

Green dentistry: a practical guide, Part I.

In the first of a three-part series, Denplan's Head Dental Officer Louis Mackenzie provides Denplan practice teams with an overview of the challenges and opportunities for practising sustainable dentistry in the pandemic era.

As the pandemic-induced PPE mountain continues to grow, health workers are increasingly recognising the need to provide care in a sustainable manner, minimising the impact on natural resources.¹⁻⁵ At home, Denplan practice teams will have made significant eco-friendly adaptations over many years. However, incorporating these changes in the work environment presents a range of challenges, made more difficult by COVID-19 conditions.

Sustainability in general dental practice

Sustainability is concerned with the sensible and responsible use of natural resources, to avoid depletion beyond the planet's ability to regenerate or replenish itself. Maintaining this ecological balance often uses the reduce, reuse, recycle model.

Sustainability can also have a powerful influence on patient choices. According to the recent report on 'Top 10 Global Consumer Trends in 2022' by Euromonitor International, 67% of consumers are reported to make decisions based on environmental factors. Informing patients of sustainable practice innovations will therefore build trust and make dental business brands increasingly popular.

While sustainability is not specifically mentioned in the GDC standards, many Denplan teams are already using a variety of methods to increase awareness of the environmental impact of dental care among staff, patients, other professionals and local communities, including:¹⁻⁵

- Developing a practice sustainability policy
- Using online resources and educational posters to communicate the 'green' vision to patients and staff
- Measuring and evaluating sustainability improvements



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Figure 1: Examinations are the most common dental procedure. Patient and staff travel accounts for 61.4% of dentistry's total carbon footprint

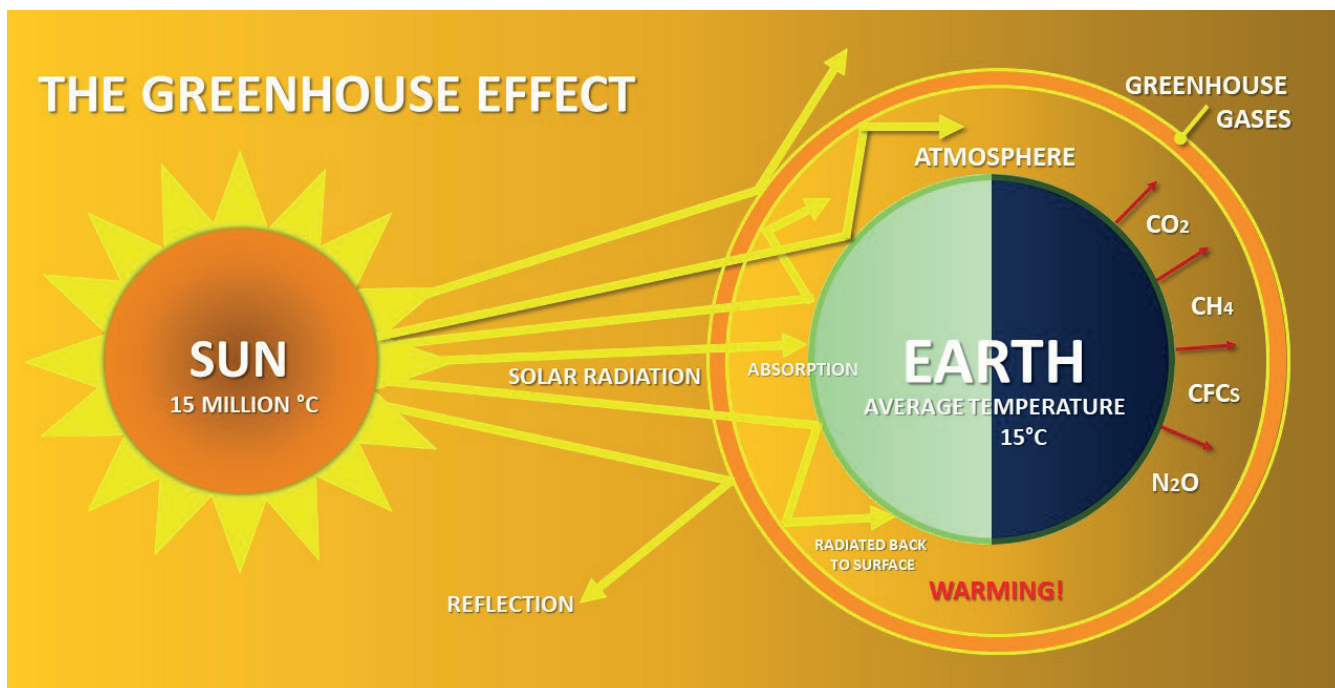
- Incorporating sustainability education in staff induction and training processes
- Calculating and disseminating information on the environmental (and financial) benefits of sustainable practice

Climate change

The Earth's climate has changed many times, going through multiple ice ages and periods when temperatures were higher than they are today. Historically, average temperature changes in the Earth's air and oceans happened over hundreds of thousands of years. The more rapid recent global warming trend is believed to result from human activity and there is concern that the rate of increase means that some organisms may not be able to survive.

The greenhouse effect

The greenhouse effect happens when certain gases, such as



Breakdown of the annual carbon footprint for dental services (England)	
Patient travel	31.1%
Staff commuting	30.3%
Procurement	19%
Electricity	7.7%
Gas	7.6%
Work travel (staff)	3.1%
Nitrous oxide release	0.9%
Waste	0.2%
Water	0.1%

Table 1: Breakdown of annual carbon footprint for dental services in England

Dental care factors that influence carbon footprint	
Average dental patient return journey	7.57 miles
Average staff return journey	7.26 miles
Examinations/scale & polish/fluoride varnish and radiographs as a percentage of all procedures (adults & children)	73%
Examinations as a percentage of all procedures (adults & children)	41%
Replacement restorations as a percentage of all operative treatments	>50%
Average dental appointment duration	15 minutes
Annual number of radiographs	14 million

Table 2: Dental care factors that influence carbon footprint

carbon dioxide, methane, nitrous oxide and chlorofluorocarbons (CFCs) collect in the Earth's atmosphere, creating an insulating layer that keeps the climate comfortable. The current global average temperature is 15°C; without greenhouse gases it would

drop to -18°C, causing most life forms to freeze.

Since the beginning of the industrial revolution (~1750), human activities have increased the greenhouse effect. Emissions of carbon dioxide, the most

important greenhouse gas, increased by 80% between 1970 and 2004. The main examples of human activities that generate greenhouse gases are:

- Combustion of fossil fuels, principally coal, petroleum (including oil) and natural gas
- Deforestation (living trees absorb carbon dioxide)
- Incineration of waste products

In 2019, the UK became the world's first major economy to legislate a binding net zero emissions target by 2050. Britain already incinerates its municipal waste at a lower rate than the rest of Europe, averaging 10% compared to 17.3%.

Medical waste disposal presents greater challenges. Across Europe, up to 25% of medical waste is incinerated, releasing greenhouse gases as well as toxic substances such as dioxin compounds, which are serious and persistent environmental pollutants.

Carbon footprint

The term carbon footprint refers to the total greenhouse gas emissions caused by an individual, event, organisation, service, place or product, expressed as a carbon dioxide equivalent.⁵ The NHS has announced a vision to be net zero by 2040. This will include dentistry, which accounts for 3% of the total health service carbon footprint.⁵

Although difficult to measure precisely, the components making up the carbon

Clinical

Relative carbon footprint of the most common dental procedures	
Examination	27.1%
Scale and polish	13.4%
Amalgam filling	9.7%
Composite filling	9.5%
Acrylic dentures	8.6%
Radiographs	6.4%
Extractions	3.5%
Non-precious metal crowns (the type most frequently prescribed)	3.3%
Endodontics	2.9%
Study models	1.6%

Table 3: Relative carbon footprint of dental procedures

Methods of reducing the environmental impact of patient and staff travel
Oral healthcare
Oral health promotion/disease prevention
Minimum intervention dentistry (reduce the amount of dental treatment)
Minimally invasive dentistry preserves healthy natural tissues and smaller interventions last longer
Focus on renovation and repair increases the functional longevity of dental restorations
High-quality restorations have greater longevity
Reduced recall frequency (based on risk assessment)
Identification and elimination of co-morbidity factors eg dietary analysis, smoking cessation
Holistic patient care promotes the early detection and diagnosis of systemic diseases, reducing the future burden on wider healthcare services
Appointment scheduling
Efficient screening/use of virtual consultations
Maximise chair occupancy (business efficiency as well as energy eg heating)
Complete multiple treatments at one appointment where possible
Combine dentist and hygienist appointments
Book family appointments together
Minimise failed appointments eg using text alerts
Optimise staff work patterns to maximise productivity and reduce the risk of work-related stress disorders eg ≤ four clinical days/week
Facilities
Display walking/cycle/bus routes on practice websites
Car sharing/public transport for staff
Encourage active travel eg pedometers for walking to work
Install secure cycle parking
Register for the government's cycle to work scheme (allows tax-free bicycle purchase)
Install shower/locker facilities
Install electric vehicle charging points
Digital impressions and in-practice milling or technicians eliminate the need for transport to and from laboratories
On-site specialists will further reduce the need for patient travel

Table 4: Proposals to reduce the environmental impact of travel in dentistry

Carbon footprint for dentistry have been estimated (see Table 1).⁵

Travel

More than 20% of global carbon dioxide is generated by transportation. Vehicle exhausts also cause air pollution (eg carbon monoxide and sulphur dioxide), which is reported to result in 40,000 UK deaths annually.

As the majority of dental appointments are short and have comparatively few material and equipment costs, patient and staff travel accounts for a massive 61.4% of dentistry's total carbon footprint (see Table 2).⁵ The relative carbon footprints of the most common dental procedures have been estimated and are listed in Table 3.⁵

Compared to a totally NHS practice, a mixed or fully private Denplan practice will see approximately 50% fewer patients daily, resulting in a significantly lower carbon footprint.

As transport is the primary contributor to dentistry's greenhouse gas emissions, a range of methods have been proposed to limit patient and staff travel.^{4,5}

The main proposals fit well with the preventive, minimally invasive focus of contemporary Denplan practices, where patients are empowered to take an active role in managing their own health and wellbeing (Table 4).

Sustainable healthcare is a well-researched subject and there is a range of evidence-based publications that focus specifically on dentistry, as listed below.

Key publications on sustainability in dentistry

¹ Duane. B et al. Environmental sustainability and waste within the dental practice. *BDJ Team*. 2019

² Duane. B et al. Environmental sustainability and procurement: purchasing products for the dental setting. *BDJ*. Volume 26 No.6: March 2019

³ Mulligan S. Sustainable oral healthcare and the environment: Challenges. *Dental Update* 2021; 48: 493-501

⁴ Harford S, Ramasubbu D, Duane B, Mortimer F. Sustainable Dentistry: How to Guide for Dental Practices. Centre for Sustainable Healthcare (2018). <https://sustainablehealthcare.org.uk/>

⁵ Carbon modelling within dentistry: towards a sustainable future. Public Health England and Centre for Sustainable Healthcare (2018). <https://www.gov.uk/government/publications/carbon-modelling-within-dentistry-towards-a-sustainable-future>