



## **Determine the Effectiveness of Anacardic Acid and Stannous Fluoride as an Anti-erosive Agent**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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**Study Protocol**

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## **ABSTRACT**

**Background:** The key goal of the study is to find out the effectiveness of anacardic acid and the stannous fluoride as an anti erosive agent.

**Objectives:** To evaluate the erosive effect of Bio vinegar and antierosive effect of Anacardic acid and Stannous Fluoride.

**Methodology:** The extracted teeth were collected for in vitro study. Three solutions were selected Bio vinegar, Anacardic acid, Fluoride to treat the extracted teeth to study and compare the anti-erosive effect. The sets of extracted teeth of ten each were grouped to be treated with different solutions. The set was immersed in Bio vinegar for 8 hours for erosive action. The second set of ten extracted teeth were immersed in anacardic acid for four days. The same set of teeth were treated with vinegar for 8 hours. The cross sectional view of stained teeth was viewed under Scanning Electron Microscope. The third set of teeth was immersed in stannous fluoride for four days and then treated with Bio vinegar for 8 hours. The cross sectional view of stained teeth was viewed under Scanning Electron Microscope. A comparison of anti-erosive effect of anacardic acid

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and stannous fluoride were studied under Scanning Electron Microscope.

**Expected Results:** Determining a better effectiveness of Anacardic acid antierosive agent than stannous fluoride.

**Conclusion:** Reduction in the level of erosion by the application of anacardic acid and stannous fluoride on extracted teeth exposed to carbonated drinks and assessment of erosive effect of carbonated drink on tooth.

*Keywords: Anacardic acid; stannous fluoride; anti-erosive agents.*

## 1. INTRODUCTION

Dental erosion can also be described as an irreversible loss of dental hard tissue, exposure to chelating agents or non-bacterial acids [1]. During the 19th century [2] the occurrence of this condition was noted and the incidence and prevalence of erosion of dental hard tissue has been rapidly documented since then [3]. This can be evident from the prevalence research held in the last decade in two separate parts of the globe that showed the percentage of subjects among various age groups affected by erosion [4-8]. It is now time for a prevention program to be implemented to monitor the occurrence of this destructive dental disease.

Therefore, the main elements needed to design and achieve a successful preventive program are:- predictors of erosion-conditions defined as predisposing teeth to dental erosion growth, the prevention and control guidelines and safety guidelines-suggestions for the protection of remaining hard tissues for further damage and deterioration. It is a multifactorial lesion which is straight connected with the standard of living of the organism. Differential diagnosis from other non-carious lesions is extremely difficult for early diagnosis. Erosion can be avoided by non-invasive approaches but at an early stage and with a successful anamnesis. Sensitivity caused by substance loss is eliminated by the products used in the procedure. Regardless there are varying products in the market for the same, but supreme treatment material is not yet obtainable. Meanwhile, applications having fluoride can also be considered the best hefty wear prevention approach available. Research is still underway to establish the necessary materials.

Recognising people at risk of dental erosion can be an essential step in avoiding wear. Details based on case statement, clinical study, epidemiological data, cohort studies, zoological science, in vitro investigations and in vivo survey

have identified gastric acids, dietary or environmental sources that could cause dental erosion. Some determinants have been studied as predictors of causation to dental wear based on this reality.

The study conducted by Milward et al in which he analyzed 38% population were affected of age group 4-5 [5]. Similarly another survey done by UK Child Dental Health Survey analysed 55% population were affected of age group 5-6 [6]. The study conducted by Batter et al. which demonstrated 57% population were affected of age group 11-14 [7]. The comprehensive generality of tooth wear was established to be moderate (8.9%).tooth wear due to chemicals was found to be greater in molar teeth (65.6%) than in incisors and canines (34.4%) loss of tooth structure with only loss of structural shape was seen in almost of the (94.8%) of the cases [8]

Erosion is essentially the consequence of a sequence of cycles of demineralization/remineralization where the state of overtime demineralization prevails. These happen when the pH decreases below the critical level (approx 5.5 for enamel and 6.2 for dentin). It allows the tooth minerals to dissolve (hydroxyapatite). By facilitating remineralisation and slowing down demineralisation, erosion can be avoided. Enamel is formed of calcium and phosphate ions which lead to formation hydroxyapatite crystals that contribute to ion demineralisation when exposed to exogenous and endogenous influences.

## 2. CAUSES OF DENTAL EROSION

- Extrinsic
- Intrinsic

### Sources from Extrinsic:

The pH level of the mouth is decreased by acidic foods and beverages, resulting in demineralization of the teeth.

Eg. Fruit juices, such as beer, wine, sports drinks, orange juices, Carbonated juices, lemonades, coco-cola, for starters.

In causing acid erosion, food like fruits, tomato ketchup and stored food in vinegar have been involve. Thus, fruit juices are at high risk of inducing chemical wear in tooth structure in children using feeding bottles.

- A variety of medications: are caustic and can lead to chemical wear, such as chewable ascorbic acid, aspirin, and certain iron supplements. Often known as perimolysis, intrinsic chemical wear is the process through which stomach acids from the gastric come into contact with the teeth, frequently subordinate to disorders like Anorexia nervosa, bulimia nervosa, gastro esophageal indigestion disorder and reasoning syndrome. A common symptom of bulimia, reducing the salivary flow rate, predisposes a person to chemical wear because of high susceptibility to the reaction of caustic food and drinks [9].

#### **Intrinsic sources**

- In comparison to good management, self-induced emesis raises the likelihood of chemical wear by a factor of 5.5.
- Medical disabilities:-Vigorous emesis in phagic disorders like malnutrition, passive hurl in gastroesophageal reflux disease (GERD) and either passive hurl or chronic emesis in chronic liquid courage and bust drinking have together been associated to continuous contact of tooth structure with stomach content, the acidifying component of which can be as lower upto 1, that evolving to caustic dissolution of tooth structure.
- Usage of caustic medicines:- Case reports have shown that dental erosion is predisposed to dental erosion by acidic medicines often prescribed for long periods of time.9,20 Tablets like acetylsalicylic acid, vitamin C supplements, liquid hydrochloric acid, ferrous tonics, caustic saliva stimulants/replacement and calcium chelating compounds have high erosive potential.

- The use of illicit medicines :-Owing to the consequences of lack of moisture and decreased salivation, the addictive use of some illicit substances like brown sugar and euphoria is linked with large amount of acidic beverage intake, thereby developing tendency of user to the possibility of chemical wear of tooth structure.
- Excessive techniques for oral hygiene:- Because of detachment of the more defensive highly mineralized outermost layer of the enamel surface and decrease in the thickness of the acquired salivary thin film, recurrent tooth brushing with coarse dentifrice as performed by few health/esthetic-concerned people may make the dental hard tissue more prone to chemical wear of tooth structure, which would negatively affect its developed protective basis opposing chemical wear [10,11,12].

#### **2.1 Background/ Rationale**

The key goal of the study is to find out the effectiveness of anacardic acid and the stannous fluoride as an anti-erosive agent.

#### **2.2 Objectives**

1. To evaluate the erosive effect of Bio vinegar.
2. To assess the anti-erosive effect of Anacardic acid.
3. To assess the anti-erosive effect of Stannous Fluoride.
4. To compare the anti-erosive effect of Anacardic acid and Stannous Fluoride

#### **3. METHODS**

The present study will be conducted in department of Public Health Dentistry, Sharad Pawar Dental College, Sawangi. The extracted teeth were collected for in vitro study. Three solutions were selected Bio vinegar, Anacardic acid, Fluoride to treat the extracted teeth to study and compare the anti-erosive effect. The three sets of extracted teeth of ten each were grouped to be treated with different solutions. The first set was immersed in Bio vinegar for 8 hours to chemically degrade the tooth structure to observe the erosiveness of Bio vinegar. It is

taken as a substitute to cause erosion which will help in comparing the anti erosive property of other two mediums. The second set of ten extracted teeth were immersed in anacardic acid for four days. The same set of teeth were treated with vinegar for 8 hours. The disking was performed on the teeth and application of methylene blue dye was done. The cross sectional view of stained teeth was viewed under Scanning Electron Microscope. The third set of teeth was immersed in stannous fluoride for four days and then treated with Bio vinegar for 8 hours. The disking was performed on the teeth and application of methylene blue dye was done. The cross sectional view of stained teeth was viewed under Scanning Electron Microscope. A comparison of anti-erosive effect of anacardic acid and stannous fluoride were studied under Scanning Electron Microscope by the means of dye penetration.

Group A: Ten extracted teeth were immersed in Anacardic acid for four days.

Group B: Ten extracted teeth were immersed in Stannous fluoride for four days.

#### 4. RESULTS

Anacardic acid is more effective antierosive agent than stannous fluoride.

#### 5. DISCUSSION

Ciata Siveira et al published an article on 3rd July 2014 at department of paediatric dentistry, university of Brasilia, Brasilia, Brazil. On anacardic acid from Brazilian cashew nut trees, reducing enamel erosion. The semi quantitative zymographic analysis reveals that saturated anacardic acid at concentration of 100  $\mu$  mole per litre diminished the activity of MMP 2. Thus the dentin erosion using a contact surface profilometer, a method widely applied for analysis of tooth loss. The study concluded that saturated anacardic acid had promising results in dentin erosion in vitro. Furthermore, its mechanism of action must be investigated in future and the quantification of thickness of organic matrix by scanning electron micrography (in cross-sectional view). Few of the related studies were reviewed [13,14].

Ahmed Gamal Abdelwahed et al published an article on 12 May 2019, conservative dentistry department, Fayoum University Faiyum, Egypt. On anti erosive effect of topical fluoride. The use of oral hygiene products containing AmF/NaF/SnCl<sub>2</sub> or NaF may be effective in prevention of erosive tooth wear. The result of the study is the risk of bias of the included studies was assessed using Cochrane Collaboration tool for assessing the risk of bias. A meta-Analysis of the present study was performed using comprehensive Meta-Analysis version 2.2.048 software.

#### 6. CONCLUSION

The key goal of care is to retain the structure of the tooth without planning. Restoration with the use of different restorative materials may be considered, particularly in patients whose sensitivity cannot be removed by the use of conservative methods or whose requirements are aesthetic. It should, however, be held in mind that in materials where acid exposure persists, surface changes can occur. Prosthetic treatment may be needed in cases of excessive substance loss. Reduction in the level of erosion by the application of anacardic acid and stannous fluoride on extracted teeth exposed to carbonated drinks and assessment of erosive effect of carbonated drink on tooth. More interventional approaches are used in advanced situations. In the event of substance loss that cannot be removed by restorative therapy, prosthetic treatment may be required. The most important point of treatment is identifying and removing the erosion factor, above all current materials and methods. Therefore, early identification of the lesions, evaluation and removal of the etiological variables are relevant topics.

#### CONSENT

It is not applicable.

#### ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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