

TED ANKARA COLLEGE FOUNDATION HIGH  
SCHOOL

*Comparison of the repairing effect of fluoride on experimentally produced white spot lesions on healthy teeth in single and repeated applications.*

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Biology Extended Essay

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## Abstract

The aim of this research was to test the repairing effect of “fluoride varnish-Duraphat” on demineralization of tooth in single and repeated applications.

My question was “What is the difference between single and repeated applications of fluoride agent (Duraphat varnish) on demineralized tooth surface?”

It was hypothesized that “ There would be a significant difference in the means of repairing effect of fluoride on demineralized tooth after repeated applications”. To test the research question and the hypothesis, experiments were conducted. The method used was taking the demineralized tooth and apply a fluoride-varnish and note down the difference in demineralization after single and repeated applications. For this, demineralization was produced experimentally by applying %37 Phosphoric acid on the surface of extracted healthy tooth. Then Duraphat solution which is introduced as an effective fluoride varnish agent was applied as single(which is claimed that it has a %77 percent effect) and repeated applications (two times by weekly interval) on demineralized tooth surface and the demineralization level on tooth was measured by a professional dental device called DIAGNOdent for each experiment stage.

The results of the experiment was analyzed with the appropriate statistical test, it was seen that there was a significant difference between the means of the beginning and the acid application, beginning and the first fluoride application. However, there was no significant difference between the means of the beginning and the Duraphat Varnish’s second application. At the end of the research, the hypothesis was accepted as fluoride varnish has repairing effect on demineralized tooth provided that this feature is gained by at least two applications.

WORD COUNT: 263

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## I. Introduction

The first time I thought about focusing on this subject in my extended essay was the day I accompany my friend to a dentistry clinic and while I was waiting him in the waiting room ,an advertisement about a tooth fluoride production drew my attention. It was indicated in this advertisement that fluoride varnish (Duraphat) was very effective in a single application in terms of remineralization action. I know from the lectures that fluoride is the most important agent preventing dental caries and fluoridated tooth pastes have been highly advocated on a daily basis for prophylactic purpose. However, I also know that in dentistry, fluoride applications are done regularly, not for once. I wondered if a fluoride product with single application is useful on tooth demineralization which is the early stage of tooth caries because dental caries are the major causes of early loses of tooth in Turkey. So I searched the subject on Internet and found out that in order to gain maximum effect of fluoride products by surface application on tooth it should be applied at least four times by weekly intervals.

Every day, minerals are added to and lost from a tooth's enamel layer through two processes known as demineralization and remineralization. Minerals are lost (demineralization) from a tooth's outer layer, named enamel, when tooth is exposed to acids, produced by special bacteria living in dental plaque<sup>1</sup>. Dental plaques are the combination of glycoproteins from saliva and microorganisms that form into a sticky deposit in other words an avoidable living quarter for bacteria. These bacteria (primarily lactobacilli and streptococi) consumes mostly the sugar accumulated in teeth and make a waste product, acids<sup>2</sup>. These acids damage the enamel and causes mineral lost. Before the formation of tooth decay, mineral lost causes white spots on tooth, which is literally named by "white spot lesions". On the other hand, remineralization is the process when the lost minerals are trying to be regained by hydroxyapatite from saliva, fluoride, phosphate and calcium, consequently preventing the formation of plaques and decays<sup>3</sup>.

Tooth enamel is composed primarily of calcium hydroxyapatite. When teeth are exposed to fluoride at high enough concentrations, fluoride ions can displace a small number of calcium ions. Tooth enamel will now have fluoride hydroxyapatite, as well as the naturally occurring calcium hydroxyapatite. This makes tooth enamel much more resistant to acid erosion or demineralization.

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<sup>1</sup> <http://www.belmontdentalcare.com/pediatricDentistry.php>).

<sup>2</sup> Øgaard B. Prevalence of white spot lesions in 19-year-olds: A study on untreated and orthodontically treated persons 5 years after treatment. *Am J Orthod Dentofac Orthop*.

<sup>3</sup> Enamel and dentine remineralization by nano-hydroxyapatite toothpastes Peter Tschoppe a, Daniela L. Zandim a, Peter Martus b, Andrej M. Kielbassa a,c,\* *Journal of dentistry*.

Dental decay formation follows the demineralization, white spot lesion formation and cavitation phases in orderly. Determining and repairing the precarious lesions of tooth as early as possible is vital in dental treatment success and providing the longevity of the tooth. However it isn't always possible to determine the mineral lost by inspection. White spot lesions are known as early detectable damages of intact enamel before the constitution of cavity. If these early lesions are not restored as early as possible, intact enamel surface will be destroyed by the rapid enamel lost.

In daily life, white spot lesions are formed because of the bacteria production on teeth resulting demineralization<sup>4</sup>. In my experiment, as long as I don't have time to wait the formation of demineralization naturally, I created my own demineralization and white spot lesions experimentally by applying %37 Phosphoric Acid. Every tooth has its own mineralization level which makes it healthy. When I apply acid to it, the mineralization level will decrease. After producing demineralization with acid, by applying Duraphat on tooth surface, I expect to gain the first mineralization level and then after repeating this application I would be comparing these two applications. As a result, I am going to test the repairing effect of Duraphat (5% sodium fluoride varnish) on teeth in a single application and observe the effect of the repeated applications.

There are mainly three fluoride application methods for the prevention of tooth demineralization in dentistry; systemic, topical and by fluoride tooth pastes on daily bases. In systemic fluoride applications, fluoride is taken as pills and fixing of dosage is very hard and high dosage can be harmful for the body health. Apart from fluoridated toothpaste, other methods of delivering fluoride to teeth include mouth rinses, gels, varnishes and combination of topical fluorides. But instead of other applications, topical fluoride applications<sup>5</sup> should be applied to tooth surface directly at least four times by weekly interval for every six months in a year. Nowadays a new fluoride varnish product named Duraphat has been introduced in the field of dentistry being strongly effective even in the single application in the repairing process of white spot lesions and increasing the fluoride ratio in enamel by %77.

In dentistry, topical applications recommended applications must be done at least four times in a month by weekly intervals. But in the Duraphat agent advertisement, it is stated that, because containing highly ratio of fluoride in it, single application in a month is very effective and enough for preventing the formation of white spot lesions on teeth. In its advertisement, it is stated that Duraphat varnish forms a Calcium and Fluoride storage on teeth surface. So when a decay treat is occurred, Fluoride and Calcium ions will be released from these storages and help teeth to maintain or regain its mineralization level.

So I decided to work on this project to measure the mineralization levels of experimentally demineralized teeth before and after treating by Duraphat Varnish with a single and regularly applications and compare them statistically and to evaluate the remineralization potency of the fluoride varnish asserting the treating effect on demineralization by single and repeated applications. So my research question is "What is the difference between single and repeated applications of fluoride agent (Duraphat varnish) on demineralized tooth surface?"

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<sup>4</sup> Schmit JL, Staley RN, Wefel JS, Kanellis M, Jakobsen JR, Keenan PJ (2002) Effect of fluoride on demineralization adjacent to brackets bonded with RMGI cement. *Am J Orthod Dentofacial orthop* 122:125-134.

<sup>5</sup> Marinho VC, Higgins JP, Logan S, Sheiham A (2002) Fluoride varnishes for preventing dental caries in children and adolescents. *Cochrane Database of Systemic Reviews* CD002280

## II. Hypothesis

White spot lesions are the chalky spots formed on the outer surface of tooth as a result of demineralization. Since the beginning of 20<sup>th</sup> century investigations on shattering white spots have been enhanced till this time. Experiments and evidences show that fluoride ion in toothpastes develops, strengthens and protects teeth. The accumulation of fluoride ions in teeth result a bond between  $\text{Ca}^+$  ions and fluoride ions which makes teeth more stronger and resistive to existing plaque formations and bacteria.

White spot lesions are signals of danger coming because the next step of white spot is tooth decays. Even people may lose their lives because of tooth illnesses and decays are just the beginning. The treatment of this decays are fluoride agents used in various types of dental medications. Nowadays, the most popular fluoride agent is shown to be “Duraphat”. If the repairing effect of “Duraphat” on tooth demineralization and shattering white spots, proved by this study;

Therefore my hypothesis will be “The mineralization level on tooth will increase which is estimated by Laser fluorescence device when a fluoride material is applied on the tooth surface in repeated applications”. Because in dentistry, it is an essential rule that people must be accurate in using the fluoride materials periodically in order to gain a great efficiency from the treatment. This treatment of fluoride will be systemic intake, by topical applications or by using fluoride toothpaste. Because if they don't, the remineralization and bacteria level can increase and the white-spot lesions can occur again. So I thought that repeated application of fluoride will increase the amount of mineralization on teeth.

### III. Method Development and Planning

My research question in this experiment is “Do Duraphat fluoride varnish has a strong repairing effect on demineralized teeth even in the single application such as % 77 percent as claimed in a dental magazine advertisement?” .To test this research question and prove or disprove the hypothesis, data must be attained and comparison must done by statistical tests .So in order to have accurate values in my experiment and reach my hypothesis successfully, I planned and designed a method development that will assist me to reach good results with low level errors and high confidence.

Because I needed the beginning baseline value for comparing, I decided to work with healthy tooth extracted due to orthodontic purposes. The teeth were collected from Gazi University Faculty of Dentistry Department of Oral and Maxillofacial Surgery. 7 upper premolar teeth are extracted from 7 different girls who are at the ages of between 14-16 and they are in the same growth period, in good general health and without systemic diseases. Patients with enamel hypoplasia, dental fluorosis or tetracycline pigmentation and carious cavity were excluded for avoiding false results<sup>6</sup>. The study took place at the Pediatric Dentistry Department of the Dental Faculty of Gazi University in Ankara, Turkey.

The next step was deciding on the fluoride material to be used in the experiment. Fluoride varnish was chosen to be the test material since it is introduced one of the most effective topical application agent in a short period to repair tooth demineralization. The fluoride used in this experiment was Duraphat varnish which is stated in its advertisement that it increases the fluoride ions in tooth enamel by %77 and help tooth to maintain its mineralization level after a decay treat.

Then, a method was designed for measuring and comparing the demineralization levels for the each stage of the study. I searched on Internet by using some related key words such as “fluoride varnish”, “demineralization”, “remineralization” and came across a device named DIAGNOdent laser induced fluorescence. Accurate sensitive diagnosis is imperative if the patients are to be categorized into risk groups on the basis of their past disease status and present disease activity. Current clinical diagnostic techniques exhibit many disadvantages, e.g. in case of the explorer, transfer of cariogenic microorganisms from one site to another, and damage to the integrity of enamel surface promoting conditions for caries development.

Laser fluorescence seems to be promising for the detection and rectification of carious lesions on occlusal surfaces. DIAGNOdent, a recently introduced laser-based instrument developed for detection and quantification of Dental caries on smooth surfaces and occlusal surfaces. It operates with diode laser having a wavelength of  $\lambda = 655\text{nm}$  and 1 m W peak power. The light is transmitted

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<sup>6</sup> Du M, Cheng N, Tai B, Jiang H, Li J, Bian Z (2012) Randomized controlled trial on fluoride varnish application for treatment of white spot lesion after fixed orthodontic treatment. Clin Oral Invest 16: 463-468

through a descendent optic fiber to a handheld probe with a beveled tip with a fiber optic eye. DIAGNOdent consist of two probes, probe A for occlusal caries detection and probe B for smooth surface caries detection<sup>7</sup>.

In order to use the device I called for technical assistance from Gazi University Faculty of Dentistry Pediatric Department. Before using, calibrating the device had been performed by pediatric assistant dentist. Then I took detailed technical information about the device and learned how to use it. After reading some related articles. I planned to measure the demineralization level for five points on each tooth and each measure repeated for three times. This procedure was renewed for five stages; in the beginning, after cleaning by a paste, after %37 Phosphoric acid application, after for hours of Duraphat varnish's first application, after a week later second Duraphat varnish application for each tooth.

Since I am working on extracted teeth and estimating mineralization level, I must have same teeth which have same enamel and physical features. If I used different type of teeth, they would also have different enamels and resistances to bacteria and dental caries, so that my estimations will not be valid. Since I cannot extract 5 teeth from one person, I paid attention to choose 5 people which have familiar teeth features. I stored all the teeth in %2 hydrochloric acid in a box in order to clean and prevent microorganism contamination until measuring.

However, this method did not work; the tooth surfaces got white after 7 days demonstrating that teeth effected by HCl changing the surface structure. The problem of this method might be effects of HCl on teeth during the storage stage. I repeated this method for a single tooth twice and since I obtained the same result I decided to perform another method for storing teeth.

I searched on the internet to find another method to store the teeth until measuring. This method is used in literature for storing teeth. I changed also my plan about the tooth number will be used in the study (5 teeth) because of statistical needs. Since I learned the needs for statistical analysis (at least 7 specimen), I asked for another 7 teeth from, Gazi University Faculty of Dentistry Department of Oral and Maxillofacial Surgery. Then I derived and stored them in distilled water in order not to lose minerals<sup>8</sup>.

Also an important part of my experiment is the application of phosphoric acid to the outer surface of teeth. %37 Phosphoric acid sufficient for creating a ragged area on tooth surface and it is the optimum percentage determined by dentists because when it is lower than %37 it would not create a remineralization and if it is higher than %37, it would harm the teeth so much.

Moreover, I decided my controlled variables for each tooth and thought about how to fix them. Measurements were made for five different stages of the investigation; in the beginning (as raw material), after cleaning by a paste with brush (if the teeth surfaces would be effected by cleaning procedure), after %37 Phosphoric acid application for 30 seconds as producing demineralization and white spot formation, four hours after from Duraphat varnish's first application, a week after from the second Duraphat varnish application. I put all the teeth into same type of elastomeric

<sup>7</sup> Sridhar N, Tandon S, Nirmala Rao "A comparative evaluation of DIAGNOdent with visual and radiography for detection of occlusal caries: An invitro study" Indian J Dent Res 20(3): 326-331, 2009

<sup>8</sup> Sridhar N, Tandon S, Nirmala Rao "A comparative evaluation of DIAGNOdent with visual and radiography for detection of occlusal caries: An invitro study" Indian J Dent Res 20(3): 326-331, 2009



boxes which is prepared by me in the faculty laboratory and was filled by cold acrylic mixture before hardened. Each tooth is embedded into acrylic with the condition its labial surface upward.

I decided to make my experiment on 7 teeth which will give me coherent and reliable results for data analysis. For every 7 teeth, 5 measurements will be done in order to minimize the random errors.

## Materials:

Test substance:

- 7 healthy human teeth

Test device:

- Laser fluorescence device (DIAGNOdent)
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Materials to be used in the experiment:

- *7 healthy human teeth extracted for Orthodontic purposes.*
- %37 Phosphoric acid (Demineralization material)
- Syringe
- Duraphat varnish (Remineralization material)
- Plaster
- Distilled water
- Marker
- Brush
- Strip
- Nail polish
- Elastomeric material
- Cold acrylic powder
- Cold acrylic liquid

- Gloves
- Mask

#### IV. Method

- 1- 7 upper healthy premolar teeth were collected in distilled water.
- 2- Each tooth is marked as A, B, C, D, E, F and G.
- 3- With elastomeric material 4.4.4 cm 7 boxes are prepared.
- 4- Cold acrylic powder and liquid are mixed in a glass
- 5- Acrylic mixture is filled in elastomeric boxes ,
- 6- Each tooth is embedded into acrylic with the condition its labial surface upward.
- 7- On the middle of the each tooth surface 4×4 mm square plastic strip was placed. The remained surface area dyed by a red nail polish. After dying, square plastic strip was taken off from the tooth surface and 4×4 mm “predetermined square tooth surface was prepared on each tooth for measuring.
- 8- On each square place, five points are determined for measure; corners and the middle of the square. Measuring was performed these five point of each square .Each measuring was repeated three times for security and the arithmetical mean of the measures are obtained. Moreover, the arithmetical mean of the five different point’s measures was calculated and recorded as a demineralization level for each tooth.
- 9- Measures were made for five different stages of the investigation; in the beginning, after cleaning, after %37 Phosphoric acid application , four hours after from Duraphat varnish’s first application, a week after from the second Duraphat varnish application for each tooth.
- 10- With the help of laser fluorescence device, the mineralization level of teeth is estimated and recorded.
- 11- The frame areas are demineralized with %37 Phosphoric Acid and also it is applied on the surface of teeth for 30 seconds, paying attention not to overflow the acid except the frame area.
- 12- Teeth are brushed with paste for 30 seconds and dried with air.
- 13- With the help of laser fluorescence device, the mineralization level of teeth is estimated and recorded.

14- A fluoride prepareate; Duraphat varnish is applied to demineralized areas.

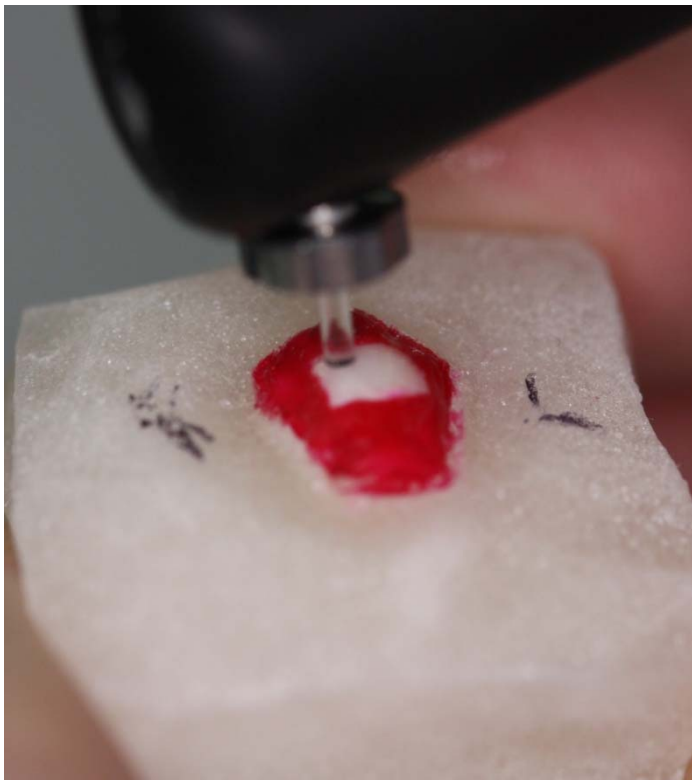
15- After 4 hours of application with the help of laser fluorescence device, the mineralization level of teeth is estimated.

16- After a week later from the first application, the second Duraphat varnish application was performed for each tooth.

17- Mineralization levels of teeth will be estimated with laser fluorescence device and datas are recorded.

Note: Same procedure was repeated for seven teeth.

The results evaluated statistically by SPSS 13 computer program.



## DATA ANALYSIS

1. The means of the stages were measured.
2. Microsoft Office Excel 2003 was used to calculate count, sum, average and variance values.
3. ANOVA (Analysis of Variance) test was done to see if there is a significant difference between the means

4. Descriptive statistics which are standard deviation, standard error and confidence interval were calculated.

## V. Data Analysis

The following formulas were used to calculate mean, standard deviation, standard error and confidence interval for descriptive statistics of the 3 test groups.(22)

### 1. Mean:

$$\bar{x} = \frac{1}{n} \cdot \sum_{i=1}^n x_i$$

n= number of trials

$x_i$ = number of colonies grown for trial i.

### 2. Standard Deviation:

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}, \quad \text{where } \mu = \frac{1}{N} \sum_{i=1}^N x_i.$$

n= number of trials

$x_i$ = number of colonies grown for trial i.

### 3. Standard Error

$$SD_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

$\sigma$ = standard deviation

n= sample size

#### 4. Confidence Interval

$$95\% \text{ CI} = \text{SE} \times t_{(n-1)}$$

SE = Standard error , t = the value of t at p= 0.05<sup>9</sup>

**Table II:** Descriptive statistics including mean, standard error, standard deviation of the Diagnodent readings for the study groups (n=7).

	Means ( $\bar{X}$ )	Standard Errors (SE)	Standard Deviations (SD)
I-Control	12,06	0,512987	1,622207
II-After cleaning	12,32	0,707547	2,237459
II- Acid Application	16,1	0,789515	2,496664
IV-Duraphat-1	16,78	0,963535	3,046966
V-Duraphat -2	13,68	0,953217	3,014336

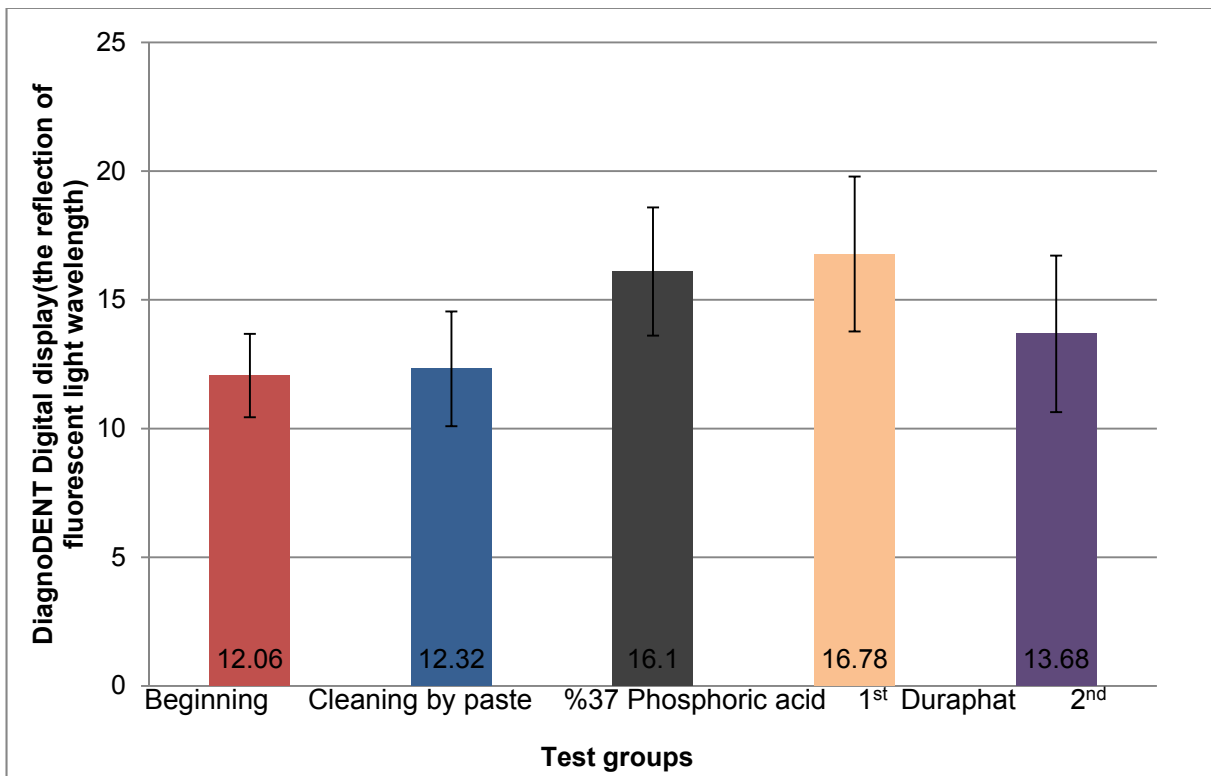
<sup>9</sup> Standard Deviation", "Standard Error", "Confidence Interval". Wikipedia the Free Encyclopedia. Web.

Table III: The results of the ANOVA (Analysis of Variance) test for the test groups groups (P-value and existence of significant difference).

n = 5	After Cleaning	Acid Application	Duraphat-1	Duraphat-2
I-Control	P=0,591 NS	P=0,002 <sup>*</sup>	P=0,023 <sup>*</sup>	P=0,105 NS
II- After Cleaning	X	P=0,002 <sup>*</sup>	P=0,029 <sup>*</sup>	P=0,075 NS
II- Acid Application	X	X	P=0,792 NS	P=0,041 <sup>*</sup>
IV-Duraphat-1	X	X	X	P=0,075 NS
V-Duraphat -2	X	X	X	X

<sup>\*</sup>  
p ≤ 0,05

NS Non-significant



Graph 1: Increased DIAGNOdent readings (demineralization level) after %37 Phosphoric acid application and reduced DIAGNOdent readings (remineralization level) after repeated applications of Duraphat as shown by column diagrams. The error bars indicate standard error for each group.



## VI. Evaluation

The research question of this investigation was “Do Duraphat fluoride varnish has a strong repairing effect on demineralized teeth even in the single application such as % 77 percent as claimed in a dental magazine advertisement?”. So the aim of this study was to find out if there is a significant repairing effect of Duraphat varnish’s single application on tooth demineralization and to compare their curative effect between the study groups. It was hypothesized that there would be no significant difference between

My question was “Do fluoride varnish have really repairing effect in a single application and what is the effect of repeated applications”. It was hypothesized that there will be a significant difference between the effectiveness of repeated applications on tooth demineralization. It is predicted that repeated applications will have the better effect on demineralization.

The results of the experiment showed that tooth mineralization level didn’t changed significantly because of cleaning by powder. However, it is not changed also after Duraphat’s single application. Second application gave the better result and tooth mineralization level closed the original level as indicated table 2. The means of the 12.06, 12.32, 16.10, 16.78, 13.68 respectively. So demineralization of tooth remineralized following Duraphat varnish application twice.

My null hypothesis was that there was significant difference between the effectiveness of repeated applications of Duraphat varnish. Five test groups were statistically analyzed by ANOVA and the p-value calculated by ANOVA was found out to be 0.002 for the first and third group differences which was smaller than 0.05 so acid application changed the tooth surface demonstrating demineralization. After Duraphat application, test results gave 0.792 value which was not smaller than 0.05 so Duraphat application did not returned the original values. However after second application of Duraphat test result gave the P value 0.041 which was smaller than 0.05 so my null hypothesis was accepted. The producer’s claim is to be refused.

My experiment will be summarized as follows:

1. The results of the present study revealed there was a significant effect of fluoride material on the demineralization ( $p = 0.002$ ). However, the only significant difference found was between the two groups (acid application and second Duraphat application).
2. Thus, single Duraphat applications did not produce a statistically significant difference in lesion remineralization.
3. In addition, the results of the present study showed that there was statistically significant effect for twice application of Duraphat varnish on the change in Demineralization recovery ( $p = 0.041$ ).
4. It is difficult to determine Duraphat varnish’s full potential in an *in vitro* study due to the numerous limitations arising from this type of model.
5. Further research is needed to evaluate applications of Duraphat varnish’s capability in enhancement of remineralization by conducting randomized clinical trials<sup>10</sup>.

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<sup>10</sup> Kristin Dumboski Clark, K D. The efficacy of 37% phosphoric acid + Mi Paste Plus on remineralization of enamel white spot Lesions, Theses and Dissertations, *University of Iowa*, (2011)

As I have hypothesized before and experimentally proved the greater effects of fluoride varnishes in repeated applications, my experiment seems to be reliable but still it has some errors and not %100 coherent. I have done my experiment on 7 different teeth with familiar mineralization levels and 5 other points on them in order to keep my random errors minimum. On the other hand, there might have been some systematical errors during my experiment;

1. I have collected 7 different teeth from 7 different girls. There is no problem with the gender but eating habits and age have great effect on mineralization levels. Since I can't extract 7 teeth from one person, there will be always an error according to that.
2. At first, I made my experiment on 5 teeth but after talking with statisticians, I learned that the experiment becomes more coherent when the number of teeth used increase so more factual result would be gained, if the experiment is done with hundreds of teeth.
3. During my experiment, I stored all the teeth in %2 hydrochloric acid in a box in order to clean and prevent microorganism contamination until measuring. However the HCl solution harmed teeth so I stored them in distilled water. So they may have lost some of their aliveness during the wait time. Experiment will be more coherent if teeth are stored in saliva solutions in order to obtain best condition.

Limitations of this extended essay:

1. I made my measurements with DiagnoDENT, but there is a more enhanced device called SEM (Scanning Electron Microscopy) which is very expensive and requires a high technical assistance. Moreover with the help of DiagnoDENT, only the remineralization level of tooth surface is measured but with SEM, histological examinations would be done.
2. In my experiment, only one type of tooth (premolar) was used. The experiments that conduct teeth with different anatomical structure will have different results because all these types of teeth have different enamel levels.
3. For the standardization, the experiment is conducted on only the one part of tooth surface. Whereas, on the occlusal surfaces, since the surface consist of small fissures, the results may be different. So, examination of all the parts of the tooth surface with same processes will result the differentiation of replies of different surfaces.
4. This experiment is an *in vitro* study. However, oral media have different conditions like washing and repairing effect of saliva. So, there is a need for *in vivo* studies which is performed in oral condition.

## VII. Conclusion

My research question “What is the difference between single and repeated applications of fluoride agent (Duraphat varnish) on demineralized tooth surface?” was answered with the use of appropriate statistical tests and it was found out that there is a significant difference between single and repeated applications. Repeated applications have the best repairing and remineralization effect on demineralized teeth. On the other hand %77 repairing effect of Duraphat varnish (fluoride agent) is rejected. So my prediction was right because I thought about my general knowledge that these fluoride applications are more effective when they are used regularly and my statistical values support this claim.

I chose this subject because I wanted to know if an effective fluoride agent like Duraphat can have a repairing and mineralization effect as %77 in a single applications and what would be the difference if we repeat this applications. Another reason why I chose this subject to deal with is that Turkey’s weakness on tooth health and their sloths on brushing or applying these fluoride agents regularly. I thought that tooth health is very important on defining a country’s development level. If the effectiveness of Duraphat in a single application wouldn’t be rejected, I would say that it could be a very useful and preferable agent for Turkish nation for protecting their teeth from decays.

## VIII. Appendix

### Quick tips to get started:



- When attaching the handpiece tubing to the unit, **SCREW THE HOSE NUT ONTO THE UNIT UNTIL SNUG**. This step is critical.
- Twist handpiece sleeve back and forth with slight down pressure until it seats. Twist to remove. Please don't pull.
- Please don't push tips onto handpiece. Rather twist tips back and forth with slight down pressure until it seats. **TWIST TO REMOVE**.

### What do the numbers mean?

**0 - 10** Healthy Tooth Structure

**11 - 20** Outer Half Enamel Caries

**21 - 30** Inner Half Enamel Caries

**30+** Dentin Caries

Important: Please refer to the KaVo DIAGNOdent Clinical Guidelines for additional information, possible course of action and references to research.

Please remember:

- ✓ Teeth must be free of organic stain, plaque and calculus as these substances tend to have a high degree of fluorescence.
- ✓ "Moment" display is the real time reading.
- ✓ "Peak" display holds the highest value attained until it is reset by one squeeze of the grey ring.

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