Scan Bodies in Dental Implants: A Review

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Abstract

Intraoral scanners (IOS) have become integral to modern dental implantology, providing a digital alternative to traditional impression techniques for implant restorations. A critical component in the digital workflow for implant-supported prostheses is the use of scan bodies—transitional components placed on implants that allow the precise capture of implant positions in a digital format. This review explores the role of scan bodies in dental implantology, the accuracy and efficiency of intraoral scanners in capturing scan bodies, their materials and design considerations, and the current challenges and future perspectives in the field.

Introduction

Digital dentistry has revolutionized various aspects of clinical practice, including implantology.[1] The adoption of digital workflows in implant prosthodontics has streamlined procedures, improved accuracy, and enhanced patient outcomes. Central to this digital workflow is the intraoral scanner (IOS), which captures digital impressions directly in the patient's mouth. When it comes to dental implants, capturing the precise position of the implant is critical. This is achieved through the use of scan bodies, which are attached to the implant or implant analogs and serve as a reference for the digital impression[2]. This review will focus on the use of scan bodies in dental implantology, specifically how intraoral scanners interact with these components to deliver precise digital data for implant-supported restorations.

Manufacturer	Dentsply	DESS	Core-3D	Elos	NT-Trading	Medentika	Biohorizons	Zimmer
Implant System	Most major	Most major	Most major	Most major	Most major	Most major	Biohorizons	Zimmer
Scanner	All	All	All	All	All	All	Trios	All
CAD software	Proprietary	All major	All major	All major	All major	All major	3shape	3shape (Proprietary)
Body Material	PEEK	PEEK	PEEK	PEEK	PEEK	Ti	PEEK	PEEK
Mating Surface	Metal	PEEK	PEEK	Ti	Metal	Ti	PEEK	PEEK
Shape/Geometry	Flat cylinder with ball top	Cylinder with triangular region	Tapered flat cylinder	Cylinder with angled flat surface	Rectangular	Flat cylinder	Cone	Flat cylinder
Recommended Torque	Hand tighten	Hand tighten	Hand tighten	5 Ncm max	10 Ncm max	Hand tighten	Hand tighten	Hand tighten
Reusable	Yes, unlimited	Single use	10x for FPDs 20x single units	100x (max 2 years)	Single use	Yes, unlimited	Single use	Single use

Fig-1: Commercially available ISBs.

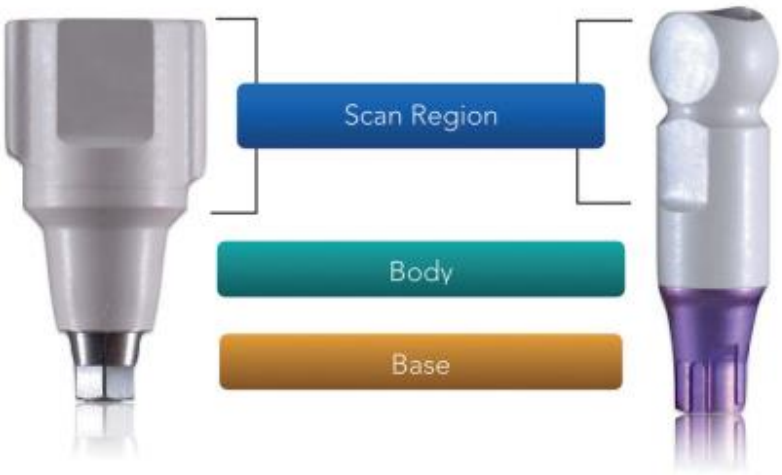

Fig-2: ISB has three components (dash) scan region, body, and base. ISB, intraoral scan body

1. Role of Scan Bodies in Digital Implantology[4]

Scan bodies are specifically designed components that are temporarily attached to the dental implant or implant analog during the scanning process. The scan body communicates the three-dimensional position and orientation of the implant within the patient's mouth to the CAD software used for designing the final restoration. They are critical in ensuring the accuracy of implant placement in the digital model, which is crucial for the proper fit, function, and esthetics of the final prosthesis (Andriessen et al., 2014).

2. Types and Designs of Scan Bodies

Scan bodies come in various shapes, sizes, and materials, depending on the implant system and the requirements of the clinical case. Commonly used materials include titanium, PEEK (polyetheretherketone), and resin. Each material has its advantages in terms of scanning accuracy and durability[5]:

- Titanium Scan Bodies: Known for their durability and biocompatibility but can create reflections and scanning artifacts, potentially affecting scan accuracy (Jemt & Lie, 2017).

-PEEK and Resin Scan Bodies: Offer a matte surface finish, which is less reflective and easier to capture accurately with intraoral scanners. They are also lightweight and less likely to cause patient discomfort during the scanning process (Nickenig et al., 2016).

The design of the scan body typically includes geometric features such as flat surfaces, grooves, or notches that allow the IOS to capture the precise location and orientation of the implant in three dimensions.

3. Accuracy of Intraoral Scanners in Capturing Scan Bodies[6]

The accuracy of intraoral scanners in capturing scan bodies is pivotal for the success of digital implant impressions. Studies comparing digital and conventional impression techniques have found that digital impressions using IOS and scan bodies can achieve a high level of accuracy and repeatability for single and multiple implant cases (Mangano et al., 2017; Lee et al., 2018). Factors influencing the accuracy include:

- Scanner Technology: The precision of IOS technologies, such as confocal microscopy, structured light, and triangulation, plays a significant role in capturing accurate details of scan bodies.

- Scanning Protocol: The scanning protocol, including the angle and distance of scanning, affects the accuracy of the digital impression. Multiple passes and a systematic approach are often required to capture all relevant details (Güth et al., 2017).

4. Clinical Application and Workflow

The clinical workflow for using intraoral scanners with scan bodies typically involves the following steps:

1. Attachment of Scan Bodies: After the implant is uncovered, the appropriate scan body is selected and attached to the implant fixture.

2.Intraoral Scanning: The intraoral scanner captures the scan body and surrounding soft tissues. Real-time visualization helps ensure that all surfaces of the scan body are captured accurately.

3.Digital Impression and Data Processing: The digital impression is processed to create a virtual model. The scan body is identified by the software, and its position is used to define the implant's location.

4. CAD Design and Fabrication: The digital model is used in CAD software to design the final prosthetic restoration. The design is then sent to a milling machine or 3D printer for fabrication.

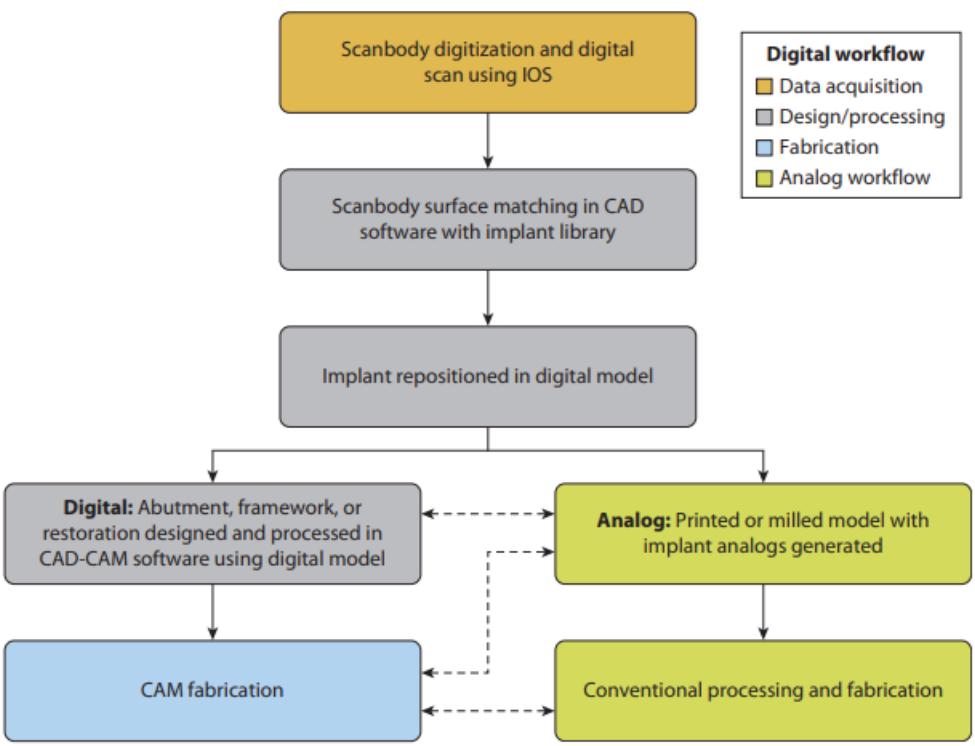

Fig-3: Workflow with ISBs can be either completely or partially digital depending on situation. CAD-CAM, computer-aided design and computeraided manufacturing. ISBs, intraoral scan bodies.

5. Advantages of Using Intraoral Scanners and Scan Bodies

- Improved Accuracy and Precision: Digital impressions with intraoral scanners eliminate the risk of errors associated with conventional impression materials, such as distortion and shrinkage (Patel et al., 2018).

- Enhanced Patient Comfort: Digital impressions are more comfortable for patients, especially those with a strong gag reflex or limited mouth opening (Mangano et al., 2019).

- Efficient Workflow: The digital workflow reduces the number of clinical steps and visits, leading to quicker turnaround times for the final restoration.

- Real-Time Feedback: Intraoral scanners provide immediate feedback, allowing clinicians to verify that all necessary information has been captured accurately.

6. Challenges and Limitations

Despite the advantages, there are challenges and limitations associated with using intraoral scanners and scan bodies[7]:

- Learning Curve: There is a learning curve for clinicians to become proficient in digital impression techniques, including proper scanning protocols and software manipulation (Edelhoff et al., 2019).

- Scanner Limitations: Intraoral scanners may have difficulty capturing scan bodies in the presence of blood, saliva, or reflective surfaces, which can lead to inaccuracies (Zaher et al., 2019).

-Edentulous Arches: Scanning completely edentulous arches or multiple implants in a row can be challenging due to the lack of distinct anatomical landmarks, which can lead to inaccuracies in the digital impression (Chia et al., 2017).

7. Future Directions and Innovations

The future of intraoral scanning and scan bodies in implant dentistry is promising, with ongoing research and technological advancements aimed at improving accuracy and efficiency. Innovations include:

-Enhanced Scanner Technology: Newer generations of intraoral scanners are expected to offer better accuracy, faster processing times, and improved ergonomics (Resende et al., 2021).

-Integration with Artificial Intelligence (AI): AI-driven software enhancements may improve the accuracy of digital impressions and automate the identification of scan bodies (Van der Meer et al., 2019).

- Advanced Materials: Development of new materials for scan bodies that are more durable and offer better scanning properties could further enhance the precision of digital impressions (Wang et al., 2020).

Conclusion

The use of intraoral scanners and scan bodies in dental implantology represents a significant advancement in digital dentistry, offering numerous advantages over conventional impression techniques. While there are challenges to be addressed, particularly regarding scanner accuracy and operator proficiency, the benefits of improved patient comfort, workflow efficiency, and clinical outcomes make this technology an essential component of modern prosthodontics. Continued research and innovation will likely expand the capabilities and applications of intraoral scanners in implant dentistry.

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