# *Microleakage of reinforced core build up materials*

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**Abstract:** Substantial microleakage at the interface between the core and the dentin substrate may occur. A tight and impervious bond between the Dentin and the restorative material is critical for the longevity of Core restorations. This study evaluated the microleakage of reinforced core build up materials, two composite resins, two glass ionomer cements and amalgam treated with dentin bonding agents or with conditioner. The results indicated that dentin bonding agent is most effective in reducing microleakage at tooth/core interface of reinforced composite cores and amalgam core, while reinforced glass ionomer cement cores with conditioners has no effect in reducing the microleakage.

**Keywords**: microleakage, reinforced core.

## Introduction:

Composite resin core and post systems used with a prefabricated metal post have become accepted. Microleakage may be the underlying cause of a number of factors that can lead to the failure of the restorations [1,2]. Available composite resins are not inherently adhesive to tooth structure and do not effectively seal the cavity preparation. Also the ability of a composite to minimize the extent of microleakage at the tooth restoration interfaces is an important factor in predicting clinical success [3-6].Failure of the materials to seal the prepared tooth may lead to Caries, Endodontic failure, Periodontal diseases, Root fracture, post-core separation and crown core separation [7]. Previous microleakage studies [8-13] demonstrated dye penetration at the interface between core build up materials and dentin substrate, as a progression of marginal leakage. The dentin bonding agent must achieve a bond between dentin and composite resin with sufficient strength to counteract the polymerization contraction force of the composite resin to prevent formation of a contraction gap [14.15] . This study evaluated the microleakage at core material/dentin interface of reinforced core build up materials and amalgam after the dentinal surfaces were treated with bonding agent or conditioner.

## Materials and methods:

Freshly extracted incisors with straight roots, free from cracks, and with similar dimensions were collected. The teeth were the decorated leaving the root faces flat, then the root canals were cleaned, shaped using step-back technique and obdurate with cold gutta percha and root canal sealer using lateral condensation technique. Gutta percha was removed from the root orifices with average of 2mm depth and sealed with zinc phosphate cement.

Fifty prepared roots were randomly divided into five groups 10 each. Five roots as experimental group were conditioned at the root faces while the other 5 roots as control group were not conditioned. Also Five core build up materials were used for this study.

(1) Two autopolymerising reinforced composite resin & Amalgam Core materials :( Ti-core Natural-Lanthanide Reinforced, EDS, New York, N. Y ., USA),(Ti-core- Titanium Reinforced, EDS, New York, N. Y ., USA )and one silver amalgam (Tytin-Kerr, Sybron, Corp., USA). Each root face was etched with 37% phosphoric acid for 15 seconds, rinsed copiously with water and dried with air. Activator of the bonding agent (Scotch bond Multipurpose plus, 3M, Dental Products, ST, Paul, MN., USA) was applied and gently dried followed by primer of the bonding agent and dried. One drop of the adhesive and catalyst was mixed and applied to the roots face. Then the core material was built up.

(2) Two reinforced glass ionomer cement cores: (Ketac-Silver Aplicap-Silver filled, ESPE, GERMANY) and (Vermeer, Hybrid, 3M Dental Products, ST .Paul., M.N., USA). The conditioner of the first brand of core was applied to the root face for 10 seconds, rinsed copiously with water and dried with air. For the second brand, its primer was applied for 30 seconds, replenished, dried with air until the surface was kept wet and visible light curing until (Espe-Elpar II, CANADA) was used for 20 seconds. Then the core material was built up.

Each core material used was mixed, filled and condensed incrementally over the root face which was circumferentially surrounded by a matrix. Each core was 4mm in height, all procedures were done following the manufacturer's instructions.

After setting, the excess material glided over the roots was removed to expose the root/core junctions. The roots were sealed with several coats of a nail polish to 0,5 mm from root/core interface. Then all roots were immersed in 2% methylene blue dye and incubated at 37 C for 48 hours.

The roots were washed in distilled water and sectional longitudinally in a buccolingual direction using a diamond disc at low speed under water cooling conditions. The linear measurements of dye penetration at the root/core interface were done under stereomicroscope (M.B.C-9-USSR) to access the microleakage (mm).

Table (1): Mean values and standard deviation of microleakage (mm) of root/core interface (t-test).

| Core Material | Control Group $\bar{X} \pm SD$ | Experimental Group $\bar{X} \pm SD$ | t- value |
|---|---|---|---|
| 1.Ti-Core Natural | 2.188 ± 0.230 | 0.227 ± 0.114 | 17.04* |
| 2.Ti-Core Titanium | 2.427 ± 0.234 | 0.282 ± 0.108 | 18.64* |
| 3.Amalgam | 2.254 ± 0.315 | 0.129 ± 0.054 | 14.88* |
| 4.Glass-ionomer | 2.187 ± 0.257 | 2.326 ± 0.224 | 0.91 |
| 5.Glass-ionomer | 0.536 ± 0.790 | 0.448 ± 0.122 | 1.35 |

*Statistically significant at P < 0.001.

Table (2): One way analysis of variance (ANOVA) for Control Groups.

| Source | D.F | Sum of Squares | Mean Squares | F Ratio | F Prob. |
|---|---|---|---|---|---|
| Between Groups | 4 | 12.1370 | 3.0343 | 54.339 | .0000 |
| Within Groups | 20 | 1.1168 | .0558 | | |
| Total | 24 | 13.2538 | | | |

*Statistically significant at P < 0.001

Table (3): One way analysis of variance (ANOVA) for Experimental Groups.

| Source | D.F | Sum of Squares | Mean Squares | F Ratio | F Prob. |
|---|---|---|---|---|---|
| Between Groups | 4 | 17.1423 | 4.2856 | 231.4500 | .0000 |
| Within Groups | 20 | .3703 | .0185 | | |
| Total | 24 | 17.5126 | | | |

*Statistically significant at P < 0.0

**Results**

Microleakage (mm) shown by dye penetration at root/core interface is presented in table(I).One way analysis of variance (Table II,III) revealed that there was highly significant differences between the seven types of core materials in experimental and control groups (P < 0,001).

When comparing the microleakage of experimental and control groups of each core material by using student t-test, there was highly significant differences between all tested groups, except for groups of glass ionomer cement cores (P > 0,05).

## Discussion

Among the important properties of dentin bonding agents are their bond strength to dentin and their effect on microleakage.

Results of this vitro study indicated that the use of dentin bonding agent afforded significant reduction in microleakage at root/core interface. Microleakage occurred in specimens of composite and amalgam cores was reduced after using the dentin bonding agent. The dentin bonding agent was most effective in reducing the microleakage with amalgam cores than composite cores. While microleakage with reinforced glass ionomer cores was not significantly different after application of conditioners.

Microleakage occurs when the force created in the composite resin bulk resulting from polymerization contraction exceeds, the bond strength generated by the dentin bonding agent [16,17]. This leakage results in pulling away of the composite resin from the dentinal adhered surfaces and creating an interfacial gap [8, 10,11]. However, the glass ionomer cores, shrink on setting and are water soluble. Also they bond to tooth structure but the relative contribution of this chemical and micromechanical bonding remained unknown [12]. The significant difference in proportion of Microleakage between bonded composite and glass ionomer may be attributed to the different micromechanical bonding and various modes of failure. Superiority of the bonded composite is due to penetrations of the exposed dentinal tubules by composite resin tags while glass ionomer cores are characterized by gradual dissolutions as all ionic substances [8, 11].

## Conclusions

From this study, the following conclusions could be obtained:

1. Dentin bonding agent is most effective in reducing microleakage at tooth / core interface of reinforced composite cores and amalgam core.
2. Reinforced glass ionomer cement cores with applications of conditioners has no effect in reducing microleakage.

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