GEORGIAN MEDICAL NEWS

ISSN 1512-0112

NO 7-8 (340-341) Июль-Август 2023

ТБИЛИСИ - NEW YORK

ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

Monthly Georgia-US joint scientific journal published both in electronic and paper formats of the Agency of Medical Information of the Georgian Association of Business Press. Published since 1994. Distributed in NIS, EU and USA.

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.

Содержание:

EVALUATION OF THE EFFECT OF DIFFERENT INTRAORIFICE BARRIER MATERIALS ON CORONAL MICRO LEAKAGE OF ENDODONTIC ALLY TREATED TEETH BY USING MICRO-COMPUTED TOMOGRAPHY TECHNOLOGY (A COMPARATIVE IN VITRO STUDY)

Marwa H. Abdullah[1]*, Sawsan H. Aljubori[2].

[1]*Ninavah Health Directorate, Mosul, Iraq.*

[2]*Department of conservative dentistry, University of Mosul, Mosul, Iraq.*

Abstract.

Background: Endodontic failure can result from insufficient coronal seal, which induces post-endodontic infections. Therefore, the intra-orifice barrier is a reliable substitute technique to reduce coronal leakage in teeth where endodontic therapy has been performed.

Aim: To evaluate the effect of three different restorative materials (Ever X Flow, Centeno forte, and Bio-C sealer ION) as intraorifice barriers (IB) of endodontic ally-treated teeth on Coronal microleakage represented by Internal adaptation of barrier materials to radicular dentin and Porosity of materials.

Materials and Method: Forty-sound removed human mandibular premolars were chosen, and decorated to a standardized root length (15 ± 0.5mm), a digital caliper was used to measure the mesiodistal and buccolingual diameters of the coronal plane of root to roughly similar buccolingual (BL) and mesiodistal (MD) dimensions (7.5 ± 0.5mm and 4.5 ± 0.5 mm respectively) and the coronal plane of the root canal be approximately similar in buccolingual (BL) and mesiodistal (MD) dimension (3.2 ± 0.2 and 1.8 ± 0.2 mm respectively). The roots were prepared and obdurate with gutta-percha and AH Plus sealer, then divided into one control group to three equal groups according to the type of intraorifice materials (n=10). Except for the control group, the coronal 3-mm of gutta-percha was removed and filled with Ever X Flow, Cention forte, and Bio-C sealer ION. After this, all groups underwent thermo-cycling ageing (1000 cycles, water temperature (5-55oC), dwell time 30s, and transfer (draining) time 10s between cycles). With micro-computed tomography (μCT), three-dimensional gap volumes at the barrier-dentin contact and the porosity of the barrier materials were investigated.

Results: The results showed a significant difference between the control and three types of barrier materials at (P 0.05); Ever X Flow demonstrated lower values of the internal gap of barrier materials to radicular dentin and porosity while the control demonstrated higher values of the internal gap to radicular dentin; however, there was no significant difference between the control and Bio-C sealer ION.

Conclusion: When compared to teeth treated with endodontics but without intraorifice barriers (IOB), those with IOB have less coronal microleakage.

Key words. Intraorifice barrier, barrier materials, endodontic treatment.

Introduction.

The success of endodontic treatment depends on several factors such as the preoperative status of the root canal, the presence of a periapical lesion, the quality of root canal treatment, and the apical and coronal seal [1]. One of the most common problems is the phenomenon of microleakage, which seems to affect most, if not all, restorative materials. Microleakage is defined as the "diffusion of the bacteria, oral fluids, ions, and molecules into the tooth and the filling material interface". Clinical investigations, both in vitro and in vivo, have shown that a post-endodontic coronal seal is equally important as an apical seal to prevent bacterial penetration in the filled root canal system, causing recontamination and failure of the root canal treatment [2].

The important objectives of post-endodontic restoration are providing an impermeable hermetic seal and increasing root fracture resistance [3]. Therefore, the use of intraorifice barrier (IB) restorative materials for endodontic ally-treated teeth was primarily suggested to prevent bacterial contamination. It would be advantageous to place material over the coronal gutta percha to act as a barrier to coronal microleakage in order to decrease leakage and improve treatment outcomes [1].

The process entails removing a portion of the coronal gutta-percha and then replacing the empty space with a restorative substance (IB). Since some studies tested various intraorifice barrier depths, ranging from 1 mm to 4 mm, and found that it typically had a better performance when it was placed at (3 mm) depth, it appears that the depth of the barrier is a key element in reducing microleakage [4].

The ideal characteristics of intraorifice barrier materials include the ability to bond to the tooth structure, prevent microleakage, be easily manipulated, and be distinguished from natural tooth structure, and they should also not interfere with the final restoration [5]. The effectiveness of barrier materials as sealants has been assessed using a variety of methods, including the fluid filtration method, bacterial and dye leakage. During leakage analysis, sample degradation is caused by bacterial and dye leaking procedures. The advantages of the computerized fluid filtering method far outweigh the drawbacks of other approaches, and this approach is computerized, very sensitive, totally electronic, safe, and equipped with a digital air pressure checking system [5].

As an alternative, micro-computed tomography (-CT) is a nondestructive technique for assessing the three-dimensional integrity of intraorifice materials to replace or support conventional leakage investigations, in which technical errors and a lack of uniformity may compromise the validity of the findings. Significant advancements in hardware and software have recently brought traditional CT's isotropic resolution (0.5–1 mm) down to that of modern μ–CT systems (10 μm) and lower [6]. The three-dimensional gap volumes in the barrier-dentin interface and the porosity of the barrier materials, which indicate coronal microleakage of intraorifice barrier materials, can be evaluated using the μ-CT data [7]. Numerous intraorifice materials have been employed, including glass-ionomer cement (GIC), resin-based composite (RBC), bio-ceramic cement, zinc phosphate cement, and others [4].

To replicate the stress-absorbing qualities of dentin, short fibre-reinforced composite (SFRC) was released onto the market in 2013. The SFRC material is designed to be utilized as a bulk basis in high-stress locations for rebuilding both vital and non-vital teeth. It can theoretically match the dentin's fracture resistance and is simple to utilize in increments of 4 mm deep. The SFRC is made up of the resin matrix containing Bis-MEPP 15-25%, TEGDMA 1-10%, and UDMA 1-10% and the fillers are a mix of short E-glass fibres and particle fillers, mostly barium glass. Average length of fibres 140μm diameter 6 μm. The total filler rate is 70% in weight. fibres (w/w) 25% according to the manufactuer (GC Corporation Tokyo, Japan) [8].

Alkasite materials are a newly developed family of resin-based ion-releasing compounds. The name is derived from their alkalizing qualities brought on by the discharge of hydroxide (OH) ions made by Ivoclar Vivadent (Schaan, Liechtenstein). Cention is a bulk-fill restorative material with photoinitiators and chemical catalysts that enable a dual cure polymerization mechanism. The material releases Ca^{2+}, F, and PO4 ions in neutral and acidic conditions, causing apatite to form on its surface. It also has an acid-neutralizing capability and prevented the demineralization of enamel and dentine when exposed to lactic acid for an extended period. The initial hand-mixed material was Cention N (Ivoclar Vivadent), whereas Cention forte (Ivoclar Vivadent) is a capsulated variant. The components of Cention forte are liquids of UDMA, aromatic aliphatic UDMA, DCP, and PEG-400-DMA and powders of inert barium alumino-boro-silicate glass, ytterbium fluoride, calcium fluoro-alumino-silicate glass, and a reactive SiO2-CaO-CaF2-Na2O glass. Hydroperoxide, Ivocerin, and acyl phosphine oxide make up the initiator system. 58-59 vol%, or filler, depending to the manufacturer(Ivoclar viva-dent AG9494/ Liechtenestein) [9].

Bioceramics are non-metallic, inorganic ceramic materials created especially for use in the medical and dentistry fields. Bioactive or bio-inert materials are used to categorize bioceramic materials [10]. Endodontics utilizes bioceramics extensively because of their excellent qualities in terms of biocompatibility, osteoinductive capacity, ability to achieve an excellent hermetic seal due to hygroscopic expansion capacity, chemical bonding with the tooth structure, antibacterial proprieties, and good radiopacity [4].

However, With recent advancements in bioceramics, the handling qualities were enhanced with the advent of premixed bioceramics. These pre-mixed bioceramics are all hydrophilic, which results in a more homogenous mixture and a consistency similar to putty that only sets in the right environment, giving sealers the advantage of uniform consistency and lack of waste. In this investigation, pre-mixed bioceramics with a bio-C sealant are used. Depending on the producer (Angelus, Londrína, PR, Brazil), the ingredients in bio-c sealer include calcium silicates, calcium aluminate, calcium oxide, zirconium oxide, iron oxide, silicon dioxide, and dispersion agents [11].

Therefore, the purpose of this study is to assess the impact of (Ever X Flow, Cention forte, and Bio-C sealer ION) as intraorifice barriers (IB) for endodontic ally-treated teeth on coronal microleakage, which is represented by internal adaptation of barrier materials to radicular dentin and material porosity. These were the null hypotheses [1]. In endodontic ally-treated roots, there was no discernible difference in the internal adaption of the three intraorifice barrier materials.

Materials and Methods.

Sample preparation: Forty single-rooted non-carious human mandibular premolar teeth with nearly similar dimensions, extracted for orthodontic treatment, were used for this study. Soft tissue and calculus were mechanically removed from the root surfaces using a periodontal scaler, then The teeth were stored in 0.1% thymol solution at room temperature until use.

The teeth are decorated with a diamond saw while being cooled by water, and digital Vernia is used to ensure a root length of 15 0.5mm to the standardization sample length shown in (Figure 1). The root canals were accessed, using a barbed broach to remove pulp tissues. A #10 K-file (Rogin Dental, China) was inserted into the root canal, with the working length being established via a stereomicroscope and being 1 mm shorter than the length when the file was observed at the apical foramen [12].

Using a digital calliper (SPAC Systems, Pune, Maharashtra, India), standardize the buccolingual and mesiodistal dimensions of the coronal plane of the root and root canal. The coronal plane of the root canal was chosen to be roughly similar in buccolingual (BL) and mesiodistal (MD) dimensions (7.5 0.5mm and 4.5 0.5mm, respectively), and the roots were chosen to be roughly similar in both dimensions (3.2 0.2 and 1.6 0.2 mm, respectively). Roots that were presented with deviations of greater than 10% from the mean mesiodistal and buccolingual diameters of the coronal plane were disregarded [1,12,13].

Each root was marked 3±0.5 mm apical to the coronal end with an indelible pen and connected to the vertical arm of the surveyor in a way that the long axis of the tooth parallel to the arm via sticky wax and mounted in a Polyvinylchloride (PVC) retention tube, with a diameter of two centimetres and height of two centimetres. Every tube was filled with polyvinyl siloxane impression material that had been mixed in accordance with the manufacturer's instructions. Each root had been placed in the centre of the PVC tube, with its long axis running parallel to the sides of the PVC tube. The impression material-filled PVC tube extended 3 mm below the root's coronal end. To allow the impression material to be fully set and allow the surveyor arm to be detached from the tooth without positional deformation, the root sample was kept in place for 10 minutes [14].

The root canal instrumentation procedure was carried out using the crown-down technique and a ProTaper Universal rotary file system (Rogin Dental, China) mounted on an E-Connect S end motor (Eighteenth, Medical) at speed and torque of 250 rpm and 300 Ncm, respectively, using sequentially SX, S1, S2, F1, F2, and F3 files, per the manufacturer's recommendations [15].

The irrigation operation was carried out using 2 ml of 5.25% sodium hypochlorite (NaOCl) solution from (AQUA Medical in Istanbul, Turkey) in each file change, The root canals were then rinsed with 5mL of 17% EDTA (Prime Dental Products, Mumbai, India) for 1 minute to remove the smear layer, and 5mL of normal saline for the final rinse. A disposable irrigation needle gauge 27 with a side vent was used for the irrigation procedure [12,16].

After the root canals were dried using F3 paper points, the obturation technique was carried out using a single cone matching gutta-percha (Rogin dentistry, China) and AH Plus Sealer (De Trey-Dentsply, Konstanz, Germany) mixed in accordance with product instructions. Glass ionomer cement (White Cimpat; Septodont, So Paulo, SP, Brazil) was used to seal the root canal openings. The samples were kept in storage for 24 hours at 37°C and 100% humidity [12,17].

Intra-orifice barrier (IB) Cavity Preparation: The cement material was removed, and The coronal 3 mm of the root canal filling material was removed in experimental groups except for the control group. To the standardized depth of 3 mm of the intra-orifice barrier, the cavity was prepared using Post space preparation drills (peso reamer, size #4, width1.3 mm). The drill was used in a low-speed handpiece (Kavo Ind. Com. Ltda., Joinville, SC, Brazil) at 15,000 to 20,000 rpm and a stopper placed at 3mm from the tips and depth of 3 mm of the intra-orifice barrier cavity verified with the help of William's periodontal probe [13,17].

A cotton pellet soaked in 70% ethanol was then used to scrape and remove any remaining sealant or gutta-percha from this area. After rinsing with 1 ml of 17% EDTA solution and 1 ml of saline, the prepared orifice cavities were gently air-dried [18].

Grouping of the specimens:

Forty prepared roots were selected randomly for µ-CT evaluation and distributed randomly into one control and three equal experimental groups (n = 10).

Group I: control (fully obdurate root canal without intraorifice barrier cavity preparation).

Group II: Intraorifice barrier cavity filled with short fibre-reinforced flowable composite (Ever X FLOW, GC Corp).

Group III: Intraorifice barrier cavity filled with Cention forte (Ivoclar Vivadent).

Group IV: Intraorifice barrier cavity filled with Bio-c sealer ion (Angelus(.

Restorative application:

The intraorifice materials will be inserted in the coronal 3 mm prepared space according to manufacture as follows:

- Sort fibre-reinforced flowable composite (EverX FLOW, GC Corp).

A one-step self-etch adhesive, G-Premio Bond (GC Corp, Tokyo, Japan), was applied, and cavities were then dried for 5 seconds under maximum air pressure and light-cured for 10 seconds. Fibre-reinforced composite (EverX FLOW, GC Corp) was placed as one layer (3mm) and light cured for 40 seconds with a light curing unit (LED cordless 10 W APOZA Enterprise Co., Ltd.Taiwan) at 2000 mW/cm2 light intensity.

- Cention forte (Ivoclar Vivadent).

Simply, apply Cention Primer and scrub it into the prepared cavity. Activate the Cention Forte capsule, mix the contents for the 15s band fill the material in the cavity. Once the material has been set, it can be finished with suitable tungsten carbide burs.

- Bio-c sealer ion (Angelus).

This material is a ready-to-use formula in injectable syringes, NO MIXING.

After the placement of intraorifice barrier materials, all specimens were stored at 37°C and 100% humidity for 1 week in an incubator [3].

Artificial ageing (Thermo-cycling):

Thermo-cycling ageing was carried out at Ankara University/ Faculty of Dentistry. all specimens were cleaned of mould, and the root of each specimen was given two coats of nail polish, leaving only the canal opening exposed to offer consistent control of any lateral or accessory canal. After the specimens had been gauze-wrapped, they had been put in a small, porous packaging that had the number of the relevant groups written on it. Next, all small porous packages were placed in a single giant package and transferred to the SD Mechatronik thermo-cycler. For 1000 cycles (5-55°C), all specimens were thermocycler in distilled water with a dwell time of 30 s and draining times of 10s [19,20].

Computerized Micro-tomography (µ-CT):

a. Micro-CT image analysis: Micro-Computer Tomography was used to inspect each root (Bruker Sky scan 1275). The root was secured using foam inside a cylindrical container, as seen in (Figure 2) which was specifically designed for that specimen, scanning was restricted to a root section that included the barrier (IB) and the highest portion of the root canal filling [7,21].

The Skyscan, 1275 scanning parameters were set to an acceleration voltage of 80 (kvp), a beam current of 125 (µA), a 1 mm Al/Cu filter with an isotropic resolution of 15 m (3.375 m voxel size), rotation of each sample by 360° in 0.2° steps throughout a 5 min integration time, and air calibration of the detector before each scanning [7,22].

The samples were visualized and quantitatively measured using the NRecon program (version 1.7.4.6, SkyScan, Kontich, Belgium) and CtAn (version 1.20.3.0, SkyScan), which employed a modified version of the technique to produce two-dimensional (2D) axial pictures. beginning at the root's most apical point and every 0.5 mm thereafter. The final micro-CT

Figure 1. *(A) Decorating the tooth with diamond saw bur. (B) Calibrating the root length by Vernia.*

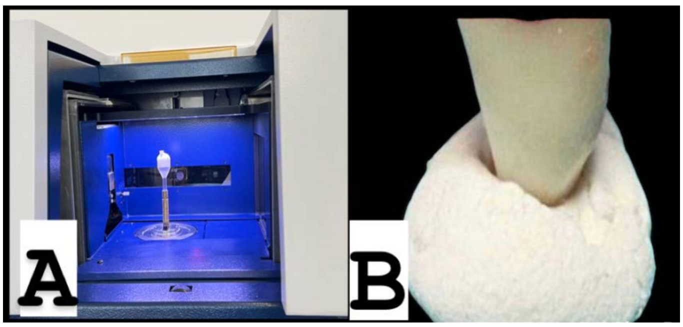

Figure 2. *(A) Tooth specimen with a special template mounted on the µ-CT stage. (B) Tooth specimen mounted in a special template made from a small round foam fitted with a small cavity.*

images were then coded and converted to TIFF files. With the help of the NRecon program (Skyscan, Kontich, Belgium), the scans were reconfigured to display 2D slices of the roots. From the entire volume of the micro-ct scanning, which was rebuilt by CTAn software, several cross-sectional pictures perpendicular to the long axis of the root were created. To see the samples in three dimensions, CTvox (version 3.3.1, SkyScan, Kontich, Belgium) was utilized. The samples were shown in a 2D data viewer (version 1.6.0.0, SkyScan, Kontich, Belgium) [22].

b. Evaluation of Internal adaptation with µ-CT: To evaluate internal adaptation (gap or interface voids) that are present between the root dentin and IB which was measured on µ-CT images. A set volume of interest (VOI) was defined as a full cross-sectional area of 1.09 mm along the long axis of the barrier. Then a 3 *3 *3 Gaussian filter was used to remove high-frequency noise near the barrier-dentin interface. Semi-automatically drawn contours were generated to define a mask for the barrier VOI. This mask was then smoothed with a 3-pixel morphologic dilation-erosion step. A 7-pixel (42 µm) space centred on the barrier-dentin border defined by the mask was then used to identify gap space via a global grayscale threshold. The gap volume was determined by simple voxel counting in the resulting binary gap image [7].

For the picture analysis, a finishing technique was used to produce a repeatable and operator-independent approach for determining the structural parameters and differentiating the proportion of voids. A total of 40 teeth were scanned to produce the diagrams. Dentin, materials, and voids were the examined components; the threshold level was determined by the peak separation points of the diagrams. With the aid of the program Catalyzer (version 1.10.1.0, Sky Scan), the 3D distribution of interface voids inside a predetermined VOI was estimated. Void volumes wider than 10.21 µm^3 with 1.35 µm diameter were detected. Through-and-through voids (continuous pores) and cul-de-sac-type voids (blind pores) were distinguished. Each 3D VOI had a 42-micron-thick interface volume that included the initial 21 microns of the IB and the superficial 21 microns of the canal wall dentine, as seen in (Figure 3) [21].

Based on the known voxel volume of 216 m3, the VOI and any detectable mean gap size were calculated directly. Any detectable gap volume between the barrier and dentin walls was calculated and analyzed by dividing the body volume excluding the pores (BV) on the total gap volume (TV) [7].

b. Evaluation of void with µ-CT:

Based on the CT values contrast between the structure of the IB materials and the air trapped in each void, 3D imaging software (TRI/3D-BON; Ratoc, Tokyo, Japan) is used to extract the IB materials and maintain the void. The software's volume calculation tool was then used to calculate the volume of each void (Vv) and the void frequency (Vf) parameter [23].

$$\textbf{Gap volume} = \frac{BV}{TV}$$

 Void Volume (Vv):

The dimensions of each void calculate by measuring the distance between the peaks at the top and bottom and void volume percentages (VP) for each IB material were obtained as the following equation [24]:

$$\textbf{VP\%} = \frac{\textit{Sum of voids volume within IB}}{\textit{Volume of IB}} \times \textbf{100\%}$$

Void Frequency (Vf):

The total number of independent voids within each IOB conducts in µ-CT obtained from each specimen [24].

Statistical analysis: The data for this study were gathered, tabulated, and statistically analyzed using a suitable personal computer and IBM SPSS (SPSS for Windows, IBM Corp., Version 26) social science software. At the significance level of ($P \leq 0.05$), Kolmogorov-Smirnov and Shapiro-Wilk tests were used to evaluate the normality of data distributions and homogeneity of variance.

The Kruskal-Wallis test was used for variance analysis with a K-independent sample because the data obtained were not normally distributed, and the Independent-Samples Kruskal-Wallis Test was used to compare significant results.

Results.

a. Internal adaptation of barrier materials to radicular dentin:

A descriptive investigation of the internal adaptation of barrier materials and control groups to radicular dentin (Table 1).

Using the Kruskal-Wallis test, a statistical analysis of the mean of internal adaptation of control and barrier materials to radicular dentin of each group is shown in (Table 2). The results showed a

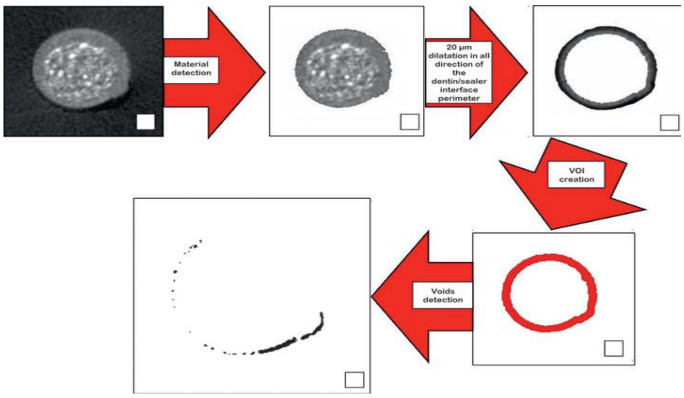

Figure 3. Demonstrates the calculations used to find voids and regions of interest in the datasets of microtomographic images.

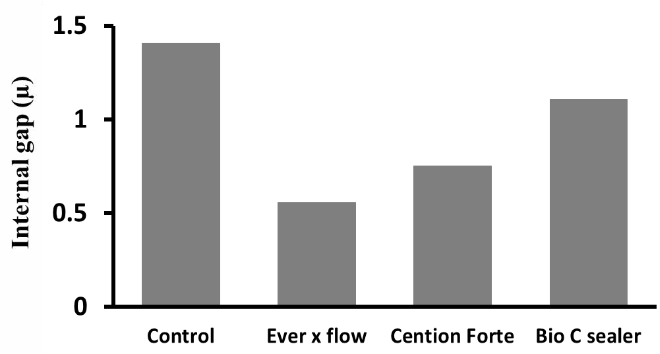

Figure 4. Bar graph depicting a comparison of Internal gap means (µs) values amongst the groups.

Table 1. *Mean values of internal adaptation of barrier material and control group.*

	N	Mean	SD	Min.	Max.
Control	10	1.4	0.12	1.22	1.54
Ever x flow	10	0.56	0.07	0.48	0.64
Cention forte	10	0.75	0.12	0.66	0.96
Bio-C sealer	10	1.11	0.07	1.03	1.19
Total	30	0.81	0.25	0.48	1.19
N: number of specimens; SD: standard deviation.					

Table 2. *Kruskal-Wallis test results for Internal adaptation of the control group and three types of barrier materials to radicular dentin.*

	N	Mean Rank	Kruskal-Wallis H	Asymp. Sig
Control	10	35.5	36.7	0.00 S**
Ever x flow	10	5.5		
Cention forte	10	15.5		
Bio-C sealer	10	25.5		
Total	30		.	
Means with letter S have highly significant at (P ≤ 0.05)**				

Table 3. *Pairwise comparison of groups by Independent-Samples Kruskal-Wallis Test.*

Sample 1-Sample 2	**P value/Sig.[a]**
Ever x flow- cention forte	0.333
Ever x flow – Bio c sealer	0.001
Ever x Flow – Control	0.000
Cention forte– Bio c sealer	0.033
Cention forte– Control	0.001
Bio c sealer– Control	0.333
a. Significance values have been adjusted by the Bonferroni correction for multiple tests.	

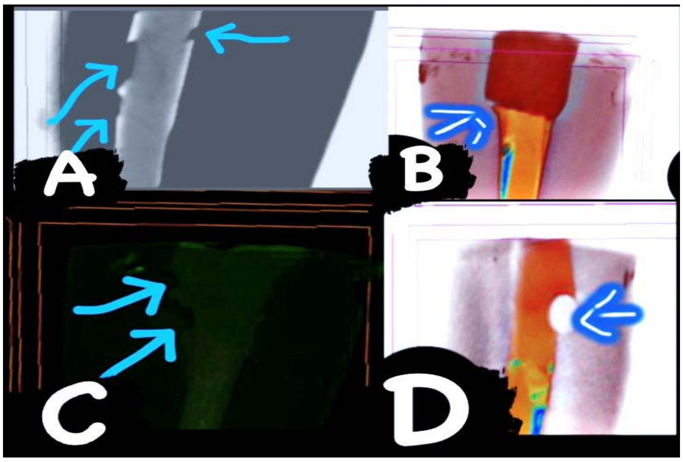

Figure 5. *Exhibited a 3D image that indicated how the amount of internal gap at the tooth-restoration interface changed in response to the application of barrier materials (blue arrows)(A) Control (B) Ever x flow (C) Cention forte (D) Bio-C sealer.*

highly significant difference between the control group and the three different kinds of barrier materials (Ever x flow, Cention forte and Bio-C sealer) at (P≤ 0.05).

Ever x flow exhibited the least amount of internal gap to radicular dentin while the control group showed the highest amount of internal gap to radicular dentin which is represented in (Figure 4 and Figures 5).

Additionally, Independent-Samples Kruskal-Wallis Test was used to statistically assess comparisons between the groups as shown in (Table 3). The results showed that there was no significant difference between the Ever x flow and Cention forte (p=0.333), a highly significant difference between the Ever x flow and Bio-C sealer and control group at (P =0.000), a significant difference between the Cention forte and Bio-C sealer at (p=0.033), and No significant difference between the Bio-C sealer and control group at (p=0.333).

b. Porosity of barrier materials:

The porosity of intra-orifice barrier materials mentioned in Table 4.

The Kruskal-Wallis test was used to statistically assess the mean internal porosity volume and percentage (%) of barrier materials for each group, as shown in (Table 5). The results showed a highly significant difference (P 0.05) between the three types of barrier materials (Ever x flow, Cention forte, and Bio-C sealer) at (P≤ 0.05).

Ever x flow exhibited the least mean of internal porosity volume and % while Bio-C sealer showed the highest mean of internal porosity volume and % which is represented in (Figure 6 and Figure 7).

In addition, comparisons between the groups were statistically analyzed using Independent-Samples Kruskal-Wallis Test as represented in (Table 6). The results showed a significant difference between Ever x flow and Cention forte (p=0.033), a highly significant difference between Ever x flow and Bio-C

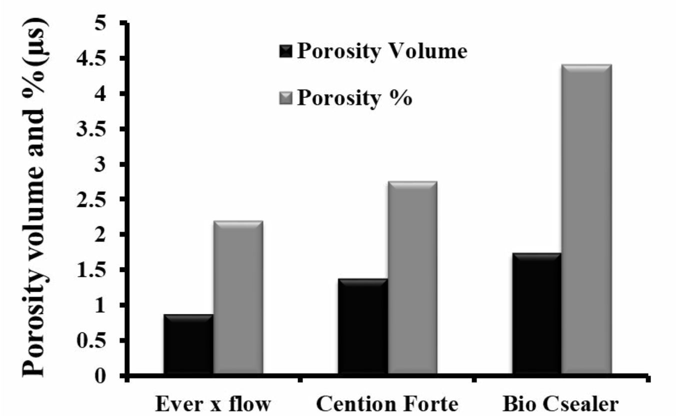

Figure 6. *Column graph depicting a comparison of Porosity volume and percentage (%) mean (µs) values amongst the groups.*

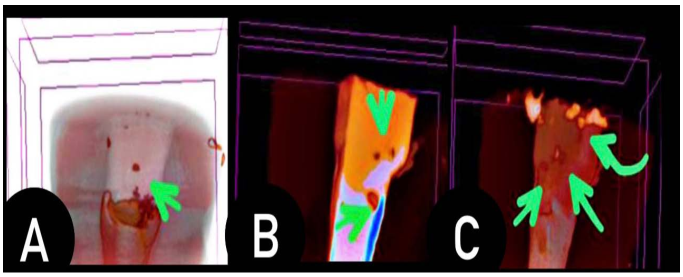

Figure 7. *3-D-CT images showing porosity within barrier materials(green arrows) (A) Ever x flow (B) Cention forte (C) Bio-C sealer.*

Table 4. Descriptive statistics of porosity volume (mm) and percentage (%) of intra-orifice barrier materials.

	N	Mean		SD		Minimum		Maximum	
		mm	%	mm	%	mm	%	mm	%
Ever x flow	10	0.88	2.2	0.05	0.06	0.82	2.14	0.93	2.3
Cention-forte	10	1.4	2.8	0.1	0.18	1.27	2.56	1.51	2.99
Bio-C sealer	10	1.7	4.4	0.06	0.42	1.66	3.98	1.80	4.98
Total	30	1.33	3.1	0.37	0.99	0.82	2.14	1.80	4.98
N: number of specimens; SD: stander of deviation.									

Table 5. Results from the Kruskal-Wallis test for the internal porosity volume and percentage (%) of three different kinds of barrier materials.

	No	Mean Rank	Kruskal-Wallis H		Asymp. Sig
			mm	%	
Ever x flow	**10**	**5.50**	**25.8**	**25.8**	**0.0 S****
Cention forte	**10**	**15.50**			
Bio-C sealer	**10**	**25.50**			
Total	**30**		.		
Means with letter S have highly significant at (P ≤ 0.05).**					

Table 6. Pairwise comparison of groups by Independent-Samples Kruskal-Wallis Test.

Sample 1-Sample 2	Sig. [a]
Ever x flow-cention forte	0.033
Ever x flow–Bio c sealer	0.0001
Cention forte–Bio c sealer	0.033
[a] Significance values have been adjusted by the Bonferroni correction for multiple tests.	

sealer at (P =.000), and a significant difference between Cention forte and Bio-C sealer (p=0.033).

Discussion.

Successful endodontic treatment depends on thorough disinfection and three-dimensional obturation of the canal spaces. Long-term failures have been related to a weakened seal, which allowed bacteria to re-contaminate the canals and reactivate the endodontic illness. The majority of scientific research has concentrated on developing tools and methods to strengthen the apical seal. Recent investigations have shown that an insufficient coronal seal increases the likelihood of re-infection because bacteria from the oral environment can enter. It has been demonstrated that the present methods for post-endodontic restorations and root canal obturation are insufficient to achieve a complete coronal seal [25].

Microleakage is a significant criterion for assessing the effectiveness of restorative materials. Both shrinkage and a poor fit between the cavity walls and the restorative material might result in minor leaks. Recurrent caries and pulpal disease are brought on by this microleakage [26].

One of the modern techniques for reducing contamination in endodontically treated root canals involves creating an impermeable barrier between the oral environment and the root canal system. The intra-orifice barrier is an effective stand-in method for lowering coronal leakage in teeth that have undergone endodontic therapy. This method involves removing the gutta-percha cones and sealer before injecting additional material with different restorative ingredients into the canal orifices before the ultimate restoration is completed [1].

This study assessed the potential of 3 materials for use as IB for endodontic teeth in order to decrease coronal microleakage by using micro-CT analysis to assess the presence of marginal gaps and internal voids (measuring the volume and percentages) formed after placement of intraorfice barrier (IB) in extracted human teeth. Data from this study indicated that endodontic teeth with (IB) had less coronal microleakage than endodontic teeth without (IB) based on radiography and CT findings. The coronal microleakage of the intraorfice barrier (IB) made of the ever-x flow (short fibre-reinforced composite) (SFRC) was significantly lower than that of the control and other groups of IB made of different materials(P≤ 0.05). These differences may be attributed to differences in the type of restorative material used and the properties of the material's constituent parts.

The findings of this investigation Dental SFRCs typically contain inorganic filler particles and short or nanofibers as reinforcing components in a resin matrix. For every x flow (short fibre-reinforced composite)(SFRC) that may be explained as connected to their composition and physical qualities, The effectiveness of fibre reinforcement is significantly influenced by the type of crosslinking at the fibre and resin matrix interface, as well as the fibres' orientation, distribution, aspect ratio, and volume percentage [27].

When used as intracanal anchorage in the post-endodontic reconstruction, Ever X Flow, a discontinuous glass fibre-reinforced resin composite resin, produced push-out retentive strengths comparable to those of conventional fibre posts because of the composition of Ever X Flow, which is made up of a resin matrix, broken E glass fibres, and inorganic particle fillers. Semi-interpenetrating Polymer Network (semi-IPN), a polymer matrix formed by cross-linked monomers such as bisphenol-A-glycidyl dimethacrylate (bis-GMA), triethylene glycol dimethacrylate (TEGDMA), and linear polymethyl methacrylate (PMMA) in resin matrix, increases the toughness of composite materials and provides good bonding properties [28,29].

Another explanation for the observed ever-x flow is that it exhibits less polymerization shrinkage than conventional particulate filler composite (PFC) resin, which results in contraction stress at the interface between the resin and cavity walls, causing gap formation and secondary caries, attributed this to the possibility that short fibre fillers with random orientations could absorb some of the stresses brought on by polymerization shrinkage and improve the matrix's resistance to stress, which could decrease marginal microleaks and improve the material's flexibility [30].

The SFRC's polymerization shrinkage stress relaxation behaviour According to the fibre's aspect ratio, which is the ratio of the fibre's length to diameter (l/d) and the amount of fibre as a filler used, Fiber of Ever X Posterior has had a bigger aspect ratio (17 µm × diameter 800 µm in length) than that fibre of Ever x flow (6 µm diameter ×140 µm in length). The fibre orientation will therefore remain parallel in the centre of the resin when filled into the glass tube, but the fibres will entwine in the inner wall of the glass tube and the filled area. It's also believed that the polymerization shrinkage along the glass fibre fibres is not very significant. This indicates that, despite the matrix resin between the fibres polymerizing and contracting, the interwoven fibre absorbed the stress at the inner wall of the glass tube, where the greatest polymerization shrinkage stress was applied. Large aspect ratio fibres intertwine with one another in the cavity and help decrease the considerable polymerization shrinkage stress during light irradiation, in contrast to fibres with a small aspect ratio, but fibres with a small aspect ratio are able to carry and scatter the irradiation light to every part of the cavity. As a result, the stress brought on by polymerization shrinkage after light irradiation was successfully reduced. This phenomenon is thought to be important in deep cavities where irradiation is difficult [27,31].

An isotropic or semi-anisotropic reinforcing effect is provided by the discontinuous, randomly oriented, and longer than the critical fibre length fibres used in the Ever X flow. This effect is related to the fibre adhesion to the polymer matrix, which is based on stress transfer from the polymer matrix to fibres, and individual fibres act as a crack stopper to prevent crack growth. It is also possible that the discontinuous glass fibres, which have a diameter of 5–6 micrometres, could micromechanically interlock the imperfections on the dentine surface, increasing the adhesive capabilities under shear stress [27,29]

The polymerization reaction of resin material is related positively to a depth of cure, The transfer of light energy may be significantly impeded by SFRC fibres. This effect further stresses the importance of the depth of cure and the necessity of suitable clinical curing settings, particularly when using anisotropic fibre systems. The deepest cure (6.7 mm) was likewise seen in the Ever X flow. This may be explained by the influence of relatively well-aligned long fibres through the small mould resulting in a probable "fibre optic-like" boosting light penetration as well as the higher translucency seen in this substance [32].

According to the result of the present study for a new class of resin-based ion-releasing alkasite materials (Cention forte) have marginal gaps and internal voids higher than short fibre-reinforced composite (SFRC) and lower than new calcium silicate–based root canal sealer (Bio-C Sealer) that could be explained as related to Cention forte have ion-releasing property included the release of ions or any other substances from a restorative material always raises questions regarding the possibility of useful filler particles dissolving. This could lead to voids in the set material when it is placed in an aqueous environment, which would promote water sorption and further dissolution. Internal porosities make restorations more brittle and less resistant to occlusal stresses [9].

Resin-based ion-releasing alkasite materials (Cention forte) show higher solubility than high-viscosity resin-based composites (Bulk Fill material) that is mostly made up of low-viscosity monomers and a dual-cure photoinitiator system is probably going to produce a more porous composite than traditional products that are delivered as a paste in a syringe. Additionally, 24.6 wt% of Cention is made up of alkaline filler particles that are meant to dissolve upon contact with water and release calcium, hydroxide, and fluoride ions as part of the product's claimed remineralizing function. Because fluoride-releasing restorative materials need a certain quantity of water diffusion to work, increased solubility can be anticipated from these materials. Additionally, it has been proposed that the release of fluoride ions from these materials through the dissolution of their fillers could lead to the formation of vacancies on their surface, which could contribute to a decrease in microhardness [33].

Another explanation for the dual-cure bulk-filling and ion-release of alkasite materials (Cention forte) relates to the kinetics of polymerization, either by self-cure mode or light-cure mode. The degree of conversion between self-cured and light-cured is significantly reduced when self-curing is activated by chemical initiators with a slow initiation rate showing the 11-min delay in starting the polymerization reaction, as shown by increases in working time from 2 to 11 min and increases in claimed setting time 6.5 min. Cention self-curing activated by chemical initiators with a slow initiation rate shows the 11-min delay in starting the polymerization reaction as demonstrated by increasing the working time from 2 to 11 min and increasing the claimed setting time to 6.5 min, dramatically lowering the degree of conversion of self-cured versus light-cured. The reactivity for light-cure activated polymerization can be increased due to the better light transmission of these bulk-fill materials and Cention light-curing is activated by additional Germanium-based initiator Ivocerin, which is advantageous for the light-cure mode that exhibits higher light reactivity than camphorquinone that is found in conventional resin composite [34].

A delay in the self-curing Cention polymerization activation caused the mass of the water sorption specimens to rapidly decrease. Leaching of unpolymerized monomers and, to a lesser extent, dissolution of functional fillers, mass loss, and higher solubility (Cention's solubility was associated with the dissolution of functional fillers in an aqueous environment) were also observed. They all arise from incomplete polymerization specimens absorbing water. Therefore, it makes sense why Cention self-cured is more soluble than the Cention light-cure. Cention must always be light cured when being applied to the oral cavity [9].

In addition, researchers evaluated the impact of distinct ion-releasing restorative dental materials' changing polymerization rates on their mechanical characteristics, water sorption, and solubility. The flexural characteristics of CN were discovered to be higher than those of a GIC and lower than those of a traditional resin composite. This substance slowly increased its flexural strength, elastic modulus, solubility, and solubility when allowed to self-cure. On the other hand, when light-cured, CN had significantly lower values in terms of mechanical characteristics and water sorption than other light-cured materials, at result concluded that Cention should not be used in self-cure polymerization mode due to its inferior chemical and mechanical properties. that can be attributed First, the mixture of UDMA, DCP, an aromatic aliphatic-UDMA, and PEG-400 DMA joins (cross-links) during polymerization. The monomer matrix's key ingredient is UDMA. Having high mechanical qualities, it has a moderate viscosity. High flexural strength is a result of the polymer's strongly cross-linked structure. Which is present within Cention and the missing polymeric structure within Glass Ionomer Cement. Second, nanohybrid composite has a modulus of elasticity ranging from 9 to 15 Gpa, bonds to tooth structure micromechanically, and offers good marginal seal, reinforcement of remaining tooth structure, and conservation of tooth structure, it also has significant flexural strength, while Cention has a modulus of elasticity of 13 Gpa [35-37].

Bio-C Sealer is a new calcium silicate–based root canal sealer, according to the present study result which showed the highest internal gap to radicular dentin and the highest internal porosity, these results related to the physicochemical properties of calcium silicate–based sealers have shown increased solubility following water immersion compared with the usual resin-based sealers, attributed to the hydrophilic nano-sized particles that enhance their surface area and permit more liquid molecules to come into touch with the sealer can be credited for the sealer's high solubility [38].

The use of bioceramic materials as root canal sealers has several significant benefits. The chemical composition and crystalline structure of bioceramic materials are similar to those of bone and tooth apatite materials as a result of the calcium phosphate present in them, which also improves the bonding of the sealer to the root dentin. This finding relates to the fact that Bio C Sealer has the highest solubility when compared to Endo Sequence and Sealer Plus BC. This is due, in part, to the fact that it doesn't include calcium phosphate, which shortens the setting time. Second, Bio C Sealer contains larger particles than Endosequence and Sealer Plus BC, which causes it to disintegrate more quickly [39,40].

Endodontic sealers' ability to penetrate the dentinal tubules depends on the anatomical root, as do the sealer's physical and chemical properties, the removal of the smear layer, and the irrigation technique employed. Root canal sealant with a calcium silicate basis, Because the coronal portion of the root contains the majority of the sealant and may experience volumetric changes during setting and dissolution, increasing porosity, as well as the lower density of these materials allowing air bubbles to move from the apical third to the coronal third of the root. Second, the solubility of calcium silicate-based sealers can be explained by the higher solubility of bioactive sealers caused by the release of OH- and Ca+ ions, which may also be the cause of the increase in porosity. As a result, porosity and other defects in the endodontic sealant's microstructure might therefore cause structural weak points, lower the material's tensile strength, and as a result produce microcracks that may cause the endodontic cement to leak in the root canal [38,41]. Therefore, the use of bioceramic materials provides protection of the whole teeth keeping it safe from porosity, enamel loss, and opalescent tooth colour [42].

Conclusion.

Within the confines of this in vitro examination, the μ-CT offers a 3D and non-destructive analytical method for the specimen's interior structures. Conclusions can be drawn from the findings, which demonstrated that placing an intraorifice barrier in teeth that have had endodontic treatment can dramatically reduce microleakage. the control group and bio c sealer demonstrated a higher internal gap to radicular dentin, While Ever X flow demonstrated a reduced internal gap to radicular dentin and material porosity. Ever x flow revealed an internal gap that was less than cention forte but did not differ significantly from it, whereas internal porosity revealed a distinct difference.

REFERENCES

1. Bhullar KK, Malhotra S, Nain R, et al. Comparative Evaluation of Intraorifice Sealing Ability of Different Materials in Endodontically Treated Teeth: An: In vitro: Study. Journal of the International Clinical Dental Research Organization. 2019;11:14-19.

2. Hajaj T, Perdiou A, Sinescu C, et al. Evaluation of Different Coronal Sealing Materials in the Endodontically Treated Teeth: An In Vitro Study. Advances in Materials Science and Engineering. 2021.

3. Deshpande SR, Gaddalay SL, Damade YN, et al. Reinforcing the cervical dentin with bonded materials to improve the fracture resistance of endodontically treated roots. Journal of Conservative Dentistry: JCD. 2022;25:179.

4. de Araújo-Neto VG, Sebold M, de Castro EF, et al. Evaluation of physico-mechanical properties and filler particles characterization of conventional, bulk-fill, and bioactive resin-based composites. journal of the mechanical behavior of biomedical materials. 2021;115:104288.

5. Bayram HM, Çelikten B, Bayram E, et al. Fluid flow evaluation of coronal microleakage intraorifice barrier materials in endodontically treated teeth. European journal of dentistry. 2013;7:359-362.

6. Carrera CA, Lan C, Escobar-Sanabria D, et al. The use of micro-CT with image segmentation to quantify leakage in dental restorations. Dental Materials. 2015;31:382-390.

7. Zakizadeh P, Marshall SJ, Hoover CI, et al. A novel approach in assessment of coronal leakage of intraorifice barriers: a saliva leakage and micro-computed tomographic evaluation. Journal of endodontics. 2008;34:871-5.

8. Abogabal AD, Goda AA. Efficacy of bulk fill flowable composite reinforced with short fibers in fracture resistance of restored extensive premolars cavities. Al-Azhar Assiut Dental Journal. 2020;3:153-72.

9. Marovic D, Par M, Posavec K, et al. Long-term assessment of contemporary ion-releasing restorative dental materials. Materials. 2022;15:4042.

10. Al-Haddad A, Che Ab, Aziz ZA. Bioceramic-based root canal sealers: a review. International journal of biomaterials. 2016;2016.

11. Debelian G, Trope M. The use of premixed bioceramic materials in endodontics. Giornale italiano di endodonzia. 2016;30:70-80.

12. Özlek E, Gündüz H. Effectiveness of different rotary file

systems in removing the root canal filling material: A micro-computed tomography study. Journal of Dental Research, Dental Clinics, Dental Prospects. 2021;15:273.
13. Yasa E, Arslan H, Yasa B, et al. The force required to fracture endodontically roots restored with various materials as intra orifice barriers. Nigerian journal of clinical practice. 2017;20:1237-41.
14. Jlekh ZA, Abdul-Ameer ZM. Evaluation of the Cuspal Deflection of Premolars Restored with Different Types of Bulk Fill Composite Restoration. Biomedical and Pharmacology Journal. 2018;11:751-7.
15. Amanda B, Suprastiwi E, Usman M. Comparison of apical leakage in root canal obturation using bioceramic and Polydimethylsiloxane sealer (In vitro). Open journal of stomatology. 2018;8:24.
16. Kumari M, Taneja S, Bansal S. Comparison of apical sealing ability of lateral compaction and single cone gutta percha techniques using different sealers: An in vitro study. Journal of Pierre Fauchard Academy (India Section). 2017;31:67-72.
17. Zuli TA, Guedes OA, Gonçalves GF, et al. Effect of post space preparation drills on the incidence of root dentin defects. Restorative Dentistry & Endodontics. 2020;45.
18. Oommen NEJ, Shetty SV, Shetty H. Effect of intraorifice depth on the sealing ability of inraorifice sealing agent – an in vitro study. Int. J. Adv. Res. 2017;5:1882-1888.
19. Sauáia TS, Gomes BP, Pinheiro ET, et al. Microleakage evaluation of intraorifice sealing materials in endodontically treated teeth. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2006;102:242-6.
20. Zavattini A, Mancini M, Higginson J, et al. Micro-computed tomography evaluation of microleakage of Class II composite restorations: An in vitro study. European Journal of Dentistry. 2018;12:369-374.
21. Moeller L, Wenzel A, Wegge-Larsen AM, et al. Quality of root fillings performed with two root filling techniques. An in vitro study using micro-CT. Acta Odontologica Scandinavica. 2013;71:689-96.
22. Orhan K, Jacobs R, Celikten B, et al. Evaluation of threshold values for root canal filling voids in micro-CT and nano-CT images. Scanning. 2018.
23. Almeida LJ, Penha KJ, Souza AF, et al. Is there correlation between polymerization shrinkage, gap formation, and void in bulk fill composites? A μCT study. Brazilian oral research. 2017;31.
24. Nazari A, Sadr A, Shimada Y, et al. 3D assessment of void and gap formation in flowable resin composites using optical coherence tomography. J Adhes Dent. 2013;15:237-43.
25. Mehta S, Ramugade M, Abrar S, et al. Evaluation of coronal microleakage of intra-orifice barrier materials in endodontically treated teeth: A systematic review. Journal of Conservative Dentistry. 2022;25:588.
26. Aakriti RJ, Bhushan J, Bhagat P. To evaluate and compare microleakage in teeth restored with conventional glass ionomer cement and two newer restorative materials EQUIA Forte and Cention N using stereomicroscope. J Adv Med Dent Scie Res. 2020;8:163-7.
27. Alshabib A, Jurado CA, Tsujimoto A. Short fiber-reinforced resin-based composites (SFRCs); Current status and future perspectives. Dental Materials Journal. 2022;41:647-54.
28. Tsujimoto A, Barkmeier WW, Takamizawa T, et al. Mechanical properties, volumetric shrinkage and depth of cure of short fiber-reinforced resin composite. Dental materials journal. 2016;35:418-24.
29. Ferrari M, Lettieri E, Pontoriero DI, et al. Particulate Filler and Discontinuous Fiber Filler Resin Composite´ S Adaptation and Bonding to Intra-Radicular Dentin. Polymers. 2023;15:3180.
30. Garoushi S, Gargoum A, Vallittu PK, et al. Short fiber-reinforced composite restorations: a review of the current literature. Journal of investigative and clinical dentistry. 2018;9:e12330.
31. Miura D, Ishida Y, Shinya A. Polymerization shrinkage of short fiber reinforced dental composite using a confocal laser analysis. Polymers. 2021;13:3088.
32. Shouha PS, Ellakwa AE. Effect of short glass fibers on the polymerization shrinkage stress of dental composite. Journal of Biomedical Materials Research Part B: Applied Biomaterials. 2017;105:1930-7.
33. Almulayounis MN, Al-Ali AA. Effect of heat treatment duration and cooling conditions on tensile properties and hardness of selective-laser-melted cobalt-chromium alloy. Georgian Medical News. 2023;337:38-42.
34. Burrer P, Par M, Fürer L, et al. Effect of polymerization mode on shrinkage kinetics and degree of conversion of dual-curing bulk-fill resin composites. Clinical Oral Investigations. 2023:1-2.
35. Di Lauro A, Di Duca F, Montuori P, et al. Fluoride and Calcium Release from Alkasite and Glass Ionomer Restorative Dental Materials: In Vitro Study. Journal of Functional Biomaterials. 2023;14:109.
36. Jain M, Mittal A, Dhaundiyal A, et al. Comparative evaluation of three different intraorifice barrier on fracture resistance of endodontically treated teeth: an in vitro study. Indian Journal of Dental Sciences. 2020;12:77.
37. Aljumaily EY, Al-Khatib AR. Hardness and elastic modulus assessment for two aligner materials before and after thermocycling: a comparative study. Georgian Medical News. 2023;338:63-8.
38. Zordan-Bronzel CL, Torres FF, Tanomaru-Filho M, et al. Evaluation of physicochemical properties of a new calcium silicate–based sealer, Bio-C Sealer. Journal of endodontics. 2019;45:1248-52.
39. Raghavendra SS, Jadhav GR, Gathani KM, et al. Bioceramics in endodontics–a review. Journal of Istanbul University Faculty of Dentistry. 2017;51:S128.
40. Silva EM, Alcalde MP, Vivan RR, et al. Evaluation of in vitro experimental model for analysis of bioceramic sealers. Brazilian Oral Research. 2022;36.
41. Radwanski M, Leski M, Puszkarz AK, et al. A Micro-CT Analysis of Initial and Long-Term Pores Volume and Porosity of Bioactive Endodontic Sealers. Biomedicines. 2022;10:2403.
42. Veličković M, Sekulić Marković S, Acović A, et al. Non-invasive treatment of multiple enamel hypoplasia: A case report. Medicinski časopis. 2021;55:144-147.