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Original Research

Comparative evaluation of Elsenz™ and GC tooth mousse in remineralization of enamel – a clinical study

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ABSTRACT:

Aim: To evaluate the surface micro hardness of enamel following use of ElsenzTM and GC tooth mousse.

Methods: Twenty extracted anterior teeth were included for the study. Teeth were decoronated and mounted mesiodistally. Baseline values of the samples were recorded and teeth were randomly divided into 2 groups. Group A: Elsenz™; Group B: GC tooth mousse. Samples were demineralized with Mc Innes solution (2 cycles, 5 minutes daily with 24-hour gap each) following which remineralization was done for 2 weeks (2 cycles, 5 minutes daily with 7 days gap) and the samples were subjected to micro hardness testing using Vickers hardness tester. The results obtained were subjected to statistical analysis using one way ANOVA and paired t test.

Results: GC tooth mousse and Elsenz™ both showed remineralization of enamel, although when statistically compared, there was no significant difference in the micro hardness values in both the groups.

Conclusion: Periodic application of Elsenz™ increases micro hardness of enamel and it can be effectively used as remineralizing agent.

Keywords: *Elsenz™ , GC tooth mousse, microhardness, remineralization.*

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INTRODUCTION

As the old saying goes "Prevention is better than cure", preventive approaches have become a key phrase in dentistry. Dental caries is the most prevalent, infectious microbial disease affecting the human dentition. It is currently recognized as a dynamic process since periods of demineralization alternate with periods of remineralization through the action of calcium, fluoride, and phosphorous present in the saliva. It is therefore, viewed as a biofilm induced disease caused by an imbalance in physiologic equilibrium between tooth mineral and biofilm fluid.[1] The process of demineralization and remineralization is influenced by the degree of saturation of oral fluids with respect to apatite minerals.[2] When there is an appropriate change in the oral environment, remineralization may become the predominant process, leading to lesion repair. [3, 4]

An increase in the calcium or fluoride concentrations may enhance remineralization.[5] For this purpose, fluorides have traditionally been used in various formulations, and the concomitant cariostatic mechanisms can be explained by an increased driving force for fluoridated apatite.[6] This preventive effect is mainly due to the formation of calcium fluoride-like precipitates hampering demineralization, however fluoride levels needed for remineralization are assumed to be higher than those to prevent lesion formation.[7] Bioavailability of fluoride depends on the solubility of fluoride containing compound and from the adhesion of fluoride compound to the surface. Despite the benefits of fluoride, occurrence of dental fluorosis has prompted for search of other remineralizing agents. Many remineralizing agents exists with well documented proof such as CPP-ACP, nano-hydroxyapatite, bioactive glass etc. [8] Although these remineralizing agents have proved their ability to strengthen the enamel surfaces, they tend to show more efficacy in remineralizing the enamel surfaces when they are used along with the fluoride. This synergic effect of remineralizing agents with fluoride has been well proved. But their efficacy in comparison with fluoride as a gold standard has been debated. [9]

The present study was carried out with an aim to evaluate the surface microhardness of enamel after using two remineralizing dentifrices: Elsenz (Biomin F: bioactive glass containing 530ppm of fluoride) and GC tooth mousse (Recaldent: Casein phosphopeptide- amorphous calcium phosphate fluoride containing 900ppm of fluoride) and to compare their effect on the microhardness of enamel after demineralization.

MATERIALS & METHODS

Preparation of samples:

Twenty extracted anterior teeth were collected and cut sagittally, using diamond disc bur and impregnated in the cold-cure acrylic resin with the labial surface levelled on top and lying flat and parallel to the horizontal plane. Baseline values for each sample were taken to set a standard and then they were randomly divided into 2 groups: Group A: GC tooth mousse and Group B: Elsenz™. All the samples were stored in artificial saliva to prevent dehydration. (0.220 g/Lt calcium chloride, 1.07 g/Lt sodium phosphate, 1.68 g/Lt sodium bicarbonate, 2 g/Lt sodium azide)

Procedure for microhardness testing:

Micro hardness testing was done with Vickers micro hardness tester. All the test specimens were first placed on the stage of the tester and stabilized. Then area to indent was selected by focusing with 10× objective lens and the test was carried out, where the indentations were made with a rate of 100 g load for 30 s. Three indentations were made in order to measure the average microhardness levels. The same procedure was repeated for all the twenty specimens.

Bleaching agent preparation and its application:

Freshly prepared Mc Innes bleaching solution which consisted of a mixture of 1 ml of 36% hydrochloric acid, 1 ml of 30% hydrogen peroxide and 0.2 ml of anaesthetic ether was mixed in the ratio of 5:5:1 and applied to the enamel surface using a cotton applicator for 5 minutes (1st cycle of bleaching). Then, the samples are washed with distilled water and blotted dry using absorbent paper and subjected to the microhardness of the enamel surfaces with the Vickers indenter. Then again, the samples were stored in artificial saliva for next 24 hours to prevent dehydration. After 24 hours, the second application of bleaching agent was carried out (2nd cycle of bleaching) and the microhardness values were recorded. Then the samples were coated with remineralizing agents, using cotton applicator, with a small pea-sized amount applied on each sample left for 5 minutes. After 5 minutes, the samples were washed with distilled water and blotted dry using absorbent paper. The application was started within 12 hours of demineralization cycle and repeated 12 hourly for seven days. All samples were stored in artificial saliva in between the application procedure.

Application of GC Tooth Mousse plus and Elsenz™:

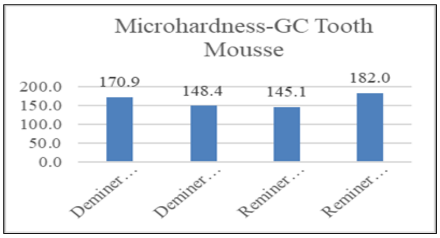
GC Tooth Mousse Plus and ELSENZ ™ were applied with cotton applicator tips on ten samples of post bleached samples of each group respectively, every day for seven days with minimum application time of 5 minutes. The samples were then washed under distilled water, stored in artificial saliva for seven days (first cycle of remineralization) after which the samples were tested for microhardness and the values were recorded. Following this, GC Tooth Mousse Plus and ELSENZ™ were applied for seven more days and at the end of fourteen days (second cycle of remineralization) the samples were subjected to micro hardness testing. The recorded values were subjected to statistical analysis.

RESULTS:

The values obtained from the microhardness testing of group A and group B were subjected to statistical analysis by one way ANOVA for intragroup comparisons and paired t test for inter group comparisons. Intragroup Comparison for Group A (GC tooth mousse): The results for group A, showed there was significant decrease in the surface microhardness of enamel after 2 consecutive cycles of demineralization and subsequent increase in the surface microhardness of enamel following 2 cycles of remineralization. (Table 1, graph 1, p value - 0.124).

Table 1 (Microhardness values for Group A)

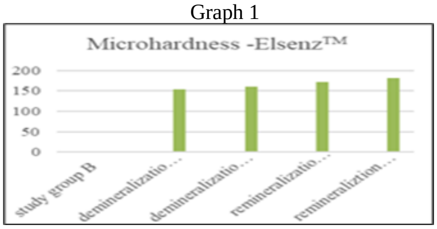
	N	Mean	Std. deviation
Demineralization– 7 Days	10	170.9	42.10918
Demineralization 14 Days	10	148.3	25.76020
Remineralization- 7 days	10	145.1	47.36821
Remineralization-14 days	10	182.0	38.64817



Graph 1

Table 2 (Microhardness values for Group B)

	N	Mean	Std. Deviation
Demineralization-7 Days	10	154.0	26.71867
Demineralization-14 days	10	160.0	63.95624
Remineralization 7 days	10	171.2	45.96460
Remineralization 14 days	10	181.8	38.85861



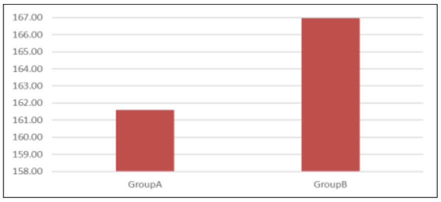
Group B also showed similar results as that of group A. (Table number 2, p value - 0.55) Graph 2

Intergroup comparisons: This was done to assess the remineralizing potential of two different dentifrices when applied to demineralized enamel surface. Although, group B (Elsenz™) showed higher values followed by GC tooth mousse, results were not found to be statistically significant. (Table number 3, graph 3, p value - 0.915).

Table 3 Comparison of Group A and Group B

	N	Mean	Std. Deviation
Group A	20	161.60	40.84714
Group B	20	166.6	45.37494

Table 3: Comparison of Group A (GC tooth mousse) and Group B (Elsenz™).



Graph 3

DISCUSSION:

The present study was done in the Department of Pediatric and Preventive Dentistry, College of Dental Sciences, Davangere. Twenty extracted teeth were collected from the Department of Oral and Maxillofacial Surgery, College of Dental Sciences, Davangere. The samples were prepared, a baseline value was taken for standardization and they were randomly divided into 2 groups. The specimens were stored in artificial saliva to prevent dehydration of samples. Demineralization procedure was carried out using MC Innes solution. In 1996, Mc Innes developed a solution that included hydrochloric acid and hydrogen peroxide to remove stains. He used 36% of hydrochloric acid, 30% of hydrogen peroxide and one part of diethyl ether.[9] In this study, Mc Innes solution was used as demineralizing agent as it is commonly used to remove stains and to demineralize enamel in the dental set up. The effect of demineralizing enamel on their micro hardness is probably related to the pH, as well as alteration on organic matrix of enamel under chemical action of hydrogen peroxide. Hydrogen peroxide diffuses through the enamel and dentin releases free radicals, reactive oxygen molecules and hydrogen peroxide ions that converts long chained dark coloured chromophores in to light coloured chromophores. This effect can probably be increased by low pH of the bleaching agent, causing subsequent alterations in the mineral composition, decreasing enamel and dentin microhardness. [10, 11, 12]

Further, the amount of demineralization was tested by using a microhardness tester [13]. The micro hardness test was used as it was economical. Measurement of microhardness of tooth material can be done in three different ways: Knoop's hardness number (KHN), Vickers's hardness number (VHN) and Brennel's hardness number (BHN). [13] In this study, Vicker hardness number was chosen over Knoop's because a square shape of indent obtained in VHN was easy and more accurate to measure. Specimen preparation was one of the factors that affects the hardness measurement because any tilt or not flat surface would yield a too large an indentation and thus a smaller Vickers hardness number. Thus, it was crucial to produce a flat surface in the specimens, but the cut enamel surface tested for microhardness did not have a flat surface. The convex surface gave variations in the VHN. Hence three indentations were made to avoid any operational bias, then average of two indentations were taken for statistical analysis. [14, 15] Once the demineralization cycles were completed, the samples were subjected to microhardness testing of enamel surface. Next step in the study was the application of two different remineralizing agents. GC tooth mousse was selected as it’s proven to have an excellent remineralizing potential in comparison to the other dentifrices. It contains casein phosphopeptide-amorphous calcium phosphate (CPP-ACP), which is water based creme remineralizing agent. Casein is derived from peptides produced by tryptic digestion of casein. Casein has the ability to stabilize calcium and phosphatase ions by releasing small sequences of peptides (CPP’S) through partial enzymic digestion. They have specific 144 calcium ions, 96phosphate ions and 6 peptides of CPP that forms a nano-complex over ph. 5-9(acidic conditions). In neutral conditions, CPP’S stabilize calcium ion and phosphate ions.[16] Main function of CPP is to modulate bioavailability of calcium ion and phosphate ion levels by maintaining ionic phosphate and calcium super saturation to increase remineralization. It also has anticaries action that influences the properties and behaviour of dental plaque by binding with adhesion molecules on mutans streptococci, impairing their incorporation into plaque. It elevates the plaque calcium ion levels to inhibit plaque formation and providing protein and phosphate buffering of plaque fluid. Along with CPP, the second component of GC tooth mousse is amorphous calcium phosphatase (ACP) which was developed by Dr. Ming .S. Tung.[17] In 1999, ACP was incorporated into toothpaste called enamelon and later reintroduced in 2004 in enamel care toothpaste by Church and Dwight.[17,18,19] The sources of calcium ion and phosphate ion comes from calcium sulphate and di potassium phosphate.[20] ACP technology requires 2 phase delivery system to keep calcium and phosphate ions from reacting with each other. When 2 salts are mixed, they rapidly form ACP that can dissolve into the saliva and can be available for tooth remineralization. It consists of unstabilized calcium and phosphate salts with sodium fluoride.[17] The technology of ACP and CPP are together used in GC tooth mousse, so the CPP-ACP is an excellent remineralizing and cariostatic agent for the control of dental caries. CPP-ACP binds well to dental plaque that provides large calcium reservoir that may inhibit demineralization and assist in subsequent remineralization.[18] A study done by Christos et al in 2007, to evaluate the remineralization potential of CPP-ACP on artificial-caries lesion confirmed that CPP-ACP completely remineralizes the enamel and dentine surfaces using infrared spectroscopy.[19] Also , a study done by Hao et al 2017 , stated that application of GC tooth mousse containing CPP-ACP can be efficiently used as a preventive strategy for initial caries , as it showed excellent remineralization potential.[20]

The second remineralizing agent used in the study was Elsenz™ that contains fluoride (530ppm) with bioactive glass (BiominF). Other materials which are present are glycerine, silica, Fluro-calcium phospho-silicate, sodium lauryl sulphate, titanium dioxide, aroma and potassium. Bioactive glass particulates with median size of less than 20 microns.[21] They have been tested for remineralization before and known for their synergic effect because of the presence of fluoride. So, bioactive glass along with fluoride when introduced into dentifrice, they presumably form nanocomplexes at enamel surface. Further, the particles are deposited onto the dentine surfaces and mechanically occlude the dentinal tubules. In, aqueous environment such as saliva, sodium in calcium sodium phosphosiliscate particles immediately within a minute, begins to exchange with hydrogen ions. This rapid exchange of ions allows calcium and phosphorous species to be released from particle structure. A localized transient increase in the pH occurs that facilitates the precipitation of calcium and phosphate from particles and from saliva to form a calcium phosphate layer on tooth surface.[22] Srinivasan et al 2010, compared remineralization potential of CPP-ACP and CPP-ACP with 900 ppm fluoride. There was statistically significant differences and this study confirmed synergic effect of CPP-ACP with fluoride.[23] Wang et al in 2011, tested dentine remineralization activity of bioactive glass containing tooth paste (Novamin). Tooth paste was applied twice daily for 7 days and samples were subjected to SEM. He concluded that it occludes dentinal tubules and effectively remineralizes the enamel surfaces. [24] Narayana et al in 2014, compared bioactive glass, fluoride tooth pastes and CCP-ACP and the lesions were subjected to high resolution scanning electron microscopy. He obtained statistically significant results in all groups and concluded that bioactive glass is an effective remineralizing agent.[25] Once the procedure was completed, the microhardness values were obtained which were subjected to statistical analysis using one way ANOVA for intragroup comparison and paired t test for intragroup comparisons. Microhardness values of group A was tabulated in table number 1 and represented in graph 1. (P value-o.124). Microhardness values of group B was tabulated in table number 2 and represented in graph 2 (P value -0.55). Intergroup comparison of table number 1 and table number 2 was done and tabulated in table number 3 and represented in graph 3. (p value -0.915). Results of this study showed that, there was increase in the values of remineralization after application of GC tooth mousse and Elsenz™. Although, Elsenz™ showed higher remineralization potential. Apparently, there is a difference in remineralizing potential of both GC tooth mousse and Elsenz™, but the results were not statistically significant. Iimplementation of Dental Home as a concept that can help identify, rectify, and rehabilitate people suffering from oral diseases at an early stage with the focus on creating awareness of the disease process and active prevention rather than expensive, resource-intensive therapeutic interventions bound to have a significant impact in how oral diseases are managed in the future.[26]

CONCLUSION:

Within the limitations of the study, it can be concluded that, Elsenz™ has the remineralizing ability and its periodic application helps to strengthen the enamel surface.

INFORMED CONSENT: The authors certified that they have obtained all informed consent from the participants for use of their teeth.

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CONFLICTS OF INTEREST: There are no conflict of interest.

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