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EDITORIAL

Contemporary Caries Management: Where Are We Heading?

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Dental caries has undergone one of the most profound conceptual transformations in modern dentistry (1). Once viewed primarily as an infectious disease caused by specific pathogenic micro-organisms, it is now understood as a complex non-communicable disease (NCD), driven by behavioural, dietary, environmental, and biological factors over time (2). This shift, from a simplistic germ-based model to a chronic, behaviour-linked condition, has reshaped not only our understanding of disease aetiology, but also the philosophy of its management, prevention, and the way we teach dentistry.

Today, dental caries is recognized as a biofilm-mediated, sugar-dependent, multi-factorial disease(3). Repeated, prolonged pH decreases in the dental biofilm, fuelled by frequent intake of fermentable carbohydrates, leading to net mineral loss from tooth tissues. The visible outcome of this process is the carious lesion, which is best understood as a sign of the underlying disease process, rather than the disease itself (2,4). A lesion may progress, remain stable, or be arrested, depending on how effectively the disease drivers are addressed at patient level. This distinction between disease (caries) and lesion (carious lesion) is now fundamental to contemporary caries management and underpins modern classification and management frameworks (5).

Recognizing caries as an NCD has major implications. It shifts the centre of gravity from the dental chair to the patient's daily life. The primary treatment for caries as a disease is control of the biofilm and the factors that disturb mineral balance, most importantly consistent mechanical plaque removal with fluoride-containing toothpaste, supported by appropriate fluoride exposure, dietary modification, and tailored preventive care. In this paradigm, it is the informed, engaged patient and family who control dental caries, while the dental professional acts as adviser, coach, and procedural expert. This aligns perfectly with minimally invasive dentistry, where the emphasis is on preventing new lesions, arresting existing ones, preserving tooth structure, and avoiding unnecessary operative intervention (6).

The Role of Non-operative Care: Prevention is Treatment

A central message in contemporary caries management is that non-operative care is not preliminary to treatment; it is treatment. For decades, dentistry has unintentionally reinforced the idea that a restoration "cures" caries. In reality, operative procedures only repair the structural consequences of the disease. Unless the underlying behavioural and biological factors are addressed, the disease persists, new lesions develop, and the patient continues along a familiar restorative cycle.

Prevention sits at the heart of effective disease control. Consistent toothbrushing with fluoride toothpaste, appropriate fluoride exposure, dietary modification with reduced frequency of free sugars, and supportive behavioural change strategies together form the foundation of caries management. These measures

directly influence the biofilm, remineralisation potential, and overall risk, helping stabilize or arrest existing lesions and prevent new ones. Non-invasive approaches, such as sealing early lesions to control the biofilm, also reflect the philosophy of intervening early without unnecessary removal of tooth structure (7,8).

Crucially, these preventive and behavioural components must be delivered, understood, and supported before any operative intervention is considered (9). A restoration placed in the absence of disease control is merely a temporary repair. Without adequate plaque control and lifestyle modification, the same risk factors that created the original lesion remain active, eventually leading to further breakdown around restorations or elsewhere in the mouth.

CariesCare International: A Structured Pathway, Not a Singular Solution

While the focus of contemporary caries management extends beyond any one framework, CariesCare International (CCI™) provides an important, practice-friendly structure for implementing evidence-based caries management (5). Developed from the International Caries Classification and Management System (ICCMS), CCI operationalizes current evidence into a clinically usable 4D cycle:

1. Determine caries risk;
2. Detect lesions, stage severity, and assess activity;
3. Decide on a patient-centred, risk-based care plan;
4. Do the appropriate preventive and tooth-preserving care.

The strength of CCI lies in its emphasis on health outcomes. It encourages clinicians to focus on preventing new lesions, stabilizing or arresting existing ones, preserving tooth structure wherever possible, and supporting patients to adopt behaviours that promote long-term oral health. By placing prevention and minimally invasive care at the centre of practice, it aligns with the broader move across dentistry toward managing caries as a non-communicable disease rather than relying solely on operative intervention. It also reinforces the idea that caries control is most effective when integrated with wider strategies for reducing shared risk factors across chronic diseases.

The Operative-Non-Operative Imbalance in Dental Education

Despite decades of progress in cariology research, dental education in many parts of the world still places disproportionate emphasis on operative dentistry. Students often graduate highly competent in cavity preparation and restoration placement, yet less prepared to diagnose and manage caries as a chronic, behaviour-driven disease. This imbalance reinforces the misconception that caries is primarily a surgical problem and contributes to the continued underuse of preventive and minimally invasive strategies. Recent international evaluations of undergraduate programmes have shown that prevention, risk assessment, behaviour change support and non-operative care frequently receive limited curriculum time compared with restorative training, and that calibration in contemporary caries detection and diagnosis is inconsistent across departments.

The European Core Curriculum in Cariology (CCC), developed jointly by Organization for Caries Research (ORCA) and the Association for Dental Education in Europe (ADEE), was intended to address this gap by providing a structured, evidence-based framework outlining the essential knowledge and skills that every dental graduate should possess (10). However, its implementation has been variable. Challenges repeatedly identified across universities include the separation of cariology and restorative dentistry into different teaching units, insufficient curricular integration, and a persistent focus on surgical management while preventive and non-operative components remain fragmented or deprioritized (11). The CCC and its international adaptations demonstrate broad agreement on what should be taught, yet aligning these expectations with real-world teaching, assessment and clinical practice continues to be a significant barrier.

Achieving genuine change requires embedding cariology as a coherent, longitudinal theme across programmes, with prevention, risk assessment, lesion staging, selective tissue removal, and behaviour change communication treated as core competences rather than peripheral topics. Integrating cariology and restorative dentistry teaching, calibrating faculty in modern diagnostic approaches, and ensuring students experience prevention and minimally invasive care in the clinic are essential steps. Only by rebalancing curricula to reflect contemporary understanding of caries as a non-communicable disease can dental education prepare graduates to deliver evidence-based, patient-centred, minimally invasive care.

The Future: Personalized, Preventive, Minimally Invasive Care

The direction of contemporary caries management is clear and aligns with global trends in chronic disease care:

- Risk-based recall and monitoring;
- Structured prevention tailored to individual needs;
- Minimally invasive operative care only when necessary;
- Integration of oral health with broader NCD prevention;
- Educational reform prioritizing disease management, not just restoration;
- Consistent terminology to improve communication and reduce confusion;
- Patient partnership at the centre of care.

The most effective "treatment" for dental caries remains the one performed at home: toothbrushing with fluoride toothpaste, reduced sugar frequency, and daily biofilm control.

Conclusions

In answer to the question of where contemporary caries management is heading, the direction is unmistakably toward a preventive, personalized, and minimally invasive model that treats dental caries as a chronic, behaviour-driven disease. The future lies in strengthening patient engagement, improving daily biofilm control, and supporting informed choices through structured risk assessment and evidence-based decision-making. Progress will depend on aligning clinical practice, dental education, and health policy, so that prevention, behaviour change, modern diagnostic approaches, and selective tissue preservation are given the same importance as restorative procedures. By moving in this direction, dentistry can shift from repeated cycles of repair to sustainable, patient-centred care that addresses the disease at its source.

Conflict of Interests

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