Egyptian Prosthodontic Association
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Edentulous Areas Scanning
Overcoming the Challenge for Implant Oral Rehabilitation

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Challenges during scanning edentulous areas

Multiple clinical factors have been proven to influence the accuracy of intraoral scanners (IOS) when scanning edentulous areas in tooth-supported or implant-supported implant prostheses (especially in fully edentulous rehabilitation cases), such as intraoral scanner brand, ambient light, scan body types, inter -implant distance, scanning range, characteristics of the mucosa, movable mucosa, and scanning pattern (1-3).

Various studies have explored the accuracy of intraoral scanners in complete arch implant rehabilitation, but there is no clear consensus. Some research suggests that intraoral scanners can be as accurate as conventional impression techniques while other studies indicate that conventional methods are still more precise (4-6).

This discrepancy or variation in accuracy results may be due to the 3D images produced by intraoral scanners being created through a series of image stitches, which can accumulate errors over longer scanning paths. Additionally, the lack of a stable identification marker on the mucosal surface can further impact the accuracy of intraoral scanning (7-8).

Furthermore, Previous studies have proven that compared with partial dental arch scans, intraoral scans with larger scan areas have greater deviation (7,9). Scanning a large area, such as full-arch implant-supported restorations, can be more challenging for IOS because digital impressions rely on the alignment of multiple images and involve complex software algorithms (10).

This deviation or variation in accuracy for IOS affects the success of fixed prosthodontics, especially in cases of implant-supported restorations. The long-term success of dental implants relies on the way the framework passively fits. misfit may lead to bone loss if there is a lack of a passive fit, as it further leads to stress concentration and improper force distribution at the bone-implant interface (11).

Solutions for scanning the edentulous areas for implant-supported cases.

1- Using an auxiliary geometric device (AGD).

AGDs were introduced to address the errors that can occur when scanning long inter-implant distances (12,13).

AGD can be fabricated by 3d printing (Figure 1&2), it aims to provide anatomical landmarks that are missing that could be simple form or tooth-like, which aid in improving the accuracy of the stitching process upon using IOS (13). A recent study (2024) showed that AGD helps to increase the accuracy of IOS for scanning implant-supported cases with large edentulous areas (14).

2- Photogrammetry Scanning.

Photogrammetry technology is a method of making precise measurements by using reference points in photographs (15). The photogrammetry system overcomes the limitations of intraoral scanners in obtaining the location of implant abutments in complete-arch implant rehabilitation.

The photogrammetry system takes all measured data in each picture and generates director vectors of the exact

position of the scan bodies in relation to one another with the help of reference points. This method makes it possible to calculate the locations of scan bodies without superimposing pictures, which potentially ensures greater accuracy. Additionally, the photogrammetry system has multiple cameras with a larger scanning range and faster scanning speed (16).

Scan body forms in photogrammetry systems are modified to ease the process of scanning calibration (Figure 3 & 4), especially after introduction of commercial IOS based on photogrammetry method.

The innovations in scanning methods aim to help in overcoming challenges of edentulous areas scanning, without the aid of additive devices. Accuracy of digital impression allows for long term success of implant supported restorations , without inducing stresses on implant fixtures (11).

Fig.1: Auxillary geometric device (AGD) designed to be 3d printed (12).

Fig.2: AGD designed with tooth-like landmarks (13).

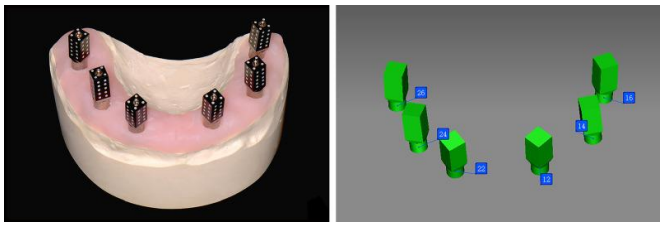

Fig.3: scan body forms for photogrammetry scanning systems (16).

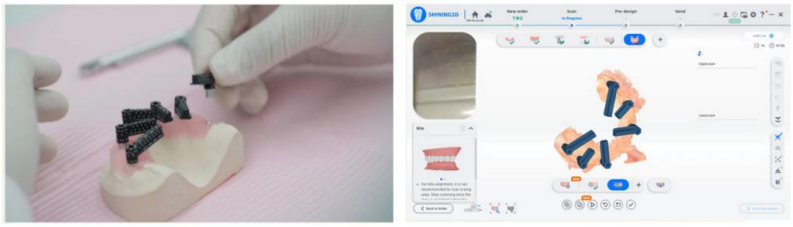

Fig.4: Scan body for intraoral photogrammetry scanner. (Courtesy Shining 3D Tech co., China)

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