

COMPARISON OF SURFACE ROUGHNESS OF RESTORATION WITH COMMERCIAL VS HERBAL BASED MOUTHWASH

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ABSTRACT

Background: Mouthwashes are commonly used as adjuncts to mechanical plaque control for maintaining oral hygiene. While they provide antimicrobial and therapeutic benefits, their prolonged use may affect the physical properties of restorative materials. Surface roughness is an important characteristic of composite resin restorations because increased roughness may promote plaque accumulation, discoloration, wear, and reduced restoration longevity. Therefore, it is essential to evaluate the influence of different mouthwash formulations on restorative materials. **Aim:** To evaluate and compare the effect of herbal and commercial mouthwashes on the surface roughness of composite resin restorative material. **Materials and Methods:** An in vitro experimental study was conducted using 40 composite resin pellets. The specimens were randomly divided into two groups (n = 20 each): Group I (Herbal mouthwash) and Group II (Commercial mouthwash). Baseline surface roughness measurements were recorded for all specimens. The samples were subjected to manual brushing followed by immersion in their respective mouthwash solutions for 2 minutes. Post-treatment surface roughness values were then recorded. The difference in surface roughness before and after treatment was calculated. Statistical analysis was performed using IBM SPSS Statistics software. Paired-samples t-test was used to compare pre- and post-treatment values within groups, while independent-samples t-test was used to compare differences between groups. Statistical significance was set at $p < 0.05$. **Results:** Both herbal and commercial mouthwashes produced changes in the surface roughness of composite resin specimens. A statistically significant difference was observed between the two groups ($p < 0.05$). The herbal mouthwash demonstrated a greater effect on the surface roughness of composite resin compared with the commercial mouthwash. **Conclusion:** Both mouthwash formulations influenced the surface characteristics of composite resin restorative material. However, the herbal mouthwash produced a greater increase in surface roughness than the commercial mouthwash. The findings suggest that mouthwash composition may affect the long-term surface integrity of composite resin restorations and should be considered when recommending oral hygiene products to patients with esthetic restorations.

Keywords: Composite resin, Surface roughness, Herbal mouthwash, Commercial mouthwash, Restorative material, Oral hygiene.

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Introduction :

The appearance and feeling of well-being are greatly influenced by oral health. New research has revealed a clear connection between dental health and overall wellness. There are several cleaning techniques that can be used to make the mouth clean and maintain oral hygiene. The goal of oral hygiene is to prevent dental issues like gum infections, tooth loss, and plaque buildup, which is a major cause of cavities. The primary cause of the onset and development of oral illnesses is dental plaque. Plaque must therefore be removed in order to avoid building up on the teeth and nearby gingival area. Interdental cleaning and tooth brushing are two common oral hygiene suggestions. Control techniques, such as mechanical and chemical ones, can be used on a regular basis to maintain good dental hygiene. Herbal remedies made from botanical sources have long been used in dentistry to inhibit bacteria, reduce swelling, calm irritation, and relieve pain. A significant variety of herbal mouthwashes have recently been reported to have shown excellent outcomes in the management of plaque and gingivitis. Herbal mouthwashes contain a variety of active ingredients, including catechins, tannins, and sterols, and are created and manufactured using extracts and essential oils from phytotherapeutic plants. Scientific studies have shown that natural remedies including triphala, tulsi patra, jyeshthamadh, neem, clove oil, pudina, ajwain, and many more are both safe and effective for treating a variety of oral health issues like bleeding gums, halitosis, mouth ulcers, and avoiding tooth decay. The lack of any adverse effects is these natural herbs' main strength. Additionally, these don't contain the sugar and alcohol present in the majority of other over-the-counter medicines. These substances are consumed by the microbes, which produce byproducts that lead to halitosis. Therefore, herbal mouthwashes provide greater dental health and hygiene. The blend of natural ingredients found in medicines derived from herbs or plants typically has mild curative effects. Herbal mouthwashes may offer extra anti-inflammatory and antioxidant capabilities in comparison to synthetic chemical antibacterial processes, which could further improve gingival health. Several studies have demonstrated the effectiveness of herbal mouthwashes in controlling dental plaque and gingivitis. In addition to their antimicrobial activity, herbal formulations are often preferred because of their lower incidence of adverse effects when compared with some conventional mouthwashes. Herbal products are generally considered safer for long-term use and are less frequently associated with complications such as

staining, altered taste sensation, and mucosal irritation. Consequently, herbal mouthwashes have gained increasing popularity among patients seeking natural and alternative oral healthcare products. Despite their clinical benefits, mouthwashes may exert effects on dental hard tissues and restorative materials. The interaction between mouthwash formulations and restorative materials is influenced by factors such as pH, alcohol content, active ingredients, preservatives, and duration of exposure. Repeated exposure to mouthwash solutions may alter the physical and mechanical properties of restorative materials through processes such as water sorption, hydrolytic degradation, and softening of the resin matrix. Composite resin is one of the most widely used restorative materials in contemporary dentistry because of its superior aesthetics, acceptable mechanical properties, and ability to bond directly to tooth structure. Composite restorations are frequently used for both anterior and posterior restorations owing to their excellent esthetic appearance and conservative nature. Surface hardness is an important indicator of the clinical performance of composite resin materials. It reflects the material's resistance to indentation, wear, and surface degradation. A decrease in surface hardness may lead to increased surface roughness, accelerated wear, discoloration, plaque accumulation, and reduced longevity of restorations. Therefore, preservation of surface hardness is essential for maintaining the functional and esthetic integrity of composite resin restorations. However, the long-term clinical success of composite resin restorations depends largely on the maintenance of their physical and mechanical properties. Considering the increasing use of mouthwashes as part of routine oral hygiene practices and the widespread application of composite resin restorations in clinical dentistry, it is important to evaluate the potential effects of these products on restorative materials. Therefore, the present in vitro study was undertaken to compare the effect of herbal and commercial mouthwashes on the surface hardness of composite resin restorative material on mouthwash exposure.

MATERIALS AND METHODS:

Study Design

This in vitro experimental study was conducted in Saveetha Dental College and Hospital to evaluate and compare the effect of herbal and commercial mouthwashes on the surface hardness of composite resin restorative materials. A pretest–posttest design

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was used to assess changes in surface hardness following brushing and mouthwash exposure.

Sample Preparation

A total of 40 composite resin pellets were fabricated according to the manufacturer's instructions. The specimens were standardized in dimensions to ensure uniformity and randomly allocated into two groups (n = 20 per group):

- Group I: Herbal mouthwash (Bio Ayurvedic Basis)
- Group II: Commercial mouthwash (Dente 91)

Brushing Procedure

All composite resin pellets underwent manual brushing to simulate routine oral hygiene practices. Brushing was performed using a soft-bristled toothbrush under standardized conditions. The same brushing technique and duration were maintained for all specimens to ensure consistency.

Mouthwash Treatment

Following brushing, the specimens were immersed in their respective mouthwash solutions:

- Group I specimens were immersed in Bio Ayurvedic Basis herbal mouthwash.
- Group II specimens were immersed in Dente 91 commercial mouthwash.

Each specimen was immersed for 2 minutes. After immersion, the pellets were rinsed with distilled water and prepared for surface hardness evaluation.

Surface Hardness Assessment

Surface hardness measurements were recorded at baseline (before brushing and mouthwash treatment) and after treatment using a standardized hardness testing procedure. The difference in surface hardness was calculated using the formula:

$$\text{Surface Hardness Difference} = \text{Pre-treatment Surface Hardness} - \text{Post-treatment Surface Hardness}$$

The calculated difference represented the change in surface hardness produced by the respective mouthwash treatments.

Statistical Analysis

Data were entered and analyzed using IBM SPSS Statistics software. Descriptive statistics including mean, standard deviation, and standard error were calculated for all variables.

A paired-samples t-test was used to compare pre-treatment and post-treatment surface hardness values of the composite resin pellets. An independent-samples t-test was performed to compare the mean surface hardness difference between the Dente 91 and Bio Ayurvedic Basis groups.

Levene's test was used to assess the equality of variances between groups. Statistical significance was established at $p < 0.05$ with a 95% confidence interval.

RESULTS :

The mean surface hardness before treatment was 0.5349 ± 0.2773 , whereas the mean surface hardness after treatment was 0.2973 ± 0.2275 . The mean reduction in surface hardness was 0.2376 ± 0.3022 .

The paired-samples t-test revealed a statistically significant difference between pre-treatment and post-treatment surface hardness values ($t = 4.971$, $df = 39$, $p < 0.001$). The 95% confidence interval for the mean difference ranged from 0.1409 to 0.3342.

Table 1. Comparison of Surface Hardness Before and After Treatment

Variable	Mean	Standard Deviation	t-value	p-value
Pre-treatment Surface Hardness	0.5349	0.2773		
Post-treatment Surface Hardness	0.2973	0.2275	4.971	<0.001*

The mean reduction in surface hardness was compared between the Bio Ayurvedic Basis (Herbal) and Dente 91 (Commercial) groups using an independent-samples t-test.

The Bio Ayurvedic Basis group demonstrated a mean surface hardness reduction of 0.3471 ± 0.3613 , whereas the Dente 91 group showed a mean reduction of 0.1280 ± 0.1780 .

Levene's test for equality of variances was statistically significant ($F = 4.131$, $p = 0.049$), indicating unequal variances between the groups. Therefore, the results corresponding to "equal variances not assumed" were considered.

The independent-samples t-test showed a statistically significant difference in surface hardness reduction between the two groups ($t = 2.433$, $df = 27.71$, $p = 0.022$). The mean difference between groups was 0.2191, with a 95% confidence interval ranging from 0.0345 to 0.4037.

These results indicate that Bio Ayurvedic Basis herbal mouthwash caused a significantly greater reduction in the surface hardness of composite resin pellets compared to Dente 91 commercial mouthwash.

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Table 2. Comparison of Mean Surface H

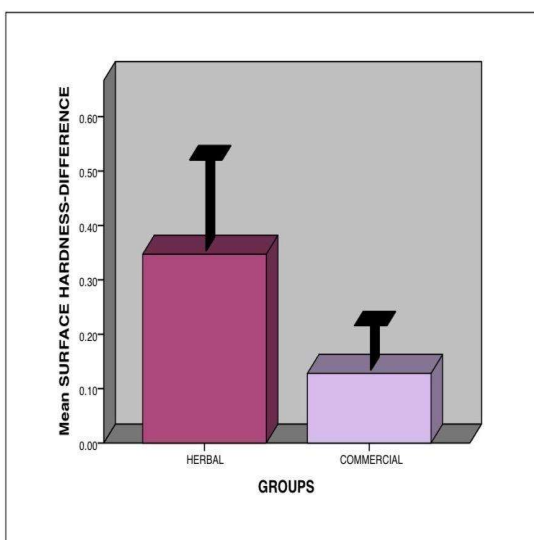
Group	N
Dente 91 (Herbal)	20
Bio Ayurvedic Basis (Commercial)	20

Table 3. Independent Samples t-test Comparing Surface Hardness Reduction Between Groups

Test Statistic	Value
t-value	2.433
Degrees of Freedom	27.71
p-value	0.022*
Mean Difference	0.2191
95% Confidence Interval	0.0345 – 0.4037

The present in vitro study evaluated and compared the effect of herbal and commercial mouthwashes on the surface hardness of composite resin restorative material following manual brushing. Surface hardness is an important property of composite resin restorations because it is directly related to wear resistance, durability, and clinical longevity. Any reduction in hardness may compromise the mechanical performance of the restoration and increase susceptibility to surface deterioration. The results of the present study demonstrated a statistically significant reduction in surface hardness following exposure to the tested mouthwashes ($p < 0.001$). These findings indicate that mouthwash solutions can alter the physical properties of composite resin materials. The reduction in hardness may be attributed to the penetration of liquid into the resin matrix, resulting in softening of the polymer network and degradation of the filler-matrix interface.

The findings of the present study are in agreement with those reported by Gurdal et al., who observed that exposure to various mouthwashes significantly affected the surface properties of resin-based restorative materials. The authors suggested that prolonged contact with mouthwash solutions may lead to surface degradation and reduction in mechanical strength. Similarly, Miranda et al. reported that composite resins immersed in mouthwash solutions exhibited alterations in surface characteristics due to chemical interactions between the restorative material and the constituents of the mouthwash. In the present study, a statistically significant difference was observed between the herbal and commercial mouthwash groups ($p = 0.022$). The herbal mouthwash produced a greater reduction in surface hardness compared with the commercial mouthwash. This suggests that the herbal formulation exerted a more pronounced effect on the composite resin surface under the experimental conditions employed. These findings are comparable to those reported by Rajavardhan et al., who found that certain herbal oral rinses produced measurable changes in the surface properties of composite restorative materials. The authors suggested that naturally occurring phytochemicals, essential oils, and organic compounds present in herbal formulations may influence the resin matrix and contribute to alterations in hardness values. Likewise, Dalmia et al. compared the effects of herbal and conventional mouthwashes on composite resins and reported significant differences in microhardness after immersion. They concluded that the composition and pH of mouthwash solutions play a crucial role in determining the extent of material degradation. Mouthwashes with greater erosive potential were associated with increased reductions in



DISCUSSION :

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hardness values. The greater reduction in surface hardness observed in the herbal mouthwash group may be attributed to the presence of plant-derived active ingredients and organic acids capable of interacting with the resin surface. Water sorption into the composite resin matrix may cause plasticization of the polymer network, thereby reducing intermolecular bonding and decreasing resistance to indentation. In addition, hydrolytic degradation at the filler-resin interface may further contribute to surface softening. The results of the present study are also supported by the findings of Yap et al., who reported that chemical solutions can adversely affect the mechanical properties of resin-based restorative materials through degradation of the organic matrix. Similar observations have been made by Bagheri et al., who demonstrated that chemical agents with acidic or reactive components can significantly reduce the hardness of composite restorative materials after immersion. Although significant differences were observed in the present study, the results should be interpreted within the limitations of an in vitro design. The oral environment is more complex and includes the buffering action of saliva, pellicle formation, masticatory forces, thermal fluctuations, and intermittent exposure to mouthwashes. These factors may modify the extent of changes observed under laboratory conditions. The present study was limited by the evaluation of only one type of composite resin, two mouthwash formulations, and a relatively short exposure period. Future investigations should assess long-term effects, include different restorative materials, and evaluate additional parameters such as surface roughness, color stability, flexural strength, and wear resistance to better understand the clinical implications of mouthwash use. Within the limitations of the present study, both herbal and commercial mouthwashes resulted in a reduction in the surface hardness of composite resin restorative material. However, the herbal mouthwash produced a significantly greater reduction in surface hardness compared with the commercial mouthwash. These findings suggest that the composition of mouthwash formulations can influence the physical properties of composite resin restorations and should be considered when selecting oral hygiene products for patients with resin-based restorations.

CONCLUSION :

It can be concluded that both herbal and commercial mouthwashes caused a reduction in the surface hardness of composite resin restorative material following manual brushing and mouthwash exposure. A statistically significant decrease in surface hardness was observed after treatment. When compared, the herbal mouthwash demonstrated a significantly

greater reduction in surface hardness than the commercial mouthwash. This indicates that the composition of mouthwash formulations can influence the physical properties of composite resin restorations. Composite resin is one of the most commonly used restorative materials in contemporary dentistry due to its aesthetic and functional properties. The reduction in surface hardness observed following mouthwash exposure may adversely affect the wear resistance, durability, and longevity of composite restorations. Therefore, dental practitioners should consider the potential effects of long-term mouthwash use on restorative materials when recommending oral hygiene products to patients.

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CONFLICT OF INTEREST:

The authors declare that there was no conflict of interest in the present study.

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