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Short Communication

Dentist Intraoral Scanner Technology Development

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DESCRIPTION

Impressions with IOS (intraoral scanner) and CAD/CAM (computer-aided design and manufacture) technologies were created for dental practice to solve the challenges associated with traditional procedures. Optical IOS devices have become more common in the recent decade, and they are based on a variety of technologies, the choice of which may have an impact on clinical application. Traditional impression techniques have been utilized to document the three-dimensional geometry of dental tissues since the seventeenth century. However, volumetric changes in impression materials and growth of dental stone appear to be error-prone, necessitating the use of a top-notch dental laboratory [1]. Impression using IOS (intraoral scanner) was developed for dental practice to solve these challenges. The IOS device was introduced into dental practices at the same time as CAD/CAM (computer-aided design and manufacturing) technology, which provided various benefits to dentists. Nowadays, IOS and CAD/CAM make treatment planning, case acceptance, laboratory communication, operative time, storage requirements, and treatment times easier.

IOS technologies

The IOS system consists of a handheld camera (hardware), a computer, and software. The purpose of IOS is to precisely record an object's three-dimensional shape. The open STL (Standard Tessellation Language) or locked STL like is the most extensively used digital format. This format, which depicts a series of triangulated surfaces defined by three points and a normal surface, is already in use in many industrial domains. Other file formats, on the other hand, have been created to record the colour, transparency, and texture of dental tissues. Regardless of the imaging technique used by IOS, all cameras require the projection of light, which is subsequently recorded as separate photos or video and then assembled by the software when the POI is recognized (points of interest).

Clinical impact of IOS technologies

According to recent studies, the digital impression technique is more comfortable and faster than the traditional technique. For novice second-year dentistry students, practitioners found that implant imprint with IOS using confocal technology was a more efficient procedure with less preparation and retake time than conventional implant impressions [2]. IOS employing confocal or AWS was considerably preferred over conventional impression in two other clinical investigations. It was more time efficient, pleasant, and patient friendly for implant impression.

Each scanner also has its own technology and captors, which affect the scan head's size and weight [3]. For example, confocal and AWS technologies are primarily hardware-based and require a large number of components. Clinical differences have been documented between IOS that use the same technology; subjects chose Trios over iTero, despite the fact that both are based on confocal technology. This is due to the time it takes for operators to become accustomed with the ergonomics and software of each IOS, which might be slow at first. Indeed, utilizing two IOS with confocal technology, a study compared experience curves between initial scan and recurrent scans. Despite the fact that both scanners' scanning times decreased with training, Trios' average scanning time was always shorter than iTero's. Furthermore, software, technology, and scanning path all appear to influence handling time during digital impressions, which has been observed to range between 4 and 15 minutes with no apparent determining factor.

Accuracy of IOS technologies

Trueness and precision are two measuring methods used by ISO 5725 to describe accuracy [4]. The technique of measurement influences the claimed trueness and precision for IOS, as it is affected by factors such as the operator, the equipment utilized and calibration, the period between measurements, and the environment (temperature, humidity, etc.). However, due to the quality of the references utilized and the measurement technique used, the methods for calculating precision and trueness for IOS are limited. *In vitro,* for example, a plaster model scan using extra oral technology is currently defined as the reference, but it's difficult to compare these results with *in vivo* files, where the reference is a plaster scan obtained from an indirect physicochemical impression (i.e., likely to contain inaccuracies). Furthermore, some research examined the distances between STL generated from a plaster model and those manually generated with IOS, while others utilized an algorithm to align

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two distinct files and measure the distance between them. However, the first strategy's measuring procedure is extremely operator dependent, whereas the alignment algorithm necessitates subjective manual operator suppression of incorrect locations, such as the tongue or soft tissues, in order to avoid false alignment. Following that, more research is needed to develop standardized and comparable methodologies for measuring IOS accuracy.

CONCLUSION

IOS appears clinically appropriate for common practice, regardless of the technology utilized, after an objective review of the research. Each technology must be assessed in the context of the practitioner's specific activity, requirements, and expectations. Any practitioner who wants to have a successful clinical approach during the scanning of prepared teeth needs to comprehend the IOS technology. Because IOS is currently dependent on confocal technology, alternatives such as software-based technologies are being researched, particularly for ergonomic considerations, patient comfort, and manufacturing cost.

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