EDSGN 100

Design Project #1

FINAL REPORT

Oral-B Pulsar 2.0

Introduction to Engineering Design
EDSGN 100 Section 24

Team 2
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Executive Summary:

We use electric toothbrushes every day but yet, some are designed inefficiently. The goal of our team is to give the customers a toothbrush that is efficient, appealing, and durable. We began by analyzing the product and researching possible modifications that we can implement into our design. By adding in these adjustments, we hope to meet the needs of the consumers.

Oral-B Pulsar 2.0

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1.0 Introduction

For our group's redesign problem, we were given an electric toothbrush and were asked to alter it's design. To do this, we had to dissect our toothbrush and learn a little bit more about our design before we could start making adjustments. The process required to open our toothbrush to observe some of the smaller components was quite tedious, so right away we encountered some flaws in it's design. We needed to use a set of screwdrivers to remove the brush head and had to use some more tools to open up the body. The toothbrush we were given was recommended to be thrown away after three months of use, which seems like a unnecessary waste.

After dissection came the surveying of customer needs. We asked consumers what they want in a toothbrush and how we can possibly make the design better. Our team assembled the customer needs and made a ranking of what each customer thought was most important. We carefully decided on the adjustments we were going to make with our toothbrush and came up with multiple concepts to decide from. We chose a concept that fit the customer's needs the most and finalized it.

In the following sections, we will be showing the process of how we went about completing our project and choosing our final design. Starting off with the initial problems, followed by the customer needs and how we ranked them and chose them, then our revised problem statement,

then the external research that we needed to have done in order to complete this project, then our internal research which includes our concepts, followed by our final design and why we chose it, and finally our conclusion in which we sum up our project and our thoughts on it.

1.1 Initial Problem Statement

The toothbrush we were given was not too environmentally friendly, as the original package recommends the disposal of the entire toothbrush after three months. The toothbrush's features were also quite inconvenient as compared to it's competitors.

2.0 Customer Needs Assessment

We didn't want to make any adjustments without asking the public thoughts on it first, so our next order of business was surveying customer needs. Our group used the media to gather thoughts on what customers wanted in a toothbrush. We also asked friends and relatives with varying age ranges so that each age range is covered. Doing this enabled us to get more varied responses as an adult's needs differ from a child's needs. We chose to use media as one of our forms of surveying because it allowed us to get varied results from different groups of people and can be done with ease. It also allowed us to get people's thoughts from all over the country, all genders, and all races and how their needs differ from a local's needs. Our other form of surveying was asking friends and relatives their thoughts on what a toothbrush should have.

The key to garnering valid and accurate responses to what the people replied with was to ask follow-up questions. Ask them why they would want that feature added in and ask if they would buy it if it was included into a new design. This brought up the more serious features that needed to be adjusted in our toothbrush and the possible solutions of how we could fix them. Asking people about the thoughts other respondents had is also a good way to gain insight on what people really look for in a toothbrush. Consumers tend to buy products that appeal to them, so asking about what colors and what designs they would like on their toothbrush is a great way to gain more design ideas.

List of common questions we asked to consumers:

1. What do you look for in a toothbrush?
2. If you were to buy a new toothbrush, what would be the reason as to why you bought it?
3. What features make a toothbrush more convenient?
4. What adjustments could a company make to make their toothbrushes to appeal to more customers?
5. How would you improve a toothbrush's appeal, what colors do you recommend?

2.1 Weighting of Customer Needs

In order to meet the customer's needs, we must satisfy their most common requests. By the process of making a ranking system in what was replied most often, we can pinpoint what customers ask for the most out of their toothbrush. In table 1, we have a full list of what customers replied with when asked the previously mentioned questions. The most common needs were attractive colors or designs, comfortable grip, durability, lightweight, and an easily accessible battery. There were a handful of other responses but they were less common. In table 2, we ordered the customer needs by ranking them on how often they were said by the respondents.

Table 1. Initial Customer Needs List Obtained from Media and Other Individuals

Easily accessible battery
Tongue cleaner on back of the brush
Replaceable brush heads that are easy to remove
Comfortable grip
Attractive colors and designs
Lightweight
Low noise
Flat bottom
Plastic cover for brush head
Adjustable speeds
Timer
Music playing from toothbrush when turned on
Durable

Table 2. Hierarchal Customer Needs List Obtained from Media and Other Individuals

1. Attractive colors and designs (blue, green, purple, swirl designs, firework designs)
2. Comfortable grip
3. Durable
4. Lightweight
5. Easily accessible battery
6. Replaceable heads that are easy to remove
7. Tongue cleaner on back of the brush
8. Flat bottom
9. Plastic cover for brush head
10. Adjustable speeds
11. Low noise
12. Timer
13. Music playing from toothbrush when turned on

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2.2 Revised Problem Statement

After collecting and analyzing our data from the customer needs surveys, we decided to re-evaluate our initial problem statement. Our toothbrush prior to this redesign project was not too convenient or environmentally friendly so our team decided we need to change a few features.

Looking at the data from our customer needs, there are quite a few more features that our toothbrush could benefit from if we were to add them. The problem isn't just that it is quite inconvenient, but it is also very bland and boring.

3.0 External Search

External research is important to fix problems that may occur in a company's first product. Company's feedback about their product can also help sell their product. In our Pulsar's case, however, the feedback that is posted would probably not help sell it. The two main review trends are both negative. The points of criticism are the lack of durability and the varying durability of the toothbrush.

3.1 Literature Review

The main point of nearly every feedback comment on Oral-B's pulsar page on their website is criticizing the Pulsar's horrible lifespan. Comments like **"***The last pack of four toothbrushes did not last longer than four weeks not nearly as long as we have become accustomed to them lasting. They are expensive so we doubt we will continue to purchase them unless you can indicate that this problem is being addressed,"* are extremely common. Other comments include,

"I was very happy with the way it worked and how clean my teeth felt after brushing. Well, after two months the battery died. I was very surprised and displeased to learn the battery is NOT replaceable. As it turns out I spent premium money on what is now a mediocre toothbrush (since it is made to function best with the pulsing motion). Why would they sell a product such as this?"

"Very nice toothbrush with a unique vibrating action. Soft bristles with some paddles thrown in, hefty feel with good balance. The problem is when you're swapping out the AAA battery - it just doesn't want to come out and when you put the new one in (if you can) it fails to work properly."

"Even though the performance is adequate, you can only use this toothbrush until the battery dies. Changing the battery, which should be a simple thing, takes several tools, much patience and a video from the internet! I replace my toothbrushes regularly but there are times that I need to replace the battery. If the battery is not meant to be replaced then just seal the battery compartment so that I know I can't.I will not purchase another Pulsar because of this."

These are the average comments on the Pulsar's feedback page. The only comments on the first two pages that vary from this trend are the comments that are about the unreliability of any kind of standard duration of the brush. One example of this is the comment, *"The first time I bought the 4 pack pulsar my brush lasted about 4 months apiece. This last time the first brush lasted 2 weeks, the 2nd brush less than 2 months. The third brush approx. 2-3 months. Just now starting on the 4th. Expect it to last anywhere from 2 weeks to 2 months. No more pulsar for me."* The only consistent statistic about the Pulsar, according to the comments, is that the Pulsar does not reach the estimated lifespan suggested on the packaging.

Common venders of the Pulsar include Wal-Mart, CVS, and Amazon. All three of these venders use comments posted on Oral-B's website.

3.2 Patent Search

We did not find any previous patents in our research for the Oral-B Pulsar.

3.3 Benchmarking

In order to re-design our toothbrush, we went through a benchmarking process. We compared our Oral-B Pulsar toothbrush and compared it to the features of three other toothbrushes. We found that our toothbrush is very similiar to the other ones in the aspects of packaging, noise level, and battery voltage. The Oral-B Pulsar stood out among the others in weight and cost.

Table 5. Benchmarking of Four Products

Feature	**Oral-B Pulsar**	**Arm & Hammer**	**Colgate 360**	**Oral-B**
Packaging	plastic covering, carboard back	plastic covering, cardboard back	plastic covering, carboard back	plastice covering, cardboard back
Aesthetics	simple design, blue and white	odd shape, plain colors	visually appealing, catches the eye	nice modern look, blue
Battery location	bottom	bottom	bottom	hidden
Convenience of on/off switch	convenient location, spearate on and off buttons	easy to turn off and on	easy off and on switch	easy off and on switch
Cost	$6.00	$7.99	$8.49	$11.39
Environmental friendly	not recyclable	not recyclable	not recyclable	not recyclable
Handle	comfortable rubber grip	fits hand, still wide	comfortable rubber grip	good grip even when wet
Quality	decent	decent	very high	high
Weight (with batteries)	76.5 g	112.5g	107g	140.7g
Battery voltage	1.46 V	3.2 V	2.9 V	3.0V
Noise level 4inch from head	67.5dB	72.5dB	70dB	68dB

3.4 Global Issues

Our toothbrush re-designs are aimed at making our toothbrush more environmentally friendly. The original design of this toothbrush is not very environmentally friendly and many countries who are conscious of their waste and recycling may not want to advertise our product or sell it in their stores.

3.5 Product Dissection

For the dissection of our toothbrush, we removed the bottom of the handle by unscrewing it. Once we took the bottom off, we were able to pull the battery out and remove it from the body of the toothbrush. We saw how where the o-ring is placed and how it blocks out water from the battery. We were able to remove the head of the toothbrush just by pulling and twisting it off. To see the motor and how it works, we used a rotary tool to cut open the handle and remove the motor.

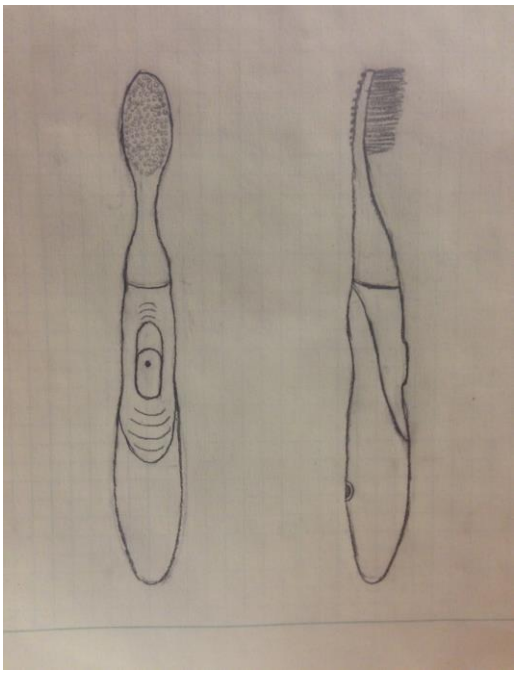
4.0 Internal Search

After gathering our customer needs and our external research, we generated concepts to incorporate the needs of the customers.

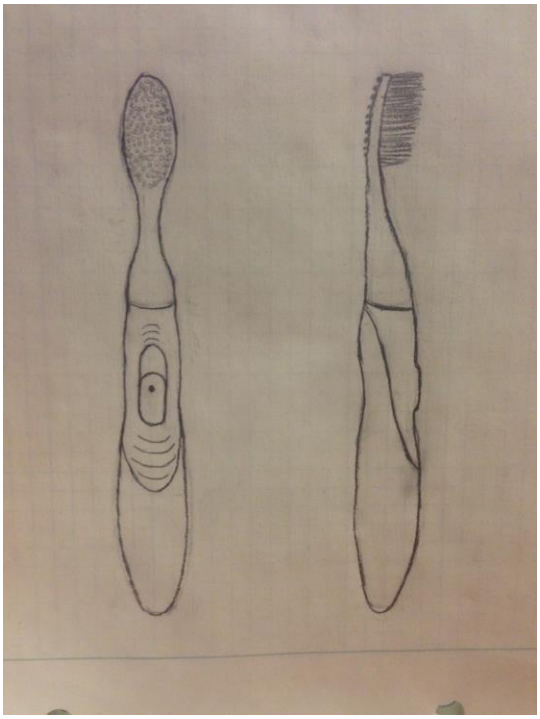
4.1 Concept Generation

We chose the brainstorming techique to come up with our concept designs. By mixing up the adjustable parts we designed, we narrowed down a list of five concepts that we accepted as a group.

Concept 1: An electric toothbrush with replaceable heads, a tongue cleaner a rechargeable battery, and a teal body color.



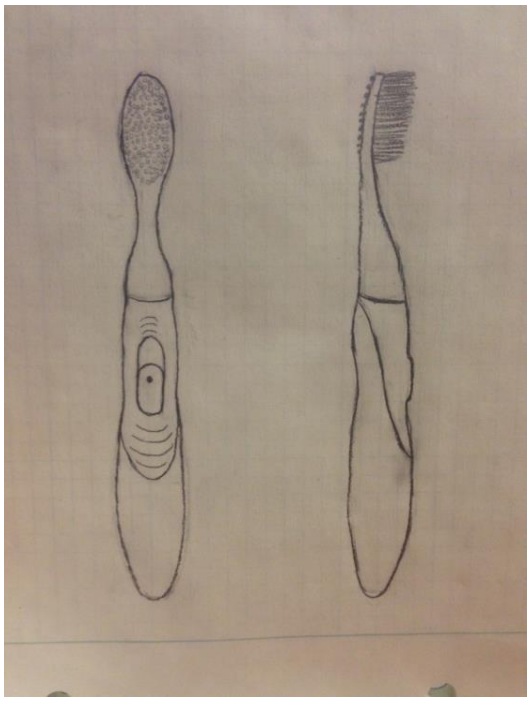
Concept 2: An electric toothbrush with replaceable heads, a tongue cleaner, an easily accessible battery, and a purple body color.



Concept 3: An electric toothbrush that has a flat bottom, a tongue cleaner, replaceable heads, an easily accessible battery, a plastic cover for the head, and a green body color.

Concept 4: An electric toothbrush with adjustable speeds, a flat bottom, and a multi-colored body.

Concept 5: An electric toothbrush with a plastic cover, replaceable heads, an easily accessible battery, and a white and blue swirled body.



4.2 Concept Selection

We chose concept five but also adapted some ideas from other concepts into it. We weighted durability the most, then asthetics, efficiency, and price.

4.3 Prototyping and Design Reviews

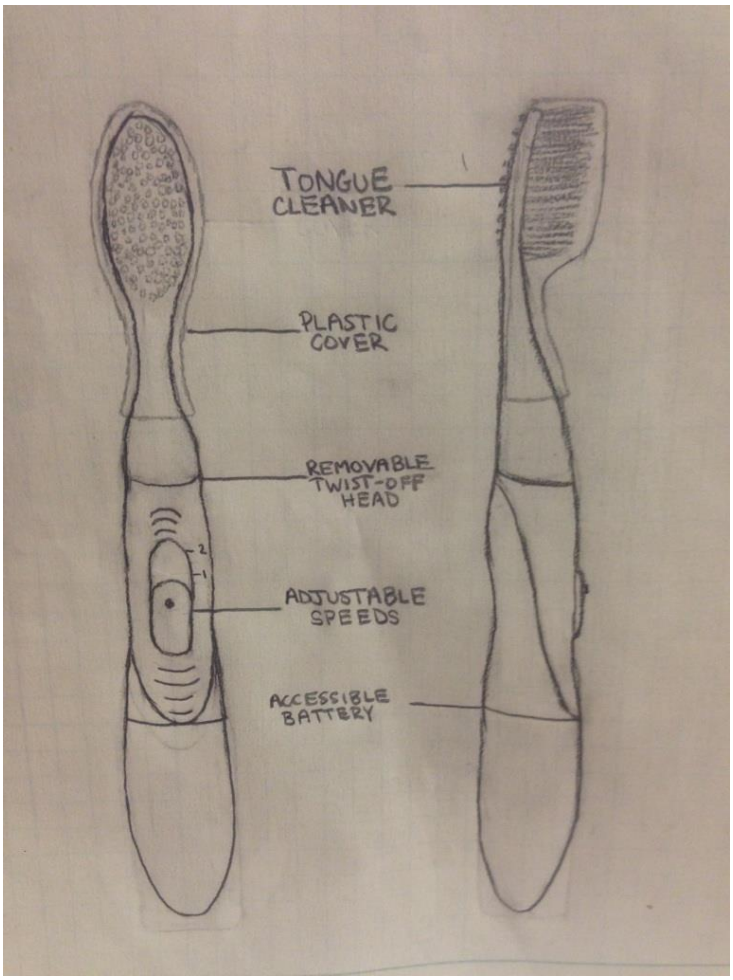
We played with many design concepts. The concepts that we generated include replacable, twist on/off head, replacable, slide on/off head, removable battery, rechargable battery, flat bottom, colors and designs, mutliple speed motor, tongue cleaner, and plastic head cover. From these designs, we choose which qualities would be implimented into the final design by the compatability with the current toothbrush.

5.0 Final Design

The qualities we chose for the final design are replacable, twist on/off head, easily replaceable battery, blue and white swirled body, mutliple speed motor, tongue cleaner, plastic head cover, and “try-me” packaging. The replaceable head and battery are to make our toothbrush more durable. The tongue cleaner and multiple speed motor enhances our toothbrush’s efficiency. The blue and white swirled body and the “try-me” packaging are made to attract the customer. The plastic head cover is to help keep the brush head sanitary.

5.1 Design Drawings and Parts List

The parts of our final design include replaceable brush head with a tongue cleaner on the back, handle, AAA battery, handle, battery cap, o-ring, motor, plastic head cover, sliding button and resistor.



5.2 Bill of materials

Part Number	**Part Name**	**Qty**	**Function**	**Mass** (g)	**Material**	**Dimensions** (L x W x H)(cm)	**Cost** ($)

1.	Brush head with tongue cleaner	1	Clean teeth, replaceable	3	Plastic, rubber, bristles	7 x 1.2 x 1.9	.20
2.	Handle	1	Grip, comfort	9.4	Plastic, rubber	10.3 x 1.8 1.9	.25
3.	AAA battery	1	Power source	11.3	Metal, electrolyte solution, plastic casing	4.4 x 1 x 1	.40
4.	Battery cap	1	Protect the battery from damage	5	Plastic	5.3 x 1.8 x 1.8	.15
5.	O-ring	1	Seal battery cap firmly	.01	Rubber	r = .7	.001
6.	Motor	1	Makes the brush vibrate	5.5	Plastic motor	10.5 x 0.9 x 0.8	.45
7.	Plastic cover	1	Protect head of toothbrush when not in use	2	Plastic	8 x 1.5 x 2.5	.25
8.	Sliding button	1	Enables user to switch between speeds	.03	Plastic	1 x 0.3 x 0.3	.01
9.	Resistor	1	Direct some current and power to allow the ability	.05	Metal, carbon film	0.5 x 0.2 x .02	.10

5.3 Instructions for Assembly

Steps:
1. Take the motor and battery sled and insert them into the handle. To insert the battery sled, with the catch on the end, you must “pry” it in so that the catch goes first.
2. Put the O-ring on the bottom of the handle and twist the battery cap on after it.
3. Twist the head of the brush onto the handle.

5.3 How does it work?

We kept the design of the rubber grip in the handle, which reduces the vibrations sent into the hand from the motor. The battery cap design is also the same. Inside the toothbrush, the battery will be on a sled shaped strip of metal like the original design but there is a catch at the end of the sled so the battery sled cannot be removed fully from the handle. In the motor, we added another switch and a simple resistor which connects to slide switch on the handle. This allows the resistor to be switched on and off, creating two speeds. Our design keeps the original concept of starting vibrations in the handle and sending them through the head which helps clean teeth. The head is changed to have a flat bottom and a corkscrew indentation on the inside, allowing an extruding corkscrew shape on the outside of the top of the handle to be connected by twist.

6.0 Conclusions

Our project utilized benchmarking tremendously. A few of our qualities came through benchmarking. However, we were unable to benchmark our data with most of the other team’s data since some data on other teams did not make sense. Our customer analysis is where the rest of our concepts came from. Using a small sample was both time efficient and productive. We did not use customers that have used the Pulsar, but we still received general concepts that improved our toothbrush. In order to add concepts specific to our toothbrush, we looked online at comments and concerns of actual users of the Pulsar. Finally, we used internal searches to interpret and adapt the concepts to incorporate them into our toothbrush. Overall, our process was a success. One of the features that is unique to our design is our speed adjustment setting. None of our competitors in the class have that on their original design.

References

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