A COMPARITIVE EVALUATION OF VIVASENS AND SYSTEMP DESENSITIZERS ON SHEAR BOND STRENGTH OF COMPOSITE RESIN TO HUMAN DENTIN: AN IN VITRO STUDY.

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Abstract:
Background
Post-restorative dentinal hypersensitivity is a common occurrence and happens due to the movement of the dentinal fluid in the exposed tubules, which excites the pulpal nerves resulting in perceived sensation. The use of dentin desensitizers has been one of the most common approaches for management of post-restorative dentin hypersensitivity.

Material & Methods
36 human premolars extracted for orthodontic purpose were collected after taking patient’s consent in Sri Siddhartha Dental college, Tumkur. Shear bond strength test was done using Instron universal testing machine at RV-TIFAC composite design center, Composite technology park, Bangalore. The teeth were carefully cleaned using a hand scaler and water-pumice slurry in prophylaxis rubber cups and stored in 0.1% thymol solution until subjected to use. The sample teeth were assigned to the following product (Table 1) groups: Groups: Per group (n = 12), Group 1: Prime and Bond NT, Germany, Group 2: Vivasens desensitizer, Ivoclar Vivadent Schaan, Liechtenstein, Switzerland, Group 3: SystemP, Ivoclar Vivadent Schaan,

Results
The mean shear bond strength between all the groups was statistically significant. So further pairwise comparisons between the groups was carried out using Mann-Whitney test. The test result shows that Group 1 values statistically significant difference between Group II and Group III (P<0.05).

Conclusion
Within the limitation of the present in vitro study SystemP desensitizer is considered to be a promising option for the treatment of dentin hypersensitivity and to enhance bond strength during composite resin restorations. It can be stated that use of desensitizers showed increased shear bond strength values as compared to application of the adhesive alone. The SystemP desensitizer have better bond strengths than Vivasens.

Key Words: Vivasens, SystemP, Desensitizers, Shear Bond Strength, Composite Resin, Human Dentin.

I. Introduction
Post-restorative dentinal hypersensitivity is a common occurrence and happens due to the movement of the dentinal fluid in the exposed tubules, which excites the pulpal nerves resulting in perceived sensation. The use of dentin desensitizers has been one of the most common approaches for management of post-restorative dentin hypersensitivity. Dentin desensitizers are applied to the tooth surface after etching and prior to the application of the bonding agent. The dentin desensitizers block the dentinal tubules and bring about a reduction...
in hypersensitivity. Current desensitizers include components such as fluoride, triclosan, benzalkonium chloride, ethylene diaminetetraacetic acid and Glutaraldehyde. Dentin adhesive/desensitizer combination can be used to mechanically block patent dentinal tubules or physiologically decrease the excitability of the intradental nerves to relieve hypersensitivity. Vivasens, the desensitizing agent contains organic acids such as phosphonic acid methacrylate and solvents such as ethanol which induce the precipitation of proteins in the dentin liquid. Moreover, the sealing effect is enhanced by co-precipitating polyethylene glycol dimethacrylate, which is present in Vivasens. Polyethylene glycol dimethacrylate is a condensation polymer, which acts as an organic filler and cross links molecular chains of polymers. SystemP is a desensitizer containing Glutaraldehyde and hydroxyl ethyl methacrylate (HEMA) which can reduce hypersensitivity by sealing or occluding the exposed dentinal tubules by precipitating plasma proteins in the dentinal fluid. However, there are no consensus and limited data available to evaluate their effectiveness in improving bond strength to resin composites. Hence, the purpose of this in vitro study is to compare the effect of Vivasens and SystemP desensitizers on shear bond strength of composite resin to human dentin.

II. Aims and Objectives

The aim of the study was to evaluate the effect of VIVASENS and SYSTEMP desensitizers on the shear bond strength of composite resin to human dentin. Objectives are to compare and evaluate the shear bond strength of VIVASENS desensitizer on composite resin and to compare and evaluate the shear bond strength of SYSTEMP desensitizer on composite resin.

III. Materials and Methods

It is a vitro experimental design which was done under laboratory settings. It was done in pre-clinical laboratory, Department of Conservative Dentistry and Endodontics, Sri Siddhartha Dental college, Tumkur. Shear bond strength test was done using Instron universal testing machine at RV-TIFAC composite design Centre, Composite technology park, Bangalore. Total duration of study was 3 months. 36 human premolars extracted for orthodontic purpose were collected after taking patient’s consent. The teeth were carefully cleaned using a hand scaler and water-pumice slurry in prophylaxis rubber cups and stored in 0.1% thymol solution until subjected to use. Materials used for study were 37% Phosphoric acid (Scotchbond Multi-purpose Etchant,3M), Dentin Bonding Agent Prime and Bond NT (Dentsply, Germany), Resin composite Filtek Z-250 (3M/ ESPE, St Paul,MN,USA), Silicon carbide disc (Moyco Precision Abrasives, Montgomeryville, PA, U.S.A), Vivasens desensitizer (Ivoclar Vivadent Schaan, Liechtenstein, Switzerland), SystemP Desensitizer (Ivoclar Vivadent Schaan, Liechtenstein, Switzerland), Distilled water (Nice Chemical Laboratory Supplies Ltd, Kochi, India), Self-Cure Acrylic ( DPI India). Sound human extracted premolar teeth with no obvious defects were included in the study. Teeth with occlusal caries/restorations, presence of cracks, obvious surface defects or developmental anomalies were excluded from the study. Random Sampling technique was used. For 80% power with significance level of 0.05 and effect size of 0.4 to be achieved, the total number of samples needed was 36 which were divided into three groups (n=12), calculated using G Power software version 3.1.9.2.

IV. Methodology

A total of 36 freshly extracted human premolar teeth were taken and were randomly divided into three groups of 12 samples each. The occlusal surface of each tooth was ground under running water to expose middle depth dentin and the specimens were treated with 37% phosphoric acid for 15 seconds and thoroughly rinsed with water for the same amount of time with water spray. The sample teeth were assigned to the following groups (Table 1) groups: Groups: Per group (n = 12), Group 1: Prime and Bond NT, Germany, Group 2:Vivasens desensitizer, Ivoclar Vivadent Schaan, Liechtenstein, Switzerland, Group 3: SystemP, Ivoclar Vivadent Schaan, Liechtenstein, Switzerland, Group 1:The samples were treated with the application of the dentin-bonding agent, alone which served as controls, Group 2: Vivasens desensitizer was applied with applicator tip over the dentin surface following which bonding agent (Prime and Bond NT Dentsply, Germany) was applied and cured as per manufacturers’ instructions, Group 3: SystemP desensitizer was applied to dentin for 10s with the help of an applicator brush and was allowed to remain on the tooth surface for 20 s. Then the area was lightly dried with an air syringe following which bonding agent (Prime and bond NT) was applied and cured as per manufacturers’ instructions, Composite resin posts of dimension 2 mm in height and width were then built on the treated surfaces and the specimens were stored in distilled water for 48 hours and prior to testing were mounted on cold cure acrylic resin stubs. Universal testing machine (Instron) was used to apply the shear load until specimen failure occurred at a crosshead speed of 0.5 mm per minute. Maximum load applied and failure load was recorded for each specimen and the shear bond strength was calculated.
A Comparative Evaluation of Vivasens And SystemP Desensitizers on Shear Bond Strength Of

V. Statistical Analysis

The data were subjected to statistical analysis using One-way ANOVA followed by post hoc tests was used for statistical analysis of differences between groups at a significance level of 0.05. All analyses were performed using SPSS v.19 (SPSS Inc, Chicago, IL, USA).

VI. Results

The present in-vitro study was undertaken to compare the effect of VIVASENS and SYSTEMP desensitizer on shear bond strength of composite resin to human dentin. The study used universal testing machine to detect the shear bond strength of VIVASENS and SYSTEMP desensitizer to human dentin. In this study, total number of specimen was 36 with 12 in each group. The test for normality is mentioned in Table 1. The comparison of mean shear bond strength of all the groups is mentioned in table 2 and chart 1. The pairwise comparison of the groups is mentioned in table 3. The data was analyzed by Shapiro wilks test, Mann Whitney and Krushkal Wallis tests. Table 1 shows the test result of normality assumption, expect Group 3 other groups data was normally distributed (p<0.05) so all the analysis was carried out using non-parametric test. Table 2 shows the mean and median shear bond strength between the groups, the mean shear bond strength between the three groups was statistically significant with p<0.005 Highest value was observed in SYSTEMP treated group (Group III) followed by Group II and Group I. Table 3 shows the pairwise comparison of the materials tested. The mean shear bond strength between all the groups was statistically significant. So further pairwise comparisons between the groups was carried out using Mann-Whitney test. The test result shows that Group 1 values statistically significant difference between Group II and Group III (P<0.05). There is significant difference between Group II and Group III values (p<0.05)

Chart 1: The comparison of shear bond strength of all the groups

<table>
<thead>
<tr>
<th>Tests of Normality</th>
<th>Material</th>
<th>Kolmogorov-Smirnov Statistic</th>
<th>Shapiro-Wilk Statistic</th>
<th>df</th>
<th>Sig.</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share Bond Strength</td>
<td>Group 1</td>
<td>0.321</td>
<td>0.752</td>
<td>12</td>
<td>0.001</td>
<td>12</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>Group 2</td>
<td>0.289</td>
<td>0.774</td>
<td>12</td>
<td>0.006</td>
<td>12</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>Group 3</td>
<td>0.109</td>
<td>0.973</td>
<td>12</td>
<td>0.200</td>
<td>12</td>
<td>0.943</td>
</tr>
</tbody>
</table>

Table 2: Intergroup Comparison of mean Shear Bond Strength in MPaShare Bond Strength (Kruskal- Wallis Test)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
<th>Median</th>
<th>Min.</th>
<th>Max.</th>
<th>Chisquare*</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>12</td>
<td>12.63</td>
<td>2.139</td>
<td>11.27</td>
<td>11.01</td>
<td>16.56</td>
<td>16.703</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Group 2</td>
<td>12</td>
<td>15.79</td>
<td>2.740</td>
<td>16.37</td>
<td>10.95</td>
<td>17.98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td>12</td>
<td>18.40</td>
<td>2.226</td>
<td>18.21</td>
<td>15.12</td>
<td>22.56</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Pair wise comparison of groups (Mann-Whitney Test)

<table>
<thead>
<tr>
<th>Group 2</th>
<th>Group 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>U value</td>
<td>P value</td>
</tr>
<tr>
<td>Group 1</td>
<td>37.50</td>
</tr>
<tr>
<td>Group 2</td>
<td>-</td>
</tr>
</tbody>
</table>

DOI: 10.9790/0853-1704167377 www.iosrjournals.org 75 | Page
VII. Discussion

Dentinal hypersensitivity has been reported after placement of restorations and more so with composite resin restorations. Application of dentin desensitizers has been one of the recommended modalities for treatment of the same. In vitro studies have shown that application of dentin desensitizers has an influence on the bond strength between the tooth surface and the restoration. Sevimay et al. conducted a study to evaluate the bond strength of composite resin on dentin surfaces that have been treated with different desensitizing agents: SystemP Desensitizer, Hybrid Bond, BisBlock, Gluma Desensitizers and concluded that specimens treated with desensitizers yield significantly lower mean bond strength except SystemP desensitizer which did not detrimentally influence the bond strength. There are conflicting reports on the effect of dentin desensitizing agents on bond strength of adhesive restorations, and thus is the need for the study. In the present study etch and rinse adhesive technique is followed during the restorative procedure as it is considered to be the most efficient and suitable option for dentin adhesion. Shear test is used in the present study as it is considered to be more representative of the clinical situation. Della Bonnre and Vannort evaluated by Finite Element Analysis the stress distribution in different configuration of a composite/ceramic specimen for shear bond strength testing. They found that stress distribution has a great influence on the failure mode and they considered the shear test to be more appropriate to measure the strength of the base material. There is statistically significant difference in shear bond strength values between the experimental groups (p<0.05) hence the null hypothesis is rejected. In the present study SystemP (group III) showed maximum shear bond strength value of 22.56 MPa when compared to Prime and Bond NT (Group I-Control) and Vivasens (Group II). This may be attributed to the stabilization of the collagen fibril network by Glutaraldehyde, facilitating easy resin infiltration. The lower bond strength observed with Vivasens can be attributed to the precipitation of Ca salts by phosphoric acid methacrylate modified polyacrylic acid present in Vivasens. In addition, the potassium ions of its fluoride component support precipitation of the salts and the precipitation of microcrystals and mineral deposits into dentin tubules prevent resin infiltration. The results of the present study are in accordance with Eeshan Arub Mushqat et al who observed similar higher bond strength values with SystemP desensitizer and recommended the use of SystemP as a better desensitizer in reducing dentinal hypersensitivity.

VIII. Conclusion

Within the limitation of the present study SystemP desensitizer is considered to be a promising option for the treatment of dentin hypersensitivity and to enhance bond strength during composite resin restorations. It can be stated that use of desensitizers showed increased shear bond strength values as compared to application of the adhesive alone. The SystemP desensitizer have better bond strengths than Vivasens.

IX. Limitations

However, in the in vitro condition of the study limits the clinical relevance due to the variability in the study design and restorative protocol. However, the validity of this in vitro study could be appreciated through the further clinical trials.

References


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