

## The Effect of Sodium Ascorbate on Strength of Shear Bond of Two Dentin Adhesive Systems

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**Abstract:** Sodium hypochlorite is a non-selective proteolytic agent that removes the dentin effectively. This study was performed to evaluate the effect of sodium ascorbate on strength of shear bond of two dentin adhesive systems. Sixty human premolar teeth were selected and the enamel was removed to prepare a dentin cylinder. Then the teeth were randomly divided into six groups; two fifth (Excite) and sixth (Clearfil SE Bond) generations of dentin adhesive systems each one were used in three situations including control, sodium hypochlorite, and hypochlorite and then sodium ascorbate and filled by composite resin and then the strength of shear bond of samples was measured according to megapascal and then the results were analyzed by T, ANOVA, and Tukey-HSD tests. The mean strength was 4.617, 1.280, 5.3810, 10.1090, 3.5560, and 11.5830 megapascals in groups 1, 2, 3, 4, 5, and 6, respectively. The most and the least strength of bonds was related to group 6 (Excite+ Naocl+Ana) and group 2 (Clearfil SE Bond+Naocl), respectively. The strength of bond in group 6 was significantly less than groups 1 ( $P < 0.001$ ), 2 ( $P < 0.001$ ), 3 ( $P=0.002$ ), and 5 ( $P < 0.001$ ). The strength of bond in group 2 was significantly less than groups 4 ( $P < 0.0001$ ), and 6 ( $P < 0.0001$ ). Use of sodium ascorbate after sodium hypochlorite would result in increased strength of composite bond and dentin after use of two dentin adhesive systems of fifth and sixth generations.

**Keywords:** Strength of shear bond, Dentin adhesive system, Sodium hypochlorite, Sodium ascorbate

### INTRODUCTION

Sodium hypochlorite is a non-selective proteolytic solution that effectively removes the non-protected collagen fibrils of dentin [1]. But different studies have shown that NaOCl may reduce the bond strength in some systems that this may be contributed to the effect of NaOCl on resin polymerization and inhibition of polymerization and characteristics of different adhesive systems in effect on sodium hypochlorite sodium action [2]. The remaining NaOCl may be neutralized by use of sodium ascorbate, as a reductive agent, and the reduced strength of shear bond due to use of sodium hypochlorite would be balanced by use of sodium ascorbate [2]. The objective in this study was evaluation of the effect of sodium ascorbate on strength of shear bond of two dentin adhesive systems.

### METHODS AND MATERIALS

Sixty perfect human premolar teeth were selected. The teeth were reserved in physiology serum after extraction all over the study. Then the roots of all teeth were cut in 2 mm of CEJ by diamond disc and water

spray and the samples were placed in acrylic block. The coronal enamel was cut by D & Z disc from occlusal surface to prepare a smooth dentin cylinder that was parallel of occlusal surface of teeth. The cut surface was grinded by 600 great silicone carbide papers for 30 seconds under continuous water stream. Then the teeth were randomly divided into six groups of ten teeth; two fifth (Excite) and sixth (Clearfil SE Bond) generations of dentin adhesive systems. The bond surface in all samples was restricted by round sticks. In group 1, the Clearfil SE bond (Kuraray, Japan) was used on dental surface as dentin adhesive from sixth generation. For this the primer was used for 20 seconds on dentin surface and was partially removed by air syringe and then the adhesive resin was used and again removed partially by air stream and cured for 20 seconds with intensity of  $750 \text{ mw/cm}^2$  in Astralis device (vivadent, liechten stein). Empty rod plastics with 2 mm diameter and 2 mm height were placed at center of bond surface as generator and then composite Clearfil APX (Kuraray, Japan) with A3 color was placed in empty rods and cured for 40 seconds with intensity of  $750 \text{ mw/cm}^2$  by

Astralis device. In group 2, before use of dentin adhesive agent, the sodium hypochlorite 5% was used for two minutes on surface and then it was rinsed for 30 seconds and after drying with air the other stages were performed similar to group 1. In group 3, before use of dentin adhesive agent, the sodium hypochlorite 5% was used for two minutes on surface and then it was rinsed for 30 seconds and after drying with air, the sodium ascorbat 10% was used on surface for one minute and then the surface was rinsed for 30 seconds and after drying with air the other stages were performed similar to group 1. In group 4, after use of phosphoric acid 37%, total etch was performed for ten seconds on dentin surface and washing for 20 seconds and blot drying of surface from dentin adhesive agent of Excite (Vivident, Lichten Stein) for 10 seconds on surface and drying with air syringe was cured with intensity of 750 mw/cm<sup>2</sup> by Astralis Light Cure device for 20 seconds. The composite placement was similar to group 1. In group 5, before use of dentin adhesive and after etching with phosphoric acid 37%, the hypochlorite 5% was used for 2 minutes and was rinsed for 30 seconds and after drying, the dentin adhesive agent, Excite, was used in dentin surface as well as group 4 and the other composite placement stages were similar to group 1. In group 6, before use of dentin adhesive and after etching with phosphoric acid 37%, the hypochlorite 5% was used for 2 minutes and was rinsed for 30 seconds after use of sodium ascorbate 10% for one minute. Then was rinsed for 30 seconds and after blot drying of the dentin surface of dentin the adhesive agent of Excite was used similar to group 4 and the other composite placement

stages were similar to group 1. Then the root of all samples were placed in green acryl and were placed under Instron Universal Testing Machine with crosshead 0.5 mm/min rate and the maximal strength of shear bond according to Mpa was measured by internal section of samples and the inserted force was measured by division of force on surface of section.

Data analysis was performed among by SPSS (version 18.0) software [Statistical Procedures for Social Sciences; Chicago, Illinois, USA]. T, ANOVA, and Tukey-HSD tests were used for comparisons and were considered statistically significant at p values less than 0.05.

## RESULTS

Table 1 represents the mean and standard deviation of bond strength in four groups. According to ANOVA test, the bond strength was significantly differed across six groups (P=0.0001). In group 6 the most bond strength was seen and the groups 2 and 5 had least one. For pair comparisons between groups, the Tukey-HSD test was used. Among groups 1, 2, and 3 the strength of group 3 was significantly more than group 2 (P=0.007); but there was no difference between group 1 with others (P=0.813). Among groups 4, 5, and 6 the strength of group 6 was significantly more than group 5 (P=0.0001); but there was no difference between group 4 with others (P=0.639). Also according to T-test, the was significant difference between groups 1 and 4 (P=0.007) and also 3 and 6 (P < 0.001); but groups 5 and 2 were not differed (P=0.068).

**Table 1- Mean and standard deviation of strength of shear bond in six groups**

Group	Mean (Mpa)	Standard Deviation
1	4.617	3.98726
2	1.280	1.50504
3	5.3810	2.24136
4	10.1090	4.05701
5	3.5560	3.27815
6	11.5830	3.48845

## DISCUSSION

Sodium hypochlorite is a non-selective proteolytic solution that effectively removes the non-protected collagen fibrils of dentin [1] and different studies have shown that NaOCl may reduce the bond strength in some systems that this may be contributed to the effect of NaOCl on resin polymerization and inhibition of poloymerization and characteristics of different adhesive systems in effect on sodium hypochlorite sodium action [2]. The remaining NaOCl may be neutralized by use of sodium ascorbate, as a reductive agent, and the reduced strength of shear bond due to use of sodium hypochlorite would be balanced by use of sodium ascorbate [2]. The objective of this study was evaluation of the effect of sodium ascorbate on strength of shear bond of two dentin adhesive systems of fifth and sixth generation.

Use of total etches system accompanying with separate stages including etching, washing, and drying may result in excess dryness or wetness leading to decreased dentin strength. More dryness may result in collagen fibrils collapse that inhibit complete resin insertion to dentin surface and on the other hand the wet surface, may result in decreased resin concentration and its effect. For inhibition of this situation, use of self-etch systems without need to separate etch and wash stages is recommended to decrease the failures by simplifying the stages by deletion of washing and drying stages [1, 3]. The most important problem of self-etch dentin adhesive systems is making a thin hybrid layer. Use of sodium hypochlorite and solving the smear layer and collagens would result in more

foramens to increase the thickness of hybrid layer [1, 3].

This study by Hayasli *et al.* the effect of sodium hypochlorite as canal washing agent was assessed on adhesion to root dentin. However in this study the effect of sodium ascorbate on strength of shear bond of two dentin adhesive systems of fifth and sixth generation was evaluated. Root and canal dentins are differed with more sensitive status of root dentin with less dentin tubules but higher diameter. The dentin tubules in dentin is S-shaped that may not be seen in root dentin tubules.

In current study one type of composite accompanying with two dentin adhesive of fifth (Excite) and sixth (Clearfil SE Bond) generations were used to compare these adhesive system in three different situations. Significantly more bond strength in group 4 and 6 compared with group 3 demonstrates that bond strength of dentin adhesive of Excite is more than Clearfil SE Bond and only in the group affected by sodium hypochlorite it was not differed. It seems that penetration of sodium hypochlorite solution to deep holes may inhibit the complete polymerization of adhesive resin [4] and presence of collagen fibers is important in this adhesion. If these fibrils be removed by sodium hypochlorite the strength of bond may be decreased [5].

Nikaido *et al.* evaluated the bond strength of dentin adhesive of Super Bond D&B single Bond, Clearfil liner Bond II to prepared teeth for root canal therapy and found that it had less bond strength in groups rinsed with sodium hypochlorite 5% compared with physiology serum [6]. This matter is in congruence with our results. The study by Ishizuka *et al.* assessed the effect of sodium hypochlorite as canal washing agent for increasing the strength of bond with a dent in self-etch adhesive system (clearfil Mega Bond) was evaluated that was similar to our findings [7]. Correr *et al.* reported that fifth generation and self-etch system had reduced bond strength due to sodium hypochlorite that approves our findings [8].

The study by Ozturk *et al.* also demonstrated that hypochlorite would result in less strength of dentin adhesives as well as our study. Also Clearfil SE Bond resulted in more bond strength compared with other groups that is similar to our findings. Vongphan *et al.* evaluated the effect of sodium ascorbate on shear bond strength and it was seen that it would results in more strength [10]. The study by Soenok *et al.* also demonstrated that ascorbic acid and ferrous chloride are improved [11]. Goke *et al.* reported that after use of sodium ascorbat, the strength of bon may be decreased as well as our findings [12]. In all other studies the sodium ascorbate results in increased bond strength due to NaOCl [13, 14].

## CONCLUSIONS

Use of sodium ascorbate after sodium hypochlorite would result in increased strength of composite bond and dentin after use of two dentin adhesive systems of fifth and sixth generations that it was statistically significant in both groups. The strength of dentin shear bond of Excite (5<sup>th</sup> generation) was more than Clearfil SE Bond (6<sup>th</sup> generation) in all three situations. Use of sodium hypochlorite on dentin adhesive systems of fifth and sixth generations would result in decreased bond strength and this was not significant in Excite dentin adhesive system.

## REFERENCES

1. Yamauti M, Hashimoto M, Sano H, Ohno H, Carvalho RM, Kaga M, Tagami J, Oguchi H, Kubota M. Degradation of resin–dentin bonds using NaOCl storage. *Dental Materials*. 2003 Jul 31;19(5):399-405.
2. Nagpal R, Tewaris, Gupa R. Effect of various surface treatments on the microleakage and ultrastructure of resin-tooth interface. *Oper Dent* 2007 jan-fab; 32(1): 16-23.
3. Roberson TM, Heyman HO, Swift EJ. *Art and science of operative dentistry*. 5<sup>th</sup> ed, London, Mosby 2006:183- 248.
4. Lussi A, Linde A. Mineral induction in vivo by proteins. *Caries Res* 1993; 27: 241-248.
5. Summit JB, Robbins JW, Schartz RS. *Fundamentals of operative dentistry third Ed*, Chicago Quintessence 2006: 183- 248.
6. Kohyoh Soeno, Yohsuke T, Ryo J, Takshi S. Surface treatment with ascorbic acid and ferric chloride improver the micro- tensile bond strength of 4- META/MMA- TBB resin to dentin. *J Dent* 2008 NOV; 36(11): 940-944.
7. <http://www.dentalcompare.com/details/1583/Excite.html>.
8. [http://www.kuraraydental.com/view\\_product.php](http://www.kuraraydental.com/view_product.php)
9. Craig RG, Powers JM. *Restorative Dental material*, 11<sup>th</sup> ed, st Louis, Mosby 2006: 260-285.
10. Vongphan N, Senawongse P, Somsiri W, Harnirattisai C. Effects of sodium ascorbate on microtensile bond strength of total-etching adhesive system to NaOCl treated dentine. *Journal of dentistry*. 2005 Sep 30;33(8):689-95.
11. Soeno k, taira y, matsumura h, atsuta m, suzuki s. Adhesion of 4-meta/mma-tbb resin to collagen-depleted dentin. *Dental materials journal*. 2004;23(2):100-5.
12. Gökçe B, Çömlekoğlu ME, Özpınar B, Türkün M, Kaya AD. Effect of antioxidant treatment on bond strength of a luting resin to bleached enamel. *Journal of dentistry*. 2008 Oct 31;36(10):780-5.
13. Vongphan N, Senawongse P, Somsiri W, Harnirattisa C. Effects of sodium ascorbate on microtensile bond strength of total-etching adhesive system to NaOCl treated dentine. *J Dentistry*; 2005: 1-7.

14. Srinivasulu S, Vidhya S, Sujatha M, Mahalaxmi S. Effect of collagen cross-linkers on the shear bond strength of a self-etch adhesive system to deep dentin. *J Conserv Dent.* 2013 Mar;16(2):135-8.