Prevention of Early Childhood Caries

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One of the most common dental problems that affect young children today is early childhood caries. Early childhood caries is defined as the presence of one or more decay (non-cavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces in any primary tooth in a preschool-age child between birth and 71 months of age (Colak H, Dülgergil ÇT, Dalli M et al). Early childhood caries is an infectious disease, primarily caused by the bacteria, *Streptococci Mutans*, located in dental plaque. Bacteria in dental plaque metabolize the sugar from consumed foods and beverages, producing acid. The acidic environment created by the bacteria, lead to the loss of calcium and phosphate from the enamel surface, a process known as demineralization. Demineralization weaken the enamel surfaces, resulting in dental caries. This paper follows five pediatric patients from the New York University College of Dentistry Dental Clinic during the spring of 2016. All five patients presented to the dental clinic with existing dental caries. The parents or caregivers were interviewed. Which factors from the children's daily lifestyle caused their existing dental caries? Are the parents educated on how to properly care for their children's teeth? What are the children's dietary habits? What are the parents' values? How can I help?

The first primary tooth to erupt into the oral cavity is the mandibular central incisor, erupting between the ages of six and ten months old. Most children have their full set of primary teeth by their third birthday (Wisconsin Dental Association, 2015). The first natural exfoliation of primary teeth does not occur until around age six. It is crucial to keep all primary teeth until its natural exfoliation.

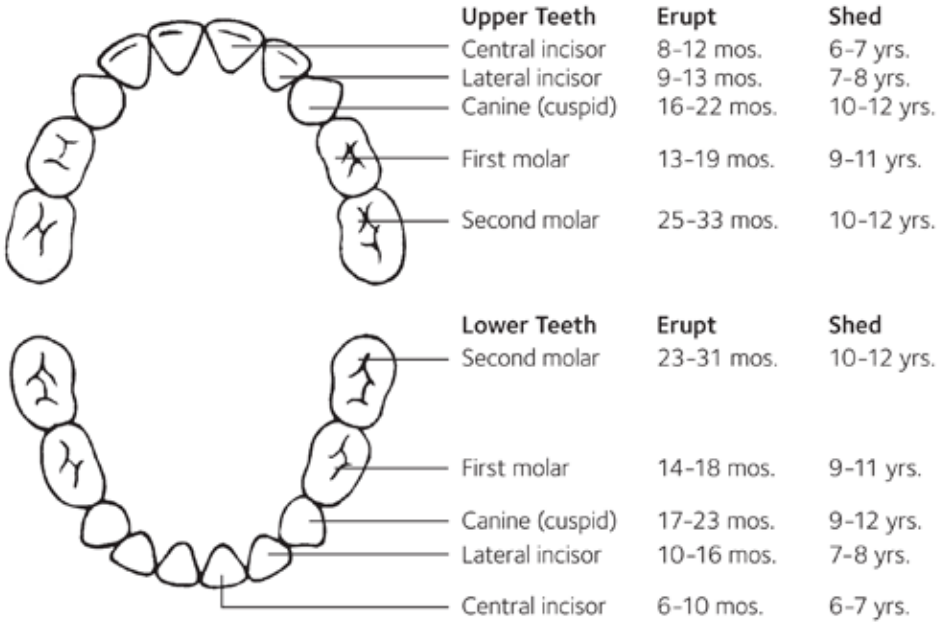

Figure 1

The teeth in the primary dentition are an important asset. The roles of the teeth in the primary dentition include breaking down food during mastication, working as space maintainers until eruption of the larger permanent teeth, helping with speech and maintaining the vertical dimension of the face (American Dental Association, 2014). The teeth of the primary dentition have so many important roles; therefore, it is ideal to keep all primary teeth until its natural exfoliation. Existing dental caries indicate that the teeth are not in optimum health and will therefore decrease the effectiveness of the teeth to perform its roles. Dental caries can be restored and saved but once these caries become too large to restore, extractions will be necessary.

Bacteria play a major role in the formation of dental caries. There are over 700 strains of bacteria can be found in the oral cavity (Woudstra, W). *Streptococci Mutans* is the bacteria primarily associated with dental caries. *Streptococci Mutans* can be transmitted horizontally, from one individual to another in the same generation, and vertically, from parent to offspring. Therefore, the sharing of utensils and kissing permit transmission of this caries-causing bacteria through saliva.

Figure 2

Dental caries result from the process of demineralization of the enamel surface. The pH level of the oral cavity play an important role in this process. The neutral, sugar-free pH level of the oral cavity is 7. Decrease of the pH level in the oral cavity occur when bacteria metabolize consumed fermentable carbohydrates producing acidic byproducts. As shown in Figure 3, after consumption of fermentable carbohydrates, the pH level drop within five minutes and will take approximately thirty minutes before the pH level of the oral cavity return to its neutral environment. A pH level of 5.5 is known as the critical pH because this is when the enamel surface begin to demineralize.

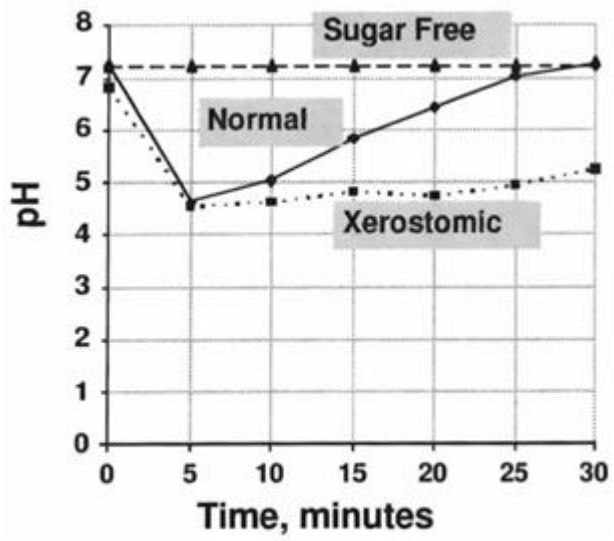

Figure 3

In patients with xerostomia, there is a reduced production of saliva. Saliva is important since it acts as a buffer in the oral cavity. For patients with xerostomia, the buffer effect of saliva is reduced, causing the pH level of the oral cavity to remain at around 5, increasing their risk for demineralization.

Fortunately, dental caries is preventable. However, it is important to find out which factors are contributing to the patient's increased risk for early childhood caries. Factors contributing to the increased risk for dental caries include poor oral hygiene care leading to accumulation of bacteria in the oral cavity, decreased salivary flow, frequent consumption of fermentable carbohydrates, lack of dental periodic examinations, and lack of fluoride use. Proper oral hygiene care include brushing, flossing, and the use of a mouthwash. Brushing and flossing are mechanical measures used to disrupt the bacterial plaque adhered to the tooth surfaces and interproximal areas. Dietary habit play an important role in the formation of dental caries, especially in children. A diet high in sugar will increase the risk for dental caries significantly; it allows bacteria in the oral cavity to have frequent access to sugar. The constant acidic environment in the oral cavity due to the frequent sugar consumption increase the rate of demineralization of the enamel surfaces. Fluoride is a substance that help protect and remineralize the enamel surface. Daily use of a fluoride-containing toothpaste in addition to periodic in-office fluoride treatments can significantly decrease the risk for dental caries.

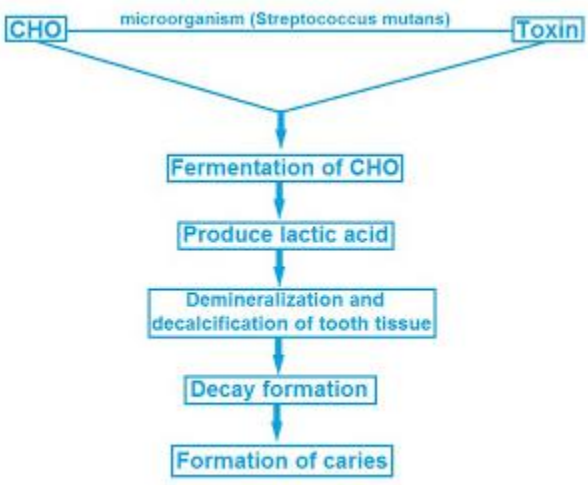

Figure 4

"Good health is not something we can buy. However, it can be an extremely valuable savings account."

-Anne Wilson Schaef

In order for an individual to have good health, preventive measures must be taken. Once preventive measures are taken, the health of the individual will be maintained or even improved over time, which is a valuable asset. A healthy, strong immune system can fight off infections more effectively and efficiently than a person who is immunocompromised or immunosuppressed. This can also be applied to the oral cavity. For children, a healthy primary dentition is considered an extremely valuable savings account. Because the teeth in the primary dentition have so many important roles, the prevention of early childhood caries is extremely important.

Early childhood caries is often neglected and can become widespread quickly. Because children lack the manual dexterity to proper remove dental plaque, parents and caregivers must supervise and help guide their children through the process. Children do not have the ability to make their own decisions yet - *What do I eat for breakfast? Lunch? Dinner? I like chocolate, I will eat that for every meal.* Because children lack the cognitive ability to make healthy food choices, their mothers or caregivers play an important role in selecting foods that

are healthy and nutritious for their children. The decisions made by mothers and caregivers are crucial in order to prevent early childhood caries in their children. Preventive measures are key to decreasing the risk for early childhood caries.

Now the responsibility lies on the caregiver. But, are the caregivers aware? Have they been educated on proper oral hygiene care? What are the benefits of fluoride? Do they know what types of food should be given to their children? What causes dental caries? Do they bring their children to the dentist every six months? The problem is, many caregivers do not know that they should bring their child to see the dentist by the first tooth eruption or no later than the child's first birthday. At the child's first dental appointment, mothers or caregivers are taught how to properly care for their child's teeth to prevent the formation of dental caries. Because most mothers or caregiver miss this crucial first dental appointment, they do not know how to properly care for their child's teeth.

"Health is not valued until sickness comes."

-Thomas Fuller

Unfortunately, many parents are not educated on the effects of early childhood caries. Many people have the tendency to only make appointments with their doctors and dentists when they are in pain or feeling some type of discomfort. They do not value their health until sickness comes. Their mentality being – *Nothing is bothering me, I am feeling fine. There is nothing wrong.* I am, too, guilty of this. Other reasons include education level, financial status, and even culture. People do not know that they should make appointments with their doctors every year for their annual physicals or that they should go to their dentists every six months for a routine examination and cleaning. The reason might be that they are not financially stable to go to their doctors every year. Maybe they are struggling just to make ends meet; therefore, if they are not in pain, there is no need to spend the extra money to go see a doctor. Culture, this reason hits close to home. My family is from Taiwan. Before going into the field of dental hygiene, I did not go to the dentist every six months for a routine examination and cleaning. Nor did I go to my doctor every year for an annual physical. I am young, what can be wrong? I was brought up to only go to my doctor when there is a problem. It was also how my parents were brought up. It was the culture, passed down from one generation to the next. It was not until after I stepped into the field of dental hygiene, that I realized the importance of oral health and preventive measures such as routine examinations and cleanings.

From my mother, I learned that in Taiwan, people do not go to the dentist for routine examinations. They go in when they are in pain. It was the culture. But, is it just the culture? Or is it the lack of education? It might even be the combination of both. Older generations of Taiwanese people are not educated so they do not understand that they need to make appointments with the dentist every six months. This idea of not needing to go to the dentist is then passed down to future generations. Now, the dentist is only needed when an individual is in pain. There is no such thing as going to the dentist for a routine examination and cleaning.

This is a problem. As a future dental hygienist, I am educated on how to properly care for teeth and how to prevent dental caries. The purpose of the hygiene field *is* preventive care, including giving oral hygiene instructions to the parents and their children, nutrition advising, dental examinations and prophylaxis every six months, and in-office fluoride treatments. Some parents do not bring their children to their dentist and hygienist for routine examinations and cleanings until their children complain that they are in pain. This is a major disadvantage for the children because they are not receiving the proper preventive care they need in order to have healthy gums and teeth. By the time the parents bring them into see their dentist, the carious lesion already exists.

Early childhood caries is an ongoing problem within the dental field and proper oral hygiene care is a major factor in preventing early childhood caries. In this research paper, I am following five parents and their children from my clinic floor at New York University College of Dentistry. Each patient has existing dental caries. The parents were all interviewed regarding their child's oral hygiene and dietary habits. A meticulous record on the patient's oral hygiene habits and lifestyle choices are kept. This record include how often and how long the children brush and if they are supervised during their brushing. Research have found several factors that contribute to the increased risk for early childhood caries. The patients that were chosen for this research paper possess one or more of the contributing factors. This research paper examines the values of the parents and *why* these specific choices were made.

Five patients with existing dental caries were selected.

Patient A: Max G - mother gives him milk every night before bedtime.
Patient B: Marcus T – mother does not supervise his brushing.
Patient C: Tiffany W - mother rejects all fluoride treatment for child.
Patient D: Nicholas C - mother rewards child with sugary snacks throughout the day.
Patient E: Kira K – mother has never taken child to dentist until now.

"*We are at our very best, and we are happiest, when we are fully engaged in work we enjoy on the journey toward the goal we've established for ourselves. It gives meaning to our time off and comfort to our sleep. It makes everything else in life so wonderful, so worthwhile.*"

-Earl Nightingale

Patient A, Max G is a four year old male. Upon examination, carious lesions on multiple tooth surfaces were found. An interview with Max's mother, Ms. G, regarding Max's oral hygiene and dietary habits was conducted. I found that Max uses fluoridated toothpaste, brushes once a day in the morning, with his mother's supervision. Max does not frequently consume sugary beverages or sugary snacks throughout the day. However, Max is given a glass

of warm milk before bed every night. Drinking milk without brushing before bed is most likely the cause of his carious lesions.

The risk for early childhood caries increase with night time milk consumption without brushing (Folayan M, Sowole C, Owotade F et al). The high caries risk is a result from the combination of sugar in milk, decrease salivary flow during sleep, and the lack of brushing to remove bacterial plaque and the sugar before bedtime. An average cup of milk contain about 14g of sugar. Salivary flow decrease during sleep, therefore the buffering action of saliva is lacking during sleep. This combination become a perfect time for bacteria in the oral cavity to metabolize the sugar left on the tooth surfaces from the milk before bedtime. The bacteria in the mouth breaks down the sugar, creating an acid environment in the oral cavity, leading to the demineralization of enamel structures, which results in carious lesions.

Max G was given warm milk before bedtime every night. When interviewing his mother, she stated that warm milk helps Max fall asleep at night. She has been giving Max warm milk before bedtime since he was an infant. Ms. G is a single mother and currently works at a hair salon as a hair stylist. Her work schedule is from 9:30am to 7:00pm. After work, Ms. G picks Max up from his grandmother's house to bring him back home. She works seven days a week and is usually exhausted by the time she gets back home with Max. When the two of them arrive home after a long day, Ms. G bathes Max and prepares dinner for the two of them. They watch some television and Ms. G gets Max ready for bed with a glass of warm milk. She heads to bed herself after Max falls asleep.

According to Ms. G, she did not know that milk before bedtime increase the risk for early childhood caries. Ms. G is a single mother and works hard to support her and her child. She gave birth to Max at a young age and therefore did not attend college. She tries her best to spend more time with Max but they are a single parent household so she must work extra hard to give Max a better life. Ms. G enjoys work and loves her career as a hair stylist but is always busy with clients. By the time she arrives at home, all she wants to do is sleep. Ms. G tries to be a good mother by spending time with Max during their baths and dinner time. After that, she helps Max sleep with a warm glass of milk.

Ms. G understands that milk contain calcium and is good for children; however, she did not realize the amount of sugar it contains. Since the warm milk can help Max sleep, she thought it was a good choice of beverage for him before bedtime. She stated, "milk is good for his growth and it helps him fall asleep so I give it to him every night." It was not until I went over Max's oral hygiene instructions that she understood the correlation between nighttime feeding and the increased risk for early childhood caries. Now, Ms. G understands that she must supervise Max's brushing in the morning and before bedtime to decrease his risk for early childhood caries. Milk can be given but Max must brush his teeth afterwards.

Max's mother has established a goal to provide the best life she can for Max. Through their interaction during the dental appointment, I can see that Max loves his mother and that she cares about him a great deal. He is also very obedient. It is excellent that Ms. G enjoys work

and is good at what she does. After all, she is working hard in order provide for her and her child. She has excellent values. However, the lack of knowledge regarding the amount of sugar in milk lead her to give Max a glass of milk every night before bedtime. She was under the impression that milk is healthy and nutritious for Max, which is accurate. But, it is crucial for Max is brush his teeth afterwards.

"We cannot always build the future for our youth, but we can build our youth for the future."

-Franklin D. Roosevelt

Patient B, Marcus T is a six year old male. Upon examination, several carious lesions were found. An interview with Marcus' mother, Mrs. T regarding Marcus' oral hygiene and dietary habits was conducted. Mrs. T informed me that Marcus brushes his teeth twice a day. She stated that they use toothpaste with fluoride at home and that Marcus does not frequently consume sugary snacks or beverages. However, although Mrs. T states that Marcus brushes his teeth twice a day with fluoridated toothpaste, she does not supervise Marcus. When questioned regarding supervised brushing, Mrs. T shook her head and stated, "No, my Marcus is a big boy. He told me he can brush on his own so I let him. It's a good thing because I want him to be independent. I don't want him to brush his teeth with me hovering over him." Unsupervised brushing is most likely the cause of his carious lesions.

Parents strive for their children to be independent. Franklin D. Roosevelt once said, "we cannot always build the future for our youth, but we can build our youth for the future." Parents are there to help guide and prepare their children for the "real world", so they want their children to be independent in order to succeed in the future. Raising a child until they are eighteen is not an easy task. Parents cannot be there to hold their child's hand every step of the way; they must let go and let them grow on their own. Therefore, parents do their best to give their children the best education they can and teach them to be the best person they can be. Parents want their children to be independent so they can survive once they start living their own life. Parents cannot be by their children's side every minute of every day to protect them.

Marcus told his mother that he is a big boy and is capable of brushing on his own. Mrs. T is also trying to let Marcus brush his own teeth, unsupervised, so he can become more independent. But, questions regarding Marcus' oral hygiene habits are now left unanswered. How long does Marcus brush for? How much toothpaste does he use? Does Marcus brush with hard or light pressure? Does Marcus cover all surfaces of his teeth? Does Marcus focus more on one area than another? Does he even brush his teeth? Without supervising Marcus, Mrs. T is unable to answer these questions. Children may want to brush their teeth on their own without their parents' supervision but at this age, children lack the manual dexterity to brush thoroughly, therefore they must be supervised (Pleis).

Disclosing tablets are a great way to find out if plaque is being removed from tooth surfaces effectively. During Marcus' hygiene visit, I provided him with a toothbrush and

toothpaste and asked him to show me how he usually brushes. After Marcus rinsed, I asked him to chew on a disclosing tablet. Immediately, I was able see the amount of plaque Marcus left on his teeth. The staining of the disclosing tablet showed that Marcus was able to effectively remove the plaque from his anterior teeth, but similar to most children, had trouble removing plaque from his posterior teeth and most lingual surfaces. With the disclosing tablet, both Mrs. T and Marcus were able to see the surfaces Marcus missed when brushing.

Parental supervision while brushing significantly decreases the risks for early childhood caries (Curnow M, M, T, Pine C, M, Burnside G et al). Children brush better, covering all surfaces, especially hard to reach areas, with parental supervision. Marcus may want to start brushing on his own because he is a "big boy" and Mrs. T may want to instill independence in Marcus by letting him brush his own teeth but Marcus still lacks the manual dexterity to brush thoroughly. With Mrs. T's supervision, Marcus can decrease his risk for early childhood caries. Proper oral hygiene is very important. Mrs. T must make sure Marcus uses a pea sized amount of fluoridated toothpaste, brushes for two minutes with light pressure, and covers all surfaces when he is brushing.

It is possible for Marcus to maintain his independence while being supervised during his brushing. Mrs. T does not necessarily have to hover over Marcus when he is brushing. She does, however, need to be in the room and make sure he covers every single surface when he is brushing. With Mrs. T's supervision, Marcus will be even more effective in removing the plaque from his tooth surfaces. Supervising Marcus during his brushing will also decrease his risk for future carious lesions.

"*Natural forces within us are the true healers of disease."*

- Hippocrates

Patient C, Tiffany W is a five year old female. Upon examination, several carious lesions were found. An interview with Tiffany's mother, Mrs. W, regarding Tiffany's oral hygiene and dietary habits was conducted. Mrs. W stated that Tiffany brushes her teeth twice a day with unfluoridated toothpaste. Tiffany does not frequently consume sugary foods throughout the day however, she does drink a minimum of two juice boxes per day. The unfluoridated toothpaste and consumption of juice boxes were most likely the cause of her carious lesions.

At the New York University College of Dentistry, fluoridated toothpastes and mouthwashes are strongly recommend to our patients to prevent tooth decay. As a part of our oral hygiene instructions, we question patients regarding their oral hygiene habits and the oral hygiene products that they use. We often ask our patients if they use any toothpaste or mouthwash containing fluoride. If patients are currently not using products containing fluoride, we educate them on the benefits of fluoride. Fluoride help remineralize the tooth structure by bringing calcium and phosphorus ions back to the enamel surface, which strengthens the teeth after an acid attack and protects against dental caries (Collins, B).

I informed Mrs. W that brushing twice a day is great for Tiffany but it would be even more beneficial if the toothpaste contained fluoride, especially if Tiffany consumes sugary beverages at least twice a day. I explained to Mrs. W that bacteria in the oral cavity metabolize the sugar from the juice, producing an acidic environment, which results in the demineralization of the enamel surfaces. Fluoride in the toothpaste facilitate by remineralizing the demineralized enamel surface, after this acidic attack.

Fluoride is proven to reduce the number of tooth decay. However, Mrs. W stated that she was afraid of the toxicity of the fluoride. She did not want Tiffany to get sick from swallowing the toxic fluoridated toothpaste. Mrs. W also refused fluoride varnish treatment for Tiffany during the visit – *Why are we putting toxic chemicals in our children's bodies? I want my child to be healthy with natural, organic products. I do not want to put poison in my child's body.* However, fluoride varnish treatment would benefit a patient like Tiffany because of her daily consumption of sugary beverages. In-office treatment of fluoride varnish after a child prophylaxis significantly decreases the child's risk for early childhood caries (Weintraub J, Ramos-Gomez F, Gansky S, et al).

Oral hygiene products containing fluoride are often recommended to patients by their dentists and hygienists, to prevent tooth decay. Studies have shown that fluoride is effective in arresting demineralized tooth structures (Gao SS, Zhang S, Mei ML et al). The Food and Drug Administration (FDA) does require toothpastes containing fluoride to include this warning on the back label: *WARNING: Keep out of reach of children under 6 years of age. If you accidentally swallow more than used for brushing, seek professional help or contact a poison control center immediately* (Connett, M). This raises concern for certain people, especially parents. Why are we putting "poison" in our body? According to the FDA, the warning is necessary because a small amount of ingested fluoride can induce fluoride toxicity symptoms, including vomiting, nausea, gastrointestinal pain, and headache (Connett, M).

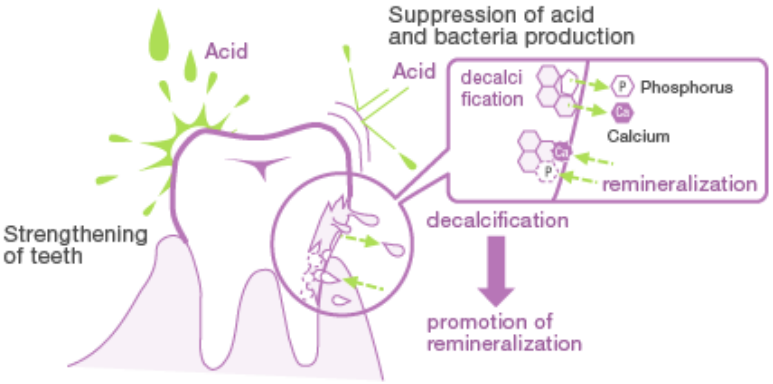

Figure 5

Mrs. W was concerned about the toxicity of ingested fluoride. She did not want Tiffany to ingest poison. After understanding Mrs. W's reason behind her refusal for Tiffany to use fluoridated toothpaste, I explained that with her supervision, and using the recommended pea-

sized amount of fluoridated toothpaste, Tiffany is not likely to get sick from the fluoride. In contrast, the fluoride would be extremely beneficial for her. Fluoride would decrease her risk for early childhood caries. Mrs. W is now educated regarding the benefits of fluoride. She also signed the consent form for a fluoride varnish treatment for Tiffany during the oral hygiene visit.

Parents need to understand that when used in a pea-sized amount and under supervision of the caregiver, fluoride is beneficial for their children. Children often consume sugary snacks and beverages, which causes the bacteria in their mouth to break down the sugar from the foods, producing an acidic environment, resulting in the demineralization of the enamel surfaces. Fluoride is significantly effective in remineralizing the enamel surface after an acid attack and in preventing early childhood caries. Fluoride varnish is highly recommended for children as an in-office treatment after their prophylaxis treatment.

Although fluoride is recommended by many dental professional, some still oppose it. Holistic dentist, Dr. Vernon Erwin, is against the use of fluoridated oral hygiene products and stated that he does not recommend products containing fluoride to his patients, nor does he use it himself. Fluoride does little to prevent tooth decay and ingesting it induces fluoride toxicity (Erwin, V). However, research has shown that the use of fluoridated toothpaste does significantly decrease the risk for early childhood caries when compared to a nonfluoridated toothpaste. When used under supervision and with the correct amount fluoride does benefit patients with a high caries risk.

"*The highest reward for a person's toil is not what they get for it, but what they become by it.*"

-John Ruskin

Patient D, Nicholas C is a four year old male. Upon examination, many carious lesions were found. An interview with Nicholas' mother, Mrs. C, regarding his oral hygiene and dietary habits was conducted. Mrs. C informed me that Nicholas brushes his teeth with fluoridated toothpaste twice a day with her help. However, Mrs. C does admit to giving Nicholas sugary snacks and beverages throughout the day. To get further into details, I questioned Mrs. C regarding the types of sugary snacks and beverages that were given to Nicholas. She stated that Nicholas, like any other child, loves cupcakes, cookies, ice cream, and soda. Because the frequency of snacking also contributes to increasing the risk of early childhood caries, I also questioned Mrs. C regarding the frequency of sugary foods consumption and if Nicholas consumes the sugary snacks with meals. Mrs. C stated that she usually rewards Nicholas with sugary snacks throughout the day, she estimated the frequency to be around 5-6 times daily. The frequency of sugary food consumption is most likely the cause of his dental caries.

Parents strive for their children to succeed in the future. They want their children to be the best person they can be and to know the difference between what is right and what is wrong. John Ruskin once said, “the highest reward for a person’s toil is not what they get for it, but what they become by it.” Parents want their children to learn to be respectful, polite, and responsible from an early age but children will not always comply with what their parents tell them to do. However, if the children are praised, or even rewarded for the desired action, the compliance rate will increase. It is through rewards and punishments that children will learn what is right and what is wrong. To parents, this rewards and punishment learning technique will condition their children to become a better person by knowing what the right thing to do is. Mrs. C is only interested in the end result, for Nicholas to learn right from wrong. She enjoys rewarding her son for the desired behaviors.

Children who consume sugary snacks and beverages even 1-2 times a day are at higher risk of developing early childhood caries than children who do not consume sugary snacks and beverages at all (Han D, Kim D, Kim M et al). This shows the significance of the *frequency* of sugary snacks and beverages consumption. It takes roughly around thirty minutes for the pH level of the oral cavity to neutralize after the consumption of sugary foods. When the frequency of sugary foods consumption is high, the pH level of the oral cavity remains low for a longer period of time, increasing the risk of dental caries. Mrs. C stated that she wants Nicholas to learn what is right from wrong, therefore she rewards him for good behavior and punishes him for bad behavior. Since Nicholas’ two favorite snacks are cupcakes and cookies, she always has them on hand to reward him when he performs a good behavior. Nicholas gets rewarded with a cookie for doing chores such as putting his toys away after he is done playing with them and helping to set the table for dinner. He gets punished with a time-out for bad behavior.

It is understandable that Mrs. C wants Nicholas to get into the habit of doing chores, being polite, and respecting other people. Those are excellent values for Nicholas to learn. To Mrs. C giving Nicholas a little reward to not a big deal. She does not mind rewarding them, as long as he learns the good values that she is trying to instill in him in the end. However, rewarding him with a snack every time he performs a desired behavior might not be the ideal way to approach this learning process. I educated Mrs. C on the effects of sugary snacks on Nicholas’ teeth. Frequent consumption of sugary snacks and beverages will significantly increase the risk of early childhood caries (Nakayama Y, Mori M). Since Nicholas has been accustomed to this reward, I advised Mrs. C to start off by giving Nicholas the sugary reward with a meal. There is a lower risk for early childhood caries when the sugary food is consumed with a meal versus in-between meals (Mobley C, Marshall TA, Milgrom P et al).

If Mrs. C stops rewarding Nicholas with sugary treats completely, Nicholas might stop his “good behaviors”. It is more realistic for Mrs. C to start off by rewarding Nicholas with a sugary snack with a meal, as a dessert. Mrs. C can also make sure Nicholas rinses his mouth or brushes his teeth after the sugary treat consumption. She can then, slowly start decreasing the frequency of sugary snacks all together and start using alternative rewards. Rewards come in all different forms. It does not have to be sugary snack. This way, Nicholas is still rewarded for the

desired good behavior. I advised Mrs. C to reward Nicholas with small items such as stickers, instead. They can also engage in some fun activities or exercises as rewards. This way, Nicholas' risk for early childhood caries will decrease. Because Nicholas' frequency of sugary food consumption is high, I asked Mrs. C to fill out two dietary recall forms for me to determine Nicholas' risk for early childhood caries. He is currently at moderate risk for caries.

Teaching children to be responsible, respectful, and to do the right thing from an early age is what parents strive to do. However, giving a child a cookie every time they perform a good behavior will increase their risk of developing early childhood caries significantly. Yes, children will most likely learn good behavior when they are rewarded for it, but is it worth it when it significantly increases their risk for early childhood caries or even to lose all their primary teeth due to decay? Rewards come in many different forms. Even something small such as giving Nicholas a sticker with his favorite superhero or cartoon character will have the same effect. Fun exercises including games will also work as rewards for children.

"*Realize that everything connects to everything else*"

-Leonardo da Vinci

Patient E, Kira K is a six year old female. Upon examination, several multi-surfaced carious lesions were found. Kira's chief complaint was a toothache with extreme pain. An interview with Ms. K regarding Kira's oral hygiene and dietary habits was conducted. Ms. K informed me that Kira brushes her teeth twice a day. However, she was not sure whether the toothpaste contained fluoride or not. Ms. K does not supervise Kira while she is brushing. Kira does not frequently snack on sugary foods but she does consume sugary foods about 1-2 times a day.

During Kira's appointment, I noticed in the chart that this was Kira's first time in our clinic. I asked Kira when her last dental exam and cleaning was. Kira told me that this was her very first dental appointment and she has never been to the dentist before. I asked Ms. K regarding Kira's dental health care and she informed me that Kira never complained about pain so it was not necessary to bring her to the dentist. Unfortunately, this is the mentality for many people. People tend to only make appointments with their doctor and dentist when they are in pain. They are unaware that they should go to the dentist every six months for a routine exam and prophylaxis and to their physician every year for an annual physical.

Oral health education and quality oral healthcare is not accessible by everyone. Because of this, many people do not know that their oral health can influence their overall health or that their overall health can be determined by looking in their oral cavity. An example of this relationship can be seen in diabetic patients. A patient with diabetes is at higher risk for developing gingivitis and periodontitis when compared to a non-diabetic patient; dental infections are also more severe in diabetic patients when compared to non-diabetic patients

(Mealey BL). When the immune system is compromised by a systemic disease, infection caused by bacteria in the oral cavity can travel to different parts of the body (Hangs, B).

Leonardo da Vinci once stated, "*realize that everything connects to everything else.*" Patients do not realize that their oral health condition will affect their general health. If patients do not have access to quality oral healthcare, they are most likely not educated on proper oral hygiene care and on the effects of oral health on their overall health. If parents were never educated on proper oral hygiene care, how can they educate their children on proper oral hygiene care? Studies have shown that parents with lower education levels have children with a higher risk of dental caries when compared to children with parents with higher education levels (Wilson A, Brega A, Albino J, et al). Parents with a higher education level are more likely to be educated on the benefits of fluoride and importance of proper oral hygiene care.

Certainly, education level is also related to socioeconomic status. Individuals with a higher education level tend to be in a higher socioeconomic class when compared to individuals with a lower education level. A patient's socioeconomic status also has an impact on their access to quality oral health care. Studies have shown that patients coming from a lower socioeconomic class are at higher risk for dental caries when compared to patients coming from a higher socioeconomic class (Nanayakkara V, Renzaho A, Oldenburg B, et al). Patients coming from a lower socioeconomic class might not have to ability to go to the dentist every six months. Oral health care might even be the least of their concern, therefore they put less funds towards buying oral hygiene products, such as toothpastes with fluoride, soft-bristled toothbrushes, floss, and fluoridated mouth rinses.

Prevention is the sole purpose of the dental hygienist and it is our job to educate the patient on proper oral hygiene care so they can maintain their oral health. We have to educate the patients and let them know that everything in the body is connected. Their oral health will have an effect on their overall health. Therefore, dental examinations every six months is crucial. I informed Ms. K that she needs to bring Kira to the dentist every six months for a routine exam and cleaning. We need to be able to monitor Kira's oral health and educate her on how to maintain it. A child should also have their first dental appointment after their first tooth eruption or no later than their one-year old birthday.

At six months old, the first tooth erupts into the oral cavity. This is the time when parents or caregivers should take their child to the dentist. There, they will learn how to properly care for the child's teeth. Primary teeth are important because they act as space maintainers, help with mastication, keep a vertical dimension of the face, and help with speech. Therefore, parents have to know that is crucial to keep the primary teeth until its natural exfoliation. We want to prevent extraction of the primary tooth due to a carious lesion. I educated Ms. K on the proper brushing technique and the benefits of fluoride. I asked her to make sure that the toothpaste Kira is using contains fluoride.

The factors contributing to an increased risk for early childhood caries are known. The five pediatric patients that I followed from New York University College of Dentistry all possess

one or more of the contributing factors. Through the interviews with their parents, their values were also examined. Patient A, Max G is given warm milk every night before bedtime. Ms. G was not aware of the amount of sugar in a glass of milk. She understands that milk contain calcium, which is good for Max's growth. Patient B, Marcus T is not supervised during his brushing. Mrs. T wanted Marcus to be able to do things on his own, to be independent. Patient C, Tiffany W was never given any type of fluoride treatment. Mrs. W did not want Tiffany to endure the toxicity of fluoride. Patient D, Nicholas C is rewarded with sugary snacks throughout the day. Mrs. C wanted to enforce good behavior in Nicholas through rewards. Patient E, Kira K has never been to the dentist before her appointment with me. Ms. K was unaware that she needed to bring her daughter to the dentist for a routine examination and prophylaxis, not only when she is complaining about pain.

As a collective group, these parents have one thing is common. They were all unware. The parents need to be educated on the factors contributing to the increased risk for early childhood caries. They need to understand that a diet high in sugar will increase their children's risk for early childhood caries. They also need to understand that proper oral hygiene care is crucial and they must supervise their children in order to make sure that they are effectively removing plaque from the tooth surfaces. Therefore, they must keep track of their children's dietary and oral hygiene habits. Parents must also understand that routine examinations are a crucial part of preventive care. As long as they maintain proper oral hygiene, a healthy nutritious diet, and visit the dentist for routine dental examinations, prophylaxis, and in-office fluoride treatments, their children's risk for early childhood caries will decrease.

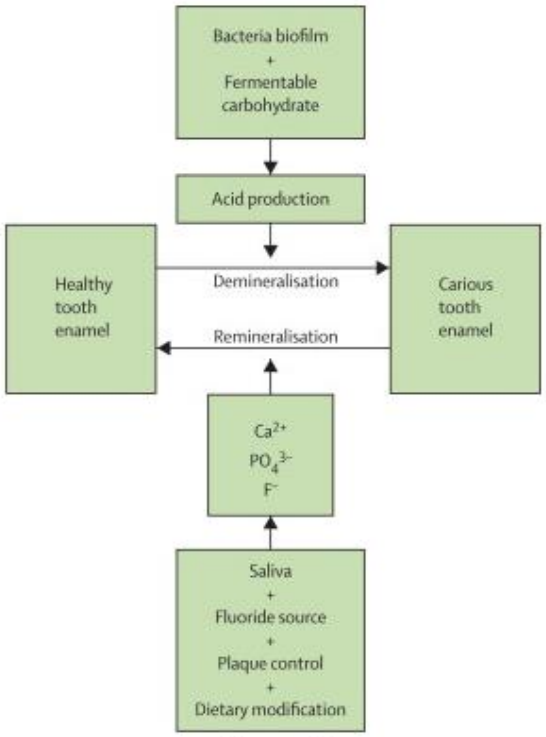

Figure 6

However, behavior modification is only successful with a change in value. Without a change in value, the behavior modification will relapse and change will not be successful. The pediatric patients are too young to make their own decisions. They do not have the cognitive ability to do so, therefore they must rely on their parents to guide them. When oral hygiene care and dietary habits are properly taught to children at a young age, they are more likely to practice these behaviors as adults.

According to the *Conscious Competence Ladder*, developed by Noel Burch in the 1970s, we become competent in a skill by going through four stages. My pediatric patients began in the unconscious and incompetent stage. At this stage, they were unaware that they do not possess the skill. As their parents guide them through proper oral hygiene care, the children become aware that they do not possess the skills but are still incompetent. After they practice over a period of time, the children become competent in the skill. The goal is for the children to be in the unconscious and competent stage, as adults. Once the stage of unconscious and competent is reached, the children will be able to practice proper oral hygiene care, make better nutrition choices, and visit their dentist for routine examinations, competently and unconsciously as adults. The proper oral hygiene habits and healthy diet choices become a habit. The question is, how can I guide my pediatric patients from the *unconscious and incompetent* stage into the *unconscious and competent* stage, as adults? How do children learn?

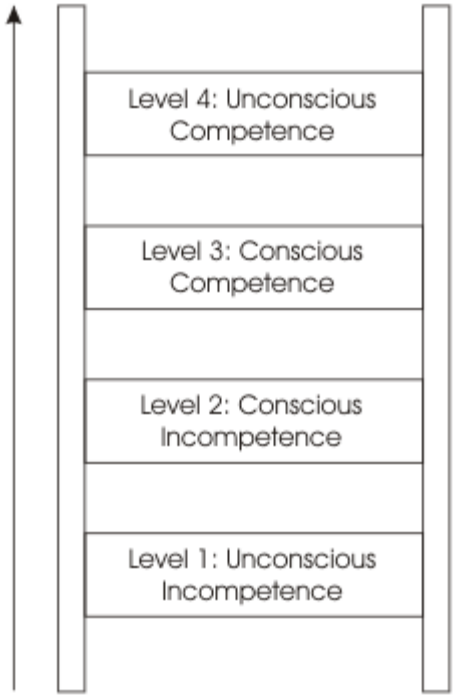

Figure 7

"*Children must be taught how to think, not what to think*"

-Margaret Mead

Who? What? When? Where? Why? How? Children are curious about everything around them; therefore, they ask a plethora of questions. Parents, caregivers, and teachers are there to help guide the children, to answer their questions, and even to be their role models. Margaret Mead stated, "*children must be taught how to think, not what to think*." This is a very important and valid statement. If children are taught *what* to think, how will they survive without their parents or caregivers by their side? How will the children survive without their parents next to them, telling them what to do? Children must be able to develop their own voices and opinions. They must learn to make the *right* choices, on their own. Parents are only there to provide *guidance* and the appropriate *resources*.

Teaching a child *what* to think lead to external behaviors, whereas teaching them *how* to think lead to internal behaviors. Internal behaviors are longer lasting and will follow the child, as they mature, into their adulthood, because these actions are coming from the *inside*. However, parents often use rewards or external bribes, in order to get their children to perform

the desired behaviors. Nicholas and his mother, Mrs. C are a perfect example. Mrs. C rewards Nicholas with sugary snacks, when desired behaviors are performed. So what is the best approach to teach children, for them to *differentiate* right from wrong on their own? How can parents internalize the desired behaviors in their children?

Children learn from their surroundings. At home, they learn from their parents, older siblings, and grandparents. At school, they learn from their teachers and sometimes even from their peers. Sometimes children even mimic what their parents do. Most importantly, children are sensory learners. Starting from the day they were born, children learn from what they see, what they hear, through touching, tasting, and even smelling (Parenting and Child Health, 2014). Children are like sponges; they absorb almost everything from their surroundings. However, children do learn different things at different ages.

Infants start absorbing and learning from their surroundings as soon as they are born. An infant between birth and one-year-old require a lot of attention from their caregivers. They learn from their surroundings by turning their heads, watching everyone and every movement around them (California Department of Education, 2015). As they grow a little older, they start exploring their surroundings, taking interest in everything by touching almost everything around the house and putting whatever they can get their hands on, into their mouths. At the ages between two and three, toddlers become even more curious. They often get frustrated because they are incapable of doing things on their own, yet.

Young preschoolers and preschoolers, between the ages of three and five years old, are at the time where they start asking these *who? what? when? where? how?* questions. Children are curious, they want to know the reason behind everything. *Why is the sky blue? Why is water wet? Why does soap make bubbles?* Sometimes, it might even be a challenge for the parents or caregivers to answer the child's questions. However, giving children explanations to certain things will help them learn. They will understand the reasons behind *why* they have to do certain things. Of course, "*because I said so*" and "*because I am your mother*" are not proper explanations.

Because children are so curious, they ask questions like, "*Why do I have to brush my teeth?"* It is important for parents to be able to explain to their children *why* they need to maintain proper oral hygiene, not just *tell* them to brush their teeth. Of course, parents will have to effectively explain the reason to their children, at a level and with vocabulary that the children can understand. At New York University College of Dentistry's pediatric clinic, we often explain everything we do to the pediatric patients, especially if it is their first time at the dentist. Because children learn through their senses, we show them *everything* before we put anything in their mouths. With the dental mirror, we show them the mirror and ask, "can you see yourself in the mirror? I am just going to use this little mirror to look at your teeth, okay?" If everything is explained to them, the children will be more cooperative during the appointment.

For Patient D, Nicholas, his mother, Mrs. C should explain *why* it is important for him to practice proper oral hygiene. The term "sugar bugs" is often used instead of bacteria. Children

would not understand the word bacteria. Because Nicholas is so accustomed to sugary snacks, as a reward for good behavior, it would be very difficult to stop rewarding him with sweets. Instead, Mrs. C can explain to Nicholas *why* sugary sweets are bad for him. *Sugar bugs from the sugary snacks will eat your teeth and make holes. If you eat too much sweets without brushing your teeth, you will get holes in your teeth. Do you want holes in your teeth?* Explaining the reasons behind actions will better help children understand the *whys* in their life.

The consequences of frequent sugary sweets snacking should also be explained to Nicholas. Nicholas has to understand that if he continues to frequently snack on sugary sweets, as he is doing now, he will be in pain. As a result, he would have to get his tooth filled or even extracted. Children are afraid of pain. By letting Nicholas know the consequences in advance will scare him into not snacking as frequently. He will stop because he does not want to be in pain.

Children are sensory learners. They learn through seeing, hearing, touching, smelling, and tasting. They learn when things are explained to them, through asking *why*. They also learn through facing the consequences. Children do not want painful and rotten teeth; therefore, they will decrease their consumption of sugary sweets. What about their parents? Will they change their values and modify their behavior?

"*One reason people resist change is because they focus on what they have to give up, instead of what they have to gain*."

-Rick Godwin

Change is not easy. The tasks we do every morning and every night are a part of our daily routine, it becomes our habit after time. How can we suddenly change something that we have been doing for so long? Habits are difficult to change. Rick Godwin once stated, "*One reason people resist change is because they focus on what they have to give up, instead of what they have to gain.*" I agree with this statement. If individuals focused more on what they will gain from change (healthy teeth and gums), instead of what they have to give up (sugary snacks and drinks), change would not be as difficult. However, it is not that simple.

Behavioral change is simply a change in behavior, such as decreasing the amount of sugar in one's diet. In order for the desired behavior to continue and become a part of one's daily routine, the behavior has to become a habit. In order for the behavior to become a habit, one's values must change. Behavioral change will never become a habit if one's values do not change. At the New York University College of Dentistry, oral hygiene instructions are given to every single patient, after an assessment of their oral condition. Which areas do they have to focus more on? Are the patients brushing too hard? How often do they consume sugary snacks and drinks? Do they have a low, moderate, or high risk for caries?

Oral hygiene instructions are specific to each patient, after thorough assessments of their oral cavities. However, will they change? As a future dental hygienist, I can teach them everything they need to focus on, but it is ultimately up to the patient to keep up with their oral hygiene care at home. I cannot just tell the patient what to do. I must motivate them to change. To accomplish this, I must change their values. What do they have to gain from the change? What do they have to lose? Are the patient's moments of craving sweets worth their tooth decay? For my pediatric patients, parents can tell them what to do or not do, but will they keep up with the desired behavior once the parent or caregiver is removed from the situation? Children need to learn the consequences of frequent sugary snack consumption, in order for them to change. They have to understand that they will feel pain, which most children are afraid of. The sensation of pain might become the children's motivation for the need to change.

Behavior modification is much easier as a child than as an adult. Children are constantly learning. Learning is defined as a process of acquiring knowledge or skills through study, instruction or experience. According to the learning ladder theory, the patient must go through certain stages in order to learn. The stages of the learning ladder theory include unawareness, awareness, self-interest, improvement, action, and habit. In order to learn, the child must be able to identify the problem. They go from the unawareness to awareness. They must understand that they are doing something incorrectly in order to change.

Figure 8

Once the problem is identified, the child must be interested in changing or learning. If they are not interested, they will not be able to learn. Once they become interested in learning, they work on improving the desired behavior by practicing what they learned. After practicing, the learned behavior will later become a habit that benefits the child by decreasing their risk for early childhood caries. It takes motivation and practice in order to master a desired behavior that will benefit the children.

The parents and caregivers of the pediatric patients that I am following, need to be aware as well. They need to be educated and also understand the risk factors contributing to the increased risk for early childhood caries. The parents need to understand the importance of decreasing early childhood caries and how early childhood caries will affect their children as they grow older. Bringing both the parents and the children into awareness is crucial to change. How can they be motivated to change their habits if they do not understand the reason or the importance of the change? The first step is to teach them what they will gain from the change: healthy gums and teeth.

In order to decrease the risk for early childhood caries, practicing proper oral hygiene care at home is essential. However, a proper diet is also a crucial part of this change.

"*The food you eat can be either the safest and most powerful form of medicine or the slowest form of poison*."

-Ann Wigmore

Proper nutrition is essential for proper growth and development. Proteins, carbohydrates, and fats are all necessary for proper functions of the human body. A deficiency in a certain vitamin or food group can lead to abnormal developments. Starch begins to breakdown in the oral cavity during mastication and it is used as an energy source for everyday bodily functions. The foods an individual choose to consume is either "the most powerful form of medicine" or "the slowest form of poison". Foods including broccoli, chicken, apple, milk, and eggs are nutritious and can be considered "powerful forms of medicine". These foods provide the nutrition that our body needs in order to carry out daily activities. Foods including candy bars, potato chips, soda, and ice cream, on the other hand, are considered the "slowest form of poison". These foods contain an excess amount of sugar. An excess amount of sugar without proper oral hygiene home care increases the risk for demineralization of the enamel.

Sugar increase the risk for early childhood caries because of the acidic environment it produces in the oral cavity. However, early childhood caries is preventable with proper home care, even with a diet high in sugar. Brushing or rinsing after the consumption of sugar increase the pH level, therefore making the oral environment less acidic, which in turn, decrease the risk for early childhood caries. If sugar consumption cannot be limited, the next best thing is to modify oral hygiene regimen to neutralize the pH level in the oral cavity. For children, it is nearly impossible for them to have a sugar-free diet. Even if sugar consumption is limited at home, children are able to get their hands on sugary snacks and beverages at school. However, if they remember to brush after consuming sugary snacks and beverages, the risk for early childhood caries can be reduced significantly. Now, the question is how? If children are at school while their parents are at work, how is it possible to monitor the brushing? Will the children remember?

After thorough research, patient interviews, and examining the parents' values, I have come up with an original solution. I questioned the parents or caregivers of my patients regarding their cell phone usage. After confirming that all the parents of my patients have smartphones and use it daily, I continued with the idea of a downloadable smartphone application.

In this day and age, technology is thriving. What if parents have a smartphone application to monitor their children's brushing and diet? Which areas do the children have to focus more on when they are brushing? Are they brushing long enough? Are they using too much pressure? What if at the click of an app, the parents are able to receive all the information regarding the factors that increase the risk for early childhood caries? What is good for the children's teeth? Which sugary snacks cause more harm than others? What are the benefits of fluoride? Which children toothpastes contain fluoride? What is the correct amount of fluoride to prevent toxicity? When should children start using mouth rinse? When does the first tooth erupt into the oral cavity? What can the parents expect?

Of course, learning sessions with the parents and children are also necessary, in addition to this new smartphone application. Because the common theme among these parents is the lack of education regarding the factors that contribute to the increased risk for early childhood caries, a smartphone educational application would be extremely helpful, in addition to learning seminars. This application would also include games for the children, in order to teach them what happens after they consume a sugary snack or beverage without brushing. The visually appealing animation of a "sugar bug eating the tooth" will help them understand *why* an excess amount of sugar is bad for them. Because children are sensory learners, the animations and little games will help them learn more regarding their oral hygiene care.

Smartphone applications are also able to sync wirelessly to some sort of mechanical device. What if this new smartphone application can be synced to an electric toothbrush for children? This way, parents are able to track their child's brushing. The toothbrush will also play a two-minute song to let the parents and children know how long they should brush for. Making brushing a fun experience is important in order to keep children *wanting* to brush. This way, they will enjoy brushing and will *want* to brush, instead of their parents or caregivers *telling* them to brush their teeth every day and every night. The electric toothbrush will also ensure that the children are brushing effectively by making up for the children's lack of manual dexterity.

"*The number one benefit of information technology is that it empowers people to do what they want to do. It lets people be creative. It lets people be productive. It lets people learn things they didn't think they could learn before, and so in a sense it is all about potential* ."

-Steve Ballmer

Technology provides infinite possibilities. Communication with friends and family across the world used to consist of expensive telephone bills. Today, communication with people across the world is possible with just a tap of a button. Applications such as Skype and Oovoo allow us to connect with our friends and family across the world, free of charge. With video chatting, not only can we hear their voices, we are able to see them, what they are doing, and their every expression while chatting. Technology brings people living across the world from each other, closer together. Downloadable smartphone applications also make learning more convenient than ever before. Today, instead of attending language classes, people are able to learn on their own time, at their own speed, with a variety of language applications, with a simple tap on their smartphones.

For my pediatric patients and their parents, a smartphone application would truly benefit them. Because the parents of my pediatric patients lack knowledge of how to properly care for their child's teeth, seminars are necessary in order to educate these parents. However, most of these parents are working full time. Will they have enough time to bring their children to these educational seminars? A downloadable smartphone application would allow these parents to look up information regarding their child's teeth with a tap of a button, on their own

time. How does this differ from an everyday internet search? Nowadays, anything can be found on the internet. Can these sources be trustworthy? This application would include information from a group of registered dental hygienists. Of course, the application does not replace the fact that these children will still have to visit their dentist every six months. Along with providing parents with information regarding proper oral hygiene care for their children, the application would also remind the parents when it is time for their child's visit to their dentist.

Preventative care plays a crucial role in decreasing the risk for early childhood caries. A lifestyle change including a proper oral hygiene regimen and proper diet is mandatory. Instilling these values into the children at a young age will allow them continue to practice proper oral hygiene care throughout their adulthood, allowing them to keep a healthy, permanent dentition. By focusing on proper oral hygiene care and a low sugar diet, the risk for developing early childhood caries will decrease. Many of these parents think that they can simply take their child to the dentist to have the tooth filled or even have it extracted, when a cavity forms, because they are only *baby teeth*. It is essential for these parents to understand the important roles of primary teeth and how an infection of a primary tooth will affect the development of the permanent tooth. This smartphone application would allow the parents to learn this information, at their own time.

Not only will this smartphone application provide important information for the parents, it will also include games, allowing the children to learn. Children are sensory learners. They also learn by playing games. Through the games, the children will learn how many times they have to brush, for how long, which foods are good for their teeth, and which foods are not. The electric toothbrush synced with this smartphone application will also allow the child to have more independence while brushing. Mrs. T wants to instill independence in her son, Marcus. The electric toothbrush can help Marcus in being independent. Supervision when brushing is recommended for children because of the child's lack of manual dexterity. With the electric toothbrush, the parent does not have to worry about the brushing technique of the child. The oscillating head of the electric toothbrush is doing the work for them. Parents also do not have to worry about the amount of time the child spends brushing in order to obtain the optimal effect, because the toothbrush includes a two-minute timer. Therefore, Mrs. T is able to give Marcus a little more independence during his daily brushing.

Understanding the importance of proper oral health care is very important. I truly believe that my pediatric patients and their parents will be able to learn from this new smartphone application and electric toothbrush. This application caters to both the parent and the child. Full-time working parents will not have to take time to attend seminars in order to learn how to properly care for their child's teeth. They can access the application whenever they want for the information. The children can definitely learn from the educational games available to them on this smartphone application. The oscillating head of the electric toothbrush will make up for the child's lack of manual dexterity. With the timer included in the toothbrush, the children will never brush for less than two minutes, the optimal time.

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