



## A Comparative Shear Bond Strength Analysis of Recent Generation Bonding System to Cervical Dentin

### KEYWORDS

cervical dentin, sclerotic dentin, bonding agent, shear strength

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**ABSTRACT** Twenty five non carious intact human molars and fifteen carious human molars with cervical sclerotic lesions were selected for this study. The specimen were divided into two groups: the control group contained 10 non carious intact human molars. The cervical surfaces of the specimen were treated to receive dentinbonding agent as per the manufacturer instructions. All the forty samples were tested for bond strength in Hounsfield Tensometer.

The experimental group was divided into 3 groups

Group 1: Prompt L Pop(self etching primer)

Group2: clearfil liner bond 2V(self etch primer)

Group 3: excite (single bottle bonding agent)

Results: Clearfill liner bond 2V required the highest mean shear load to fracture in both sclerotic dentin (12.18 MPA) and normal dentin (8.94MPA). Prompt L Pop required the lowest mean shear load in both sclerotic dentin (8.17MPA) and normal dentin (6.28MPA). Inter comparison was done using Kruskal Wallis test where sclerotic dentin and normal dentin were compared with each other. The results showed very highly significant difference.

### INTRODUCTION

Dentin has been characterized as a biologic composite of matrix filled with submicron to nanometer sized calcium deficient carbonate rich apatite crystals dispersed between parallel micron size hypomineralized collagen poor hollow cylinders. The bulk composition of dentin 50% volume mineral, 20% volume water and 30% volume organic matrix although the composition may change with position of a tooth and even within a tooth. Non carious cervical lesions present special problems with any restorative material because the restorative material is usually required to adhere to more than any one type of tooth structure. The coronal margins of the cervical restorations are usually in enamel whereas the cervical margins in dentin and cementum. Bowen in early 1970's have realized that an adhesion promoter was required to bond composite resins to dentin. This was the beginning of the dentin bonding systems used with all modern composite resins. Non carious cervical lesion was described by Zsigmondy in 1894 as "angular defects" and Miller in 1907 as "wasting of tooth tissues" that was characterized by a slow gradual loss of tooth substances resulting in smooth wedge shaped defects along CEJ. Sclerotic dentin is a clinically relevant bonding substrate in which the dentin has been pathologically altered, often resulting in partial or complete obliteration of dentinal tubules with tube or rod like sclerotic casts. Recent studies have demonstrated that the sclerotic cast that obliterated the dentinal tubules were still present after acid conditioning of the sclerotic dentin resulting in minimum or no resin tags formation. It has demonstrated that regional bond strength to cervical root dentin with some contemporary adhesives to be 20-45% lower than bonded to artificial wedge shaped lesions created in normal cervical root dentin. The aim of the present study was to test the hypothesis that regional shear bond strength to cervical sclerotic dentin is comparatively low compared to normal cervical root dentin and effectiveness of various bonding agent to cervical sclerotic dentin.

### METHODOLOGY

Forty freshly extracted intact human maxillary and mandibular molars were collected, stored, disinfected and handles as per the recommendation and guidelines laid down by OSHA and CDC. All the collected teeth were cleared of saliva and stored in buffered isotonic saline solution. The specimen teeth were utilized for this study within one month of extraction. The specimens were divided into two groups:

Control Group: it contained 10 non carious intact human maxillary and mandibular molars. The enamel surfaces were etched using 35% phosphoric acid for 10 seconds and cleansed using air spray. After etching enamel bonding agent was applied and cured according the manufactured instructions.

Experimental group: It was divided into three groups based upon the material used each group was again subdivided into two subgroups that is normal and sclerotic. The cervical surfaces of the teeth were ground on a water cooled trimming wheel to prepare flat dentin surfaces.

Preparation for cervical sclerotic specimens- they were first cleaned with the slurry of pumice, washed with air water spray and dried with air from an oily surface.

Group 1: Prompt L Pop was used. It is a sixth generation bonding agent. It is a unique adhesive system with etchant, primer, adhesive and microbrush sealed in triple lollipop shared aluminium foil package. Liquid from the red blister is transferred to the yellow blister. It is then passed on the green blister from where is squeezed to transfer the liquid into the open elongated channel using application tip. Prompt L Pop was applied to the prepared dentin surface rubbing the solutions with moderate finger pressure for approximately 15 seconds. Stream of air was used evenly disperse the material into a thin film. The material was then cured for 20 seconds. Composite resin was packed over this prepared surface using

Teflon mould and cured layer by layer. The procedure was carried out on all ten specimens which included the normal teeth as well as the teeth with cervical sclerotic lesion.

Group 2: Clearfil liner bond 2V was used. Primer A&B was mixed and applied on the prepared dentinal surface. It was then dried with mild air stream and left for 30 seconds primer was not washed. Bonding agent was applied and light cured for 20 seconds. Composite resin was packed over this prepared surface using Teflon mould and cured layer by layer. The procedure was carried out on all ten specimens that included the normal teeth as well as the teeth with cervical sclerotic lesion.

Group 3 where Excite was used, the prepared dentinal surface was etched using 35% phosphoric acid for 15 seconds and cleansed and dried using oil free air water spray. After etching bonding agent was applied cured according to manufacturer's instruction. After curing the bonding agent, composite agent was packed over the prepared dentin surface using teflon mould measuring 3x3mm and cured layered by layer. This procedure was carried out on all the ten specimens. All the forty specimens were transferred to Hounsfield tensometer for bond strength studies.

## RESULTS

**Table 1: Shear load in mega pascals: Sclerotic dentin**

| Group 1 | Group 2 | Group 3 | Group 1 | Group 2 | Group 3 |
|---------|---------|---------|---------|---------|---------|
| 6.28    | 8.96    | 6.91    | 7.83    | 12.46   | 8.96    |
| 6.51    | 9.31    | 6.89    | 8.41    | 12.21   | 9.45    |
| 5.81    | 8.86    | 7.11    | 7.91    | 12.38   | 9.39    |
| 5.97    | 9.21    | 7.31    | 8.21    | 11.89   | 8.81    |
| 6.81    | 8.35    | 7.11    | 8.46    | 11.94   | 8.61    |

Mean shear load and standard deviation

**Table 2:**

| Comparison | Sclerotic dentin | Normal dentin |
|------------|------------------|---------------|
| Group 1    | 6.27±0.40        | 8.16±0.28     |
| Group 2    | 8.94± 0.37       | 12.17±0.25    |
| Group 3    | 7.07±0.17        | 9.04±0.36     |

The shear loads required to fracture the specimen of sclerotic and normal dentin were determined.

According to results analysed clearfill liner bond 2v required the highest mean shear load to fracture in both sclerotic dentin (12.18) and normal dentin (8.94). Prompt L Pop required the lowest mean shear load in both sclerotic dentin(8.17) and normal dentin(6.28). inter comparison was done using Kruskal Wallis test where sclerotic dentin and normal dentin were compared with each other. The results showed very highly significant difference.

**Table 3**

Comparison between normal and sclerotic dentin using Kruskal Wallis test

| Comparison | Z      | P     | Remarks |
|------------|--------|-------|---------|
| Normal     | 21.923 | 0.001 | V.H.S   |
| sclerotic  | 21.923 | 0.001 | V.H.S   |

## DISCUSSION

The restoration of a cervical lesion has remained a problem even with modern adhesive restorative materials. Most clinicians are of opinion that on an average 20% of permanent teeth requires cervical restoration in adults. The restorative materials used to restore non carious cervical lesion have special properties. Dentin becomes transparent or sclerotic as a result of obliteration of tubules by a highly radio-opaque material.

There are considerable variations on the reported results of experimental test on shear bond strengths of composite resin to normal dentin and sclerotic dentin using modern bonding system. The results of the present investigation indicated that generally all the three dentin bonding system selected for this study exhibited higher mean shear bond strength values when bonded to normal dentin in comparison to sclerotic dentin. This finding may be related to the partial or complete obliteration of tubules and intertubular dentin by mineral deposition. Less resin tag formation is frequently associated with sclerotic substrate. Clear liner bond 2v, a sixth generation self etching primer exhibited higher shear bond strength values to both normal and sclerotic dentin in comparison to excite a 5<sup>th</sup> generation adhesive and Prompt L Pop. Among the 3 bonding agents selected for this study Prompt L Pop exhibited comparatively low shear bond strength values to both normal and sclerotic dentin.

Although still unpredictable self etching primer system have undergone a rapid evolution over the years. The present in vitro study has a clinical relevance since sclerotic and old dentin is more clinically relevant bonding substrate than normal dentin.

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