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A STUDY ON EVALUATION OF THE BEST METHOD TO DECONTAMINATE THE TOOTH-RESIN INTERFACE

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Abstract:

Introduction: *Clinically, saliva contamination is a problem when new increments of composite are necessary to improve the contour of restorations after the rubber dam is removed.*

Aims and objectives: *The main objective of the study is to analyse the best method to decontaminate the tooth-resin interface among local population of Pakistan.*

Material and methods: *This cross sectional study was conducted in THQ Hospital, Fortabbas during December 2018 to July 2019. This study was done with the permission of ethical committee of hospital. The specimens were randomly allocated in five groups (n = 30). One group was assigned to be the control and it was not submitted to any contamination or surface treatment. Consequently, these specimens represented the cohesive strength of the material. The four remaining experimental groups had the top surface of the composite resin contaminated with fresh human saliva.*

Results: *The analysis of variance detected significant differences for the surface treatments ($p < 0.001$) and the storage condition ($p < 0.001$). An interaction effect was also found between the surface treatments and storage condition ($p < 0.001$). As variances were not homogeneous, Dunnett T3 test was performed. Regarding the surface treatments, the highest bond strength was registered for the control group, in which no surface treatment and no contamination with saliva were performed.*

Conclusion: *It is concluded that if contamination with saliva occurs during the insertion of composite resin, an effective decontamination of the surface must be performed to improve the adhesive strength between resin-resin increments.*

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INTRODUCTION:

Clinically, saliva contamination is a problem when new increments of composite are necessary to improve the contour of restorations after the rubber dam is removed. It may also be a problem when the use of rubber dam is not possible in time-consuming clinical procedures, especially in Pediatric Dentistry [1]. It is well documented that the contamination of enamel and dentin with saliva has resulted in lower bond strength between the composite resin and the tooth. However, information about the effect of contamination among increments of the composite resin and which decontamination method is needed to re-establish the original resin-resin bond strength is still required. Several studies have evaluated the resin-resin union between aged resin surfaces and new resin increments, simulating a repair condition. Different surface treatments have been proposed, with variable results [2].

Contamination is the most common problem of the dental composites when the incremental technique is used to restore a tooth, which results in low bond strengths between the tooth and the resin composite [3]. However, in case of contamination of recently inserted materials, the best approach to provide an appropriate union between the resin increments needs further investigation. Eiriksson, et al., recently reported a decrease in the microtensile bond strength at resin-resin interfaces contaminated with saliva [4]. Additionally, it is interesting to evaluate the long-term behavior of the decontamination methods on the adhesive strength of the resin-resin interface. *In vitro* aging can be simulated in the laboratory by storage of specimens in aqueous solutions for prolonged periods. The immersion in water at 37°C has been frequently used to simulate aging of the adhesive interface. On the other hand, the storage in ethanol solution may accelerate the degradation of the material by diffusion and softening of the resin [5].

Aims and objectives:

The main objective of the study is to analyse the best method to decontaminate the tooth-resin interface among local population of Pakistan.

Material and methods:

This cross sectional study was conducted in THQ Hospital, Fortabbas during December 2018 to July 2019. This study was done with the permission of ethical committee of hospital.

Data collection:

The specimens were randomly allocated in five groups (n = 30). One group was assigned to be the control and it was not submitted to any contamination or surface treatment. Consequently, these specimens represented the cohesive strength of the material. The four remaining experimental groups had the top surface of the composite resin contaminated with fresh human saliva. The saliva was collected from one person after stimulation with a piece of rubber. The saliva produced during the first minute was discarded and the saliva collected during the next minute was used for the fabrication of five specimens. This protocol was repeated until all specimens were fabricated. The saliva was then actively spread on the surface of the specimens for 10 seconds using a microbrush. Air drying was performed for 40 seconds at 45° and a standard distance of 10 cm, until a thin layer of dried saliva was visible. After water evaporation, only the solid components of the saliva were present on resin surface. Specimen preparation was immediately proceeded.

Statistical analysis

Data were submitted to two-way analysis of variance and Dunnett T3 test ($\alpha = 0.05$). Chi-square test was used to investigate the effect of the storage protocol and surface treatment on failure mode ($\alpha = 0.05$).

RESULTS:

The analysis of variance detected significant differences for the surface treatments ($p < 0.001$) and the storage condition ($p < 0.001$). An interaction effect was also found between the surface treatments and storage condition ($p < 0.001$). As variances were not homogeneous, Dunnett T3 test was performed. Regarding the surface treatments, the highest bond strength was registered for the control group, in which no surface treatment and no contamination with saliva were performed. The lowest bond strength ($p < 0.05$) was observed when only rinsing and drying of the contaminated surface was performed (G1). The preparation of the contaminated resin surface and application of the adhesive system (G3) or etching and application of silane and adhesive (G4) resulted in similar values to the original bond strength (control group) for all storage conditions.

Table 01: Number of specimens that showed mainly adhesive failure.

	Water 24 hours	Storage Water 3 months	Ethanol 3 months
Control	0	0	0
G1	10 *	10 *	9 *
G2	2	0	10 *
G3	0	0	2
G4	0	0	0

Values marked with an asterisk (*) are significantly different from the control group ($p < 0.05$)

DISCUSSION:

The application of adhesive on the recently contaminated surface has demonstrated good results. Similar findings were obtained in the present study (G2) when specimens were stored in distilled water during 24 hours or 3 months [6]. Brosh, et al. also observed that the application of adhesive, alone or combined with silane, was the most effective procedure for enhancing the shear bond strength of the repaired composite specimens. The use of bonding agents allows a better surface wetting and infiltration of the resin. Additionally, single-bottle adhesives, such as the one used in this study, contain solvents that seem able to denature the glycoprotein sugars and remove the saliva contamination [7].

Etching of the contaminated surface followed by application of silane and adhesive (G4) also resulted in similar bond strength values to the control group. Brosh, et al. suggested that silane might be unnecessary in the repair of composite resins because the combination of silane and adhesive did not significantly improve the repair strength when compared with adhesive alone [8]. On the contrary, silane application significantly affected bond strength in the study carried out by Bouschlicher, et al. In that case, the increase in shear bond strengths after silane application was a general trend, but different results were observed for the different composite resins tested [9]. Additionally, these authors tested the use of silane combined to different mechanical preparations of the resin surface, such as diamond bur, sandblasting with aluminum oxide or tribomechanical silica deposition. Although some studies have investigated the effect of contamination and decontamination between resin increments, none of them evaluated the long-term effect of the different surface treatments. Thus, the storage protocols in this study were chosen to simulate the effect of aging in the shear bond strength [10].

CONCLUSION:

It is concluded that if contamination with saliva occurs during the insertion of composite resin, an effective decontamination of the surface must be performed to improve the adhesive strength between resin-resin increments.

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