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COMPARATIVE EVALUATION OF BOND STRENGTH OF TOTALETCH AND SELF ETCH BONDING SYSTEMS TO BLEACHED ANTIOXIDANT TREATED ENAMEL – AN INVITRO STUDY

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ABSTRACT

Aim: The aim of this study was to evaluate and compare the bond strength of fifth generation bonding agent and eighth generation bonding agent onto bleached enamel and antioxidant treated enamel following in office bleaching. **Materials and Methods:** 30 human maxillary central incisors will be randomly divided into3 groups (n=10) **Group 1: (control):** No bleaching, no antioxidants. **Group 2:** Bleaching only, no antioxidants**Group 3:** Bleaching and antioxidant treatment. Each group will be divided into subgroups(n=5) **Subgroups A:** Bonding done with fifth generation bonding agent(Tetric Econom Bond) **Subgroup B:** Bonding done with eighth generation bonding agent(Tetric N Bond Universal). Labial surfaces of specimens in group 2 & 3 will be bleached using 35 % hydrogen peroxide gel for 30 mins. The green tea extract antioxidant solution will be applied on the prepared enamel surface in group 3 using an applicator brush. Enamel surfaces of subgroup Awill be etched with 37% phosphoric acid (3M ESPE Scotchbond multipurpose) for 15 secs.2-3 generous coats of bonding agent were applied onto all enamel surfaces with a microbrush applicator for 20 seconds, air dried for5 seconds and light cured for 10 seconds. Composite will be packed into teflon mold, using incremental technique and cured. Each specimen will be loaded in universal testing machine for shear bond strength testing. **Results:** Data were analysed using Kruskal Wallis tests and Mann Whitney U tests. Significant differenceswere found between all groups; group 3 showing the highest bond strengths. There were no significant differences between the sub-groups. **Clinical Significance**: Bond strength of bleached enamel can be improved by antioxidant treatment and newer bonding systems.

KEYWORDS: Bleaching, Antioxidants, Bonding Agents, Green tea extract.

INTRODUCTION

The increase in the demand for minimally invasive dentistry resulted in widespread practice of vital tooth bleaching, as it is considered as a safe, popular, conservative and well accepted treatment option for discolored teeth. This procedure should be combined with tooth colored restorative procedures in most cases to achieve optimal esthetic results.[1] Bleaching process transitionally reduces enamel and dentin bond strength when immediate bonding is performed after bleaching.[3] This decreased bond strength is due to the presence of oxygen ions which interfere with polymerization of the resin bonding agent. One of the methods to enable immediate bonding after bleaching procedures is to apply antioxidative agents. Green tea is an antioxidative agent which is extracted from camellia plant, contains several catechin compounds. Catechins are chemical antioxidants, which have the capacity to destroy free radicals. Epigallocatechin gallate (EGCG) is the most active and abundant catechin in green tea.[1] The bonding of composite resin can be carried out with the total etch system, which is a two-step system, where the surface is first treated with phosphoric acid which opens the dentinal tubules, allowing for better penetration of the applied adhesive. In contrast, the self- etch adhesive system is a one-step system, enabling smaller chair time.[4] They eliminate the risk of promoting the collapse of collagen fibers, but the use of weak acids may prevent the adequate penetration of bonding agent.[7]So the aim of the study was to evaluate and compare the bond strength of fifth generation bonding agent and eighth generation bonding agent on bleached enamel and antioxidant

treated bleached enamel.

MATERIALS AND METHODS

Specimen preparation

30 human maxillary central incisor teeth, extracted for periodontal reasons will be collected. After extraction all teeth will be cleaned with distilled water and stored in saline until mounting. Self-cure acrylic resin blocks of 15mm diameter and 25mm height will be made using a mold and root of each specimen will be embedded in the resin block till cemento-enamel junction, when it is soft, keeping only the coronal portion exposed. Labialsurfaces of all the specimens will be flattened with 600 grit silicon carbide paper. It will be ensured that the enamel surfaces are intact and no dentin is exposed. Specimens will be randomly divided into 3 groups. **Group 1 (control):** . The samples will be etched, rinsed and bonded, followed by composite buildup using teflon mold without bleaching and application of antioxidant solution **Group 2:** The samples will be etched, rinsed and bonded, followed by composite buildup using teflon mold after bleaching **Group 3:** The samples will be etched, rinsed and bonded, followed by composite buildup using teflon mold after bleaching and application of antioxidant solution immediately. Each group will be divided into 2 subgroups **Subgroup A:** Bonding was done with fifth generation bonding agent **Subgroup B**: Bonding was done with eighth generation bonding agent.

Bleaching procedure

Labial surfaces of specimens in group 2 & 3 will be bleached using 35 % hydrogen peroxide gel (Pola Office) according to the manufacturer's instructions for 30 mins. Then the specimens will be rinsed with distilled water and air dried.

Preparation of antioxidant solution

50 g of green tea extract powder (Nutrija products, India) was dissolved in 1 litre of distilled water to obtain 5 % of green tea extract**.** Antioxidant solution will be applied on the enamel surface of each specimens in group 3 using an applicator brush and after 10 mins it will be rinsed with distilled water and air dried.

Bonding and restorative procedure

Subgroup A- 5th generation adhesive: The samples were etched with 37% phosphoric acid (total etch etching gel, 3M ESPE Scotchbond multipurpose) etchant for 30 seconds, rinsed for 15 seconds and dried with gentle air stream. 2-3 generous coats of 5th generation bonding agent (Tetric Econom Bond) were applied on the enamel surface with a microbrush applicator for 20 seconds and air dried for 5 seconds. The surfaces were then lightcured for 10 seconds.

Subgroup B- 8th generation adhesive: The samples were rinsed; 2-3 generous coats of eighth generation bonding agent (Tetric N Universal) were applied on the enamel surface with a microbrush applicator for 20 seconds and air dried for 5 seconds. The surfaces were then light cured for 10 seconds.

Composite will be packed in increments using a teflon mold of 3mm diameter and 5mm height placed at the center of the enamel surface and cured. Then the mold will be gently removed. All the specimens will be stored in distilled water until testing procedure (within 3hrs).

Shear Bond Strength Analysis

Each specimen will be loaded in universal testing machine for shear bond strength testing. Force will be applied parallel to the long axis of the tooth at the junction between the composite and enamel interface. The shear bond strength will be measured in shear mode ata crosshead speed of 0.5mm/min until fracture occurs.

RESULTS

Statistical analysis was done using Krusukal Wallis and Mann Whitney U tests. Highest shear bond strength was found in control group or Group 1B (25.55) followed by Group3 B (24.948) Group 1 A (17.468) Group 3A(16.298) Group2 B (15.61) Group 2A (12.74) There was significant reduction in shear bond strength after bleaching in both the subgroups of group 2. Between two bonding agents eighth generation bonding agent showed higher shear bond strength than fifth generation bonding agent in all groups. For both the adhesive agents used, only group B (bleached group) showed significantly decreased bond strength compared to other groups. There was no significant difference between the unbleached (control) group and the antioxidant treated group for both the adhesive agents. Also, the bond strengths of self-etch adhesive (subgroup B) were higher than total-etch adhesive (subgroupA) in all groups as shown in Table 1 and 2.

Table I: Shear bond strength in MPa.

SHEAR BOND STRENGTH in MPa				
GROUP	**N**	**Mean**	**Std. Deviation**	**p**
1A	5	17.4680	1.48009	<0.001*
1B	5	25.8580	1.48385	
2A	5	12.7400	.85466	
2B	5	15.6100	1.04838	
3A	5	16.2980	1.46785	
3B	5	24.9480	1.71916	

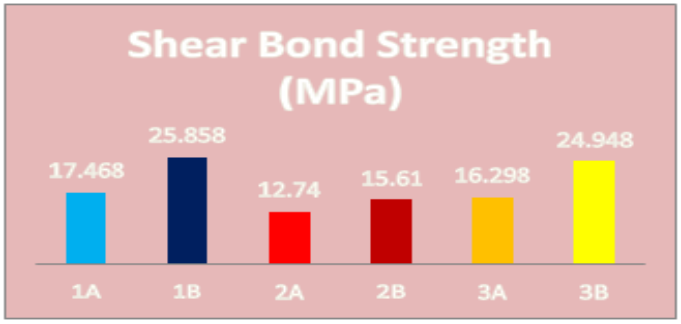

Table II: Pair wise comparison between sub groups.

Pair wise Comparisons			
REFERENCEGROUP	**COMPARISON GROUP**	**Mean Difference**	**p**
1A	1B	-8.39000	0.009*
	2A	4.72800	0.009*
	2B	1.85800	0.117
	3A	1.17000	0.251
	3B	-7.48000	0.009*
1B	2A	13.11800	0.009*
	2B	10.24800*	0.009*
	3A	9.56000	0.009*
	3B	0.91000	0.602
2A	2B	-2.87000	0.009*
	3A	-3.55800	0.009*
	3B	-12.20800	0.009*
2B	3A	-0.68800	0.295
	3B	-9.33800	0.009*
3A	3B	-8.65000	0.009*

DISCUSSION

Tooth bleaching is an esthetic treatment modality which is a non-invasive, conservative procedure and is relatively easy to carry out. It has been observed that there is decrease in bond strength of composite if restoration is done immediately after bleaching. So to overcome this, it has been suggested to delay the bonding for 24 hours to 4 weeks. The use ofantioxidants is an alternative to regain the bond strength immediately.

Discoloration can be extrinsic, intrinsic or combination of both.[9] A 35% concentration of Hydrogen Peroxide is recommended by many clinicians for in- office dental bleaching.[11] Higher concentration bleaching agents can produce more peroxide radicals for bleaching, resulting in a faster whitening process. Therefore in this study in office bleaching with 35% hydrogen peroxide was done.[12]

In bleached specimens large area of enamel surface were free of resin & when tags were present they were fragmented, poorly defined and penetrated to lesser depth than unbleached controls.[10] They also displayed a granular & porous surface with a gaseous bubbled appearance due to entrapment of peroxide in the sub surface layer of enamel.[13] In the present study, immediate bond strength to bleached enamel i.e. Group A in all sub-groups was significantly reduced compared to group B. Delayed bonding by immersion of bleached specimens in distilled water or artificial saliva results in complete reversal of reduced bond strengths due to dissolution of entrapped oxygen but after a prolonged time period of 1-2 weeks.[14,15] The use of alcohol based bonding agents with bleached enamel might be able to minimize the inhibitory effect of bleaching process as the acetone in dentin adhesives displaces surface water containing oxygen.[16-18]

The duration of EGCG application did not result in significant differences in shear bond strength values, indicating that this material can provide sufficient antioxidative effect in at least 10 minutes, therefore antioxidant was applied for 10 minutes in this study.[18] There is nostatistically significant difference among the different forms of antioxidant 10% sodium ascorbate used (solution and gel). The differences are in the flow ability and the time of application, where the gel form is more convenient in application but the solution form requires less time to work. In clinical conditions, applying the solution form is difficult because of its high flow ability and it requires continuous application, especially if application to more than one tooth is required.[19]Antioxidants are economic, natural, nontoxic and biocompatible product. In this study, green tea extract was used. The green extract showed slightly higher SBS than grape seed extract.[20,21]

Bonding to enamel surface relies on resin tag formation in etched enamel to create micro-mechanical interlocking where the unfilled phase of resin system penetrates and polymerizes in enamel irregularities. The self-etching primer systems are developed to provide shortened bonding procedures, as well as sufficient bonding ability to both enamel and dentin. The self-etch adhesive system is a one-step system, enabling smaller chair time and eliminating the risk of promoting the collapse of collagen fibers.[22] Among functional monomers used in contemporary dental adhesives, 10-methacryloyloxydecyl dihydrogen phosphate (MDP) has been found to interact chemically with hydroxyapatite most intensively and stably. Thiseffect was thought to be the basis of the superior bonding effectiveness of MDP-based self- etch adhesives to dentin. Cross-linking monomers provide most of the mechanical strengthand eighth generation bonding agent contain micro sized cross linking functional monomers therefore, there is a potential for higher bond strength than any other generations.[23,24] According to results of our study eighth generation bonding agent is showing higher shear bond strength than fifth generation bonding agent due to reduction of a number of application steps which inturn reduces manipulation time, and abate technique sensitivity, thus improving bonding effectiveness. This trend in adhesive dentistry has led to the introduction of eighth generation adhesives, of which the one-step self-etch adhesives or the so-called all-in-one adhesives are the most user-friendly adhesive systems nowadays in the market.[26] The invitro design of the study and the absence of complete accommodation of the results to the clinical condition with few samples are the limitations encountered in this study.

CONCLUSION

From the results of the study it can be concluded that

1. Bleached enamel showed lower bond strength compared to control group with alladhesives
2. Green tea extract treatment showed significant improvement in the bond strength on bleached enamel for both subgroups.
3. Total-etching adhesive showed significantly lower bond strength compared to theirrespective self-etch sub groups.

REFERENCES

1. Shah V, Patel M, Bhavsar B. An in vitro comparative evaluation of various newer bonding agents on bond strength of bleached enamel treated with an antioxidant. IOSR-JDMS, 2018; 17: 50-3.
2. Sachdeva B, Dua P, Mangla R, Kaur H, Rana S, Butail A. Bonding efficacy of 5th, 6th, 7th & 8th generation bonding agents on primary teeth. Int J Dent Med Sci, 2018; 17: 61.
3. Kaya AD, Türkün M. Reversal of dentin bonding to bleached teeth. Oper Dent, 2003 Nov-Dec; 28(6): 825-9.
4. Lai SC, Mak YF, Cheung GS, Osorio R, Toledano M, Carvalho RM, Tay FR, Pashley DH. Reversal of Compromised Bonding to Oxidized Etched Dentin. J Dent Res, 2001 Oct; 80(10): 1919-24.
5. Josey AL, Meyers IA, Romaniuk K, Symons AL. The effect of vital bleaching technique on enamel surface morphology and bonding of composite resin to enamel. J Oral Rehab, 1996; 23: 244-50.
6. Unlu, N., Cobankara, F. K. and Ozer, F. Effect of elapsed time following bleaching on the shear bond strength of composite resin to enamel. (2008). J. Biomed. Mater. Res, 84B: 363–368
7. Joseph P, Yadav C, Sathesh K, Rahna R. Comparative evaluation of the bonding efficacy of sixth, seventh and eighth generation bonding agents : An In Vitro Study. Int Res J Pharm, 2013; 4: 141-143.
8. Kamble SS, Kandasamy B, Thillaigovindan R, Goyal NK, Talukdar P, Seal M. In vitro Comparative evaluation of tensile bond strength of 6 th , 7 th and 8 th generation dentin bonding agents. J Int Oral Health, 2015; 7: 41–43.
9. Hattab FN, Qudeimat MA, AL-RIMAWI HS. Dental discoloration: an overview. Journal of Esthetic and Restorative Dentistry, 1999; 11(6): 291-310.
10. Titley, K.C. et al. Adhesion of a resin composite to bleached and unbleached human enamel. J Endod, 1993; 19(3): 112-115.
11. Langsten, R.E., Dunn, W.J., Hartup, G.R., Murchison, D.F. Higher-concentration carbamide peroxide effects on surface roughness of composites. J. Esthet. Restor. Dent, 2002; 14: 92–96.
12. Tabatabaei SH, Sehatpour A, Abedinejad MS, Oliadarani FK. Effect of Pepsi and 40 Hydrogen Peroxide on Microhardness of Amaris Composite Resin: An In Vitro Experimental Study. Journal of Research in Medical and Dental Science, 2018; 6(2): 222-6.
13. Kaya AD, Türkün M. Reversal of dentin bonding to bleached teeth. Oper Dent, 2003 Nov-Dec; 28(6): 825-9.
14. Josey AL, Meyers IA, Romaniuk K, Symons AL. The effect of vital bleaching technique on enamel surface morphology and bonding of composite resin to enamel. J Oral Rehab, 1996; 23: 244-50.
15. Unlu, N., Cobankara, F. K. and Ozer, F. Effect of elapsed time following bleaching on the shear bond strength of composite resin to enamel. (2008). J. Biomed. Mater. Res, 84B: 363–368.
16. Sung EC, Chan SM, Mito R, Kaputo AA. Effect of carbamide peroxide bleaching on the shear bond-strength of composite to dental-bonding agent enhanced enamel. J Prosthet Dent, 1999 Nov; 82(5): 595-9.
17. Niat AB, Yazdi FM, Koohestanian N. Effects of drying agents on bond strength of etch-and-rinse adhesive systems to enamel immediately after bleaching. J Adhes Dent, 2012 Dec; 14(6): 511-6.
18. Khamverdi Z, Rezaei-Soufi L, Kasraei S, Ronasi N,

Rostami S. Effect of Epigallocatechin Gallate on shear bond strength of composite resin to bleached enamel: an in vitro study. Restorative dentistry & endodontics, 2013 Nov 1; 38(4): 241 7.
19. Awdah AS, Habdan HA, Muhaisen NA, Khalifah RA. The Effect of Different Forms of Antioxidant Surface Treatment on the Shear Bond Strength of Composite Restorations to Bonded to Office-Bleached Enamel. Research & Reviews: Journal of Dental Sciences, 2016; 4: 5-11.
20. Farahnaz Sharafeddin, Mehran Motamedi and Shiva Modiri. Effect of Immediate Application of Pomegranate Peel, Grape Seed and Green Tea Extracts on Composite Shear Bond Strength of In-Office Bleached Enamel. Research Journal of Biological Sciences, 2013; 8(3): 83-87.
21. Berger SB, De Souza Carreira RP, Guiraldo RD, Lopes MB, Pavan S, Giannini M, Bedran-Russo AK. Can green tea be used to reverse compromised bond strength after bleaching?.Eur J Oral Sci, 2013; 121: 377–381.
22. Evangelista Souza-Gabriel, Aline, Marchesan, Melissa Andrea, BonattoBruniera, João Felipe. Influence of the bleaching agent and adhesive system on the bond strength of the restorative material to intracoronary dentin. RSBO, july-sept 2012; 9(3): 303- 308.
23. Fukegawa D, Hayakawa S, Yoshida Y, Suzuki K, Osaka A, Meerbeek VB. Chemical interaction of phosphoric acid ester with hydroxyapatite. J Dent Res, 2006; 85: 941-944.
24. Nair M, Paul J, Kumar S, Chakravarthy Y, Krishna V, Prasad S. Comparative evaluation of the bonding efficacy of sixth and seventh generation bonding agents: An *In-Vitro* study. J Conserv Dent, 2014; 17(1): 27–30.
25. Joseph P, Yadav C, Sathseesh K, Rahna R. Comparative evaluation of bonding efficacy of sixth, seventh and eighth generation bonding agents : An In Vitro Study. Int Res J Pharm, 2013; 4(9): 143-147.
26. Dey S, Shenoy A, Kundapur SS, Das M, Gunwal M, Bhattacharya R. Evaluation of the effect of different contaminants on the shear bond strength of a two-step self-etch adhesive system, one-step, self-etch adhesive system and a total-etch adhesive system. J Int Oral Health, 2016; 8(3): 1.