

Photogrammetry vs IOS:

Capturing Full Arches in the 3D Realm

by Dr. Isaac Tawil

In the realm of digital dentistry, accurately capturing a full arch as a 3D model presents challenges that often stem from human error. Among the preferred methods for achieving this are Photogrammetry and Intraoral 3D scanning, both offering impressive results albeit with their own set of pros and cons and associated costs.

Photogrammetry

Photogrammetry involves obtaining precise 3D coordinate measurements by analyzing photographic images and electromagnetic radiation patterns. This method typically requires fiducial markers placed within a patient's mouth (Fig.1), with detailed images captured by either a photogrammetric machine or high-end DSLR camera. However, reliance on intraoral scanners is still necessary to capture tissue surfaces and bite relationships accurately. Factors such as improper camera settings or inadequate lighting can compromise the quality of the 3D model, underscoring the importance of meticulous setup. Moreover, the cost of dental photogrammetry systems can range from \$35,000 to over \$50,000 USD, making it a significant investment despite its potential benefits. Due to its extraneous nature, photogrammetry cannot provide a true intraoral full arch 3D rendering.



Fig. 1: Fiducial markers placed within a patient's mouth.



Fig. 2: Intraoral scan data for all-on-X implant case.

Intraoral Scanning (IOS)

In contrast, intraoral scanners directly capture digital impressions of the oral cavity using projected light sources. This method promises high precision and efficiency, eliminating the need for traditional physical impressions (Fig.2). However, challenges arise in capturing full-arch data comprehensively, particularly in anatomically complex areas like the posterior regions of the maxilla and mandible. The direct line-of-sight required for intraoral scanning can be obstructed by structures such as the tongue or cheeks, potentially leading to incomplete digital impressions.

Comparison and Limitations

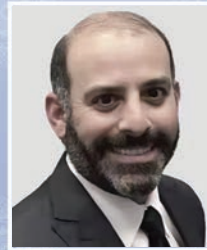
While intraoral scanners excel in capturing detailed sections of the oral cavity, they struggle with capturing picture perfect imaging due to the fact that they capture the image by creating polygon data. In contrast, photogrammetry, despite its higher

cost and external setup, can capture comprehensive data of multiple implants simultaneously, thereby offering more accurate relationships between implants in 3D space. But unfortunately, photogrammetry uses an extra oral approach, creating a demand for further intraoral imagery that can't be obtained without the use of an intraoral scanner.

Conclusion

Both intraoral scanners and photogrammetry systems serve specific roles in digital dentistry. Intraoral scanning simplifies the process of obtaining 3D images of full arches, albeit with limitations in certain areas. Photogrammetry offers enhanced accuracy in implant positioning but requires a larger financial investment and specialized setup. Choosing between the two depends on the specific needs and budget constraints of dental practices. As technology advances, costs may decrease, potentially leading to integrated solutions that combine the strengths of both methods into a single, more accessible unit.

In conclusion, while both technologies continue to evolve, their current applications cater to distinct needs within the dental community. The choice between intraoral scanning and photogrammetry ultimately rests on the practitioner's preferences and the specific demands of their practice. ■



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