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Effects of mouthrinses on surface properties of CAD CAM manufactured temporary restorative materials

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ABSTRACT

Objective: Aim of the study is to evaluate the effects of mouthrinse on surface properties of CAD CAM manufactured temporary restorative materials.

Methodology : In this study CAD CAM manufactured PMMA blocks were used. A total of 4 samples of PMMA blocks with shade A2 (10mm in diameter and 2 mm in thickness) were constructed in standardized manner in Saveetha dental College. Then the blocks are divided into four groups Group I Listerine, Group II Chlorhexidine, Group III Herbal mouthwash , Group IV Distilled water. The baseline micro hardness values of the specimens were recorded using the Mitutoyo Surface hardness tester.

Results: Significant Reduction in the microhardness was observed in all groups after the immersion in the mouth rinses compared the baseline values with $P<0.01$. After the immersion of PMMA block in CHX, herbal mouthwash and Listerine there is reduction in roughness, whereas in distilled water there is increase in the surface roughness than before immersion. The blocks were then checked for post immersion micro hardness using the same micro hardness tester previously mentioned for baseline values. The data was tabulated and subjected to statistical analysis.It was done in SPSS Software.

Conclusion: The present study showed the surface roughness of PMMA blocks immersed in different mouthwash. The CHX, herbal mouthwash and Listerine there is reduction in roughness, whereas in distilled water there is an increase in the surface roughness than before immersion.

Keywords: *PMMA, Mouthrinse, Chlorhexidine, Listerine, Novel technique*.

INTRODUCTION

These days, Because of the interest of esthetic restorations, the scientists have been attempting to advance the physical and mechanical properties in which Composites are made of matrix, filler particles and silane-coupling specialist that connects the matrix to fillers which is to a great extent used to develop the anterior and posterior restorations, whereas Ceramics has low tensile strength, high esthetics, brittleness and biocompatibility which lead to the formation of different restoration such as PMMA, which is of high mechanical and biological properties.(1) Earlier, PMMA was used for the fabrication of complete denture bases. Despite the disadvantages of using PMMA, such as fracture of denture due to water sorption and poor flexural strength, many researchers have attempted to introduce a variety of changes to overcome the disadvantages and to improve their properties.(2)(3) Minor changes of dental material have led to long-term clinical success of the restorative materials, which is associated with chemical degradation, which makes the restoration more prone to mechanical degradation.(4) The aging of dental materials in the oral environment is caused by diet, which can be effectively simulated by submerging them in liquids that mimic food.(5),(6) Submerging dental materials in liquids that resemble food effectively mimics diet, which is what causes dental materials to age in the oral environment. (7),(8) Over the past thirty years, the development of computer-assisted design and computer-assisted manufacturing (CAD/CAM) technology has resulted in the unprecedented creation of new materials, manufacturing methods, and treatment alternatives that outperform those previously available.(9)

Clinicians prefer monolithic CAD/CAM block materials because they speed up the manufacturing process and reduce the number of clinical appointments required to produce aesthetic all-ceramic restorations.(10) In light of the fact that gingivitis can be treated effectively with oral hygiene, caries has emerged as a major global health issue.(11) Instead of using chemical therapies, they can be maintained with routine mechanical plaque.((12) Chemical mouth rinses are prescribed by dentists to patients who are at risk for periodontal disease and dental caries.(13) Mouth washes have been extensively used to combat plaque, caries, and periodontal diseases for a long time(14)It's a good way to keep up good oral hygiene. Antimicrobial agents, detergents, emulsifiers, organic acids, and alcohol are all components of these mouth rinses.(15),(16)The oral pH is altered by varying the concentration of these substances.(14,17). The surface roughness and hardness of the composites have been shown to be influenced by alcohol-containing mouth rinses, according to studies.(18) On the other hand, some studies assert that alcohol mouth rinses have no negative impact on the composite material's hardness and that the material's microhardness value is more important than the rinsing solutions used.(19,20)

The material's mechanical properties, such as its abrasion resistance and compressive strength, are well correlated with its surface hardness, an important physical property.(21)It is assumed that this property is very important to the restoration's clinical longevity and aesthetics. (22),(23)

Most of the time, chlorhexidine digluconate is used to treat periodontal disease and dental caries as an antibacterial.(24,25) It is available as a mouthwash, spray, and gel. effectiveness of chlorhexidine in lowering plaque levels and gingival inflammation caused by plaque.

(26) By coating the surface of the bacteria, chlorhexidine also affects the colonization rate of oral bacteria on the enamel surface, resulting in prolonged and persistent antimicrobial action.(27,28) It has been demonstrated that a daily rinse with 10 milliliters of mouthwash containing 0.2% chlorhexidine can effectively control plaque and prevent the development of gingivitis. Staining of dental materials, the formation of calculus, and brief halitosis are all side effects of CHX administration.(29),(30) Gingivitis can be treated with the anti-plaque medication Listerine. Listerine's chemical composition consists of 24-27 percent ethanol, which serves as a solvent to preserve the phenolic component.(31),(32) Nowadays, herbal mouth rinses with essential oils like peppermint, eucalyptus, thyme, and wintergreen are also popular.(33),(34) The aim of the study is to evaluate the effects of mouthrinse on surface properties of CAD CAM manufactured temporary restorative materials.

METHODOLOGY

In this study CAD CAM manufactured PMMA blocks were used. A total of 4 samples of PMMA blocks with shade A2 (10mm in diameter and 2 mm in thickness) were constructed in standardized manner in Saveetha dental College.

Then the blocks are divided into four groups Group I Listerine, Group II Chlorhexidine, Group III Herbal mouthwash , Group IV Distilled water.

The baseline micro hardness values of the specimens were recorded using the Mitutoyo Surface hardness tester.

The specimens were then immersed in 20 ml of respective mouth rinses and kept at room temperature at 37°C for 24 h. In CHX, a block is immersed in 10ml of 0.2% of CHX mouth rinse, group 2 block was immersed in 10ml listerine mouthrinse, group 3 block was immersed in himalaya herbal mouth rinse and group 4 in Distilled water. The solution was replaced for every two days.The blocks were then checked for post immersion surface roughness using the same tester previously mentioned for baseline values. The data was tabulated and subjected to statistical analysis.

The pre operative and post operative values comparison of mean and standard deviation of surface hardness was done.For inter group comparison Kruskal–-Wallis test was used with SPSS

RESULTS

Significant Reduction in the microhardness was observed in all groups after the immersion in the mouth rinses compared the baseline values with $P<0.01$

Kruskal wallis test showed a statistically significant difference in surface roughness between the four mouthrinses with $P= 0.021$ of $P<0.05$. After the immersion of the blocks in mouthrinse, we observed that there is no significant difference $p=0.341$

The surface roughness given the values of Ra,Rq,Rz is shown in figure 1, where the mean and standard deviation was done for the comparison of mouthrinse is shown in the table1.

TABLE 1: Change in roughness (mean values + standard deviation) of PMMA block in each mouthrinse(n=4)

	Pre operative	Post operative
CHX	0.21+0.2858	0.23+0.2977
Listerine	0.18+0.2426	0.26+0.3292
Herbal mouthwash	0.18+0.2369	0.14+0.1646
Distilled Water	0.18+0.2396	0.21+0.2806

FIGURE 1: Surface Roughness of PMMA block using tester.

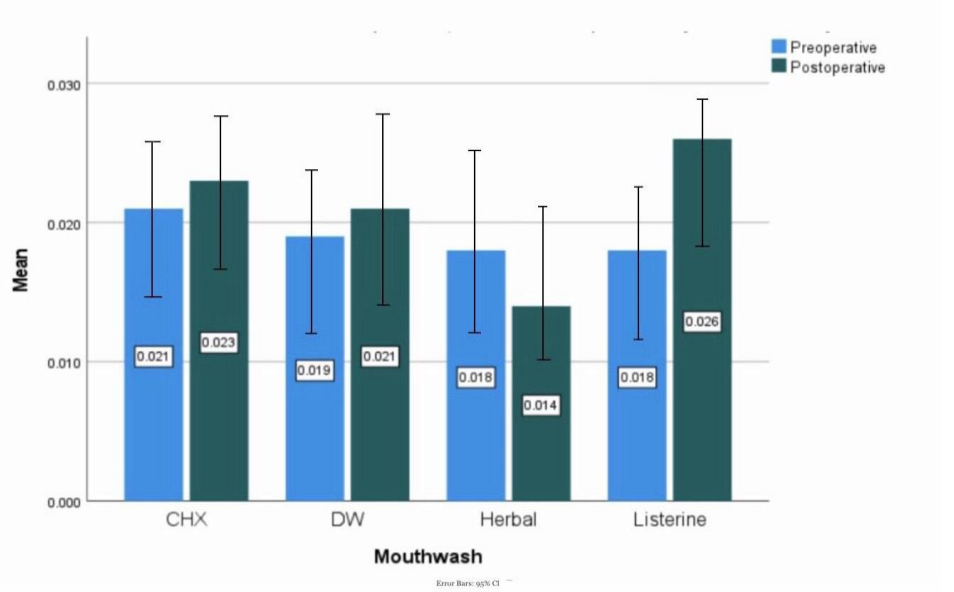

FIGURE 2: shows the descriptive statistics of surface roughness of preoperative and post operative measurement of PMMA blocks immersed in different mouthrinse solutions. X axis represents the mouthwash used and y axis represents mean value of preoperative and postoperative roughness. It is observed that after the immersion of PMMA block in CHX, herbal mouthwash and Distilled water there is reduction in roughness, whereas in Listerine there is increase in the surface roughness than before immersion. P value = 0.32>0.05, which is statistically insignificant.

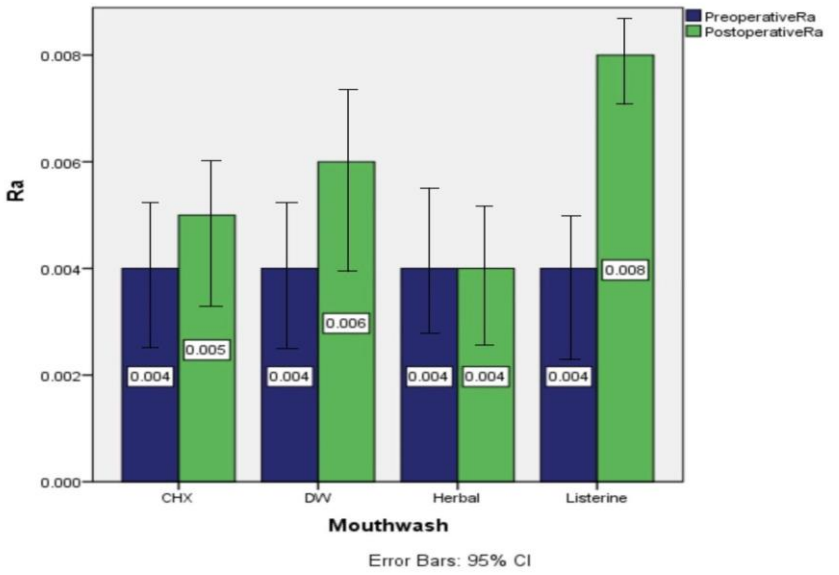

FIGURE 3: shows the descriptive statistics of Ra of preoperative and postoperative measurement of PMMA blocks immersed in different mouthrinse solutions. X axis represents the mouthwash used and y axis represents mean value of preoperative and postoperative Ra. It is observed that after the immersion of the PMMA block in CHX, Listerine and Distilled water there is an increase of Ra, whereas in herbal mouthwash there is the same in Rz before and after immersion. P value = 0.25>0.05, which is statistically insignificant.

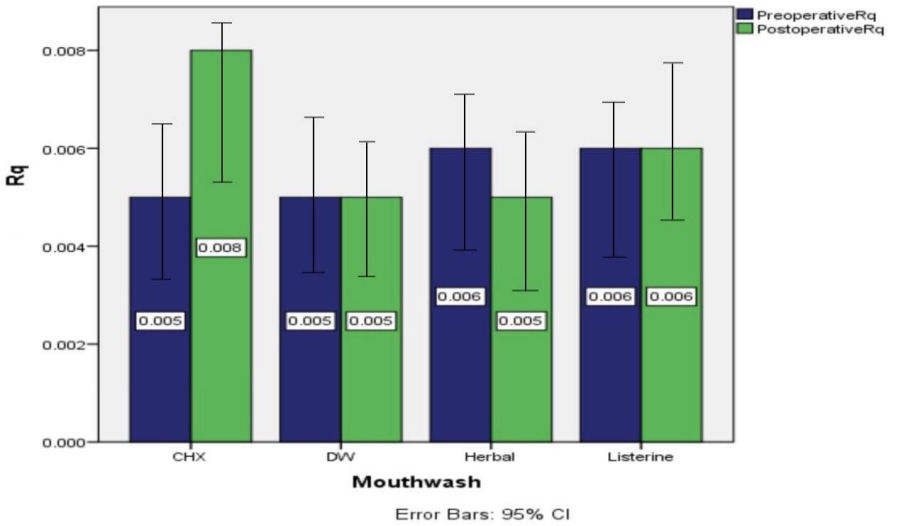

FIGURE 4: shows the descriptive statistics of Rq of preoperative and post operative measurement of PMMA blocks immersed in different mouthrinse solutions. X axis represents the mouthwash used and y axis represents mean value of preoperative and postoperative Rq. It is observed that after the immersion of the PMMA block in CHX, Herbal mouth wash there is an increase of Ra, whereas in Listerine and Distilled water there is the same in Rz before and after immersion. P value = 0.12>0.05, which is statistically insignificant.

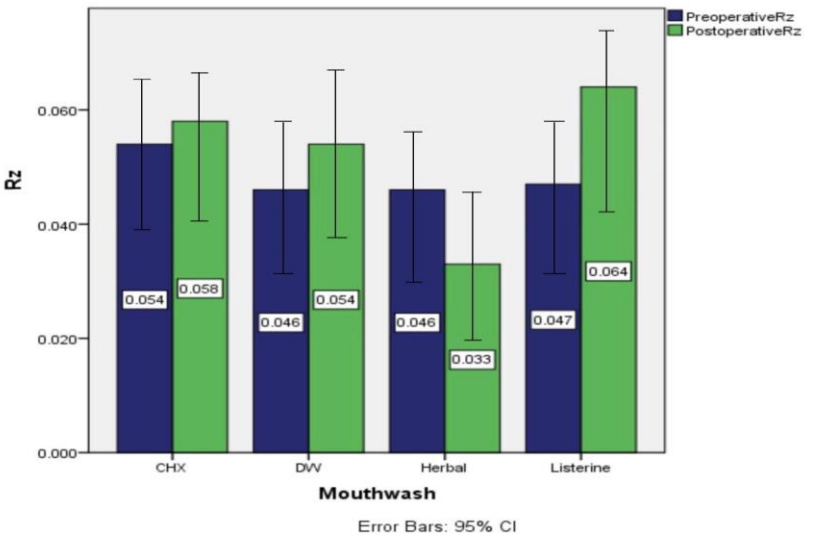

FIGURE 5: shows the descriptive statistics of Rz of preoperative and post operative measurement of PMMA blocks immersed in different mouthrinse solutions. X axis represents the mouthwash used and y axis represents mean value of preoperative and postoperative Rz. It is observed that after the immersion of PMMA block in CHX, Listerine and Distilled water there is increase of Ra, whereas in herbal mouthwash there is reduction in Rz than before immersion. P value = 0.28>0.05, which is statistically insignificant.

DISCUSSION

Under various masticatory functions and the shifting oral environment, dental material ought to perform the same function as natural teeth. They ought to have a look that is very similar to that of natural teeth. PMMA is an alternative material for restoration due to its improved mechanical and physical properties.(35). The purpose of this study is to determine how mouth rinses affect PMMA's surface properties. Chlorhexidine, Listerine, herbal mouthwash, and distilled water are the mouthwashes that can be purchased in stores.(36).According to the findings of this research, Listerine has a direct impact on one of the physical properties, such as Surface Roughness. The explanation could be low Ph of natural solvents like liquor of around 11-6% prone to harm the long polymer chain which are more slender in PMMA(37). The mouth rinse's alcohol does not damage the chain because it does not penetrate into it.(38)

According to Alnasser et al.'s research, mouth rinses with an acidic pH are likely to cause acid etching and leaching of the primary matrix-forming cations, resulting in hydrolytic degradation of the material.(39)Even though herbal mouthwash has a lower pH than distilled water, it exhibits less surface roughness because distilled water does not contain alcohol, as the study found that mouth rinses that contain alcohol and have a low pH cause surface roughness. According to Netuschil et al., alcohol's effect on dental materials is caused by the susceptibility of Bis GMA-based polymers in mouth rinses, which causes irreversible component leaching.(40) Because of their low pH and higher alcohol content, mouthwashes like listerine and chlorhexidine are frequently used. These mouthwashes have acted on the nanofilled and hybrid composite's polymeric matrix by catalyzing ester groups from dimethacrylate monomers. The alcohol and carboxylic acid molecules produced by the hydrolysis of ester groups accelerate the resin's degradation as the matrix's pH drops.(41)

Another study shows that the hybrid composite had lower sorption values than the nanofilled composite. However, when the hybrid composite was exposed to Listerine and Plax Fresh Mint, both of which contained 6% alcohol, its sorption rates were higher than those of the Plax and remained in the control group. Again, alcohol clearly played a role in the sorption phenomenon here.(42) In fact, previous research has shown that resin composites are more likely to release monomers and are more soluble in ethanol and water than in water or artificial saliva.(43)

Our study's findings are in line with those of Haffajee et al.'s previous research.(33) who discovered that the presence of alcohol led to lower values of micro-hardness; Almeida, others(18) work which found significant reduction in mean VHN (Vickers micro hardness number) of specimens immersed in alcohol based mouth rinses. (44–53)

When compared to the control, the present data demonstrated that alcohol-containing mouthrinses had a significant impact on surface hardness values. Our study was constrained by the inability to precisely and completely replicate a dynamic oral environment under in vitro laboratory conditions. In order to replicate the clinical oral condition, additional studies need to be conducted to access longer exposure times using artificial saliva and other solvents. In addition, other properties like tensile strength and color stability can be tested to get more specific information about how different solvent pH and alcohol concentrations affect aesthetic restoration materials.

CONCLUSION

The present study showed the surface roughness of PMMA blocks immersed in different mouthwash. The CHX, herbal mouthwash and distilled water there is reduction in roughness, whereas in Listerine there is an increase in the surface roughness than before immersion.

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CONFLICT OF INTEREST

Nil

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