Unit 90 158 171 street, Surrey, B.C V3Z 0X2

March 26th, 2022

Dr. Jordan Turton Principal Owner and Dentist Flagship Dental 17717 57 Ave Surrey, BC, V3S 1H1

Dear Dr. Turton:

Here is the report assessing the feasibility of the Implementation of improving environmental practices at Flagship Dental to reduce its carbon footprint. In the process of researching and writing this report, I have gained a deeper understanding into the environmental practices within Flagship Dental and areas where things can be improved. I hope that this paper will offer knowledge that will not only benefit Flagship Dental but add to the current body of literature on this subject. Thank you for your assistance throughout this process.

I recognize that there are numerous considerations when procuring, modifying, and implementing new environmental practices within a dental office, so I hope that this paper offers suggestions that can be taken into consideration. The literature review reveals the need for choosing "green" alternatives to PPE, sterilization materials, plastic barriers and one time use dental products is crucial in reducing the environmental impact created from dental offices. I believe implementing some of the recommendation will help Flagship Dental play an active role in addressing the current climate crisis.

I have thoroughly enjoyed the breadth of work that went into this report and would be happy to answer any questions. Please contact me at 250-575-6930 or email trishabhamra@hotmail.com at your convenience.

Sincerely,

Trisha Bhamra

Running head: FEASIBILITY ANALYSIS

Feasibility Analysis of the Implementation of improving environmental practices at Flagship Dental to reduce its carbon footprint.

> for Dr. Jordan Turton Principle Dentist and Owner Flagship Dental Surrey, BC

Trisha Bhamra Student ENGL 301 99C

March 26th, 2022

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Abstract

The feasibility of implementing improved environmental practices at Flagship Dental to reduce its carbon footprint depends on the carbon footprint of the dental practice and the perceived need to address this issue by the owner.

With the current climate crisis, eco consciousness is being embraced by businesses from supermarket chains to car manufacturers. They are actively looking for ways to create and market "green" products. Although, Flagship Dental has some environmental practices in play, the current environmental practices are inadequate in reducing the establishment's carbon footprint. The sterilization program lacks accountability for implementing environmentally friendly options and the current PPE (masks and gloves) use and disposal is adding significantly to the carbon footprint.

The staff at Flagship dental recognize the environmental impact of the traditional dental office with inadequate environmentally friendly options for PPE, sterilization materials, plastic barriers and one time use dental products. The simple changes required to implement "green" practices can lead to increase in business, lowered operating costs, and reduced environmental impacts.

Recommendations for "green" alternatives are as follows:

- Replace plastics with paper or biodegradable alternatives where possible and ensure an

appropriate recycling program is in place for hazardous material paper waste.

- Minimize the use of single use saliva ejectors and HVE suctions and opt out for materials that can be sterilized under the "plastics cycle".
- Consider cups, barriers, bibs and headrest covers made from recyclable materials or repurposed recycled materials.
- Seek out local vendors for PPE to minimize the environmental impact through the process of procurement of raw materials, manufacture, transport, and distribution of these products.

INTRODUCTION

In the last year, extreme climate change such as severe forest fires, floods, tsunamis, and cyclones has highlighted the effects of global warming. The ramifications for not caring for the planet have become apparent now more than ever. Most countries are taking an action to improve their environmental practices and reduce the carbon footprint. As eco-consciousness is becoming popular, businesses from supermarket chains to car manufacturers are looking for ways to create and market "green" products. Dental offices could benefit from considering "green" dentistry in efforts to reducing their carbon footprint. (Hanoon and Henry)

College of Dental Surgeons of British Columbia (CDSBC) sets infection control guidelines for general dental practices to follow daily. Dental offices must follow the sterilization and personal protective equipment (PPE) use guidelines set by CDSBC to ensure patient, clinician, and staff safety. (Cuny and Bednarsh) Sterilization guidelines exist for critical items, semi critical items, and non-critical items. (Cuny and Bednarsh) Critical items include instruments/items that penetrate soft tissue and bone, enter, or contact the bloodstream. (Cuny and Bednarsh) These items must be cleaned, appropriately packaged, and then sterilized in the autoclave (a sterilizing machine that uses steam to kill bacteria, viruses). To ensure appropriate sterilization and storage of sterile instruments proper packaging is required. Packaging materials used for instruments and cassettes prior to sterilization cycle include textile wrap (woven vs. unwoven material), paper pouches and a combination of paper/plastic pouches (i.e., autoclave bags). (Cuny and Bednarsh, Farahani and Suchak)

Plastic bags can take anywhere from 20-1000 years to degrade. (Donaldson) On average within a given day about 24 autoclave bags are used and disposed of in the garbage. Calculated

on a 200-day work year, that amounts to 4,800 pieces of autoclave paper and plastic being diverted from the landfill each year. (Donaldson and Kay) In North America, dentistry discards approximately 1.7 billion sterilization pouches and 680 million chair barrier, light handle covers, and patient bibs into landfills every year. (Donaldson) Autoclave bags, which contain no biohazard materials, can be recycled in most communities after separating the plastic and paper portions of the bags. Alas, most dental offices don't recycle the autoclave bags.

Such startling statistics can be found for Personal Protective Equipment (PPE) such as masks and gloves, especially since the pandemic started. Single use materials, such as disposable cups, bibs, saliva ejectors, and plastic barriers to protect surfaces that cannot be sterilized are used frequently in dentistry. (Kay and Sitterson) The daily waste created from day-to-day operations of a dental office makes a significant impact on the environment. Dental offices must do more than just recycling paper and other plastics within dental office to be considered truly "green". But they must also consider the business costs and operating costs post pandemic when implementing "green alternatives" to reduce their carbon footprint.

Purpose of this report

Although, Flagship Dental has some environmental practices in play, the current environmental practices are inadequate in reducing the establishment's carbon footprint. The sterilization program lack accountability for implementing environmentally friendly options. The current PPE use and disposal is adding to the waste created by the establishment. We all must be held accountable at home and work in trying to minimize our carbon footprint. Flagship Dental's lack of green alternatives is resulting in significant consequences for the current climate crisis. One possible solution to the problem of improving environmental practices at Flagship Dental is by choosing "green" alternatives to PPE, sterilization materials, plastic barriers and one time use dental products. To determine the feasibility of such an intervention, 6 staff members responded to a short survey designed to analyze the current carbon footprint of Flagship Dental as well as gauge an interest in a potential environmentally friendly solutions to reduce the carbon footprint. An analysis of potential costs of going "green" was determined through secondary research and by interviewing the owner of the dental office.

Methods

The primary sources will include interviews with Dr. Jordan Turton, principal dentist and owner of Flagship Dental. The purpose of interviewing the decision maker is to gather insight on how "green" they believe their current practice is. They will also provide some insight on their budget for dental materials.

A survey will be dispersed to the other workers (dental assistants, reception staff, dental and dental hygienists) within the office to determine the "green" changes they would like to see within the dental office. The primary research will be rounded with an online survey asking about the feasibility of current green alternatives within other dental offices in Surrey, B.C. This will provide data from other "green" dental offices and how they are faring with these changes.

Secondary sources will include publications on the feasibility and acceptance of green alternatives vs. traditional dental office equipment while staying within the best practices standards.

Scope of the Investigation

To assess the feasibility of improving environmental practices at Flagship Dental to reduce its carbon footprint the following questions will be explored and answered within the report.

- 1. What are the available green alternatives to PPE, single-use plastics, and the current sterilization program?
- 2. How large is the demand for green alternative for PPE, the current sterilization program, plastic barriers within the dental practice? Will there be enough support from the staff to pursue this endeavour?
- 3. Can green alternatives meet the day-to-day demand of the dental office as well as traditional plastic/ non green version?
- 4. Does the dental market at large contain room for green alternatives?
- 5. What are the costs for retrieving these green alternatives to meet the day-to-day demands of the dental office? Is switching to these alternatives economically feasible?"

II. DATA SECTION

A. Carbon footprint data summary

On any given day at Flagship Dental five operatories are functional, servicing on an average of 8 patients per operatory. Per patient, 1 paper tray cover, 1 disposable saliva ejector and 1 disposable HVE suction, 1 level 3 mask, 1 headrest cover, 1 bib, 1 paper cup, 7 pieces plastic barrier film, 1 autoclave bag and 4 nitrile gloves are used. This equates to 40 paper tray covers, 40 disposable saliva ejectors, 40 disposable HVE suctions, 40 Level 3 masks, 40 headrest covers, 40 bibs, 40 paper cups, 280 pieces of plastic barrier film, 40 autoclave bags and 160 nitrile gloves being disposed of in the garbage per day.

The carbon footprint of Flagship Dental is moderate according to 60% of the respondents of the survey. More than 2/3 of the staff believes the current sterilization practices at flagship dental is somewhat environmentally friendly to not at all environmentally friendly.



Figure 1.1 Staff perception on the carbon footprint of Flagship Dental

Current measures to reduce the carbon footprint at Flagship Dental include recycling program for regular paper waste, plastic containers, and cardboard, use of woven material wraps for cassettes instead of one time use paper wrap, and automated lights that turn off to conserve energy when no one is using the operatory. Water conservation is encouraged by everyone in the office as well. During the interview, Dr. Turton mentioned inquiring about the possibility of recycling the paper/plastic waste from the sterilization process, but the city of surrey recycling program denied the request. Currently the paper and plastic waste form the sterilization process is disposed of in the garbage.

B. Staff opinions on "green" dentistry

Flagship Dental has 10 staff members apart from the principal dentist. Out of the 10 staff members only six staff members were willing to participate in the survey and share their opinions. The office survey was also intended for other dental professionals in the city of Surrey to gauge the feasibility of current green alternatives within other dental offices. Due to lack of consent from the dental professionals' group on Facebook, primary data is limited to the responses from Flagship Dental.

The staff at Flagship Dental were unsure about benefits of implementing "green" practices within the office. Plastic is easy to manufacture, ensures cleanliness and sterility, and it is economical. (Whitcare and Martin) Dental offices must maintain their overhead costs while abiding by the CDSBC guidelines for sterilization; the current use of barriers, plastic sterilization pouches, and single-use saliva ejectors allow costs to remain low. One of the benefits of implementing green practices would ensure a reduction in the carbon footprint of the dental office. Some disadvantages would entail increased cost and manpower to find and procure the "green" alternatives and the office not meeting the day to day demands from using the "green" alternatives on busy days (i.e., triple hygiene days). The staff consensus is 50:50, half the staff is open to trying "green" alternatives while the other half is not.



Figure 1.2 Staff perception of implementing "green" practices at Flagship Dental



Figure 1.3- Staff perception on "green" alternatives meeting the day-to-day demand of the dental office.

C. Switching the dental materials to "green" alternatives

The current cost of dental materials such as PPE, one time use plastic materials, and sterilization materials is economical as shown below in Table 1.1. There was an even split noted in making the switch to reusable saliva ejectors that can be sterilized. One of the reasons for using the one time use plastic saliva ejectors is its ability to bend and its ease of use according to Jess, RDH at Flagship Dental. Switching to bagless sterilization was not widely supported because it could raise issues of guaranteed sterility due to contamination from open air.

Table 1.1 Cost of current dental materials such as PPE, sterilization materials, plastic barriers and one time use dental products.

Dental material	Cost

Disposable plastic high volume saliva ejectors (HVE)	\$ 6.00 /100 pack
Disposable plastic saliva ejectors	\$ 8.00 / 100 pack
Maxill poly all barrier film	\$18.89/ roll (1200 pieces of 4' X6' sheets)
Paper tray cover	\$ 22/ 1000 sheets
Plastic headrest Covers	\$27 /500 pieces
Paper cups	\$30 / 1000 pieces
Bibs	\$ 25/ 500 pieces
Masks (level 3)	\$8.99/ box (each box has 50 masks)
Gloves nitrile	\$ 35 / box (100 gloves, 50 pairs)
Autoclave bags	\$25/ box (200 pouches per box)

Meeting the standards of infection control guidelines set by CDSBC when using the "green" alternatives to PPE, barriers and sterilization procedures is of utmost importance for the dental office to operate. Some barriers to making the switch include cost of the procuring the "green" alternatives, "green" sterilization practices unable to keep up with the demand of the office.



Figure 2.1 sterilization demands

Resources required to make the switch to "green" alternatives would require the dentist to research, compare prices and find suitable alternatives to traditional PPE and sterilization bags. During the interview Dr. Turton mentioned his resistance to "green" alternatives suggested in the survey as it will cost more money and require more manpower to procure these alternatives. About 75% of the staff responses indicate that it would be difficult or somewhat difficult to procure "green" alternatives to PPE and one-time dental materials.



Figure 2.2 Perceptions about procurement of "green" PPE

D. Secondary studies comparing "green" alternatives vs. traditional dental equipment

In response to the significant increase in use of masks during the COVID -19 pandemic, the government of Canada launched a research program to innovate and develop biodegradable masks. (Government of Canada) University of British Columbia (UBC) has developed a cellulosic N95 prototype ('Can-Mask') with promising particulate filtration efficiency and breathability, but it is hydrophilic (water loving) and highly flammable. As such, there are no current safe and economical options for biodegradable masks yet. PPE such as masks could be recycled through companies such as Vitacore (partnered with Recycling Council of BC and The Canadian Coalition for Green Health Care). The recycling program is available to businesses, medical clinics, and hospitals. The collected PPE travels through a series of machines that will sterilize, compact, and reprocess the polypropylene into pellets. The first step sterilizes and compacts the materials into a dense mixture of plastic and aluminum. Those blocks are then fed into a machine that shreds it into smaller fragments to allow for the separation of materials.

Finally, the polypropylene fragments are processed and turned into plastic pellets. (Vitacore) Regular nitrile gloves can take more than 100 years to biodegrade in a landfill, whereas Eco Best Technology® (EBT) gloves can degrade within 1-5 years in the landfill. (Advantech) Companies such as Ronco earth gloves and Adavntech Bio glove are two companies that were available through Patterson Dental website for purchase.

One study noted that using cassettes to house the instruments and wrapping with blue textile/woven wraps prior to sterilization led to a significant reduction in paper/plastic waste from using autoclave bags. (Farahani and Suchak) They also encouraged using the local blue bin program to recycle the plastic/ paper autoclave bag after separating the plastic and paper portion. Traditional bibs are made of 1-2 ply paper and 1 ply plastic, recycling the bibs is difficult as it has biological material on it and is considered a biohazard. They found that using clean towels as a "bib" and washing them in office at the end of the day was a great way to reduce the paper/plastic waste. (Farahani and Suchak) Some offices like Camosun College Dental clinic used a hard plastic bib that can be wiped with cavicide (surface disinfectant) to sterilize the bib after each use.

A few studies suggested using reusable HVE suctions that can be sterilized under the plastics cycle in the statim machine. (Farahani and Suchak) This was met with concerns regarding the lack of malleability of hard plastic suctions thus making it difficult to maneuver them in the mouth.

Carbon footprint would be reduced significantly by using "green" alternatives. The quantitative impact can be measured by reduction in number of traditional items ending up in the

garbage. The green alternatives are mostly paper based or biodegradable, proper disposal of these materials will be very important in ensuring a reduced carbon footprint.

III. CONCLUSION

A. Summary and interpretation of findings

The carbon footprint of Flagship Dental is moderate according to 60% of the respondents of the survey. More than 2/3 of the staff believes the current sterilization practices at flagship dental is somewhat environmentally friendly to not at all environmentally friendly.

One of the benefits of implementing green practices would ensure a reduction in the carbon footprint of the dental office. Some disadvantages would entail increased cost and manpower to find and procure the "green" alternatives and the office not meeting the day to day demands from using the "green" alternatives on busy days (i.e., triple hygiene days). The staff consensus is 50:50, half the staff is open to trying "green" alternatives while the other half is not.

Some barriers to making the switch include cost of the procuring the "green" alternatives and "green" sterilization practices unable to keep up with the demand of the office. About 75% of the staff responses indicate that it would be difficult or somewhat difficult to procure "green" alternatives to PPE and one-time use dental materials.

There are options for biodegradable nitrile gloves and cups with an apparent lack of sustainable and biodegradable options for masks. In lieu of COVID-19 pandemic new companies like Vitacore have taken on the responsibility of recycling PPE such as masks, making it a good "green" alternative to masks ending up in the landfill.

The limitations of the report include a lack of robust primary data set due to time limitation, lack of willing participants, and the nature of the research. Large-scale research in this area could be beneficial in bringing forth the recommended changes within other dental offices in B.C.

B. <u>Recommendations</u>

Traditional (moderate to high carbon footprint)	"Green Alternative" (less than moderate carbon footprint)
PPE – nitrile gloves, masks	 PPE - use biodegradable gloves enroll in a recycling program for traditional PPE like masks. Use face shield to minimize the need to replace the mask for every patient.
Plastic headrest covers	Paper headrest covers.

Table 1.3 Traditional vs "green" alternative to dental equipment

1

Plastic barriers and films	Compostable plastic barriers made from corn,	
	potato, and soy starches can break down more.	
	easily than plastic. Aluminium foil could be a	
	good alternative as well.	
	Don't replace plastic barriers for each patient, instead use Cavicide to sanitize the barrier.	
Paper cups	Remove pre procedural rinse to reduce the paper cup use or use biodegradable paper cups.	
Bibs (plastic/paper combo)	Paper or recycled material bibs	
	use towels that can be laundered at the end of	
	the day.	
Single use plastic saliva ejectors	Bent saliva ejectors that can be sterilized on "plastics cycle" and reused.	

Paper cassette wraps	Reusable woven Fabric cassette wraps reduce
	the paper waste from wrapping cassettes.
Plastic/Paper sterilization sleeves	
	Plastic/Paper sterilization sleeves can be
	reused with a proper sterilization indicator to
	reduce the waste created from one time use.
	Autoclaves in dental offices don't have a
	vacuum component therefore a true seal is not
	mandatory for sterilization to occur.
	Autoclave bags, which contain no biohazard materials, can be recycled in most communities after separating the plastic and paper portions of the bags.

Specific recommendations for Flagship Dental include the following:

- Replace plastics with paper or biodegradable alternatives where possible, ensure an appropriate recycling program is in place for hazardous material paper waste.
- Minimize the use of single use saliva ejectors and HVE suctions, opt out for materials that can be sterilized under the "plastics cycle".

- Consider cups, barriers, bibs and headrest covers made from recyclable materials or repurposed recycled materials. Use towels for bibs as they can be laundered at the end of the day.
- Seek out local vendors for PPE instead of overseas because the supply chain has a significant impact on the environment through the process of procurement of raw materials, manufacture, transport, and distribution.
- Minimize the use of multiple gloves with single patient. Buy biodegradable gloves.
- Use a face shield to minimize the need to switch the mask for every patient. Enrol in a PPE recycling program for masks with companies like Vitacore in Burnaby, B.C
- Autoclave bags without biohazard materials can be recycled with the blue bin program after separating the plastic and paper portions of the bags.
- Reuse autoclave bags with a proper sterilization indicator to reduce the waste created from one time use.

Appendix (Online survey)

I am an undergraduate student at UBC engaged in a technical writing project. The purpose of this survey is to obtain primary data for an analysis and investigation that aims to provide recommendations for improving the carbon footprint of Flagship Dental. The final formal report will be addressed to Dr. Jordan Turton, principal owner of Flagship Dental. Together with the reports available from UBC Library Journals, the data I gather from this survey will serve the ultimate purpose of providing recommendations for reducing the carbon footprint of Flagship Dental. The survey contains 13 multiple-choice questions, and it should take about than 5 minutes of your time. Your responses are voluntary and anonymous. Thank you, I appreciate your generous participation in my survey.

- I accept
- I do not accept

1.What is the current carbon footprint of Flagship Dental? Very low, low, mod, large, very large

- Low
- Moderate
- High

2.Do you think finding "green" options for Personal Protective Equipment (PPE) such as masks and gloves, one time use materials such as disposable cups, bibs, and saliva ejectors and plastic barriers would be feasible at Flagship Dental?

- Yes
- Maybe
- No

3. Would it be difficult to find "green" alternatives to PPE and one time use dental materials?

- Yes
- Maybe
- No

4. How environmentally friendly are the current sterilization practices?

- Not at all
- Somewhat environmentally friendly
- Very environmentally friendly

5. Would you be open to replacing the one time use saliva ejectors with more environmentally friendly options such as saliva ejectors that can be sterilized?

- Yes
- Maybe
- No

6. Would bagless sterilization be an efficient and economical way to reduce paper and plastic waste?

- Yes
- Maybe
- No

7.A pre procedural rinse is no longer recommended according to our CDHA, BCDHA and

CDA. How likely are you to forego pre procedural rinse to reduce paper cup waste?

- Extremely unlikely
- Somewhat unlikely
- Neither likely nor unlikely
- Somewhat likely

• Extremely likely

8.Could recycled material paper cups and bibs be a good "green" alternative for current cups and bibs?

- Yes
- Maybe
- No

9.Can green alternatives meet the day-to-day demand of the dental office as well as traditional plastic/ non green version?

- Yes
- Maybe
- No

10.Would implementing "green" alternatives affect the ability to keep up with sterilization demands?

- Yes
- Maybe- depends on the day (triple hygiene vs. 2 hygiene days)
- No

11.To reduce the PPE waste, how likely are you to support enrollment into a PPE recycling program like Vitacore? https://www.vitacore.ca/recycling-program

- Extremely unlikely
- Somewhat unlikely
- Neither likely nor unlikely
- Somewhat likely
- Extremely likely

12. To reduce to PPE waste, how likely are you to use biodegradable nitrile gloves?

- Extremely unlikely
- Somewhat unlikely
- Neither likely nor unlikely
- Somewhat likely
- Extremely likely

13.To reduce to PPE waste, how likely are you to use biodegradable nitrile gloves?

- Extremely unlikely
- Somewhat unlikely
- Neither likely nor unlikely
- Somewhat likely
- Extremely likely

14.Do you have any suggestion on how we can reduce our carbon footprint as a dental office when using Personal Protective Equipment (PPE) such as masks and gloves, one time use materials such as disposable cups, bibs, and saliva ejectors and plastic barriers? Please comment

Link to the survey: https://ubc.ca1.qualtrics.com/jfe/form/SV_9SpjS57KTAMzejI

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