

# Impact of Toothpaste Formulations on Tooth Decay



Bryn Goldsmith

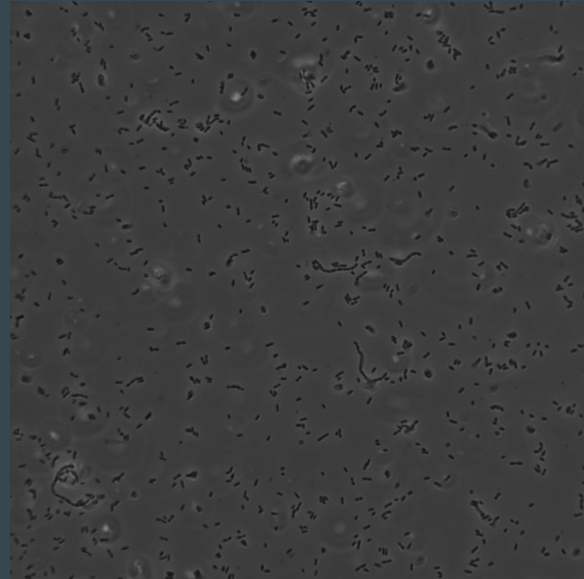


**Do some toothpastes protect teeth better than others?**

**How do different toothpastes, specifically whitening toothpaste, prevent decay when challenged with oral bacteria?**

# *Streptococcus mutans*

- gram-positive facultative anaerobe
- Causes dental caries (cavities)
- How does *S. mutans* cause cavities?
  - *S. mutans* or another oral bacteria forms a biofilm on teeth, if not removed, this can cause decay
  - A biofilm is a layer of bacterial cells that stick to a surface
  - The biofilm + sugar we consume results in acidification, lowering the pH of the area.
  - The lowered pH allows bacteria like *S.mutans* to grow even more, demineralization of the tooth occurs.
  - If demineralization continues to occur and occurs faster than remineralization, dental caries result.

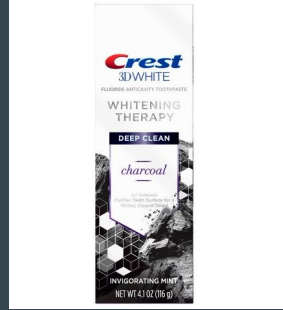


*S. mutans* under the microscope

# Part 1: Whitening

Each array of teeth was whitened for 3 weeks total, using each toothpaste formulation and a control without toothpaste.

The teeth were brushed once a day for two minutes each and placed in an artificial saliva medium. Lingual and buccal sides were labeled. Only lingual sides were brushed.



# Whitening Results



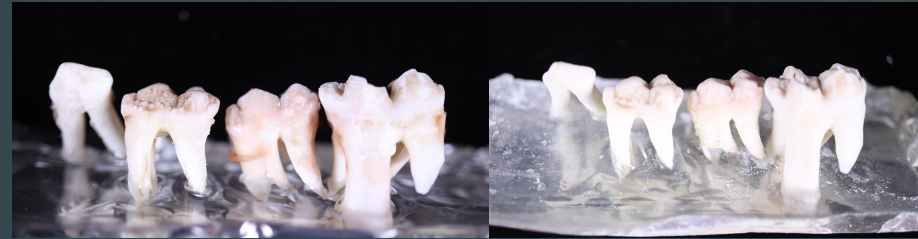
Charcoal, lingual



Crest 3D White, Lingual



Crest 3D Gum Detoxify, Lingual



Crest cavity toothpaste, lingual

## Part 2: Incubation with *S. mutans*

- Each teeth array was incubated with *S. mutans* and Tryptic Soy Broth without Dextrose for 2.5 weeks, changing the medium every 3 days.
- This created plaque (biofilm) on the teeth and resulted in tooth decay.



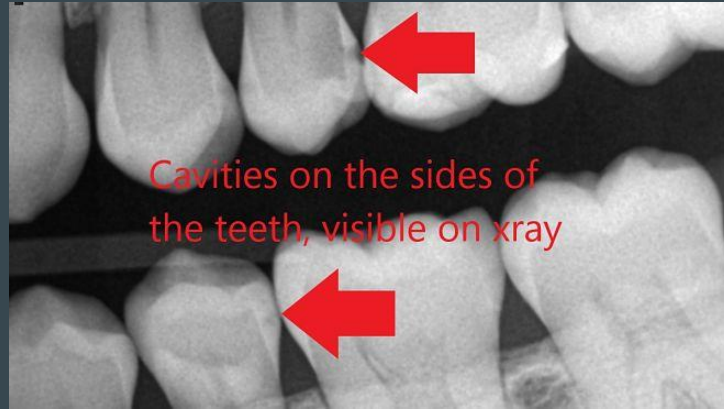
Before incubation



After incubation

# How to assess decay?

- Dental professionals assess decay via dental radiographs (x-rays) and observe radiolucencies (dark areas which radiation passes through easily).
- I used a radiograph at the end of the incubation period.
- Young's TRACE disclosing solution shows areas of plaque (biofilms of bacteria). The dye sticks to these areas.





# X-ray analysis of dental caries

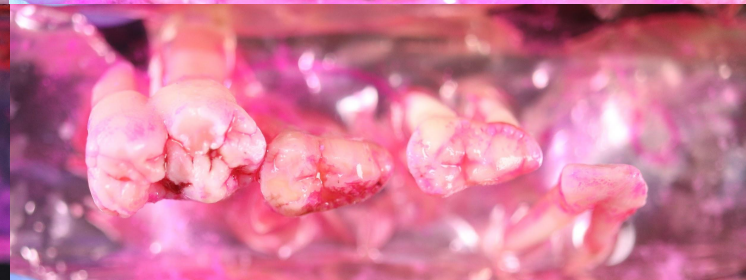
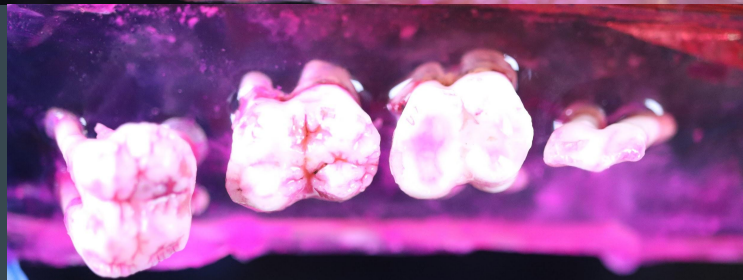
Diagnosed by Dr. Bryan Goldsmith, a general dentist.



# Plaque analysis

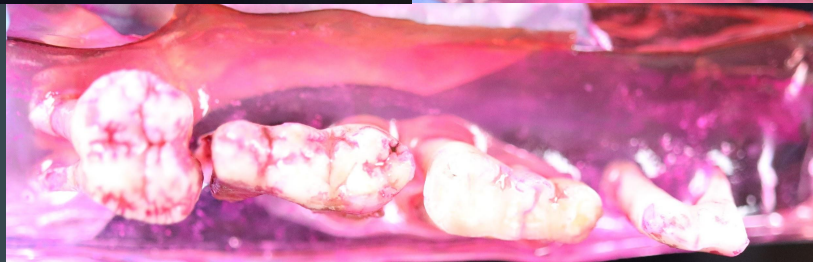
Charcoal

3D White



Gum Detoxify

Cavity Protection



No toothpaste

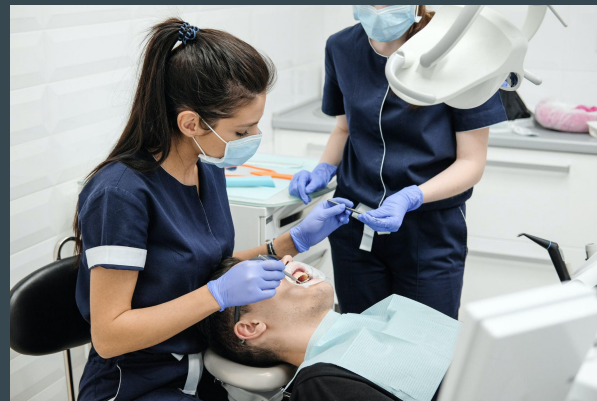
# Conclusions

- Each toothpaste formulation removed surface stains in the whitening trial
- The difference in whitening between whitening toothpaste and regular toothpaste was minimal
- Charcoal toothpaste appears to be best at preventing biofilm (plaque) formation
- No toothpaste is 100% effective against cavities



# Application

- Brushing your teeth is very important for oral and overall health!
- Supplementing tooth brushing with other activities like flossing, fluoride mouthwash, and regular dentist appointments is important for preventing tooth decay!



# Citations

- Robinson, D. (2019, July 24). Do I really have a Cavity? Retrieved April 5, 2021, from <https://cranforddental.com/do-i-really-have-a-cavity/>
- Retrieved April 4th, 2021, <http://youngdental.com/product-cat/disclosing-solutions-tablets/>
- Retrieved April 1st, 2021, <https://crest.com/en-us>

**Thank you!**

# Green growth phenomenon?

During the whitening process, two of the tooth arrays started to have a bright green growth.

We attempted to recreate the whitening trial to determine the identity of the green growth.

It seems that the bacteria growing in the artificial saliva is most likely *Pseudomonas aeruginosa*.

