

## Chocolate (theobromine) prevents caries

### Abstract

**Objective:** The objective of this study was to determine if 300ppm theobromine has the ability to prevent enamel erosion and/or to prevent lesion progression. We hypothesized that a 300ppm theobromine rinse would prevent enamel demineralization and erosion compared to a non-theobromine rinse.

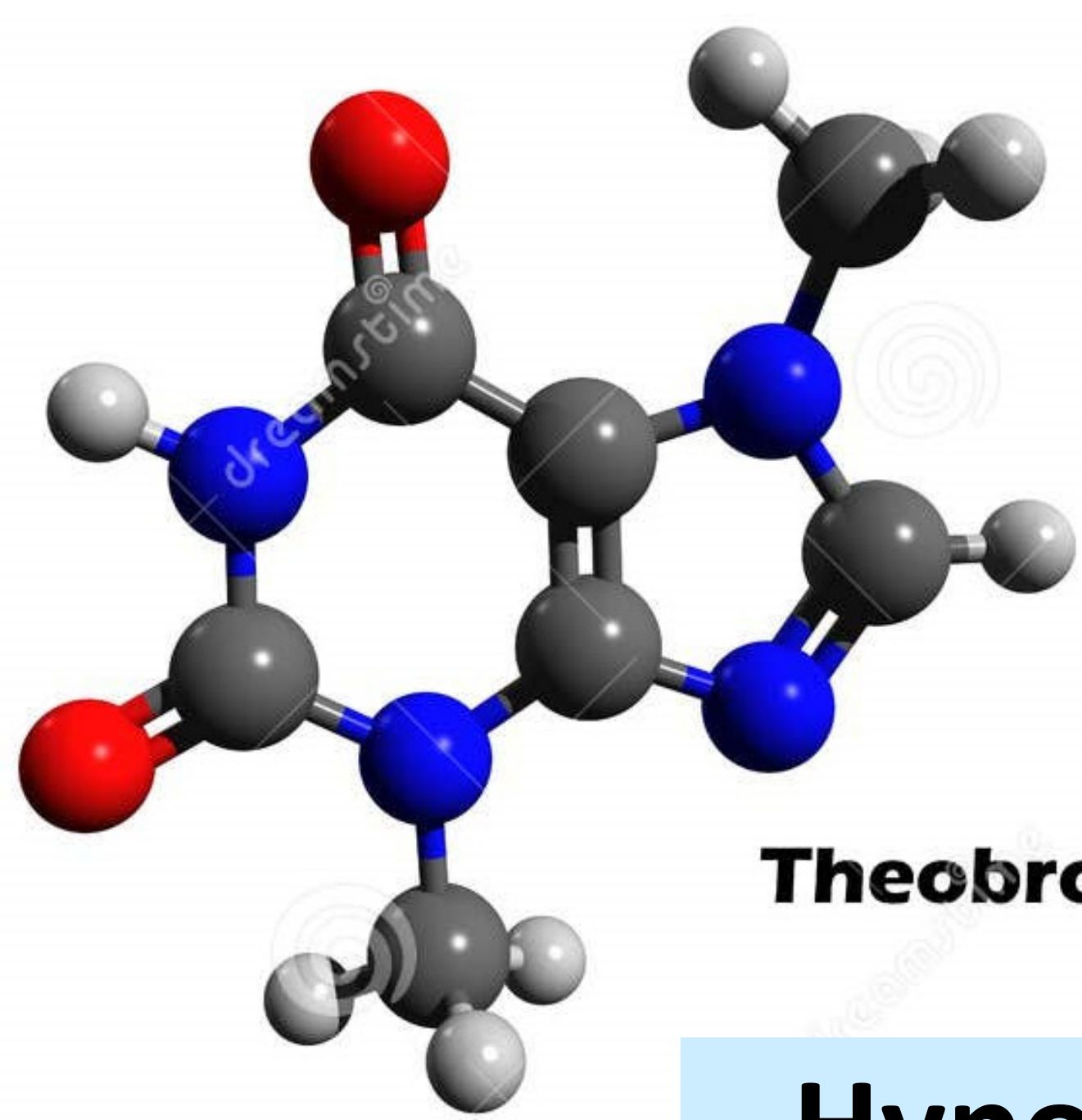
**Methods:** Human enamel samples were cut into (2x2x) mm blocks and mounted on plastic blocks. The natural surface of each sample was bisected into a lacquer protected and a non-treated area. The samples (n=9/group) were placed in a modified Featherstone model mouth system that simulated a realistic salivary flow with 3x/day lactic acid challenges. During the 5-day trial, the test group (THBr) received a 2x/day 300mmol theobromine rinse, and the control group (Ctrl) received a water rinse 2x/day. The enamel samples were then cross sectioned, microscopically imaged and analyzed for erosive loss and lesion depth using Image-J software.

**Results:** In this mouth model 2x/day exposure to a rinse of 300ppm theobromine significantly reduced the amount of enamel erosion {THBr=46±14µm vs Ctrl=124±37µm} at p<0.0001; and also significantly reduced the lesion depth {THBr=43±20µm vs Ctrl=83±20µm} at p=0.0003. For the THBr samples only, a mineralized layer 33±22µm thick was observed at the surface of the lesion.

**Conclusions:** The data supports our hypothesis that the theobromine rinse has a significant protective effect on the demineralization of enamel. Further studies are needed to confirm these results and to analyze the composition of the mineralized layer observed on the surface of the lesion.

### Introduction

- Theobromine is a neurotransmitter that is found in cacao leaves and chocolate.
- This substance has been observed as coating on the teeth of Incan runners who chewed cacao leaves in the ancient Americas. As compared to those who did not have the same diet in the same time period, those with the theobromine coating boasted teeth with fewer caries.
  - This led to the question if the cacao leaves could be the etiologic factor for the healthier enamel in these individuals.
- We believe the mechanism of theobromine to act like a pellicle, keeping the enamel from being demineralized. Other studies suggest the theobromine creates larger hydroxyapatite crystals with calcium and phosphate to strengthen the enamel and act as a remineralization agent.
- We are interested in theobromine's possible ability to protect enamel from demineralization, particularly given the growing population of fluoride concerned people.



- Our goal was to simulate the human mouth using saliva like solution in a continuous flow model. The control was treated with lactic acid (2x/day ten minutes each) until erosion was visible five days later. The theobromine runs were then scheduled for the same amount of time in the model mouth environment.

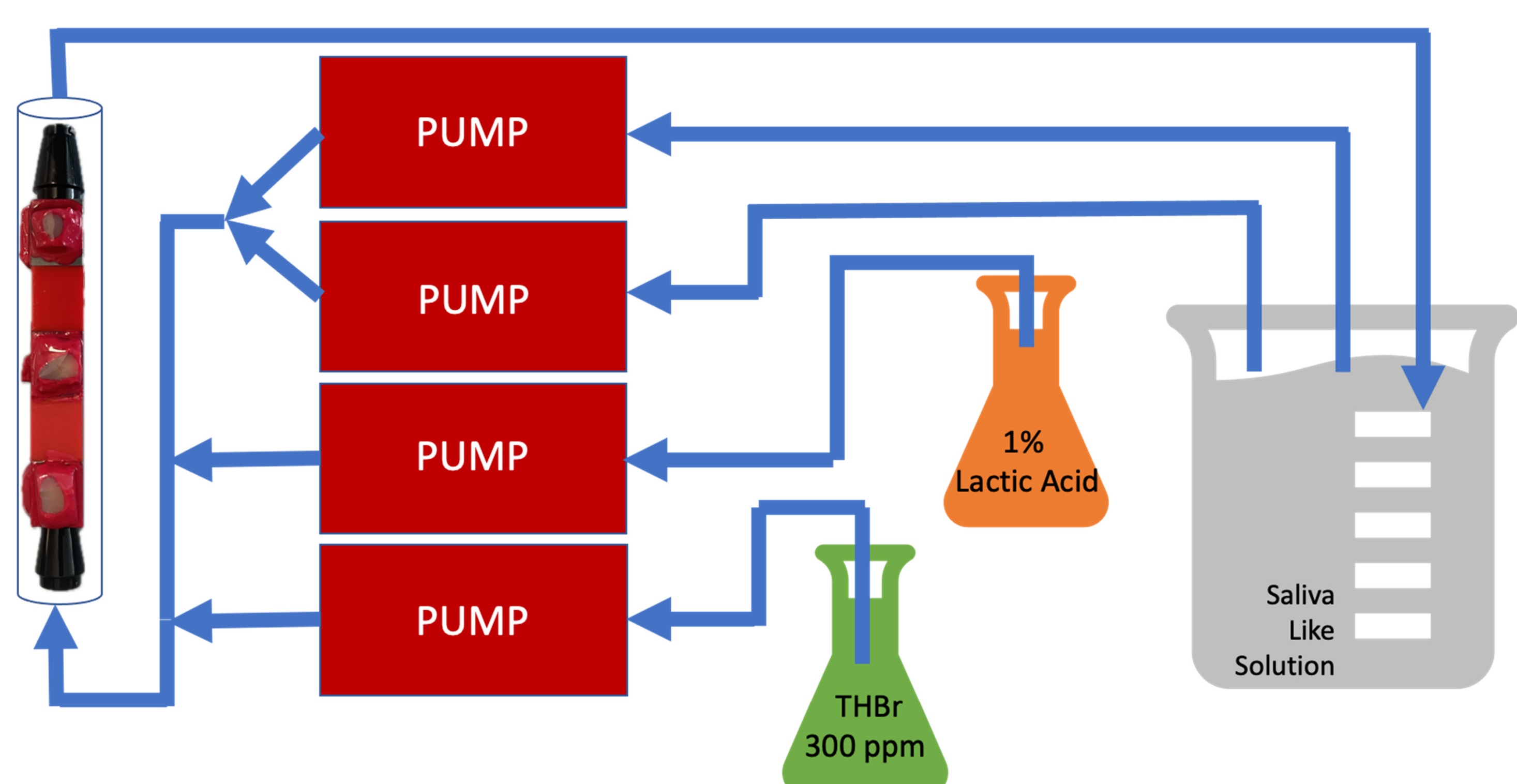
### Hypothesis and Aim

**Hypothesis:** A 300ppm theobromine rinse would prevent enamel demineralization and erosion compared to a non-theobromine rinse.

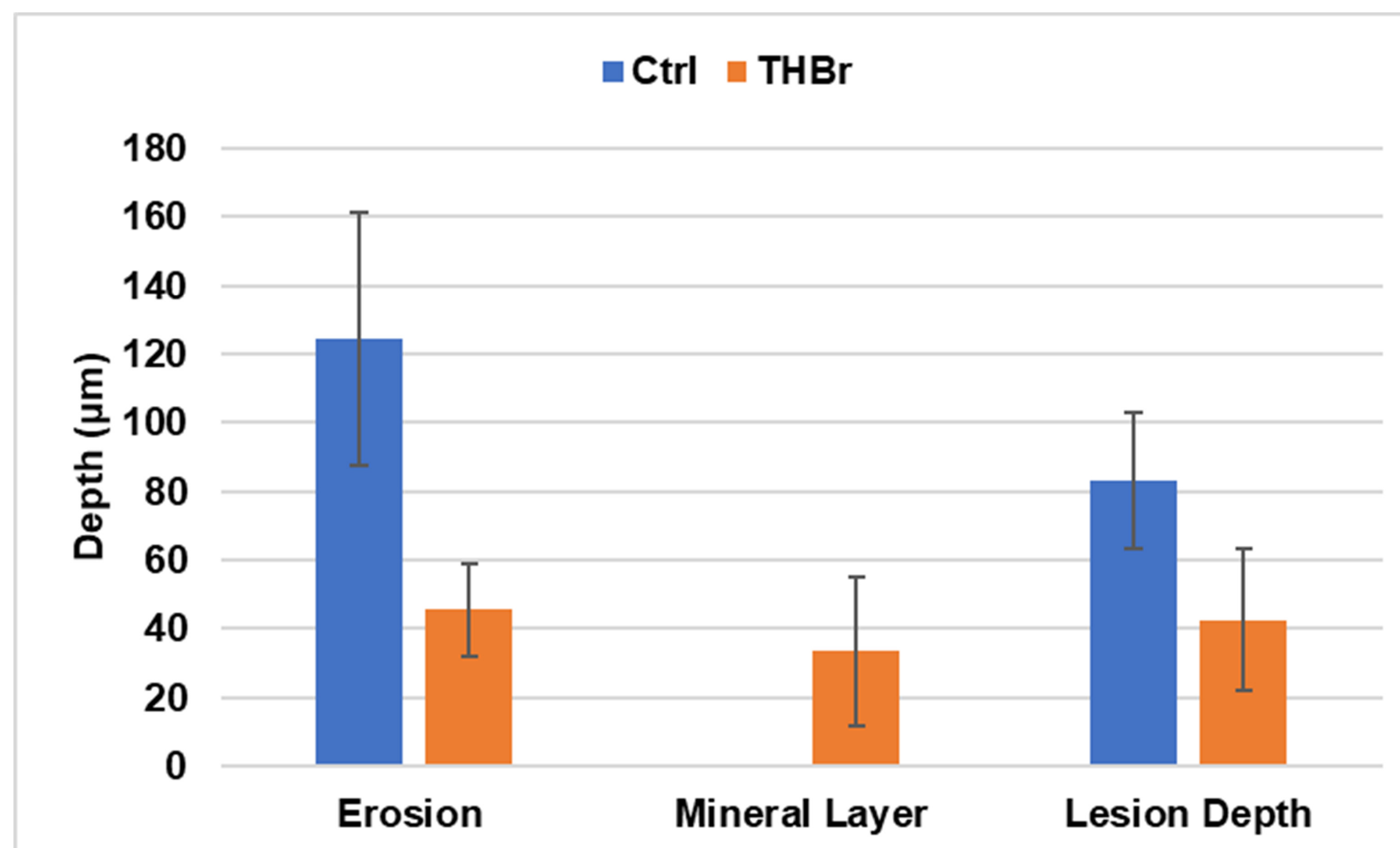
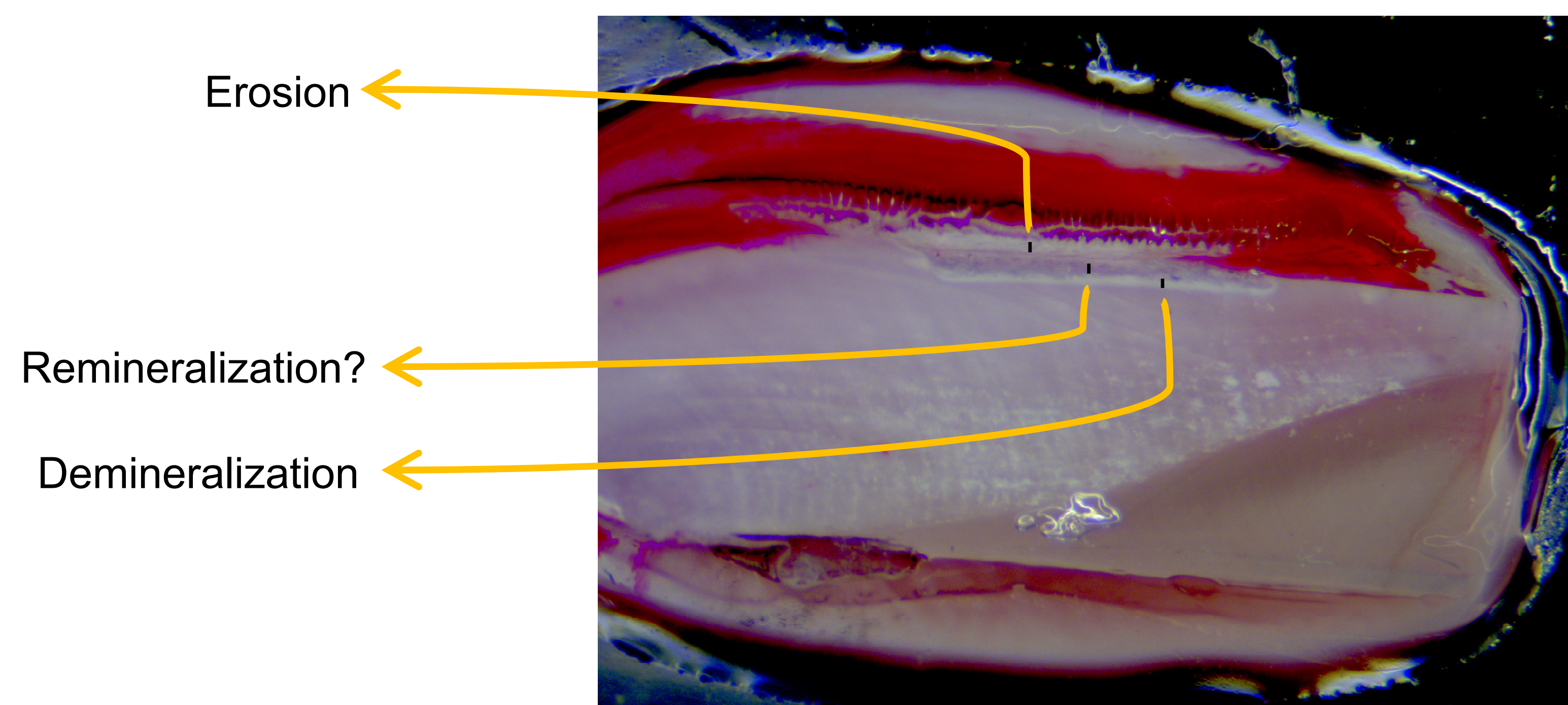
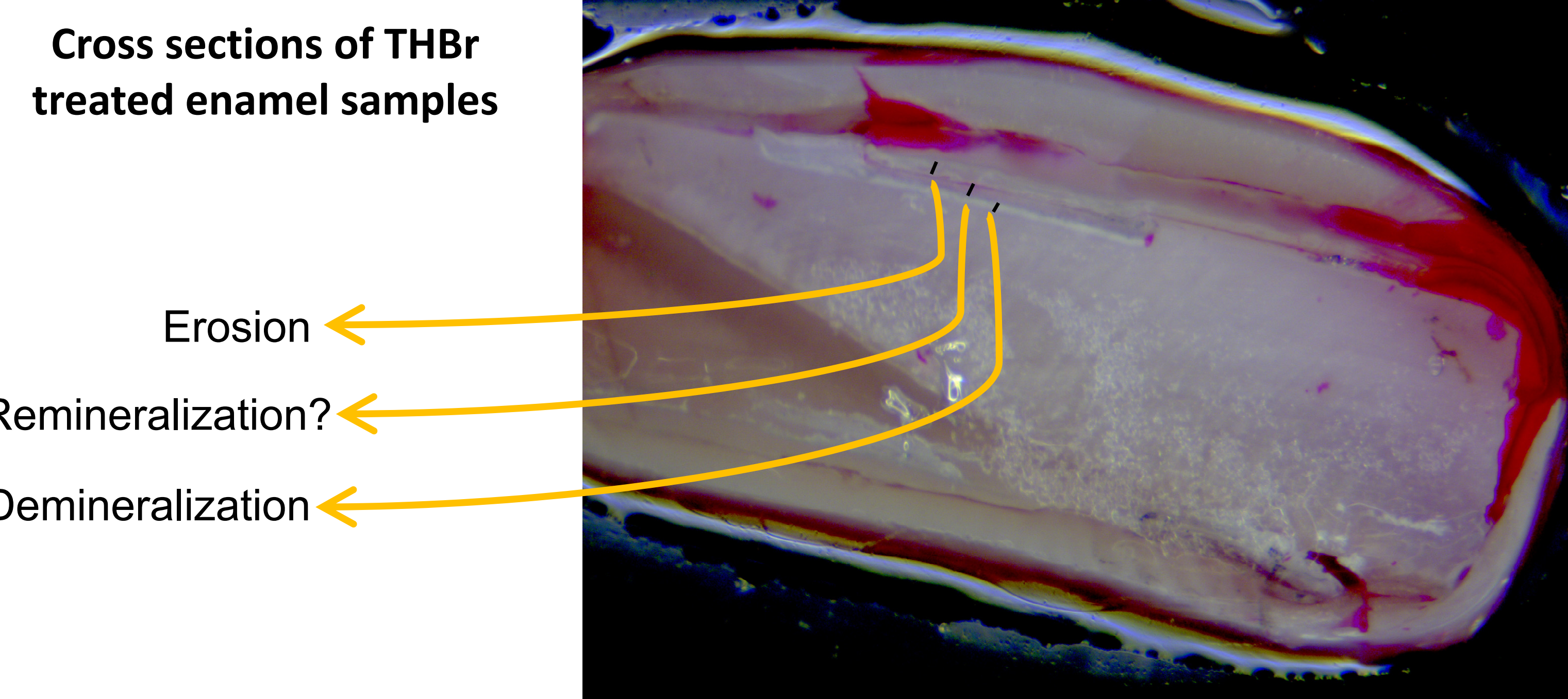
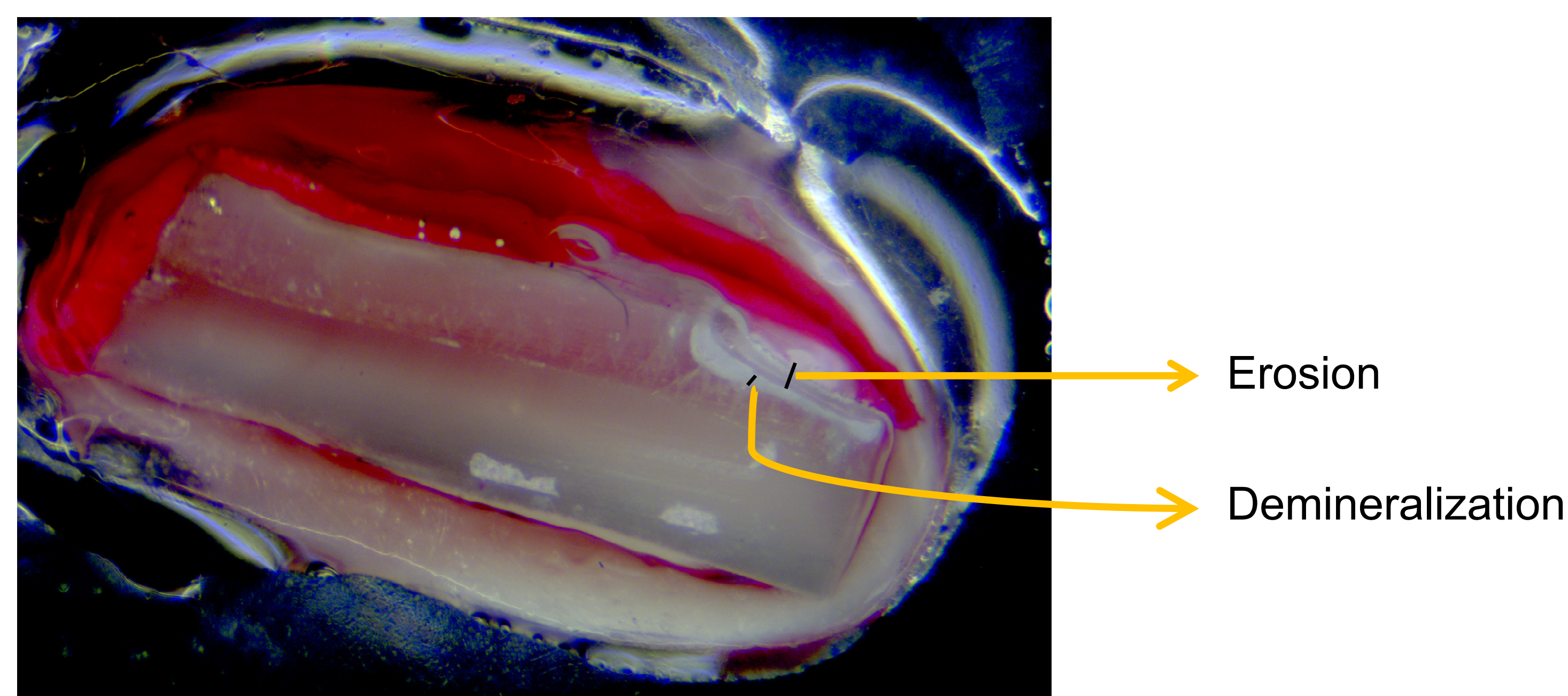
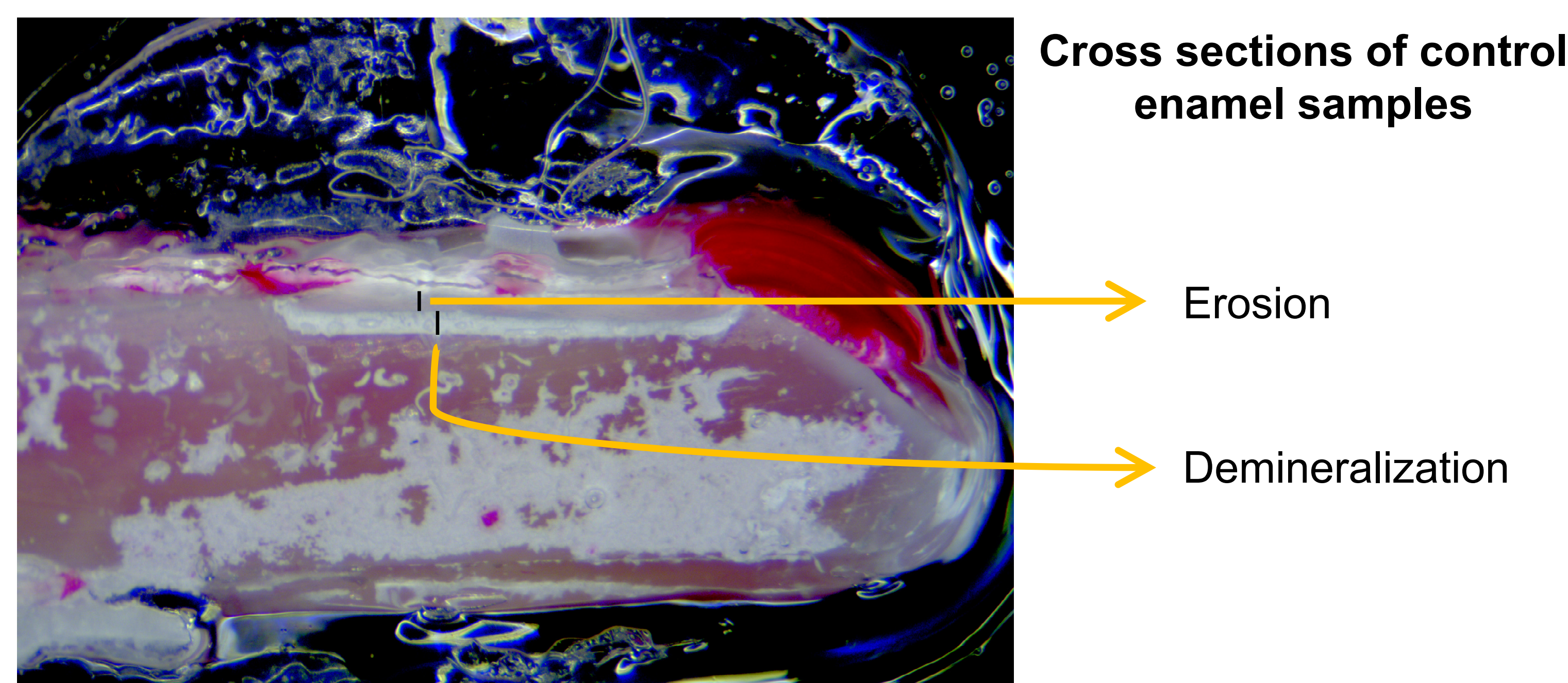
**Aim:** We want to determine if theobromine can slow enamel erosion and demineralization as well as fluoride does.

### Study Design

- Extracted human teeth were cut into 2x2x1 mm blocks and sanded to reveal untouched enamel, then mounted onto Lego spears. The test area was isolated with lacquer, with nine samples per Lego unit.
- The Lego block was placed in the Modified Featherstone model mouth for five days, being tested to ensure the pH did not drop below 5.5.
- The samples were divided into three slices to evaluate lesion depth under a microscope and measured with Image-J software.



### Results



### Discussion

- Our hypothesis has thus far been supported by the data. The theobromine demonstrates a significant decrease in the demineralization of enamel.
- Further studies to compare this data to a fluoride control, as well as a synergistic trial with theobromine and fluoride, are planned.

### Conclusions

- In this study, theobromine has been shown to have the ability to protect the enamel by preventing demineralization. Therefore, theobromine can be beneficial to the growing population of fluoride concerned people.

### Funding

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