Effect of casein phosphopeptide-amorphous calcium phosphate on surface roughness of a silorane-based and methacrylate-based composite resin  
(In vitro comparative study)

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ABSTRACT

Background: When using a fluoridated agent for caries-preventive intervention, the clinician should be careful not to allow the agent to come into contact with the composite restorations since topically applied fluorides were found to induce adverse effects on the morphologic characteristics and composition of composite restorations. A new remineralizing agent "MI Paste" and its fluoridated form "MI Paste Plus" based on Recaldent technology (CPP-ACP) were developed. This study was conducted with the aim of assessing the effect of these new remineralizing agents on surface roughness of two types of composite resin materials.

Materials and Method: Cylindrical specimens 12mm in diameter and 2mm in height were prepared from two types of composite resin materials: Filtek™ P90 (a silorane-based composite material) and Filtek™ Z350 XT (a methacrylate-based nanofill composite material). Each specimen was cured against a celluloid strip in a specially designed cylindrical mold using a QTH light curing unit for 40 seconds. Forty specimens were prepared for each composite type and subdivided into four subgroups of ten specimens each: Subgroup 1: without treatment, dry-stored in an incubator at 37°C for one week (control subgroup), Subgroup 2: without treatment, stored in deionized water in an incubator at 37°C for one week, Subgroup 3: treated with MI Paste once daily for one week, and Subgroup 4: treated with MI Paste Plus once daily for one week. Surface roughness of the specimens was obtained with a surface profile testing machine, which used the roughness average (Ra) to assess surface changes. Several measurements were taken for each specimen and the mean value of these measurements on one specimen was regarded as the Ra of that specimen. The mean Ra value of each subgroup was then calculated.

Results: The results of this study showed statistically non-significant differences among the different subgroups of Filtek™ P90 composite resin material. Concerning Filtek™ Z350 XT composite resin material, the results showed a statistically highly significant difference in surface roughness between the subgroup stored in deionized water and the control one, with statistically non-significant difference between the subgroups treated with MI Paste and MI Paste Plus and the control subgroup. Comparison of significance between the corresponding subgroups of both composite types revealed statistically non-significant differences except for subgroup 2 which showed a statistically significant higher surface roughness in Filtek™ Z350 XT than Filtek™ P90.

Conclusions: The daily application of the MI Paste and MI Paste Plus for one week had non significant effect on surface roughness of the silorane-based composite resin material Filtek™ P90. On the other hand, the application of these agents caused surface smoothing of the nanofilled methacrylate-based composite resin material Filtek™ Z350 XT.

Key words: MI Paste, MI Paste Plus, surface roughness, silorane, Filtek™ P90, Filtek™ Z350 XT.

INTRODUCTION

Composites are widely used in dentistry due to their excellent esthetic, strength, moderate cost compared to that of ceramics, and ability to micromechanically bond with the adequate tooth structure(1). Composite materials have improved greatly since their introduction and there is a general shifting away from amalgams toward composite resins (2). Composites consist of fillers embedded in a chemically-reactive organic resin matrix. Improvements in the composite materials were achieved, to a great extent, by optimizing the fillers (3). One of the most important advances of the last few years in the field of filler technology is the application of nanotechnology to dental composites (4).

The nanotechnology is aimed to improve the physical and mechanical properties of the composite restoratives. Moreover, inclusion of smaller filler particles as nano-size in the final formulation of the composites results in reduction of composite's shrinkage and improving their total mechanical properties (5). However, the shrinkage intrinsic to the methacrylate resin has remained a major challenge. Therefore, exchanging the resin seems the most promising pathway to solve the shrinkage problem (3).

With the same objective of reducing the polymerization shrinkage, different high molecular weight matrix resin compositions have been employed. One of these new matrix resin systems is silorane. Siloranes are a totally new class of compounds for use in dentistry. The name silorane derives from its chemical building blocks siloxanes and oxiranes. The combination of the two chemical building blocks of siloxanes and oxiranes provides a biocompatible, hydrophobic

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and low-shrinking silorane. This innovative resin matrix represents the major difference of silorane-based materials compared to conventional methacrylates (6).

Application of fluorides agents to the tooth surface is effective in preventing dental caries. The most commonly used professionals applied fluoride agents are fluoride varnishes and acidulated phosphate fluoride gel (APF) (7). APF agents have been used in caries-preventive interventions for more than two decades, and their effectiveness is widely known. In recent years, APF agents have been used by dentists to treat adults as well as infants and young children because of effectiveness and convenience. However, APF agents have been shown to have several practical disadvantages, one being that the hydrofluoric acid generated in APF agents is known to dissolve porcelain surfaces and negatively affect glass-ionomer cement and composite materials. Furthermore, the color of some composite materials has reportedly been influenced by repeated use of a fluoride varnish (8). On the other hand, topically applied stannous fluoride and sodium fluoride gels have been found to induce adverse effects on the surface roughness and morphologic characteristics of composite materials (9).

An increase in the surface roughness and discoloration has been used as a criterion to assess and predict the clinical deterioration of restorations constructed with different types of materials (10). Surface roughness increase of composite resins has many negative effects, such as susceptibility to staining, recurrent caries, plaque retention, and increase the colonization and adhesion of bacteria on composite resins. The smoother the resin composite, the more comfortable it may be to the patient (11). The mean critical value of surface roughness for bacterial colonization of several dental materials has been measured as 0.2μm. Above this value, increased bacterial colonization and dental plaque accumulation may occur and thus favoring the development of both caries and periodontal inflammation on one hand and could damage the restorative material surface from the other hand (10).

A new remineralizing agent named GC Tooth Mousse® or MI Paste® based on Recaldent technology (CPP-ACP) was developed to capitalize the anti-caries properties of milk. The anticariogenic properties of milk and its products have been attributed to direct chemical effect of phosphoprotein casein and calcium phosphate. It has been suggested that casein phosphopeptides (CPP) have the ability to stabilize calcium phosphate in solution by binding amorphous calcium phosphate (ACP) with their multiple phosphoserine residues, thereby allowing the formation of small CPP-ACP clusters. CPP-ACP prevents tooth demineralization and enhances remineralization (12).

An analysis of the chemistry of demineralization and remineralization indicates that a major source of mineral loss in the caries process is the destruction of apatite with the creation of water as a by-product, and the leakage of a neutral species calcium hydrogen phosphate across a porous enamel surface. When placed on the surface of a tooth, CPP-ACP interacts with hydrogen ions and forms the same species with calcium hydrogen phosphate which, under a diffusion gradient, can enter into the tooth, react with and consume the water to produce enamel mineral, thereby removing subsurface mineral defects. It has too many applications in dentistry such as the treatment of white spot lesions, treatment of tooth sensitivity, after bleaching and after removal of orthodontic appliances, caries stabilization, root surface caries, fluorosis, and to protect the very young child (13).

This study was conducted with the aim of assessing the effect of these new remineralizing agents on surface roughness of a silorane-based and methacrylate-based composite resin materials.

**MATERIALS AND METHOD**

Two types of composite resin were used in this study: (1) Filtek™ P90 (a silorane-based low shrink posterior composite, shade A2) (3M ESPE, USA) and (2) Filtek™ Z350 XT (a methacrylate-based nanofill composite, shade A2 body) (3M ESPE, USA).

Filtek™ P90 is a light-curing, radiopaque, silorane-based composite for the posterior area. It contains 55% volume (76% weight) inorganic fillers of quartz and yttrium fluoride with a particle size between 0.1 and 2 μm (mean 0.47 μm). It contains a hydrophobic resin matrix composed of siloxane and oxirane (14).

Filtek™ Z350 XT is a universal restorative material designed for use in anterior and posterior restorations. The fillers are a combination of a non-agglomerated/non-aggregated 4-11 nm zirconia filler and an aggregated zirconia/silica cluster filler (comprised of 20 nm silica and 4-11 nm zirconia particles). The inorganic filler loading is about 63.3% by volume (78.5% by weight). It contains bis-GMA, UDMA, TEGDMA, PEGDMA and bis-EMA resins (15).

*GC MI Paste® / GC MI Paste Plus® and GC Tooth Mousse® / GC Tooth Mousse Plus® are synonymous. In the United States, it is called MI Paste or MI Paste Plus. In Australia, it is called Tooth Mousse or Tooth Mousse Plus.
Two remineralizing agents were used in this study: GC MI Paste™ and GC MI Paste Plus™ (GC America Inc, USA). MI Paste and MI Paste Plus contain the same ingredients except that the MI Paste Plus contains 0.2% sodium fluoride (900 ppm). The ingredients are: pure water, glycerol, CPP-ACP, D-sorbitol, CMC-Na, Propylene glycol, Silicone dioxide, Titanium dioxide, Xylitol, Phosphoric acid, Flavoring, Zinc oxide, Sodium saccharin, Ethyl p-hydroxybenzoate, Propyl p-hydroxybenzoate, and Butyl p-hydroxybenzoate (16).

Sample Preparation
A specially designed cylindrical mold (12mm diameter and 2mm height) was used to prepare cylindrical composite specimens. A celluloid strip was placed on a flat glass slide on top of a white background. The mold was then placed on it and slightly overfilled in one increment with one of the composite materials and a second celluloid strip was then placed on top of the mold and overlaid with another glass slide with the application of 100gm load to extrude excess material. The top slide was then removed and the composite resin light-cured with Coltolux 5 conventional quartz-tungsten-halogen (QTH) light curing unit (Coltene Whaledent, France) for 40 seconds following the manufacturer's instructions. The tip of the light curing unit was placed in direct contact with the overlaid celluloid strip. After light curing, the overlaid celluloid strip was removed and the specimen was taken from the mold. No polishing of the specimens was done.

Sample Grouping
For each type of composite, 40 specimens were prepared and divided into 4 subgroups of ten specimens each:
- Subgroup 1: without treatment, dry-stored in an incubator at 37°C for one week.
- Subgroup 2: without treatment, stored in deionized water in an incubator at 37°C for one week.
- Subgroup 3: treated with MI Paste once daily for one week, stored in deionized water in an incubator at 37°C.
- Subgroup 4: treated with MI Paste Plus once daily for one week, stored in deionized water in an incubator at 37°C.

Subgroup 1 represented a control group which provided baseline measurements with which surface roughness of other subgroups would be compared.

Subgroup 2 represented a negative control group to exclude the effect of deionized water on surface roughness as subgroup 3 and subgroup 4 were stored in deionized water.

The method of application of MI Paste and MI Paste Plus was as follows: Eight milligrams were freshly squeezed from the tube and placed on the top surface of the composite specimens for four minutes. Then each specimen was thoroughly rinsed with deionized water for two minutes. The specimens were then restored in deionized water for the next day at a temperature of 37°C in an incubator. This procedure was repeated daily for one week (17).

Surface Roughness Measurement
Surface roughness of the specimens was obtained with a surface profile testing machine (Hand-Held Roughness Tester, TR200, TimeGroup Inc. China). The roughness average (Ra) was used to assess surface changes, which is the arithmetic mean of roughness profile within a measuring length. Several measurements were taken for each specimen and the mean value of these measurements on one specimen was regarded as the Ra of that specimen. The Ra values were automatically calculated by the profilometer. The mean Ra value of each subgroup was then calculated (18).

RESULTS
The descriptive statistics (mean and standard deviation) of surface roughness (Ra value in µm) of the different subgroups of Filtek™ P90 and Filtek™ Z350 XT composite resin materials and the comparison of significance of the different subgroups of each composite resin material by One-way ANOVA test are presented in Table 1.

From this, it can be seen that the mean Ra values of all subgroups of Filtek™ P90 composite resin material were higher than the mean Ra values of their corresponding subgroups of Filtek™ Z350 XT composite resin material except for the subgroup in which the composite resin specimens were stored in deionized water, which showed a higher mean Ra value in Filtek™ Z350 XT than Filtek™ P90 composite resin material.

Comparison of significance among the different subgroups of Filtek™ P90 and Filtek™ Z350 XT composite resin materials by One-way ANOVA test revealed statistically non-significant differences among the different subgroups of Filtek™ P90 composite resin material (p>0.05), and a statistically highly significant difference among the different subgroups of Filtek™ Z350 XT composite resin material (p<0.01).

Further analysis among the different subgroups of Filtek™ Z350 XT composite resin material using LSD (Least Significant Difference) test revealed a statistically highly significant difference in surface roughness between the subgroup stored in deionized water and the
untreated control subgroup (p<0.01), while statistically non-significant difference between the subgroups treated with MI Paste and MI Paste Plus and the untreated control subgroup (p>0.05) as shown in Table 2. In addition, there was a statistically highly significant difference in surface roughness between the subgroup stored in deionized water and the subgroups treated with MI Paste and MI Paste Plus (p<0.01), with statistically non-significant difference between the latter two subgroups (p>0.05).

Comparison of significance between the different subgroups of Filtek™ P90 composite resin material and their corresponding subgroups of Filtek™ Z350 XT composite resin material using student t-test (Table 3) revealed statistically non-significant differences (p>0.05) except for the subgroup stored in deionized water, which showed a statistically significant higher surface roughness in Filtek™ Z350 XT than Filtek™ P90 (p<0.01).

DISCUSSION

Topical fluoride treatment has been advocated for patients with a high incidence of caries, and daily applications were shown to reduce the caries index and arrest existing lesions. However, topically applied fluorides were found to induce adverse effects on the morphologic characteristics and composition of composite restorations, and thus it is recommended when using a fluoridated agent for caries-preventive intervention that the clinician should be careful not to allow the agent to come into contact with the composite restorations.

Due to the above mentioned detrimental effects of topically applied fluorides on composite materials and with the introduction of the new remineralizing agent "MI Paste" and its fluoridated form "MI Paste Plus" based on Recaldent technology (CPP-ACP), this study was conducted to assess the effect of these new remineralizing agents on surface roughness of a silorane-based and methacrylate-based composite resin materials.

MI Paste Plus offers the same benefits of regular MI Paste, enhanced with 0.2% sodium fluoride to further promote remineralization and protect teeth from caries development. MI Paste Plus is the only product that provides the correct bio-available ratio of: 5-calcium, 3-phosphate, 1-fluoride, the same ratio that is found in healthy enamel. For children under the age of 6 years, it is recommended to use MI Paste which does not contain fluoride, while MI Paste Plus is recommended for patients 6 years and older.

The selection of Filtek™ P90 and Filtek™ Z350 XT composite resin materials for use in this study is due to their different filler and resin matrix formulations. and each one represents one of the recent developments in composite technology: Filtek™ P90 which is a silorane-based low-shrinking material, and Filtek™ Z350 XT which is one of the newest products based on nanotechnology.

The surface roughness property of any material is the result of an interaction of multiple factors. Some of them are intrinsic that are related to the material itself, such as the filler (type, shape, size and distribution of the particles), the type of resinous matrix as well as the ultimate degree of cure reached, and the efficiency at the filler/matrix interface. Other factors are extrinsic that are associated with the type of polishing system used.

In this study, the composite specimens were cured against a celluloid strip and were not polished in order to exclude the effect of the extrinsic factors on the surface roughness as the tested composite resins differ in their inorganic component (the type, size, and amount of filler loading) which affects their polishability. In addition, it has been shown that the experimental finishing and polishing procedures are inherently destructive to the restoration and may lead to micro-crack formation. Moreover, it has been shown that the smoothest surface was obtained when the composite resin is cured against a clear matrix.

Deionized distilled water was used as a storage medium because it simulates the wet oral environment provided by saliva and water. Saliva is a dilute fluid comprising 99% water and the concentration of the dissolved solids (organic and inorganic) are characterized by wide variations, both between individuals and within a single individual. Due to these variations, water was used as a storage medium in this study.

One week storage of the specimens in deionized water was done in this study since it has been found that the maximum amount of water absorption occurs in the first week.

The increase in surface roughness of Filtek™ Z350 XT composite resin material after one week of storage in deionized water as compared with the control could be attributed to water sorption. Water could cause softening of the polymer component by swelling the network and reducing the frictional forces between polymeric chains, resulting in hydrolytic degradation of the resin matrix with micro-cracks formation and exposure of the filler particles. It has been found that the polymerization shrinkage of the methacrylate-
based composite materials and water sorption with the diffusion of moisture through the resin component lead to the initiation and propagation of micro-cracks in the resin matrix(24). Filtek™ Z350 XT contains bis-GMA, UDMA, TEGDMA, PEGDMA and bis-EMA resins.(15) Except for bis-EMA, which is an ethoxylated version of bis-GMA, other molecules (bis-GMA, UDMA, and TEGDMA) have hydroxyl groups which promote water sorption. Moreover, the incorporation of TEGDMA in Filtek™ Z350 XT composite material resulted in an increase in water uptake as this monomer presents higher hydrophilicity when compared with bis-GMA and UDMA.(25)

This finding is in agreement with the results of Yesilyurt et al.(2009)(25) and Catelan et al. (2010)(23) who observed a significant softening of Filtek™ Z350 XT after immersion in deionized water for 7 days and 28 days, respectively.

On the other hand, Yap et al. (2001)(26) reported that zirconia glass fillers were also susceptible to aqueous attack. Filtek™ Z350 XT contained zirconia/silica fillers which could be another cause for the increased roughness after water immersion. However, this disagrees with Nayif et al. (2004)(27) who claimed that deionized distilled water is the least solution that causes filler debonding in comparison with the oral environment.

When MI Paste and MI Paste Plus were applied to Filtek™ Z350 XT composite resin, it was found that the surface roughness was decreased as compared to composite resin specimens that were stored in deionized water, a decrease to the limit that it became statistically non-significant when compared with the untreated composite resin specimens of the control subgroup. This finding would suggest that the MI Paste and MI Paste Plus might have chemically attacked the inorganic filler particles, counteracting the water sorption effect of deionized water which acted on the resin matrix, resulting in surface smoothening. This effect could be attributed to the presence of phosphoric acid in the chemical composition of the MI Paste and MI Paste Plus, which might caused etching of the filler particles exposed after disintegration of the superficial resin layer as a result of water sorption, and the presence of silicone dioxide and titanium oxide which act as abrasives. Phosphoric acid, silicone dioxide, and titanium oxide can attack the inorganic particles, and when these are very small, as in the nanofiller composite resin, the size of the defects created are practically imperceptible, resulting in surface smoothening. Another possible cause for such a surface smoothening effect could be attributed to that when MI Paste and MI Paste Plus were applied, they were retained in the micro-porosities created by water sorption resulting in surface smoothening.(28) However, this finding disagrees with the results of Prabhakar et al.(2009)(27) who found that the application of GC Tooth Mousse causes minimal changes in color and surface roughness of composite and glass ionomer cement. Such contrary in results could be attributed to the difference in the composite resin type used which was Z250, a microhybrid composite resin, which has larger filler particles than Filtek™ Z350 XT composite, so the size of the defects created after the application of MI Paste and MI Paste Plus would be relatively larger as compared with the nanofilled composite resin Filtek™ Z350 XT used in this study.

The statistically non-significant difference in surface roughness of Filtek™ Z350 XT composite resin specimens treated with MI Paste and those treated with the MI Paste Plus despite the fluoride content of the latter, whose surface roughening effect on composite resin is well documented, could be attributed to that the MI Paste Plus contains sodium fluoride which is neutral (pH=7) and its concentration is lower than that used in the sodium fluoride gel intended for professional application. The concentration of sodium fluoride in the MI Paste Plus is 0.2% (900 ppm) which is the equal to fluoride concentration in a tooth paste, while its concentration in the gel intended for professional application is 2%.

Concerning Filtek™ P90 composite resin, the statistically non-significant differences in surface roughness after one week of immersion in deionized water and after application of the MI Paste and MI Paste Plus as compared with the surface roughness of the control subgroup could be related to its novel chemistry. Siloranes are a totally new class of compounds for the use in dentistry. The name silorane derives from its chemical building blocks siloxanes and oxiranes. Siloxanes are well known by their distinct hydrophobicity. By incorporating the siloxanes into the dental silorane resin, this property was transferred to the Filtek™ P90 composite. The oxirane polymers are known for their low shrinkage and the outstanding stability toward many physical and chemo-physical forces and influences. The combination of the two chemical building blocks of siloxanes and oxiranes provides the biocompatible, hydrophobic and low-shrinking silorane base of Filtek™ P90 Low Shrink Posterior Restorative. This innovative resin matrix represents the major difference of Filtek™ P90 restorative compared to conventional methacrylates(6). While Filtek™ Z350 XT resin

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matrix is composed of molecules with hydroxyl groups which promote water sorption. Filtek™ P90 composite has 3,4-epoxycyclohexyl-cyclopoly(methyl)siloxane. This backbone imparts hydrophobicity, thereby curtailing water sorption [25].

On the other hand, in addition to the hydrophobicity of the silorane resin, the difference in filler composition could be another contributing factor for the statistically non-significant difference in surface roughness of Filtek™ P90 after storage in deionized water as reported by Yap et al. (2001) [26]. Filtek™ P90 contains quartz fillers which are more resistant to aqueous attack than the zirconia/silica fillers of Filtek™ Z350 XT composite material.

The lower surface roughness of Filtek™ Z350 XT at baseline as compared with Filtek™ P90, although statistically not significant, is due to the smaller mean particle size of Filtek™ Z350 XT which is classified as a nano-filled composite, while Filtek™ P90 is classified as a microhybrid composite with larger mean particle size of 0.47 μm. However, the statistically non-significant difference in surface roughness could be attributed to the lower filler volume of Filtek™ P90 as compared with the Filtek™ Z350 XT. Moreover, both materials were cured against a celluloid strip which produced a smooth surface. However, this finding disagrees with the results of Jehad (2011) [9], who found that the surface roughness of Filtek™ P90 composite resin specimens was lower than that of Filtek™ Z350 XT composite resin specimens. Such a difference in results could be attributed to that the composite resin specimens were polished prior to surface roughness measurement, while in our study no polishing was done.

An interesting finding in this study is that the average surface roughness of both materials in all circumstances didn’t exceed the critical threshold value of 0.2μm, which allows plaque accumulation. Surface roughness may be clinically relevant only when the Ra values were above this critical threshold. Thus it can be stated that the application of the MI Paste or MI Paste Plus as a remineralizing agent has no detrimental effect on surface roughness of silorane-based composite material. On the other hand, these agents could cause a surface smoothing effect of nanofilled methacrylate-based composite resin material, so when the MI Paste or MI Paste Plus would be used for any of the intended indications for their use the clinician could allow these agents to come into contact with the composite restorations in contrary to topically applied fluorides which were found to induce adverse effects on the morphologic characteristics and composition of composite restoration.

As a conclusion, the daily application of the MI Paste and MI Paste Plus for one week had no significant effect on surface roughness of the silorane-based composite resin material Filtek™ P90. On the other hand, the application of these agents caused surface smoothening of the nanofilled methacrylate-based composite resin material Filtek™ Z350 XT.

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15. Leaflet of Filtek™ Z350 XT Universal Restorative. 3M ESPE, USA.
16. Leaflet of MI Paste and MI Paste Plus. GC America Inc, USA.

Table 1: Surface roughness (µm) (mean ± standard deviation) of different subgroups of Filtek™ P90 and Filtek™ Z350 XT composite resin materials

<table>
<thead>
<tr>
<th>Subgroups</th>
<th>Filtek™ P90</th>
<th>Filtek™ Z350 XT</th>
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<tbody>
<tr>
<td></td>
<td>Without Treatment</td>
<td>Deionized Water</td>
</tr>
<tr>
<td>Mean ± S.D.</td>
<td>0.0568 ± 0.0065</td>
<td>0.0572 ± 0.0064</td>
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Table 2: LSD test for comparison of surface roughness among the different subgroups of Filtek™ Z350 XT composite resin material

<table>
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<tr>
<th>Subgroups</th>
<th>With Treatment</th>
<th>Without Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Deionized Water</td>
<td>MI Paste</td>
</tr>
<tr>
<td>0.001 (HS)</td>
<td>0.885 (NS)</td>
<td>0.758 (NS)</td>
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<tr>
<td>0.876 (NS)</td>
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Table 3: Student t-test comparison between different subgroups of Filtek™ P90 composite resin material and their corresponding subgroups of Filtek™ Z350 XT composite resin material

<table>
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<th>Subgroups</th>
<th>t</th>
<th>Significance</th>
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<tr>
<td>P90 (Without Treatment) – Z350 XT (Without Treatment)</td>
<td>1.240</td>
<td>.246 (NS)</td>
</tr>
<tr>
<td>P90 (Deionized Water) – Z350 XT (Deionized Water)</td>
<td>-2.300</td>
<td>.047 (S)</td>
</tr>
<tr>
<td>P90 (MI Paste) – Z350 XT (MI Paste)</td>
<td>1.243</td>
<td>.245 (NS)</td>
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<tr>
<td>P90 (MI Paste Plus) – Z350 XT (MI Paste Plus)</td>
<td>0.848</td>
<td>.419 (NS)</td>
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