Effects Of Dentifrices On Discolouration Of Cad Cam Manufactured Temporary Restorative Materials

Research Article

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Abstract

Aim: To assess the effects of dentifrices on discolouration of CAD/CAM manufactured temporary restorative materials.
Introduction: Color match is one of the most important characteristics of aesthetic restorative materials. Maintenance of color throughout the functional lifetime of restorations is important for the durability of treatment. This characteristic is not constant among dental materials. Restorative materials must maintain long-term color stability in order to avoid replacement of restorations. Color differences (ΔE) more than 3.3 units reflect clinically significant visual discoloration. The degree of discoloration of resins can be influenced by a number of factors such as incomplete polymerization, water sorption, chemical reactivity, diet, oral hygiene or surface roughness of the restoration. Discoloration can be due to extrinsic or intrinsic cause. The null hypothesis was that colour stability of tested materials were not affected by the dentifrices or toothbrushing simulation.
Materials and Methods: In this study, CAD/CAM manufactured PMMA blocks were used. The blocks were mounted with a die and the preoperative values for colour stability were recorded using Digital spectrophotometer (VITA Easyshade Advance 4.0- VITA Zahnfabrik). The values included "l", "c", "h", "a", "b" values. Then the PMMA blocks were subjected to toothbrush simulator (Toothbrush simulator ZM3.8- SD Mechatronik) .The simulator was run for 1 month cycle (i.e. 833 cycles) and 3 month cycle (i.e. 2500 cycles). Then the values were recorded again.
Results and Discussion: Results show that there is no significant differences between colour stability of PMMA blocks before and after brushing with different dentifrices for 1 month and 3 month cycles. The graph shows the delta E values for the samples treated with different dentifrices for the 1st month, 3rd month and between 1st and 3rd month. P values for 1 month, 3 month and between 1 and 3 months cycles were found to be 0.992, 0.25 and 0.895. Hence the values are not statistically significant.
Conclusion: This study concludes that different dentifrices have no effect on discolouration of CAD/CAM manufactured temporary restorative materials.

Keywords: Dentifrices; Discolouration; Pmma Blocks; Innovative Technology; Toothbrush Simulator; Spectrophotometer.

Introduction

Color, shape and surface texture are very important in aesthetics characterising and personalising a smile [1]. Even though aesthetic treatments have been one of the most required dental treatments, coming just after pain related treatments, in depth property of aesthetic restaurateur material is their long-term colour stability and an acceptable colour match is the primary reason for the replacement of composite resin restoration [2]. As possessing good esthetic properties, resin composite materials are widely used in clinical practice. Any aesthetic restorative material should duplicate the appearance of a natural tooth in colour and the success of an aesthetic restoration depends first on the colour match and then on the Colour stability of the material [3].

Three types of discolouration are generally described : external discolouration due to their accumulation of plaque and surface stains(extrinsic stain), Surface or subsurface colour alteration implying superficial degradation or slight penetration and reaction of staining agents within the superficial layer of composite resins

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and body or intrinsic discolouration due to physio chemical reactions in the deeper portion of the restoration [4]. Discolouration of composite resin materials can be caused By Intrinsyc and/ or extrinsic factors [5]. The new resin based CAD/CAM blocks combining the strength and colour stability of ceramics with the improved flexibility and low abrasiveness of composites have been made available for the dental practice [6]. However it has been stated that the optical and mechanical properties of these materials should be acceptable for long term use [7].

The esthetic appearance of the teeth restored with composite resins affect the characteristic features such as the surface roughness, brightness, colour stability of the restorative material [8]. Discolouration occurring over time will probably limit the longevity and perceived quality of restorations. Colour changes of dental restorations could vary depending on oral hygiene, diet and smoking habits of patients. When exposed to the oral environment, discolouration may occur due to external and internal factors [9]. Among external factors, colour change occurs by adsorption of colorants because of contamination from exogenous sources. The aim of this study was to investigate the effects of dentifrices on discolouration of CAD/CAM manufactured temporary restorative materials.

Materials and Methods

In this study, CAD/CAM manufactured PMMAblocks were used. 8 samples of PMMA blocks were collected from the CAD/CAM department valueof Saveetha dental college and hospitals. The blocks were mounted and preoperative values for colour stability were recorded using spectrophotometer (VITA Easyshade Advance 4.0- VITA Zahnfabrik). . The values included L,c,h,a,b values. The PMMA blocks were then subjected to toothbrush simulator (Toothbrush simulator ZM3.8- SD Mechatronik). Four different pastes that were commercially available was applied onto the blocks. Dabur red toothpaste was used for the first two samples , Meswak toothpaste was used for the next two samples, sensodyne toothpaste was used for the next two samples and Colgate toothpaste was used for the last two samples and the simulator was run for 1 month cycle (i.e 833 cycles) in a linear motion (x and y axis). The values L,c,h,a,b for 1 month cycle were recorded and then again subjected to the simulator continuously after 833 cycles till 2500 cycles (3 month cycle). Then the 3 month cycle values were recorded.

Results and Discussion

8 samples of PMMA blocks were collected and the brushing was done for 4 randomly chose toothpastes using a toothbrush simulator. The values for each sample (pre op and post op) were recorded.In this study, a clinical spectrophotometer (Vita Easyshade Advance) and the L*, a*, and b* CIE coordinate system were utilized, as they were reported to offer more objective values with a higher level of accuracy and repeatability. In the system of CIELAB, color difference ΔE is the value used to evaluate color changes and it is calculated by a special formula using the differences in L*, a*, and b* values.

$$\Delta E = [\Delta a2 + \Delta b2 - \Delta L2]^{½}$$

Where, L - lightness and darkness, a - greenish or reddish and b - bluish or yellowish.

There is no observable difference for 1 month cycle in all the tooth pastes. On analysing the 3 month cycle, Colgate tooth paste showed a relatively higher discolouration among all tooth pastes and Sensodyne tooth paste showed a higher discolouration next to Colgate toothpaste. On analysing the colour change between 1 month and 3 month cycle, Sensodyne tooth paste showed a higher rate of colour change when compared to other toothpastes. Although there are some differences observed from the graph, Results show that there is no significant differences between colour stability of PMMA blocks before and after brushing with different dentifrices for 1 month and 3 month cycles. The graph (fig. 1) shows the delta E values for the samples treated with different dentifrices for the 1st month, 3rd month and between 1st and 3rd month. P values for 1 month, 3 month and between 1 and 3 months cycles were found to be 0.992,0.25 and 0.895 (p<0.05 is considered significant). Hence the values are not statistically significant. Our team has extensive knowledge and research experience that has translate into high quality publications [10-29].

Color stability is the ability of any dental material to retain its original color. The color stability of resin composite is related to the resin matrix, dimensions of filler particles, depth of polymerization, coloring agents, and certain extrinsic and intrinsic factors. The most prominent disadvantage of resin-based CAD/ CAM blocks used for esthetic restoration of teeth is unpredictable color change and staining occurring over time. Discoloration or loss of translucency in restorative materials can lead to patient dissatisfaction [30].

As a result of abrasion by brushing, as well as by the corrosive process (erosion), restorative materials can become rough and wear out. The presence of irregularities can influence the appear-

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
Mean Delta E Values for First month cycle	Between Groups	0.053	3	0.018	0.032	0.992
	Within Groups	4.38	8	0.548		
	Total	4.433	11			
Mean Delta E Values for Third month cycle	Between Groups	2.843	3	0.948	1.670	0.250
	Within Groups	4.539	8	0.567		
	Total	7.382	11			
Mean Delta E Values between First and Third month cycle	Between Groups	0.294	3	0.098	0.198	0.895
	Within Groups	3.96	8	0.495		
	Total	4.254	11			

Figure 1. Graph representing the mean delta E values for different dentifrices with tooth simulation at 1st month, at 3rd month and between 1st and 3rd month. P values for 1 month, 3 month and between 1 and 3 months cycles were found to be 0.992, 0.25 and 0.895 which are statistically insignificant implying that there are no significant differences in the mean delta E values between the different dentrifices.
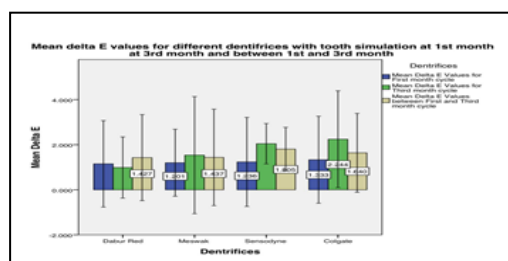
ance, lead to surface discoloration, bacterial biofilm retention and gingival irritation, increasing the risk of caries and periodontal inflammation. The important factors affecting color stability are the surface roughness, surface integrity, finishing, and polishing techniques.

In a study by Cesar and Regina [31] there was no difference in color stability between brushed and not brushed specimens, regardless of toothpaste used, showing that despite the greater roughness of the brushed specimens, did not result in color change which is in accordance with our study.

Also, the present study result is contradicted in a previous study (2) that use of whitening tooth paste will cause colour change and surface roughness of restorative material making it prone to deformation and also affects the clinical success of restoration.

Conclusion

Toothbrushing also brings negative effects over a period of time whether done or not done appropriately to maintain oral hygiene on the surface of composite restorations. Within the limitations of this study, the ΔE values after tooth simulation for a period of time did not significantly change. Hence, this study concludes that different dentifrices have no effect on discolouration of CAD/CAM manufactured temporary restorative materials.

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