Academicia Globe:
Inderscience Research

ISSN: 2776-1010 Volume 5, Issue 11, November 2024

ACCURACY AND EFFICIENCY OF INTRAORAL SCANNING

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Abstract
Different types of restoration materials have different refractive indices and transparency parameters, which can affect the accuracy of the intraoral scanner. The application of auxiliary means to the surface of restorations can help eliminate the influence of the reflective properties of restoration materials and increase the accuracy of scanning.

Introduction

Digital intraoral scanners have become a constant trend in the dental industry, and their popularity is only growing. But what is an intraoral scanner? Here we take a closer look at this incredible tool, which is crucial in taking the quality of scans for both doctors and patients to a whole new level.

What are intraoral scanners?

An intraoral scanner is a portable device used to directly create digital impressions of the oral cavity. The light source from the scanner is projected onto the scan objects, such as complete dentition, and then the 3D model processed by the scanning software is displayed in real time on the touchscreen. The device provides precise detail of the hard and soft tissues located in the oral cavity area through high-

ISSN: 2776-1010 Volume 5, Issue 11, November 2024

quality images. It is becoming an increasingly popular choice for clinics and dentists due to the short laboratory run time and excellent 3D image quality.

Development of intraoral scanners

In the XVIII century, methods of taking prints and making models were already available. At that time, dentists developed a variety of impression materials such as impregnum, condensation/additive silicone, agar, alginate, etc. But making an impression seems error-prone and is still inconvenient for patients and time-consuming for dentists. To overcome these limitations, intraoral digital scanners have been developed as an alternative to traditional casts.

The advent of intraoral scanners coincided with the development of CAD/CAM technologies, which brought many advantages to practitioners. In the 1970s, the concept of computer-aided design/computer-aided manufacturing (CAD/CAM) was first introduced in dentistry by Dr. Francois Duré. By 1985, the first intraoral scanner had become commercially available and was used in laboratories to make precise restorations. With the advent of the first digital scanner, dentistry has received a wonderful alternative to traditional casts. Although the scanners of the 80s are far from the modern versions we use today, digital technology has continued to evolve over the last decade, creating scanners that are faster, more accurate and smaller than ever before.

Today, intraoral scanners and CAD/CAM technologies offer simpler treatment planning, a more intuitive workflow, simplified learning curves, improved case acceptance, provide more accurate results and expand the types of treatment available. Unsurprisingly, more and more dental practices are realizing the need to enter the digital world — the future of dentistry.

How do intraoral scanners work?

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The intraoral scanner consists of a portable camera, a computer and software. A small smooth stick is connected to a computer on which special software is installed that processes the digital data received by the camera. The smaller the scanning wand, the more flexibly it is able to penetrate deep into the oral cavity to obtain accurate and accurate data. The procedure is less likely to cause a gag reflex, which makes the scan more comfortable for patients.

First, dentists insert a scanning wand into the patient's mouth and gently move it over the surface of the teeth. The wand automatically fixes the size and shape of each tooth. The scan will only take a minute or two, and the system will be able to produce a detailed digital impression. (For example, the Launca DL206 intraoral scanner takes less than 40 seconds to fully scan the dental arch). The dentist can view images in real time on a computer, which can be enlarged and manipulated to improve detail. The data will be transferred to the laboratory for the manufacture of any necessary devices. Thanks to this instant feedback, the whole process will become more efficient, which will save time and allow dentists to diagnose more patients.

What are the advantages?

Advanced patient scanning capabilities.

Digital scanning significantly reduces the discomfort of patients, since they do not have to endure the inconveniences and discomfort associated with traditional casts, such as unpleasant impression spoons and the possibility of a gag reflex.

Time saving and fast results

The time required for treatment is reduced, and scan data can be immediately sent to the dental laboratory using software. You can instantly contact the dental laboratory, reducing the number of alterations and reducing processing time compared to traditional practice.

Increased accuracy

Intraoral scanners use the most advanced three-dimensional imaging technologies that capture the exact shape and contours of teeth. It allows the dentist to obtain better scan results and clearer information about the structure of patients' teeth, as well as to carry out accurate and appropriate treatment.

Better patient education

This is a more direct and transparent process. After a full scan of the dental arch, dentists can use 3D imaging technology to identify and diagnose dental diseases by providing a high-resolution magnified image and digitally sharing it with patients on the screen. By seeing the condition of their oral cavity almost instantly in the virtual world, patients will be able to communicate effectively with their doctors and are more likely to move forward with a treatment plan.

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Is it easy to use intraoral scanners?

The scanning experience varies from person to person, according to many dentists, it is easy and convenient to use. To implement an intraoral scanner in dental practice, you just need some practice. Dentists with experience and enthusiasm for technological innovation can easily master a new device. For those who are used to traditional methods, their use may seem a bit complicated. However, do not worry. Intraoral scanners vary depending on the manufacturer. Vendors will offer scanning guides and tutorials that will show you how best to scan in a variety of situations.

This device is necessary for intraoral scanning in order to obtain a real-time digital impression of one tooth or the entire row, as well as photographs of soft tissues.

It is used in:

Orthopedics instead of the classic removal of individual jaw casts. It allows you to manufacture prosthetic structures with an accuracy of up to hundredths of a millimeter: bridges, crowns, veneers, inlays.

Implantology for diagnosis before surgery for the installation of dental implants and the manufacture of surgical templates (a special matrix that ensures accurate and atraumatic implantation).

Orthodontics for a detailed study of the clinical picture, making the most accurate diagnosis, and manufacturing orthodontic structures. Comfortable

Usually, an impression for the manufacture of an orthopedic structure is made as follows: the impression spoon is filled with silicone, after which the patient must bite it and hold it for 6-7 minutes until the impression mass hardens. This is not the most pleasant procedure, especially for patients with an increased gag reflex. During the extraction of the silicone impression, the patient also experiences discomfort.

Our clients deserve the best, they no longer need to endure discomfort during the removal of the impression. The intraoral scanner allows you to quickly (scan the entire arc takes up to 2 minutes) and comfortably (no unpleasant sensations) take a digital impression.

High precision

Very often, voids and bubbles appear on the casts in the most important places. As a result, the impression model turns out to be inaccurate and the dental technician returns it for reshaping. This delays the treatment process. The patient is wasting time because he needs to come to the clinic again. Intraoral 3D scanning allows you to obtain a digital impression without errors. If the doctor sees digital pores, glare, or areas with incomplete scanning in the image, he additionally performs a local additional scan. Quickly

Previously, patients had to wait up to 2 weeks for a dental technician to make a prosthesis. Thanks to intraoral 3D scanning, the whole process will take several days.

The purpose of this in vitro study was to study the effect of eight CAD-CAM restoration materials, as well as auxiliary tools, on the accuracy and time of scanning.

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Materials and methods

The accuracy of scanning of artificial crowns made of hybrid ceramics, tetragonal zirconium dioxide stabilized with 3 mol % yttrium, zirconium dioxide partially stabilized with 4/5 mol% yttrium, Co-Cr, plastics, lithium disilicate and feldspar ceramics under conditions of using powder-based, liquid-based or non-powder-based aids, as well as the effect of metal restorations was analyzed the accuracy of scanning other crowns in the dental arch and the scanning time of complete dental arches.

Results

Without the use of auxiliary tools, there was a statistically significant difference in the accuracy of scanning various restoration materials. When using a powder or liquid-based scanning aid, there was no statistically significant difference between the groups. For each restoration material, in the absence of auxiliary tools, the scanning accuracy was significantly lower than when using them. The presence of a Co-Cr crown did not affect the scanning accuracy of other restorations in the dental arch. When using an auxiliary tool, the scanning time is significantly increased.

Conclusion

Powder-based or liquid-based aids increase the accuracy and efficiency of intraoral scanning of CAD-CAM restoration materials.

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