

Guest Editorial

Sustainable Oral Healthcare: A Joint Stakeholder Approach

Introduction

Climate change and environmental pollution are amongst the greatest threats affecting the planet, humanity, and biodiversity. The 2030 *United Nations Agenda for Sustainable Development*,¹ adopted in 2015, included an urgent call for action from all sectors and established 17 goals to stimulate efforts over the coming years in areas of critical importance. This agenda is a plan of action for people, planet, and prosperity. Oral health is an essential part of human life. There is a growing recognition within the oral healthcare community, including clinical professionals and industry, of its responsibility to deliver healthcare and products that improve oral health in a sustainable manner in compliance with United Nations (UN) goals.

Momentum to formalise policy around the issue began in August 2017 at the FDI General Assembly in Madrid, Spain, with the adoption of the pioneering *FDI Sustainability in Dentistry Policy Statement*.² This statement sowed the seeds for the creation of an education infographic for providers of oral health care that set the framework for reducing environmental impact in oral health care based on the pillars of prevention and care quality (*FDI Sustainability in Dentistry, 2020*) Infographic interactive version.³ Following these initial steps, there was a recognition of a general lack of knowledge associated with the challenges and potential restraints to the implementation of sustainability in the sector.

In 2021, the FDI Sustainability in Dentistry Task Team sought to establish a baseline of knowledge for sustainability in dentistry through the publication of a 2-part scoping review. The first part, investigated the awareness and challenges to sustainability in dentistry⁴ and, the second part, the drivers and opportunities to sustainability in dentistry.⁵ This key baseline study establishes a comprehensive review of the environmental sustainability of oral health provision in dentistry. This was investigated through the lens of identified themes that subsequently provided the framework for the routes to sustainability identified in the consensus statement ([Figure 1](#)).

The scoping review provides the foundation and structure for the process of achieving a stakeholder consensus. This has brought together a broad coalition including leading figures from industry, health professionals, academic experts, legislative authorities, and dental associations. The focus of this consensus statement is to improve sustainability without compromising the oral health care of the current and future generations. It represents the collective views from across the whole supply chain, with all stakeholders equally committed to deliver impactful, robust, and practical remediation strategies that cross boundaries and take a truly collaborative, nonpartisan, and evidence-based approach.

The consensus statement has been created through an iterative inquiry process from June 2021 to March 2022, through a 3-wave Delphi survey of the founding partner stakeholders and a series of consultation workshops with the listed participants during November 2021 (see acknowledgements).

Rationale

In keeping with the urgent call for action by the United Nations (UN), the oral health care industry and supply chain stakeholders have joined forces. This is under the continued leadership of the FDI World Dental Federation to collaborate with a strong and genuine ambition to engage with the *UN Agenda for Sustainable Development*. This is the foundation for the *Consensus on Environmentally Sustainable Oral Healthcare: A Joint Stakeholder Statement*.

There is broad agreement that stakeholders in the oral health care sector could potentially make significant reductions in the volumes of waste generated, most notably from modifying manufacturing processes, packaging, and the high prevalence use of single-use products (mostly plastic and personal protective equipment).⁶

Contaminated biomedical waste is generated downstream of manufacturers in the supply chain by oral health care professionals, patients, and consumers. There is now a desire and strong agreement to act in unison throughout the supply chain to address this challenge and reduce environmental impacts.

Knowledge of the impact of oral health care on the environment is not uniform, with significant awareness amongst manufacturers but relatively little insight from end users including oral health care professionals, patients, and consumers. Carbon dioxide (CO₂) emissions and plastic waste, packaging, and end-user single-use plastics (SUPs) are recognised as the main contributors to unsustainable practice. The oral health care industry has a responsibility to promote innovation and research and harness best operational models to identify and support sustainable activities within the supply chain.

Scope

The objectives of the joint stakeholder consensus statement are as follows:

1. Raise awareness and outline the opportunity relative to decreasing carbon emissions, improved choice and use of materials, improving waste generation and management, and other environmental impacts relative to oral healthcare.

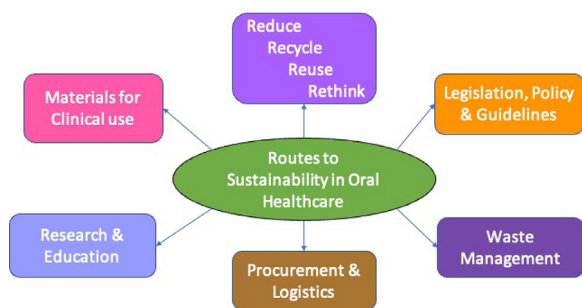


Fig. 1 – Routes to sustainability in oral health care (FDI Consensus Statement, 2022).

- Promote impactful research and educate all sectors of the supply chain, to ensure broad consensus around sustainable oral health practice and sustainable lifestyle habits.
- Acknowledge individual and joint responsibilities to understand and seek to minimise the environmental impact of our activities whilst improving the quality of products and health care provision.
- Seek to work jointly and proactively, to achieve environmentally sustainable solutions for the good of our profession, the population we serve and the environment we share globally.

This consensus statement identifies the complex drivers that underpin current behaviours and practices and the best opportunities to improve and deliver sustainable oral health care for people and the planet. The statement further emphasises the routes to sustainability in oral health care, drawing on evidence from the published literature.^{4,5} Each of these routes is considered in a 3-step process that sequentially informs future strategy, including positive actions that should be implemented across the sector:

Awareness and Challenges. This recognises the importance of raising awareness of the impact of oral health professional practices and consumer behaviours on the environment, and it identifies the challenges that all stakeholders face to improve dissemination and understanding in this space.

Drivers and Opportunities. There are numerous drivers now operating that promote the development of, and engagement with, sustainable practice. This represents a major opportunity to make improvements across the sector.

Strategic Action Framework. Specific recommendations and potential best practices can deliver environmental benefits whilst potentially improving oral health outcomes.

Recommendations

Manufacturing companies across the supply chain have identified that impactful solutions will only come about through unbiased and open inter- and intra-stakeholder communication and collaboration. There is an opportunity for all stakeholders to identify and embrace every element of sustainable practice. In this way, there is scope for significant cumulative gains through the compounded activity of the multiple individual stakeholders in the supply chain, including oral health

care professionals and end users. Due to the sheer scale of the oral health care supply chain, small positive changes by all stakeholders will have large cumulative benefits.

Education will be essential to promote behaviour change by raising awareness amongst all stakeholders with a focus on end users (clinical and consumers). Educational messages should focus on disease prevention and maintenance regimes with sustainable oral hygiene practices at home. There is a requirement for accountability in the clinical environment and more clinically cost-effective service models that can deliver optimum and sustainable oral health care. Consideration should be given to implementing impactful prevention and screening services in population hotspots, such as schools, care homes, and shopping precincts. Products and services should be advocated that enable consumers to reduce their oral health carbon footprint following validated oral health care messages.

A comprehensive strategic action framework in the consensus statement, identifies agreed objectives and actions achievable through the different 'Routes to Sustainability' that are based on the themes identified in the literature^{4,5} (Figure 1).

Reduce, recycle, reuse, and rethink (The 4Rs)

Of the 4 Rs (reduce, recycle, reuse, and rethink), *reduce* and *recycle* are the most impactful routes to sustainability in this sector. Reduction of the need for clinical interventions for preventable diseases remains the most impactful and practical approach. This is best achieved through the delivery and maintenance of good oral health, focused on prevention and with the provision of durable interventions, using high-quality products and materials that will last longer and/or require fewer revisions. Every stakeholder in the supply chain, from manufacturing to the end-user clinicians and consumers, has a role to play to optimise this reductionist approach. The emphasis is on ensuring high quality, fitness for purpose, and durability. At the point of delivery of care, *reduction* is achieved through the provision of good oral health care by engaging in good practice (Figure 2).⁷

Reduction of packaging at all levels (primary, container/delivery vehicle, secondary, and tertiary) is recognised as a key goal that should be sought throughout at all levels of the supply chain.

Recycling remains a challenge at the patient and consumer end-user level but is less so with packaging and uncontaminated single use products (SUPs,) which should be readily recyclable. For both scenarios, there is an opportunity to engage in robust research that will drive the required know-how and supporting technologies. Recycling opportunities are possible for products and packaging at various points in the supply chain (especially preclinical). This could include the design and development of plastic items made from monopolymer plastics that can be readily recycled together with engagement with end-user consumers and waste management companies to segregate, collect, and recycle clinical SUPs as a valuable commodity (eg, the Flexible Plastics Consortium).⁸ There is a recognition that recycling can only be a 'successful strategy' if the collected waste is considered as a "valued commodity" that can replace or complement virgin feedstock to manufacture new products and associated packaging in a circular economy.

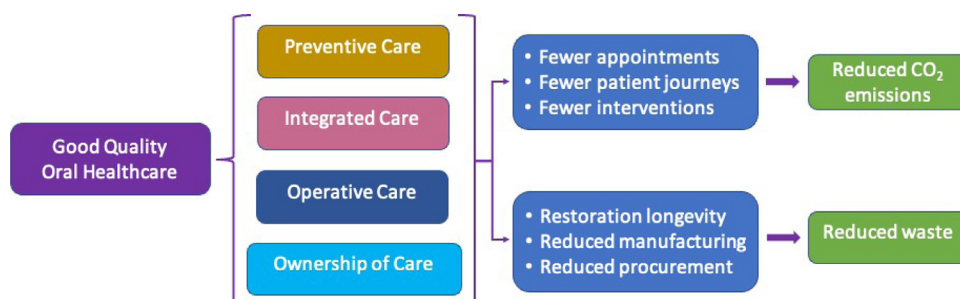


Fig. 2 – Reduction in clinical practice is achieved through the provision of good oral health care.

Legislation, policy, and guidelines

Appropriate legislation is key to ensure that products are safe and fit for purpose whilst driving sustainable practice. Designing and working with the duality of this legislation is challenging at all levels, but especially so for end-user and oral health care providers who have to work within the constraints of stringent regulations that promote patient and workforce safety. There are undoubtedly opportunities to work with legislative authorities at all levels to seek effective remediation strategies. Legislation can be complemented by targeted public health policies that promote oral health care as the most important and impactful route to environmental sustainability. These could include screening and health promotion campaigns and water fluoridation.

Waste management

This presents its own significant challenges. There is a need to educate both the profession and the public about the merits, usefulness, and indispensability of plastic in the health care sector. This will require improved knowledge and attitudes towards the generation and management of biomedical waste globally.

Procurement and logistics

The fourth “R” in sustainability represents a *rethink* of procurement and logistics. More efficient manufacturing, distribution, and procurement logistics with shared facilities are going to be needed. A creative strategy to drive this could include procurement summits as an opportunity for sector leadership, stakeholder collaboration, and sharing knowledge of sustainable best practice. Another strategy might involve the development of a ‘sustainability index’ as a means to inform purchasers on the sustainability credentials of a product. The index would potentially include information on environmental sourcing, ethical manufacturing, supply chain distribution, and procurement.

Research and education

The road to sustainability requires significant underpinning with effective and impactful research and education programmes. Establishing research and innovation partnerships, scoping and mapping studies to identify fundamental research gaps, conducting combined health-economic-

sustainability impact analysis, and exploring (through quality research) the effectiveness of existing and alternative service delivery models are interventions that can drive change. The promotion and support of research into the recovery and recycling of all forms of plastics used by the industry in collaboration with supply chain stakeholders up and down the supply chain are vital. This should include effective communication and education of end users about the ability to recycle waste plastic so that it can be re-purposed as valuable feedstock in a circular economy. It will mean a shift to focusing on the life cycle of products and materials that considers the whole picture of the environmental impact in the context of the intended purpose of the device, its durability, and its management as eventual waste.

Materials for clinical use

Strategies for the management of SUPs need to focus on all plastic products used throughout the supply chain to develop a circular economy. This includes personal protection equipment products, sundries, dental materials and all levels of associated packaging. Preclinical or pre-consumer SUPs are easier to recover and recycle as they pose a lower contamination risk. Appropriate strategies should also be considered for clinical and end-user products.

Manufacturers, legislative authorities, end users, and waste handlers need to review opportunities for effective recovery and recycling of clinical and consumer plastic items. Some plastic items such as packaging that are used in the oral health care sector do not need to be considered as medical waste if they are not in direct contact with clinical environments. In addition, other plastics such as dental sundries (eg, composite compules, micro-brushes and dispensing pots, waste sterilised autoclave pouches, and even uncontaminated gloves) present further opportunities for recovery and recycling, if safely and effectively placed in the correct waste stream.

Oral health care products and clinical dental materials need to be fit for purpose, built from sustainably sourced materials, and durable, so that they can perform for a prolonged period and require reduced revisions and/or replacements. Labelling materials and products as ‘sustainable’ if they are made from sustainably sourced constituents and/or recycled is overly simplistic. In the context of restorative materials, for example, there is also a requirement for durability. A product or material that is not durable will require replacement with additional associated negative environmental impacts, such as increased patient travel.

Next steps

2022

- The consensus statement is designed to motivate, drive, and inform changes within the oral health care sector that better embrace sustainability.
- The FDI is in the process of producing an interactive tool kit that will assist stakeholders in measuring levels of sustainability around their various activities. A webinar will be held to promote the tool kit.
- The consensus statement will provide the basis of an industry Code of Good Practice to be launched at the FDI World Dental Congress in September 2022.

2023

Next year, FDI plans to focus in on the implementation and promotion of some of the consensus statement's remediation strategies:

- Creation of an education module and supporting resources for undergraduate and postgraduate oral healthcare educational programmes.

- Host a massive open online course (MOOC) for oral health-care professionals and dental practices providing further guidance to improve sustainability.
- Convene a Sustainability in Dentistry Conference for all stakeholders with presentations and workshops focused on research, collaborative initiatives, and consumer/patient engagement in product and policy issues.
- Establish a mechanism for funding research with the potential to transform the sustainability of oral health care provision.
- Raise public awareness of the importance of sustainable oral health choices with an educational campaign.

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FDI would like to thank all the contributors to the consensus statement:

Task team

Nicolas Martin
Steven Mulligan
James Zenk
Duygu Ilhan

Chair, FDI Sustainability in Dentistry Task Team
Member, FDI Sustainability in Dentistry Task Team
Chair, FDI Dental Practice Committee. Member, FDI Sustainability in Dentistry Task Team
FDI Councillor, Member, Sustainability in Dentistry Task Team

Founding partners

Ann Tracy
Gareth Rudduck
Maria Jung
Cristina Morillo
Joel C. Hornberger

Chief Sustainability Officer, Colgate-Palmolive
Senior Global Marketing Director, Oral Health Conscious Consumption, GlaxoSmithKline, Consumer Healthcare
Communication Manager, TePe
Director Global Oral Care ESG Brand & Communications, P&G
Director, Global Environmental, Health & Safety, Dentsply-Sirona

Participants

Ali A. Theyab
Andreas Syrek
Angela Rovera
Anna Nilvéus Olofsson
Annette Altenkirch
Arish Naresh
Bart Dopheide
Gabriele Burkhardt
Chrispinus Hakimu Mumena
Christopher H. Fox
Claudia Jimena Rodriguez
Clio Boura
Corrie Jongbloed-Zoet
Donna M. Hackley
Elizabeth Shick
Falk Schwendicke
Hasan Jamal
Helena Ossmer Thedius
Helen Whelton
Ian Shellard
Jeffrey A. Platt
Jefferson Clarke
John Milne
Jonas Billen
Julian Fisher
Julie Hunt
Les Kalman
Manon Agrissais
Manu Raj Mathur
Mick Armstrong
Pam Clark
Paul Batchelor
Paul Farrar
Paul Hatton
Raman Reddy
Rick Glass
Virginia Hochstetter
Wa Than Lin

Head of Advisory Board, International Association of Dental Students (IADS)
Global Medical Director and Chief Dental Officer; 3M Oral Care
ANDI - Italian National Dental Association
Manager Odontology and Scientific Affairs, TePe
Innovation Manager, MULTIDENT Dental GmbH
Chief Executive, Omeo District Health and President, International Oral Health Association
General Manager Scientific Services, GC Europe NV
Head of Product Segment Treatment Auxiliaries Coltène/Whaledent and Certified Partner of Terra Institute
Head of Dental Clinical Sciences Department, School of Medicine, Copperbelt University, Zambia
Chief Executive Officer International Association for Dental Research
El Bosque University, President of SOCI Colombian Dental Implant Association
Head of Packaging Oral Healthcare, GlaxoSmithKline Consumer Healthcare
President, International Federation of Dental Hygienists (IFDH)
Instructor, Harvard School of Dental Medicine
Associate Professor, University of Colorado
Director, Oral Diagnostics, Digital Health and Health Services Research, Charité - Universitätsmedizin Berlin, FDI Science Committee
Paediatric Dental Surgeon - BDS, DClindent Paediatric Dentistry, MSC Regenerative Dentistry, MSC Biomaterials
Director Marketing & Innovation, TePe
Head of College of Medicine and Health, University College Cork, Chief Academic Officer HSE South, South West Hospital Group
Director, Aqos Consulting Ltd
Professor and Chair, Department of Biomedical Sciences and Comprehensive Care, Indiana University School of Dentistry
Barbados Dental Association
National Dental Advisor Care Quality Commission
EHS Specialist – Kulzer GmbH
Coordinator and Senior Researcher, Planetary Health and Global Oral Health, Charité University Berlin, Germany
Senior Director Global Oral Care R&D, Sustainability, P&G
Assistant Professor, Schulich Dentistry
Senior R&D Project Leader, SDI Limited
Head: Health Policy; Public Health Foundation of India and Professor in Dental Public Health, Queen Mary University of London
FDI Dental Practice Committee Vice-Chair, British Dental Association Health and Science Committee Chair
Member of Royal Australian College of Dental Surgeons, International Dental Manufacturers Association
Associate Centre for Sustainable Healthcare, Hon. Professor School of Medicine UCLan
Research & Development Manager, SDI Limited
Professor of Biomaterials Science, School of Clinical Dentistry, University of Sheffield
Dental Officer at Rakiraki District Hospital, Fiji
Vice President – Global Sourcing, Henry Schein, Inc.
Head of Sustainability and Corporate Responsibility, Straumann Group
Member of Executive Committee, Secretary of Oral Health Education Committee, Myanmar Dental Association

Conflict of interest

None disclosed.

R E F E R E N C E S

1. United Nations. The 2030 Agenda for Sustainable Development. Report No.: A/RES/70/1. 2015. Available from: <https://sdgs.un.org/publications/transforming-our-world-2030-agenda-sustainable-development-17981>. Accessed 14 February 2022.
2. FDI Policy Statement on Sustainability in Dentistry. Adopted by the FDI General Assembly August 2017 in Madrid, Spain. Available from: <https://www.fdiworlddental.org/sustainability-dentistry-statement> (Accessed 18 March 2022).
3. Sustainability in Dentistry v1.0. <https://www.fdiworlddental.org/sustainability-dentistry> 2021. [Accessed 18 March 2022].
4. Martin N, Sheppard M, Gorasia G, et al. Awareness and barriers to sustainability in dentistry: a scoping review. *J Dent* 2021; 112:103735. doi: [10.1016/j.jdent.2021.103735](https://doi.org/10.1016/j.jdent.2021.103735).
5. Martin N, Sheppard M, Gorasia G, et al. Drivers, opportunities and best practice for sustainability in dentistry: a scoping review. *J Dent* 2021;112:103737. doi: [10.1016/j.jdent.2021.103737](https://doi.org/10.1016/j.jdent.2021.103737).
6. Martin N, Mulligan S, Fuzesi P, Hatton PV. Quantification of single use plastics waste generated in clinical dental practice and hospital settings. *J Dent* 2022:103948. doi: [10.1016/j.jdent.2022.103948](https://doi.org/10.1016/j.jdent.2022.103948).
7. Martin N, Mulligan S. Environmental sustainability through good-quality oral healthcare. *Int Dent J* 2022;72(1):26–30. doi: [10.1016/j.identj.2021.06.005](https://doi.org/10.1016/j.identj.2021.06.005).
8. Rizan C, Mortimer F, Stancliffe R, et al. Plastics in healthcare: time for a re-evaluation. *J R Soc Med* 2020;113(2):49–53. doi: [10.1177/0141076819890554](https://doi.org/10.1177/0141076819890554).

Nicolas Martin

School of Clinical Dentistry, The University of Sheffield, 19A
Claremont Crescent, Sheffield, S10 2TA

Rachael England

FDI World Dental Federation, Geneva, Switzerland

Steven Mulligan

School of Clinical Dentistry, The University of Sheffield, Sheffield,
UK

E-mail address: n.martin@sheffield.ac.uk (N. Martin).

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