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Original ARTICLE

Analysis of efficacy of mouthwashes on sorption and solubility of three different esthetic restorative materials

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ABSTRACT
Background: Because of the increasing demand for having whiter teeth, researchers and manufacturers have aimed to produce novel whitening agents with improved efficacy and with a higher level of safety. Composite resins are commonly used as tooth-colored restorative materials due to advantages such as ideal aesthetics and their ability to bond to enamel and dentin. Aesthetic dental materials must be able to simulate the natural appearance of teeth and match the color of the remaining tooth structure. Studies have shown influence of alcohol containing mouth rinses on the surface roughness and hardness of the composites. **Aim of the study:** To analyze efficacy of mouthwashes on sorption and solubility of three different esthetic restorative material. **Materials and methods:** The present study was conducted in the Department of Conservative Dentistry of the Dental institution. For the study, we used four 3 mouthwashes and one control (distilled water). The color stability of 3 restorative materials was evaluated, Nanohybrid composite resins, glass fiber reinforced GIC and low viscosity resin. A total of 20 specimens of each restorative material was prepared using manufacturer's guidelines using Teflon molds. After specimens were prepared. 5 specimens of each material were randomly distributed for each group. Standard immersion solutions were prepared for all groups. The specimens were immersed in the preventive mouthwash agents and distilled water (control) at 37 °C, in different groups, to evaluate the color stability of the different tested composite resin restoration materials for periods of 24, 48, and 72 h, which is equivalent to 2 min of mouthwash per day for two, four, and six years. **Results:** We observed that sorption was seen to be highest with Listerine (with alcohol) in all the restorative materials and lowest with control (distilled water). We observed that among all the mouthwashes studied, average solubility was seen to be highest in Listerine (with alcohol) in all the restorative materials and least in control. **Conclusion**: Within the limitations of the present study, it can be concluded that the sorption and solubility of tested restorative materials were higher in mouthwashes containing alcohol.
Keywords: Mouthwash, Composite, GIC, Sorption

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INTRODUCTION

Because of the increasing demand for having whiter teeth, researchers and manufacturers have aimed to produce novel whitening agents with improved efficacy and with a higher level of safety. [1] The public knowledge about dental aesthetics has greatly enhanced during recent years, and as a result, the demand for durable and aesthetic tooth-colored restorations has increased. [2] Composite resins are commonly used as tooth-colored restorative materials due to advantages such as ideal aesthetics and their ability to bond to enamel and dentin. Aesthetic dental materials must be able to simulate the natural appearance of teeth and match the color of the remaining tooth structure. [3] In recent years, the use of mouth rinses has increased tremendously to thwart action against plaque, caries and periodontal diseases. [4] It is an effective method for oral hygiene maintenance. These mouth rinses contain water, antimicrobial agents, detergents, emulsifiers and organic acids and in some cases alcohol. [5] Changing the concentration of these substances

alter the oral pH. Studies have shown influence of alcohol containing mouth rinses on the surface roughness and hardness of the composites. [6] Hence, the present study was conducted to analyze efficacy of mouthwashes on sorption and solubility of three different esthetic restorative material.

MATERIALS AND METHODS

The present study was conducted in the Department of Conservative Dentistry of the Dental institution. The ethical clearance for the study was approved from the ethical committee of the hospital. For the study, we used four 3 mouthwashes and one control (distilled water). The color stability of 3 restorative materials was evaluated, Nanohybrid composite resins, glass fiber reinforced GIC and low viscosity resin. A total of 20 specimens of each restorative material was prepared using manufacturer's guidelines using Teflon molds. After specimens were prepared. The final specimen dimensions were discs with an 8 mm internal diameter and a 3 mm height. The specimens were polished with 3M Sof-Lex discs to obtain a clinical finish and stored in distilled water for 24 h at 37 °C before initial color assessment. 5 specimens of each material were randomly distributed for each group. Standard immersion solutions were prepared for all groups. The specimens were immersed in the preventive mouthwash agents and distilled water (control) at 37 °C, in different groups, to evaluate the color stability of the different tested composite resin restoration materials for periods of 24, 48, and 72 h, which is equivalent to 2 min of mouthwash per day for two, four, and six years. Twelve hours of immersion simulate one year of rinsing. Throughout the study, all specimens in the groups were shaken on an orbital rotational table every 3 h to provide homogeneity.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

RESULTS

Table 1 shows the average of sorption of different mouthwashes in various restorative materials. We observed that sorption was seen to be highest with Listerine (with alcohol) in all the restorative materials and lowest with control (distilled water). On comparing the results were statistically non-significant. [Fig 1] Table 2 shows average of solubility of different mouthwashes in various restorative materials. We observed that among all the mouthwashes studied, average solubility was seen to be highest in Listerine (with alcohol) in all the restorative materials and least in control. [Fig 2] Among the restorative materials analyzed in this study, low viscosity resin was the one with the worst performance, in which a greater degree of sorption and solubility was observed in comparison to other materials.

Table 1: Average of sorption of different mouthwashes in various restorative materials

Mouthwashes	Low shrinkage resin	Low viscosity resin	Nanohybrid composite resin	p-value
Listerine (with alcohol)	22.32	23.14	19.32	0.221
Listerine (without alcohol)	12.65	14.65	12.25	0.65
Periogard	11.65	14.72	10.65	0.58
Control	9.23	8.65	7.65	0.09

Table 2: Average of solubility of different mouthwashes in various restorative materials

Mouthwashes	Low shrinkage resin	Low viscosity resin	Nanohybrid composite resin	p-value
Listerine (with alcohol)	9.21	14.65	7.35	0.2
Listerine (without alcohol)	5.2	8.6	4.2	0.54
Periogard	4.92	6.2	3.45	0.09
Control	2.98	5.25	2.54	0.2

Fig 1: Average sorption in different restorative materials

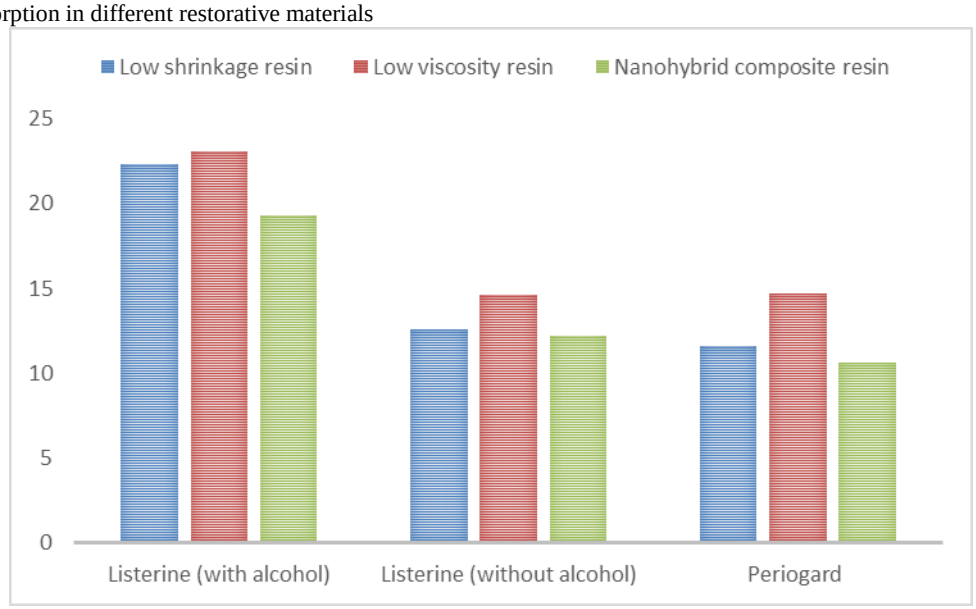
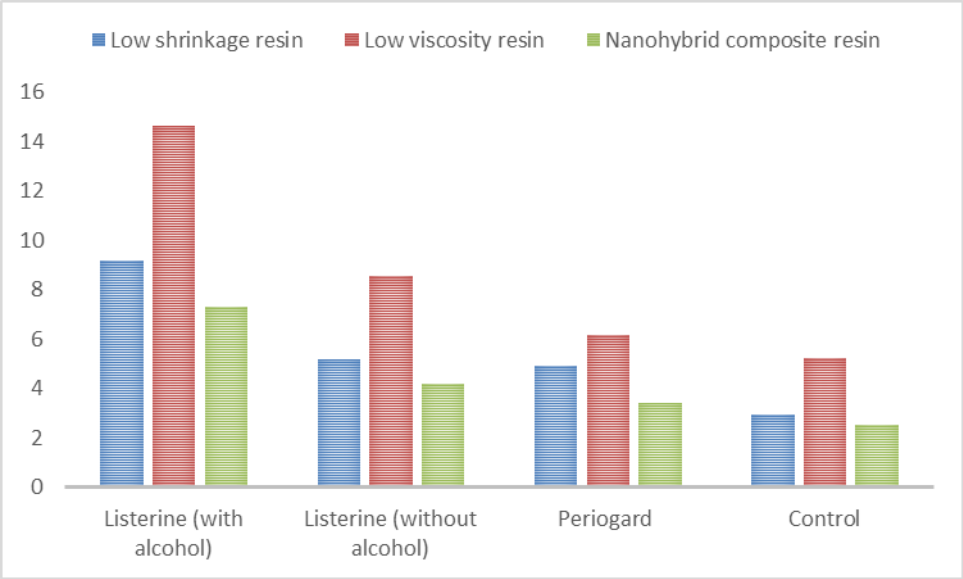


Fig 2: Average solubility in different mouthwashes



DISCUSSION

In the present study, we observed that among the restorative materials analyzed in this study, low viscosity resin was the one with the worst performance, in which a greater degree of sorption and solubility was observed in comparison to other materials. It was also found that mouthwashes containing alcohol in their composition showed higher sorption and solubility in the evaluated restorative materials. The results were statistically non-significant. Leal JP et al evaluated the effect of mouthwashes on solubility and sorption of composite resins. Forty-two specimens of each evaluated composite (Filtek Bulk Fill Flow, Opallis Flow, Durafill VS, and Filtek Z350) were prepared and randomized into seven groups for each solution (mouth rinses with and without alcohol and distilled water) and stored for seven days. Solubility and sorption tests were performed according to ISO4049. Data were analyzed using 2-way-ANOVA followed by Tukey's test for means comparison. In addition, paired t-test was performed to analyze the alcohol effect on the studied composite resin properties. Listerine Cool Mint (containing alcohol in its composition) caused the greatest degree of sorption for all composites tested in comparison to other rinses, while for solubility this behavior was observed for Opallis Flow and Durafill VS composite resins. Regarding the composites, Opallis Flow showed the highest sorption and solubility values in general. In conclusion, the sorption and solubility of composites were higher in mouthwashes containing alcohol in its composition, with Opallis Flow being the most affected composite resin. Armas-Vega A et al identified their possible effects of it on the integrity of nanohybrid composite resin and resin modified glass ionomer. A total of 144 samples were manufactured with two nanohybrid composite resins and two resin modified glass ionomer restorative materials. The specimens were immersed in one of the three mouthwashes used in the study, for a total of 1092 minutes, with intervals of contact with artificial saliva. This strategy simulates three years of constant use of mouthwashes. The samples weight and surface roughness measurement was recorded with a precision scale and profilometer, at different stages: At the beginning of the study, after 546 minutes, and after 1092 minutes. The collected data on surface roughness and weight were submitted to the analysis of variance (ANOVA), with repeated measures of three factors. The results determined shifts in values in terms of weight and roughness in all the samples. The composite resin "Grandio" group was the one that showed bigger shifts, while the glass ionomer group "Vitremer" showed stability on its structure. The evaluated mouthwashes displayed similar behavior between each other. It was concluded that the use of mouthwashes triggered changes on the structure of both dental materials: composite resin and resin modified glass ionomer mostly associated with surface roughness. [7, 8]

Giti R et al compared the sorption and solubility of 2 conventional and 2 self-adhesive resin-based luting cements immersed in four different storage media. A total of 32 disc-shaped specimens were prepared from each of four resin luting cements; seT (SDI), Panavia F (Kuraray), Clearfil SA Cement (Kuraray), and Choice 2 (Bisco). Eight specimens of each material were immersed in all tested solutions including n-heptane 97%, distilled water, apple juice, or Listerine mouth wash. Sorption and solubility were measured by weighing the specimens before and after immersion and desiccation. There was a statistically significant interaction between the materials and solutions. The effect of media on the sorption and solubility was material-dependent. While seT showed the highest values of the sorption in almost all solutions, Choice 2 showed the least values of sorption and solubility. Immersion in apple juice caused more sorption than other solutions. They concluded that the sorption and solubility behavior of the studied cements were significantly affected by their composition and the storage media. The more hydrophobic materials with higher filler content like Choice 2 resin cement showed the least sorption and solubility. Due to their lower sorption and solubility, these types of resin-based luting cements are recommended to be used clinically. Al-Samadani KH et al assessed the effects of using various mouthwashes on the color stability of various dental restorative composite materials. For this purpose, four mouthwashes/gels (Flocare gel (0.4% stannous fluoride), Pascal gel (topical APF fluoride), Pro-Relief mouthwash (sodium fluoride), and Plax Soin mouthwash (sodium fluoride)), and distilled water as a control, were selected. These were divided into five groups: Group 1: Flocare gel; Group 2:

Pascal gel; Group 3: Pro-Relief mouthwash; Group 4: Plax Soin mouthwash; and Group 5: distilled water (control). Prepared restorative materials samples were immersed in the groups of mouthwashes/gels and the distilled water (control) for 24, 48, and 72 h. The discoloration that all materials exhibited with all immersion groups was significantly different at each of the three time periods for all groups ($p < 0.05$). Results from immersion in Flocare gel, Pascal gel, Pro-Relief mouthwash, and Plax Soin mouthwash were statistically significant. They concluded that the color change chroma was not significant for Pro-Relief and Plax Soin mouthwash. Mouthwashes/gels affect color shifting for all composite resin materials, and changes are exaggerated over time. However, discoloration effects are not perceptible to the human eye. [9, 10]

CONCLUSION

Within the limitations of the present study, it can be concluded that the sorption and solubility of tested restorative materials were higher in mouthwashes containing alcohol.

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