responses, that influence oral tissues, saliva, the microbiome, and bone.

All parts of oral biology act on each other. Saliva affects the oral microbiome, the microbiome influences the immune system, and hormones can affect all three. While gum disease is the most extensively studied part of oral biology, it represents only one component of a much broader biological system.

Why women, and why midlife

A hormone-responsive system

Oral biology is hormonally responsive, and the significance extends beyond hormone sensitivity alone. It also intersects with many of the conditions that affect women only, differently or disproportionately, including cardiovascular disease, autoimmune disease, osteoporosis, diabetes, and Alzheimer's disease, as discussed in the evidence section below. The oral cavity is part of a broader biological system involving immune activity, microbial ecology, saliva, epithelial barriers, inflammation, and bone remodeling. Many of these same processes change throughout the female body with age and declining estrogen.

The oral mucosa and its vaginal parallel

The oral mucosa is especially relevant. Oral and vaginal mucosa are biologically analogous, though not identical, hormone-responsive epithelial barriers. Both are lined by stratified squamous epithelium, contain estrogen receptors, and interact continuously with resident microbial communities and local immune systems. Both undergo changes associated with declining estrogen.^{9,10} In the vagina, declining estrogen is associated with epithelial thinning and impaired cell maturation, and with reduced, altered cervicovaginal mucus that can weaken barrier function. These changes occur alongside lower glycogen, higher pH and shifts away from *Lactobacillus*-dominant communities. These microbial shifts are most evident in women with symptoms, suggesting that changes in the epithelium and host defenses may be as important as the microbiome itself.^{11,12} The oral environment also changes during and after menopause, including changes in the oral mucosa and salivary function.¹⁰ But whether the mouth undergoes comparable changes in epithelial maturation, barrier function and microbial ecology has received far less study.

This raises an important research question: could estrogen-related changes in the oral mucosal barrier, including its maturation, salivary environment, and microbial ecology alter susceptibility to microbial translocation, local inflammation, or systemic inflammatory burden? Barrier integrity and microbial translocation are increasingly studied in the vaginal and gastrointestinal tracts, but the oral mucosa has received much less attention within this framework. Given the mouth's dense microbial ecosystem and vascular and immune interfaces, this represents an important gap.

Saliva, dry mouth and gum disease in midlife

In some studies, about 60% of postmenopausal women report dry mouth,¹³ and women are about nine times more likely than men to have Sjögren's disease, which causes severe dry mouth.¹⁴ Gum disease (periodontitis) also rises with age: depending on the survey years, about 42% to 47% of US adults 30 and older have it, and about 70% of those 65 and older, with a steeper rise in women.^{3,15,16} Together, these

patterns suggest that midlife is an important period for monitoring salivary function and periodontal health, particularly as hormonal, immune, medication-related and age-related changes begin to overlap.

Why oral biology belongs in the women's health framework

The larger question is whether a biological system involving hormones, immune activity, microbial ecology, saliva, epithelial barriers, inflammation, and bone remodeling can reasonably remain outside research frameworks studying those same processes throughout the rest of the female body. This does not mean oral biology matters only for women. It means its biology can be shaped differently in women, just as cardiovascular disease and diabetes can be. Women's health frameworks include conditions that 1) occur only in women, 2) occur most often in women, or 3) manifest differently in women because of sex-specific biology, hormonal transitions, life stages, symptoms, risk patterns, or disease trajectories. Oral biology belongs in this third category.^{1,17}

Menopause is associated with changes across the whole oral system

Reviews of the menopause literature describe changes across the oral system, not only in the gums. Most of the evidence is observational, however, making it difficult to separate the effects of declining estrogen from those of aging, medications and chronic disease.^{10,13}

Component	Reported around menopause	Why it matters
Saliva and salivary glands	Dry mouth in about 60% of postmenopausal women in some studies. ¹³	Saliva protects teeth and tissue; low flow raises the risk of decay, infection and microbiome shifts. ¹⁴
Oral lining (mucosa)	Dryness, burning, thinning and greater susceptibility to infection. ¹⁰	It resembles vaginal tissue in structure and estrogen response, ^{9,10} which makes it a candidate for the same menopause framework.
Oral microbiome	Shifts in microbial communities are described, but their clinical meaning is unclear. ^{10,13}	Oral microbes interact with immunity and may influence the gut and inflammation elsewhere. ¹⁸
Gums and supporting bone	Gum disease rises with age, ¹⁵ and is associated with osteoporosis in postmenopausal women. ¹⁹	Shared bone and inflammatory biology may link the mouth and skeleton; this is unresolved.
Immune and inflammatory signaling	Menopause raises systemic inflammation in many women, ²⁰ and gum disease adds to the inflammatory load. ²¹	Oral and systemic inflammation may reinforce each other.
Hormone therapy	Effects on saliva, oral tissue and microbes are not well established. ^{9,13}	Whether treatment changes the oral changes of menopause is an open question.

The evidence: association is consistent, causation is unproven

Oral inflammation, microbes, saliva and bone connect to systemic disease through several pathways. Gum disease is the best-studied window into this system, and clinical trials suggest that treating it can improve some blood markers, but more research is needed to understand how treatment affects clinical disease outcomes.

Pathway	What the evidence shows	How firm
Metabolic regulation	In people with diabetes, treating periodontitis has been associated with an average reduction of HbA1c of about 0.43 percentage points at three to four months, an improvement that has been described as comparable in magnitude to adding a second glucose-lowering medication. ^{22,23}	Strong evidence: A Cochrane systematic review found moderate-certainty evidence for this effect.
Inflammatory signaling	Treating periodontitis lowers C-reactive protein (CRP), a blood marker of inflammation. ²¹	Strong evidence for lower CRP; effect on disease outcomes unknown
Cardiovascular disease	In about 40,000 women followed for roughly 16 years, self-reported periodontal disease carried a 42% higher risk of major cardiovascular disease. ²⁴ The American Heart Association finds strong evidence that treatment improves blood pressure, HDL cholesterol and inflammatory markers, but none that it prevents cardiovascular events. ³	Strong association; benefit for risk markers, prevention of cardiovascular events has not been demonstrated
Immune-mediated disease	About 80% of people with autoimmune disease are women. ²⁵ Sjögren's disease, far more common in women, directly impairs the salivary glands, ¹⁴ and periodontitis is more common in lupus than in people without it (odds ratio 2.64). ²⁶	Association between periodontitis and other autoimmune diseases; established salivary gland involvement in Sjögren's
Bone remodeling	A meta-analysis links periodontitis with osteoporosis in postmenopausal women. ¹⁹	Association between periodontitis and osteoporosis
Microbial movement	Oral bacteria or their DNA have been detected away from the mouth: in atherosclerotic plaque, ³ in brain tissue from people with Alzheimer's disease, ²⁷ in some colorectal and pancreatic tumors, ²⁸ and in breast tumor tissue, where <i>Fusobacterium nucleatum</i> is enriched compared with matched healthy tissue. ²⁹ Daily toothbrushing reduces hospital-acquired pneumonia by about one-third (risk ratio 0.67), with the clearest benefit in patients on ventilators. ³⁰ Oral microbes may influence the gut and inflammation elsewhere. ¹⁸	Oral microbes are detected in other parts of the body, but their role in disease is still being investigated; clinical benefit of oral care is established for reducing hospital-acquired pneumonia.
Cognition	Periodontal disease is associated with dementia and cognitive impairment. ³ How oral bacteria might reach the brain is studied mostly in animal and laboratory work. ^{27,31}	Association established with cognitive impairment and dementia; mechanisms remain under investigation.

Pathway	What the evidence shows	How firm
Mental health	The odds of depression are about 1.4 times higher in perimenopause than before menopause. ³² Depression is associated with periodontitis (odds ratio about 1.3), caries and tooth loss in a 2026 meta-analysis of observational studies, which cannot show which comes first. ³³ In a national US survey, more than half of adults with moderate depressive symptoms had periodontal disease. ³⁴	Association with depression; direction and causality remain unclear

Most of these findings are observational, and shared risk factors such as smoking, diabetes and low income can confound them.³ Saliva, the oral mucosa and the microbiome have received far less attention than periodontitis, leaving important questions about their role in menopause and systemic health unanswered.

The gap: oral biology is largely absent from menopause research and frameworks

Despite its biological relevance, oral biology is rarely included in the research priorities, clinical frameworks and assessment tools that shape menopause care.

Source	How oral biology is included	Notes
Menopause Rating Scale	Not included	11-item symptom scale; asks about vaginal dryness but no oral symptoms. ³⁵
Kupperman Index and Greene Climacteric Scale	Not included	Neither includes oral symptoms. ³⁶
Menopause-Specific Quality of Life questionnaire	Not included	Includes vaginal and skin dryness, but no oral symptoms. ³⁶
<i>Science</i> 2026 menopause review	Not included	Describes menopause as a whole-body transition with up to 72 symptoms, but does not address oral biology. ²
National Academies 2025 women’s health report	Not included	Calls for a more integrated understanding of female biology across the life course but does not substantively address oral biology or include it among its research priorities. ¹
Office on Women’s Health, 2026 National Women’s Health Week focus areas	Not included	Addresses hormones, midlife and chronic disease without integrating oral health. ³⁷
American Heart Association 2025 statement	Oral-systemic, but not menopause-specific	Supports greater medical–dental integration but does not address impact of menopause or hormonal transitions. ³

Source	How oral biology is included	Notes
Office on Women's Health oral health page	Included as a separate oral-health topic	Recognizes menopause-related symptoms, including burning mouth, dry mouth and bone loss. ³⁸
NIH Office of Research on Women's Health, 2022	Included as a separate oral-health topic	Recognizes women's oral health as an often overlooked area. ³⁹

Oral health appears in women's health resources but remains largely separate from the frameworks used to study menopause and chronic disease. This reflects the longstanding separation of medicine and dentistry in the US healthcare system, not a lack of biological relevance. NIH's Office of Research on Women's Health has noted that features of the US health system encourage oral health to be treated separately from general health.³⁹ That separation carries into the research. The National Academies' 2025 report, *A New Vision for Women's Health Research*, calls for a more integrated understanding of female biology across the life course and highlights hormonal, immune, cardiovascular, metabolic, and other systemic processes, yet it does not substantively address oral biology or include it among its research priorities.¹ Studies that collect detailed hormonal, cardiovascular, and metabolic data may include few or no oral measures, while oral health studies may collect little information about hormones or the menopause transition.

The same pattern appears in the cohorts designed to follow women throughout midlife and the menopause transition.

Cohort	Oral measures found?	Notes
SWAN (3,302 women; ~20 years of follow-up through Visit 16)	No	Despite extensive longitudinal measures across the menopause transition, SWAN confirmed that no visit through Visit 16 collected dental or oral health information in any instrument, and that no site or ancillary study collected oral biological measures (Karla Ramos, SWAN Access, written communication, October 7, 2026). The published data collection schedule likewise lists no oral or dental assessments, but does include hearing, vision, vaginal microbiome and epithelial measurements. ⁴⁰
Women's Healthy Ageing Project (Melbourne)	None described	The published cohort profile describes extensive health and aging measures but does not identify oral health among its measures. ⁴¹
Women's Health Initiative	Yes, in an ancillary study	Oral health was assessed in the Buffalo OsteoPerio Study, which added clinical oral examinations in a subset of postmenopausal WHI participants rather than as a core measure across the broader cohort. ⁴²

What we do not know

Five questions remain unresolved, and menopause sits at the center of each.

- **Hormone effects.** We still do not know which oral changes are driven by hormonal changes, and which reflect aging, medications or chronic disease because few studies follow women longitudinally across the menopause transition.¹³
- **Causation.** It remains unclear how much of the oral-systemic relationship is causal because most evidence comes from observational studies.
- **Mechanisms.** It remains unclear which biological pathways drive oral-systemic relationships, including inflammatory signaling, microbial products entering the circulation or immune dysregulation.
- **Menopause and systemic links.** It remains unclear whether the menopause transition changes the relationship between oral and systemic health. For example, a 2026 systematic review of periodontitis and cardiovascular biomarkers found that none of the included studies analyzed women by menopausal status.⁴³
- **Hormone therapy.** It remains unclear whether menopausal hormone therapy improves the oral changes associated with menopause or whether oral tissues respond to treatment in ways similar to vaginal tissue. Evidence is limited, mostly observational and mixed; many studies cannot separate the effects of menopause from aging, and few include perimenopausal women.^{9,13} Long-term randomized studies have been called for since at least 2009.⁹

Recommendations

Closing the gap requires modest, practical changes. If only three happen, they should be these:

1. **Include menopausal status in oral-systemic research.** Collect and report data by menopause stage so researchers can determine whether these relationships change across the transition.
2. **Add oral symptoms to menopause assessments.** Include measures such as dry mouth, burning, and other oral changes in menopause symptom scales, clinical intake, and longitudinal studies.
3. **Include oral health explicitly in women’s health and menopause research priorities.** Name oral health explicitly in menopause and women’s health research agendas, funding priorities, and major cohort studies.

Audience	Recommended actions
Researchers	Include salivary function, oral mucosa, microbiome, periodontal and bone measures in midlife cohorts, alongside oral symptoms and mental health measures. Include perimenopausal women and oral outcomes in hormone therapy studies. Test whether treating periodontal disease throughout the menopause transition affects systemic markers and clinical outcomes.

Audience	Recommended actions
Funders and policymakers	Include oral biology explicitly in women's health and menopause research priorities. Fund integrated medical–dental research, as the American Heart Association has called for, ³ and datasets that link oral, hormonal and systemic measures.
Clinicians and professional bodies	Incorporate oral symptoms into routine midlife assessment, including dry mouth, burning, periodontal disease and tooth loss. Strengthen communication between medical and dental providers, particularly for women with diabetes, cardiovascular risk, autoimmune disease or severe dry mouth.

About this paper

This paper synthesizes selected research and policy sources to make the case that oral biology belongs in women's health research, policy and care. It is not a systematic review, and a more comprehensive review of the evidence base is currently being submitted to a peer-reviewed journal.

Statements about what documents omit reflect a review of the cited sources as of October 2026. SWAN Access confirmed in writing on October 7, 2026 that no visit through Visit 16 collected dental or oral health information in any instrument, and that no site or ancillary study collected oral biological measures. For the other cohorts, conclusions are based on the published schedules, codebooks and cohort profiles reviewed for this paper, and oral measures could appear in instruments or data sources not reviewed.

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Glossary

- **Oral biology:** the tissues, fluids, microbes and immune processes of the mouth, and how they interact with the rest of the body.
- **Periodontitis:** chronic inflammatory gum disease that damages the tissues supporting the teeth.
- **Oral microbiome:** the community of microorganisms that lives in the mouth.
- **Xerostomia:** the sensation of dry mouth, with or without reduced saliva flow.
- **HbA1c:** a blood test that reflects average blood sugar over about three months.
- **C-reactive protein (CRP):** a blood marker of inflammation.

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