RESEARCH
www.commprac.com
ISSN 1462 2815

EFFECTS OF DRIED MELON JUICE CONCENTRATE ON BOND STRENGTH OF BLEACHED ENAMEL

Vignesh P [1] and Dr. Vigneshwar T [2]

[1] Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai. Email: vpvignesh519@gmail.com
[2] Department of Conservative and Endodontics, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Chennai. Email: dr.vigneshwart@gmail.com

DOI: 10.5281/zenodo.10983480

Abstract

Objective: Compare 10% Sodium Ascorbate (SA) with Dried Melon in reducing the compromised bond strength of bleached enamel. **Materials and Methods:** Eight extracted human premolar teeth were randomly divided into four antioxidant groups. Bonding was done immediately or after a 14-day delay post-bleaching, thus making two subgroups for each group. A Universal testing machine was used to measure Shear bond strength (SBS). Statistical analysis involved one-way ANOVA with Tukey's post-hoc tests. **Results:** The shear bond strength measurements among three groups were compared. The highest SBS was obtained from the Melon extract group as opposed to those without antioxidants. **Conclusions:** Meanwhile, a 10% Melon extract can recover compromised bond strengths damaged by the bleaching process.

INTRODUCTION

Tooth bleaching has become one of the most popular esthetic dental treatments and also done to enhance a person's smile. It has been reported that the adhesion between the tooth surface and the bonding agent is hampered post bleaching. The contributing factor for this reduced bond strength has been attributed to the oxygen free radicals accountable for the whitening effect; they adversely influence the penetration of the bonding agent into the tooth surface and inhibit the complete polymerization of the bonding agent.(1–3) Methods proposed to reverse the compromised bond strength of the resin material to bleached enamel are delay of 24 h to four weeks, removal of superficial layer of enamel, treatment of the bleached enamel with alcohol before the restoration, (4,5)use of adhesives containing organic solvents, application of antioxidant agents before bonding the resin composite, and use of antioxidant incorporated bleaching agents.(6–8) Food lord's dried melon has many lovers among fans of tropical dried fruits. Dried melon has many health benefits, (9) it is an excellent source of antioxidants, vitamins and minerals, rich in beta carotene, an antioxidant that is converted to vitamin A as well as vitamin C in the body. (10)In addition, its nutritious phytonutrients help fight inflammation and stress.the present study is conducted with the aim to evaluate and compare the effects of 10% sodium ascorbate (SA) versus dried melon on the reversal of compromised bond strength of bleached enamel.(11–15)

MATERIALS AND METHODS

It is an in vitro study conducted at saveetha dental college, Chennai, India. Some 6-sound extracted natural teeth with intact enamel surfaces without pretreatment with chemicals and devoid of developmental defects were included in the study. (16)

Fractured teeth and teeth with dental caries, attrition, abrasion, erosion, and previously restored or endodontically treated teeth were excluded from the study. The teeth were cleaned to remove any residual tissue tags. The roots were amputated from the crowns at the cementoenamel junction using slow speed diamond disc under copious water spray. The teeth were then mounted in cold-cure acrylic resin using Teflon mold, with the labial surface facing upwards. Some 8 teeth were sampled as Group I (n=4) which served as the positive control group and did not receive any bleaching treatment. Remaining 8 teeth were equally divided into two groups, Group 2 with melon extract and Group 3 without antioxidants.

Bleaching procedure

Bleaching procedures were done by immersing the sample in 30% hydrogen peroxide for 20 min The bleaching agent was then completely rinsed off with water (Figure 1).

Preparation of solutions

Two solutions were prepared for this study:

1) 100 ml of melon extract was boiled till it comes to 10ml to make a 10% melon extract solution.
2) The samples were immersed in 10% Melon Extract solution for 10 min following the bleaching process and then the specimens were rinsed with distilled water and dried.

Bonding procedure

Bonding procedure All of the specimens were etched with 37% phosphoric acid gel for 15 s and then rinsed with water for 20 s and air dried for 5 s. Adhesive was then applied, gently air thinned, and light cured for 10 s.

A split-mold metal casing (3 mm in diameter and 5 mm in height) was used to maintain uniformity in composite build-up. The casing was placed on adhesive-applied enamel surfaces; composite was then filled into the hole in layers and each layer was light cured according to the manufacturer's instructions. After polymerization, mold was removed and specimens were placed in distilled water for 24 h.(Figure 1)

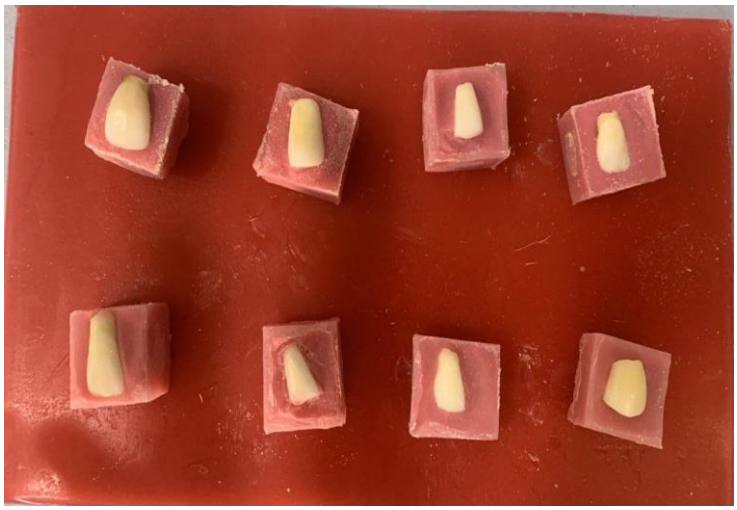

Figure 1

After 24 hours all specimens were tested for shear bond strength (SBS) in shear mode (using a steel knife edge shearing rod) using a Universal testing machine at a crosshead speed of 0.5 mm/min (Figure 2). SBS values were expressed in megapascal (MPa).

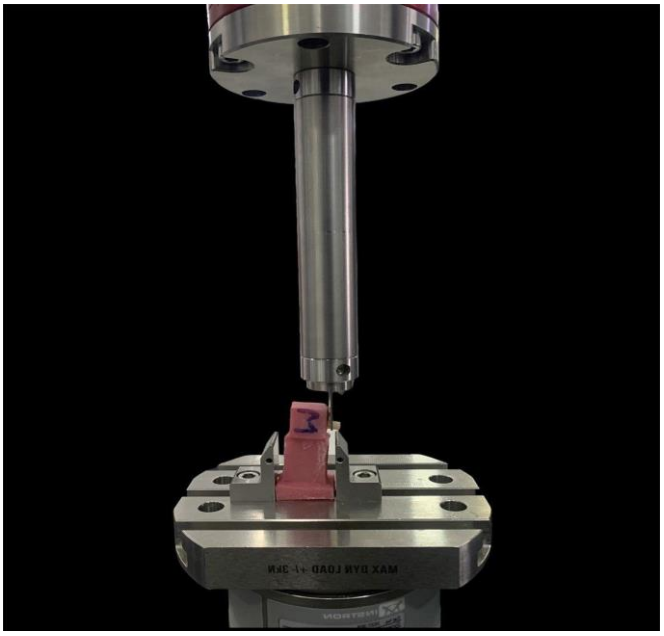

Figure 2

The data were subjected to parametric tests -- one way ANOVA (analysis of variance) for multiple group comparison of SBS followed by Tukey's post-hoc test for group wise comparison depending on the normality of data and p-value (<0.05) was considered statistically significant.

RESULTS

The mean shear bond strength measurements, expressed in MPa, revealed notable differences among the three groups. The control group exhibited a mean shear bond strength of 10.45 MPa, with a standard deviation of 0.6695, indicating relatively high bond strength. In comparison, the dried melon extract group demonstrated a lower mean shear bond strength of 6.7075 MPa, accompanied by a standard deviation of 0.9569. Conversely, the group with no antioxidants displayed the lowest mean shear bond strength of 5.065 MPa, with a standard deviation of 0.6763. These results suggest that bleaching without any antioxidant intervention yielded the highest bond strength, followed by the dried melon extract group, and finally, the group with no antioxidants.

Also, the groupwise comparison of significance levels showed important insights. The p-value of 0.9 for the comparison between the control and dried melon extract groups indicates that both have similar bond strength. It means that using dried melon extract did not essentially change bond strength compared to the control. However, contrasting p-values of 0.208377 and 0.19668 indicate substantial differences in bond strength between these three groups: control versus no antioxidants; dried melon extract versus no antioxidants respectively. Therefore, both control and dry melon extracts showed significantly higher bond strength than no antioxidants group. In conclusion, these findings demonstrate how dry melon extracts may be used to restore

weakened bonds following bleaching, but more research needs to be conducted so as to clarify its efficacy against other antioxidant interventions too.

The SBS measurements were compared among the four groups including the subgroups and are shown in (Figure 3).

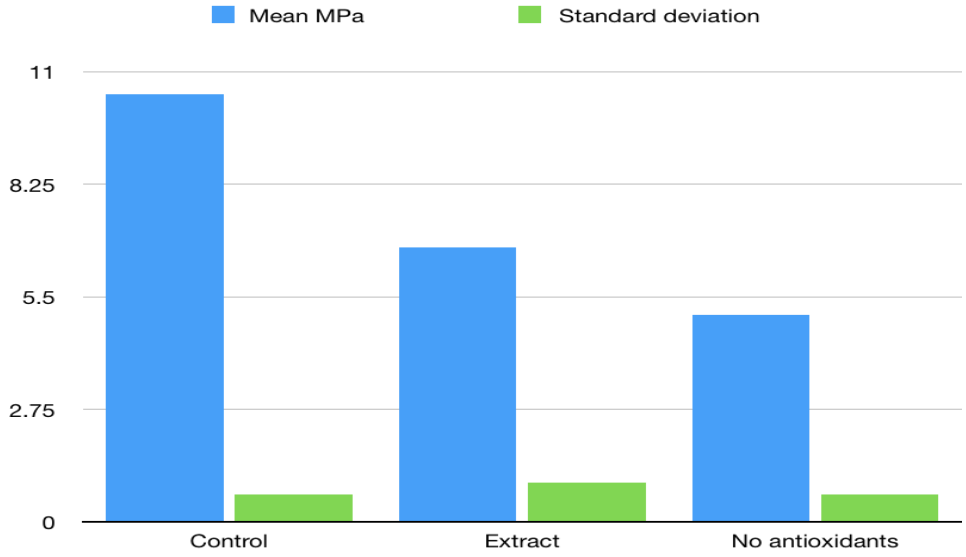

Figure 3: Comparison of mean shear bond strength (MPa)

The shear bond strength was highest in the control group without any application of bleaching agents and lowest in the no antioxidants group. A statistically significant difference was found between the Extract group and no antioxidants group. (Table 1). Comparison of the highest mean value of SBS was recorded by the Control group in the order of Group 1 > Group 2 > Group 3. However, the difference between the Extract groups was statistically insignificant.

Table 1: Comparison of mean shear bond strength (MPa)

Groups	Mean MPa	Standard deviation
Control	10.45	0.6695
Extract	6.7075	0.9569
No antioxidants	5.065	0.6763

Table 2: Inter-group comparison of level of significance.

Inter-group comparison	p-value
Control vs extract	0.9
Control vs antioxidants	0.208377
Extract vs antioxidants	0.19668

DISCUSSION

Our results proved a decrease in SBS of composite resin to enamel after bleaching without any antioxidants and SBS is highest in Extract group compared to no antioxidants group.(17)

Many studies have shown that the inclusion of peroxide ions may be reversed by the use of SA as an antioxidant. (18)Hence in this study, 10% solution of SA with application time of 10 min was preferred to be adequate for clinical application of the antioxidant in solution form.(19–23)

Etched appearance of enamel surfaces after ascorbic acid usage in bleached enamel specimens demonstrated super etching of the already bleached enamel surface under scanning electron microscope (SEM). (24,25)Despite the wide-spread application of SA as an antioxidant, Savadi et al. showed that the cumulative effect of SA and bleached material may lead to increased retention of pathogenic microorganisms in enamel surfaces. Usage of flavonoid-rich melon with proanthocyanidins as antioxidants presents as a viable alternative.

Treatment with 10% melon solution enhanced the bond strength of bleached enamel when compared to the bleached group not treated with any antioxidants, both when bonding was performed immediately and after storage in distilled water for two weeks following bleaching.

CONCLUSION

In our findings 10% Melon extract has proven to be superior compared to no antioxidants reversing the bond strength of composite resin to bleached enamel. We conclude that 10% Melon solution can also be used as a viable antioxidant in the reversal of compromised bond strength of bleached enamel. Future studies are required to authenticate our observations.

Reference

1) Dentistry. External tooth bleaching products [Internet]. Available from: http://dx.doi.org/10.3403/30168912u

2) Cracked.com. The De-Textbook: The Stuff You Didn't Know About the Stuff You Thought You Knew. Penguin; 2013. 225 p.

3) Felicita AS. Quantification of intrusive/retraction force and moment generated during en-masse retraction of maxillary anterior teeth using mini-implants: A conceptual approach. Dental Press J Orthod. 2017 Sep;22(5):47–55.

4) [No title] [Internet]. [cited 2024 Apr 12]. Available from: http://paperpile.com/b/JaEBE6/S2OTG

5) [No title] [Internet]. [cited 2024 Apr 12]. Available from: http://paperpile.com/b/JaEBE6/e7BB5

6) Jafari S, Meimanatabadi M. New generation of nanozyme based-tooth bleaching gel with dual effect: tooth whitening and enamel microhardness improving [Internet]. Available from: http://dx.doi.org/10.21203/rs.3.rs-1627486/v1

7) Liu JYC. Safety and Effectiveness of Tooth Whitening by In-office Vital Tooth Bleaching. 2001. 323 p.

8) Millar B. Comparison of Tooth Bleaching Results [Internet]. Tooth Whitening Techniques. 2017. p. 271–83. Available from: http://dx.doi.org/10.1201/9781315365503-18

9) [No title] [Internet]. [cited 2024 Apr 12]. Available from: http://paperpile.com/b/JaEBE6/WaMHu

10) [No title] [Internet]. [cited 2024 Apr 12]. Available from: http://paperpile.com/b/JaEBE6/uA3KU

11) Jain AR. Prevalence of Partial Edentulousness and Treatment needs in Rural Population of South India [Internet]. Vol. 8, World Journal of Dentistry. 2017. p. 213–7. Available from: http://dx.doi.org/10.5005/jp-journals-10015-1440

12) Patturaja K, Pradeep D. Awareness of Basic Dental Procedure among General Population [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1349. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00258.4

13) Rajapakse R. Inflammatory Bowel Disease: Pathogenesis, Diagnosis and Management. Springer Nature; 2021. 362 p.

14) Sivamurthy G, Sundari S. Stress distribution patterns at mini-implant site during retraction and intrusion—a three-dimensional finite element study [Internet]. Vol. 17, Progress in Orthodontics. 2016. Available from: http://dx.doi.org/10.1186/s40510-016-0117-1

15) Kumar MS, Vamsi G, Sripriya R, Sehgal PK. Expression of matrix metalloproteinases (MMP-8 and -9) in chronic periodontitis patients with and without diabetes mellitus. J Periodontol. 2006 Nov;77(11):1803–8.

16) Muthukrishnan L. Imminent antimicrobial bioink deploying cellulose, alginate, EPS and synthetic polymers for 3D bioprinting of tissue constructs. Carbohydr Polym. 2021 May 15;260:117774.

17) Azeem RA, Sureshbabu NM. Clinical performance of direct versus indirect composite restorations in posterior teeth: A systematic review. J Conserv Dent. 2018 Jan;21(1):2–9.

18) Krishnan V, Lakshmi T. Bioglass: A novel biocompatible innovation. J Adv Pharm Technol Res. 2013 Apr;4(2):78–83.

19) Sekar D, Lakshmanan G, Mani P, Biruntha M. Methylation-dependent circulating microRNA 510 in preeclampsia patients [Internet]. Vol. 42, Hypertension Research. 2019. p. 1647–8. Available from: http://dx.doi.org/10.1038/s41440-019-0269-8

20) Felicita AS, Chandrasekar S, Shanthasundari KK. Determination of craniofacial relation among the subethnic Indian population: a modified approach - (Sagittal relation). Indian J Dent Res. 2012 May;23(3):305–12.

21) Neelakantan P, Subbarao C, Subbarao CV, De-Deus G, Zehnder M. The impact of root dentine conditioning on sealing ability and push-out bond strength of an epoxy resin root canal sealer. Int Endod J. 2011 Jun;44(6):491–8.

22) Jain RK, Kumar SP, Manjula WS. Comparison of intrusion effects on maxillary incisors among mini implant anchorage, j-hook headgear and utility arch. J Clin Diagn Res. 2014 Jul;8(7):ZC21–4.

23) Johnson J, Lakshmanan G, Biruntha M, Vidhyavathi RM, Kalimuthu K, Sekar D. Computational identification of MiRNA-7110 from pulmonary arterial hypertension (PAH) ESTs: a new microRNA that links diabetes and PAH [Internet]. Vol. 43, Hypertension Research. 2020. p. 360–2. Available from: http://dx.doi.org/10.1038/s41440-019-0369-5

24) Keerthana B, Thenmozhi MS. Occurrence of foramen of huschke and its clinical significance [Internet]. Vol. 9, Research Journal of Pharmacy and Technology. 2016. p. 1835. Available from: http://dx.doi.org/10.5958/0974-360x.2016.00373.5

25) Lakshmi T, Krishnan V, Rajendran R, Madhusudhanan N. Azadirachta indica : A herbal panacea in dentistry - An update [Internet]. Vol. 9, Pharmacognosy Reviews. 2015. p. 41. Available from: http://dx.doi.org/10.4103/0973-7847.156337