

Background of the Problem

The cost of toothbrushes may not seem huge, but if we use them and toss them, the actual costs, including environmental and out of pocket expenses can add up over a lifetime.

Problem and Goal Statement

Traditional toothbrushes, although not costly per say, have a replacement suggestion of 3-4 months from the American Dental Association. In order to save money and natural resources as well as to produce less slow-degrading plastics from replaced toothbrushes, I'd like to suggest a replacement head for the traditional toothbrush that is economical, doesn't use a lot of natural resources and would degrade quickly once its life is spent.

Problem Solving Approach (Engineering Design Process)

1. **(define the problem)** I looked into current solutions regarding replacement heads for toothbrushes and found that a lot of the battery powered toothbrushes have replaceable heads.
2. **(brainstorm)** My idea is for a traditional (non-battery or alternatively powered) toothbrush that has a replaceable head.
3. **(identify criteria)** The toothbrush head needs to be quicker at biodegrading than current toothbrushes so it will allow you spend less, use your toothbrush ergonomically, dispose of it and not have the worry it hurting the environment.
4. **(develop/propose design/choose alternative solution)** My design includes an ergonomically designed handle, a replaceable head that screws into the handle or snaps on to the head and bristles that are made out of a biodegradable material that will last at least the minimum time recommended for keeping a toothbrush.
5. **(implement the proposed solution)** First, I checked into several ideas for the bristles of the brush in looking for a product that was a renewable energy resources as well as biodegradable and safe for human use. I came up with bamboo and a process of using wood (sometimes called “chewsticks”) as the bristles. Secondly, the head for the toothbrush needs to fit safely on the handle so as not to be a choking hazard. Thirdly, the handle needs to be made in an ergonomic fashion that allows proper

grasping of the handle while brushing without causing damage to the median nerve in the wrist which can cause carpal tunnel after long term use.

6. **(make a model or prototype)** I chose to draw an example as I don't readily have materials available to create a prototype
7. **(evaluate the solution and its consequences)** will need feedback from class.
8. **(refine the design)** what can I do differently?
9. **(create the final design)** will wait on feedback.
10. **(communicate processes and results)** see below.

Information Collected

I started with a traditional toothbrush and noted that it should be thrown away after a couple months usage, according to the American Dental Association. I've looked into several toothbrush products that have replaceable heads but most of them are battery or electric powered. I checked out products from Sonicare, Oral-B and other leading dental accessory suppliers. Noting this issue, I began thinking of the problem above. Is this an original idea? Would it work? How would it work? What goes into creating a product like this? In my research I found that another company had the same kind of idea although it's marketed a little differently. They're called Eco-Dent and are sold on a website called www.reuseit.com (illustrations 2 & 3). While their design is different from mine, it has a lot of the same ideas. I don't think there's enough research yet from their company to define whether their goal is being met on the level that I had for mine as far as the changing of the bristles into something biodegradable. However, according to their research, the difference in waste (see illustration 1) is huge. As far as the bristle product, more research would have to be conducted. I did find that in some places wood is being used and has been used for thousands of years to aid in cleaning teeth (illustration 4) and for natural bacterial sanitation. According to an article by Andrew Parker, one product for the “chewstick” is called *miswak*. It “kills gum disease-causing bacteria, fights plaque, and increases salivation and hence inhibits dry mouth”. Another article on this “twig” states that this process “is more effective than your toothbrush”. So I think there's something to the idea of creating a bristle out of natural material. I also looked into using bamboo since it's a natural, renewable source that's safe for human consumption. Not much research has been done in using this so it'll remain to be seen.

Sources

Council on Scientific Affairs, Statement on Toothbrush Care: Cleaning, Storage and Replacement. November 2005. Retrieved February 4, 2011, from <http://www.ada.org/1887.aspx>

Parker, A. (2010, August 4). *Nature's Organic Super Toothbrush*. Retrieved February 4, 2011, from <http://ezinearticles.com/?Natures-Organic-Super-Toothbrush&id=4796855>

Stan, C. (2009, October 9). *Miswak-Nature's Alternative to Toothbrush Sanitation*. Retrieved February 4, 2011, from <http://ezinearticles.com/?Miswak---Natures-Alternative-to--Toothbrush-Sanitation&id=1569213>

Jarvik JG, Comstock BA, Kliot M, Turner JA, Chan L, Heagerty PJ, et al. Surgery versus non-surgical therapy for carpal tunnel syndrome: a randomized parallel-group trial. *Lancet*. 2009;374(9695):1074-1081. [[PubMed](#)]

Keith MW. American Academy of Orthopaedic Surgeons clinical practice guidelines on the diagnosis of carpal tunnel syndrome. *J Bone Joint Surg Am*. 2009;91(10):2478-2479. [[PubMed](#)]

Keith MW. American Academy of Orthopaedic Surgeons clinical practice guidelines on the treatment of carpal tunnel syndrome. *J Bone Joint Surg Am*. 2009;91(1):218-219

Development of Alternative Solutions

During the first stages of development for my product, I discovered that the Eco-Dent company had the same idea with a snap on head. After further review of it, I became afraid that it might be a choking hazard, especially if the reusable head popped off while a child or an elderly person was brushing their teeth. I began to consider the alternatives and found that if the handle itself had a hole for the head to screw onto that it might be a safer bet than the snap-on version from Eco-Dent. Also, the Eco-Dent toothbrush is not touted as having an ergonomically correct handle either. I began to design one that allows you to use it safely, daily without causing harm to the median nerves in the wrist which can cause carpal tunnel syndrome if damaged and left alone.

Selection of Best Solution

I decided on the screw on head and ergonomically correct handle. The bristle could be created out of miswak and inserted into the replaceable head either by sliding in or being formed from the factory. My prototype shows the various ideas that might work for a product like this.