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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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INFLUENCE OF AGING, BEVERAGES, AND MOUTH WASH SOLUTIONS ON THE MICROSTRUCTURAL AND COLOR STABILITY OF DIFFERENT DENTAL CERAMICS: AN IN VITRO STUDY

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Abstract.

Purpose: To evaluate the influence of aging, beverages, and mouthwash solutions on the microstructural and color stability of three CAD/CAM ceramic materials.

Materials and Method: In total, 87 specimens (7×5×1.5 mm) were prepared from 3 CAD/CAM ceramic groups, Lithium Disilicate glass ceramic (IPS e.max CAD), Extra translucent zirconia (VITA YZ), and Resin Nanoceramic (Cerasmart 270). All the materials were A2 or equivalent shades. After hydrothermal aging in distilled water at 5 C to 55 C for (10.000 cycles). The samples were randomly allocated into 3 groups (n=27) and immersion (staining) for one week in 3 different solutions coffee, green tea, and chlorhexidine. The baseline measurements of ceramic discs were recorded for color change and 2 samples of each group sent for SEM (microstructure) images before aging and staining. The second measurement was recorded after 10000 thermocycling and immersion in staining agents for 7 days. Statistical analysis were performed with an independent Kruskal-wallis test . The significant level was set at $P \leq 0.05$. **Results:** ΔE values for lithium Disilicate after immersion in coffee, green tea and chlorhexidine gluconate were 3.167, 1.847 and 2.022, respectively. corresponding ΔE values for VITA XT were 3.438, 4.201 and 2.267. meanwhile Cerasmart shows more sensitivity for staining than LD and VITA of 4.454, 2.926 and 2.933.

Conclusion: within limitation of this study lithium disilicate showed the best color stability with values less than perception threshold. VITA and Cerasmart show higher sensitivity for staining with VITA more affected by green tea (Higher than clinically accepted threshold) and Cerasmart more affected by coffee (higher than clinically accepted threshold).

Key words. Dental aging, beverages, mouthwash solutions, dental microstructural, dental ceramics.

Introduction.

The need for aesthetic is consistently increasing as a result of a society that places a high value on aesthetics. The field of aesthetic dentistry has introduced a multitude of advanced clinical techniques and has sparked a transformative shift in dental materials [1]. The advanced aesthetic CAD/CAM materials transformed the two-step bilayer, ceramic restoration to a monolithic single step restoration that decreased the veneering chipping and wear issues [2]. Because of their superior physical qualities, attractive appearance, best biocompatibility, low heat conduction, and good wear resistance, dental ceramics are perfect for recreating natural teeth. As a result, ceramics are used extensively in dental restorations, including porcelain veneers, crowns, inlays, and onlays [3]. Among the often-employed aesthetic dental ceramic materials in routinely dental clinic are glass ceramics, polycrystalline ceramics, composite resins, and translucent zirconia [4].

The lithium disilicate (LD) is the widely utilizing glass ceramic material because of its excellent optical properties, high strength, less porosity, easily fabrication and less likely to crack or chip. Despite the fact that lithium disilicate is a useful indirect restoration material, there is some limitations of (LD) when we try to restore bruxism patients, or patients with heavy occlusion or non-vital teeth because of fracture toughness [1]. Yttrium stabilized trigonal zirconia polycrystalline (Y-TZP) was developed as a result of the need for a material with both the excellent optical features of glass-ceramic and the mechanical properties afforded by metal restoration. Because of its restricted translucency (Y-TZP), it is difficult to create aesthetic restorations that look natural. Zirconia cores can have porcelain veneers placed over them to improve their appearance, although problems with veneer chipping and delamination have been noted frequently. Recently introduced high translucent monolithic zirconia have removed the necessity for significant reduction of tooth structure and also to reduce the chipping occurrence. From the main factors that affect the translucency of zirconia is a grain size, opacity is increased when the wavelength of the incident light less than the size of grains. the amount and types of dopants and stabilizers also affect translucency [5].

While ceramic continue to be the materials of choice for all indirect restorations, many manufacturers have introduced resin matrix ceramic materials, which blend polymer flexibility with ceramic beauty. Resin-matrix ceramics have a small particle microstructure that helps to avoid milling damage, increase mechanical performance, and shorten polishing time. Because no additional fire or sintering is necessary, resin-matrix ceramic materials provide a practical time- and cost-saving advantage for patients and physicians [6]. The intraoral structures react differently to the several beverages and mouth washes that people drink or use on a regular basis due to differences in their quantity, temperature, color, and content. Everyday solutions like coffee, green tea, and CHX can stain restorations in various ways [7].

The aim of this study was to assess the effects of staining by three different solutions on color stability and microstructure (SEM) of three CAD/CAM ceramic materials. The null hypothesis was that there would be no differences between the different ceramic groups after staining in regarding color and microstructure so that aging and staining procedures would not influence these properties.

Materials and Methods.

Specimens Preparation: A study was conducted to investigate three different types of dental ceramics, namely lithium disilicate glass ceramic (IPS emax CAD, Ivoclar vivadent, USA), VITA YZ Extra translucent Zirconia (VITA, Germany), and CERASMART 270 (hybrid ceramic, GC dental products,

Japan). The total number of samples used in the study was 87, with each ceramic type having a sample size of (27). The color change value (ΔE) of these materials were assessed both before and following the processes of staining. The compositions of the items under investigation are displayed in Table (1) of this study. The specimens, which were rectangular in shape, were created by cutting CAD/CAM blocks with dimensions of (7 mm x 5 mm x 1.5 mm) using a water-cooled low-speed saw (Isomet 1000, Buehler.IL). The accuracy of the dimensions was verified using a digital micrometer. Subsequently, the specimens were polished using 400-, 600-, and 800-grit silicon carbide sheets while being continuously exposed to running water. Following the completion of the polishing process, the lithium disilicate specimens underwent glazing and crystallization in a Programat EP 3010 furnace manufactured by Ivoclar Vivadent, Schaan, Liechtenstein. On the other hand, the zirconia specimens were sintered in a ZETIN furnace (ZTCF-30B) in accordance with the instructions provided by the makers.

Table 1. *CAD/CAM Materials.*

Materials	Composition	Manufacturer
Cerasmart	Composite resin materials (UDMA, BisMEPP, DMA)with 71wt.%SIO2(20nm)and barium glass(300nm) nanoparticles	Cerasmart (GC dental products Tokyo. Japan)
lithium disilicate glass ceramic(IPS emax CAD	57–80%SiO2,11-19% Li2O,K2O,MgO, Al2O3, P2O5 and other oxides	Ivoclar vivadent, schaan, liechtenstein
Extra translucent zirconia	Zro2(86-91%),Y2O3(8-10%),HFO2(1-3%),AL2O3(0-1%) pigments(0-1%).	Vita zahnfabrik germany

Staining Process: The samples obtained from each ceramic material were randomly allocated into three subgroups, each consisting of (9) samples. The participants were organized into three categories based on the type of staining solutions used, namely chlorhexidine gluconate (CHX), coffee, and green tea. The ceramic samples underwent a thermocycling process consisting of 10,000 cycles in distilled water, with the temperature oscillating between 5ºC and 55ºC. After aging ceramic groups will go into staining as follows; 9 samples of each ceramic group were kept in coffee (Nescafe Classic) at 37 degrees Celsius. It was made by dissolving in 300 ml of heated water (Nestle, Brazil). This subgroup's nine samples were kept in green tea at a temperature of 37 °C. For this, 300 ml of boiling water was added to two green label tea, lipton, turkey (2 g) tea bags. The samples (9) in this subgroup were kept at 37°C in a solution of chlorhexidine gluconate (perio KIN, spain).

Each ceramic sample was submerged in 15 ml of test solution for 7 days in a room setting with a regulated temperature of 37 10 C. To keep the test solutions homogeneous, they were changed every day and mixed once every 12 hours. 7 days into the immersion phase, the testing solution was withdrawn from the specimens. They were blotted after being cleansed with distilled water using tissue paper to dry.

Color Change Measurement Procedure: The color of each specimen was documented both prior and after the processes of thermocycling and immersion in the testing solutions. The color of each sample was measured at both intervals using a portable spectrophotometer (Vita Easy shade, Vita Zahnfabrik H. Rauter GmbH, Bad Sackingen, Germany) at the identical position, which was the center. During each instance, the color of the sample was measured on three separate occasions. The color of the disc was determined by taking the average value of three repeated color measurements. The CieLab color system was used to record three color characteristics, namely 'L', 'a', and 'b', for each ceramic sample. The formula used to determine the mean color difference resulting from the immersion of the sample is $\Delta E^* = ((\Delta L^*)2 + (\Delta a^*)2 + (\Delta b^*)2) \times 1/2$, where ΔL^* represents the change in L*(the color in the black – white axis), Δa^* represents the change in a*(red – green axis) , and Δb^* represents the change in b*(the yellow – blue axis). In this study, a lower value of ΔE^* was deemed indicative of superior shade matching performance. a score equal to or less than 3.5 was deemed to be within an acceptable range [1].

Statistical Analysis: The statistical analysis was performed using SPSS 19. Data were analyzed by Kruskal-Wallis and Dunns analysis test.

Results.

Color Change Measurements: Table 2 summarizes the mean L, a, and b values for each investigated material as well as the mean color change (ΔE) following immersion in the staining solutions. Upon submerging the ceramic samples in a coffee solution, the highest alteration in the mean color was in Cerasmart group (ΔE=4.4), followed by VITAXT (ΔE=3.4) and the least color change value was in lithium disilicate (ΔE=3.1). The highest color change was also in Cerasmart group (ΔE=2.9) after submersion in chlorhexidine solutions. the least was also lithium disilicate group (ΔE=2.0). After green tea submersion the highest discoloration value was seen in VITA XT (ΔE=4.2) and the least was also in lithium disilicate (ΔE=1.8). CHX was the least staining solution between the coloring agents.

Table 2. *Mean ΔL, Δa , Δb and mean colour change (ΔE) values after staining for all ceramic samples.*

Ceramic type	Staining solutions	ΔL	Δa	Δb	ΔE
Lithium disilicate	Coffee	-1.65	-0.2	-0.25	3.167
	Green tea	-1.266	-0.167	0.733	1.847
	Chlorhexidine	-0.35	-0.025	-1.225	2.022
VITA XT	Coffee	-1.85	0.475	-0.975	3.438
	Green tea	-3.95	0.1	1.125	4.201
	Chlorhexidine	-1.275	0.2	-0.725	2.267
Cersmart	Coffee	-0.35	1.2	4.225	4.454
	Green tea	0.2	0.55	2.775	2.926
	Chlorhexidine	2.575	0.65	1.075	2.933

Table 3. *Kruskal-waallis analysis of mean color change between different cereamic groups.*

	Coffee	Tea	CHX
Kruskal-Wallis H	3.920	6.017	4.020
df	2	2	2
Asymp. Sig.	0.141	0.049	0.134

Table 3 demonstrate the results of Kruskal-Wallis analysis of mean color changes of all tasted materials. There was a

significant difference in the mean ΔE values between the groups within green tea solution.

Table 4 show the comparison between every 2 groups within the green tea solution using Duns test analysis demonstrated the significant difference between (LD) group with each VITA XT and Cerasmart.

Table 4. *Dunes test to compare between each 2 groups with green tea solution.*

Samples	Test statics	Sig.
LD-CER.	-6.000	0.34
LD-VITA	-6.000	0.34
CER.-VITA	0.000	1.000

Scanning Electron Microscopy: The SEM images of ceramic groups used in this study are shown in figure 1. Before staining the lithium disilicate show needle like shapes distributed across the homogenous background, these needles like shapes accumulates in some places to form un regular grain like shapes. After staining in 3 different solutions the lithium disilicate images figure 1 show no clear scratches or defects on the surfaces. as general there was disappearance of the needle like structures and these shapes looking now smaller and, rounded and widely distributed than before.

VITA XT SEM images before staining show the grain sizes are not uniform and the grain boundaries mostly visible the grain size mostly large with homogenous structure after staining there is no clear defects or deformity with same grain shape and clear boundaries as shown in Figure 1.

For Cerasmart samples the SEM images show grainy surface with many different size protruding particles. The boundaries between the grains and the surrounding background are not clear.

After staining the images showed the same grainy surface with no clear scratches or defects in surface.

Discussion.

The efficacy of dental prostheses is based upon their capacity to reinstate both functional and cosmetic aspects. Achieving precise color matching with adjacent teeth, as well as addressing other aesthetic considerations such as location, texture, and contour, is crucial for obtaining a favorable aesthetic result. All-ceramic restorations are commonly favoured in the anterior region because to its enhanced translucency, which closely resembles that of natural teeth. The durability of the established color is crucial for the sustained efficacy of dental restorations over an extended period. In order to analyse the impact of regularly consumed beverages such as coffee, tea, and chlorhexidine mouthwash on the color durability of all-ceramic restorations, we conducted an experiment using a spectrophotometer to assess the samples of these restorative materials. The spectrophotometer was employed in the current investigation for the purpose of color measurement due to its superior accuracy, ability to provide numerical representation of color, and lack of subjective bias [1].

The findings of the current study led to the rejection of the null hypothesis that there is no discoloration of ceramic restorations when exposed to drinks and mouthwash. In this study the greater color stainability was found with a Cerasmart samples, and the lowest one was lithium disilicate samples, due to the presence of Bis-MEPP, UDMA, and DMA monomers in the resin matrix of CERASMART, which gives the material the ability to absorb stress, CER was found to be the most discolored material in the study. It has been claimed that resin materials are discolored more than ceramic materials due to the hydrophilicity of the matrix, making UDMA and triethylene glycol dimethacrylate (TEGDMA) undesirable additives on stainability [8].

Demonstrated the effect of long-term use of CHX on Cerasmart (ΔE = 4.41) which was higher than 3.3 and higher than the value in our study [9]. Previous research has shown that IPS E.max CAD discolors less than CERASMART and our findings confirm this [10]. Another study tested the effects of Staining and aging-dependent changes in color of CAD-CAM materials, lithium disilicate based ceramics, exhibited better color stability as compared with resin nanoceramics and PICN, because of polymer up taking water and higher surface energy for resin CAD/CAM materials [11].

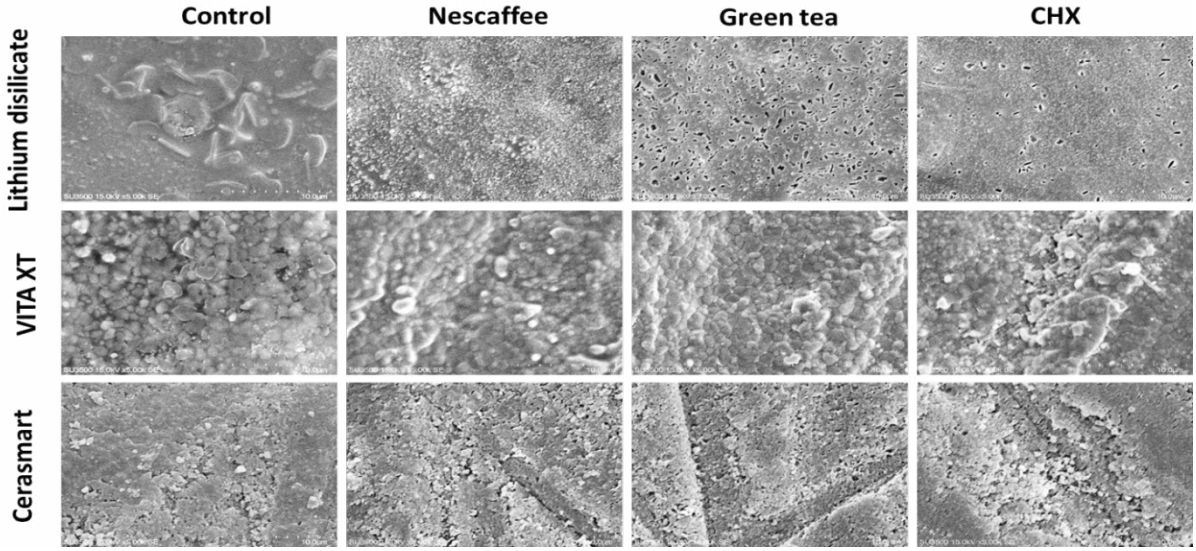

Figure 1. *Representative SEM images (5000 X magnification) of ceramic samples before and after staining.*

Haralur et al., found that lithium disilicate ceramic was found to have better color stability compared to monolithic zirconia, because of lacking surface irregularities and microcracks prevent the penetration of water and silica network dissolution [1]. And this good stability for CAD/CAM lithium disilicate was supported also by Palla et al. [12].

The finding of this study shown that VITA XT zirconia shows higher color change value than lithium disilicate and these results are consistent with those of Haralur et al. [1], who indicated that monolithic zirconia was susceptible to higher doscoloration from coffee, green tea and CHX. Kanpalta et al. [13] concluded in their study the artificial aging affected the optical properties in VITA XT, but no effects on lithium disilicate [13].

Kurt and Turhan [14] investigated the effect of artificial aging on color stability of zirconia and lithium disilicate ceramics, the results of the aging process affected the color of the specimens, especially the zirconia specimens, which were found to be clinically unacceptable (ΔE=5.03), they explained the cause to the transformation from tetragonal to monoclinic phase which called low temperature degradation (LTD), this lead to increase in volume and stress formation and increase the roughness of surface. Also reduced alumina content to increase translucency lower its resistant to (LTD). Dikicier et al., found the mean color difference of the zirconia specimens after aging was (ΔE = 1.29) [15].

In the SEM observations conducted in previous studies, showed that Cerasmart exhibited the most consistence appearance before and after aging, while lithium disilicate exhibited more random irregularities in lithium disilicate particles after aging however these irregularities were not significant and no changes in surface composition were observed and this appeared in this study [16].

The SEM images of microstructural analysis for VITA XT which done by Sen et al. which exhibited anon-uniform grain size, with clearly observable grain borders with a high degree of homogeneity, with no discernible presence of residual porosity [5]. The study observed the presence of larger grains, with higher quantities of yttria. The highest concentration of the cubic phase (32.9 wt%) was also observed. It was reported that an increase in the amount of Y2O3 (from 3% to 9%) was associated with an increase in grain size and the presence of the cubic phase in the zirconia structure. This resulted in an improvement in translucency, making it comparable to lithium disilicate.

Another study investigated the effects of thermocycling on lithium disilicate showed the milled samples of Emax CAD presented more significant changes after aging [17]. The ceramic microstructure influences the properties of ceramic. grain sizes and porosity are significant microstructural parameters that can show impact on the mechanical and optical properties of ceramic [17]. Cerasmart contain uniform sized filler particles that are less than 500nm [18]. the filler loading of Cerasmart is 71 mass% and the filler particles are very small with rather narrow distribution [19,20].

Conclusion.

Discoloration of coffee was more significant in Cerasmart than VITA XT and lithium disilicate. Green tea affected VITA XT more the Cerasmart. Coffee solution had the highest staining effect and the CHX was the least. Lithium disilicate exhibited the best color stability followed by VITA XT and Cerasmart.

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