Sustainability in dentistry

Background

In many areas of life, sustainability, environmental protection and resource conservation are part of social and political discussions. It has been known for nearly 20 years that healthcare systems may also have a negative impact on the environment [10]. Likewise, dental healthcare has contributed to climate change and environmental pollution over time due to the required use of large amounts of electricity, water and plastic. However, dentists around the world are searching for ways to design processes of dental practices that are more resource-efficient and sustainable. In the following article, the current state of academic literature will be examined in detail.

Statement

In scientific databases, the number of publications pertaining to the relatively young field of "sustainability science" has increased noticeably over the last 10 years in both medicine and dentistry. However, to date, as far as comprehensive systematic reviews and meta-analyses are concerned, only a few publications can be found; this is due to the fact that the environmental impact of dental practice is very diverse and uniform quantifications are difficult to obtain. The lack of standardized study designs thus leads to publications with a broad spectrum.

There are a variety of articles in specialist journals which discuss strategies for environmentally friendly or "green dentistry" [2, 4, 8]. Furthermore, scientific studies have explored the environmental impact of disposable or reusable materials, as well as the quantity and quality of dental waste [5, 18, 19]. Moreover, through questionnaire-based interviews, the level of understanding and the prevailing attitudes towards the concept of "green dentistry" have been investigated [1, 16].

Development

The first recorded reference to the term "eco-friendly dentistry" goes back to a Canadian study which was published in 2007. The authors defined it as "an approach to dentistry that implements sustainable practices by keeping the consumption of resources in harmony with nature, protecting the external environment by eliminating or reducing waste, and promoting the well-being of all persons in the clinical environment by consciously reducing the chemicals in the air we breathe" [9].

Ten years later, in a secondary data analysis that is still unique to this day, Duane et al. determined the estimated ecological impact of dentistry in terms of emissions. The results show that the emissions for the National Health Service in England amounted to 675 kilotons of carbon dioxide equivalents in one year. Interestingly, within the spectrum of dental treatment, "dental check ups" contributed to the largest share of emissions (27.1 %). Although the least amount of CO_2 is produced per individual appointment, this dental procedure is by far the most frequently performed. With regard to dentistry as a whole, almost two-thirds (64.5 %) of emissions stem from employee and patient commutes, 19 % are caused by the purchasing of dental products and 15.3 % by the energy consumption of buildings and equipment in dental offices [6].

Only few industrialized countries have publically disclosed the share of emissions arising from their general health care system in proportion to the country's total yearly emissions. For instance, emissions amount to about 10 % for the USA, 7 % for Australia and 3 % for the National Health Service in England [6, 7, 11].

Although research suggests that the (dental) medical sector has a detrimental impact on the environment, the understanding for increased sustainability must continue to grow. In a prospective questionnaire study implemented in Romania in 2015, Popa et al. showed that dental professionals and students were interested in environmentally friendly alternatives. However, the concept of "green dentistry" was not well understood, shown for example by their lack of understanding of the environmental risks of incorrect waste disposal [15]. In two other studies conducted among Indian dentists, a positive attitude towards adopting "green dentistry" measures was determined. From the pool of 800 dentists which were surveyed, 91.9 % of dentists claimed to be open towards implementing new strategies [1].

Translation from German: Cristian Miron
Citation: Hlawa I, Lang H: Sustainability in dentistry Dtsch Zahnärztl Z Int 2020; 2: 203–205
DOI.org/10.3238/dzz-int.2020.0203–0205

Concept of "green dentistry"

"Green dentistry", first mentioned by Pockrass in 2008 [14], is a multidisciplinary approach and a concept that has been adopted across numerous academic articles that focus on the efficient use of resources in the dental practice. The concept can easily be summarized by the four R's: Reduce, Reuse, Recycle and Rethink.
Reduce: This requirement emphasizes the reduction of energy and resource consumption. The use of energy-efficient light sources, the switching off of devices as well as the use of digital documentation systems instead of paper or lead foil are environmentally friendlier and can additionally reduce the costs for electricity consumption in dental offices [17].

Reuse: The use of reusable and autoclavable instruments, suction tips, patient bibs, chair covers and water cups could significantly reduce the enormous amount of plastic waste. Petroleum-based plastics are only recyclable to a limited extent and they result in environmental pollution that lasts for several centuries [13]. In cases where disposables are absolutely necessary, alternatives such as plant-based and biodegradable plastics for disposables in the dental industry should be considered.

Recycle: A study conducted in Iran by Momeni et al. in 2017 showed that most of the waste generated in a dental clinic was semi-household waste which could easily be recycled. They also found that more than half of the dental clinics that which participated in the study had not implemented waste reduction or recycling programs [12].

Rethink: Rethinking already established processes can reduce their negative environmental impact and promote sustainable development. Besides waste disposal and separation, this includes optimizing office processes, rethinking the use of reusable materials and consumption of renewable energy [3].

Conclusion

The scientific interest with respect to the possible influence of dental or medical technologies on the environment has grown since the beginning of the 21st century. Regardless of the indispensable and positive impact of these technologies, topics such as environmental protection and sustainability are very likely to play an increasingly important role in this existential field in the future. This requires not only the development of strategies for applying "sustainability" in the dental office, but also the realization of studies on implementation and effectiveness of such strategies. In order to increase the acceptance of novel concepts, it is inevitable that obstacles must be considered and analyzed. The fact that a sustainable approach to medicine is not always impartial is often reflected in the frequently cited concerns about the quality of treatment and hygiene regulations. However, these concerns fail to notice that a large part of the potential measures to protect the environment and make dentistry more sustainable, can be implemented outside the immediate treatment room. Frankly, decades after the development of the concept of "green dentistry", there is still a clear need for research into the knowledge and practices of environmentally friendly dentistry in order to thoroughly establish this concept in the future and make it accessible to as many dentists as possible.

Conflicts of interest

The authors declares that there is no conflict of interest within the meaning of the guidelines of the International Committee of Medical Journal Editors.

References

1. Al-Qarni MA, Shakeela NV, Alamri MA, Alshaikh YA: Awareness of eco-friendly dentistry among dental faculty and students of King Khalid University, Saudi Arabia. J Clin Diagn Res 2016; 10(10): ZC75–ZC78

2. Avinash B, Avinash BS, Shivalinga BM, Jyothikiran S, Padmini MN: Going green with eco-friendly dentistry. J Contemp Dent Pract 2013; 14: 766–769

3. Chadha GM, Panchmal GS, Shenoy RP, Siddique S, Jodalli P: Establishing an eco-friendly dental practice: a review. IJSS Case Rep Rev 2015; 1: 78–81

4. Chopra A, Gupta N, Rao N, Vashisth S: Eco-dentistry – the environment-friendly dentistry. Saudi J Health Sci 2014; 3: 61–65

5. Duane B, Ramasubbu D, Harford S et al.: Environmental sustainability and waste within the dental practice. Br Dent J 2019; 226: 611–618

6. Duane B, Berners Lee M, White S, Stancliffe R, Steinbach I: An estimated carbon footprint of NHS primary dental care within England. How can dentistry be more environmentally sustainable? Br Dent J 2017; 223: 589–593

7. Eckelman MJ, Sherman J: Environmental impacts of the U.S. health care system and effects on public health. PLoS ONE 2016; 11: 0157014

8. Eram P, Shabina S, Rizwana M, Rana N: Eco dentistry – a new wave of the future dental practice. Annals of Dental Speciality 2017; 5: 14–17

9. Farahani A, Suchak M: Eco-friendly dentistry, the environmentally responsible dental practice. University of Waterloo, Ontario 2007

10. Flintrop J: Umweltschutz im Krankenhaus: Eine lohnende Investition. Dtsch Aerztbl 2001; 98: 28–29

11. Malik A, Lenzen M, McAlister S, McGain F: The carbon footprint of Australian health care. Lancet Planet Health 2018; 2: 27–35

12. Momeni H, Tabatabaei Fard SF, Arefinejad A, Afzali A, Talebi F, Rahmanpour Salmani E: Composition, production rate and management of dental solid waste in 2017 in Birjand, Iran. Int J Occup Environ Med 2018; 9: 52–60

13. Nasser M: Evidence summary: can plastics used in dentistry act as an environmental pollutant? Can we avoid the use of plastics in dental practice? Br Dent J 2012; 212: 89–91

14. Pockrass F, Pockrass I: The four "Rs" of eco friendly dentistry. Am Dent Hyg Ass 2008; 22: 18–21

15. Popa D, Mariana Constantinescu M, Kui A, Burden A, Campian RS: Attitudes and behaviors in dental practice regarding human and environment. Procedia Environmental Science 2015; 2: 107–112

16. Prathima V, Krishna Priya Vellore, Arpitha Kotha, Saka Malathi, Vedati Santosh Kumar, Mrunalini Koneru: Knowledge, attitude and practices towards eco-friendly dentistry among dental practioners. J Res Dent 2017; 4: 123–127

17. Rahman H, Chandra R, Tripathi S, Singh S: Green dentistry – clean dentistry. IJRD 2014; 3: 56–61

18. Singh T, Ghimire TR, Agrawal SK: Awareness of biomedical waste management in dental students in different den-

tal colleges in Nepal. Biomed Res Int 2018; 2018: 1742326

19. Unger SR, Landis AE: Comparative life cycle assessment of reused versus disposable dental burs. Int J Life Cycle Assess 2014; 19: 1623–1631

(Photo: Imke Hlawa)

IMKE HLAWA
University Medicine Rostock
Polyclinic for Dental Preservation and Periodontology
Strempelstr. 13, 18057 Rostock
Imke.Hlawa@med.uni-rostock.de

(Photo: Herrmann Lang)

PROF. DR. HERMANN LANG
University Medicine Rostock
Polyclinic for Dental Preservation and Periodontology
Strempelstr. 13, 18057 Rostock
Hermann.Lang@med.uni-rostock.de