

Damage From Teeth Cleaners

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Introduction

There are many different kinds of teeth cleaners on the market, and often people question: which is the right one to use? When we discussed our ideas with our science teacher, he mentioned as a point of interest that his dentist told his patients to brush solely with water because all toothpastes are much too abrasive. We found this intriguing, so we checked Internet sites to see how much was already known on the subject of teeth cleaners' abrasiveness. We found out that there was very little information, so we decided that exploring which teeth cleaner is the most harmful would be a novel idea.

Purpose: To determine which teeth cleaner is most abrasive over a long period of time. The teeth cleaners used in this experiment will be Arm and Hammer toothpaste, baking soda, and Topol.

Hypothesis: We believe that baking soda will be the most abrasive, Topol will be in the middle, and Arm and Hammer will be the least abrasive.

Equation: example: $\frac{5\text{min} \times 30\,000\text{r/min}}{10\text{ strokes/day} \times 365\text{days/yr}} = 150\,000\text{ r (revolutions)}$
 $= 3650\text{ strokes/yr}$

Assume 1r = 1stroke

$$\frac{150\,000\text{ r}}{3650\text{ strokes}} = \text{yrs}$$

Using this equation, we found out that 5 min. of brushing (from ex.) with a Dremel tool is equal to 41 yrs., 10 min. = 82 yrs., and 15 min. = 123 yrs.

Procedure

9 extracted adult teeth (obtained from a dentist), one Dremel tool (with a bristle brush attached to it, going at 30 000 RPM), plaster moulds, Arm and Hammer toothpaste (a baking soda-based toothpaste), Topol (a harsh toothpaste, often used by smokers), and plain baking soda (sodium bicarbonate).

First we encased the 9 teeth into 3 plaster moulds, each mould holding 3 teeth. Then we carefully examined the teeth beneath a bright light and took notes on how each tooth looked. (how shiny, how many scratches, etc.) We realized that the teeth have already been brushed by their owners, and that some teeth are more scratched than others, so we decided to use each tooth's previous condition as the zero point. When the teeth would be brushed, we would only count the damage that occurred when we brushed them, so that the tooth's earlier condition would not affect the results. We also made sure that the bristle brush on the Dremel tool was similar to a regular medium-hard toothbrush. We brushed each tooth on the first mould for 5 min., each tooth on the second mould for 10 min., and each tooth on the third mould for 15 minutes. On each mould we brushed one tooth with Topol, one with Arm and Hammer toothpaste, and one with baking soda. After brushing all the teeth for their appropriate time with the Dremel tool, we examined the teeth to see our results.

Results: Tooth 1- Before: Barely any surface scratches, but one deep scratch down the centre. There are a few tiny scratches, but the tooth is quite shiny.

After: (baking soda for 10 min.=82 yrs.) Lots of difference, many more scratches, a lot duller. 30% more damage.

Tooth 2- Before: A few small surface scratches, but very shiny.

After: (Topol for 10 min.=82 yrs.) Barely any noticeable difference, maybe a few more minuscule scratches. 7% more damage.

Tooth 3- Before: Not extremely shiny, but not too dull either. Almost no surface scratches.

After: (Arm and Hammer for 10 min.=82 yrs.) The toothpaste made no changes to the tooth. (no scratches or reduced shininess). 0% damage.

Tooth 4- Before: Many small scratches on the enamel, but very shiny.

After: (baking soda for 5 min.=41 yrs.) Quite a few more scratches, also slightly duller. 15% more damage.

Tooth 5- Before: Few surface scratches on a shiny yet stained enamel. The tooth has more scratches and becomes duller the closer you look to the root.

After: (Topol for 5 min.=41 yrs.) Almost no difference. 5% more damage.

Tooth 6- Before: Somewhat shiny enamel, many surface scratches, but most are close to the root.

After: (Arm and Hammer for 5 min.=41 yrs.) No difference. 0% damage.

Tooth 7- Before: A few surface indentations, but very, very shiny.

After: (baking soda for 15 min.=123 yrs.) Big change. Lots more scratches, quite a bit duller. 45% more damage.

Tooth 8- Before: Uneven surface, still very shiny.

After: (Topol for 15 min.=123 yrs.) Just a few more tiny scratches. 9% more damage

Tooth 9- Before: Uneven surface, quite shiny.

After: (Arm and Hammer for 15 min.=123 yrs.) No more noticeable scratches appeared on the tooth. 0% damage.

Error Analysis

Initially, we encountered a lot of trouble in our efforts to obtain nine adult teeth, but with much perseverance, we finally succeeded in obtaining the specimens from one of the many dentists we contacted. Next we made the mistake of not putting the teeth in moulds. This was a big problem because it was very hard to hold the teeth in our gloved hands and brush them at the same time, since they kept slipping from our grip. To solve that problem, the dentist helped us fit the teeth into moulds. Our next mistake was that we tried to use an ordinary toothbrush. We soon realized that this would not work, because we would have to brush the teeth for our entire lifetimes to see the long-term effects of the brushing. To solve this toothbrush problem we thought that we could use a drill with a brush attached to it, but when we bought the brush we found that it was too hard and gave off colour, staining the teeth. We went through a variety of

brushes, but none was soft enough and many of them had the potential to stain the teeth. In the end we discovered that my brother's Dremel tool was best to solve our problem because it already had a soft brush attached to it, and also its rotating capacity was greater than that of the drill. After all that trouble, we encountered more difficulty realizing we could not take pictures of the teeth through a microscope to show scratches because we did not have the right equipment. To solve this problem we used a regular camera to take more or less close-up pictures of the teeth, observed the teeth under a bright light, and documented our observations in detail.

Conclusion

Our results show that the baking soda was most abrasive when used for teeth cleaning during our assimilated lifetime brushing experiment. Secondly, we found that Topol was only slightly abrasive, and the Arm and Hammer toothpaste showed no signs of abrasion.

One could ask: when Arm and Hammer contains baking soda, then why did it not scratch the teeth at all while baking soda did? Our explanation is that the baking soda in the toothpaste is ground into a much finer powder and into a paste, while the plain baking soda is made of hard, rough grains.

Below is a chart comparing our results with the information we found on the Internet

Teeth cleaner	Our experiment	Info on the Internet
Baking Soda	Very abrasive	Not mentioned
Arm and Hammer	Not abrasive	Peroxides harmful to gums
Topol	Slightly abrasive	Very, very abrasive

First of all, we found out that the Internet sites did not mention baking soda as a teeth cleaner at all. This could be a problem, since we know people who actually use plain baking soda to brush their teeth. They are probably unaware of the damage that it can cause given the lack of information on the subject. We found that baking soda was very, very abrasive.

Second, the Internet sites did not comment on whether Arm and Hammer toothpastes were abrasive, but they did point out that baking soda-based toothpastes contain peroxides that can harm your gums with their bleaching agents. Next, the Internet sites warned against use of harsh toothpastes such as Topol describing them as much too abrasive. In our experiment we discovered that Topol is only slightly abrasive, and in particular, its abrasiveness is insignificant in comparison to baking soda. It is odd that the site should warn against Topol and not against baking soda when the latter is so much more abrasive.

In comparing our results, we have realized that the information on the Internet is quite limited: it did not mention baking soda, it did not comment on whether Arm and Hammer was abrasive, and it warned how abrasive Topol is. Our experiments have produced results above and beyond those posted on the Internet. However, we do acknowledge that there was a limit to the objectivity of our procedure due to the lack of equipment. For example, our observations would

have been more reliable and valid had we been able to use an electron microscope, and had we been able to carry the experiment on a much larger quantity of extracted teeth. Our experiment may have been slightly biased because tiny scratches and small details can be missed when you look at the teeth with your naked eye. Still, we did the best that we could with the equipment we had.

So- do teeth cleaners do more harm than good? As we discovered in our experiment, some do and some do not. We recommend using just a plain white or gel toothpaste, steering clear of baking soda, and using Topol sparingly.

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References: www.toothpastes.com
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www.toothcare.org