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Development and assessment of addition of Fluoroapatite or Calcium Fluoride to two types of adhesive

(in vitro and vivo study)

A Thesis
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Abstract

With increase use of composite resin materials due to their aesthetic properties and their ability to bond with enamel and dentin, the concerns about the polymerization shrinkage resulting in the formation of marginal gaps in the tooth/restoration interface, secondary carries and discoloration has increased.

A great effort has been made to diminish the microleakage around the restorations including the development of adhesive system to improves the adhesion of composite restoration to the tooth substances especially to dentin.

One of these efforts is to add an inhibitory effect against secondary caries to the restorative materials because the difficulty of having perfect seal at the cervical margins. The aim of the study was to evaluate the effect of reinforcement of bonding adhesive systems with Fluoroapatite or Calcium Fluoride without affecting the shear bond strength of bonding adhesive systems: Fluoroapatite was added in percentage of 3% to Tetric® N-Bond and 1 % to Tetric® N-Bond Self-Etch, while Calcium Fluoride was added in percentage of 5% to Tetric® N-Bond and 7 % to Tetric® N-Bond Self-Etch.

Sixty sound upper premolar teeth were used for testing shear bond strength on flat surface for bonding which was obtained by cutting the buccal and palatal cusps and the results showed that these additions didn't affect the shear bond strength.

Biocompatibility study were done by histopathological test which was carried out on rabbits by subcutaneous implantation of fluoridated adhesive and was compared to the control non-fluoridated adhesive using a polyethylene tube as a carrier. The results showed that all fluoridated adhesive systems were biocompatible and there was no systemic toxicity.

Fluoride release evaluation were done by preparing ten cylindrical disc-shaped specimens of the six tested materials (TE, TE+FA 3%, TE+ CaF_2 5%, SE, SE+FA 1% and SE+ CaF_2 7%), data obtained were then analyzed and the results showed that all the groups with addition of Fluoroapatite or Calcium Fluoride release fluoride and the peak level of fluoride ion release was in the first two days and also the SE+ CaF_2 7% group was releasing the largest amount of Fluoride among all other groups.

The microbiological study was carried out to evaluate and test antibacterial activity of fluoridated adhesives and were compared to the control non-fluoridated adhesives against Streptococcus mutans and Lactobacilli. Ten discs for each group were prepared, 5 discs of each group used for each microorganism were used to assess the antimicrobial effect of the fluoridated adhesives in vitro by direct contact against selected microorganisms and comparing it with control groups. The results showed that all Fluoridated adhesives have antibacterial effects against streptococcus mutans and Lactobacilli.

For linear dye penetration, sixty sounds human lower third molar teeth were used for microleakage test study, ten teeth for each group. On the buccal and lingual surfaces, preparation of a standardized class V cavities were done (3mm height, 3mm width, 2mm depth) in which the cervical margins of the cavities were located about 1 mm occlusal to the cemento-enamel junction. After restoration of each cavity as recommended by manufacturer's instructions, all the specimens were subjected to thermomechanical loadings, then stored in container containing 2% Methylene Blue for 24 hours at room temperature then segmented into two equal halves by the sectioning machine with water cooling to measure the linear dye penetration using stereomicroscope under a magnification of 45x with the aid of Image analysis (Image J) software. After analyzing

data, the result showed that the linear dye penetration whether occlusally or gingivally were confined to enamel and didn't reach the dentin and this may be due to chemical reaction between fluoridated adhesive and dentin in addition to the micromechanical interlocking.

One restored tooth from each one of the six groups after thermomechanical loading was studied by a scanning electron microscope and EDS (Energy-dispersive X-ray spectroscopy). The results showed incorporation of released fluoride from fluoridated adhesive into the tooth surface which may indicate a chemical reaction between fluoridated adhesive and tooth structure.