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Is Dentistry Contributing to Climate Change? Knowledge-Based Awareness and Education Survey in Maharashtra

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Abstract-

Background: According to HCWH 2019, healthcare industry is 5th largest greenhouse gas emitter. Dentistry is highly energy and resource intensive with significant environmental impact. With rising temperatures across the world due to global warming, efforts are being made worldwide to mitigate the effects of environmental damage by resorting to sustainability concepts and green solutions in a myriad of ways. Despite the many benefits offered by eco-friendly approach, one of the main hurdles is the unawareness among the profession itself and related patients. *Aim:* To assess the knowledge and spread awareness amongst dental students, dental practitioners and dental academicians about carbon foot printing in dentistry. *Materials&Methodology:* We conducted cross-sectional awareness survey in Maharashtra for dental practitioners, dental academicians and dental students on topic named "is dentistry contributing to climate change?" to check knowledge and spread awareness about carbon foot printing in dentistry and dental practice. To share view on dentistry and its impact on climate change. There were five questions. After knowledge-based questionnaires, answers were provided to create awareness. Followed by shared a poster for awareness and education on carbon footprint in dentistry. Dentists are encouraged to motivate patients for good oral hygiene so that promoting green dentistry. *Result&Observations:* Results showed Dentists are 50% aware about what is carbon footprint but they don't know about various dental treatment impact and how to reduce greenhouse gas emission. Statical data showed overall no significant difference between knowledge of dental students, dental practitioners and dental academicians. *Conclusion:*Oral health is an extremely important part of human life. Dentistry as a profession should amalgamate sustainable development goals into regular practice and support a shift to an Eco-dentistry practice in pursuing healthy lives and well-being for all through all stages of life. It is the responsibility of all dental professionals to meet the demands of society to reduce the impact on natural resources at the same time promoting optimal oral health for all people and maintaining patient safety. The dentist should take steps to educate all of the dental team on eco-friendly practices and simultaneously reinforce safety of the patient and quality of treatment. It is important to spread awareness about how to reduce carbon footprint in dental practice. Together let us contribute to slow down and reverse the climate change.

Keywords-Sustainable, carbon footprint, eco- friendly, green dentistry

Article classification-Technical paper

Problem-According to HCWH 2019, healthcare industry is 5th largest greenhouse gas emitter. Being part of this, it's our responsibility to learn and start sustainable dental practice. The concept of eco-friendly dental practice was evolved, focusing on environmentally sustainable dental practice. Despite the many benefits offered by eco-friendly approach, one of the main hurdles is the unawareness among the profession itself and related patients. To switch from conventional and established dental practice to the concept, design and implementation of green dentistry to promote eco-friendly dentistry is need of an hour. Sustainability is about the sensible and responsible use of natural resources in order to avoid depletion and maintain an ecological balance. Example is from a sustainability perspective; the dental team should ensure that waste is dealt with in the most ecologically sound way. Ensuring clinical waste is kept to a minimum will reduce the carbon emissions associated with incineration. Recycling will help reduce the depletion of natural resources in terms of paper, plastic and glass products, with associated lower carbon emissions than landfill. Appropriate management of food waste will return nutrients to the soil, again, resulting in lower carbon emissions.

The Climate Change Bill-2012 (India) focuses on the reduction of targeted greenhouse gas emission (GHG) emissions in India. It also aims to provide carbon budgeting and trading schemes. The Indian national committee on climate change advises the government bodies on all matters related to the emission of GHG from different sectors, such as, industry, transport, education and power. Dentistry is highly energy and resource intensive with significant environmental impact. Factors inherent in the profession such as enormous electricity demands of electronic dental equipment, voluminous water requirements, environmental effects of biomaterials (before, during and after clinical use), the use of radiation and the generation of hazardous waste involving mercury, lead etc. have contributed towards this. With rising temperatures across the world due to global warming, efforts are being made worldwide to mitigate the effects of environmental damage by resorting to sustainability concepts and green solutions in a myriad of ways. In such a scenario, a professional obligation and social responsibility of dentists makes it imperative to transform the practice of dentistry from a hazardous to a sustainable one, by adopting environmental-friendly measures or 'green dentistry'.

Approach –

It is a matter of concern that some dental clinics are not taking into consideration the environmental impact on the general hygiene and safety of their patients and surrounding.

Carbon footprint is the sum of direct and indirect greenhouse gas emissions which are produced throughout the supply chain of activities and products expressed in carbon dioxide equivalents (CO2e). Indirect emissions (other)- • Supply chain • Travel • Waste disposal, Indirect emissions (electricity)- • Electricity use, Direct emissions- • Energy generation • Vehicle emissions. Dental practices could consider following points are: • Energy use per unit activity (for example, unit of dental activity [UDA] or patient appointment) • Travel per unit activity • Procurement (purchases) per unit activity • Organization water use per unit activity or patient appointment • Organization waste in kg or bags to landfill per unit activity or patient appointment. Additional useful indicators could be: • Evidence the organization promotes sustainability to its employees • Proportion of procurement spend in the local community • Measures recognizing work towards more sustainable care pathways.

Four A's management protocol: Ask, Assess, Advice and Assist the dentists. This could be a way to ensure its sustainability in dentistry. The 4 A's adapted from the strategies of tobacco cessation may be used in eco-friendly dentistry as described below theoretically: a) Ask – Gather all the details from the dentist on his routine dental practices; b) Assess – Assess what all practices can be modified towards promoting eco-friendly dentistry; c) Advice

– A clear set of guidelines that can be followed; and d) Assist – In preparing a framework as per the environmental conditions at the place of the dental clinic/ Hospital.

Process based life cycle analysis (PBLCA) was considered to calculate the greenhouse gas emissions of each of the procedures. The individual steps which the dentists and their patients follow when carrying out/undergoing treatment and the resources used at each step were noted down. The resources used can be categorized as follows:

1. Staff travel: commuting and travel for work.

2. Patient travel: it was assumed that patients travel to the dental surgery from home.

3. Energy: gas and electricity as an overhead in the dental surgery (excluding use of electricity for dental machinery and equipment).

4. Water: used in the dental surgery.

5. Generic disposable materials which are used for all procedures, eg, dentist's and assistants face masks and gloves, disposable paper towels etc.

6. Reusable sterilizable tools, e.g., dental probe and tweezers.

7. Electrical equipment and the duration of time they are used for a procedure and their energy consumption.

8. Bespoke materials specific to particular procedures, eg, amalgam used for a restoration, nitrous oxide used for conscious sedation.

Dental services have an important opportunity to address the sustainability of services – from the design of clinical pathways to the organization and delivery of care. To achieve Sustainable Development Strategy for the Health and Social Care System, we need to understand where and how we use finite resources within the system, including carbon and money, and reduce their use whilst still maintaining or improving quality of care. The key to maximizing sustainability in dentistry lies in the innovation of green dental products and processes, refining available or developing newer technologies and initiating research in the area of sustainable practice to generate data where none exists so far, to guide future actions. Currently, very few green products, for example Earth-friendly High Volume Evacuator paper tips or nontoxic, non-corrosive, environment-friendly waterline treatment systems, exist in the market. Demand from the dental fraternity can spur the manufacturers to innovate, design and supply more 'green' products and adopt measures like reduced packaging. 'Bioplastics' are environment-friendly organic plastics derived from renewable biomass sources, such as vegetable oil, corn starch, microbiota, etc. However, their lower emissions and higher green quotient notwithstanding, these products pose a threat to global food security due to deforestation and diversion of agricultural land for alternate purposes. Thus, the challenge in innovating 'green' products, lies in balancing eco-friendly attributes with practicality, usability and biocompatibility. Research and development in the hitherto unexplored field of green dental biomaterial research offers new opportunities, possibilities and scope for the sustainable future of dentistry, based on green chemistry.

Dentists play a very vital role in helping to promote and create an ecofriendly environment. This aspect being important may also be taught at a university level as a part of the curriculum in dentistry. Dentists should realize that efforts have to be made towards creating an eco-friendly environment at a clinical level to be community friendly. Continuous dental education programs should be conducted to increase awareness among the dentists to create an eco-friendly environment. Dental professionals should advice patients that maintaining good oral health is good for environment also along with that encourage to save water and energy which they use for brushing and maintaining their teeth/oral hygiene. And also reinforce eco-friendly habits in their daily activities. Dental

associations, institutions and National authorities should encourage research on the environmental impact of dental practice so that dentists can understand, monitor and report the impact of their actions.

We have conducted survey in Maharashtra (no funds) for dental practitioners, dental academicians and dental students on topic named "is dentistry contributing to climate change?" to check knowledge and spread awareness about carbon foot printing in dentistry and dental practice. To share view on dentistry and its impact on climate change. There were five questions viz.

1. Do you know what is carbon foot printing?
2. Do you know how oral health will affect nature and environment?
3. Do dental interventions create greenhouse gas emissions?
4. Do you know which dental treatment cost major carbon footprint?
5. Do you know different ways for how to reduce carbon foot printing of dentistry?

Findings-

Prof. Nicolas Martin, chair of the FDI Sustainability in Dentistry Task Team, explained in the press release: "Prevention is better than cure and it is the most impactful and practical way of reducing the need for clinical interventions and associated environmental impacts."A global study conducted by Dentsply Sirona among over 1,300 dentists found that more than three-quarters of them believe that there is a lack of education on sustainability in dentistry. Here in our survey after knowledge-based questionnaires, answers were provided to create awareness. Results showed dentists quite aware about carbon footprint but they don't know about various dental treatment impact and how to reduce greenhouse gas emission.We also shared a poster for awareness and education on how to reduce carbon footprint in dentistry. Dentists are encouraged to motivate patients for good oral hygiene so that promoting green dentistry.
Results are mentioned below in figures.

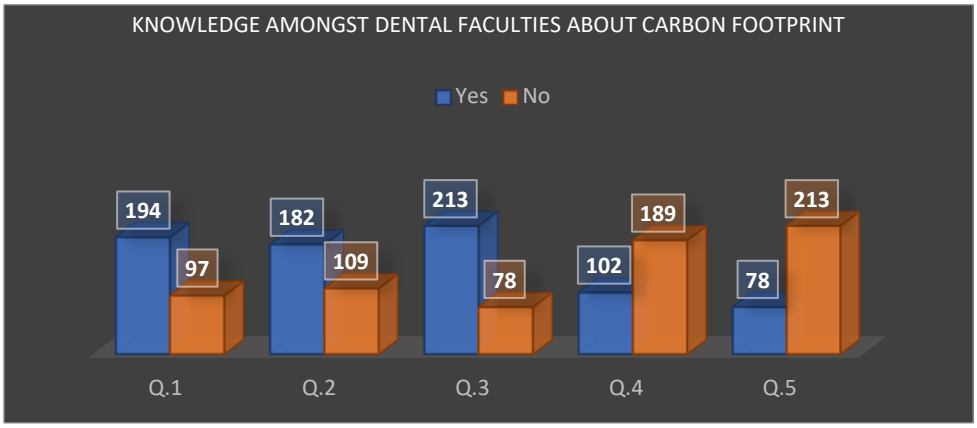
Conclusion-

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.

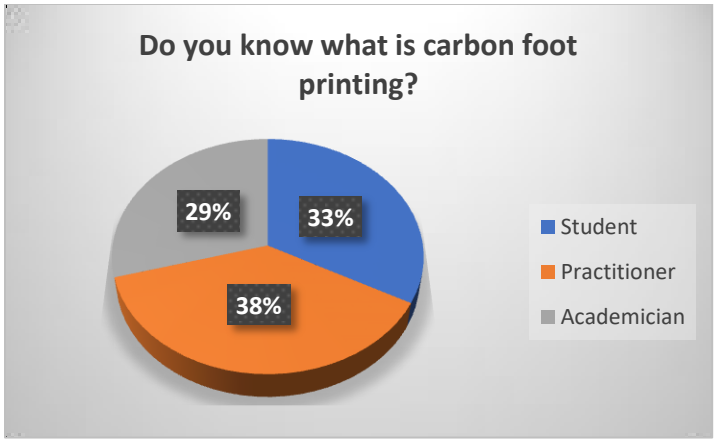
This was just mere presentation of condition of dentists in Maharashtra over different districts based on their knowledge regarding carbon footprint and dental impact on nature and greenhouse gas emission. This is indication that we should start educating and applying same policies/regulations to each dental clinic to follow sustainable practice ways and start reducing carbon emission from dental clinic. As rightly quoted by Tom Ziglar, "change starts with you, but it doesn't start until you do." Together let us contribute to slow down and reverse the climate change.

Figures-

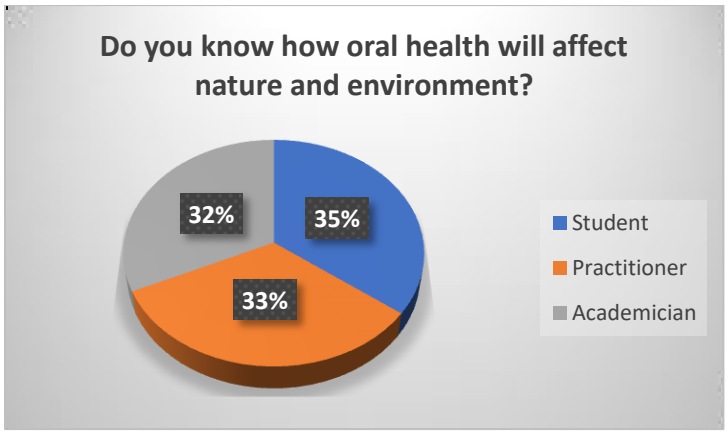
*No- 1)*Overall representation of results for all 5 questions (yes/no)



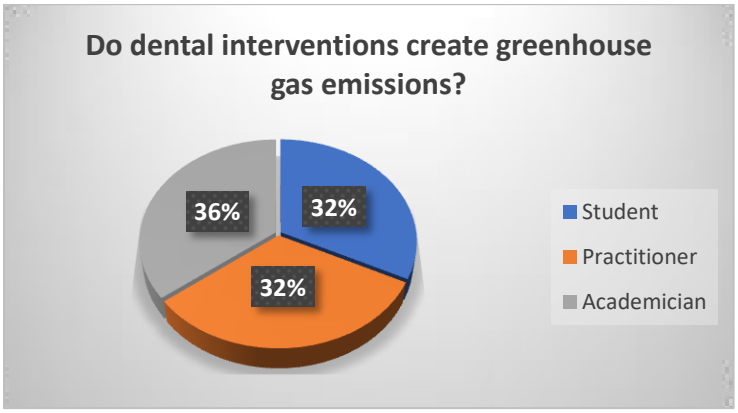
*No 2)*Question no-1 and its result



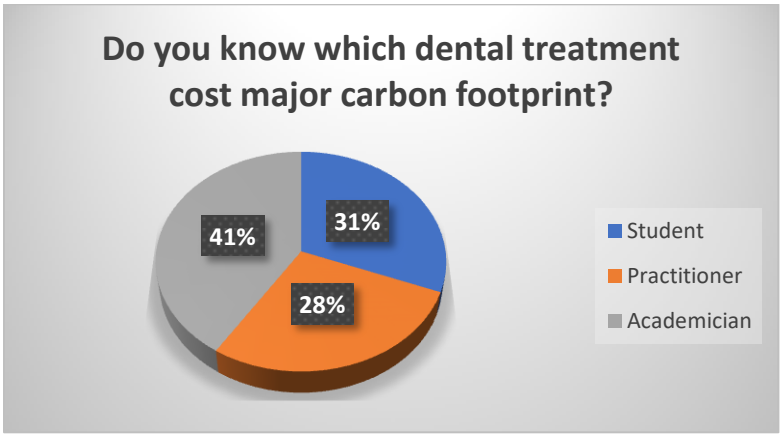
*No- 3)*Question no-2 and its result



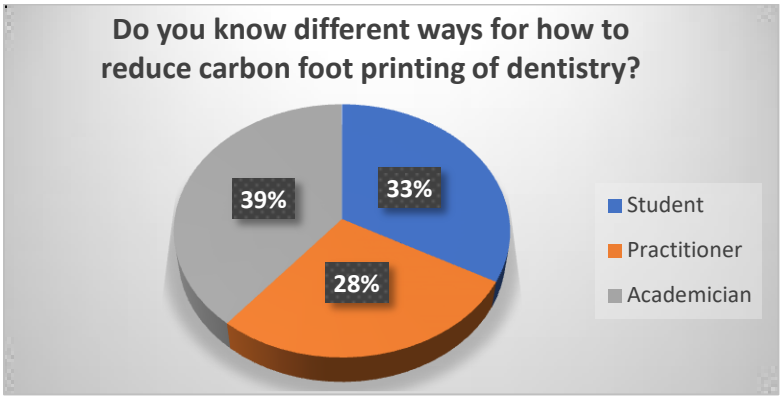
*No- 4)*Question no-3 and its result



*No- 5)*Question no-4 and its result



No- 6) Question no-5 and its result



No-7) Education poster for carbon footprint in dentistry


ECO-DENTAL PRACTICE: HELPING HAND TO STOP CLIMATE CHANGE
REDUCE YOUR CARBON FOOTPRINT
Prevention of oral and dental disease is the single most important factor in reducing the environmental impact of dentistry long-term.
Good oral health routine and healthy habits helps the environment.
RETHINK
Change starts with you, but it doesn't start until you do
INDOOR PLANTS
WATER HARVESTING & RECYCLING
Use LED for illumination
LINOLEUM FLOOR & ZERO VOC WALL PAINT
HAND SANITIZER & SENSOR TAPS
SOLAR PANELS
USE PUBLIC TRANSPORT
GO DIGITAL LESS PAPER AND SAVE MATERIAL
REDUCE REUSE RECYCLE
AMALGAM SEPERATOR
WASTE MANAGEMENT
Book family appointment
SEVOFLURANE USE
NITROUS OXIDE DESTRUCTOR
BIODEGRADABLE GLOVES
METAL SUCTION TIPS
HU-FRIEDY'S PROGRAMME OF RECYCLING OLD INSTRUMENTS & GIFTING NEW ONE
ENVIRONDENT
BIOPLASTIC PRODUCTS
GLASS SYRINGE
CERAMIC OR BRASS TOOLS
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, by adopting environmental-friendly measures.

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3) Duane B, Ramasubbu D, Harford S, Steinbach I, Stancliffe R, Ballantyne G. Environmental sustainability and biodiversity within the dental practice. British dental journal. 2019 May;226(9):701-5.
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