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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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EFFECTS OF ACID ETCHING ON COLOR CHANGES AND SURFACE MORPHOLOGY OF ENAMEL TO BE BLEACHED WITH DIFFERENT TECHNIQUES

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Abstract.

Background and aims: To compare the color changes, the surface roughness and morphology of the enamel bleached with two different bleaching solutions (chemical and laser activated), preceded or not with acid etching.

Materials methods: Thirty teeth of bovine prepared and haphazardly assigned to 2 groups (n=15) depending on bleaching technique. Each group subdivided to 3 subgroup (n=5) consistent with acid etching by 37% phosphoric acid. Atomic force microscopy and VITA easy shade spectrophotometer were performed twice for all the specimens before and after bleaching. ANOVA, the Paired sample t-test, and the independent sample t-test used for statistical analysis.

Results: As for the color changes, the groups that were bleached by the chemical method, the difference among the three subgroups was statistically significant. This also applies to the groups bleached with the laser method. When comparing the results of the chemical bleaching subgroups with the laser bleaching ones, the difference was not significant. Roughness results showed significant differences between certain subgroups and non-significant differences among others. However, the difference was statistically significant between the chemical and laser groups, laser technique resulted in less surface roughness than the chemical one. **Conclusion:** Acid etching before bleaching produced better colour change in both the chemical and laser assisted bleaching. In chemical bleaching, surface roughness was higher when acid etching was used. This was also true for laser bleaching technique. In general, laser assisted bleaching produced less surface roughness than chemical bleaching.

Key words. Bleaching, acid etch, surface roughness.

Introduction.

After the development of chair-side teeth whitening treatments besides the institution of commonly used home bleaching modules, patient desire for an esthetic white flawless smile may now be met in a popular way. The elimination of superficial surface pigments by means of the scaling and the polishing, micro- and macro-abrasion, the veneering, the insertion of the full-coverage porcelain restorations and dental whitening (bleaching) are just a few of the treatment options available for discolored teeth [1]. The Bleaching procedure has gained popularity with patient and dentist as conservative techniques to lighten the natural teeth in order to enhance harmony of smile using dental products that include hydrogen peroxide (H_2O_2) in some form. Peroxide, sodium perborate, chlorine, and chloride are the most well-known bleaching agents that are commercially accessible [2].

Bleaching with peroxide takes the shortest time and is most frequently utilized. Through the organic dentin and enamel matrix, H_2O_2 diffuses and enhances the tooth structure's permeability, enhancing ion flow through the tooth. The H_2O_2 is a potent oxidizing agent with the capacity to produce potent, extremely reactive free radicals. These radicals will interact with the majority of other organic molecules to acquire stability and produce further radicals. A good whitening action is produced by the formation of the simple molecule which absorbing less and reflecting more light [2]. Both vital tooth bleaching and non-vital tooth whitening are techniques that can be used. There are three leading methods to whiten the vital teeth: in-office or the power bleach, at-home or the night guard bleach under a dentist's surveillance, and the bleaching with over counter (OTC) remedies [3].

A variety of non-vital bleaching methods are employed, including the inside/ the outside bleach, non-vital power bleaching, the walking bleaching, and modified walking bleach [4]. Laser lighting can be used to activate bleaching materials. However, for this technique to work, the bleaching gel must incorporate particular chromophores for each distinct wavelength of the laser [5]. When compared to other professional bleaching methods, using the laser light as the bleaching agent's activator has an array of benefits: It reduces session time and the danger of over-bleaching treatment and after-bleaching hypersensitivity by raising the perhydroxyl concentration created by hydrogen peroxide breakdown [6-8]. It minimizes the danger of pulp damage by preventing the intra-pulpal temperature increase to more than 5.5°C [9]. It helps even the deepest dyschromia, such as tetracycline staining, to be reached by allowing deeper penetration of nascent oxygen to the enamel and dentin [10].

Before the bleaching treatment, the acid etching technique might be utilized. This method works by inflicting two different types of modifications on the enamel surface. The acid initially removes the topmost layer. Second, when previous acid etching is carried out, the enamel layer beneath it, which has a more porous surface, is exposed, resulting in a larger propensity for peroxide penetration. On the other side, it is yet unclear how effective the procedure is and how much tooth structure is harmed. According to Soares et al. (2015), there was increased wear [11]. Costa et al., 2015, found that when acid conditioning was done prior to bleaching procedure, color analysis showed no difference in the results [12].

However, in clinical situations where conventional whitening techniques have not yielded satisfactory results after several tries, especially in patients with a high degree of pigmentation, acid etching prior to bleaching may be indicated in order to increase the gel's penetration into the enamel [11].

Materials and Methods.

Specimens' collection and preparation: Thirty teeth from bovine aged between two and three years old were obtained a local slaughterhouse in Mosul city. To minimize the requirement for refrigeration and prevent tooth dehydration at the same time, they were removed by the researcher herself with forceps on the same day that cattle were slaughtered. After the teeth were

collected, it was important to first gently and carefully remove any remaining soft tissues from the teeth using a dental scaler [13].

To warrant that the samples were free from cavities, surface crack or fractures, or whatsoever other enamel faults, they were inspected visually and via a stereomicroscope. The teeth were cleaned by submerging them in a 0.1% thymol solution at room temperature (20–25°C) within a securely closed container inside an incubator [14].

Before cutting the roots, the teeth's surfaces were refined with pumice (non-fluoridated) by (Pd / Switzerland), a one-use rubber cup, and a slow speed handpiece. To avoid heat generation. Root of prepared the incisors cutaway by way of the diamond discs and the slow speed hand pieces at cemento-enamel junction. Root was then discarded and the pulpal tissue of the crown part was removed using a barbed broach. The pulp chamber was then cleaned with deionized water and dried with an absorbent cotton pellet before the orifice was sealed with composite (Nexobio, Korea).

After cutting the roots, the specimens were once again inspected under stereomicroscope [15].

During the study, the samples were kept in taped up jars with deionized water (Intravenous solutions factory/Iraq) at room temperature (20–25°C) for a period not exceeding two months [14].

The treatment region was selected to be in the center of the middle third of the facial surface [16]. Using a pencil, a line was drawn horizontally from center of mesial border to midpoint of distal border and a vertical stroke from middle of gingival limit to middle of the incisal edge to determine the center of the labial surface. The labial surface should be thought of as having its reference point at the junction of the two lines.

Staining procedure: An artificial staining procedure was performed similar to previous study procedure [17]. A staining solution was put together by soaking of (2 g) one black tea paper bag (Lipton, India) in 100 ml of boiling water for 5 min. Specimens then immersed and stored inside the incubator for 7 days at 37°C. After the staining procedure, the specimens were washed and dried up by triple syringe. Labial surfaces of stained specimen covered with covering tape with a 5 mm-diameter window. This procedure was done to standardize the treatment area. The shade of each sample was measured after staining and after bleaching procedures.

Study design and specimens grouping: Thirty teeth of bovine prepared then arbitrarily apportioned to 2 equal group (n=15) accorded to the bleaching procedure as the following:

CB group: Conventional in office bleach technique (chemical), subdivided to 3 subgroups (n=5) according to using of acid etch by 37% phosphoric acid (Spident, Korea) as follow: C1: Conventional bleaching preceded by five seconds acid etching, C2: Conventional bleaching preceded by ten seconds acid etching and C3: conventional bleaching without acid.

Clarident X (Tedequim/Argentina) was used in current study as chemical activated gel. The teeth were taken out from their storing solution and then dried up using cotton pellets. The preparation of whitening gel was done according to the manufacture instruction by uncapping the factor B syringe and fit the connector tightly then uncap the factor A syringe and attach it to the connector. Pass factor A into factor B and vice versa. The passage was repeated eight times until homogenized. After that the connector and the empty syringe were removed and attached to the applicator tip. A layer of a resulted bleaching gel applied to a target area with 2 to 3 mm thickness. The gel lefting on samples for 40 min. After the gel was sucked away by surgical sucker and teeth were washed by deionized water. Finally, specimens were kept in deionized water to avoiding dehydration.

LB group: Laser–assisted in the office bleach technique, (n=15) partitioned to 3 subgroups (n=5) were L1: laser assisted bleaching preceded by five second acid etching, L2: laser assisted bleaching preceded by ten second acid etching and L3: laser-assisted bleaching without acid etching

The laser utilized in this study was a Biolase EPIC laser (Waterlase iPlus, USA) with 940 nm wavelength. It was applied to each specimen at 7 W for 30 seconds [18].

LaserWhite20 (Biolase/USA) is the patented with gel of dental whitening used in combination by a system of Biolase diode laser. The laser, through a specialized hand piece and conveyance assembly, stimulates the LaserWhite20 whitening gel to hasten the process of whitening.

Base gel holds percentage of 45% H_2O_2 as an active element. Activator is framed by an exclusive dye that is activated by taking up laser power in the specific BIOLASE diode laser system wavelengths. When mixed, LaserWhite20 whitening gel outcomes a 35% hydrogen peroxide.

Procedure for measurement the Color Change: color measurement executed for all samplings, before each measurement session, VITA Easy shade spectrophotometery adjusted according to manufacturer's guidelines then samples was illumined by the periphery of probe tip, pointing light from the white LEDs to samples exterior. To enable the tip to be as parallel to the surface as possible, the equipment was secured on a platform. A uniform tile was used as the background on which the dental blocks were set. The readings of the spectrophotometery depending on CIE L*a*b* (Com. Inter. del'Eclairage) to complete color changing test. L* referring to lightness coordinate, the a* values is a measuring of red-green axis, while b* values is a measuring of yellow-blue axis [19].

Measure repeated twice before and after bleaching per capita and mean of read was obtained. color change (ΔE) for each sampling was judged by varying of L* (ΔL*)\ a* (Δa*)\ and\ b* (Δb*) values, mean values of ΔL*\ Δa*\ Δb* records were calculate and over-all the color change of each sampling is calculate by means of the :

$$\Delta E^* = \sqrt{(\Delta L*)^2 + (\Delta a*)^2 + (\Delta b*)^2}$$

Surface roughness measurement: Samples' surface roughness was studied using an atomic force microscope (AFM) (NaioAFM) (Nanosurf AG. Graubernstrasse, Liestal, Switzerland) as shown in Figure (1). The arithmetic mean height (Sa) parameter which is extension of Ra (the arithmetical mean height of the line) to the surface was determined from 10um. It expresses, as an absolute values, difference in the height of each point comparing to arithmetical mean of surface.

Statistical Analysis: normal distribution of the data certified by carrying out test of the normality (Shapiro-Wilk). All data exhibited normally distribution. An ANOVA test with independent sample t-test used to comparing between the before, after treatment read, also with groups correspondingly for color changes and surface roughness change.

Results.

Tables (1 and 2) illustrate the findings of ANOVA test for color changes evaluation of conventional (chemical) bleaching and the laser assisted bleaching subgroups. Conventional bleach showed significant color changes among the 3 subgroups with the C2 group showing the best results followed by C1 group while C3 group showed least changes. The same pattern applies to the laser-assisted bleaching groups with the L2 group showing the most significant color changes followed by L1 and L3 respectively.

Table 1. *Color changes (ΔE) assessment of conventional (chemical) bleaching and laser bleaching subgroups.*

Groups (n=5)	C	L
5sec. acid etch	24.6±0.8b	25±1.3b
10sec. acid etch	26.9±1.2a	27.2±1.1a
Without acid etch	22.4±1.7c	23±1.9c
Data expressed as mean±SD, C=Conventional, L=laser, a,b,c =*Numbers with different letters are significantly different at p value 0.05 using ANOVA test		

Table 2. *Color changes results of chemical bleaching groups and laser-assisted bleaching groups.*

	ΔE	Sum Squares	df	Mean Square	F	Sig.
Chemical bleaching	Between Groups	50.727	2	25.364	15.459	0.0001
	Within Groups	19.688	12	1.641		
Laser-assisted bleaching	Between Groups	44.770	2	22.385	10.692	0.002
	Within Groups	25.123	12	2.094		
ANOVA test conducted between groups						

Table 3. *Independent sample t-test comparing color changes between chemical bleaching and laser assisted bleaching.*

	N	Mean	t-value	sig	Std. Deviation	Std. Error Mean
Group C1	5	24.57	-0.632-	0.545	0.77466	0.34644
Group L1	5	24.9	-0.632-	0.548	1.25089	0.55942
Group C2	5	26.8820	-0.461-	0.657	1.15636	0.51714
Group L2	5	27.2080	-0.461-	0.657	1.07860	0.48236
Group C3	5	22.3780	-0.525-	0.614	1.72765	0.77263
Group L3	5	22.9780	-0.525-	0.614	1.88488	0.84294

Table (3) illustrates independent sample t-test that compares the chemical bleaching subgroups with their counterpart laser-assisted bleaching ones. It shows that there is no significant difference between the compared subgroups regarding the color change.

Data in tables (4) illustrates the findings of ANOVA test for surface roughness evaluation of chemical and the laser-assisted bleaching group respectively. It showed significant differences between C3 and C2, with non-significant difference between C3 and C1, C2 and C1 for chemical bleaching sets. Laser bleaching showed significant differences between L3 and L2, L2 and L1, with non-significant differences between L3 and L1.

Table 4. *Surface roughness (Sa) assessment of conventional (chemical) bleaching and laser bleaching subgroups.*

Groups (n=5)	Sa before	Sa after	Groups (n=5)	Sa before	Sa after
Gp C1	83.3±13c	229.3±50.8ab	Gp L1	73.8±11c	141.6±17.2b
Gp C2	82.4±14.7c	267.6±42.5a	Gp L2	79.2±18.5c	180.2±27.2a
Gp C3	83.5±13.3c	208±26.1b	Gp L3	77.6±16.2c	119.3±38.2b
Data expressed as mean±SD, C=Conventional, L=laser, a,b,c =*Numbers with different letter are significantly different at p value 0.05 using ANOVA test					

Table 5. *Independent sample t-test comparing surface roughness between chemical, and laser assisted bleaching.*

		N	Mean	t-value	sig	Std. Deviation	Std. Error Mean
Sa after	Gp C1	5	2.2926E2	3.654	0.006	50.83893	22.73586
	Gp L1	5	1.4158E2	3.654	0.015	17.16196	7.67506
Sa after	Gp C2	5	2.6757E2	3.875	0.005	42.50051	19.00681
	Gp L2	5	1.8016E2	3.875	0.006	27.15616	12.14461
Sa after	Gp C3	5	2.0804E2	4.283	0.003	26.14075	11.69050
	Gp L4	5	1.1933E2	4.283	0.004	38.23356	17.09857

Table (5) shows independent samples t-test comparing surface roughness resulting between chemical and laser assisted bleaching subgroups after the performing the procedure. Test showing that there are significant differ between subgroups with chemical bleaching technique resulting in more surface roughness in all conditions (Figure 2).

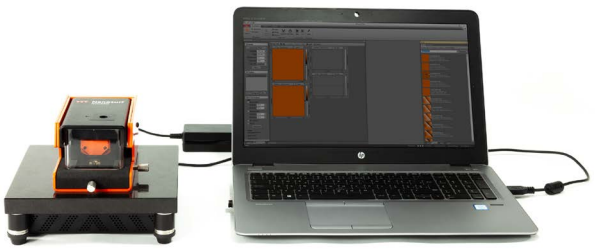

Figure 1. *The atomic force microscope used in the study.*

Discussion.

Dental bleaching is a very frequent non-invasive dental procedure that is gaining popularity due to the growing demand for whiter teeth. Maintaining dental bleaching as a non-invasive operation requires making sure that the equipment and techniques utilized don't harm the tooth structure. The direct interaction between a potent oxidizing bleach gel and enamel surface during the prolonged bleaching process required for vital teeth varies depend on product using, raising concerns about potential enamel damage. According to published research, bleaching chemicals may harm the structural integrity of organic enamel components including collagen and proteins. Additionally, there is proof of

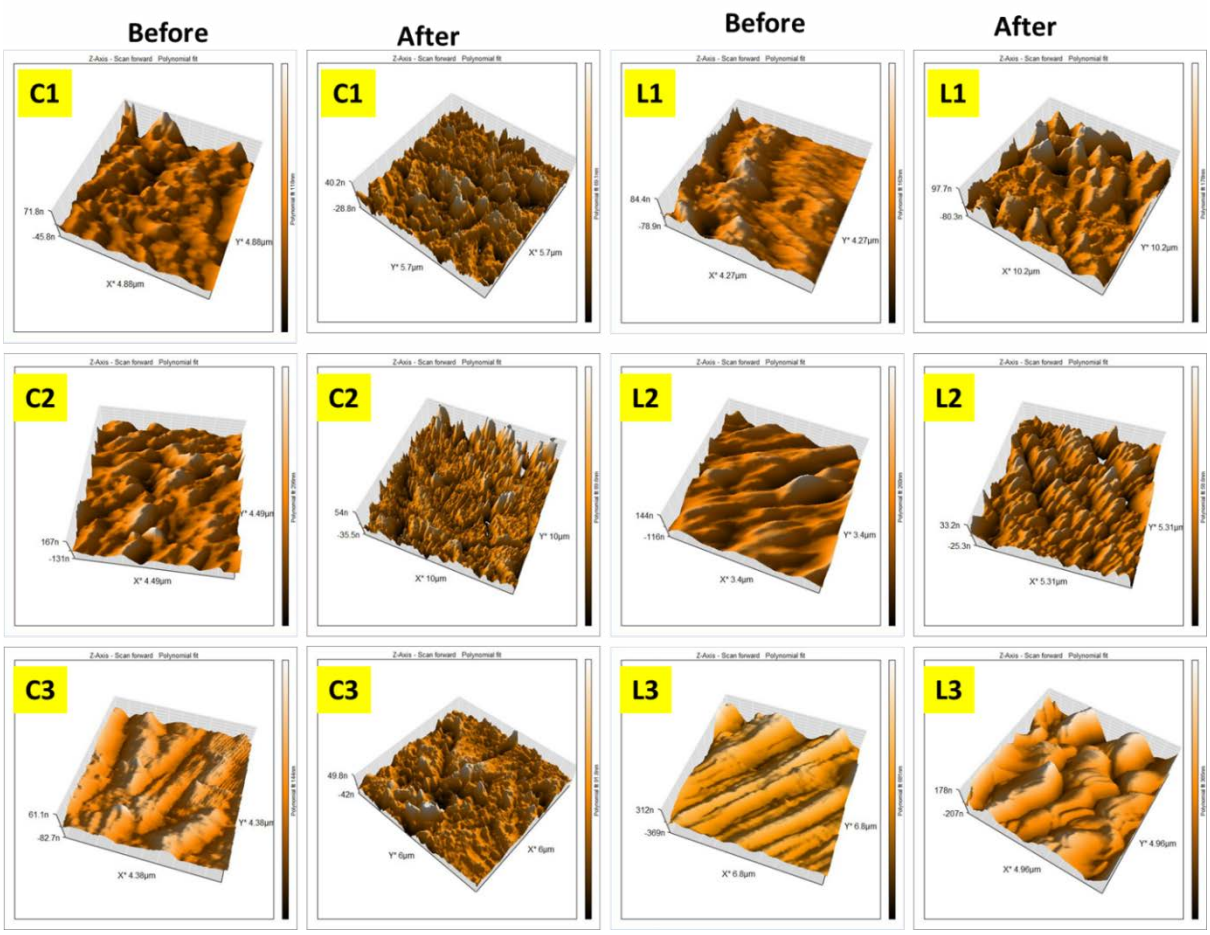

Figure 2. *A representative AFM image for enamel topography of the studied groups before and after bleaching [C1: Conventional bleaching preceded by five seconds acid etching, C2: Conventional bleaching preceded by ten seconds acid etching and C3: conventional bleaching without acid etch. While for the LB group they were L1: laser assisted bleaching preceded by five second acid etching, L2: laser assisted bleaching preceded by ten second acid etching and L3: laser-assisted bleaching without acid etching].*

inorganic components loss, greater than before porosity, loss of the fluoride, alteration in calcium to the phosphate proportion, the organic matrix degradation, increasing vulnerability to the erosion or the caries, higher the surface roughness, lessened enamel micro tensile strength, reduced the fracture stability, or a diminution in the resistance abrasion of bleaching the dental hard tissue, backing up idea the bleach substances are chemical active substances theoretically capable of inducing noticeable structural alterations in the human dental enamel [21].

Bovine teeth were utilized in the study rather than human teeth for the reasons listed below: The cows were slaughtering between the ages of 2 and 3 years and had the same eating habits, acquiring a significant number of human front teeth for dental research is more challenging since there is no age homogeneity. It is also necessary to consider infection exposures and ethical concerns [22]. Bovine teeth also have a noticeable flat labial surface [22]. In the realm of dentistry research, bovine teeth have been put forward as a viable substitute for human teeth due to less changes in their chemical composition and microhardness values [16].

Two methods of in-office dental bleaching were used: traditional (chemical) in-office bleach and a laser-assisted in-office bleach approach utilizing a diode laser. Employing 35% hydrogen peroxide concentration for the purpose of comparing the results.

Both the light-activated and chemical activated in-office bleaching utilized in this investigation were successful at whitening teeth. Similar to the findings of the Gurgan et al. (2010) study, which involved bleaching with and without usage of the additional light source and produced a noticeable lightening of the teeth, even though the group devoid of light activation had maximum mean value of the shade alteration [23].

According to the study's findings, there were no appreciable changes between traditional in-office dental bleaching and diode laser bleaching. This outcome is consistent with Omidi et al. (2017) finding that there are no discernible differ in effectiveness of the whitening discolored the teeth using a diode laser or not for all color groups (coffee, tea, and juice). The findings of earlier research by Auschill et al. (2005), Sulieman et al. (2005), Marson et al. (2008), and Polydorou et al. (2013) were likewise similar to this one [25-28]. Hein et al. (2003) also showed that, in the split-mouth of clinical design, none of 3 bleach lights (LumaArch, Optilux 500, and Zoom) examined had any extra benefit above bleach gel alone for 3 commercial solutions [29].

However, the outcome of the present study was distinct from that of Zekonis et al. (2003), who had bleached the teeth for 60 minutes [30]. Additionally, it differed with the findings of Baygin et al. (2012), who employed Whiteness HP as a bleaching agent together with 980 nm diode lasers with powers of 0.8 Watt and 1 Watt for 30 seconds and came to the conclusion that the laser increased the efficacy of the bleaching process [31]. Additionally, Gurgan et al. (2010) used a variety of bleach technique, including bleach without using of the light, bleach with using of the diode laser, bleach with the plasma arc lamp, and the bleach with the lighting emit diode (LED) lamps. With the use of a spectrophotometer, the bleaching outcomes were compared in terms of shade alterations. group bleach uses the diode laser as the light sources had the biggest changes in the overall shade (ΔE), which indicated that there was a noticeable difference [23]. Wetter et al. (2004) discovered that bleaching with Laser and Whiteness HP bleaching gel produced results that were noticeably superior to those obtained with the same agent used alone or in conjunction with LED [5]. These variations in outcomes were caused by a variety of variables, including bleaching material concentration, material type, and application duration [32,33].

This investigation demonstrated that bleaching with and without acid etch had noticeable differences in the final outcome. The ten-second acid etch, followed by the five-second acid etch, produced the best results. This method works by altering enamel surface in 2 different ways. The plaque and acquired film are first eliminated when the surface layer is eliminated by the acid, and then remain enamel is formed with a more porous surface layers [34].

When bleaching gel was applied after acid etching and boosted by light, a higher ability for peroxide penetration was obtained [12]. Atomic Force Microscope (AFM) was utilized to learn impact of bleach on surface roughness of the enamel at Nano scale resolution [35]. AFM has several key advantages, including the ability to conduct subsequent analyses before and after the bleaching process in (almost) the same area of the sampling's surface needless to make replica models of the sampling and the ability to produce three-dimensional images. For the purpose of determining the structure of numerous biological models, AFM has become a corresponding method to electron microscopy (EM) as a result of ongoing developments in sample preparation, imaging techniques, and instrumentation [36].

In the current study, the mean Sa value for the chemical bleaching was significantly greater after than before bleaching. This result is consistent with those of previous studies that found that enamel surface roughness significantly increased when treated with the same 35% hydrogen peroxide concentration [37,38].

This increasing may be accredited to lossing of the interprismatic ingredients and the sodium and the magnesium ions. Another study has likewise report micro morphological observe of bleaching enamel clues to the exaggerated prism irregularities with higher mean Ra value [39].

No matter concentration, H_2O_2 was found to make the enamel's surface rougher. Bleaching gels' peroxide component lowers the enamel's mineral composition. nuclei of enamel prism and the interprism regions deform, surface hardness falls, and roughness rises as the minerals are removed from the surface [40].

Findings of current study disagree with these of McGuckin et al. (1992) and Mondelli et al. (2009), who found that enamel micro-rough did not increasing during a traditional bleaching technique. Different sources of light, various tooth types used for the study, different study materials, and specimen preservation in saliva might all be contributing factors to the discrepancy in these results [41,42]. The specimens in present study kept in deionized water, which lacks fluoride and lacks remineralize properties of the saliva.

surface roughness of the enamel increased significantly as a result of the laser-assisted in-office bleach technique, which is consistent with the findings of a study that used alike bleach gel (Laser White 20 whiten gel kit, Biolase, Irvine, USA) and the diode laser activater device (Epic 10, Biolase, Irvine-California, USA) [43].

Additionally, Selivany and Al-Hano (2015) came to the conclusion that the enamel's surface roughness significantly increased when 35% hydrogen peroxide was exposed to an 810 nm diode laser combined with LED [44]. The mean Sa value achieved following both chemical and the laser-assisted in-office tooth whitening techniques in this vitro investigation showed a significant difference.

According to Mirzaie et al. (2016), conservative bleaching with 35% hydrogen peroxide and the laser-assisted bleach with diverse the laser activator system (810nm diode or Nd: YAG) and with dissimilar hydrogen peroxide (30% or 45%) both causing the substantial upsurge in surface rough of enamel, with conventional bleaching technique causing the higher significant increase in surface roughness [37]. These findings may be a reflection of the variety of methodological approaches used in the studies previously mentioned, such as the different bleaching protocols (sessions, treatment time), type of laser activation, and irradiation settings [45]. Contrarily, Anaraki et al. (2014) discovered that laser-assisted bleaching using an 810nm diode laser induced a substantial increase in surface roughness of enamel whereas traditional bleach use 40% H_2O_2 causing a non-significant rise in the surface rough of enamel [10].

By enhancing free radicals produced by bleach agents during bleach procedures, laser, which is widely regarded as gadget of choice in numerous dental applications, is said to expedite bleach reaction and improve efficacy of bleach material [18]. When compared to traditional bleaching, hydrogen peroxide bleaching therapy triggered by diode laser was recommended to avoid lossing of the enamel mineral structure in the bovine teeth and retain it’s the crystalline configuration. The findings of two research Anaraki et al., 2014 and Mirzaie et al., 2016 are consistent with the finding that laser triggered bleaching resulted in less enamel surface abnormalities than chemical bleaching [10,37].

Findings of this investigation demonstrate that etching with 37% phosphoric acid for five- or ten-seconds increase enamel wear without appreciable variations between them in chemical bleaching and significant variation between them when laser bleaching used. Soares et al. (2015) study, which discovered

an increase in surface roughness when using 37% phosphoric acid supports these findings. In an effort to avoid more invasive procedures, this technique should not be used routinely; rather, it should only be used when necessary [11], to avoid initiating enamel hypoplasia [46,47], enamel hardness [48-50], and gingival defects [50,51].

Conclusion.

Acid etching for 10 seconds before bleaching produced better colour change compared to the control or 5 seconds acid etching for both the chemical and laser assisted bleaching. However, colour changes were not significant when the subgroups of chemical bleaching were compared with their counterparts of the laser bleaching. In chemical bleaching, surface roughness was also higher when 10 seconds acid etching was used but it was not significantly different with e 5 seconds etching subgroups. In laser bleaching, significantly higher surface roughness was obtained in 10 seconds etching than other groups. In general, laser assisted bleaching produced not as much surface roughness as chemical bleaching.

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