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# Comparative Evaluation of Shear Bond Strength of Resin Bonded Dentin With and Without Dentin Deproteinization

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***Abstract:*** *The aim of the study is to compare and evaluate the Shear Bond Strength of Resin Bonded Dentin with and without dentin deproteinization.*
***Material and Methods*** *A total of 20 extracted premolars were divided into 2 groups, each one consisted of 10 teeth. The occlusal surface was wet ground to expose superficial dentin. In Group 1, teeth were etched, in Group 2 teeth were etched and deproteinized with Bromelain enzyme. Upon the completion of adhesives procedures, resin composite was inserted into plastic tubes and light- polymerized. All specimen were stored at 37°c in water for 24h, and the specimen were then transferred to universal testing machine, and then subjected to Shear Bond Strength analysis at a cross head speed of 1mm/min.*
***Result:*** *The bond strength results were significantly influenced by the application of bromelain enzyme.*
***Conclusion:*** *Within the limitations of the present study, it was concluded that removal of unsupported collagen fibre with bromelain enzyme after acid etching results in improved bond strength.*
***Keywords:*** *Bromelain, Detin deprteinization, Shear Bond strength, sodium hypochlorite (10 Italic)*

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## I. Introduction

Restoring posterior teeth with resin-based composite materials continues to gain popularity, and the demand for such aesthetic restorations is increasing.[1] Strong durable bonds between composite and tooth structures are essential to achieve mechanical as well as biologic and aesthetic properties and bonding to enamel is a relatively simple process while bonding to dentin is a less reliable technique due to the intrinsic characteristics of the substrate[2].Although, the collagen matrix exposed by acid etching is crucial to formation of hybrid layer, it plays a negative role in dentin adhesion by presenting a delicate bonding substance susceptible to collapse. Enhancement of the dentin bonding can be done by improving physical properties of the bonding agent, or by modifying the dentin substrate to act as foundation for the subsequent applied adhesive restoration

One of the techniques for removing the collagen network is by using dentin deproteinizing agents like Sodium Hypochlorite, Collagenase, Bromelain and Nd: YAG laser. Bromelain, is a proteolytic enzyme is obtained commercially from the fruit or stem of pineapple. It can reduce Nano leakage and improve bond strength after removing the collagen network

## II. Material And Methods

A Total of 20 premolars were selected and stored in distilled water. Then, the root base of each tooth was embedded in cylindrical shaped metal mold (2.5mm in diameter and 1.5 cm in height) acrylic resin till the cervical line parallel to the floor. Occlusion surface of the teeth was ground flat using tapering fissure bur. Occlusal reduction = 1mm below the DEJ was done. Adhesive punch tape was placed on the finished dentin surface to demarcate the working area. Then the Dentin was etched with 37% phosphoric acid for 15 sec and rinsed with water for 10 sec .Teeth was divided into 2 groups. In group 1, no dentin deproteinizing agent was used. Dentin bonding agent(Prime Bond NT, Dentsply) was applied and light cured according to manufacturer's instructions. Composite (Spectron 360, Dentsply) resin was filled in three increments and light cured for 20 sec in cylindrical shaped Teflon mold .Group II application of Bromelain was done for 60 sec. Dentin bonding agent (Prime Bond NT, Dentsply) was applied and light cured according to manufacturer's instruction .Composite resin was filled in three increments and light cured for 20 sec in cylindrical shaped Teflon mold. After composite build up,

specimens were mounted in universal testing machine with a custom made jig and loaded with cross head speed of 0.5mm/min. Shear bond force was applied on the junction between the tooth and the composite and the force was recorded in Kgf using the software. This value was converted into Newton. Shear bond strength was calculated using the formula: Force( N)/Bonded surface area

1kGF=9.8

**Inclusion criteria:**

1. Freshly extracted premolars

**Exclusion criteria:**

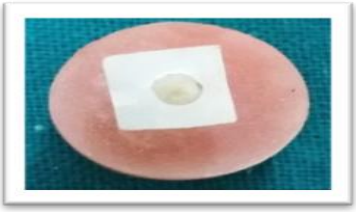
1. Carious teeth
2. Badly mutilated teeth
3. Teeth with previous restoration
4. Teeth with previous endodontic treatment
5. Teeth with pre-existing fractures or cracks

**III.**

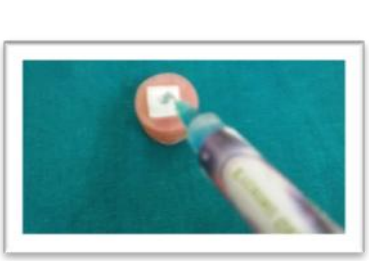
**Figure 2.**Bromealin powder:


**Figure3.** all 2o premolars

Occlusal reduction



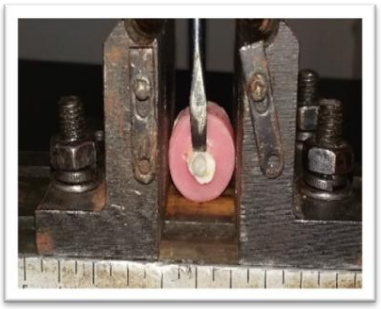
Demarcation



Etching

Bonding

Light cure



shear bond strength analysis

## Result:

### IV. Statistical analysis

Data was analyzed using SPSS version 21 (SPSS Inc., Chicago, IL). Normality of the data was checked by Shapiro Wilk Test . Data was found to be normal. Keeping in view the nature (continuous) & distribution normal inferential statistic were performed using parametric tests of significance. Inferential statistics were performed using one way Analysis of Variance. One way analysis of variance test was used to compare more than 2 independent means. Post Hoc pair wise comparison was done using Post hoc Tukey's test .The level $P < 0.05$ was considered as the cutoff value or significance.

### V.

**Table 1: Shear Bond Strength of all samples in Group I**

| Group I (n=10) | Force (N) | SBS (Mpa) |
|---|---|---|
| S1 | 413.0 | 21.04 |
| S2 | 440.0 | 22.42 |
| S3 | 250.0 | 12.74 |
| S4 | 400.0 | 20.38 |
| S5 | 143.0 | 7.30 |
| S6 | 368.0 | 18.75 |
| S7 | 727.0 | 37.04 |
| S8 | 143.0 | 7.03 |
| S9 | 831.0 | 42.34 |
| S10 | 106.0 | 5.40 |

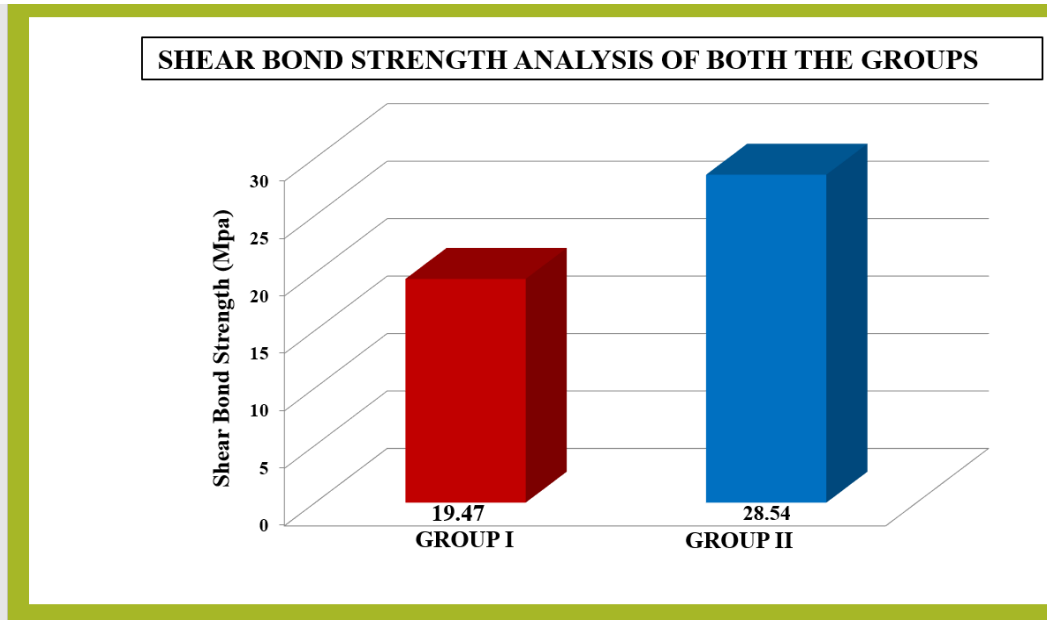
**Table 2:** Shear Bond Strength of all samples in Group II

| Group I(n=10) | Force (N) | SBS (Mpa) |
|---|---|---|
| S1 | 502 | 25.80 |
| S2 | 791 | 40.30 |
| S3 | 506 | 30.43 |
| S4 | 701 | 35.71 |
| S5 | 444 | 22.62 |
| S6 | 602.0 | 36.21 |
| S7 | 642 | 32.71 |
| S8 | 449 | 22.88 |
| S9 | 335 | 17.07 |
| S10 | 431 | 21.96 |

**TABLE 3**: **Intergroup Comparison of Shear Bond Strength of both Group I and Group II**

**Independent Student's t test**

| Group | N | Shear Bond Analysis (Mpa) | | | | P[a] value 0.05 |
|---|---|---|---|---|---|---|
| | | Minimum | Maximum | Mean | SD | |
| Group I | 10 | 5.40 | 42.34 | 19.47 | 12.40 | 0.005, S |
| Group II | 10 | 17.07 | 40.30 | 28.54 | 7.58 | |




DISCUSSION:

Adhesion of dental material to enamel is a well-known reliable procedure. However, bonding to dentin has been referred to as less reliable technique due to the intrinsic characteristics of this substrate, especially when compared to enamel bonding.[7] It is because dentin is dynamic substrate that contains 17% collagen by volume. It also contains dentinal tubules containing dentinal fluid. The number and diameter of tubules varies depending on location and depth. Other factors such as age of teeth and type of dentin also affect dentin bonding.[8]Inadequate adhesion of composite resin restoration to dentin results in reduced retention, microleakage, and finally recurrent caries.[9] Progressive loss of bond strength of etch and rinse adhesives has been demonstrated in some studies. [10]One of the factors which is responsible for this degradation is incomplete infiltration of resin monomers into unsupported collagen network after acid etching with strong acids which produces a zone of collagen without any support of either minerals or resin in the base of the hybrid layer.[11 ]Although the hybrid layer has been described being responsible for the restoration's longevity, there is evidence that primer and adhesive resin may not always completely fully penetrate the demineralized dentin collagen

layer. The discrepancy between depth of dentin demineralization after acid etching procedure and depth of resin infiltration allows the formation of microporous zone underneath and within the hybrid layer detectable by silver nitrate.[12] The removal of collagen with Naocl has been suggested as a suitable method to overcome this problem since it alters the composition of dentin surface as it becomes similar to etched enamel, that is more predicatble and hydrophilic substrate for bonding. [13]In the present study Naocl was used as deproteinizing agent. Several authors recommended its use because of its non-specific deproteinizing and disinfecting deproteinizing action. [14]Numerous studies have evaluated the effect of Naocl on adhesion process, and different result have been achieved. [15] Some studies have shown lower bond strength Using NaOcl.[16 ]This decrease in bond strength can be attributed to the generation of oxygen after disintegration of Naocl into NaCl and $O_2$. The released oxygen in this chemical reactions prevents the polymerization of adhesive agents. These reactive residual free radicals free radicals in NoCl-treated dentin compete with the propagation of vinly free radicals generated during light activation of the adhesive system, resulting in premature chain termination and incomplete polymerization.[ 17]

In this present study, Bromelain enzyme performed better which could be because of reduced nanoleakage as shown by the previous study. It has better effectiveness in removing unsupported collagen matrix as compared to NaOCl, and lower nanoleakage is seen.[6]

This could be because of depletion of collagen from the surface of acid etched dentin resulting in increased permeability of dentin substrate due to the enlargement of dentinal tubules near the outer dentin surface. This enhances the spreading and diffusion of adhesive monomers through dentin. [18]The surface energy of the dentin is improved, because the hydroxyapatite has a high surface energy susbtrate while collagen has a low energy surface and this leads to enhanced diffusion of adhesive monomers through dentin.[19

## VI. Conclusion

- ✓ Within the limitations of this study, it is concluded that removal of unsupported collagen fibres with Bromelain enzyme after acid etching results in improved bond strength
- ✓ This step of deproteinization is very important and should be taken into consideration before the application of bonding agent
- ✓ However, more studies and further research on Bromelain in improving the bond strength is recommended

## Acknowledgements

An acknowledgement section may be presented after the conclusion, if desired.

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