

Role of Dentistry in Ecosustainable Development in Latin America *

Papel de la odontología en el desarrollo ecosostenible en Latinoamérica

Papel da odontologia no desenvolvimento ecosustentável na América Latina

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ABSTRACT

Background: Climate change is the global variation in the climate on earth due to natural causes and pollution, gas emissions and carbon dioxide. Dentistry must actively participate to be eco-sustainable. **Purpose:** To analyze the role that Latin American dentistry should play to promote eco-sustainable development. **Methods:** An exploratory review of the literature was conducted in the databases of PubMed, ScienceDirect, SciELO, and Google Scholar. The search terms were sustainable development, Latin America, environmental medicine, environmental responsibility, dentistry, and oral health. **Results:** A framework for sustainable development is first established based on the analysis of three pillars (environment, economy and society) and the objectives of sustainable development. Second, the need to enact policies and recognize the importance of this issue by the dental profession and its impact on the environment is emphasized. Third, fundamental elements for eco-sustainable dentistry are listed. Fourth, a model of good practices for the dental office is introduced. **Conclusions:** In Latin America, the commitment of the dental profession is to work institutionally and individually to provide eco-sustainable oral health. In the current context, the joint work of public and private institutions is required. Dentistry must modify the factors that support current behaviors and practices. Concrete actions must be implemented towards sustainability in oral health care, based on scientific evidence to reduce, reuse, recycle and rethink care policies, waste management, distribution logistics, education, research and production of eco-sustainable materials.

Keywords: dentistry; environmental responsibility; Latin America; environmental medicine; sustainable development; oral health

RESUMEN

Antecedentes: El cambio climático es la variación global del clima en la tierra debido a causas naturales y la contaminación, emisiones de gases y dióxido de carbono. La odontología debe participar activamente para ser ecosostenible. **Objetivo:** Analizar el papel que debe tener la odontología latinoamericana para promover el desarrollo ecosostenible. **Métodos:** Se realizó una revisión exploratoria de la literatura en las bases de PubMed, ScienceDirect, SciELO y Google Académico. Los términos de búsqueda fueron: desarrollo sostenible, Latinoamérica, medicina ambiental, responsabilidad ambiental, odontología, salud bucal. **Resultados:** Se establece primero un marco para el desarrollo sostenible a partir del análisis de tres pilares (medio ambiente, economía y sociedad) y los objetivos del desarrollo sostenible. Segundo, se enfatiza la necesidad de promulgar políticas y reconocer la importancia de este tema por parte de la profesión odontológica y su impacto en el medio ambiente. Tercero, se listan elementos fundamentales para una odontología ecosostenible. Cuarto, se introduce un modelo de buenas prácticas para el consultorio odontológico. **Conclusiones:** En Latinoamérica, el compromiso de la profesión odontológica es trabajar institucional e individualmente para proporcionar una salud bucodental ecosostenible. En el contexto actual, se requiere del trabajo mancomunado de instituciones públicas y privadas. La odontología debe modificar los factores que sustentan los comportamientos y prácticas actuales. Se deben instaurar acciones concretas hacia la sostenibilidad en la atención de la salud bucal, basándose en la evidencia científica para reducir, reutilizar, reciclar y repensar políticas de atención, gestión de residuos, logística de distribución, educación, investigación y producción de materiales ecosostenibles.

Palabras claves: América Latina; desarrollo sostenible; Latinoamérica; medicina ambiental; responsabilidad ambiental; odontología; salud bucal; salud oral

RESUMO

Antecedentes: As alterações climáticas são a variação global do clima na terra devido a causas naturais e à poluição, às emissões de gases e ao dióxido de carbono. A Odontologia deve participar ativamente para ser ecosustentável. **Objetivo:** Analisar o papel que a odontologia latino-americana deve desempenhar para promover o desenvolvimento ecosustentável. **Métodos:** Foi realizada uma revisão exploratória da literatura nas bases de dados PubMed, ScienceDirect, SciELO e Google Scholar. Os termos de busca foram: desenvolvimento sustentável, América Latina, medicina ambiental, responsabilidade ambiental, odontologia, saúde bucal. **Resultados:** Um quadro para o desenvolvimento sustentável é inicialmente estabelecido com base na análise de três pilares (meio ambiente, economia e sociedade) e nos objetivos do desenvolvimento sustentável. Em segundo lugar, enfatiza-se a necessidade de promulgar políticas e reconhecer a importância desta questão pela profissão dentária e o seu impacto no ambiente. Terceiro, são elencados elementos fundamentais para uma odontologia ecosustentável. Quarto, é apresentado um modelo de boas práticas para o consultório odontológico. **Conclusões:** Na América Latina, o compromisso da profissão odontológica é trabalhar institucional e individualmente para proporcionar saúde bucal ecosustentável. No contexto atual, é necessário o trabalho conjunto de instituições públicas e privadas. A Odontologia deve modificar os fatores que sustentam os comportamentos e práticas atuais. Devem ser implementadas ações concretas rumo à sustentabilidade nos cuidados de saúde oral, baseadas em evidências científicas para reduzir, reutilizar, reciclar e repensar políticas de cuidados, gestão de resíduos, logística de distribuição, educação, investigação e produção de materiais eco sustentáveis.

Palavras-chaves: América Latina, desenvolvimento sustentável; medicina ambiental; responsabilidade ambiental; odontologia; saúde bucal; saúde oral

INTRODUCTION

Currently, humanity faces great challenges due to climate change. The United Nations (UN) is making efforts to mobilize a rescue plan for the planet that aims to commit human beings to environmental care that cannot be postponed. Researchers around the world have, for decades, warned about the worsening climate crisis as greenhouse gas emissions continue to increase (1).

In 1988, the UN created the Intergovernmental Group of Experts to facilitate comprehensive assessments of the state of scientific, technical, and socio-economic knowledge on climate change, its causes, potential impacts, and response strategies. Its latest 2023 report concludes that global temperatures are already 1.1 °C above pre-industrial levels and are likely to reach or exceed the critical tipping point of 1.5 °C by 2035. Catastrophic heat waves and increasingly intense droughts, floods, and forest fires have become too frequent (1). Rising sea levels threaten hundreds of millions of people in coastal communities. Additionally, the world is currently facing the largest species extinction event since the age of the dinosaurs and the oceans were burdened with more than 17 million metric tons of plastic pollution in 2021, with projections showing that will likely double or triple by 2040 (2). To provide solutions to these problems, various institutions around the world work on the articulation of public policies that promote better options to meet the sustainable development goals.

The first time in history that the concept of sustainable development was addressed was in the work of the German-British professor Ernst Friedrich Schumacher (1911-1977). This economist, academic, researcher, philosopher, writer and lecturer formed the Intermediate Technology Development Group (ITDG) in London in 1965. Through the ITDG, Schumacher focused on economics as a discipline in which human being has priority importance. Through his multiple works he advocates environmental awareness, sustainable development, an organization of the economy on a human scale, and intermediate technology as instrumental for a friendly relationship between people and their environment. In “Our Common Future” from 1987 (3), Schumacher is mentioned as the pioneer of the sustainable development approach.

The UN (4), in the Resolution adopted by the General Assembly on September 25, 2015, outlines how the 17 sustainable development goals seek, among other priority issues, to act on the deterioration of the environment due to the depletion of natural resources and environmental pollution. This deterioration will have consequences for future generations who will have to receive an environment with natural resources reduced by pollution. Sustainable development is one of the current topics that is most discussed at the national and international levels by different actors such as governments, companies, and society in general. However, the topic is little discussed and overseen in disciplines such as dentistry. The purpose of this study was to analyze the role that Latin American dentistry should play to promote eco-sustainable development.

MATERIALS AND METHODOS

To contextualize the object of study, a descriptive exploratory approach was used through a review of the literature composed of three phases: search and detection; obtaining; and consultation, in order to carefully present the bibliographic data focused on aspects related to the concepts “sustainability and dentistry” and integrate them in a coherent and logical way. Databases used for the literature search included PubMed/Medline, ScienceDirect, SciELO, and Google Scholar. The keywords used in Spanish were the following: sustainable development, Latin America, environmental medicine, environmental responsibility, dentistry, and oral health with the Boolean connector “AND.”

The bibliographic analysis was complemented by consulting the references cited in the selected studies. The information was analyzed to establish the main environmental, social, and economic impacts. Finally, the review and study of the information allowed us to extract the necessary and relevant content to discuss the main challenges projected by the sustainability paradigm of raising awareness to establish, throughout Latin America, an eco-sustainable dentistry. This paradigm will require the protagonism of decision makers, to have a necessary starting point to implement policies within the framework of this new concept. This will allow the dental profession to identify how environmental problems can be resolved through sustainable development strategies that include, within the health area, the oral health component.

In the following results and discussion section, a framework for sustainable development is first established based on the analysis of the three pillars and UN sustainable development goals. Second, the need to enact policies and recognize the importance of this issue by the dental profession and its impact on the environment is emphasized. Third, fundamental elements for eco-sustainable dentistry are listed. Fourth, a model of good practices for the dental office is introduced.

RESULTS AND DISCUSSION

Pillars and Sustainable Development Goals

The UN 2030 Agenda for Sustainable Development, approved in 2015, established 17 goals to stimulate efforts in the following years in areas of critical importance for the planet. This agenda consists of an action plan for humans, the planet, and global well-being. These goals are called Sustainable Development Goals (SDGs) (4). Based on this premise and considering the approach presented by De Lombaerde, *et al.*, in 2014 (5) three main pillars were defined: the environment, the economy, and society (figure 1). To achieve sustainability, these three pillars must work as gears that allow establishing equity between human needs and maintaining biodiversity.



FIGURE 1
Three Sustainable Development Pillars
Source: The author.

Environment: It is related to the natural resources that the planet offers and how society, communities and companies distribute those resources. To maintain biodiversity, it is of utmost importance to use renewable energies, since traditional energies compromise the atmosphere and the general health of all living beings in the world. In this way, human activities must adapt to the needs of the environment in order to preserve the environmental balance and ecosystems.

Economy: Refers to manufacturing, delivery coordination, and consumption of goods or services. It seeks to increase the well-being of society using responsibility, through a system of green companies. In this way, wealth is produced considering human values and respect for nature. Sustainability ensures that natural resources are used cautiously, but at the same time covering the needs of current societies without affecting future generations.

Society: Considers all people, as well as their quality of life with respect to education, health, and their basic needs. It seeks to provide unity between the population and their well-being, since it aspires to live in a more just society, eliminating poverty and injustice. This responsibility falls into the hands of each of the people who make up society.

The three pillars have a direct link with health, as a key input for sustainable development and human well-being that is fundamental for the spirit and advancement of the 2030 Sustainable Development Agenda. The third SDG (SDG 3) focuses in health and aims to guarantee a healthy life and promote well-being for everyone at all ages. Other SDGs (2, 6, 7, 11, and 17) also relate to health issues such as stunting and childhood obesity, clean water and sanitation, clean energy for all, environmental pollution, knowledge sharing, and networking. The above SDGs are under the coordination of other sectors but create opportunities for intersectoral programming and activities to improve health, among which oral health is an essential part of human life (6).

Impact of Dental Practice on the Environment

If we understand that comprehensive health care of people encompasses all its components, including oral health, dentistry cannot be isolated from this integrationist vision. The promotion of oral health habits, added to the accessibility of all people to health services, contributes significantly to the well-being of the populations of Latin America and around the world. They could also contribute to achieving environmental goals and leading healthy, inclusive and productive lives (7). For this reason, the dental profession must incorporate the SDGs into daily practice and support the change towards a green economy conscious of ecology, in pursuit of well-being and throughout the life cycle to promote a healthy life for all (7).

Teams of oral health professionals and assistants, as well as patients, must recognize the importance of collaborating in favor of sustainability. This can be achieved by taking responsibility for meeting demands and reducing the impact on natural resources, while promoting optimal oral health for individuals, families and communities. Sustainability in dentistry implies that all actors involved work together and in a transdisciplinary manner. This includes national governments, researchers, oral health professionals, universities, the productive sector, and training institutions at the undergraduate and postgraduate levels, the sector industry, its manufacturers and distributors, dental equipment technicians and those responsible for the collection and treatment of pathological waste (7).

With respect to policy, it is essential to have those that promote regulations or regulatory frameworks on the professional practice of dentistry that consider its environmental impact in Latin America and the world. At the General Assembly of the International Dental Federation (IDF) in August 2017, which took place in Madrid, Spain, a position was taken for the first time regarding sustainability in dentistry and in support of the 2030 Agenda for Sustainable Development. This position stated that oral health professionals must recognize the importance of collaborating in favor of sustainability and taking responsibility for meeting society's demands to reduce the impact on natural resources, while promoting optimal oral health for all people and maintaining patient safety (8). It also established that the FDI and national dental associations are important channels to coordinate this work and interact with local authorities to advocate for and facilitate activities related to sustainable development (9).

When conducting this review in different networks to identify legislative acts or regulations in this regard in Latin America, only some have been found that refer exclusively to the treatment of hospital waste in Argentina, Brazil, Colombia, Costa Rica, Ecuador, Mexico, Uruguay and Venezuela . By 2006, these countries had explicit regulations for the management of their pathological waste, but they did not mention clinical protocols or other standards of professional dental practice with respect to the environmental care of the planet (10). This finding would need an update. However, it is clear that dental institutions should promote in each country in the Latin American region the enactment of laws and regulations that guarantee that dental practice respects environmental sustainability (11-13).

It has been proven repeatedly in epidemiological studies that the population needs dental care for pathologies of cariogenic or periodontopathic origin that afflict patients of various age groups. This indicates that there is a constant flow of people demanding attention in dental offices. The World Report on the Status of Oral Health estimates that these diseases affect almost 3.5 billion people worldwide (14). The estimated global prevalence of these conditions combined is 45 %, which exceeds the prevalence of any other non-communicable disease (14). It is interesting to describe the impact that the practice of dentistry can produce. To create this context, it is essential to analyze some key indicators. If it is taken as a basis that an average of two patients are seen in each office in one hour, in two consultations per hour 4 pairs of gloves and 4 face masks would be needed (dentist and a dental assistant), as well as 2 saliva ejectors, 2 bibs, and 2 disposable rinse cups. If it is estimated that a dentist works 8 hours a day, it could be inferred that, in waste units, 32 pairs of gloves, 32 face masks, 16 ejectors, 16

bibs and 16 disposable rinse cups would be used per day. Table 1 estimates the annual impact in terms of waste materials.

TABLE 1
Estimation of amount of waste units produced in 8 hours of daily work by a dentist

Items	Per day	Per month *	Per year **
Gloves	32	640	7680
Face masks	32	640	7680
Ejectors	16	320	3840
Bibs	16	320	3840
Rinse cups	16	320	3840
Total waste units	112	416	26880

* Estimating 20 workdays per month. ** Estimating 240 workdays per year.

Source: the authors.

According to a 2019 report by the World Health Organization (WHO) (14), it is estimated that 2.4 million dentists work in the world, of which half reside in Latin America. Likewise, the WHO reports that disposable material waste is equivalent to an average of 1.75 kg of waste/per dentist/per day. From this estimated data, it is calculated that Latin American dentistry produces 2.1 million kilograms of waste per day, that is, more than two tons. Therefore, the correct management of waste must be a fundamental part of the actions that must be implemented, which includes its classification and recycling or replacement with equivalent products that contribute to reducing the environmental impact on the planet (14-15). Here, as an illustration, the impact of the accumulation of disposable items is considered, without considering others, such as personal protective equipment, remains of gauze and materials. However, waste and materials are not the only things that cause concern. There are also the primary, secondary, and tertiary packaging in which the materials are boxed. Martin, *et al.*, (16) state that dentistry is a significant contributor to the global burden of discarded plastic packaging. Even so, the net polluting effect between different packaging systems is unknown, which is an important research opportunity.

After visualizing the global problem and the impact that dental practice produces on the environmental balance, we can highlight the importance of working on the implementation of solutions that promote eco-sustainable dentistry. This is understood as a sensitized practice of the profession in which changes that promote responsible care of the environment are made.

Objectives of Eco-sustainable Dentistry

Dentistry must be practiced ethically and with the highest quality and biosafety standards in order to achieve optimal oral health for the population. Sustainability implies a broader commitment by oral health professionals to social and environmental responsibility. Likewise, dentistry must respect the right of future generations to a world with adequate natural resources. To achieve this objective, the dental profession must advocate for the establishment of public policies that include the right to oral health as a State-based policy. Eco-sustainable dentistry must establish some fundamental guidelines such as (7):

- Dentistry must work together with regulatory entities in accordance with environmental health policies that include sustainability without compromising patient safety and the quality of care provided in public and private settings.
- Undergraduate dental programs (as they exist in Latin America) and postgraduate training programs should integrate the concept of sustainable dentistry in their curricula, academic programs, academic-professional conferences or events, and continuing education activities.
- National dental associations and other related organizations must ensure that their activities and operations are based on principles of sustainability.

- The most sustainable way to guarantee optimal, accessible and inclusive oral health, with the minimum possible impact on the environment, in the best cost-benefit equation, is the establishment of plans and programs to promote health and prevent oral disease.
- All areas of the dental profession must issue documents that exalt the importance of sustainability and be effective communicators in mass media, social networks, and institutional websites to raise society's awareness of its importance.
- The industry and manufacturers of dental products and equipment must develop more sustainable technologies and dental materials that are biodegradable or recyclable. Promote the use of low-consumption and low-pollution technologies, by reducing energy, water, and paper consumption to replace, when possible, disposable products with reusable materials that are less harmful to the environment and reduce carbon emissions in the air.
- Researchers can provide scientific evidence and studies of new systems, materials, and good-practice clinical protocols that promote the improvement and evaluation of the sustainability and environmental impact of dental practice. Thus, oral health professionals, auxiliary personnel, and patients will be able to understand and apply concepts of the impact of eco-sustainable practices.
- The dentist must lead the taking of initiatives to educate the entire work team regarding sustainable practices, prioritizing a practice based on quality of care, ethics, and patient safety.

Good Practices Model for the Dental Office

In 1999, Smith, *et al.*, estimated that between 25 % and 33 % of deaths worldwide could be attributed to environmental pollution (17). According to Vargas (18), of the 460 tons of waste generated monthly in the health system, approximately between 8 % and 10 % are generated by the dental sector, due to the use of plastics, paper, chemicals used in washing of instruments, non-biodegradable polymers, and excess drinking water. The dental area generates a significant environmental impact due to the production of waste and the existing “disposable” mentality, which can be replaced by more ecological and simplified alternatives (19). The following are suggested good practices that can be implemented to achieve an ecological and sustainable dental clinic.

Elimination of Disposable Plastic Materials

Disposable plastic materials, used only once, such as saliva ejectors or suction cups, could be replaced by biodegradable poly paper or metal ejectors that are reusable. Regarding the glasses used by the patient to rinse, there are options that are not plastic. For example, there are cups based on cornstarch, sugar cane fiber and other plant fibers, such as hemp or pineapple, which are compostable and recyclable (19-20).

Currently, gowns, face masks, hats, and shoe covers are part of the personal protective equipment essential in the activity of dentists and human teams who care for patients daily. It is suggested to replace kits made of different plastic materials with others made of recycled paper or microfiber materials that can be autoclaved (19-20).

Energy in the Sustainable Dental Office

In the present and the immediate future, there must be increasing awareness of the impact of human activity on the environment. Energy consumption is no exception; every kilowatt/hour (kWh) we save is equivalent to 308 g less CO₂ in the atmosphere (21). Efficient energy management is a path towards sustainability that allows generating savings that, with adequate planning, can be reinvested in advanced technical solutions. It is a virtuous circle that must include lower operating costs, reduced CO₂

emissions, and facilities that operate at full performance, minimum consumption, and maximum user satisfaction (21).

Once good practices are implemented and inefficiencies have been corrected, it will be time to propose advanced technical solutions to take another step towards quality and evolve towards sustainable dental offices from the point of view of energy consumption. It is not just about applying technology but about studying the present and future needs of the office to allocate the savings generated to improvements in the facilities that contribute to the sustainability of the company and the comfort of professionals and patients. The following are some of the recommendations for energy savings in a dental office (21):

- Install low consumption LED lights and make the most of natural lighting.
- At the end of workday, turn off the lights and all unused electrical devices to avoid consuming energy at night, when it is not necessary.
- Install motion sensors so that, for example, in bathrooms, only turn on when they are occupied. Motion sensors can help reduce energy consumption by up to 50 %.
- Regarding air conditioning systems, use individual heating and air conditioning equipment that allows you to regulate the temperature and optimize energy consumption. It is important to use devices that comply with energy efficiency and biosafety regulations, as well as supporting the international environmental management standard ISO 14001. Although its application is not yet mandatory in the field of dentistry, its observation makes the world more respectful of the environment in all areas.
- Reduce paper use. With the development of new technologies, it is possible to have digitalized dental clinics in which the majority of documents, such as reports, x-rays, informed consents, or patient records are stored in digital spaces and there is no need to have physical documents. This will help reduce the use of paper and, when necessary, it will be advisable to use recycled paper.
- Reduce CO2 emissions. Members of the dental team must be trained in environmental matters and how they can contribute to improving it in each job. You can use equipment that has the highest performance coefficients (energy efficiency category A) or use public transportation to get to the workplace, when possible.

Use and Prescription of Toothbrushes

Marine pollution is largely produced by garbage in the form of floating solid waste, such as plastic bottles, covers, straws, tires, fishing nets, wood, and other items. To this type of garbage, the waste of personal protective equipment that is used to protect against cross infections in each dental care is added (22). According to a Greenpeace study, by 2050, there will be more plastic than fish in the oceans. It is estimated that 1 % of this material comes from an essential cleaning utensil for daily routine: the toothbrush. Every plastic toothbrush ever made still exists somewhere on the planet (23-25) (Figure 2).



FIGURE 2
Time it takes for plastics used in dental clinics to degrade
Source: WWF Australia, 2021 (23)

With a global population of 7.53 billion people, approximately 29.4 billion toothbrushes are manufactured each year. Considering that a plastic toothbrush weighs around 20 g on average, humanity produces 600 million kg of plastic toothbrush waste in just 365 days. It can take more than 500 years for a plastic toothbrush to degrade. Changing a toothbrush for a biodegradable one made with ecological materials is a simple gesture that will have a great positive impact on the environment. You can find some bamboo or wooden brushes, biodegradable products or disposable clinical use material. In addition to the handles, attention should be paid to the material the bristles are made of (23-25).

Although the toothbrush is a widely recommended health device around the world, little quantitative data is currently available on its impact on the environment. A study by Lyne, *et al.*, (25) uses life cycle analysis (LCA) for the first time to measure the environmental consequences of a medical device. The researchers considered different models of toothbrushes and measured their environmental impact (carbon footprint). To do this, they compared an electric toothbrush, a standard plastic toothbrush, a plastic toothbrush with a replaceable head, and a bamboo toothbrush. The electric toothbrush was shown to be the most harmful to the health of the planet. The LCA showed that a plastic manual toothbrush with a replaceable head and a bamboo manual toothbrush performed better than traditional plastic manual toothbrushes and electric toothbrushes on all environmental impact measures used in the study. This research concluded that the most environmentally sustainable toothbrush is not the bamboo one, as might be expected, but a hypothetical plastic brush that was continually recycled.

The study by Lyne, *et al.*, (25) also evaluated the impact on people's health derived from the manufacturing process of each model. Again, the electric toothbrush was found to be the most harmful. Molina Castro, *et al.*, (24) suggest that these findings could be used to inform consumers and toothbrush manufacturers, as well as in oral health recommendations or when purchasing toothbrushes for public health programs.

As mentioned above, the ideal toothbrush is not bamboo, but rather one that uses plastic that is recycled in a continuous process (25). To achieve this, a system should be designed in which plastic toothbrushes can be collected, like batteries, and then recycled into new products. This change could only be achieved through joint work between recycling programs, government public policies, and the industry, health professionals, and consumers.

Leadership Foundations for a Sustainable Dentistry

At the global level, prioritizing the leadership role necessary to achieve changes for a frankly friendly practice of dentistry towards the care of the planet, the proposal of the International Dental Federation to achieve sustainable dentistry (8,9,12,14,25 -26), adopted at the General Assembly in Madrid, Spain, in August 2017 establishes 5 fundamental points:

1. Increase awareness (25).
 - Acquire a clear and public commitment to improve environmental sustainability in oral care.
 - Communicate to all parties the need to understand, learn, and promote sustainable actions.
 - Identify opportunities to disseminate informational content.
 - Promote oral care and disease prevention as the most effective way to achieve environmental sustainability.
2. Reduce greenhouse gas emissions (25).
 - Reduce the generation of greenhouse gases associated with the provision of oral care.
 - Use increasingly clean renewable energy and depend less on fossil fuels.

- Try to minimize carbon emissions in all processes.
 - Explore smart procurement and distribution options.
 - Offset unavoidable carbon emissions where possible.
3. Promote reduction and recycling solutions (25).
- Promote reduced need and use of resources by providing and maintaining good oral health.
 - Improve waste management strategies that allow recycling when possible.
 - Identify recycling opportunities at all levels of the supply chain.
 - Recycle single-use plastics, where possible and safe, to reduce dependence on fossil fuels and encourage a circular economy.
 - Correctly separating waste as a practice that must be integrated into daily life. Avoid at all costs mixing hazardous waste with other types of waste and, in this way, prevent heavy metals from reaching urban landfills.
 - Encourage and promote a mindset that aims to reduce and recycle packaging in all its forms.
 - Always manage hazardous waste with the help of companies specialized in the management of pathological waste.
4. Promote science, technology, and innovation to achieve the SDGs (25).
- Implement a collaborative research ethic that results in sustainable solutions.
 - Make a transition towards the use of renewable energy.
 - Identify and use digital technologies that enable sustainable solutions at all stages of the supply chain, including digital patient care workflows.
5. Promote sustainability as a matter of collective responsibility (25).
- Collaborate to achieve a shared vision for a sustainable future.
 - Identify ways to work together to advance a sustainable circular economy.
 - Work with regulatory authorities to overcome obstacles to sustainable solutions.
 - Recognize and promote the sum value of individual actions.
 - Support those leading sustainability efforts across sectors.

Good sustainable dentistry practices in preventive dental programs

In accordance with the topics specified above, some recommended good practices are proposed when designing and implementing health education and preventive dentistry programs (15).

- Include good environmental care practices in the programmatic designs of community, family, and social dentistry.
- Work as a team to establish public oral health policies that include the foundations of sustainable dentistry.
- Train human resources who participate in programs about knowledge on sustainable dentistry.
- When selecting material resources, such as toothbrushes or fluoridated sippy cups, give preference to using recyclable or compostable ones. In all actions, minimize the use of the amount of water, closing taps during brushing in groups, when it is not necessary.
- Organize implementation schedules during daylight hours to avoid the use of light or electrical energy.

- Digitize the collection of indicators, preparation of clinical histories, or survey forms to minimize the use of paper.
- Analyze as a team, including users, each of the steps of the programmatic activities, thinking about options that advocate for the care and sustainability of the planet and reinforcing the motivation of the groups.

A precedent among Latin American dental institutions is the Environmental Policy of the College of Dental Surgeons of Costa Rica, which was enacted in 2021 by Executive Decree No. 36499 of Law No. 8839 of the Ministry of Environment and Energy of its country for their performance in the implementation of the Institutional Environmental Management Program (27). To date, it is the only institution in the region that promotes excellence in dental work in that country, as well as the well-being of the members who form a fundamental part of its professional association, assuming a commitment to the protection of the environment, knowing the impact that the daily activity of dental practice has on natural resources, and acting preventively to mitigate them. The management system implemented consists of measuring its greenhouse gas emissions annually and investing the required resources in mitigating its impact, transforming it into a more eco-efficient institution. This Environmental Policy will be reviewed every 5 years and will be supported by its own environmental management tools derived from the legal regulatory framework, as well as environmental policies and guidelines of national impact (27).

A study on sustainable dentistry recognizes that healthcare contributes around 5% of global greenhouse gas emissions. This could be the fifth polluter in the world. In 2021, the Pan European Commission on Health and Sustainable Development has highlighted that the planet is at a critical moment that requires the implementation of sustainable health, until now absent in the Latin American region. A review of health care practices, the determinants of health analyzed, and collaboration and coordination between all sectors proposed should be conducted (26-30).

At the beginning of 2000, Mexico ranked first in emissions of carbon dioxide into the atmosphere, followed by Brazil, Argentina and Venezuela, thereby substantially altering the climate on a global scale. At the XIV United Nations Conference on Climate Change and the Fourth Meeting of the Kyoto Protocol, held in Poznan, Poland, the Mexican government committed to reducing its carbon dioxide emissions by 50 %, a situation that has not been achieved to date. Under this situation, other Latin American countries made the same commitment, for example, Chile with its National Action Plan against Climate Change; Brazil with stopping the destruction and protection of the Amazon rainforest; and Costa Rica with the use of neutral carbon and wind farms and solar parks (29).

At the end of 2023, the Global Climate Action Summit was held in Dubai during the United Nations Climate Change Conference - COP 28, with the participation of representatives from 100 countries. The global nature of the climate emergency and its different impacts on communities and societies were once again recognized. Consequently, starting in 2025, work will be done on the transition so that the world reaches zero net greenhouse gas emissions by 2050 and follows the dictates of climate science, which includes a call to triple the use of renewable energy and double the energy efficiency and abandon the use of fossil fuels. Health professions, including dentistry, must consolidate new legislation, regulations, and projects that are in accordance with these urgent lines of action (30).

CONCLUSIONS

In the Latin American region, the present and future commitment of the dental profession is to work at the institutional and individual levels to provide eco-sustainable oral health. Oral health is essential for overall health, well-being and quality of life. Therefore, it is necessary to provide ethical oral care based on preventive dentistry, with high levels of quality and safety, and in a way that is sustainable for the environment.

In the context of the global situation and in the face of the urgent need for environmental care that the planet needs, the joint work of all public and private institutions in all regions of the world is required to provide solutions. Health and, therefore, dentistry must be an active participant in this process, modifying the complex factors that support current behaviors and practices, and the best opportunities to improve and offer sustainable oral health care for the care of people and the planet's environment. Emphasis should be placed on establishing concrete actions towards sustainability in oral health care, based on scientific evidence on reducing, reusing, recycling and rethinking, legislation and policies, on care protocols, management of pathological waste, coordination of distribution, undergraduate and graduate education, research and industrialization of new eco-sustainable materials for clinical use.

Climate change, pollution and biodiversity loss are issues that affect everyone, including people, their families, and communities. There is an urgent need for oral care professionals to acknowledge their responsibility for the effects they cause and ensure sustainable, high-quality, environmentally friendly care for everyone, for current and future generations.

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