A changing climate and the dental profession

Hannah Batsford,*[1] Sagar Shah[2] and Gavin J. Wilson[3]

Key points

Discusses the climate crisis and its relevance for the dental profession.	Considers some of the current issues and challenges to sustainability within dentistry.	Highlights some changes dental teams can make to improve their impact on the environment.

Abstract

Climate change is the defining crisis of our time and experts fear it is happening faster than first predicted. In November 2021, the UK hosted COP26 where world leaders met to coordinate actions and renew commitments to tackle the problem head on. Whether COP26 galvanised the international community enough to turn a corner remains to be seen; however, as dental professionals, we face significant considerations regarding our opportunities to effect positive change. The aim of this paper is to provide a short account of the impact of dentistry on the environment, as well as to highlight some challenges and the potential for change available to the dental profession to become more sustainability-conscious. In dentistry, the main sources of carbon emissions are travel, procurement and energy use. Prevention of oral and dental disease is the single most important factor in reducing the environmental impact of dentistry long-term. It is essential that clinicians, manufacturers and relevant stakeholders are united in dealing with the environmental crisis to bring about effective change. Clinicians and patients should be encouraged to consciously think about their impact on the environment and to consider what adjustments they can make to their clinical practice and oral health habits.

Introduction

The aim of this opinion piece is to chronicle recent events on the subject of climate change and discuss its relevance to dentistry. This article will also deliberate on some of the issues and challenges around sustainability for the dental profession, including the role of dental products and procurement, dental materials, prevention, travel and green energy.

Background and policy actions

The human impact on the environment has been robustly critiqued and researched over the last 50 years – human influence on the planet is undeniable. The Sixth Assessment

[1]Speciality Trainee in Orthodontics, Bristol Dental Hospital, UK; [2]Managerial Dental Officer in Acute Dentistry, University Dental Hospital, Cardiff, UK; [3]Speciality Trainee in Oral Surgery, Bradford Teaching Hospitals Foundation Trust, UK.
*Correspondence to: Hannah Batsford
Email address: Hannah.Pugh4@nhs.net

Intergovernmental Panel on Climate Change (IPCC) report confirmed a 1.09 °C rise in global surface temperature over the last decade, with the global mean sea level rising by 0.2 m over the period 1901–2018, a rate of increase that has accelerated since the 1960s.[1] It is thought this increase in temperature could lead to a collapse of food production, access to fresh water, habitable ambient temperatures and ocean food chains – resulting in a planet inhospitable to life.[2]

A survey of public opinion across 50 countries (the largest to date) found that 64% of people believe climate change is a global emergency,[3] and over recent times, this pressure has led to policymakers around the world hurriedly committing themselves to tackling this issue. However, despite some of the rhetoric, there are major difficulties in agreeing national contributions to international reductions in global emissions of greenhouse gases. The Climate Change Act (2008) was introduced in the UK, to provide the legal framework to cut carbon emissions by 80% by 2050 (from the established baseline in 1990). In 2019, that target was revised to net zero greenhouse gas emissions by 2050.[4] The UK has been celebrated by the International

Energy Agency (IEA) as a world leader in decarbonisation of energy supply, both in terms of actual emissions reduction and ambitions set out in future carbon targets.[5] Between 1990 and 2017, the UK reduced its emissions by 42% while also growing the economy by 72%,[6] demonstrating to G20 countries and other developing nations that progress in addressing this challenge need not be to the detriment of growth and prosperity. The UK Committee on Climate Change (CCC) has modelled that reaching net zero emissions by 2050 would cost less than 1% of GDP annually through to 2050.[7] For comparison, the UK's military defence budget is between 2–3% of GDP each year. With experts warning that climate change is the biggest threat to global security humanity has ever faced, investing in a transition away from fossil fuels would appear to be a sensible allocation of resources. It is estimated that the cost of annual flooding alone in the UK could increase to 0.2–0.4% of GDP if the increase in global average temperatures reaches 3 °C or 4 °C.[8] Other internal and external financial impacts to the economy include a fall in agricultural output, loss in global productivity, and mass migrations and

conflict. The UK hosted the 26th UN Climate Change Conference of the Parties (COP26) where the Glasgow Climate Pact was agreed. This included international agreements on carbon dioxide emissions, reduction of coal use and reduction in deforestation. Many argue the agreements have not gone far enough and most countries will not be making their pledges legally binding.[9]

The climate challenges faced have no national boundaries and require international cooperation and solutions at all levels. Although China has established itself as the world's largest clean energy market and is deserving of praise, coal still plays a dominant role in its energy supply, accounting for 58% of its energy consumption in 2019.[10] That same year, China was responsible for over 27% of total global greenhouse gas emissions, far exceeding the US – the second highest emitter – which contributed 11%.[11] In a statement to the 75th session of the UN General Assembly in September 2020, President Xi Jinping declared China will 'aim to have CO_2 emissions peak before 2030 and achieve carbon neutrality before 2060'.[12] Whether large energy-consuming countries like China or India can begin to flatten their carbon emissions within the decade remains to be seen; however, at COP26, they did commit to net zero, but fell short of pledging to phase out their use of coal.[9] The recent invasion of Ukraine by Russia highlights how policymakers will also have to balance the security and stability of global energy markets with climate goals into 2050 and beyond. Russia is the world's second largest producer of gas and third largest producer of oil, most of which is exported to Europe.[13] This geopolitical disaster has heightened aspirations to shift to renewables in the EU and may lead to greater dependence on green energy alternatives; for example, wind, solar power and nuclear power. However, it may also lead to countries increasing domestic fossil fuel use; for example, coal.[14]

As a global brand and the largest employer in the UK, the National Health Service (NHS) should be a leader in transitioning to sustainable practice and an example of innovation in healthcare. In 2020, NHS England released a report outlining their commitment to 'Delivering a "net zero" National Health Service'.[15] The Net Zero agenda complements the NHS Long-Term Plan by introducing new models of care which simultaneously improve outcomes,

reduce carbon emissions, and increase NHS adaptive capacity and resilience. Examples include increasing out-of-hospital care, empowering people to have more control over their health and digitally enabling primary and outpatient care.

Where is sustainability relevant to dental practice?

Although many dental professionals are interested and do play their part, it is generally unknown how and what dental teams can do to have an impact in their day-to-day professional lives.[16] This is likely due to a number of factors, most notably a lack of awareness due to a paucity of research funding and therefore a lack of evidence to share with the dental community and patients. The findings of a seminal report from the Centre for Sustainable Healthcare commissioned by Public Health England found that the largest contributors to the carbon footprint of NHS dental services were travel (both patients and staff – 64.5%) followed by procurement (19%) and energy use (15.3%).[17]

Prevention
The single most important factor to improve sustainability in dentistry is prevention of oral and dental disease, which would reduce the need for travel, production and use of dental materials and waste production – ultimately reducing the clinical burden currently placed on dental care provision. One might think this would reduce the viability and profitability of dental practices; however, the idea of total prevention of dental disease across the population is implausible if not impossible and the demand for aesthetic dental procedures is likely to continue to increase. Prevention-focused approaches should underpin any future NHS dental contract and improvement of oral health through national water fluoridation schemes should also be realised. Under the present system, prevention of oral diseases is not appropriately financially rewarded. A future solution to this could be that dentists and their teams are paid a set fee per hour of contact time with patients, to be used on prevention or on invasive dental procedures – rather than being paid depending on the band of procedure performed. A supplement would be added to pay for any laboratory-produced appliances (crowns, dentures etc).

This would ensure there was adequate time to engage with patients to provide thorough preventative advice and care.

Travel
With travel accounting for over 60% of the carbon footprint for NHS dental services, it would be expensive and impractical to move established premises – travel for patients and staff in some form is also unavoidable. However, when commissioning new contracts and services, consideration should be given to patient travel patterns and accessibility via public transport. Providers should also be encouraged to implement a travel plan, promoting walking, cycling and car sharing by dental practice team members whenever possible. Installing electric charging points for both staff and patient use would reduce emissions and promote use of electric vehicles. Reducing the number of patient appointments and use of appropriate recall intervals will play a key part in a more sustainable model of dental care for NHS and private dental practice. Increased training of carers and availability of domiciliary care in dentistry would prevent travel required by elderly, vulnerable and medically compromised patients. The use of technology – as seen over the course of the COVID-19 pandemic – can also be used, in certain instances, to reduce the need for travel. Some professional and work-related activities such as meetings, conferences and educational courses have also been shown to work quite successfully online, improving access and increasing participation. Providing remote clinical services such as dental triage, consultations and retainer reviews may, in certain circumstances, be indicated and desirable. The use of digital technology could also reduce waste in dentistry; for example, by using digital study models rather than traditional plaster casts.

Dental materials
The use of many restorative materials impacts the environment. Placement and removal of resin-based composite restorations result in microparticle pollutants through human excretion into the local environment which can contaminate the waste system.[18] Despite these known environmental impacts, the use of resin restorations is promoted within the profession. Amalgam is still widely used in dentistry due to its versatility as a restorative material; however, mercury

waste is damaging to the environment. The Minamata Convention aims to reduce the use and subsequent impact of mercury waste on the environment after mercury contamination of local marine life in Minamata (Japan), resulted in neurological disease in those who ate contaminated fish.[19] Articles within the treaty refer to compliance on amalgam waste management and prohibit its use in the treatment of deciduous teeth, in children under 15 years, or in pregnant or breastfeeding women (except when deemed strictly necessary for the specific medical needs of the patient).[20] As amalgam and composite materials are the mainstay of restorative and cosmetic dental treatment, prevention of disease is key to the industry becoming more environmentally sustainable.

Plastics

Regulations in dentistry are necessary to protect patients and avoid preventable harm; however, they present some barriers to the sustainability agenda and the promotion of sustainable practice. Single-use materials and instruments (generally manufactured from plastics) are considered to reduce the risk of cross infection in the profession; therefore, single-use is the safest option, while also maximising patient confidence. However, a clear consequence of this practice is increased waste production and the subsequent detrimental environmental impact. In dentistry, examples include personal protective equipment (PPE), instruments, sundry items and the packaging used to store items between use. Perhaps one of the most noticeable effects of the pandemic has been the increase in demand for PPE, not only in medical facilities but in general society too. Most single-use plastics in healthcare are defined as clinical waste and require disposal through landfill and incineration.

Plastics in healthcare follow a largely linear economy, meaning products are manufactured, used once and disposed. A more sustainable framework would be a circular economy, in which products are maintained and used at the highest-value application for as long as possible, without termination on disposal. Transition to a circular economy is expensive and requires the cooperation of diverse stakeholder groups moving towards a shared goal of systemic transformation. Although some of the most commonly used single-use items are mandatory in dentistry and medically necessary on the grounds of patient safety, others are chosen out of convenience. The risk-averse culture within the profession and cost-effectiveness of using single-use items also make them an attractive choice. It is important that regulations are produced to facilitate sustainable dentistry and guidance such as HTM 01–05 should be revised to promote this practice, including clear evidence to support any recommendations. In addition, research into the practice of dentistry and a circular economy is also required.

Dental products and procurement

The concept of sustainable procurement will be a critical factor in the profession's ability to make a positive environmental impact. Manufacturers and suppliers must share the environmental responsibility and should incorporate sustainable practice into their production and distribution operations. One proposed solution in meeting this responsibility is through transparent disclosure of information relating to the materials and methods used in the manufacture of their products. This information should be easily accessible, allowing practice owners and clinicians to make more informed choices when equipping their surgeries and inventory. A further indirect benefit of such a measure could be increased competition among manufacturers, encouraging and driving manufacturers to adopt more sustainable processes and produce more environmentally focused products. As an example, sustainability data could be presented on product packaging as red, amber or green, similar to the colour-coded nutritional labels which provide customers with information to make healthier choices on the food and drink they buy. This could be further extended to providing life cycle assessments on products.

Systems thinking and working is becoming commonplace in healthcare with the development of integrated care systems. This networking is demonstrated in dentistry through the existence of Local Dental Networks (LDNs) and presents an opportune platform from which to tackle environmental challenges at a local and regional level. One example that should be considered is the idea of group purchasing, whereby several businesses procure through one buying group. This minimises operational and transportation waste, and may also improve the affordability of products. Furthermore, and importantly, group purchasing would also reduce the environmental impact of procurement, resulting in an eco-friendly and more centralised supply chain – although this may present challenges in and of itself.

Green energy

Practices could switch to green energy companies, monitor energy use and invest in insulation of their premises. Generating power using green energy sources, such as solar panels and ground source heat pumps, would reduce emissions from use of fossil fuels. The authors acknowledge that there are obvious practical and financial implications to implementing some of these suggestions and that government subsidies would be crucial to the success of any such proposals.

Conclusion

Climate change is happening, and dentistry should be doing its part to reduce carbon emissions and waste. It is essential that clinicians, manufacturers and relevant stakeholders understand and are united in dealing with the environmental crisis facing our planet. Oral disease prevention and improvement must be key to this, as is further research to understand what actions dental teams can implement at a local level. Clinicians should be encouraged to think and act on what adjustments they can make to their clinical practice to make them more environmentally considerate. Some helpful resources for the dental team can be found from the Centre for Sustainable Healthcare and the Green Impact website.[21,22]

Looking at the wider policy landscape, the authors hope the international community and UK government will honour their pledges made at COP26 and take the necessary bold steps towards a more sustainable and secure future.

References

1. Intergovernmental Panel on Climate Change. Climate Change 2021 – The Physical Science Basis. 2021. Available at https://www.ipcc.ch/report/ar6/wg1/#FullReport (accessed August 2021).
2. United Nations. Meeting Coverage and Press Releases. 2021. Available at https://www.un.org/press/en/2021/sc14445.doc.htm (accessed August 2021).

3. The United Nations Development Programme. The Peoples' Climate Vote. 2021. Available at https://www.undp.org/publications/peoples-climate-vote (accessed August 2021).

4. UK Government. UK becomes first major economy to pass net zero emissions law. 2019. Available at https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law (accessed July 2021).

5. International Energy Agency. The United Kingdom has made major progress in reducing emissions, according to the IEA's latest country review. 2019. Available at https://www.iea.org/news/the-united-kingdom-has-made-major-progress-in-reducing-emissions-according-to-the-ieas-latest-country-review (accessed September 2021).

6. UK Parliament. Statement: Environment and Climate Change: Response to the Resolution of the House, 1 May 2019. 2019. Available at https://questions-statements.parliament.uk/written-statements/detail/2019-06-27/HCWS1675 (accessed July 2021).

7. Committee on Climate Change. Net Zero: The UK's contribution to stopping global warming. 2019. Available at https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf (accessed August 2021).

8. Stern N H. *The Economics of Climate Change: The Stern Review.* London: HM Treasury, 2007.

9. UK Parliament. What were the outcomes of COP26? 2022. Available at: https://commonslibrary.parliament.uk/what-were-the-outcomes-of-cop26/ (accessed February 2022).

10. U.S. Energy Information Administration. Country Analysis Executive Summary: China. 2020. Available at https://www.eia.gov/international/content/analysis/countries_long/China/china.pdf (accessed August 2021).

11. The Rhodium Group. China's Greenhouse Gas Emission Exceeded the Developed World for the First Time in 2019. 2021. Available at https://rhg.com/research/chinas-emissions-surpass-developed-countries/ (accessed July 2021).

12. Ministry of Foreign Affairs of the People's Republic of China. Statement by H.E. Xi Jinping President of the People's Republic of China at the General Debate of the 75th Session of The United Nations General Assembly. 2020. Available at https://www.fmprc.gov.cn/mfa_eng/zxxx_662805/t1817098.shtml (accessed September 2021).

13. US Energy Information Association. Russia. 2022. Available at https://www.eia.gov/international/analysis/country/RUS (accessed March 2022).

14. Carbon Brief. Q&A: What does Russia's invasion of Ukraine mean for energy and climate change? 2022. Available at https://www.carbonbrief.org/qa-what-does-russias-invasion-of-ukraine-mean-for-energy-and-climate-change (accessed March 2022).

15. NHS England. Delivering a 'Net Zero' National Health Service. 2020. Available at https://www.england.nhs.uk/greenernhs/publication/delivering-a-net-zero-national-health-service/ (accessed August 2021).

16. Wilson G, Shah S, Pugh H. What impact is dentistry having on the environment and how can dentistry lead the way? *Fac Dent J* 2020; **11:** 110–113.

17. Public Health England. *Carbon Modelling Within Dentistry.* London: PHE, 2018.

18. Mulligan S, Kakonyi G, Moharamzadeh K, Thornton S F, Martin N. The environmental impact of dental amalgam and resin-based composite materials. *Br Dent J* 2018; **224:** 542–548.

19. Minamata Convention on Mercury. Text and annexes. 2019. Available at https://www.mercuryconvention.org/en/resources/minamata-convention-mercury-text-and-annexes (accessed July 2021).

20. UK Government. Regulation (EU) 2017/852 of the European Parliament and of the Council. 2017. Available at https://www.legislation.gov.uk/eur/2017/852/article/10 (accessed September 2021).

21. Centre for Sustainable Healthcare. Dentistry. Available at https://sustainablehealthcare.org.uk/what-we-do/sustainable-specialties/dentistry (accessed September 2021).

22. NUS Green Impact. Green Impact in Dentistry. Available at https://greenimpact.nus.org.uk/Green-Impact-In-Dentistry/ (accessed September 2021).