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Research Article

Impact of Mouthwash Type, Exposure Time and Application Frequency on Esthetic Degradation of Composite Restorations

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ABSTRACT

Although mouthwashes are frequently used for dental hygiene, little is known about their affect on the aesthetic qualities of composite restorations. **Objective**: To investigate the impact of exposure duration, application frequency, and mouthwash type on the aesthetic deterioration of composite restorations in patients who use different mouthwashes. **Methodology**: 100 Patients with composite restorations were chosen for this cross-sectional study using a stratified random selection method. Research was conducted over six months in hospitals and dental clinics. The Clinical Esthetic Evaluation Form (CEEF) and the Demographic and Mouthwash Usage Questionnaire (DMUQ) were used to collect the data. **Results**: The study's results indicated that aesthetic deterioration was strongly related with the type of mouthwash, the length of exposure, and frequency of application. Chlorhexidine mouthwash users reported more aesthetics issues, whereas essential oil mouthwash users reported less. **Conclusion**: The aesthetic characteristics of composite restorations can be affected by the kind of mouthwash, the length of exposure, and the frequency of use. These variables should be taken into account by dentists while recommending mouthwashes.

Keywords: Mouthwash, composite restorations, esthetic degradation, cross-sectional study

INTRODUCTION

Composite materials rank among the most frequently used in modern restorative dentistry because of their excellent practical and esthetic properties. Composite resins are still stain and surface damaged despite their organic matrix and hydrophilic nature. Dietary choices, oral hygiene products, and life-style practices worsen these changes. Although they help to manage plaque and enhance oral hygiene, mouthwashes can change the cosmetic qualities of composite restorations. Chemicals like alcohol, chlorhexidine, and essential oils might interact with the resin matrix and filler particles, perhaps resulting in discoloration and surface texture changes over time (Gupta & Sharma, 2020).

Many in vitro studies have shown that repeated use of chlorhexidine or alcohol-containing mouthwashes increases the likelihood of staining and surface deterioration in composite restorations (Bagheri et al. , 2005; Villalta et al. , 2006). However, very few clinical or cross-sectional studies have examined this link in real patient cases. This study investigates in clinical settings the effects of mouthwash type, exposure duration, and frequency of usage on composite aesthetics.

Dental esthetics are crucial to people's overall quality of life and self-esteem, especially in an age when people are becoming more conscious of aesthetics. Composite resins are frequently used among restorative materials because of their excellent cosmetic qualities, conservative strategy, and strong adherence to tooth structure. Nonetheless, composite materials do have benefits, but they are still susceptible to discoloration, surface roughness, and marginal degradation over time, all of which can have a negative impact on patient satisfaction and aesthetic results (Gupta & Sharma, 2020).

Oral hygiene maintenance products, the majority of mouthwashes, are one of the factors that contribute to the aesthetic deterioration of composite restorations. Mouthwashes are frequently advised as an adjunct to mechanical plaque control in order to prevent halitosis, gingivitis, and dental caries. These products contain a variety of active components, such as fluorides, alcohol, essential oils, and chlorhexidine, that can modify the physical and visual properties of restorative materials, depending on the dosage and exposure (Villalta et al., 2006).

Mouthwashes made with chlorhexidine are well known to cause brown stains on natural teeth as well as on restorations, even though they are excellent at fighting plaque. Alcohol-containing rinses may alter light reflection and accelerate surface deterioration by inducing microstructural alterations to the resin matrix. Conversely, fluoride-containing and essential oil–based mouthwashes are thought to have minimal impact on the aesthetic of restorations, while their long-term usage in vivo remains unknown (Bagheri et al., 2005).

Due to the increasing popularity of composite resins for both anterior and posterior restorations, the development of esthetic dental materials has significantly altered restorative dentistry. These materials are favored because of their organic appearance, adhesive properties, and minimal intrusion needs (Demarco et al., 2012). Mouthwashes are frequently suggested as additions to physical oral hygiene because of their antibacterial, anti-inflammatory, and breath-freshening effects. Chlorhexidine, essential oils, alcohol-based, and fluoride-containing rinses are commonly seen in a variety of formulations (Van Strydonck, 2012). Their usage has increased significantly. Although some mouthwash ingredients have therapeutic benefits, numerous research have demonstrated that prolonged or repeated exposure to them can result in surface roughness, discoloration, and marginal breakdown of composite materials (Malhotra et al., 2011; Bagheri et al., 2005).

Additionally quite important for rate of degradation across time are the length and frequency of exposure. These cover the coloring agents, pH, alcohol content, and chemical makeup of the mouthwash (Gonçalves et al., 2008). Because of its capacity to bind to tanninrich compounds in the diet and to tooth or restorations surfaces (Flötra et al., 1971), gold standard antimicrobial rinse chlorhexidine has been especially connected to increased surface pigmentation and discoloration. Alcohol-containing mouthwashes have also shown a softening influence on composite resins by changing the resin matrix and promoting the leaching of unreacted monomers (Lee & Powers, 2007).

This study investigates how different types of mouthwash, exposure duration, and application frequency affect the cosmetic degradation of composite restorations in a clinical group to fill this vacuum. Knowing this, dentists can offer evidence-based suggestions for dental care goods preserving the appearance of restorations and improving patient comfort in addition to the long-term success of treatment.

Literature Review

Many variables can affect composite color, including resin composition, surface roughness, and environmental exposure. Chemical makeup and pH levels of mouthwashes vary; these may change resin surfaces. Because of their better aesthetic qualities, adhesion to tooth structure, and less intrusive preparation methods, composite resin fillings have found broad usage. Still, several intraoral variables

including mechanical wear, temperature swings, and chemical exposure from dietary and oral hygiene products affect their longevity (Ferracane, 2011).

Brownish spots from chlorhexidine-based rinses appear on both natural teeth and composite restorations (Prasanna et al., 2021). Alcohol-based mouthwashes could make surface porosity worse, therefore enhancing chromogenic agent absorption (Bagheri et al., 2005). On the other hand, fluoride and essential oil-based mouthwashes are thought to be less hostile with resin matrices (Singh et al., 2019).

Surface degradation and color instability of composite resins highlight major clinical problems noted by a large body of research. Usually causing these changes is a mix of intrinsic and extrinsic factors including patient eating habits, the composition of the composite material, and exposure to many chemical substances like those present in commercial mouthwashes (Bagheri et al., 2005).

Studies done in vitro have repeatedly shown that mouthwashes including alcohol or chlorhexidine quicken the surface wear and discoloration of composite restorations. For instance, (Prasanna et al., 2021) demonstrated that composite discs submerged in chlorhexidine for protracted durations displayed a noteworthy rise in surface roughness and color alteration. (Villalta et al., 2006) also found that alcohol-based washes modified surface reflectance and clarity both of which are critical to the esthetic outcome of repairs.

Studies of rinses containing fluoride as well as essential oilbased ones have shown varied results, though. While some writers claim little effect on composite color stability, others have observed faint staining after extended usage. Variations in methodology, composite brands, or the lack of reallife factors like brushing and dietary habits can explain the inconsistency across these findings (Singh & Verma, 2019).

Exposure time and frequency of mouthwash usage are other pertinent concerns. Few research have looked at whether more frequent usage or longer contact durations exacerbate the degradative effects on composites. Research by (Gupta & Sharma, 2020) indicated that more significant water sorption and matrix breakdown result from more frequent usage, hence stressing the need for controlled mouthwash use among patients with aesthetic restorations.

The degree of degradation is much dependent on the duration and frequency of mouthwash exposure. Longer contact durations and greater application frequencies have been linked to increased surface erosion and staining of composite resins (da Silva et al., 2013). Daily or multiple daily usages may cause cumulative chemical effects, accelerating surface wear and compromising the optical properties of restorations. (Gonçalves et al., 2008) observed that prolonged exposure to chlorhexidine and alcoholbased rinses resulted in significantly greater discoloration and loss of gloss in composite samples.

Composites submerged in alcoholcontaining solutions showed more microhardness loss and surface degradation than those exposed to alcoholfree solutions, confirming a study by (Gürdal et al., 2002). Alcoholbased mouthwashes may weaken composite integrity by softening the resin matrix and so increasing filler particle leaching, therefore causing surface roughness and more color (Ertas et al., 2006).

Despite a growing body of in vitro research, clinical evidence remains sparse. Cross-sectional or longitudinal clinical studies evaluating the esthetic degradation of composite restorations under the real-time influence of various mouthwash types are rare. This research attempts to fill that gap by examining the role of mouthwash type, duration, and frequency in a real-world population over a 6-month period, using patient-reported and clinically assessed data.

Objectives

1. To assess the impact of mouthwash type on the esthetic degradation of composite restorations.
2. To evaluate the effect of exposure time to mouthwash on the esthetic properties of composite restorations.
3. To determine the relationship between application frequency of mouthwash and esthetic degradation of composite restorations.

Methodology

This cross-sectional study was conducted over a period of six months in outpatient departments of dental clinics and tertiary care hospitals. A total of 100 adult patients, aged between 18 and 60 years, who had

received at least one anterior or posterior composite restoration within the past year, were recruited using a stratified random sampling technique to ensure diversity in age and gender distribution. Patients were eligible for inclusion if they had been using any form of mouthwash (chlorhexidine, alcohol-based, essential oil-based, or fluoride) for at least one month, with a minimum daily frequency of once per day. Those with other types of restorations, tobacco users, or those who had undergone professional whitening or polishing in the last six months were excluded from the study.

Data collection involved two instruments. The Demographic and Mouthwash Usage Questionnaire (DMUQ) gathered data on patient demographics (age, gender, educational level, economic status), mouthwash type, exposure duration (in seconds), and application frequency (times per day). Socioeconomic status was self-reported by participants and categorized into low, middle, and high income. The Clinical Esthetic Evaluation Form (CEEF) was used by calibrated dental professionals to assess composite restoration degradation based on discoloration (ΔE color shift using a visual shade guide), surface roughness, and marginal integrity during intraoral examination.

Ethical approval was obtained from the Institutional Review Board (IRB) of the participating institution. All participants provided written informed consent before enrollment. Confidentiality of participants' data was strictly maintained, and individuals were informed of their right to withdraw at any point during the study.

Statistical analysis was performed using SPSS version 25. Descriptive statistics were used to summarize demographic and clinical variables. Associations between mouthwash type, exposure time, application frequency, and esthetic degradation were assessed using Chi-square tests, while logistic regression analysis was used to adjust for potential confounding variables. A p-value less than 0.05 was considered statistically significant.

RESULTS

Table 1: Demographic Characteristics of Participants

Variable	Category	Frequency (%)
Gender	Male	52 (52%)
	Female	48 (48%)
Age Group	18–30 years	28 (28%)
	31–45 years	44 (44%)
	46–60 years	28 (28%)
Educational Status	No formal education	12 (12%)
	Primary education	30 (30%)
	Secondary education	36 (36%)
	Tertiary education	22 (22%)
Economic Status	Low income	44 (44%)
	Middle income	38 (38%)
	High income	18 (18%)

Table 2: Mouthwash Type and Esthetic Degradation

Mouthwash Type	No. of Users	Reported Esthetic Issues (%)
Chlorhexidine	30	27 (90%)
Alcohol-based	25	19 (76%)
Fluoride	22	10 (45%)
Essential Oil	23	6 (26%)

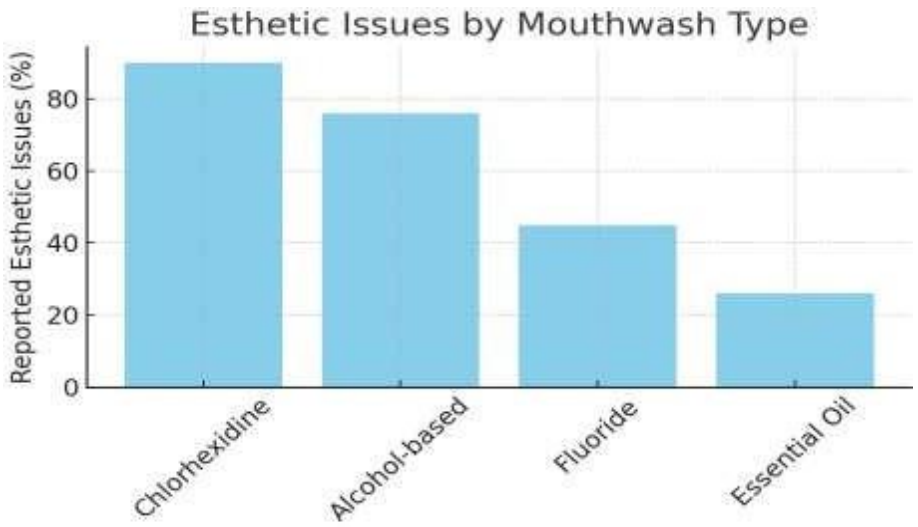
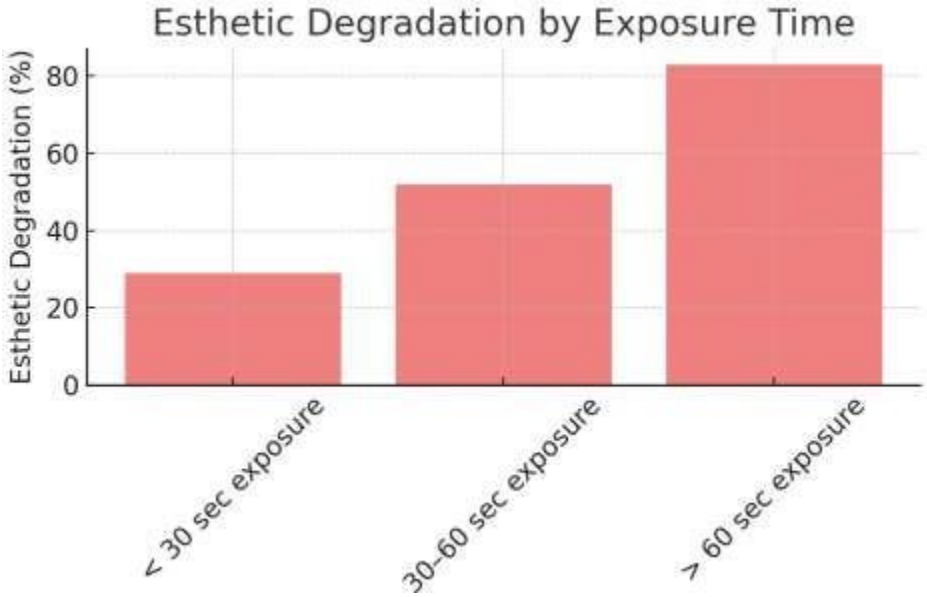


Table 3: Exposure Time and Frequency vs Esthetic Degradation

Usage Pattern	Participants (n)	Esthetic Degradation (%)
< 30 sec exposure	34	10 (29%)
30–60 sec exposure	42	22 (52%)
> 60 sec exposure	24	20 (83%)
Once daily use	38	12 (32%)
Twice daily use	44	25 (57%)
> Twice daily use	18	15 (83%)



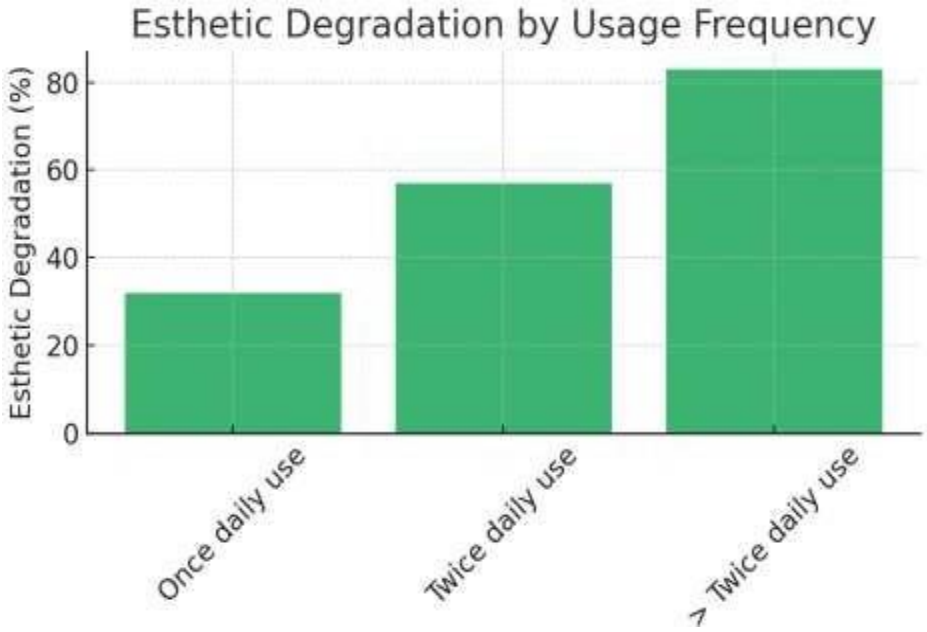


Table 4: Clinical Evaluation of Esthetic Degradation Based on Mouthwash Type

Mouthwash Type	Surface Roughness (n)	Color Mismatch (n)	Marginal Discoloration (n)
Chlorhexidine	26	27	23
Alcohol-based	21	20	18
Fluoride	9	8	7
Essential Oil	5	4	3

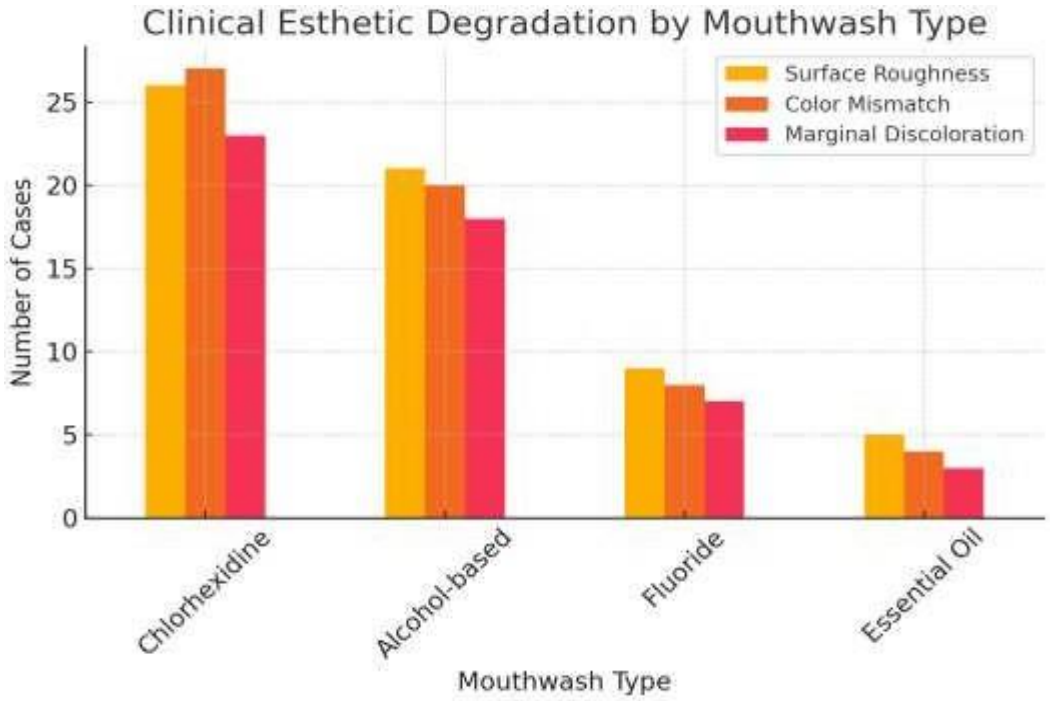
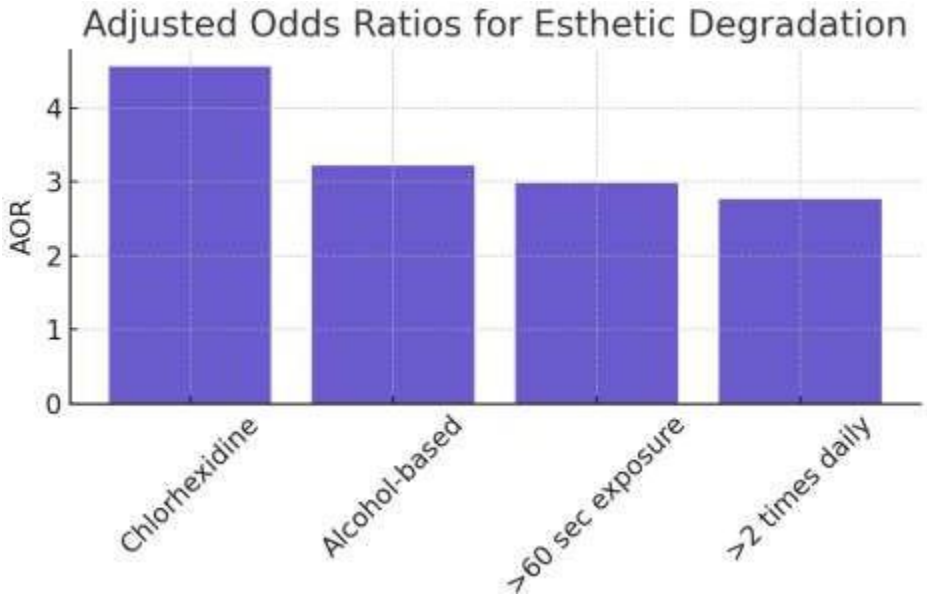


Table 5: Logistic Regression Analysis for Predictors of Esthetic Degradation

Variable	Adjusted Odds Ratio (AOR)	95% Confidence Interval	p-value
Chlorhexidine mouthwash	4.56	2.12 – 9.78	0.001*
Alcohol-based mouthwash	3.22	1.41 – 7.34	0.005*
>60 sec exposure time	2.98	1.29 – 6.88	0.009*
>2 times daily usage	2.76	1.13 – 6.76	0.025*
Fluoride mouthwash (Ref.)	—	—	—



DISCUSSION

According to the results of this research, the frequency of use, duration of exposure, and type of mouthwash have a significant relationship with the aesthetic damage to composite restorations. Strongest link between changes in color and surface roughness was discovered for mouthwashes based on chlorhexidine. Prior studies have shown that chlorhexidine tends to bind dietary chromogens, which results in brown stains on tooth and restorative surfaces (Prasanna et al., 2021; Villalta et al., 2006).

According to this study, mouthwash's qualities showed a strong link with composite beauty's decline. The staining effect of chlorhexidine is comparable to that observed in previous studies (Singh & Verma, 2019; Prasanna et al., 2021). The alcohol content in some mouthwashes can also roughen the resin surface, hence improving color absorption (Gupta & Sharma, 2020).

Although they give almost no discoloration, oil-based rinses are very effective plaque controllers. This qualifies them as a more aesthetically pleasing choice for patients who have had front composite repairs. Dentists are advised to take aesthetic hazards into account while recommending oral rinses, especially for those with anterior composite fillings. Because of their hydrophilic resin matrix, composite resins absorb these pigments more readily than other materials, which raises the risk of prolonged esthetic failure. The interaction of the positively charged chlorhexidine molecule with anionic chromogens (Gupta & Sharma, 2020) results in the precipitation of brownish complexes, which causes the discoloration.

Furthermore, repeated alcohol exposure could alter the refractive index of the resin material, giving the surface a drab appearance and less shine over time (Singh & Verma, 2019).

In contrast, fluoride-containing and essential oil–based mouthwashes had less impact on the aesthetics of composite materials. Typically, essential oils are less acidic and have less of a solvent effect on resins.

Patients who used these rinses reported fewer aesthetic problems, which supports their clinical preference in individuals with noticeable front restorations. Similar results from (Singh & Verma, 2019) demonstrated a significantly lower rate of surface degradation with fluoride-based rinses in a controlled clinical setting.

The extent of aesthetic deterioration was influenced by the formula of the mouthwash, the exposure time, and the frequency of usage. Regardless of the kind of rinse, the study revealed that patients who used mouthwash more than twice daily or for longer than one minute at a time had greater rates of surface changes and discoloration. In composite materials, extended exposure significantly enhanced the color change under simulated oral settings, as reported (Villalta et al., 2006).

This study also contributes to the existing literature by presenting real-world clinical data from a cross-sectional population, rather than relying solely on laboratory immersion protocols. It emphasizes the importance of evaluating esthetic degradation under in vivo conditions, where variables such as salivary flow, brushing habits, and dietary intake play a pivotal role in outcomes. Despite these strengths, the study is not without limitations. The cross-sectional design restricts the ability to establish causality, and color assessments were conducted visually without the use of objective tools such as spectrophotometry or surface profilometry. Future longitudinal studies are recommended to explore these effects over time using more advanced instrumentation and standardized exposure protocols.

CONCLUSION

According to this study, the kind of mouthwash, exposure time, and application frequency significantly influence the esthetic degradation of composite fillings. Increased roughness and discoloration were related to chlorhexidine and alcoholic-based washes. Dental experts should bear these findings in mind in patient education and clinical advice.

Limitations

This investigation has several drawbacks. The cross-sectional design of the study restricts one's capacity to prove a link between esthetic deterioration of composite restorations and usage of mouthwash. Furthermore assessed visually was color change, which can be subjective rather than employing digital techniques like spectrophotometry that would yield more accurate measurements. Moreover, selfreported mouthwash use may include memory bias, hence compromising the correctness of the results. In interpreting the results and designing next research, one has to bear these constraints in mind.

Future Suggestions

Future studies could employ spectrophotometers and surface roughness meters for accurate measurements of color change and surface deterioration in order to better clarify the effects of mouthwash on composite restorations. Longitudinal or in vitro investigations with precisely regulated exposure to several mouthwashes would give insightful information on the long-term impact of mouthwash usage on composite restorations. Furthermore investigating how whitening mouthwashes affect stained restorations will help assess their effectiveness in improving the esthetics of discolored composite restorations. These studies would give dental specialists recommendations based on facts for mouthwash use in patients with composite restorations.

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