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1st Place Contest Entry: Provisional Patent Research Process

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Essay:

On the first day of BCHM 320 this semester, an elective course emphasizing the history, development, and application of biotechnology and bioengineering, Dr. Chang enthusiastically presented our class with the final project and suggested we start on it right away. This final project was to write a provisional patent using the information we learned in class and how this information relates to our personal interests. As an aspiring dentist, I immediately thought of how to improve dental technology. My interest in the field has led me to learn that fluoride, an active ingredient in nearly all mainstream toothpaste brands has sparked controversy regarding its safety to human health. With this in mind, I decided to write my provisional patent on a safer toothpaste.

I first started my research by using the Search Discover on the Leatherby Libraries homepage. I searched key phrases such as “sodium fluoride,” “adverse effects,” “oral bacteria,” and “dentin.” After searching, I immediately began to find literature that supported by new use and improvement patent that not only fluoride had adverse effects, but a handful of other chemicals within most toothpastes are not optimal for human health. The Search Discover only scratched the surface, so I inquired help from Dr. Doug Dechow, Leatherby’s Digital Humanities & Science Librarian. Dr. Dechow helped me narrow my research down by suggesting the following databases: SciFinder, ScienceDirect, and PubMed. We had a one-on-one meeting in which Dr. Dechow taught me how to optimize my searches by using advanced functions as well as how to formulate key words and phrases.

Using these scientific research-oriented databases, I was able to further refine my research and incorporate many primary literature sources as a foundation for my provisional patent by using the advanced search function. This capability of the databases led to research of other abrasive chemicals used in toothpaste, such as sodium lauryl sulfate (SLS), a common foaming agent in mainstream toothpastes. As many studies have been performed on the adverse effects of a variety of products that contain SLS (including makeup, mouthwash, shampoo, and body wash), I used the advanced search function on SciFinder to limit my search to only studies done on toothpaste products. By using this more specific search system feature, I was able to narrow down approximately 5,000 works to around 20.

Similarly, I used the advanced search function of PubMed. I typed in the phrase, “sodium fluoride in toothpaste dangerous” and found a primary literature source titled “Sodium fluoride induces

apoptosis in odontoblasts via a JNK-dependent mechanism.” Moreover, I chose this article using the criteria outlined by the acronym TRAAP: timeliness, relevance, authority, accuracy, and purpose, which are fundamental to selecting sources.

Timeliness of scholarly works is crucial to research, especially in science. This study was published in 2013 and is the most recent study on the negative effects of sodium fluoride on oral health.

As I am writing a provisional patent to improve common ingredients amongst commercial toothpastes, this source provides relevant insights of the imperfections of the common active ingredient of many toothpastes, sodium fluoride.

I pay close attention to the authority behind papers as quality research relies on reputable sources. Amongst the authors of this paper are Dr. Peng Li from the School of Stomatology, Fourth Military Medical University of Xi'an, and Dr. Bing Song from the School of Dentistry at Cardiff Institute of Tissue Engineering & Repair. As prominent figures in dental research, their publication has enhanced the platform of my research.

This primary literature source accurately narrowed down the specific metabolic pathway of odontoblasts (teeth cells) that ultimately result in cell death upon fluoride exposure.

The purpose of this article is to prove that fluoride, though effective in fighting oral bacteria, also damages human cells of the oral cavity. This study opens the door for my research in improving the ingredients and overall quality and safety of toothpaste.

From this research project, not only did I learn more about the chemicals used in oral healthcare products, but I have mastered the techniques of searching databases. This aptitude in research will not only be beneficial to my future endeavors in science-based research and lab work for courses, but this knowledge is valuable in my research to better the dental field. I currently plan to attend dental school where I desire to further improve the field by continuing my independent research. I hope that my research will inspire others to aid my mission of revolutionizing modern dentistry.

3. Summary and Bibliography Instructions

Please provide a 250-500 word abstract of your paper/project along with a complete works cited list, reference list, or bibliography in APA, MLA, Chicago, or other recognized style. Do not submit your entire paper!

Summary and Bibliography:

Colgate Total Advanced Fresh® toothpaste is one of the most successful lines on the current oral healthcare market, making its debut in 1995. This product aims to optimize dental health through using sodium fluoride as an active ingredient. Sodium fluoride is able to kill streptococcus mutans, which are bacteria that are the primary cause of cavities. The inactive ingredients listed by the company include: sodium lauryl sulfate that serves as a detergent and foaming agent, and triclosan, which controls plaque build-up. Many toothpastes on today's market have some of these abrasive chemicals that have sparked much controversy in the realm of oral healthcare. Two chemicals that are particularly detrimental to human health in this current product are sodium lauryl sulfate and sodium fluoride.

Sodium lauryl sulfate (SLS) has been proven to cause the development of recurrent ulcers in the mouth, and even the stomach if the toothpaste is accidentally ingested. Moreover, SLS is linked to the degradation of protective, mucous-producing surfaces within the body, including within the oral cavity. In place of SLS, I propose to use coconut oil as a foaming agent and detergent. Coconut oil has the ability to increase mucous levels and concurrently reduce high levels of acid in the body that will elongate any ulcerations. My research also finds that coconut oil is effective in reducing inflammation and serves as a strong antioxidant. Coconut oil even has antibacterial and teeth whitening properties.

Addressing the active ingredient of the current product, sodium fluoride interferes with the JNK-MAPK pathway of odontoblasts (teeth cells), which ultimately results in cell death. These cells are responsible for the production of dentine, which is a major component of the structure of the tooth. In place of sodium fluoride as an active ingredient, matcha, a powder ground from green tea leaves, is a much safer, organic alternative. Matcha has the ability to reduce plaque, fight off gingivitis, and enhance the freshness of breath. Matcha, green tea in particular, is an effective killing agent of oral bacteria.

The premise of this provisional patent is to improve the current product on the market. Though well-tested, approved and regulated by the U.S. Food and Drug Administration (FDA), certain features of many of the mainstream toothpaste brands, such as Colgate®, have potential health risks to consumers. As a future healthcare provider and researcher, my goal is to ensure that not only my patients are healthy and free of any risks, but also the rest of the general population is guaranteed the same level of safety. Moreover, I hope to increase the prevalence of dental research to further develop and improve this particular healthcare discipline.

References

- Arana-Chavez VE, Massa LF. Odontoblasts: the cells forming and maintaining dentine. *The international journal of biochemistry & cell biology*. <https://www.ncbi.nlm.nih.gov/pubmed/15147714>. Published August 2004. Accessed March 19, 2018.
- CDH1 gene - Genetics Home Reference. *U.S. National Library of Medicine*. <https://ghr.nlm.nih.gov/gene/CDH1>. Published March 13, 2018. Accessed March 19, 2018.

- Healy C, Paterson M, Joyston-Bechal S, Williams D, Thornhill M. *The effect of a sodium lauryl sulfate-free dentifrice on patients with recurrent oral ulceration.* Oral Diseases [serial online]. January 1999;5(1):39-43. Available from: CINAHL Plus with Full Text, Ipswich, MA. Accessed March 4, 2018.
- Li P, Xue Y, Zhang W, et al. *Sodium fluoride induces apoptosis in odontoblasts via a JNK-dependent mechanism.* Toxicology. <https://www.sciencedirect.com/science/article/pii/S0300483X13000784>. Published April 8, 2013. Accessed March 19, 2018.
- Lin T-K, Zhong L, Santiago JL. Anti-Inflammatory and Skin Barrier Repair Effects of Topical Application of Some Plant Oils. *International Journal of Molecular Sciences.* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5796020/>. Published January 19, 2018. Accessed March 19, 2018.
- Lindinger MI. Reduced Dental Plaque Formation in Dogs Drinking a Solution Containing Natural Antimicrobial Herbal Enzymes and Organic Matcha Green Tea. *Scientifica.* <https://www.ncbi.nlm.nih.gov/pubmed/27867678>. Published October 27, 2016. Accessed March 19, 2018.
- Narotzki B, Resnick AZ, Aizenbud D, Levy Y. Green tea: A promising natural product in oral health. *Archives of Oral Biology.* <https://www.sciencedirect.com/science/article/pii/S0003996911003979>. Published January 5, 2012. Accessed March 19, 2018.
- Neppelberg E, Costea DE, Vintermyr OK, Johannessen AC. Dual effects of sodium lauryl sulphate on human oral epithelial structure. *Experimental dermatology.* <https://www.ncbi.nlm.nih.gov/pubmed/17576237>. Published July 16, 2007. Accessed March 19, 2018.

Oh J, Jo H, Cho AR, Kim S-J, Han J. Antioxidant and antimicrobial activities of various leafy herbal teas. *Food Control*.

<https://www.sciencedirect.com/science/article/pii/S0956713512005798>.

Published October 26, 2012. Accessed March 19, 2018.

Pavithran V, Krishna M, Kumar V, Jaiswal A, Selvan A, Rawlani S. The effect of oil pulling with pure coconut oil on *Streptococcus mutans*: A randomized controlled trial. *Journal of Indian Association Of Public Health Dentistry* [serial online]. 2017;(3) Available from: Health & Wellness Resource Center, Ipswich, MA. Accessed March 4, 2018.

Roberts FD, Steinke JJ. Toothpaste Formulations. January 27AD. p. 6;

<https://patentimages.storage.googleapis.com/5a/df/92/da4e6003312512/US3935306.pdf>

Selvarajah M, Ahmad Z, Hakim M, et al. Comparative investigation into the anti-ulcer activity of virgin coconut oil and coconut oil in pylorous ligated animal model.

TANG [HUMANITAS MEDICINE]: *International Journal of Genuine Traditional Medicine* [serial online]. 2015;(4):28.1. Available from:

KoreaScience, Ipswich, MA. Accessed March 4, 2018.

Thomas P. Colgate Total Advanced Fresh Toothpaste. *Ecologist* [serial online].

October 2004;34(8):20-21. Available from: Academic Search Premier,

Ipswich, MA. Accessed March 4, 2018.

Yetty Herdiyati N, Arya Arta A, Mieke Hemiawati S, Willyanti S. Comparison of

Antibacterial Effects Between Aloe Vera And Sodium Fluoride On The

Amount Of *Streptococcus Mutans* Colony ATCC In Vitro. *International*

Journal Of Scientific & Technology Research, Vol 4, Iss 8, Pp 56-61 (2015)

[serial online]. 2015;(8):56. Available from: Directory of Open Access Journals, Ipswich, MA. Accessed March 4, 2018.