International Journal of Dentistry and Oral Science (IJDOS)
ISSN: 2377-8075

Comparative Evaluation Of Colour Stability Of Two Different Commercially Available Glass Ionomer Cement After Immersion In Carbonated Beverages

Research Article

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Abstract

Background: Glass ionomer cement is a versatile acid base material formed by reaction between weak polymeric acids with glass powdered base. The three essential components of glass ionomer cement namely, water soluble acids like maleic acid or acrylic acid which acts as rate modifier, basic glass which reacts to form salt and water acting as medium, solvent promoting proton release.
Aim: To study the comparative evaluation of two different commercially available glass ionomer cement on immersion in different carbonated beverages.
Materials and Methods: Two different glass ionomer cements were selected, purchased and processed. The samples were prepared as pellets and stored. The samples were then numerically labelled, trimmed and polished. The samples were then immersed in carbonated drinks and left undisturbed for 24 hours. The colour change was then noted using a VITA easy shade advance spectrophotometer. The comparison was documented, analysed using spss statistics version 22.0.
Results: The L,A,B values of the samples were documented, tabulated. The comparison was done using SPSS statistics, independent samples t test. The comparison of delta E values were done for all samples between immersion of different drinks. On an independent sample test, the p value was found to be 0.229, proving to be statistically insignificant, $p>0.05$.
Conclusion: Pyrax glass ionomer cement showed more colour stability. Sprite drink made the maximum colour change than the other drinks used.

Keywords: Colour Stability; Glass Ionomer Cement; Immersion; Carbonated Beverages; Innovative Technology.

Introduction

Glass ionomer cement is a versatile acid base material formed by reaction between weak polymeric acids with glass powdered base. The three essential components of glass ionomer cement namely, water soluble acids like maleic acid or acrylic acid which acts as rate modifier, basic glass which reacts to form salt and water acting as medium, solvent promoting proton release. The GIC as a restorative material holds a wide variety of bioactivity which helps adhesion between tooth surfaces increasing the durability. Fluoride release is considered as an important advantage of glass ionomer cement improving oral hygiene over a certain period of time [1]. The clinical performance of glass ionomer cement is determined by various categories and properties like adhesion, fissure sealants, effect over caries dentin, ART, etc. making it ideal for various restorative situations. Glass ionomer cements is well known as a restorative material but with its versatile properties, unique set of advantages and uses, plays a major role in paediatric dentistry in the recent decades as cavity liner, caries control, cavity restorations in primary, permanent tooth, luring cement, etc. [2]. Glass ionomer cement is considered as bioactive material releasing fluoride on pH acidity, increasing its potential as first choice restorative material in today's world [3].

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Received: September 13, 2021
Accepted: September 23, 2021
Published: September 24, 2021

Citation: Moulishree Ramesh, Jayalakshmi S, Balaji Ganesh S. Comparative Evaluation Of Colour Stability Of Two Different Commercially Available Glass Ionomer Cement After Immersion In Carbonated Beverages. *Int J Dentistry Oral Sci.* 2021;8(9):4658-4663. doi: http://dx.doi.org/10.19070/2377-8075-21000949

India is a famous place known for its cuisine rich in flavours and spices with high quality food colourants. Knowing the susceptibility of our teeth to various ingredients with high staining capacity in our country, colour stability, the ability to withstand decolourants and maintain the original colour is an important characteristic which needs to be analysed on all categories of restorative materials. Viewing the mechanical and physical properties of the materials, this property is often ignored which should also be included in making a choice in choosing restorative material to be used for the treatment [4]. Understanding the importance of colour stability criteria in restorative dentistry, there are various studies which determine the degree of surface staining of various compounds and colour stability capacity of various restorative materials. Different resin based composites, glass ionomer cement after immersion in various colour stimulants and stains which was measured using spectrophotometer method. Mostly all materials were susceptible with exception of Fuji IX with least susceptibility to stains like coffee, red wine, etc.[5]. *In vitro* study was done on colour stability of crystallised acetyl resin material on suscepting to different stains and comparing with different restorative materials and was found to be most reliable among the other materials [6]. The colour stability of five different fluoride releasing restorative materials on different pH levels where glass ionomer cement show great colour stability and no significant changes with pH [7].

Children generally are more susceptible to sweetened substances, flavours and different coloured drinks. Various restorative materials were exposed to different coloured drinks, stains to check their colour stability. Fuji II showed the most while Fuji IX showed great colour stability after immersion in various beverages. These tests help choose proper restorative material for esthetic reasons. [8]. This study aims to study the comparative evaluation of colour stability of two different commercially available glass ionomer cement after immersion in carbonated beverages.

Materials and Methods

In this present study, the colour stability of two different commercially available glass ionomer cement after immersion in carbonated beverages. The required amount of glass ionomer cement commonly used - D-tech and pyrax were purchased from the online dental enterprises. The purchased glass ionomer cement was moulded to pellets of 2mm diameter. The pellet moulds were then finely trimmed and polished using a micromotor. The pellets were numbered numerically.(figure 1). The colour stability of the samples were calculated and noted before immersion as pre-immersion values. The carbonated drink used in this study- coca cola, sprite, control (distilled water). The sample pellets 1,2(d-tech) , 6,7(pyrax) were immersed in coca cola drink in a beaker. The sample pellets 3,4(D-tech), 8,9(pyrax) were immersed in sprite drink in another beaker. The remaining samples 5(D-tech) and 10(pyrax) were immersed in control(distilled water). (figure 2) The sample pellets after immersion in their respective drink were then left undisturbed in a cool, dry place at room temperature. After a period of 24 hours, the samples were taken out, washed and dried. The colour stability of the glass ionomer cement was calculated and noted as post-immersion values. The colour stability was calculated using VITA easyshade spectrophotometer.(figure 3). The pre- immersion and post-immersion values of the sample GIC were tabulated, compared and analysed for comparative evaluation. The statistical analysis was done using SPSS statistics Version 22.0 to study the association and their statistical significance.

Results

In this present study, the colour stability of glass ionomer cements were focused and the comparative evaluation of different commercially available glass ionomer cements were studied. The L,A,B values of each sample pellet were recorded before(Table 1,2) and after immersion(Table 3,4) in control and carbonated beverages respectively for each sample. The delta E values of each sample according to their pre-immersion and post-immersion values were calculated(Table 5,6). The delta E values were found to be of moderate colour change values. The comparison of the samples of two different commercially available glass ionomer cement after immersing in different carbonated beverages based on their colour stability was done using independent sample t test analysis in SPSS version 22.0. The association was virtually represented in table 5. The delta E value showed the range of colour

Figure 1. The picture representing the sample pellets of two different types of commercially available glass ionomer cement in which the first five(numbered- 1, 2, 3, 4, 5) were from Dtech and the next five (numbered- 6, 7, 8, 9, 10) were from Pyrax was used for this present study.

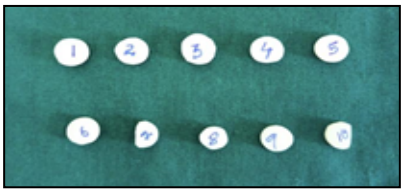


Figure 2. The picture represents the selected GIC sample pellets numbered for our convenience kept near the carbonated beverages in which the two different GIC is to be immersed to compare their colour stability. 1,2,6,7 to be immersed in coca-cola, 3,4,8,9 to be immersed in sprite drink whereas the remaining 5,10 to be immersed in distilled water as control.

Figure 3. The picture represents the recording of L,A,B values of each sample pellet used before and after immersion in carbonated beverages and entered as pre immersion and post immersion values for comparative study using VITA easyshade spectrophotometer.

Table 1. Table representing the L,A,B values collected for the D-Tech samples before immersion using VITA easyshade spectrophotometer.

SAMPLE NUMBER	L VALUE	A VALUE	B VALUE
1	78.1	3.2	28.7
2	74.4	2.7	24.2
3	73	3.2	24.5
4	82.4	2	22.7
5	81.9	2.8	26.8

Table 2. Table represents the L,A,B values collected for Pyrax sample before immersion using VITA easyshade spectrophotometer.

SAMPLE NUMBER	L VALUE	A VALUE	B VALUE
6	88.8	0.7	21.2
7	87.6	0.3	21.8
8	89.1	1.9	21.6
9	88.6	0. 7	23.4
10	88.9	0	19.1

Table 3. Table representing the L,A,B values of D-Tech samples collected after immersion using VITA easyshade photospectrometer.

SAMPLE NUMBER	L VALUE	A VALUE	B VALUE
1	76.4	2.5	25.5
2	75.3	2.4	24.8
3	73.7	3.4	30.4
4	87.2	1.4	23.5
5	78.3	1.2	19.4

Table 4. Table showing the L,A,B values of the pyrax samples collected after immersion using VITA easyshade spectrophotometer.

SAMPLE NUMBER	L VALUE	A VALUE	B VALUE
6	87.1	1.8	23.7
7	88.4	1.2	23.8
8	91.4	1.8	20.4
9	93.3	0.1	20.4
10	85.9	0.4	20.7

Table 5. Table showing the delta E values of the D-Tech samples used in this study.

S. No	Delta E value
1	3.6905
2	1.0296
3	5.9447
4	4.9031
5	8.3833

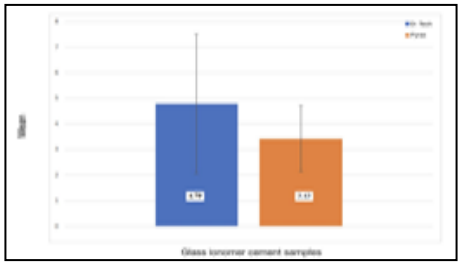
Table 6. Table showing the delta E values of the pyrax samples used in this present study.

S. No	Delta E value
1	3.2171
2	2.3345
3	2.5962
4	5.6080
5	3.4234

Table 7. Table representing the mean average, standard deviation and significance for the two different samples of GIC.

Group Statistics					
Groups		N	Mean	Std. Deviation	significance
Delta E	D-tech	5	4.790240	2.7206358	0.229
	Pyrax	5	3.435840	1.2926935	

Figure 4. Bar graph representing the comparison of mean delta E values of two different commercially available glass ionomer cement samples. X axis represents glass ionomer cement sample type whereas Y axis represents the mean value of the delta E values. The mean delta E value of D-Tech was found to be 4.790; pyrax was found to be 3.435 for the calculated delta E values from pre-immersion and post-immersion values. The comparison was found to be statistically insignificant.(independent sample t test; p= 0.229; p<0.05).



change seen in the sample after immersion. The group statistics such as mean, standard deviation, mean standard error was added to the table, (Table 7) based on the delta E values derived. Figure 4, the bar graph was derived from the comparative evaluation done via sample t test showing the mean average of delta E values from pre-immersion and post-immersion values of different GIC samples.

Discussion

Our team has extensive knowledge and research experience that has translated into high quality publications [9-28]. In the present study, the colour stability of the two different commercially available glass ionomer cements were studied via L,A,B values by comparing the pre-immersion and post-immersion values. The L,A,B values of d-tech, pyrax samples were noted before and after immersing in the carbonated drinks- coca cola, sprite with control as pre-immersion and post-immersion values respectively. The delta-E values of each sample were calculated and tabulated. On comparing the colour stability of the samples between the different types of carbonated drink on the basis of the delta-E values of the samples, it was found that the colour variation was more on immersion in sprite drink. On comparing the colour stability between the glass ionomer cement brands- D-Tech, Pyrax, the delta E values were maximum in d-tech in comparison with pyrax showing that pyrax have more colour stability than D-Tech. The delta E difference seen in the correlation graph is less than 10 which shows that the colour change in the cement seems to be moderate with not much colour change and significant potential of colour stability in both the GIC brands. On immersion in coca cola, the colour change was more in pyrax showing 2.78 delta E difference while D-Tech showed 2.38 delta E difference. On immersion in sprite drink, D-Tech showed a greater colour change than pyrax with delta E value 5.42 while pyrax had 4.10 delta E difference. Dtech showed maximum colour change in control with 5.9 deltaE value while pyrax showed no colour change. These evaluations help us conclude that D-tech seems to show maximum colour change than pyrax which inturn shows that pyrax has more colour stability than D-tech. On comparing the colour change based on the carbonated drink, sprite showed maximum colour change than coca-cola.

In this present study, the comparison between the colour stability of different GIC after immersion in different carbonated beverages were done via delta E values obtained from the L,A,B values of all the sample pellets. The delta E values of both the carbonated beverages and control was correlated and compared between two different commercially available GIC used. The statistical significance of this correlation and delta E values were studied using independent sample t test where the p-value was found to be 0.229, $p<0.05$. the limitations like less sample pellets, short trial period, comparison of only two commercial GICs should be minimised and focus on enhancing the statistical significance of the study.

Previously, there were various studies done focusing on the colour stability of several adhesive materials exposed to different adverse environmental conditions. The effect of thermocycling on the

colour stability of adhesives like Cention N, Fuji IX GP Extra, and Fuji IX GP using spectrophotometer. It was found that there exists significant colour change on thermocycling which was statistically significant [29]. Previously, The effect of different types of children's beverages on the colour stability of different types of GIC- giomer, resin-modified glass ionomer cement was focused. The glass ionomer on immersion in beverages like juice, bournvita, coke, the giomer cement showed less colour change with better colour stability [30]. The colour stability of different restorative materials- conventional GIC, composite, porcelain on immersion in red wine was studied. The colour change was noted and statistically analysed via an independent sample t test and found that porcelain had higher colour stability than GIC and composite [31]. These studies help us understand the importance of colour stability, their effect on immersion at different mediums and exposure to various conditions.

In the present study, the effect of carbonated drink over glass ionomer cements were studied, the colour changes analysed using delta E values via spectrophotometer. The correlation between different carbonated drinks via delta E values were studied. The present study holds certain limitations like limited sample size, the comparative evaluation was done only between two different brands over a limited trial period. In future studies, more inclusion criterias should be included and compared with many more GIC brands over a long trial period.

Conclusion

On comparative evaluation, Pyrax glass ionomer cement showed maximum colour stability with limited colour change. Sprite drink showed maximum colour change in GIC in comparison with coca cola and control (distilled water). Further studies should be done to see the colour stability on various restorative materials and by different drinks and spread awareness about the same.

Acknowledgement

This research was done under the supervision of the Department of Research of Saveetha Dental College and Hospitals. We sincerely show gratitude to the corresponding guides who provided insight and expertise that greatly assisted the research.

Source of Funding

The present study was supported by

- Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, Chennai
- Sarkov health services, chennai.

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