AN IN VITRO INVESTIGATION OF MICROLEAKAGE OF BONDING AGENT TREATED C1-I AMALGAM FILLINGS

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SUMMARY: Marginal leakage was investigated in vitro on C1-I amalgam fillings, placed alone and placed with two different bonding agents (Adaptabond, Heliobond). Teeth were immersed in 2% basic fuchsin dye solution, after thermal cycling. Dye penetration degree was evaluated according to the index suggested by Going. Results was significantly better in experimental groups than control group. Bonding agents were found effective in reducing micro leakage around the margins of amalgam restorations.

Key Words: Micro leakage, amalgam, bonding agents.

INTRODUCTION

Micro leakage has been an important problem in operative dentistry for years. It may be defined as the diffusion of bacteria, oral fluids, ions and molecules into the tooth-filling interface. Many studies emphasize that margins of restorations are not fixed, inert and impenetrable borders, but "dynamic micro crevices which contain a busy traffic of ions and molecules" (4,9). It has been implicated with secondary caries, tooth discoloration, hypersensitivity, pulpal damage and marginal breakdown. One of the main reason is the difference between the thermal expansion coefficient of the tooth and the restorations (10). Many studies have been done and many techniques have been tested to eliminate or to reduce micro leakage.

In this study, marginal leakage was investigated in vitro on C1-I amalgam fillings placed alone and placed with two different bonding agents. The effectiveness of bonding agents in reducing leakage around the margins of amalgam restorations was tested.

MATERIALS AND METHODS

Sixty freshly extracted human molars and premolars which were free caries and restorations were selected for this study. The teeth were cleaned from debris and tartar. They were stored in tap water in room temperature until they were used. Teeth were randomly separated into two groups.

A.. Restorative Procedures

Group 1-(Control): Comprised twenty teeth which C1-I cavities were prepared in the center of the occlusal surface by using high-speed and water-coolant. The floors of the cavities were kept just below the dentino-enamel junction. Teeth in this group were restored in the usual was using a nongamma 2 amalgam alloy (Solia Nova-De Trey).

Group II - (Experimental): C1-I cavities were prepared in the same way in two experimental groups. Enamel on the cavity margins was etched with 37% phosphoric acid solution for one minute. Than, cavities were washed and dried. Heliobond (Vivadent) was applied as a thin layer to the etched area of twenty teeth, by using a thin artistic brush (# 0). The other twenty teeth in experimental group was treated with Adaptabond (Johnson and Johnson) in the same way. Then the same amalgam alloy was placed to the all cavities, likewise in the control group.

The restorations were left to dry by itself for five minutes. Then the teeth were kept in tap water to prevent dehydration. All of the restorations were polished after twenty-four hours.

B. Thermal Cycling and Dye Penetration

Each specimen was immersed in a hot water bath 60°C ± 2 for four minutes, followed by 37°C ± 2 bath for four minutes. Finally transferred to a cold water bath 4°C± 2 for minutes. This procedure was repeated twenty five times. In this type of cycling, teeth were allowed to return to body temperatures to simulate oral conditions.

After thermal cycling, to prevent dye penetration from unnecessary focusus, teeth were covered with nail polish and in addition a layer of melted wax from the apex up to occlusal surfaces. Amalgam tooth interface were left uncovered. Then the teeth were immersed in a 22 basic fuchsin dye solution for twenty four hours. After removing the teeth from dye each tooth was cleaned separately and sectioned longitudinally through the restorations by using a diamond separator (Fis 345-220).

Dye penetration degree on the longitudinal sections was evaluated under a dissecting microscope, according to the scale suggested by Going (5). The criteria for evaluation shown in Figure 1 and below.

RESULTS

Frequency distribution and average scores of the degrees of micro leakage are given in Table 1. The highest degree was belong to the control group which placed without bonding agent. The experimental groups showed minimal leakage.

Results was significantly better in experimental groups than control group, statistically with chi-square test (P<0,01).

Degree	Dye Penetration
0-	No dye penetration (Figures 2 and 3)
1-	Penetration up to a half of the wall depth
2-	Penetration of dye to the floor of the cavity, but not including it.
3-	Penetration to the cavity floor (Figure 4)
4-	Penetration into the dentin.
5-	Penetration into the pulp chamber (Figure 5)

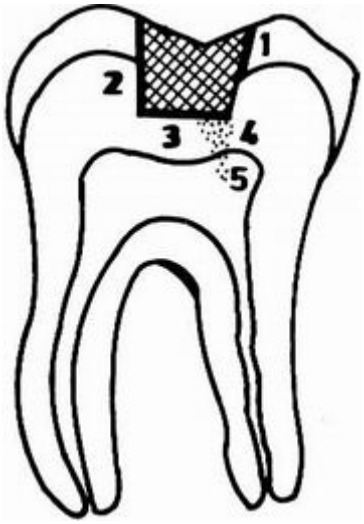

Figure 1:Schematic represantation of the microleakage evaluation.

Table 1: Frequency distrubution and average scores of the microleakage degrees.

Degree	Heliobond	Adaptabond	Control
0	9	7	3
1	5	10	4
2	2	2	4
3	-	1	4
4	-	-	2
5	-	-	3
Mean	0.65	0.85	2.35

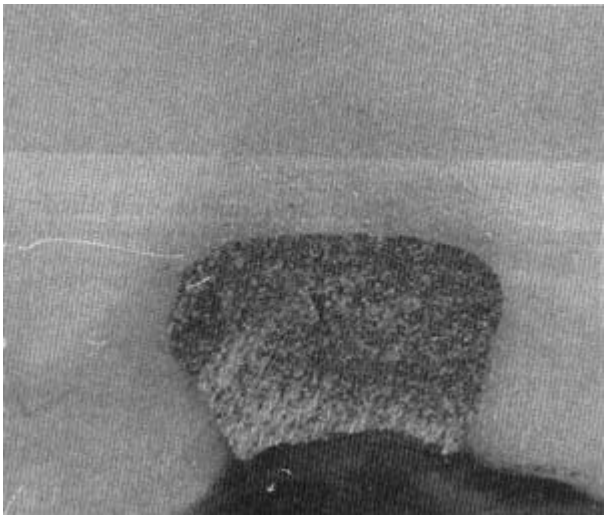

Figure 2: Dye penetration degree 0

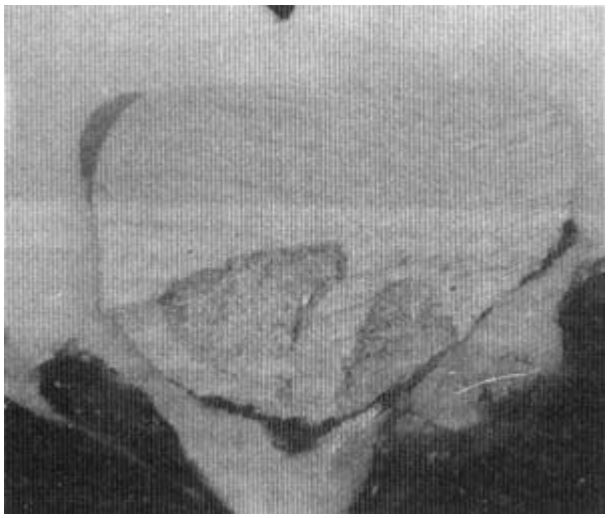

Figure 3: Degree 0 (it is given to express the relation between the existance of bonding agent and 0 skor Excess bonding material is seen at the bottom corner of cavity.

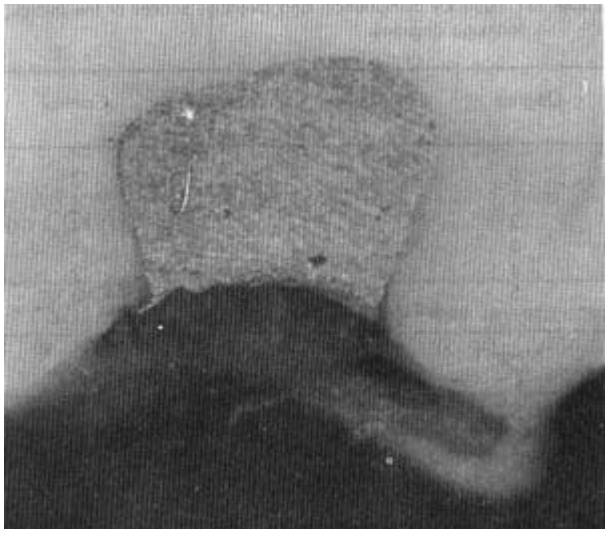

Figure 4: Dye penetration degree 3

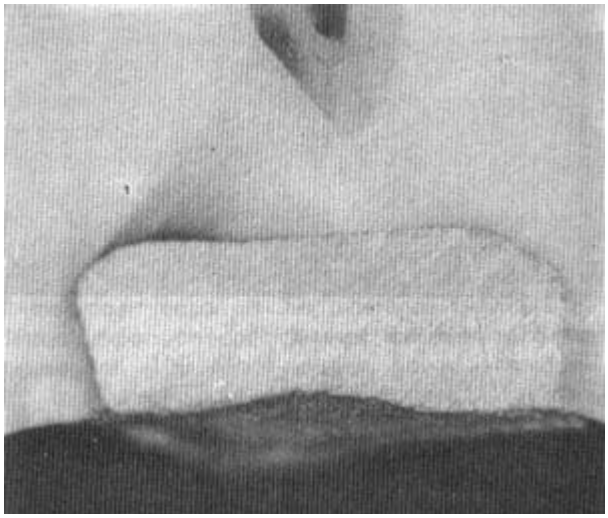

Figure 5: Dye penetration degree 5

DISCUSSION

Nowadays, there is an increasing tendency to use combined techniques, in operative dentistry. Purpose of this applications is to get positive properties of different materials, side by side. Applications of composite resins and their integral parts; acid etching and bonding agents are rapidly extending into many areas of dentistry. The bonding agents currently available for composite resins are known to be a stronger adhesive capability to both tooth and dental alloys.

Also there are some investigations which showed unfilled resins are effective in reducing marginal leakage in composite resin restorations (6,7).

On the other side micro leakage problem even if reduces with time, has not been solved in freshly packed amalgam. Cavity liners and varnishes could not be effective (8,11).

From this considerations the bonding agents were checked in reducing micro leakage in amalgam restorations. They were found effective under the conditions of this study. Results are correlated with a few previous studies (2,3,12).

Successful results in the experimental groups. May be explained; because of the low viscosity, bonding agents can seal the crevices at the cavity margins betted than amalgam. In addition, with water absorption capability, all resins undergo hygroscopic expansion and marginal gaps can be closed (1).

It is desirable to support these data by in vivo studies.

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