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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 ინგ-ლისურენოვან 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. ექსპერიმენ-ტული 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, შემა-ჯამებელი 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. მიკროფოტო-სურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სუ-რათის 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 უცხო-ური 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 ხელმძღვანე-ლის 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 შე-ჯერება 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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INTRAORAL SCANNERS AND CONVENTIONAL IMPRESSIONS: A LITERATURE REVIEW

Gem Muçolli[1]*, Fidan Nikç[2], Genit Muçolli.

[1]*Private dental Clinic "Ismile Dental Studio", Prishtina, Republic of Kosovo.*

[2]*Private dental Clinic "Vurall Dent" Peja, Republic of Kosovo.*

Abstract.

Introduction: Using digital technology, respectively the use of intraoral scanners has increased exponentially in recent years. Intraoral scanners have gained traction and widespread use in the field of dental prosthetics and orthodontics. While the use of these digital devices enables the detection of visible areas of error in order to allow clinicians to correct those areas immediately without a need of restarting the entire process from the beginning as it should be done in the conventional method and subsequent procedures. While intraoral scanners provide notable benefits in terms of efficiency, accuracy, and patient comfort, they do come with certain drawbacks. The high initial cost, along with the ongoing expenses for maintenance and software updates, can place a financial strain on many dental practices. Additionally, there is a learning curve associated with mastering these devices, and certain clinical situations—such as limited mouth openings or areas that are difficult to scan—can pose challenges to their effectiveness. Accuracy may also be affected by factors like patient movement, insufficient salivation, or the presence of reflective or dark surfaces. Moreover, issues related to software compatibility, extended chair time in complex cases, and the need for multiple scanning attempts can reduce some of the time-saving advantages. Intraoral scanners also raise concerns about data security and patient privacy, and technical issues or system failures can disrupt clinical workflows. While intraoral scanners are undoubtedly valuable in modern dentistry, it is important for clinicians to carefully evaluate these limitations to ensure their effective integration into practice.

Aim of study: Acquaintance with intraoral scanners, understanding the way they're used, advantages and disadvantages, differences with the convenctional method of impression, familiarity with the materials of impression measurement.

Material and methods: This study was conducted as a literature review, using the latest literature on intraoral scanners and their use in dentistry, disadvantages and advantages over conventional impressions. Analysis of scientific papers published in online databases such as PUBMED and MEDLINE, EBSCO, Google Schoolar, using the keywords "Intraoral scanners, convenctional impression, impressions, digital dentistry".

Conclusion: Intraoral scanners present tremendous comfort in the field of prosthodontics. When comfort is mentioned, it is worth emphasizing the advantages of working with an intraoral scanner, where the benefits are the same for both parties, patients and clinicist. Therefore, it is very important that in this period where technology is closely related with new and modern methods not only for taking impressions, but also for other procedures.

Key words. Intraoral scanners, convenctional impression, impressions, digital dentistry.

Introduction.

Intraoral scanners are advanced digital devices designed to capture detailed images of the teeth and soft tissues within the oral cavity. These systems are increasingly being used in the clinics as an alternative to traditional dental impression methods [1,2].

The rapid progression of digital imaging technologies has led to significant advancements in the creation of virtual replicas of both soft and hard oral tissues. Through the use of lasers and optical scanning devices, these innovations offer enhanced capabilities and benefits for both dental professionals and patients [2,3].

Intraoral scanners can generate highly accurate three-dimensional (3D) digital models of teeth, which can be utilized to design precise dental restorations fabricated in dental laboratories [2].

A dental impression is a negative replica of the teeth and surrounding oral tissues, capturing their shape, size, and arrangement. It provides a detailed mold of the maxillary and mandibular arches as well as other structures within the oral cavity [4,5]. Dental impressions are traditionally made from various materials that harden upon contact with the oral tissues [6]. The choice of material depends on the intended clinical application [6].

Functional impressions are primarily made using elastomers, which are flexible and allow for accurate replication of functional movements, while anatomical impressions are typically made using irreversible hydrocolloid materials [6].

The impression is used to create a working model, which is a positive replica cast from dental gypsum. Depending on its intended use, an impression can be classified into two types: anatomical and functional. An anatomical impression is taken to produce a diagnostic model, which may be used for treatment planning or to fabricate an individual tray for subsequent functional impressions. A functional impression captures the tissue in its functional state and is crucial for the creation of a working model, typically made from hard gypsum. The functional impression defines the relationship between the base of the prosthesis and the soft tissues supporting it, as well as the tissues that come into contact with the prosthesis' borders, both at rest and during functional movements such as speaking, chewing, swallowing, and breathing [6].

- Polysulfides – Composed of two pastes: a base paste containing a sulfur-based polymer and a catalyst paste.
- Silicones – Available in paste form, these are silicone polymers combined with additional substances for improved handling and performance.

- Addition Silicones.
- Polyether – These materials consist of a base paste and a catalyst.
- Condensation Silicones – Classified based on their polymerization mechanism.

Materials that absorb moisture are classified into two categories: hydrophilic and hydrophobic [6,7].

Although intraoral scanning technologies have made significant advancements, several challenges still need to be addressed. One key issue is the accuracy of digital impressions, particularly in complex clinical situations, such as deep overbites, limited mouth openings, and the presence of highly reflective or dark surfaces, which can interfere with scan data. While these scanners offer enhanced comfort compared to traditional impression methods, challenges such as patient gag reflex, longer scanning times, and difficulty accessing the posterior regions of the mouth still remain. Additionally, integrating intraoral scanners with other dental technologies, like CAD/CAM systems and 3D printing, often faces compatibility issues, hindering the creation of seamless digital workflows. Concerns regarding data security and patient privacy are also significant, and these aspects are yet to be fully addressed in current research. These ongoing issues highlight the need for further exploration, and this study seeks to tackle these challenges in order to improve the overall functionality and clinical application of intraoral scanners.

Materials and Methods.

This study was conducted as a literature review, focusing on the most recent research regarding intraoral scanners and their application in dentistry, including their advantages and disadvantages compared to conventional impression methods.

Data for this review were primarily collected from university textbooks and literature from various research publications available in electronic databases. A comprehensive analysis of scientific articles was performed using online platforms such as PUBMED, MEDLINE, EBSCO, and Google Scholar. Keywords used for the search included: "Intraoral scanners", "conventional impression", and "digital dentistry".

The review included all relevant scientific papers published in English up until 2022, covering topics such as impression techniques in dentistry, emerging digital measurement methods, clinical studies, in-vitro studies, and research reports. Additionally, data from reputable international sources published on official websites were also incorporated.

Intraoral Scanner.

Intraoral scanners are advanced digital devices used to capture high-resolution images of the teeth and soft tissues within the oral cavity. These devices are increasingly utilized in clinical settings as an alternative to conventional impression techniques.

The development of digital imaging technology has rapidly advanced, offering enhanced features and benefits for both dental professionals and patients. In particular, these technologies enable the creation of digital replicas of both soft and hard oral tissues through the use of lasers and other optical scanning devices.

These systems are capable of generating accurate, virtual 3D images of the teeth, which can then be used to fabricate precise digital models. These models serve as the foundation for creating restorations, such as crowns, bridges, and dentures, which are subsequently fabricated in a dental laboratory [2].

History and Current State.

The first digital impression was taken in 1982, marking the beginning of the evolution of scanning technologies in dentistry. Over the subsequent decades, these technologies have undergone significant advancements, and today, the dimensional accuracy of intraoral scanners is comparable to, or even surpasses, that of traditional impression methods.

The digital impression, or "negative," captured through scanning is transmitted electronically to facilitate the continuation of the dental procedure. Initially, these devices were not as refined as they are now, and clinicians were understandably skeptical of their accuracy in clinical applications. However, with the substantial progress in technology over recent years, these concerns have largely been alleviated.

Today, the traditional workflow in dentistry is rapidly being replaced by digital processes, with intraoral scanning becoming a mainstream method in modern dental practice [2,8,9].

Accuracy of Intraoral Scanners.

The accuracy of conventional impressions and the fit of prosthetic restorations are highly dependent on the precision of each step in the process. In contrast, intraoral scanners provide significant advantages by allowing the detection of obvious errors during the scanning procedure. This enables clinicians to address and correct discrepancies immediately, without the need to restart the entire process, as would be necessary with traditional impression techniques and the subsequent procedures.

Furthermore, the accuracy of measurements taken with intraoral scanners is generally considered superior to that of conventional methods. However, despite these advances, there remain concerns and uncertainties regarding the reliability of digital impressions, particularly when using different scanning devices or under varying intraoral conditions [2].

Use of Intraoral Scanners.

Intraoral scanners capture highly detailed digital images of the oral cavity's structures, eliminating the need for traditional impression materials. Many patients find this technology more comfortable and convenient, as it eliminates one of the most distressing aspects of conventional impression-taking: the gag reflex. This reflex is commonly triggered during traditional impressions, which often cause discomfort for patients [1-3].

Procedure.

The procedure involves capturing a digital impression using an intraoral scanner, where the handheld probe is inserted into the patient's mouth and moved over the teeth and soft tissues. The digital scan is displayed on the screen in real-time. This process typically takes just a few minutes for fully prepared teeth and only a few seconds for the antagonist arch. During the review, the images can be enlarged, and any potential errors can be identified, corrected, and refined before sending the data to the dental laboratory [1,3].

Type of Imaging Technology.

The type of imaging technology of intraoral scanners plays a crucial role in determining the measurement speed, resolution, and overall accuracy of the scan. Several types of imaging technologies are currently in use, each with its specific advantages and applications [9].

Triangularity.

In the CEREC system, triangularity is used to measure angles and distances from known reference points using projected laser light. The distance between the laser source and the sensor is precisely known, as is the angle between the laser and the sensor. When the laser light is reflected from the object, the system calculates the angle of reflection, allowing it to determine the distance from the laser source to the object's surface, based on the Pythagorean theorem.

To ensure consistent and predictable light distribution, it is necessary to apply a thin layer of opaque powder to the tissue being scanned. This powder helps in improving the reflection and accuracy of the scan [9].

3D Video.

An HD camera with trinocular imaging is used, consisting of three small cameras within the lens to capture three precise views of the tooth. A complementary semiconductor metal oxide sensor converts light energy into electrical signals. The distance between two data points is simultaneously calculated from two perspectives, allowing the system to determine the 3D data, which is captured in a video sequence and modeled in real time.

To record the data points, a thin layer of powder is generally applied, although only a minimal amount is needed for accurate scanning.

In contrast, AFI (Active Feedback Imaging) also uses an HD camera, but instead of a sensor, it rapidly captures images in real time. AFI scanners feature a higher dynamic range of illumination, enabling them to scan reflective surfaces without the need for dust coverage. AFI utilizes two light sources to project three distinct light patterns onto the teeth and soft tissues [9].

Differences of conventional impression from the intraoral scanner impression.

Conventional or traditional impression-taking involves the use of various materials and often requires multiple steps or visits to complete. This process introduces a higher risk of errors, such as air bubbles, voids, or improper material mixing, which can compromise the accuracy of the impression.

While digital impressions taken with an intraoral scanner eliminate many of these errors by providing a more precise and streamlined approach. The digital process significantly reduces the time required for the procedure.

Advantages.

The integration of digital technology into dental practice significantly enhances accuracy, efficiency, and productivity. It allows for the immediate transmission of digital impressions to the laboratory via information technology, streamlining the entire process. Additionally, restorations can be delivered to patients much faster, reducing the need for multiple visits and standardizing clinical procedures.

Other key advantages include:

- Reduced time in the dental unit.
- High accuracy and precision in imaging, ensuring correct placement of restorations.
- Enhanced patient comfort, as the ergonomic design of the scanner allows for easy and comfortable placement in the patient's mouth.
- A more pleasant experience, minimizing discomfort and anxiety for patients.
- Lower risk of measurement errors and elimination of inaccuracies.
- Efficient electronic storage of patient records, saving space, supporting paperless practices, and improving record-keeping.

Additionally, digital impressions overcome many of the limitations associated with traditional impression methods, including:

- Material contraction.
- Time-consuming pouring.
- Sensitivity to temperature and improper material mixing [2,9].

Disadvantages.

The main disadvantages of intraoral scanning include:

- High cost of the equipment and technology.
- Difficulty in detecting deep marginal lines on prepared teeth.
- Training requirements for proper implementation and effective use of the technology.

Required Training.

The effective use of an intraoral scanner requires training for all clinic personnel. Clinicians with a stronger aptitude for technology generally adapt more quickly to the equipment. To maximize the benefits of this technology, clinics adopting intraoral scanning should invest in comprehensive training for their team members. Well-trained clinicians can better explain how CAD/CAM restorations preserve maximal tooth structure and why this approach is crucial for maintaining tooth strength [8].

Cost Considerations.

Training is only one aspect of successfully integrating intraoral scanning technology into a dental practice. Clinics must also consider how to incorporate the scanner into their daily workflow, as each intraoral scanner has unique components that need to be seamlessly integrated.

Intraoral scanners are available in both open and closed formats. Open-format scanners allow clinicians to immediately access and edit the digital files after scanning. This format is preferred for its versatility and cost-effectiveness, as it reduces future expenses related to closed-format systems, such as the need for proprietary licenses or recurring fees to unlock files.

However, purchasing an open-format scanner requires a certain level of technical expertise to ensure proper integration with the clinic's existing systems. Clinicians without experience in software and computer integration may opt for closed-format scanners, which are fully proprietary and do not integrate with third-party components or software [8].

Types of Intraoral Scanners.

Intraoral scanners can be categorized into two main types:

- **Contact Scanners:** These scanners rely on physical contact between the probe and the structures being scanned.

- **Non-Contact Scanners:** These scanners use technologies such as radiation, ultrasound, or light to capture data without direct contact with the tissues [2].

Conventional Impression.

A conventional impression is a negative replica or reproduction of the teeth and other tissues in the oral cavity. It captures the shape and size of the teeth, as well as the surrounding soft and hard tissues of the upper and lower jaws [4,5]. This impression is created using various materials that set or harden upon contact with the tissues being registered [6]. The choice of material depends on the intended use of the impression [6].

For functional impressions, elastomers are typically used, while anatomical impressions are commonly made with irreversible hydrocolloid materials [6].

Materials for Conventional Impression.

Today, a variety of materials are available for capturing impressions of soft and hard tissues. Based on their historical development, these materials are typically classified as follows:

- Reversible Hydrocolloids
- Polysulfides
- Condensation Silicones
- Addition Silicones
- Polyether

Each of these materials offers distinct advantages and limitations. However, they all share a critical characteristic: when used properly, they produce accurate impressions that can serve as the foundation for subsequent procedures [2,10,11].

Clinical Application of Dental Impression Materials.

Elastic impression materials can be slightly stretched or compressed and then return to their original shape when the impression dental tray is removed from the patient's mouth. These materials are capable of accurately replicating both hard and soft tissue structures in the oral cavity, including the interproximal spaces.

Non-elastic bulk materials, such as Zinc Oxide-Eugenol (ZOE) and gypsum, are ideal for impressions in cases of edentulous jaws or for soft tissue applications. At the correct consistency, these materials do not compress the tissue during tray placement, ensuring accurate impressions without tissue distortion [10].

Reversible Hydrocolloids.

Reversible hydrocolloids, also known as agar hydrocolloids, were initially derived from algae. However, the material used today has undergone significant modifications. When applied immediately after mixing, reversible hydrocolloids offer excellent dimensional accuracy and acceptable detail in replicating structures.

At high temperatures, this material transitions from a gel to a liquid form. This change is reversible: when the material cools, the liquid form solidifies into an elastic gel. Agar hydrocolloid changes from gel to solution at 99°C but remains in liquid form up to 50°C, forming a gel only slightly above body temperature. These unique thermal properties make it highly suitable as a material for impression making.

Reversible hydrocolloids are available in various viscosities, and the required temperature adjustments are facilitated by specialized conditioning units. However, the material's dimensional stability is compromised by its tendency to release or absorb water, which can affect the accuracy of the impression. Nevertheless, the precision of an impression improves when the material is compacted [2,12].

Polysulfides.

Polysulfides, also known as rubber bases, were introduced in the early 1950s and quickly gained popularity among clinicians due to their superior dimensional stability and tear strength compared to reversible hydrocolloids. However, these materials should be poured as soon as possible after taking the impression, as delays of more than one hour can result in significant dimensional changes [2,13].

Polysulfides undergo slight shrinkage during polymerization, though this can be minimized by using a bulkier impression tray to reduce material compaction. Typically, a double-mixing technique is applied, using a heavier-bodied tray combined with a less viscous material. These components polymerize simultaneously, forming a chemical bond of sufficient strength.

The high tear resistance and increased elasticity of polysulfides make them particularly effective for capturing impressions in sulcular areas. These properties contribute to better dimensional stability when compared to reversible hydrocolloids. Despite being a higher-cost elastomer, polysulfides are less favored by patients due to their unpleasant sulfur odor and the long setting time required in the mouth.

Additionally, polysulfides are sensitive to temperature and humidity, which can significantly shorten the working time, to the point that polymerization begins before it is placed in the mouth, resulting in an inadequate impression. Historically, polysulfides were polymerized using lead peroxides, which gave the material its characteristic brown color. Modern formulations are typically polymerized with copper hydroxide [2,13].

Conditional Silicon.

Conditional silicones address some of the limitations of polysulfides, particularly their odor, and can be pigmented to match nearly any shade. While their dimensional stability is not as high as that of polysulfides, it is greater than that of reversible hydrocolloids. A significant advantage of conditional silicones is their relatively short setting time in the mouth, typically around 6-8 minutes, making them more comfortable for patients who tend to prefer them over polysulfides. Additionally, conditional silicones are less affected by high temperatures and humidity commonly found in dental clinics.

However, the main disadvantage of conditional silicones is their poor wettability, which is a result of their highly hydrophobic nature. This means that the teeth must be well-prepared, and the gingival sulci must be completely dry to ensure the impression material forms without defects. Achieving an accurate cast without air bubbles can be more difficult with conditional silicones than with other impression materials, which may necessitate the use of a sprayer. The material is available in various viscosity grades, and one common technique involves lining the impression tray with a polyethylene spacer. This separator creates space, allowing for better handling and easier material cleaning.

It is essential to exercise great care during the impression process to avoid putting undue strain on the material. If strain occurs, the impression must be repeated after it is removed from the oral cavity. Furthermore, conditional silicones are highly sensitive to contamination by saliva, which renders the material unusable, as it makes cleaning impossible.

Similar to polysulfides, conditional silicones exhibit dimensional instability due to the nature of their polymerization. Both materials are considered conditional polymers, releasing alcohol and water as byproducts during polymerization. As a result, evaporation from the material can lead to dimensional shrinkage, affecting the accuracy of the impression [2,10].

Addition Silicones.

Addition silicones, also known as polyvinyl siloxane, were introduced in the 1970s. These silicones are similar to conventional silicones but offer greater dimensional stability, with their working time being more sensitive to temperature changes. The set of this material is less rigid than polyether and more rigid that polysulfides.

A potential drawback of some addition silicones is their sensitivity to gloves containing latex or resins, which can interfere with the material's preparation and placement. To avoid this, gloves should be used when handling addition silicones to ensure proper manipulation.

Like conventional silicones, addition silicones are hydrophobic. To overcome this, hydrophilic sprays may be applied to improve the material's wettability. However, like polyether, addition silicones may swell when exposed to moisture, which can impact the accuracy of the impression.

These silicones are typically used in combination with low-viscosity syringe materials to provide better flow and detail capture [2,14].

Polyether.

Unlike other elastomers, polyether has a distinct polymerization mechanism. They do not produce unstable by-products during polymerization, contributing to excellent dimensional stability. Additionally, polyether exhibits minimal shrinkage due to temperature changes compared to other impression materials, although their thermal expansion is greater than that of polysulfides.

One of the primary advantages of polyether is their ability to produce highly accurate patterns even if the material is poured more than a day after the impression has been made. This makes polyether particularly useful when immediate pouring is impractical or impossible. Furthermore, polyether has a relatively short, strengthened time in the mouth—approximately 5 minutes—significantly shorter than the time of polysulfides. This quick setting time contributes to their popularity among clinicians.

Despite these advantages, polyether has some drawbacks. Additionally, the impressions obtained from polyether are stable only if stored in a dry environment, otherwise they absorb moisture and undergo dimensional changes.

Another limitation is the relatively short working time, which may limit the number of decorticated teeth that can be included in a single impression. Additionally, there have been isolated reports of allergic reactions to polyether, manifesting as burning, itching, or general oral discomfort. For patients with known sensitivities, alternative elastomers should be considered. While there have been improvements to reduce these issues, they have not been entirely eliminated [2,10,15].

Discussion.

The conventional impression method, also known as the traditional method, is one of the oldest and most established techniques in dental practice. It is considered a sensitive clinical procedure, requiring precision and careful handling. For many young clinicians, this method presents a challenge, as the accuracy of the impression directly impacts the final outcome of the prosthetic work. Despite its sensitivity, conventional impressions have been instrumental in enabling clinicians to achieve their desired results for patients. This success has been achieved through the use of various materials, which have helped improve the quality of the work. In some cases, clinicians have had to repeat the process from the beginning to obtain an adequate impression that meets the required standards.

However, the introduction of intraoral scanners has significantly changed the way measurements are taken. A growing number of clinicians now view digital impressions as an essential alternative to the conventional method. The contemporary approach provided by intraoral scanners has allowed clinicians to produce final prosthetic work more quickly and with fewer errors or adjustments. Unlike traditional impressions, where the clinician's experience plays a significant role in ensuring accuracy, digital scanning provides a more standardized and reliable method.

The only drawback of intraoral scanners remains the technology. This is particularly relevant for senior clinicians who have significant experience with the conventional method of taking impressions. Many of them are not familiar with this form of work and see adapting to this method as an unattainable task. While intraoral scanners offer clear advantages in terms of efficiency, accuracy, and patient comfort, they also come with several challenges that must be carefully considered. The high initial cost of these devices, combined with ongoing expenses for maintenance, software updates, and training, can create a significant financial burden, particularly for smaller dental practices. Additionally, mastering these devices requires technical expertise, and clinicians with extensive experience in traditional impression methods may find the learning curve steep. This challenge is especially evident among senior clinicians, who may struggle to adapt to the new technology.

Furthermore, despite the time-saving potential of intraoral scanners, their effectiveness can be limited by certain factors. In cases with restricted mouth openings, deep overbites, or surfaces that reflect light, the accuracy of digital impressions may be compromised. Extended scanning times can also occur in more complex cases, reducing the overall efficiency of the process. In addition, compatibility issues between the scanners and other systems, such as CAD/CAM and 3D printing, can hinder the creation of a seamless workflow. Data security and patient privacy concerns also remain largely unexplored, while technical malfunctions or system failures may disrupt clinical procedures, potentially impacting patient care.

Conclusion.

Based on scientific articles comparing the work of intraoral scanners and conventional impressions, as well as insights from online databases, university textbooks, and the analysis of conclusions and discussions in research works, it has been concluded that intraoral scanners offer significant advantages in the field of dental prosthetics. When it comes to ease of work, the advantages of working with an intraoral scanner should be emphasized, where the greatest benefit is the same for both parties, both patients and clinicians.

Therefore, in this era of advancing technology, it is crucial to stay connected with new and contemporary methods—not just for taking impressions, but for all dental procedures. Embracing these innovations not only streamlines our work but also enhances patient comfort, making procedures faster, easier, and, most importantly, more successful. Despite the significant advantages offered by intraoral scanners, conventional methods are unlikely to become obsolete. Dentistry is a complex and varied field, with patient needs differing greatly depending on individual circumstances. As such, traditional impression techniques will continue to play an important role. While digital scanning has advanced considerably, there are still cases where it cannot achieve the required level of accuracy, such as those involving excessive reflections, deep overbites, or patients who experience difficulty tolerating the digital scanning process. In these instances, a combined approach that utilizes both intraoral scanning and conventional methods may provide the most effective solution. This approach allows clinicians to tailor their techniques based on the specific needs of each patient, thereby ensuring both accurate treatment and optimal patient comfort, ultimately leading to the best possible outcomes.

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