Foreign studies show e-cigarettes harmful to oral health

By DTI

ROCHESTER, USA/QUEBEC CITY, Canada: In the Western world, electronic cigarettes continue to grow in popularity among young adults and current and former smokers because they are often perceived as a healthier alternative to conventional cigarettes. However, two recent studies conducted by scientists in the US and Canada have found that regular exposure to e-cigarette vapours causes damage to the gingival tissue, which may lead to infection, inflammation and periodontal disease.

Both studies investigated the effect of e-cigarettes on oral health on cellular and molecular levels through in vitro experiments. The team of Prof. Mahmoud Rouabhia from the Faculty of Dentistry at Université Laval in Quebec City exposed gingival epithelial cells to e-cigarette vapour, finding that a large number of these cells died within a few days. “Mouth epithelium is the body’s first line of defense against microbial infection,” Rouabhia explained. “This epithelium protects us against several microorganisms living in our mouths.”

To simulate what happens in a person’s mouth while inhaling, the Canadian researchers placed human epithelial cells into a small chamber containing a saliva-like liquid. E-cigarette vapor was pumped into the chamber at a rate of two 5-second “inhalations” per minute for 15 minutes a day. Observations under the microscope showed that the percentage of dead or dying cells, which is about 2 per cent in unexposed cell cultures, rose to 10, 40 and 73 per cent after one, two and three days of exposure to e-cigarette vapour, respectively.

“Contrary to what one might think, e-cigarette vapour isn’t just water,” Rouabhia stated. “Although it doesn’t contain tar compounds like regular cigarette smoke, it exposes mouth tissues and the respiratory tract to compounds produced by heating the vegetable glycerine, propylene glycol, and nicotine aromas in e-cigarette liquid.”

The cumulative effects of this cell damage have not yet been documented, but they are worrying, according to Rouabhia. “Damage to the defensive barrier in the mouth can increase the risk of infection, inflammation, and gum disease. Over the longer term, it may also increase the risk of cancer. This is what we will be investigating in the future,” he concluded.

Researchers at the University of Rochester Medical Center in the US came to similar conclusions. Dr Irfan Rahman, Professor of Environmental Medicine at the university’s School of Medicine and Dentistry, and his colleagues exposed cell cultures of human gingival epithelial cells and periodontal ligament fibroblasts to e-cigarette vapours. “We showed that when the vapours from an e-cigarette are burned, it causes cells to release inflammatory proteins, which in turn aggravate stress within cells, resulting in damage that could lead to various oral diseases,” he explained.

Most e-cigarettes feature a battery, a heating device and a cartridge to hold liquid, which typically contains nicotine, flavourings and other chemicals. The US researchers found that the flavouring chemicals negatively affect gingival cells too. “We learned that the flavourings—some more than others—made the damage to the cells even worse,” said study author Fawad Javed, a postdoctoral resident at Eastman Institute for Oral Health, part of the university’s medical centre.
Measures to reduce waste and pollution and to conserve natural resources such as water and energy already play a major role in many aspects of daily life. Likewise, acting in an environmentally friendly manner is becoming increasingly important in dentistry as well. Dental Tribune spoke with Dr Claudio Pinheiro Fernandes, head of the Sustainable Dentistry Center at Fluminense Federal University in Nova Friburgo in Brazil and consultant to the FDI World Dental Federation’s Science Committee, about sustainability principles in dentistry, the preservation of natural resources and the economic dynamics of going green.

**Dental Tribune:** Being environmentally friendly is becoming increasingly important in everyday life. When did this topic first gain momentum in dentistry?

**Dr Claudio Pinheiro Fernandes:** Sustainability is relevant to everyone and we face this challenge every day. Every single newspaper that one opens includes something about climate change or sustainable development. It is the responsibility of dentistry too to become involved as a profession to pursue sustainability in the field of oral health for the good of society.

The dental profession is being challenged by the increasing demand for better oral health care for more people in more countries than ever. At the same time, we have the challenge of needing to do so using less resources. In this context, the question is how exactly we are to do that.

**What can dentists do and what defines a sustainable practice?**

As dentists, we have to realise that there are certain aspects and areas of our work that can be organised better. From a procedural point of view and concerning the equipment used, there are certain sustainability principles to consider. Take a simple example: when one buys a refrigerator or an air conditioner today, one looks for energy efficiency labels that indicate the most efficient device in terms of its energy use. This means that it is good both for one’s pocket, being cheaper to run, and for the environment, since it needs less energy. Why do we not have this kind of labelling in dental equipment? We could introduce energy-efficient dental equipment, with labels indicating how much electricity one would be using by way of green energy.

Another thing to keep in mind is how much water we use. That is an extremely important issue in dentistry. A dentist uses eight times more water than the average person does—a large volume! Usually the equipment used in daily practice causes this high consumption. For example, some brands of suction equipment use clean water to drive the suction mechanism. On average, they use 200 litres per hour and this water goes from the pumps directly to the drain. Of course, suction is important, but could we not apply different technologies to achieve the same results? Do we have to waste clean water for that?

How open is the dental community regarding this? When it comes to change, such as going digital, there are early adopters and some that find it difficult to adjust to something new. That is a good point. Digital dentistry represents a different mindset on production. The primary objective is to have more control and to be more efficient in production; however, a third point is that digital technology generates less emissions, since there is less transportation and less production waste. This is just one example that serves to demonstrate that there are many more efficient means of manufacture. Certainly, digital dentistry is one of those areas of increasing technology use that results in greater sustainability. Science, technology and innovation play a key role in most areas of business. Improvements in efficiency, accessibility and cost-effectiveness of products and processes may allow fulfilment of global need in a more sustainable way. Furthermore, dental research needs to be directed towards improving sustainability in dentistry.

**Speaking of waste management, what should dentists consider?**

A great deal of waste is generated in dentistry and some of it is very toxic. Another issue that the FDI has pursued is the Minamata Convention on Mercury, which includes the phase-down of dental amalgam. We have to face our responsibility of dealing with amalgam waste, for example. Nordic countries and some good example in this regard, having implemented well-established amalgam management practices for many years. One area in which we could do a great deal more is the management of recyclable materials. All the disposables, instruments that we use in dentistry generate hundreds of kilograms of waste every day. What can we do to address recycling of those materials? A considerable amount of waste is generated with disposable barriers, gloves and masks. Much of this could be safely recycled with current technologies.

**How are sustainability principles to converge?**

In many respects, dentists cannot implement a shift themselves alone; awareness of the importance of sustainability is important on the company side as well. That is why the FDI is taking a stand on the sustainability issue right now. The whole thing started back in 2012 during the Rio+20 meeting, the United Nations Conference on Sustainable Development, in which the FDI had decided to participate. Back then, we had already begun gathering information and thinking about what we could do in dentistry. I represented the FDI in those meetings and was able to see how much we could do even without going to a great deal of trouble. For example, the most sustainable thing to do is to focus on prevention. If we act on prevention of oral disease, this would reduce the need for extensive treatment and the related use of products and, in particular, the associated generation of a large volume of waste, as well as the substantial amount of water and energy required, and the large carbon footprint that all of this creates.

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**Dentistry may be considered a very conservative profession. How difficult is it to change the predominant mindset?**

We are doing that already. One way or another, people are coming to realise that going green is our business, not somebody else’s, but everybody’s responsibility. We as dentists have to play our part as well. In addition to efficient equipment and waste management, we should consider the topic of recycling, particularly in light of all the products that we use in daily practice.

**What is the situation right now? Is the topic covered in the curriculum at all?**

There is a great deal going on right now. I would say that we are in the moment of great activity. For example, the International Organization for Standardization has developed very good materials for action. There is also a United Nations Educational, Scientific and Cultural Organization platform for integrating education on sustainable development. It is called Education for Sustainable Development. In addition, it should be noted that many universities are already going green today. So, there is progress.

**Behind it all, there is one driving force, the United Nations’ 2030 Agenda for Sustainable Development. This agenda has defined 17 sustainable development goals that were adopted by all member states in September 2015. This is very recent, but we are on a schedule of looking at the reduction of poverty, the reduction of hunger, better health for more people and more educational opportunities—a number of issues that will impact the environment on the one hand, as well as social and economic development on the other. By utilizing the environment in an intelligent, sustainable manner, we allow society to develop in a healthy way. We need to have jobs, we need to produce, but we can all do that in a responsible manner and at the same time sustain a good economy.**

When it comes to food and clothing, an eco-friendly option may sometimes be even more expensive than the alternative. For dentists, is there an economic barrier to going green as well?

Yes, there are challenges regarding entry and investment is required because everything must be reoriented to the future. As with everything, it is very difficult to start all over again, but when attitudes change, when dentists actively decide to pursue sustainability then they will start reviewing their own procedures and little by little implement changes. For example, if one actually starts to implement a sustainable approach, it becomes evident that energy and resources were wasted before—which is not a good business strategy. There will be no need for an investment. One’s patients, one’s clients and the public will recognise one as an active member of a responsible society. It will take time, but the dental profession will achieve this.

So in the future it could be a selling point for companies to identify themselves as “green”.

Yes, this is already happening in many business areas, because the public is driving sustainability awareness by seeking more sustainable alternatives. As always, there may be some companies that already say that about themselves even if they have not achieved that yet. However, standards have already been established to determine whether certain things have been applied. Based on these indicators of sustainability, auditors and reviewers are able to evaluate objectively whether sustainability is being achieved by the company.

Of course, investment is required in the beginning. However, some business reports indicate that going green can save as much as 40 per cent of costs on water, energy and unnecessary product waste, which is a great deal of money. Many companies, big and small, are already considering it their corporate responsibility to act for the social and environmental good.

Thank you very much for the interview.

“Going green is our business, not somebody else’s, but everybody’s responsibility” An interview with Dr Claudio Pinheiro Fernandes, Brazil

By Kristin Hübner, DTI

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Dr Claudio Pinheiro Fernandes: Sustainability is important on the one hand, as well as social and economic development on the other. By utilizing the environment in an intelligent, sustainable manner, we allow society to develop in a healthy way. We need to have jobs, we need to produce, but we can all do that in a responsible manner and at the same time sustain a good economy.

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