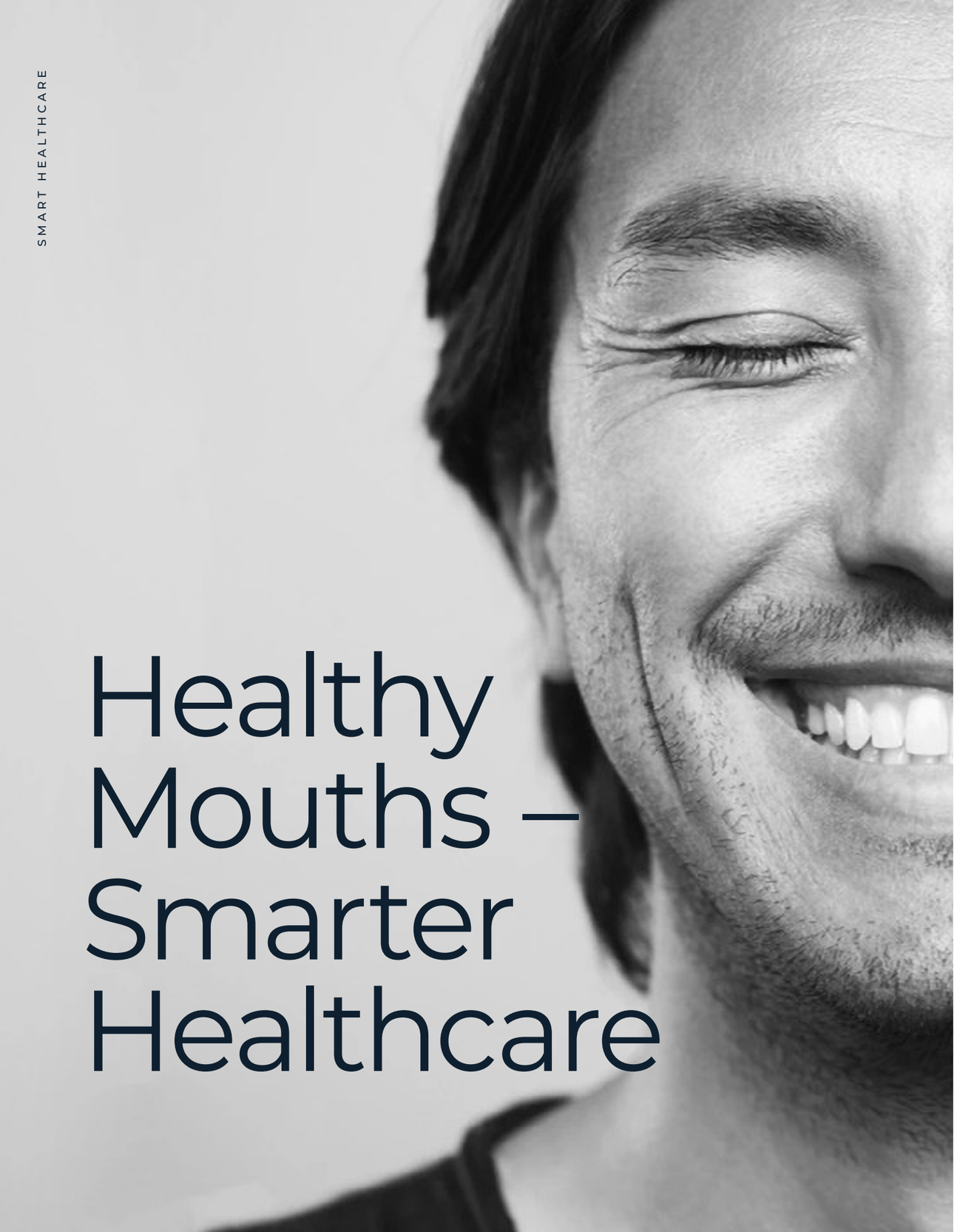


Healthy Mouths – Smarter Healthcare

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Can we afford to wait until prevention is no longer possible? Nearly 3.7 billion people live with oral diseases, close to half of the world's population. Yet healthcare systems still invest more readily in repairing damage than in preventing it. The question is no longer whether prevention has value. It is whether we can afford to continue acting too late.[1,2]

Bleeding gums when brushing rarely feel like a health emergency. There is usually no severe pain and often no major diagnosis. Gingivitis, an inflammation of the gums that may cause bleeding when brushing, is common, usually reversible and easily dismissed as a minor dental problem. But this seemingly small sign may represent one of the clearest opportunities in healthcare: What if we stopped treating gingivitis as an insignificant inconvenience and began recognising it as an early opportunity for prevention?[3,4]

Healthcare has become highly skilled at diagnosing, treating and repairing. However, it remains less organised around recognising early signals and changing the trajectory before disease becomes complex, expensive and irreversible.

Where does disease begin and how early can prevention truly start?

The oral cavity is home to a complex and dynamic microbial ecosystem that exists in close interaction with the human host. In a healthy system, this relationship remains dynamic but relatively stable: oral biofilm is present, the immune system responds, and the tissues remain clinically healthy. This balance is influenced by saliva, diet, fluoride exposure, oral hygiene, smoking, medication, systemic conditions and the individual immune response.[5,6]

Oral disease rarely begins as a dramatic event. More often, it develops through a gradual deterioration in the relationship between microbial ecology and host response.

In dental caries, frequent sugar exposure can favour acid-producing and acid-tolerant microorganisms, contributing to mineral loss from the teeth. In gingivitis, accumulated biofilm triggers an inflammatory response in the gingival tissues. If inflammation persists, some susceptible individuals may progress towards periodontitis, where destruction of the tissues supporting the teeth is no longer fully reversible.[3,4,6]

This distinction matters. Biofilm is a structured microbial community, whereas gingivitis is an inflammatory response to its accumulation. Periodontitis is a chronic inflammatory disease involving irreversible tissue destruction.[3,4]

Prevention depends on recognising where a person stands along this pathway.

Gingivitis is not insignificant because it is common and often reversible. Its reversibility is precisely what makes it valuable. It represents a window in which action can still alter the direction of disease.[3,4]

Bleeding gums may not feel alarming. Clinically, however, they may indicate that the relationship between biofilm, behaviour and host response is deteriorating. Prevention begins when that signal is recognised rather than dismissed.

Biofilm, behaviour and daily prevention

Daily behaviours influence the oral microbiome. Toothbrushing, interdental cleaning, fluoride use, dietary patterns and smoking all affect the relationship between the oral microbiome and the host. When biofilm accumulates, it can trigger gingival inflammation. In susceptible individuals, persistent inflammation may contribute to periodontitis.[3,4,5,6]

This is the thinking behind a simple but powerful message: There is no magic pill, only daily biofilm control.

These actions may appear ordinary, but repeated consistently over time, they become meaningful forms of prevention. Oral hygiene is not merely a cosmetic routine; it is one of the ways in which people can influence their oral ecology and long-term health.

However, scientific knowledge alone does not change behaviour. Daily routines are shaped by motivation, manual ability, stress, family habits, culture, cost, access, fear, shame and previous experiences of care. Preventive advice can therefore fail even when the information itself is scientifically correct.

A successful preventive approach must be both biologically sound and behaviourally realistic.

For one person, the most relevant intervention may be improving interdental cleaning. For another, it may be reducing frequent sugar exposure, improving fluoride use, stopping smoking or attending supportive care more consistently.

Personalised prevention should not mean vague advice. It should translate individual risk into actions that are clear, achievable and meaningful.[4]

A human-centred approach asks:

- What does this person understand about their risk?
- What action feels realistic this week?
- What information will motivate rather than frighten them?
- What barriers make change difficult?
- What support would make healthier behaviour more possible?

This also broadens the role of the healthcare professional. Diagnosis and treatment remain essential, but professionals must also be able to communicate risk,

support behaviour change and recognise when oral findings form part of a wider health pattern. Dentists, dental hygienists, physicians, dietitians, psychologists and other professionals need to know when collaboration matters. Prevention becomes stronger when disciplines stop treating one person as a collection of unrelated systems.

The mouth as part of systemic health

The connection between oral and systemic health is particularly evident in periodontology. Periodontitis shares several risk factors with other non-communicable diseases, including smoking, dietary patterns, socioeconomic factors and systemic conditions. It is also associated with diabetes and cardiovascular disease. While periodontitis should not be presented as a simple cause of every associated systemic condition, it contributes to inflammatory burden, interacts with metabolic and immune pathways and may influence systemic health in clinically relevant ways.[7,8]

The relationship with diabetes is one of the strongest examples. Poor glycaemic control can negatively affect periodontal tissues and treatment response, while periodontal inflammation may make metabolic control more difficult.[7] This bidirectional relationship demonstrates why oral inflammation should not be regarded only as a local dental problem. It forms part of the person's broader inflammatory and metabolic status.

Cardiovascular disease is another area in which periodontal disease is discussed in relation to systemic inflammation and shared risk factors, although causal interpretations require appropriate caution.[8]

The practical implication is important. An oral health professional may identify signs that belong to a wider metabolic or inflammatory picture. A medical professional caring for a person with diabetes may need to consider periodontal health as part of disease management. The same person may also experience gut symptoms, stress, disrupted sleep, dietary risks, smoking exposure or a relevant family history.

If oral health is treated in isolation, the larger picture may be missed. When it is incorporated into a broader assessment of health and risk, the mouth becomes a valuable clinical window rather than a separate technical territory. This is where oral health begins to move from dentistry into healthcare.

From the mouth to the gut: two ecosystems, one body

The emerging discussion around the oral-gut axis adds another dimension, but it must also be approached with scientific care. The mouth is the first part of the gastrointestinal tract, and oral microorganisms are swallowed continuously. Under healthy conditions, this is part of normal physiology. However, in circumstances involving oral dysbiosis, periodontal inflammation, gut dysbiosis or reduced host resilience, interactions between the oral and intestinal ecosystems may become clinically relevant.[9]

> The smartest healthcare does not wait for disease. It acts while prevention is still possible.

Historically, dentistry has focused on teeth, gingiva and oral biofilm, while gastroenterology has focused on digestion, the intestinal mucosa and the gut microbiome. Biologically, however, these fields are connected through microbial exposure, epithelial barriers, immune signalling, nutrition and inflammation.

Current evidence supports the biological plausibility of this oral–gut connection. Shared microbiological and immunological pathways are being explored, particularly in relation to periodontitis and inflammatory bowel disease. Nevertheless, the evidence does not justify simplistic claims that every oral problem is a gut problem or that every patient requires microbiome testing.[9] Scientific caution is essential.

The value of the oral-gut concept is not that it offers one explanation for every disease. Its value is that it reminds us that oral health exists within a wider biological system.

Oral inflammation, systemic inflammation, metabolic health, nutrition, behaviour and gut health may be connected, but not in a simple linear way.

The economic value of acting earlier

Oral diseases are among the most prevalent health conditions worldwide. Approximately 3.69 billion people were living with major oral conditions in 2021, and untreated caries in permanent teeth remains the most prevalent health condition globally.[1,2]

Untreated caries, periodontitis, tooth loss and repeated restorative or rehabilitative interventions generate costs for individuals, healthcare systems and society. These include direct costs for treatment, maintenance and prosthetic rehabilitation, but also pain, impaired chewing, reduced quality of life, absence from work and lost productivity.[1,2,10]

Recent estimates illustrate the scale of this burden. In 2025 worldwide direct treatment costs and productivity losses associated with periodontitis, including periodontitis-related tooth loss, were estimated at approximately US$186 billion and US$142 billion, respectively.[10]

Disadvantaged populations often face a combination of higher disease risk, more challenging social determinants and reduced access to preventive and professional care.[10]

Therefore, an important economic question is not only: How much does treatment cost? It is also: What does it cost when an opportunity for prevention is missed? Gingivitis offers a practical way to consider this questions. It is common, detectable and often reversible before irreversible periodontal destruction occurs. Once periodontitis is established, treatment becomes more complex, long-term maintenance becomes necessary, and the consequences may include tooth loss, reduced function and ongoing inflammatory burden.

From a health-economic perspective, the transition from gingivitis to periodontitis is therefore not only a biological progression. It is a missed opportunity.

Economic modelling suggests that preventing periodontitis through the prevention and management of gingivitis, supported by effective oral home care, may be more cost-efficient than several treatment-focused alternatives. In the Economist Impact model discussed by Pattamatta, Chapple and Listl, eliminating gingivitis through professionally supported home care increased healthy life years, reduced costs and produced a positive return on investment across the countries studied.[10]

This supports the biological argument that prevention has its greatest value when applied before irreversible periodontal destruction has occurred.

It does not mean that treatment is unnecessary. Established periodontitis must be diagnosed and managed appropriately. Teeth affected by disease require professional care, and advanced conditions will continue to demand advanced treatment.

The choice is not between prevention and treatment. The challenge is to place greater emphasis on the stage at which prevention can still change the disease trajectory.[4,10]

A healthcare system that mainly reacts after disease has become irreversible will carry a greater clinical and economic burden than one capable of recognising risk and intervening earlier.

Prevention is often described as an expense. However, it may be one of the most valuable investments a healthcare system can make.

From individual action to shared responsibility

Oral health begins with daily action, but it cannot end there. Individuals brush, clean interdentally, make food choices and attend care. Families establish early routines and influence microbial and behavioural development. Dental teams identify risk and provide professional support. Medical teams manage systemic conditions. Researchers and educators produce knowledge and translate it. Policymakers, insurers and industry influence whether preventive care is accessible, rewarded and scalable.

Hence, health is more than an individual experience; it is shaped and influenced within the communities to which we belong. This is why prevention must move from me to we. From me: my toothbrush, my biofilm, my habits and my risk. To we: our families, our clinics, our systems and our responsibility.

Prevention cannot be reduced to a private lifestyle project available only to highly informed and motivated individuals. It must become a shared health culture:

- A culture in which gingivitis is recognised as an early opportunity rather than dismissed as a minor inconvenience.
- A culture in which oral health is understood as part of whole-body health.
- A culture in which scientific evidence is translated into practical daily action.
- A culture in which healthcare professionals collaborate before disease forces them to.

These perspectives point in the same direction. Prevention must begin early enough to matter. It must remain scientifically credible. It must be translated into realistic daily behaviour that connects oral health with the whole person. And it must be supported by systems that value health creation, not only disease treatment.

The mouth may be where the discussion begins. The ambition is much broader: earlier, more integrated and more sustainable healthcare.

For clinicians, the practical takeaway is simple: Treat gingivitis as the intervention point, not attachment loss as the alarm bell. The question is no longer whether the world can afford to invest in prevention. It is whether the world can afford not to.

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