Original Research Article

EFFECT OF STRAWBERRY EXTRACT ON TOOTH DISCOLORATION AND MORPHOLOGY- AN IN VITRO STUDY

Running Title: Effect of strawberry extract on tooth discoloration and morphology

ABSTRACT:

Background: Teeth whitening or dental bleaching is a procedure that is most often asked by patients because it is a very effective way to improve the appearance and aesthetics of a smile when compared with other invasive restorative treatments. Strawberry being a natural ingredient helps in the teeth whitening process.

Aim: The aim of the study is to find the effect of strawberry extract on tooth discoloration and morphology

Materials and methods: Non- carious tooth samples were used for the experiment. Mandibular premolars were used as the samples, in which one tooth was immersed in strawberry extract and the other was in distilling water and kept for three days. The height and size of the tooth were measured to determine morphological changes before and after experiments. The results were compared between the dimensions of both the teeth for 72 hours and plotted into a bar graph.

Results: The results indicated that there were no significant morphological changes between the tooth immersed in strawberry extract and distilled water.

Conclusion: Fruits and leaves of strawberry plants are used to whiten teeth. Chewing strawberries every day can help to nourish the mouth, such as whitening of teeth and making breath more fresher. All these processes take place only if teeth are exposed to strawberry for a long period. Our study established the teeth whitening and anti-decay properties of strawberry extract in the teeth. Further research is required to observe the effect of strawberry extract on teeth in detail.

KEYWORDS: Strawberry extract, tooth discoloration, morphological changes

INTRODUCTION:

The neat arrangement of the teeth and the colour has become so important which raises the need for "aesthetic dentistry". It has now gained more attention from both the public and the dentist. (1). Tooth erosion is a pathological disease in which the dental hard tissue is lost due to its chemical removal from the surface with an acid or other involvement. The causative factors of this multifactorial disease are of two types that are extrinsic and intrinsic. The extrinsic causes are environment, medication, lifestyle factors, and diet. Intrinsic tooth erosion occurs if gastric acid reaches the mouth due to regurgitation, vomiting, or gastro-oesophageal reflux disease (2). An individual will not be aware of this problem until it affects the dentine and pulp, which further leads to tooth sensitivity and poor aesthetics (3).

Teeth whitening or dental bleaching is a procedure that is often asked by the patients because it is an effective way to improve the appearance and aesthetics of a smile when compared to other invasive dental treatments. Also teeth whitening improves oral health and quality of life (4). Teeth whitening can be done during dental practice which includes two things that are eliminating extrinsic colors and intrinsic colors. Extrinsic whitening can be done by mechanical or chemical techniques, which will be done by the dentist, known as office bleaching (5). Tooth bleaching is generally done to remove yellow or dull coloured teeth because scraps of food such as coffee, chocolate, cigarettes, medicines or some other color changes or structural changes in the teeth. Tooth whitening is also done to restore the color of the teeth into a natural color or make it whiter (1). The chemicals used for teeth whitening are Hydrogen Peroxide (H_2O_2), Carbamide Peroxide {$CO(NH_2)_2.H_2O_2$} and Sodium Perborate ($NaBO_3.4H_2O$) (6).

Strawberry being a natural ingredient is used to whiten decolorized teeth. Strawberries are a herbaceous fruit plant and it's from the family of Rosaceae. Strawberries (*Fragaria* sp.) Is one of many fruits consumed due to its rosy red color, sweet and sour taste, and various benefits (7). Strawberries have many health benefits to control high blood pressure, and the ability to prevent coronary heart disease (8). Strawberries are also used to whiten teeth. Besides having many vitamins and minerals, strawberries contain secondary metabolites like Ellagic acid which acts as a redox reagent in the bleaching process (9). It also contains malic acid which binds with calcium in the tooth enamel which has an impact on tooth erosion which will reduce the hardness of the tooth surface (10). Strawberry also contains pectin, a natural fiber which acts as a self cleaning agent for the tooth. It can help in cleaning the plaque on the tooth surface (11). Our team has extensive knowledge and research experience that has translated into high quality

publications
(12),(13),(14),(15),(16),(17),(18),(19),(20),(21),(22),(23),(24),(25),(26),(27),(28),(29),(30), (31)

. The present study is aimed to know whether strawberry has any effect on teeth discoloration and morphology.

MATERIALS AND METHODS:

The study was conducted in Saveetha Dental college in the laboratory of the biochemistry department. The strawberries were collected and aqueous extract was prepared. Extracted teeth were collected from the Oral and Maxillofacial surgery department. Non carious teeth were collected carefully, which were extracted due to periodontal reasons and the collected teeth were kept in a dry environment under room temperature. The teeth taken were measured according to buccal length, palatal length, buccal width, palatal width, mesial width and distal width using scale. Photographs were also taken to note the colour changes

Later the teeth were put separately in distilled water (n=6) and strawberry extract (n=6) and kept in a chilled environment. Measurements were taken every 24 hours for three days and the values were noted.

RESULTS:

The collected measurements of the teeth put in strawberry extract and distilled water were compared separately. There was no change in the measurement for both teeth as strawberry was a natural substance teeth undergo changes only after a long period of time,.and the erosive nature of malic acid can also be seen only after long periods of exposure to strawberry extract.

Figure 1: Buccal length

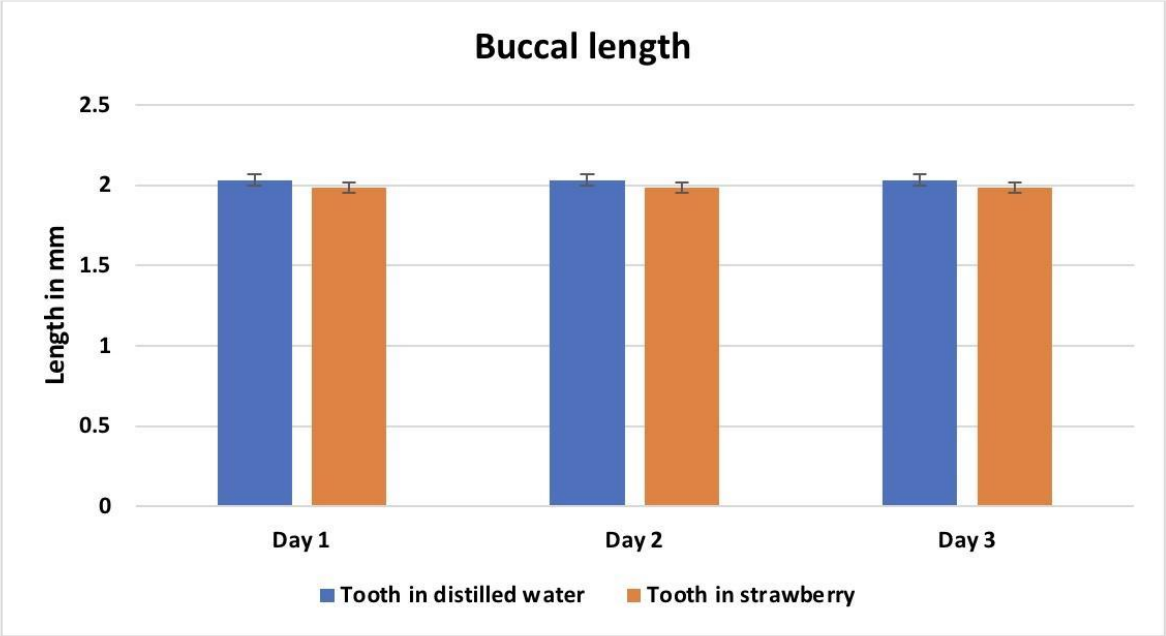

Figure1: The above graph shows the buccal length measurements of the tooth immersed in strawberry extract and distilled water. X-Axis represents the number of days the teeth are immersed and the Y-Axis represents the measurements of buccal length of teeth immersed in the strawberry extract and distilled water. Each bar represents a mean ± SEM of 6 independent observations.The mean value of the Buccal length of the tooth immersed in strawberry is 2cm and that of the tooth immersed in distilled water is 2.1cm. There observed no significant changes in the buccal length measurements of all the teeth during the 3 days.

Figure 2: Lingual length

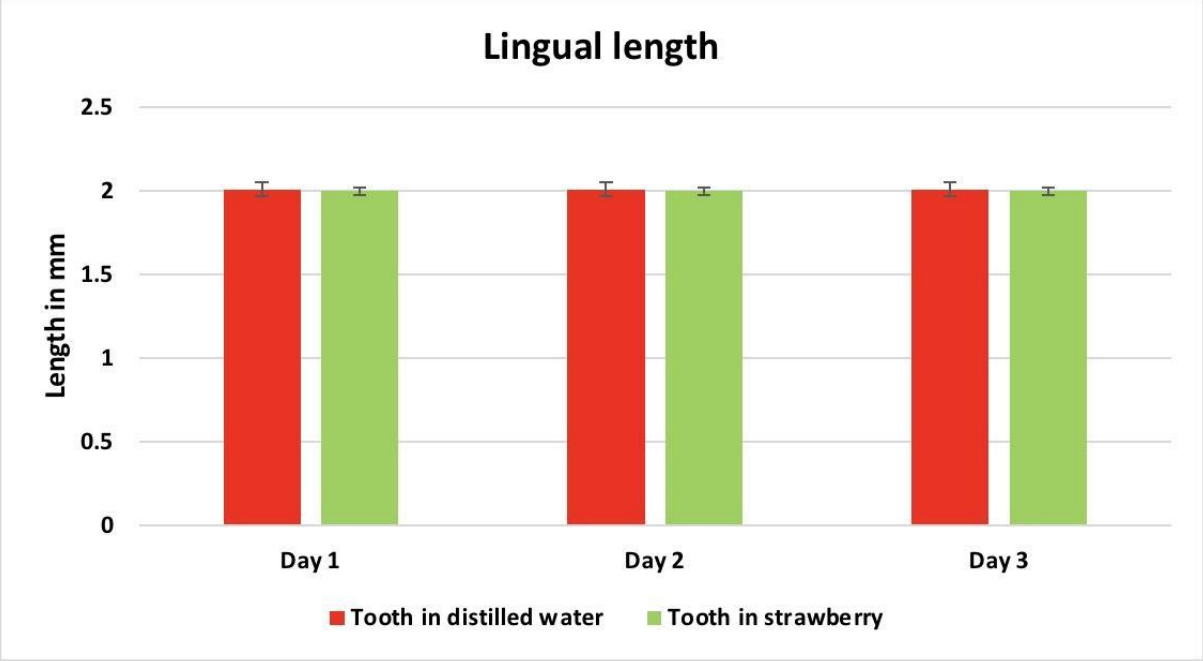

Figure2: The above graph shows the lingual length measurements of the tooth immersed in strawberry extract and distilled water. X-Axis represents the number of days the teeth immersed and the Y-Axis represents the measurements of the lingual length of teeth immersed in the strawberry extract and distilled water. Each bar represents a mean ± SEM of 6 independent observations. The Lingual length of the tooth immersed in strawberry is 2cm and that of the tooth immersed in distilled water is 1.95cm. There observed no significant changes in the lingual length measurements of all the teeth during the 3 days.

Figure 3: Buccal width

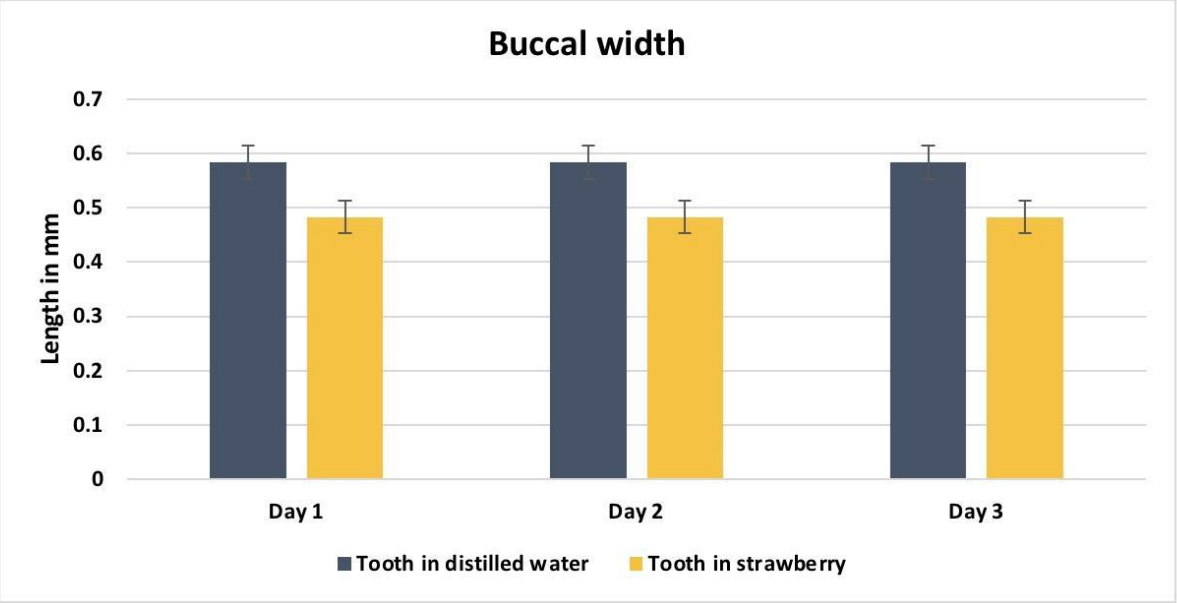

Figure3: The above graph shows the buccal width measurements of the tooth immersed in strawberry extract and distilled water. X-Axis represents the number of days the teeth immersed and the Y-Axis represents the measurements of the buccal width of teeth immersed in the strawberry extract and distilled water. Each bar represents a mean ± SEM of 6 independent observations. The mean value of theBuccal width of the tooth immersed in strawberry is 0.5cm and that of tooth immersed in distilled water is 0.5 cm.There observed no significant changes in the buccal width measurements of all the teeth during the 3 days.

Figure 4: Lingual width

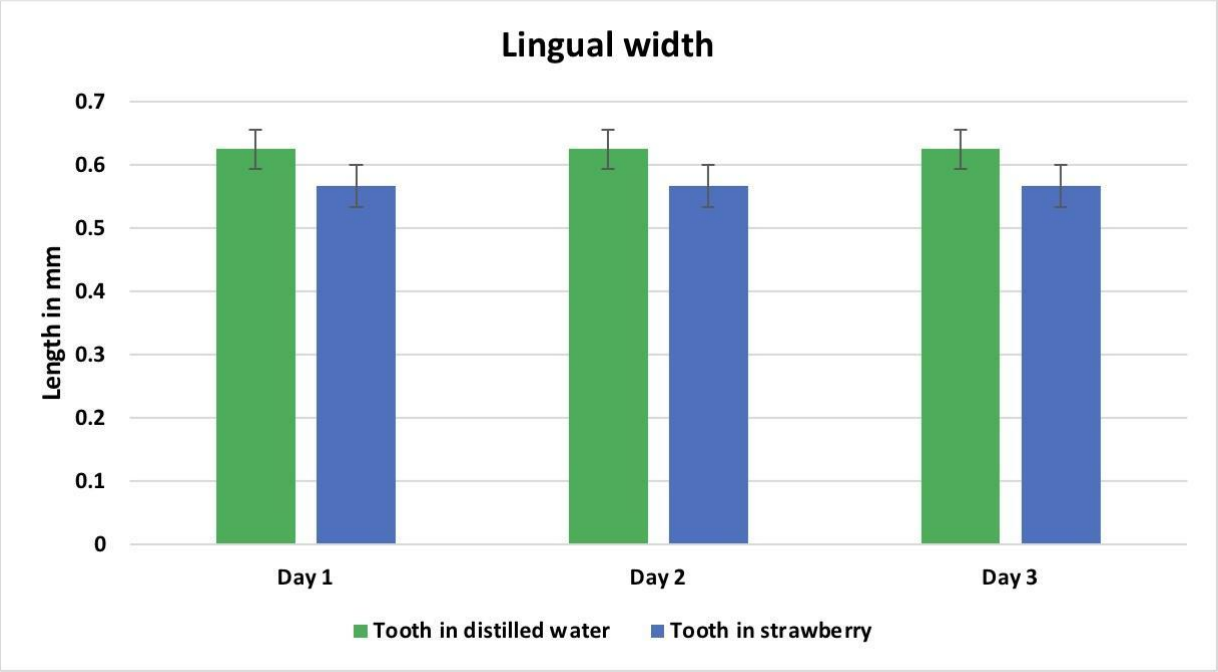

Figure4: The above graph shows the lingual width measurements of the tooth immersed in strawberry extract and distilled water. X-Axis represents the number of days the teeth immersed and the Y-Axis represents the measurements of the lingual width of teeth immersed in the strawberry extract and distilled water. Each bar represents a mean ± SEM of 6 independent observations. The mean value of theLingual width of the tooth immersed in strawberry is 0.5cm and that of the tooth immersed in distilled water is 0.55cm. There observed no significant changes in the lingual width measurements of all the teeth during the 3 days.

Figure 5: Mesial width

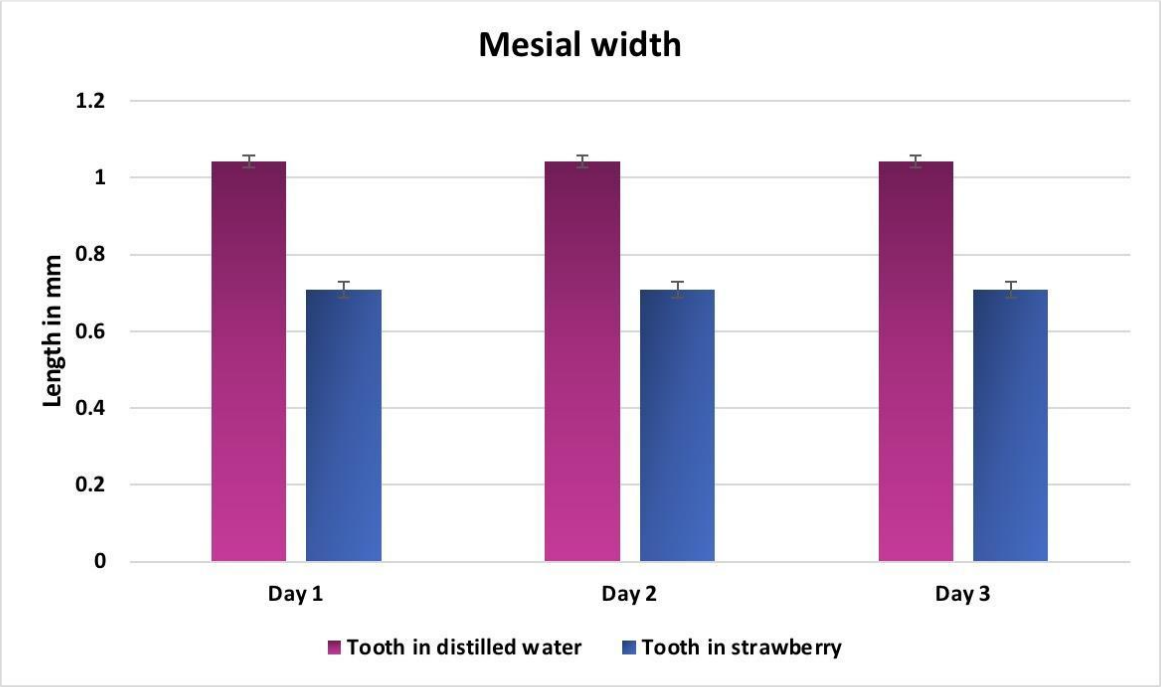

Figure5: The above graph shows the mesial width measurements of the tooth immersed in strawberry extract and distilled water. X-Axis represents the number of days the teeth immersed and the Y-Axis represents the measurements of the mesial width of teeth immersed in the strawberry extract and distilled water. Each bar represents a mean ± SEM of 6 independent observations. The mean value of the Mesial width of the tooth immersed in strawberry is 0.75cm and that of the tooth immersed in distilled water is 1.05cm.There observed no significant changes in the mesial width measurements of all the teeth during the 3 days.

Figure 6: Distal width

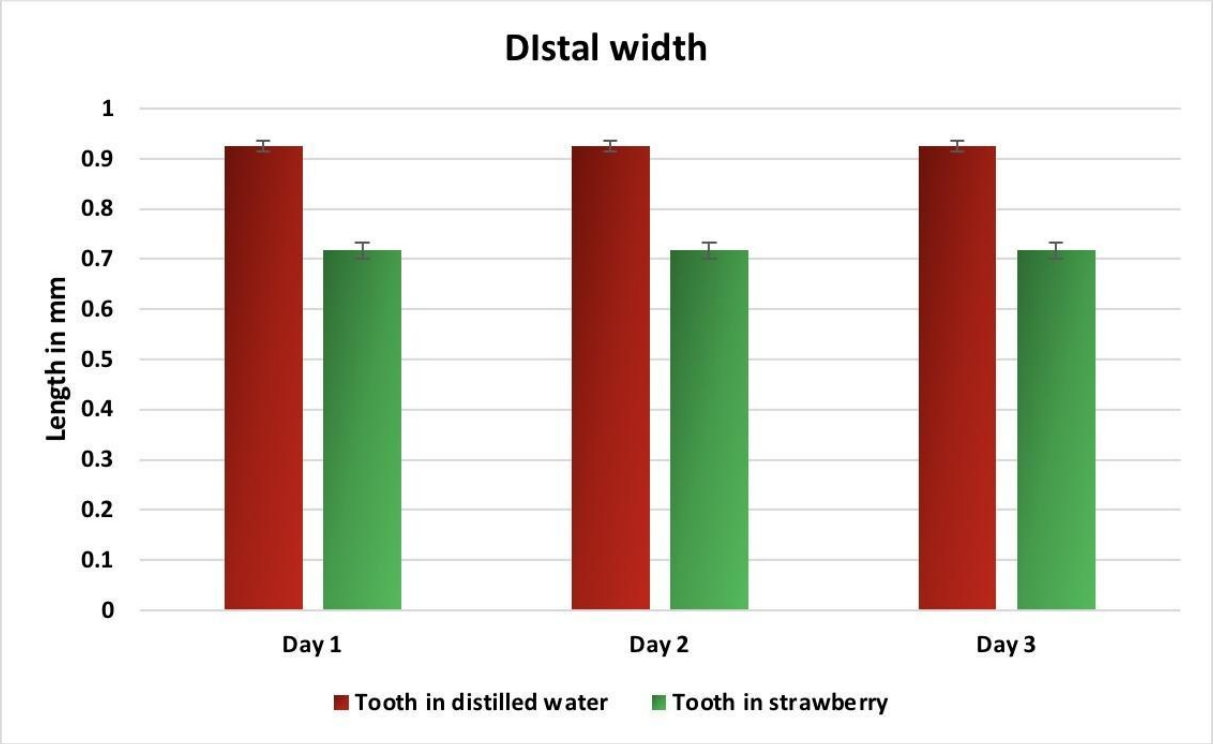

Figure6: The above graph shows the distal width measurements of the tooth immersed in strawberry extract and distilled water. X-Axis represents the number of days the teeth immersed and the Y-Axis represents the measurements of distal width of teeth immersed in the strawberry extract and distilled water. Each bar represents a mean ± SEM of 6 independent observations. The mean value of Distal width of the tooth immersed in strawberry is 0.75cm and that of the tooth immersed in distilled water is 0.95cm. There observed no significant changes in the distal width measurements of all the teeth during the 3 days.

Figure7: Tooth colour before placing in distilled water

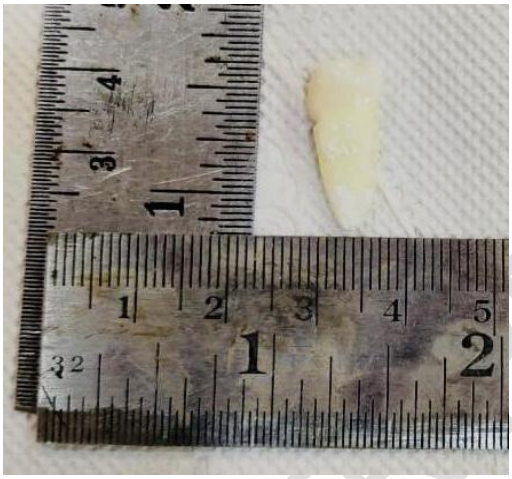

Figure 8: Tooth colour before placing in strawberry extract

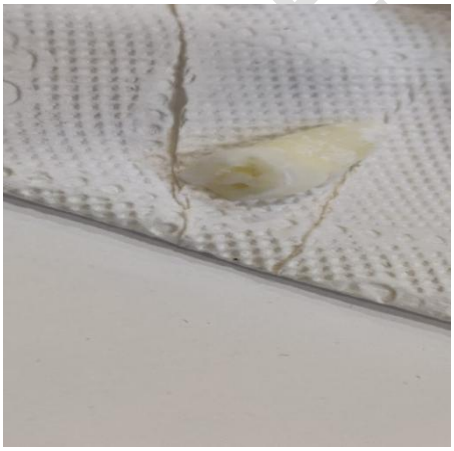

Figure 9: Tooth colour after 3 days of exposure in distilled water

Figure 10: Tooth colour after 3 days of exposure in strawberry extract

DISCUSSION:

Teeth whitening has been one of the most widely used aesthetics enhancing procedures in the field of dentistry (32). Studies indicated that strawberry juice effectively lightens tooth enamel colour after soaking it for 3 hours. It is proposed that high acidity of strawberry juice with pH value 3-4 is one of the factors involved in whitening of the teeth (10). From our study it was evident that there are no significant changes in the buccal width, mesial width, distal width, palatal width, palatal length and buccal length among the teeth immersed in strawberry extract in all the 3 days (Figure 1-6). Our study also indicated that the tooth does not show any detrimental changes when it is kept in strawberry extract for a duration of three days. The results of the present study also revealed that the extract did not show any changes in the tooth enamel as it was kept for limited number of days which is similar with another study done by Asmawathi et al in which the tooth enamel structure after the strawberry gel application found that there was no significant effect between the duration of application time and changes in tooth enamel structure (33). Another study (34)stated that rosella(hibiscus sabdariffa) contains bioactive saponins which bound the dye that was able to make the tooth colour become neutral and white.

The results of the study were consistent with the research conducted by Pramesti et al showed that strawberry consumption can remove stains caused by soda, wine and coffee. The natural tooth whitening can happen when consumed in proper time and concentration (35).

As enamel did not experience any erosive process until the pH value reached 5.5. This increase in PH is associated with enamel solubility resulting in dental erosion. Teeth whitening agents can

cause changes in the chemical structure as well as changes in the superficial texture of tooth enamel(10). In theory it can be said that enamel erosion is due to the acids present in the strawberry. Although Strawberry juice is used to whiten teeth, further research is required to study the effect in detail. Strawberry juice when exposed to teeth for a longer period of time shows a whitening effect due to its acidic properties, which act as a potent oxidising agent on the tooth's enamel surface(36). The results showed that strawberry is harmless to the teeth as there were no detrimental changes in tooth morphology and colour of the teeth.

Limitation:

Small sample size and less duration can be the limitations of the present study.

Future scope:

In the future the study can be expanded by increasing the sample size, duration of experiment and inclusion of other characteristics and chemical composition of strawberry extract to study the effect of it in detail.

CONCLUSION:

The tooth placed in strawberry extract did not show any changes in tooth morphology and tooth colour. Hence strawberries can be used in mouthwashes, and tooth pastes to maintain a good oral health.

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