

To Evaluate the Effect of Dentin Sealers on Postoperative Sensitivity of Teeth After Crown Preparation: In Vivo Study

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ABSTRACT

Background: The present study was planned to assess the effectiveness of varnish, dentin bonding agent, polyethylene glycol dimethacrylate as desensitizers in reducing post operative sensitivity in teeth after crown preparation.

Material and Methods: 3 groups formed each containing 20 patients. Dentin sealer was applied on premolars with molars as control, then provisional was given to patient cemented with non eugenol zinc oxide cement. The patient was then recalled on the 7th day. The temporary crown was removed. The post operative sensitivity was again checked with the help of airblast and by questionnaire and then final cementation was done.

Results: Dentin bonding agent was best sealer in the prevention or reduction of sensitivity after crown preparation.

Conclusions: Dentin bonding agent is the best dentin sealer followed by systemp desensitizer and then cavity varnish.

Keywords: Bonding agent, Dentin, Varnish.

INTRODUCTION

Dentin hypersensitivity is defined as a transient pain arising from exposed dentin, typically in response to chemical, thermal, tactile or osmotic stimuli, which cannot be explained by any other dental defect ^{1,2,3}. After analysing the definitions following characteristics can be deduced of the condition:

- a) Sharp transient pain
- b) Stimulated pain (Thermal, evaporative or osmotic or chemical)
- c) Occurs when dentin is exposed or pathology (Addy, 1985).

Various theories have explained the mechanism of dentin hypersensitivity^{4,5}. However Hydrodynamic Theory by Barnstorms (1963) is widely accepted theory.

Three theories for dentin hypersensitivity.

- a) Direct innervation theory
- b) Odontoblast receptor
- c) Fluid movement/hydrodynamic theory

According to direct innervation theory, nerve endings penetrate dentine and extend to the dentino-enamel junction. Odontoblast receptor theory states that odontoblasts acts as receptors by themselves and relay the signal to a nerve terminal^{6,7}. The basic principle of treatment of post

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operative sensitivity are altering fluid flow in dentinal tubules with tubule occlusion or blocking pulpal nerve response⁸. Post operative sensitivity can be reduced with the help of dentin adhesive sealers (Varnish, dentin bonding agent, composite) and desensitizers containing Polyethylene glycol dimethacrylate (PEG-DMA) and glutaraldehyde⁹. Recent research reveals that 88% of dental professionals believe dentin hypersensitivity can affect patients' quality of life, and 79% believe the condition is on the rise. Post-operative sensitivity may also be due to post-operative hyperocclusion, a condition in which the bite forces on the tooth arrangement. Post operative sensitivity can be reduced with the help of dentin adhesive sealers (Varnish, dentin bonding agent, composite) and desensitizers containing Polyethylene glycol dimethacrylate (PEG-DMA) and glutaraldehyde¹⁰. This study is conducted to check the efficacy of these dentin sealers in reducing post operative sensitivity.

MATERIALS AND METHODS

Inclusion Criteria

- Healthy vital teeth for bridge (premolars and molars)
- Teeth with healthy periodontium.
- Teeth with no periapical pathology
- Teeth with no pathological wearing
- Patients without parafunctional habits.
- 20-40 yrs of age group

Exclusion Criteria

- Non vital teeth
- Mal aligned teeth
- Patients with neurological disorder
- Restored teeth
- Teeth with mal occlusion and supraerupted teeth

This study was conducted in Peoples Dental College, Bhopal. Out of 60 patients, 120 teeth were selected (2 teeth per patient). 20-40 yrs of age group seeking extracoronary restoration on the vital tooth and taking no medications that would affect pain perception, inflammation or infection were selected. In this 3 groups were made each containing 20 patients with control group included in it.

Three groups were-

Group A – Cavity Varnish group – Tooth preparation with copal varnish (Fluoroprotector) applied on it

Group B – Dentin Bonding Agent group – Tooth preparation with 7th generation tech bond Group C – Systemp Desensitizer

Methodology

The study protocol consisted of following steps:

- Tooth preparation
- Application of dentin sealers.
- Post operative sensitivity assessment after application of dentin sealer with air blast and questionnaire.
- Provisional bridge cementation with non eugenol Zinc oxide cement.
- Removal of provisional F.P.D on 7th day followed by post operative sensitivity assessment with the help of air blast and questionnaire.
- Cementation of final f.p.d.

Armamentarium used

- Light cure unit
- Microapplicator tip
- Applicator dish
- Glass slab
- 3 way air syringe
- Cement spatula
- Cotton pellet
- Bur for tooth preparation

Material used

- Copal or ether varnish (Fluoroprotector).
- Dentin bonding agent (7th generation tech bond)
- Poly ethylene glycol and glutaraldehyde containing desensitizer (Systemp)
- Eugenol free zinc oxide luting cement
- Questionnaires about post operative sensitivity.

Scale for measuring sensitivity categorized as 0=none, 1=mild, 2=moderate, 3=considerable and 4= severe on the basis of S Kossatz et al (2011) in the article "Effect of light activation on tooth sensitivity after in office bleaching with the help of

air blast at 45 PSI pressure at 5 mm of distance from dental unit air syringe.”¹¹

Method

After the assessment of the inclusion criteria and oral prophylaxis, local anaesthesia (LOX 2%, Adrenaline (1:200000) was given to the patient. Tooth preparation was done on premolars and molars of selected patients. Tooth preparation criteria – The preparation was done according to standard porcelain fused metal crown preparation. Occlusal reduction of 1-1.5 mm followed by axial reduction. A chamfer finish margin 0.3-0.5 mm wide was formed by round ended tapered bur. Preparations were finished by rounding sharp angles. The patient was allowed to wait for 60 minutes (since the effect of the local anesthesia works for 1 hr). After that, dentin sealer was applied on premolars with molars as control. There were 3 groups formed each containing 20 patients.

Group A – Varnish applied

In this prepared tooth (premolar) was cleaned and dried, the small cotton applicator is dipped into recently purchased bottle of copalite and quickly painted on the dentin surface. The surface is then dried with the gentle stream of air for 30 seconds. Subsequent application are placed at 2 minutes intervals. (Figure 1-6)

Group B – Dentin Bonding Agent

In this the dentin bonding agent is shaken and opened. One drop of dentin bonding agent is dispensed in the dish. Then the micro applicator tip is dipped into the dish containing the bonding agent. It is then applied with the help of micro applicator tip to entire tooth preparation and left to permeate for 10 seconds. The excess is removed with a stream of air at 5-6 cm distance for 10 seconds, following manufactures instructions and then light cured for 10 seconds. (Figure 7-11)

Group C – System Desensitizer

The smear layer is left untreated. Systemp desensitizer is opened and dispensed in the dish. Then with the help of small cotton pellet it is brushed onto dentin for 10 seconds and carefully dried with 3 way syringe for 20seconds.

Same procedure was repeated for all 3 groups and all in 3 dentin sealers. Then post operative sensitivity was assessed by questionnaire and evaluated by airblast from 3 way syringe at 45psi pressure and 5 mm of distance. Provisional crown was given to patient and cemented with non eugenol zinc oxide cement. The patient was recalled on the 7th day. The temporary crown was removed. The post operative sensitivity was again checked with the help of airblast and by questionnaire as previously done and then final cementation was done.

RESULTS

Table 1 - Distribution of tooth sensitivity score among three different sealer and control immediately after crown preparation.

Groups	Tooth Sensitivity Evaluation				
	0-None	1-Mild	2-Moderate	3-Considerable	4-Severe
Group A: Cavity Varnish	0(0.0%)	0(0.0%)	0(0.0%)	7(35.0%)	13 (65.0%)
Group B: Dentin Bonding Agent	0(0.0%)	0(0.0%)	10(50.0%)	10(50.0%)	0(0.0%)
Group C: Desensitizer	0(0.0%)	0(0.0%)	14(70.0%)	6(30.0%)	0(0.0%)
Group D: Control	0(0.0%)	0(0.0%)	1(1.7%)	15(25.0%)	44 (73.3%)

Total	0(0.0%)	0(0.0%)	11(9.2%)	46(38.3%)	63(52.5%)
Chi Square Value	70.494				
Significance P Value	0.001(HS)				

Table 1 reveals distribution of tooth sensitivity score among three different sealer and control immediately after crown preparation. Out of total 120 teeth samples, 20 teeth received cavity varnish, 20 teeth received dentin bonding agent, 20 teeth received dentin desensitizer as a sealer and 60 teeth as controls which did not received any sealer for comparison. Immediately after tooth preparation when sealer was applied, severe sensitivity was found in 13 (65.0%) cavity varnish subjects. Among

dentin bonding agent group, 10(50.0%) had moderate and 10(50.0%) had considerable sensitivity while among desensitizer group 14(70.0%) had moderate and 6(30.0%) had considerable sensitivity. Among control group (without sealer) 44 (73.3%) had severe sensitivity. There was statistically highly significant difference (**P=0.001**) was found in the distribution of tooth sensitivity score among three different sealer and control group immediately after preparation.

Table 2 – Distribution of tooth sensitivity score among three different sealer and control group after 7 days of crown preparation.

Groups	Tooth Sensitivity Evaluation				
	0-None	1-Mild	2-Moderate	3-Considerable	4-Severe
Group A: Cavity Varnish	0(0.0%)	0(0.0%)	2(10.0%)	16(80.0%)	2(10.0%)
Group B: Dentin Bonding Agent	10(50.0%)	10(50.0%)	0(0.0%)	0(0.0%)	0(0.0%)
Group C: Desensitizer	0(0.0%)	10(50.0%)	9(45.0%)	0(0.0%)	1(5.0%)
Group D: Control	0(0.0%)	0(0.0%)	1(1.7%)	13(21.7%)	46(76.7%)
Total	10(8.3%)	20(16.7%)	12(10.0%)	29(24.2%)	49(40.8%)
Chi Square Value	194.267				
Significance P Value	0.001(HS)				

Table 2 reveals distribution of tooth sensitivity score among three different sealer and control group after 7 days of crown preparation. Seven days

after application of sealer sensitivity was reduced from 13 (65.0%) to 2(10.0%) among cavity varnish group. Among dentin bonding agent group,

moderate sensitivity 10(50.0%) was reduced to 10(50.0%) mild sensitivity and considerable sensitivity 10(50.0%) was reduced to no sensitivity in 10(50.0%) subjects. Among desensitizer group 14(70.0%) moderate and 6(30.0%) considerable sensitivity reduced to 9 (45.0%) moderate and 10 (50.0%) mild sensitivity after seven days. Among

control group without sealer, 44 (73.3%) subjects had severe sensitivity initially and after 7 days it was increased to 46(76.7%) subjects. There was statistically highly significant difference (**P=0.001**) in the distribution of tooth sensitivity score among three different sealer and control group 7 days after crown preparation.

Table 3 – Evaluation of tooth sensitivity immediately and after 7 days of crown preparation among each sealer and controls.

Groups	Immediately	After 7 Days	Mean % Change	P Value*
	Mean±SD	Mean±SD		
Group A: Cavity Varnish	3.65±0.489	3.00±0.459	17.80%▼	0.001(HS)
Group B: Dentin Bonding Agent	2.50±0.513	0.50±0.513	80.0% ▼	0.001(HS)
Group C: Desensitizer	3.30±0.470	1.60±0.754	51.51% ▼	0.001(HS)
Group D: Control	3.72±0.490	3.75±0.474	0.80% ▲	0.617(NS)

*Wilcoxon Signed Rank Test

Table 3 reveals evaluation of tooth sensitivity immediately and after 7 days of crown preparation among each sealer and controls.. It was highest among controls while among three sealers it was found highest among cavity varnish, followed by desensitizer and least among dentin bonding agent. It was reduced from 3.65±0.489 to 3.00±0.459 among cavity varnish. It was highly reduced 3.30±0.470 to 0.50±0.513 among dentin bonding agent and reduced from 2.50±0.513 to 1.60±0.754 among desensitizer. There was slight increase in tooth sensitivity from 3.72±0.490 to 3.75±0.474 among controls. Mean % reduction was highest among dentin bonding agent i.e 80.0%, among desensitizer 51.51 % and 17.80% in cavity varnish. There was statistically highly significant reduction in the Mean tooth sensitivity from immediately after sealer application to 7 day after among three different dentin sealers (P=0.001). Result showed dentin bonding agent was best sealer in the prevention or reduction of sensitivity after crown preparation.

DISCUSSION

It is widely recognized phenomenon that after restoring a tooth, patient can experience post operative sensitivity, particularly to thermal stimuli, which in many cases disappears after a short time. These complain have seen to occur in 20-30% of crowns. Patients frequently experience pain or sensitivity in prepared abutment teeth following placement of restoration. Many reasons for sensitivity from glass ionomer luting agent has been postulated such as Initial acidity of cement and prolong low pH, hydraulic pressure in dentinal tubules produced during cementation, dehydration of tooth and water solubility during cementation.^{12,13}

There are different theories proposed for post operative sensitivity and the most accepted theory among those is the hydrodynamic theory. This theory postulates the rapid shifts of fluid within the dentinal tubules following stimuli activation which

result in activation of sensory nerve ending thereby inducing pain.

Various attempts have been made to reduce post operative sensitivity. Traditionally 2 or 3 thin coats of cavity varnish have been used under crowns to provide the barrier against sensitivity. Few studies had used dentin desensitizing agent for reducing sensitivity after crown preparation or before cementation. Researchers had also used dental adhesives to reduce the occurrence of post operative sensitivity.

This study evaluated the effect of the dentin sealers like varnish, desensitizer and dentin bonding agent on the post operative sensitivity immediately and 7th day after the crown preparation in an attempt to find the best sealer to control the sensitivity. The results showed that among the three

dentin sealers, the dentin bonding agent caused significant reduction in the post operative sensitivity.

Michel et al in their study compared dentin adhesive and copal varnish in preventing the microleakage in primary teeth and found that dentin adhesive was superior to cavity varnish with significant reduction in microleakage. This study was in accordance with study by Michael et al. There was significant reduction in mean tooth sensitivity after 7 days of crown preparation from 2.50 ± 0.470 to 0.50 ± 0.513 among dentin bonding agent group when compared to cavity varnish group where reduction was from 3.65 ± 0.489 to 3.00 ± 0.459 .^{14,15}

The dentin bonding agent used in this study was Tetric bond which is 7th generation self etch bonding agents which has usually less post operative sensitivity as compared to 4th and 5th generation total etch bonding agent. This is because the self-etching products demineralize with an acid and prime the dentin with hydrophilic resin simultaneously in a one-step procedure that dissolves the smear layer without exposing the dentinal tubules. Thus, there is no potential to etch the dentin deeper than the primer will absorb. With the total-etch systems, phosphoric acid is used to demineralize dentin. In a separate step, a primer is applied to the demineralized dentin. So, there is potential for a layer of weak demineralized dentin

below the dentin that has been penetrated by the primer. This layer of wet, collapsed collagen can potentially cause a weak adhesive layer, thus causing microleakage. Browning WD et al in their study compared two bonding agents and stated that self-etching primers had been associated with less postoperative sensitivity than Royldhouse and Weiss noted that cavity varnish was effective in decreasing microleakage as long as it was fresh, with decreasing sealing capacity as function of increased varnish viscosity¹⁶. The result of our study is in accordance with Royldhouse and Weiss. The reason for varnish to be less effective in controlling sensitivity is due to breakdown of varnish over time (Jodiakin's three-step bonding system). Thus dentin bonding agent is best in reducing post operative sensitivity.

CONCLUSION

Under the light of above mentioned data, the authors conclude that Dentin bonding agent is the best dentin sealer followed by systemp desensitizer and then cavity varnish.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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