



THE COMPLETE ARCHITECTURAL DIGITAL WORKFLOW — THE DENTAL AVATAR CONCEPT

Isaac D Tawil DDS MS

DISCLOSURE

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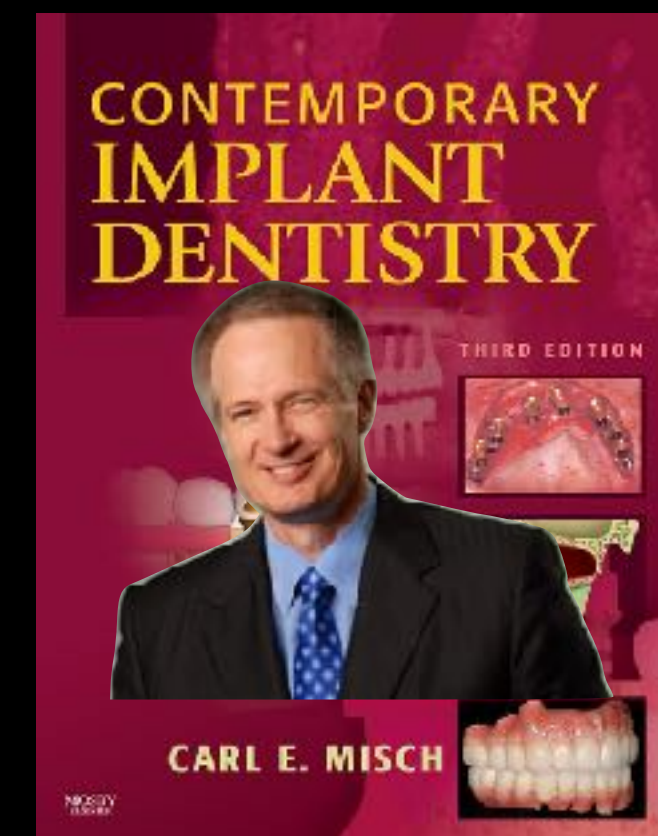
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Company name(s) **CLINICAL DIRECTOR**

SHINING 3D
DENTAL

FULL ARCH PROSTHETIC



RP4/RP5

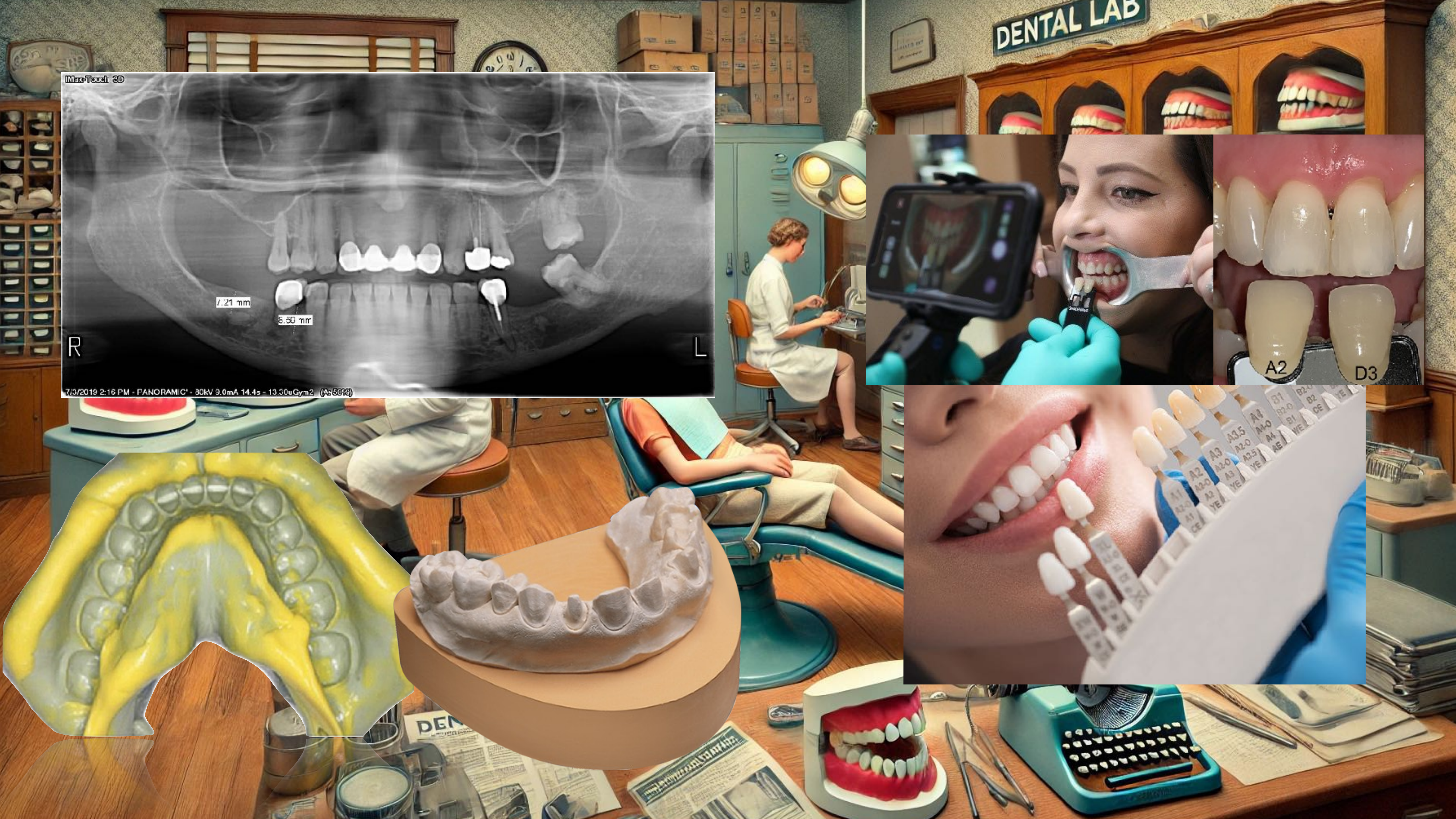


**Determine our
full arch prosthetics**

Treatment Planning

Communication

Restoratively Driven Treatment Planning



Max-Touch 3D

7.21 mm

8.59 mm

R

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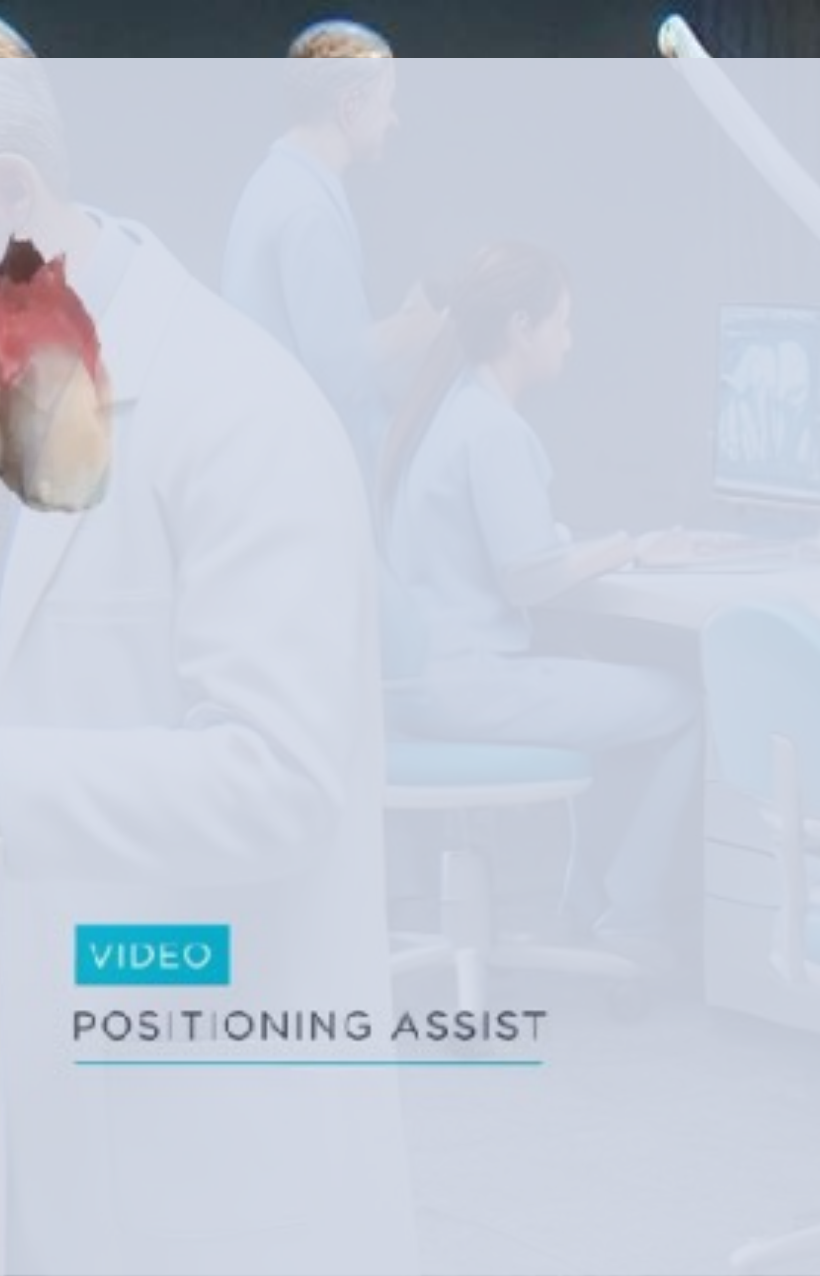
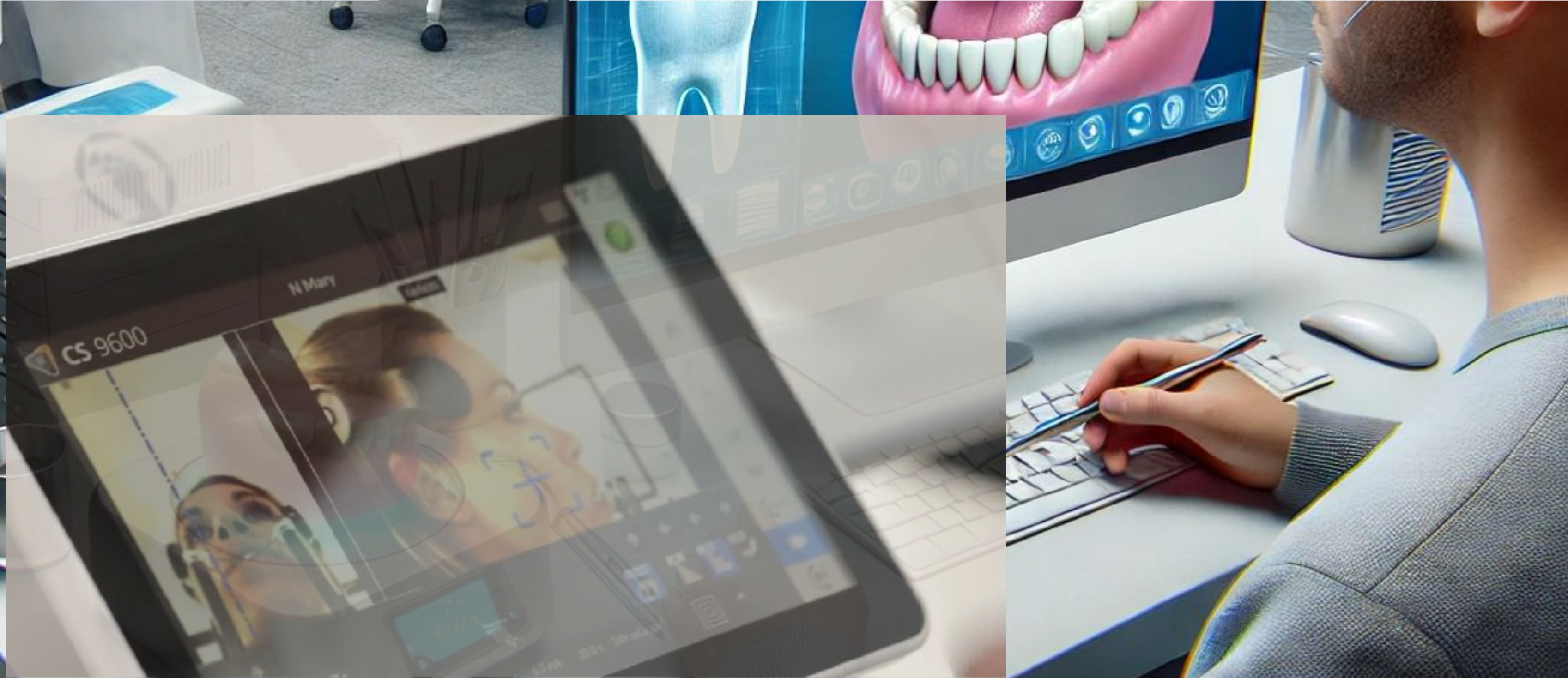
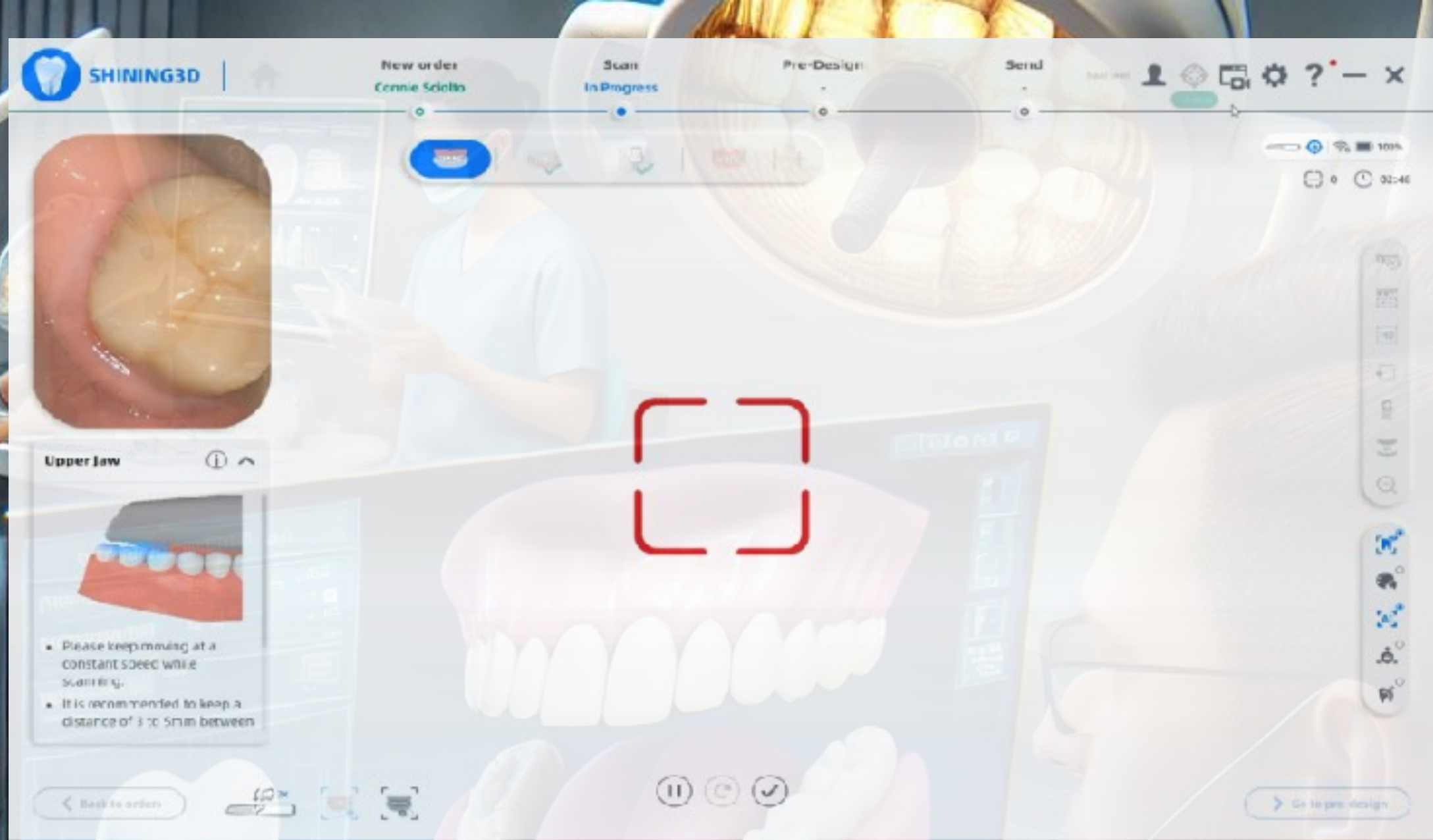
7/3/2019 2:16 PM - PANORAMIC - 80kV 9.0mA 14.4s - 13.30uGym2 (A:50%)

DENTAL LAB

A2

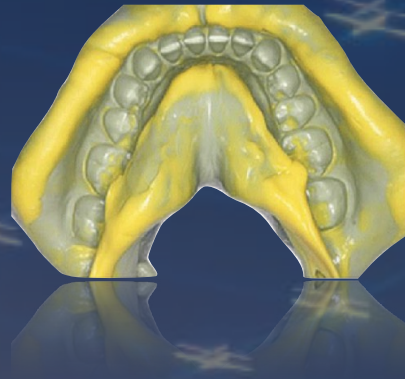
D3

DENTAL



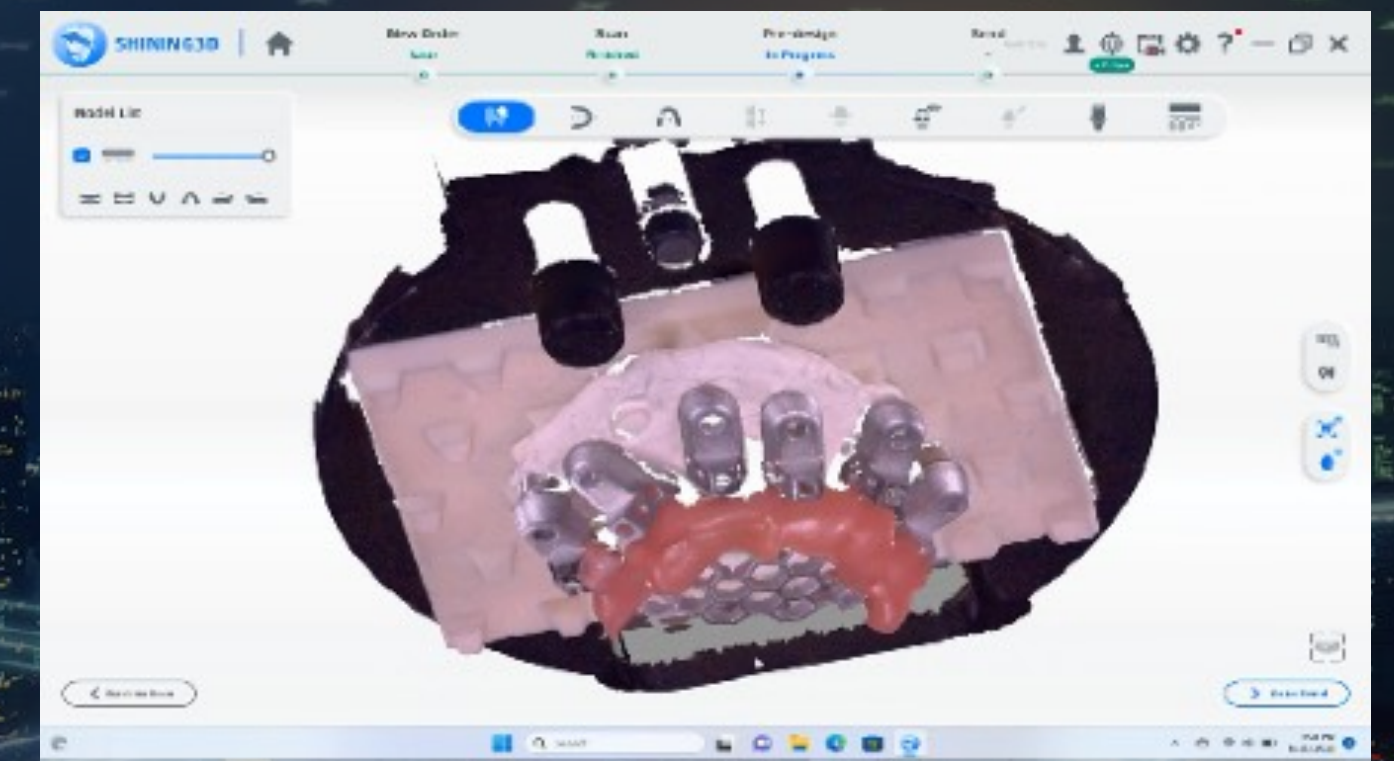
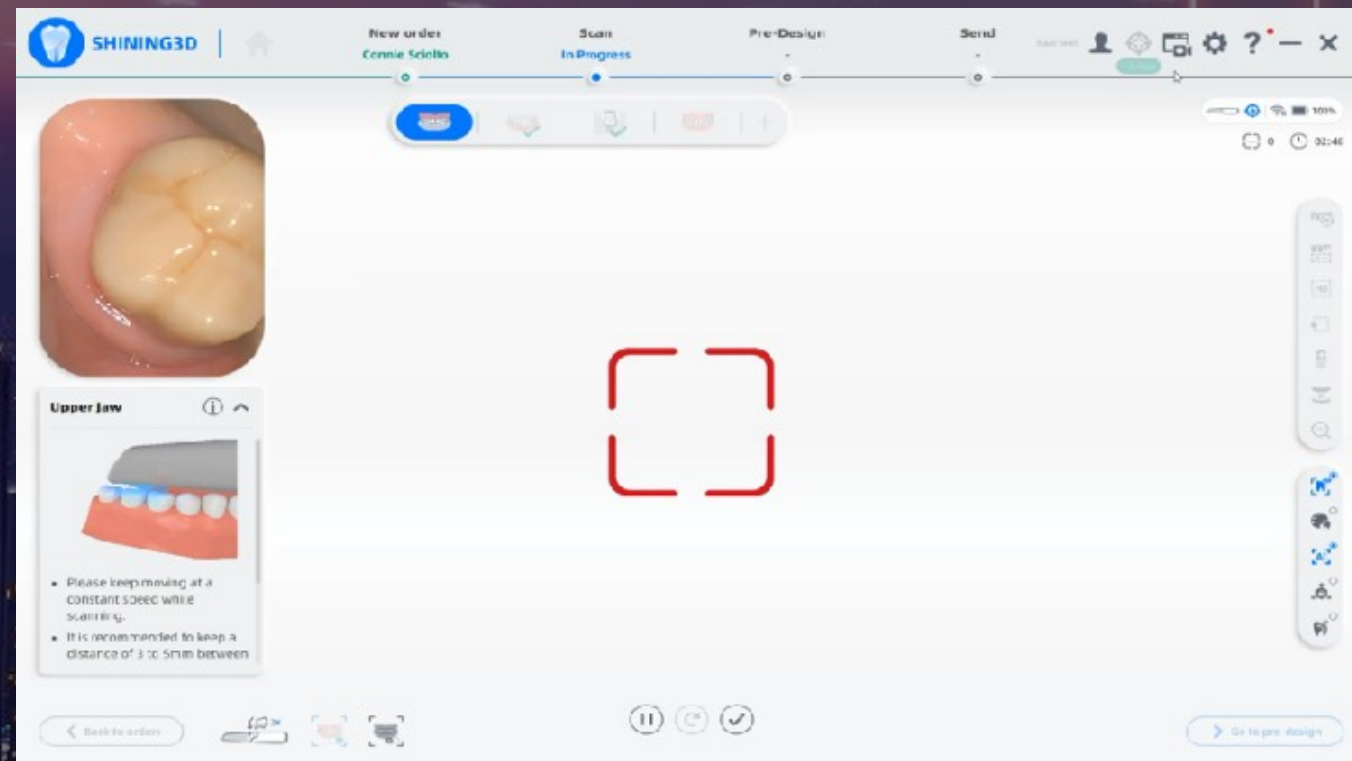
VIDEO
POSITIONING ASSIST





A N A L O G —————> D I G I T A L

The digital Handshake



井千の口口口ては井口チニク

$$5 \times 2 + 3 = 13$$
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[illegible]

ム・ナニヲシテハニテモナニコチクハ
マシ・ハニ見レキコチニビバるナニハ

[illegible][illegible]

POWELL-PYREB-NR 4475

[illegible]

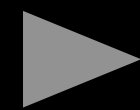
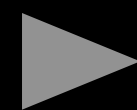
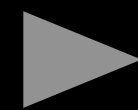
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五ノ子

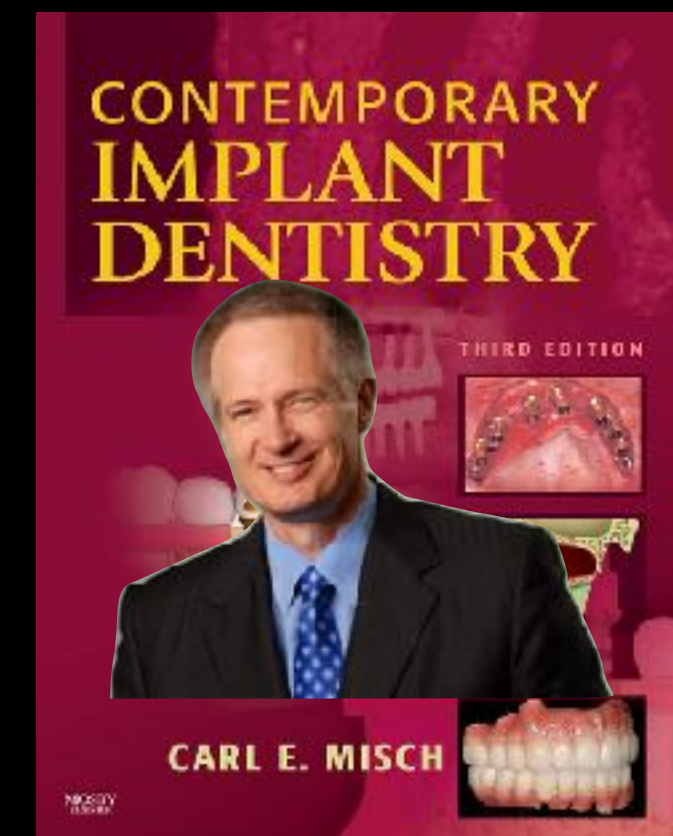
「兄8大」

「三つエロム」ムズコ「ミヤの」ムズキ

FULL ARCH PROSTHETIC



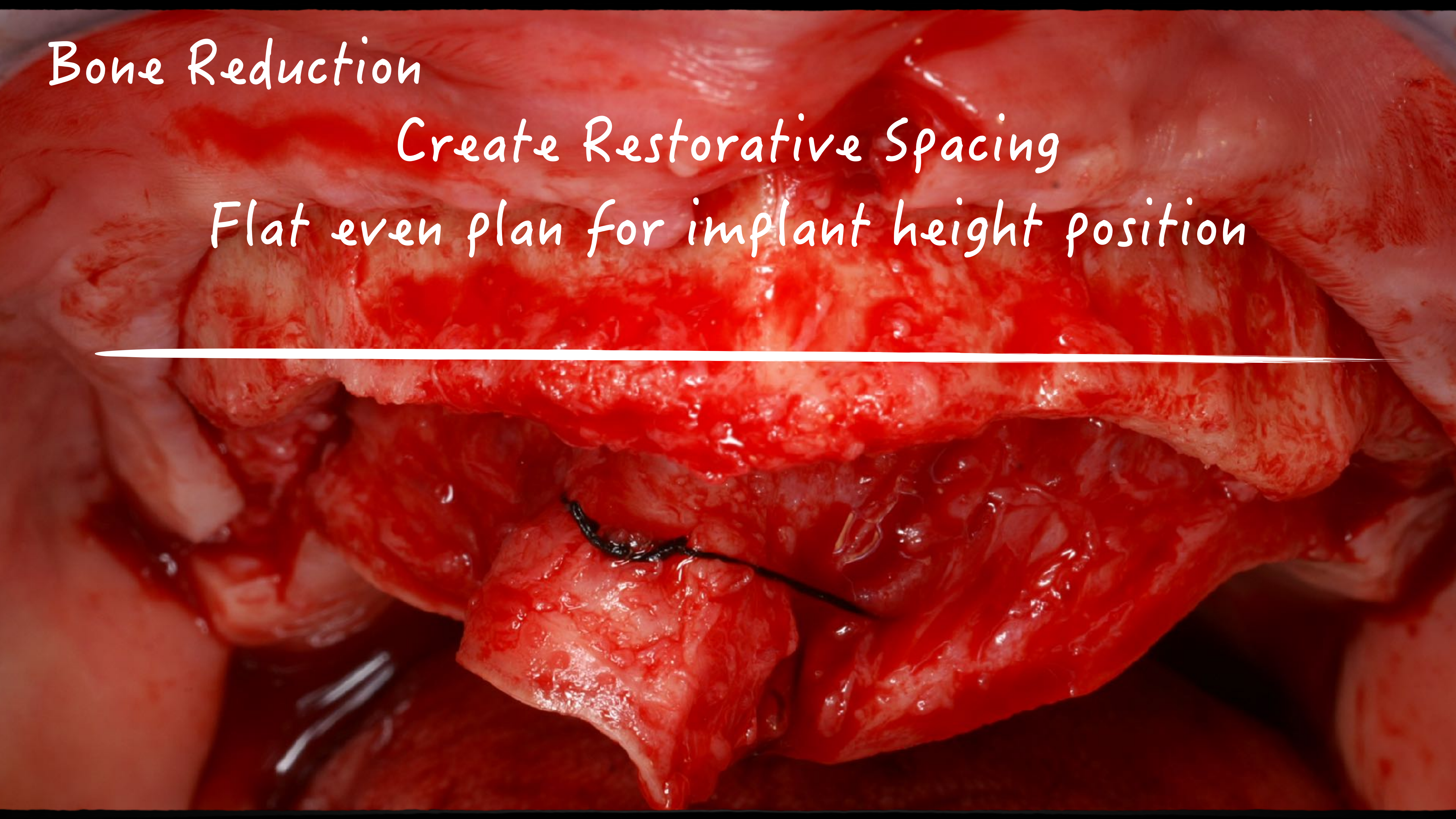
RP4/RP5



Bone Reduction

Create Restorative Spacing

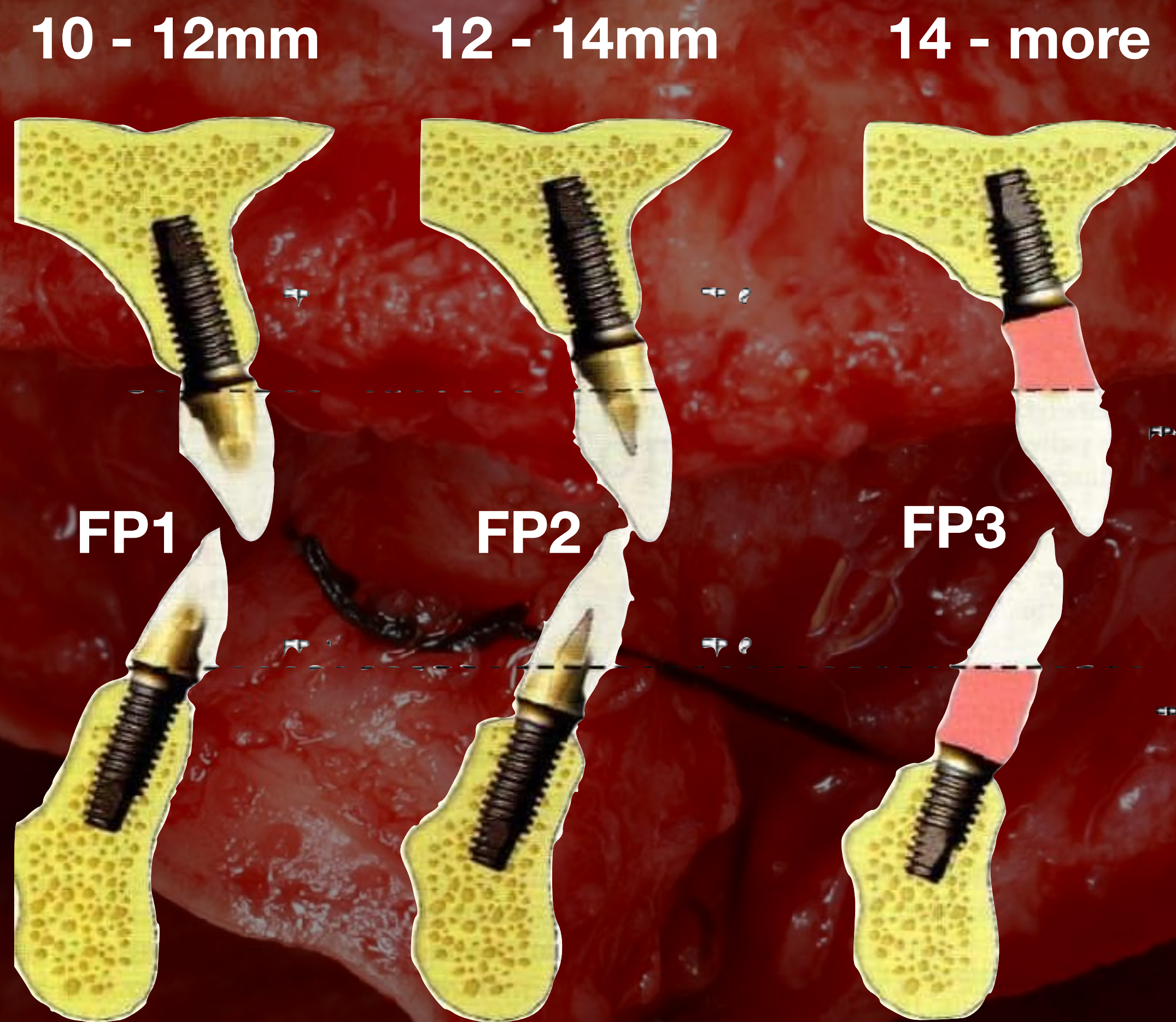
Flat even plan for implant height position



Bone Reduction - Material strength

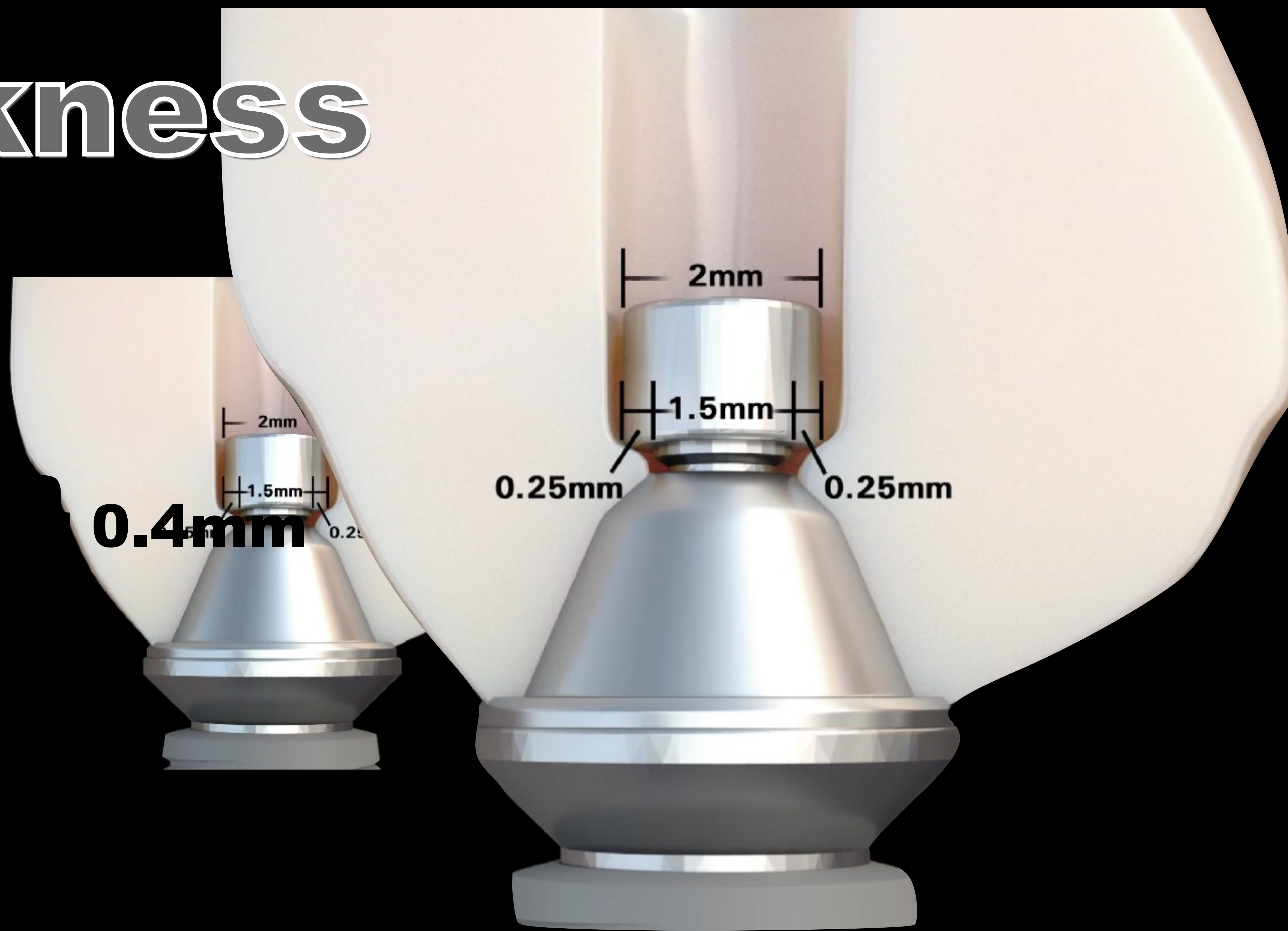
How much to reduce???

Create Restorative Spacing



Flat even plan for implant height position

Thickness



PROSTHETIC FAILURE



Metal-Free



**Direct
To MUA**



Multi Unit Abutment

Metal -Free

**METAL OCCUPIES SPACE
REQUIRING INCREASED
THICKNESS**

INTERMEDIARY STRUCTURE

Metal-Free

Direct To MUA

IMPLANTS

Fully Digital Full Arch?

Continued Advancements in Full-Arch Implant Restorations

INTRODUCTION

Full-arch, implant-supported reconstruction continues to provide viable solutions to restore and improve function, enhance aesthetics, and change the quality of life for our patients. All-on-X implant reconstruction has been the focus of new advancements and technical innovations. In this current edition, the authors continue the journey, navigating through new developments that impact the full-arch analog and digital workflows. Our previous articles introduced several elements to aid the clinician in both the surgical and restorative phases of full-arch replacement, including the use of CBCT-guided surgical applications¹ and how they have greatly improved the assessment for implant placement relative to the desired restorative positions for preliminary and definitive restorations while also reducing implant complications. The authors have previously described an ancillary surgical protocol that utilizes autologous, such as an autogenous solution² to bone grafting. This has greatly enhanced healing and long-term aesthetic stability and provided ample graft volume with a significantly reducing biomaterial costs. Subsequent publications also reported on improving the restorative time and treatment outcomes utilizing 3D technology³ and employing small hole technology (SHT) to enhance the physical integrity and anatomy of milled or 3D printed provisional restorations⁴ and improving inter-arch alignment and occlusion. The goal of these articles has been to improve time, efficiency, costs, and long-term results for the betterment of clinicians, laboratory technicians, and patients. This latest article endeavors to provide updates in the acquisition of data necessary to complete the restorations with an emphasis on achieving improvements in conventional full-arches for monolithic restorations that incorporate multi-unit abutments.



Dr. David J. Tarnai, DDS



Dr. Scott B. Gans, DMD

requiring additional applications to achieve fully digital solutions.

All-on-X, fixed surgical and restorative protocols require the placement of 4 or more implants with a favorable anterior-posterior spread to achieve the necessary long-term support. Capturing the position of these implants with accurate cross-sectional scanning, especially in the mandible, has been one of the major struggles for clinicians and dental laboratory technicians to overcome. IOS technology requires a sterile environment for data to be stitched and captured accurately. Several techniques have emerged to aid the clinician in scanning these difficult environments, including proper retraction; salt water rinses; and the use of protective caps. While the use of a protective cap is a common technique, it is not always practical. The use of a protective cap with a clear window for the scanner to capture the implant area is a more practical solution. The authors have previously described an ancillary surgical protocol that utilizes autologous, such as an autogenous solution² to bone grafting. This has greatly enhanced healing and long-term aesthetic stability and provided ample graft volume with a significantly reducing biomaterial costs. Subsequent publications also reported on improving the restorative time and treatment outcomes utilizing 3D technology³ and employing small hole technology (SHT) to enhance the physical integrity and anatomy of milled or 3D printed provisional restorations⁴ and improving inter-arch alignment and occlusion. The goal of these articles has been to improve time, efficiency, costs, and long-term results for the betterment of clinicians, laboratory technicians, and patients. This latest article endeavors to provide updates in the acquisition of data necessary to complete the restorations with an emphasis on achieving improvements in conventional full-arches for monolithic restorations that incorporate multi-unit abutments.

Data Acquisition

As the dental industry continues to strive for fully digital solutions, the development and improvement of intraoral data devices and acquisition technology has continued to evolve. Intraoral scanning (IOS) speeds and accuracies have become a viable solution for replacing direct analog impressions. Native IOS software applications now provide several impressive features that enhance and streamline the complete digital workflow. However, due to inherent logistical limitations, the difficulty and accuracy of IOS technology used for full-arch dental implant restorations has presented major obstacles

alternative workflows to aid in acquiring accurate intraoral data. Photogrammetry (PG) in dentistry is a relatively new development that has revolutionized capture and postulation analysis. PG is a diagnostic and research method using an external capture device with specific photogrammetric scanning abutments to acquire measurements from 2D digital images (Figures 2A and 2B). PG scans allow dental clinicians to acquire precise measurements of individual scan bodies (Figure 2C) secure to dental implants as they are in their natural state⁵ either at the time of surgical placement or after the implants are uncovered. While extremely accurate for recording the spatial positioning of the implants, PG does not acquire the topography of the soft tissue. Therefore, a second scan is required with an intraoral scanner. The IOS data can then be used to facilitate a virtual 3D model used to measure various parameters of the implant analogs.⁶ The software combination of these measurements can be used to measure and validate the correct positioning of implants and the alignment of a patient's occlusal axis, rise, clearance, and angle. The combination of IOS and PG data provides the CAD software designer with all of the necessary information to virtually create a provisional prosthesis or a final restoration to be 3D printed or CAM-milled. The advanced capability of this highly accurate technology is discussed on page 52.



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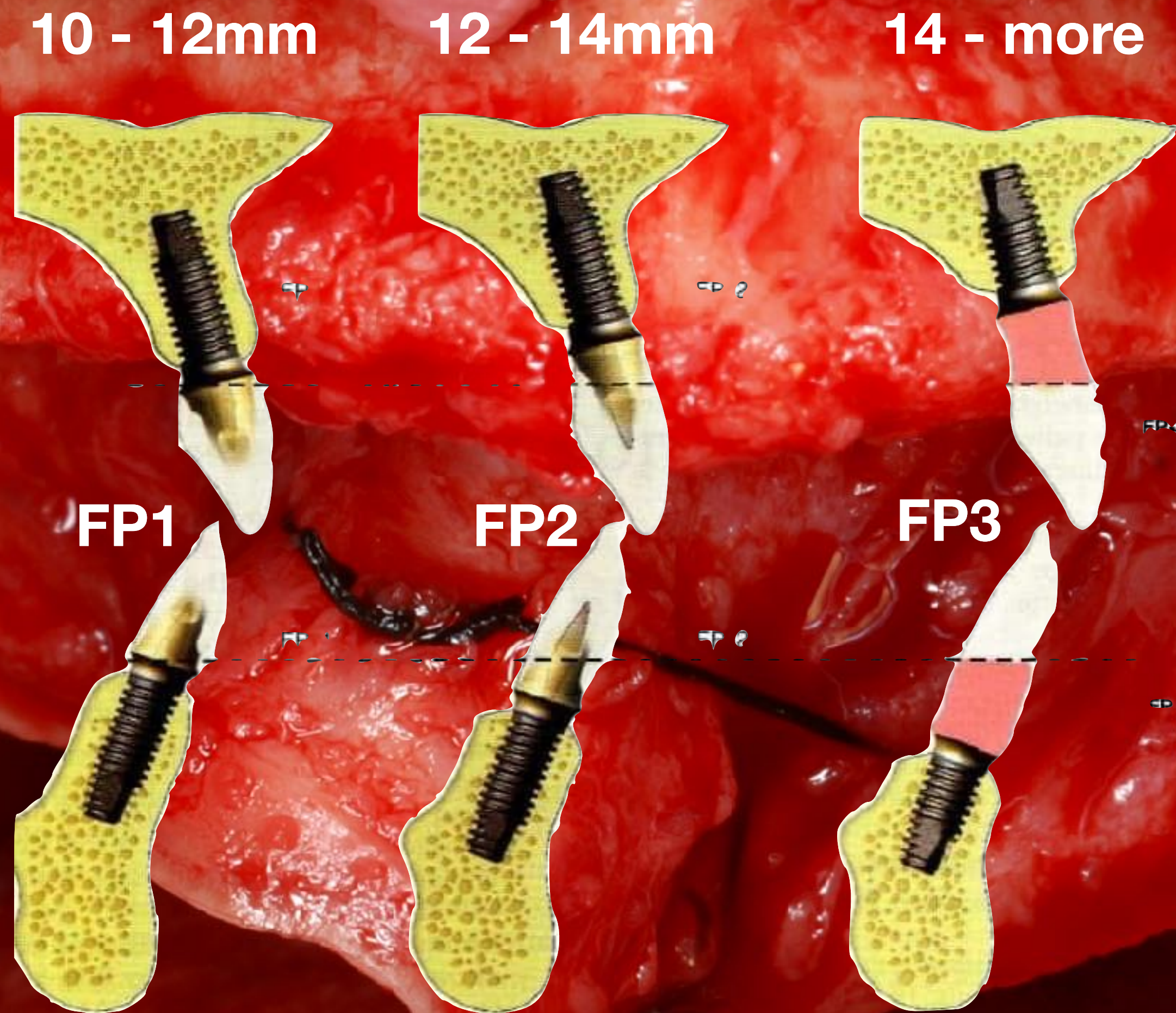
Metal-Free



Bone Reduction

How much to reduce???

Create Restorative Spacing



Flat even plan for implant height position

Transition Zone

Reestablish the transition zone



FACIAL ANALYSIS

Transition Zone

2D

PHOTOGRAPHY



Dental Photography

Facial measurements

Tooth measurements



Importance of facial height in Orthodontic treatment



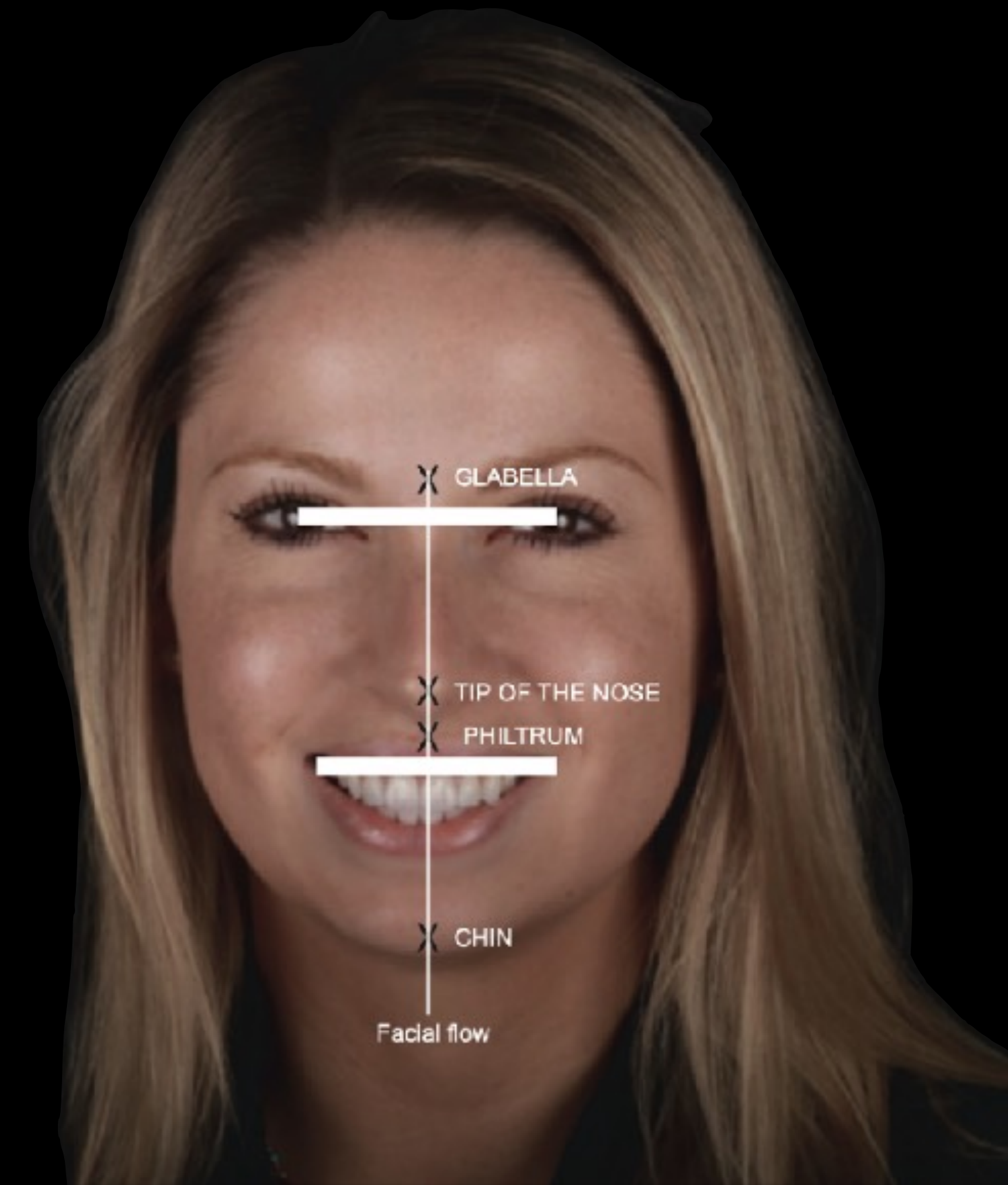
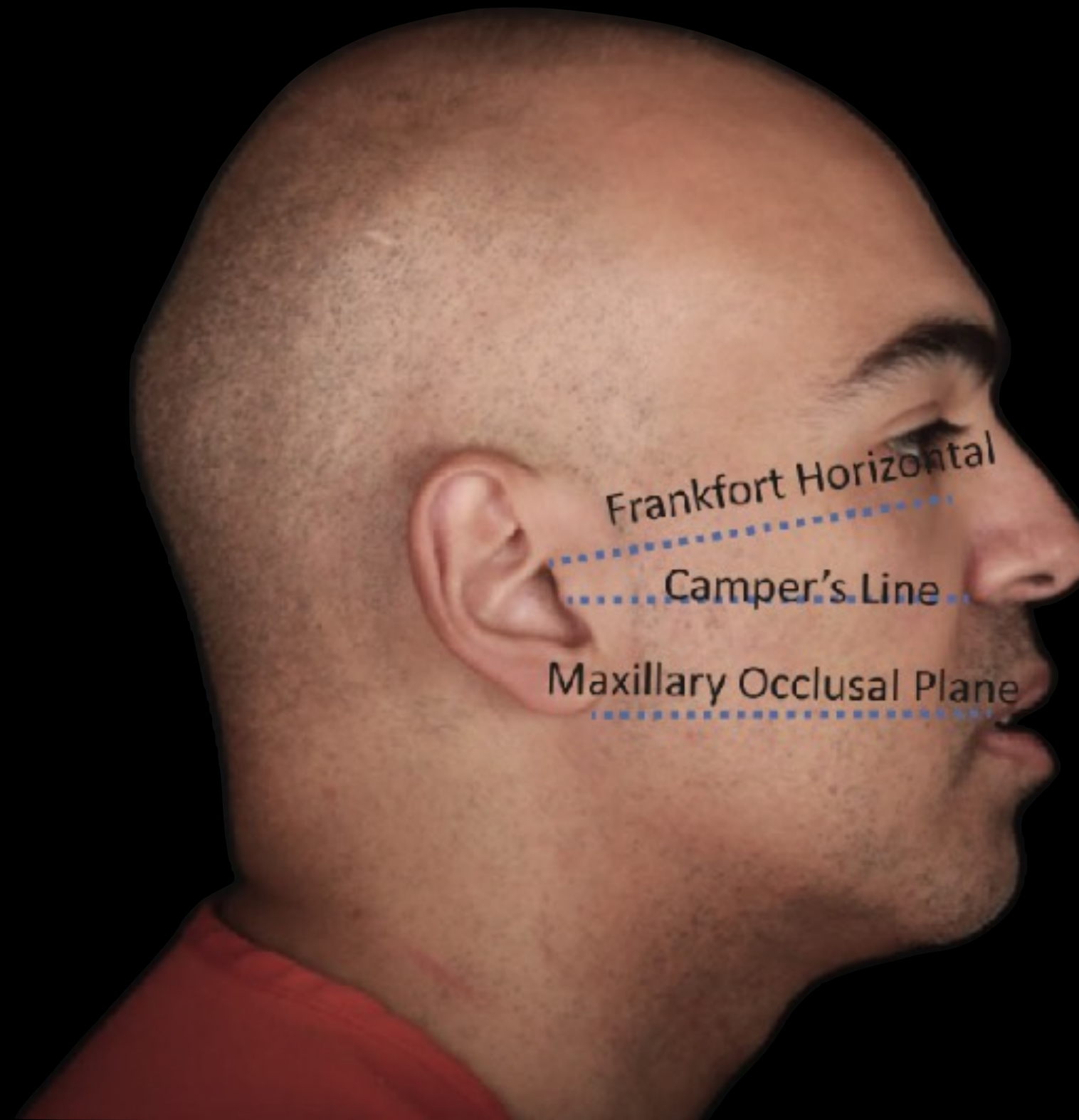
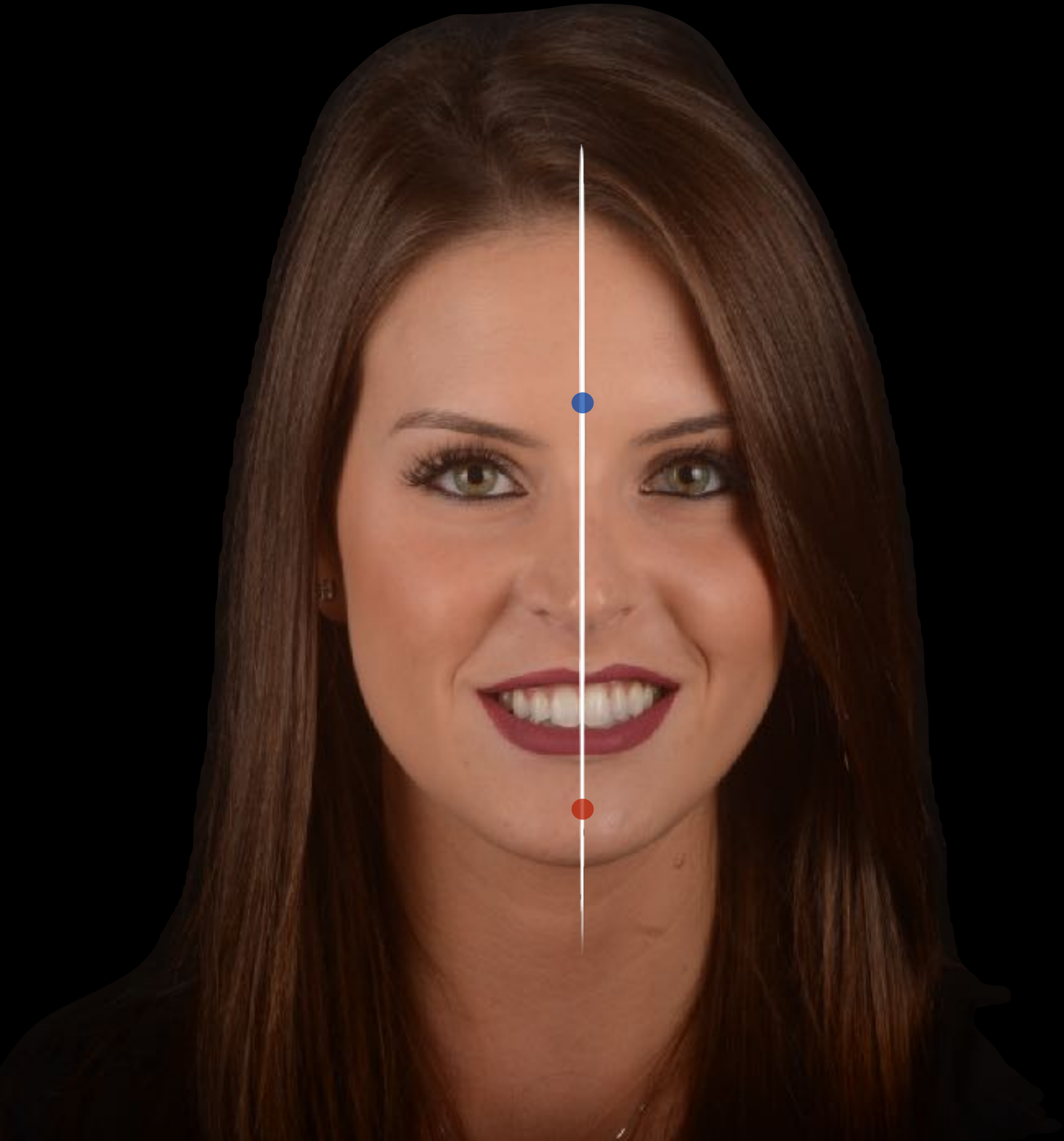
Kian Fazeli Niaki DMD, MClIn Pros. PGC Orth.

Academic Director at the LSFO

Published Jun 8, 2015

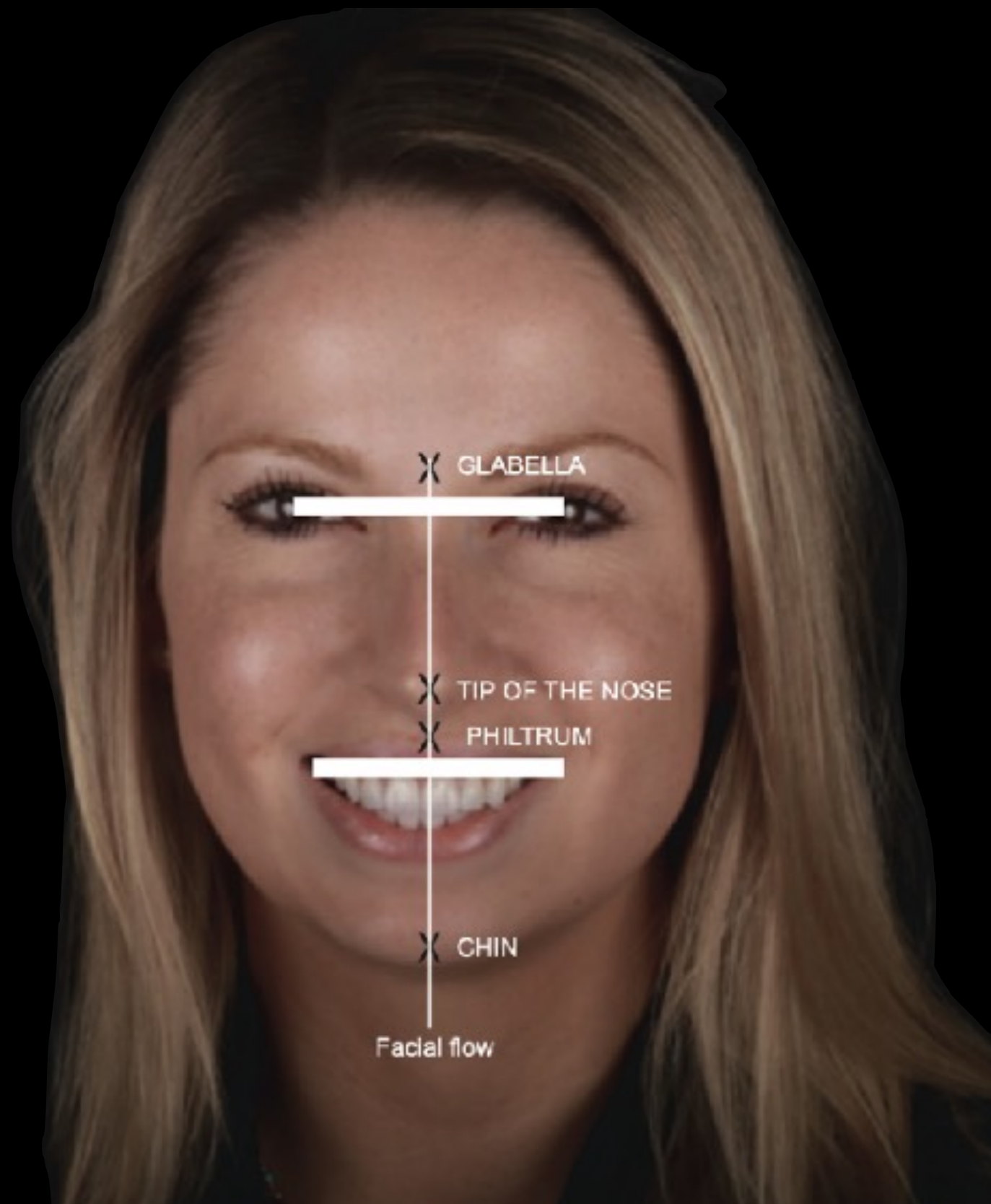
Facial Analysis

Reference Lines



MIDLINE

Facial midline is a straight line drawn through the glabella, the tip of the nose, philtrum, and the tip of the chin



Reference Lines

FRONTAL VIEW

A longer lower third is diagnosed as VME

This patient's middle third measures at 64 mm and lower third is 74 mm.

FACIAL ANALYSIS

SYMMETRY

Facial FLOW: concept that states that due to the **natural asymmetry** of the human face, it is impossible to define a straight line as the midline. Rather, a **curved line** connecting facial landmarks is more acceptable.



Reference Lines

FRONTAL VIEW

F-D 70% match
75% max-mand
discrepancy

Bodden, Miller, Jamison A
study of the relationship of
the dental midline to the
facial median line

J Prosthet Dent

1979 Jun; 41(6):657-60. doi:
10.1016/0022-3913(79)90065-

SYMMETRY



Facial FLOW: concept that states that due to the **natural asymmetry** of the human face, it is impossible to define a straight line as the midline. Rather, a **curved line** connecting facial landmarks is more acceptable.

Reference Lines

FRONTAL VIEW

• D 70% match
75% max-mand
discrepancy

Bodden, Miller, Jamison A
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facial median line

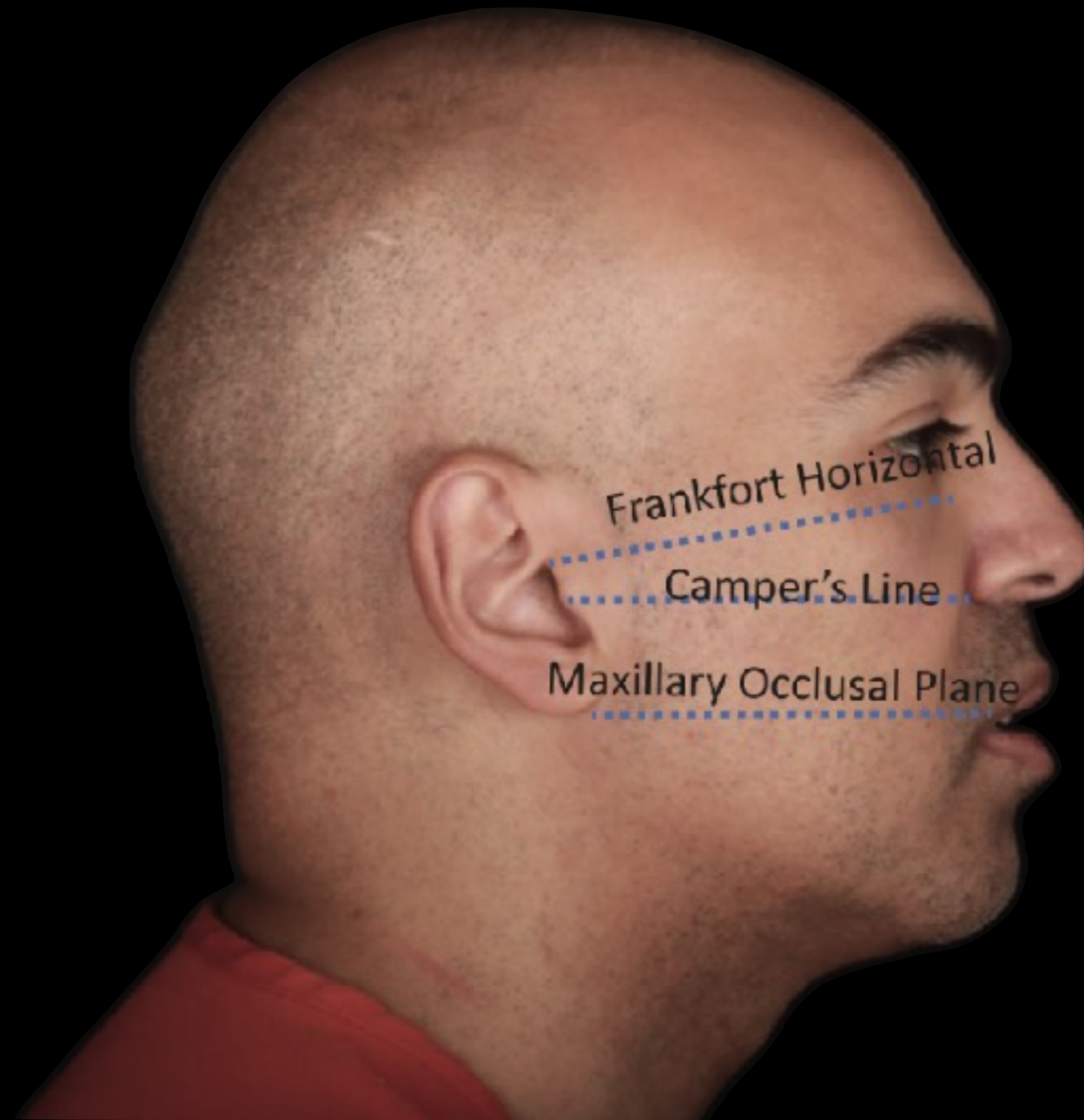
J Prosthet Dent

1979 Jun; 41(6):657-60. doi:
10.1016/0022-3913(79)90065-

PLANES

Frankfort horizontal:

Straight line from the highest point on the margin of the **auditory meatus** to the lowest point of the **orbit**, Should be parallel to the horizon when the patient is in NHP



Reference Lines

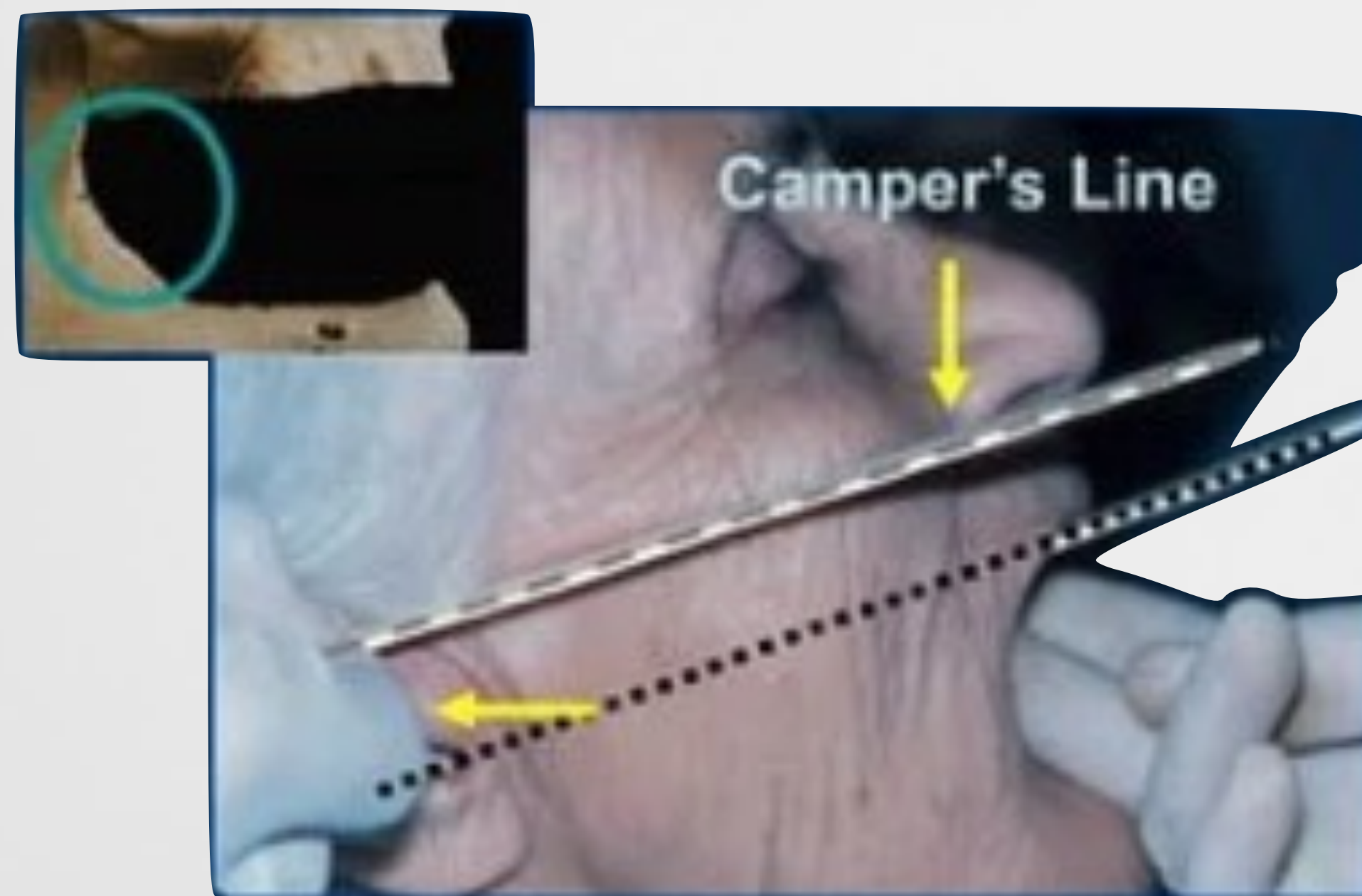
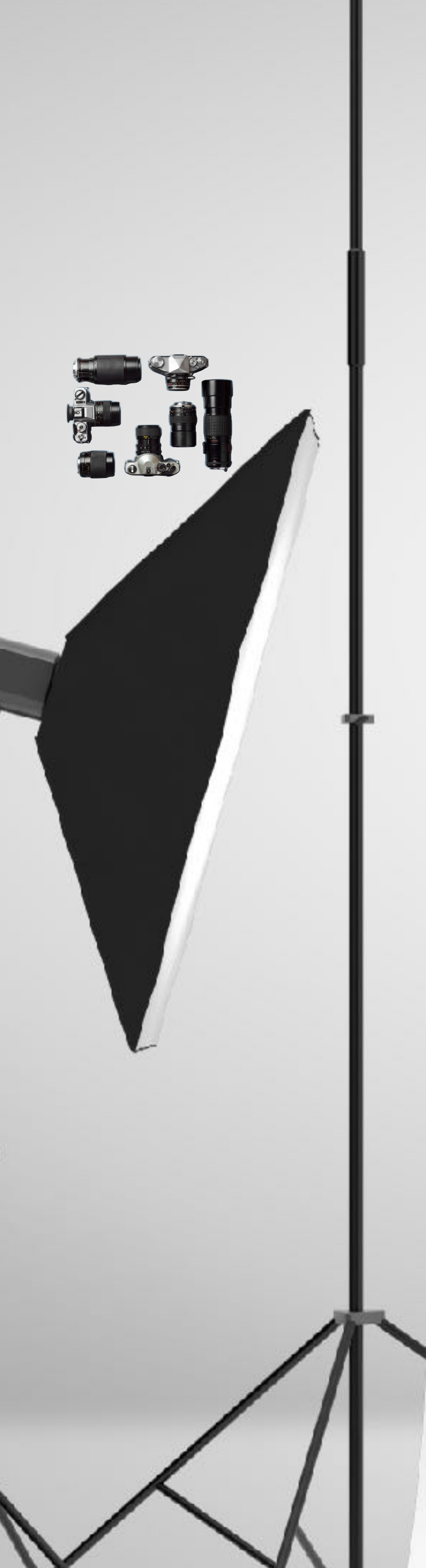
PROFILE VIEW

Camper's plane or Ala-Tragus line: A line running from the inferior border of the ala to the superior border of the tragus of the ear, determines the maxillary occlusal plane.

2D PHOTOGRAPHY

Can we capture all
these details?





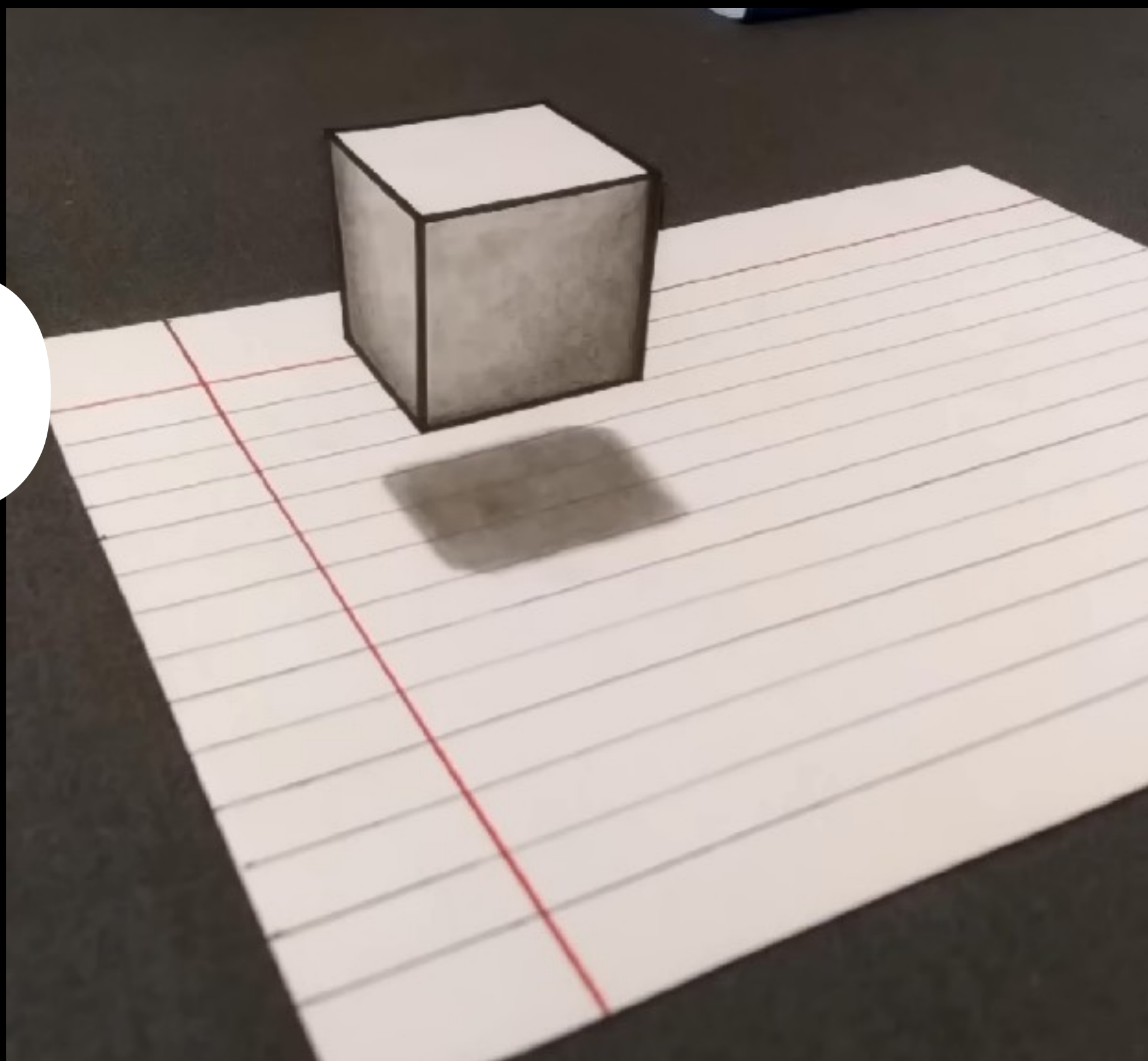
Common errors in extraoral photographs

- The absence of a plain, non-distractive backdrop
- An incongruous, asymmetrical frame with too much background, or over-trimmed areas of interest, including cropped head or smile
- An incorrect distance between the patient and operator
- Capturing images that are too bright or too dark
- Portraying patients wearing excessive jewelry and accessories; hair disguising the patient's face; ears with no visible landmarks
- Allowing patients to tilt the head, or to look away, up, or to the side of the camera **causing unreliable measurements**

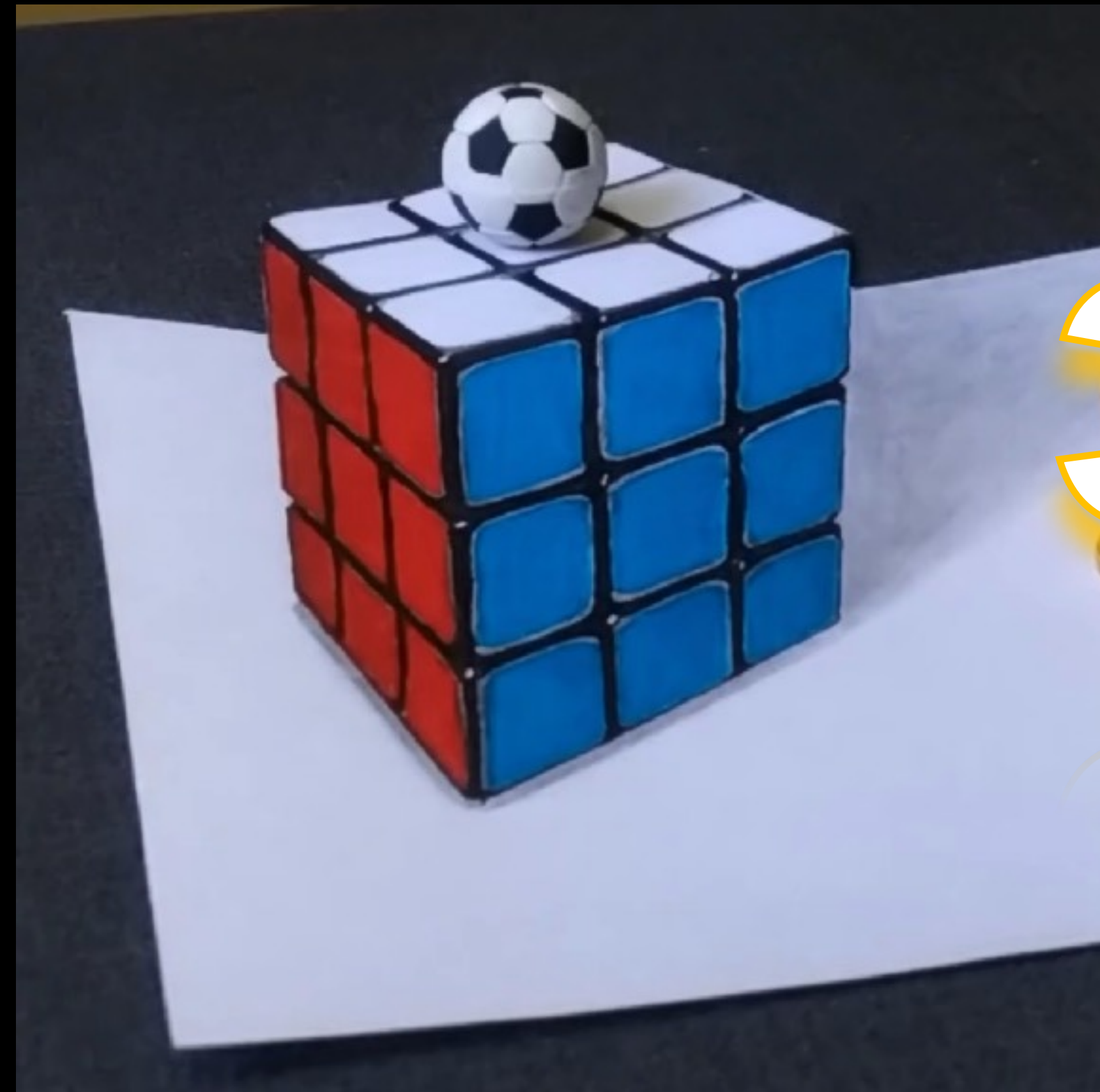
The American Board of Orthodontics (ABO)

[https:// www.americanboardortho.com/orthodontic-professionals/about-board-certification/ clinical-examination/case-record-preparation/photograph-requirements/](https://www.americanboardortho.com/orthodontic-professionals/about-board-certification/clinical-examination/case-record-preparation/photograph-requirements/). Accessed March 10, 2017

2D



3D



ALL ABOUT



THE SMILE



OUR SMILE IS OUR

SIGNATURE



Dental Professionals all around
the world are increasingly
confronted with high esthetic
Demanding patients.

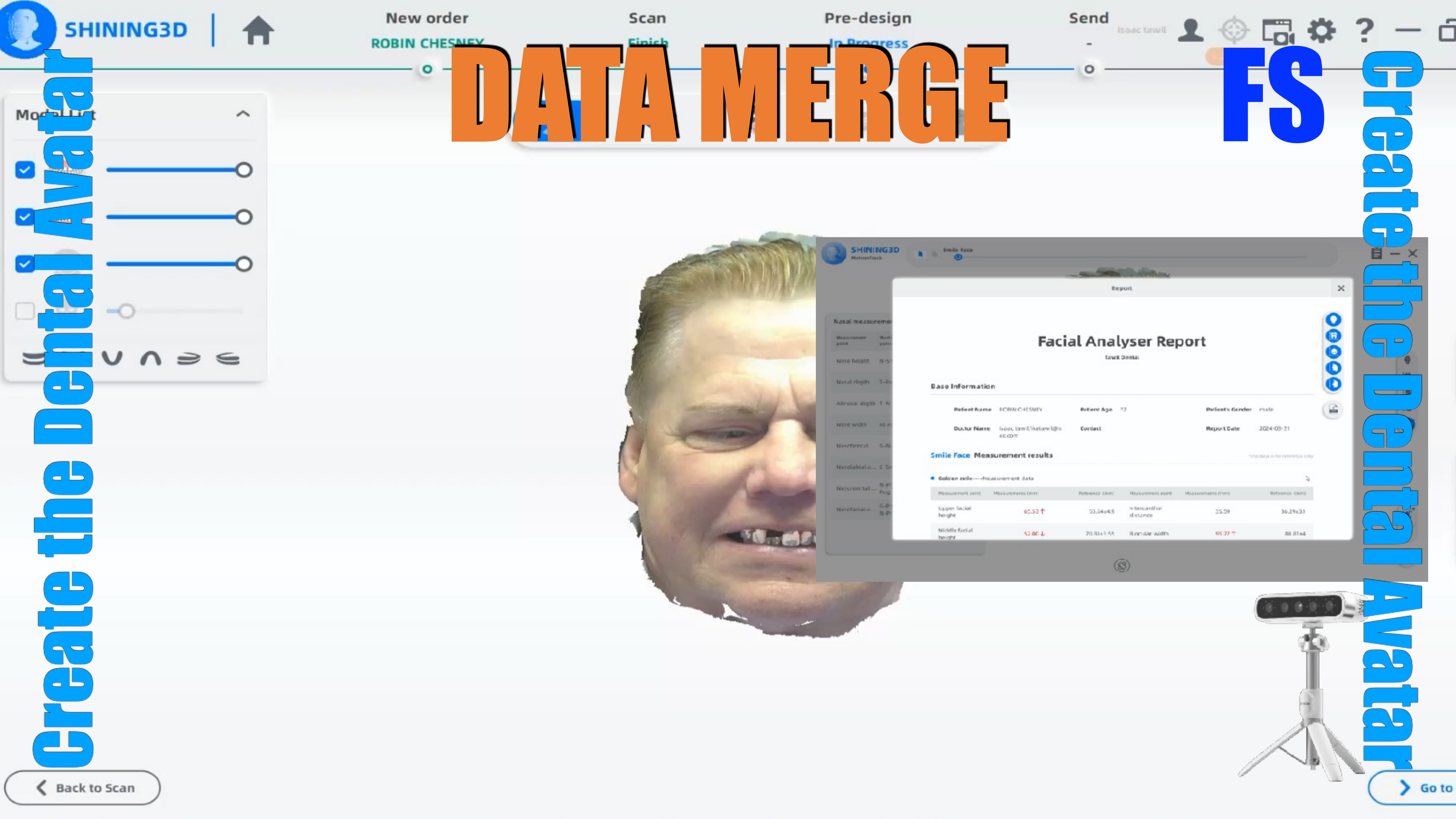


MetiSmile

3D



CAPTURE



DATA MERGE

FS

Create the Dental Avatar

Create the Dental Avatar

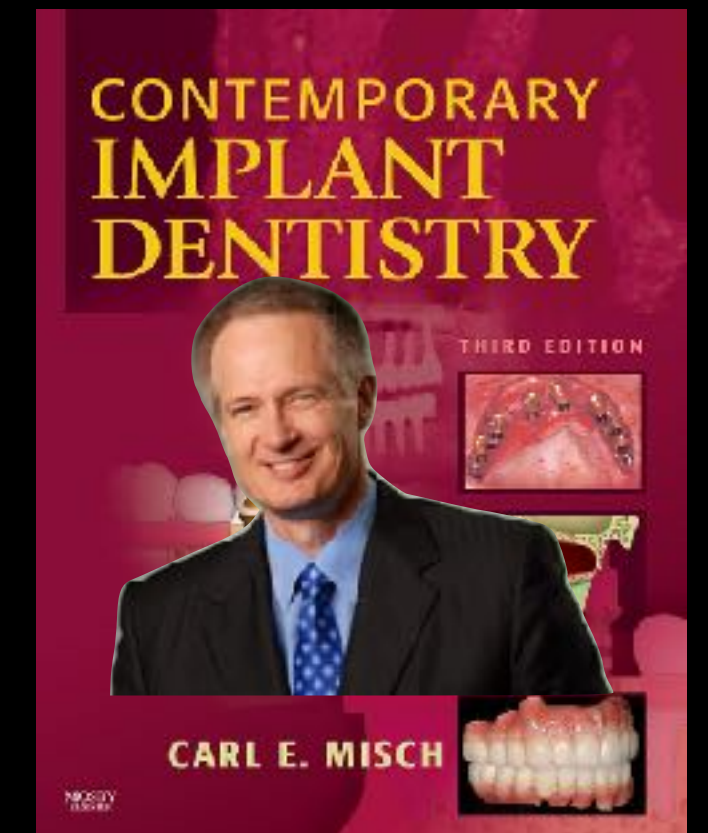
Back to Scan

Go to

FULL ARCH PROSTHETIC



RP4/RP5





FULL ARCH



PRE-FABRICATED



POST-FABRICATED

PROSTHETIC CHOICE? (FP1,2,3)

FABRICATION TIME?

SURGERY LENGTH?

COMMITMENT TO IMPLANT POSITION?

QUALITY OF TEMPORIZATION?

BACK UP PROVISIONAL?

CASE ACCEPTANCE?



SURGICAL GUIDANCE



Scott D. Gawe, DMD



Jesse Treier, DDS

Full-Arch Implant Surgical and Restorative Considerations

Utilizing a Full Template Guidance Technique

INTRODUCTION

Full arch dental implant reconstruction requires proper diagnosis and treatment planning to assess the existing patient anatomy, any pathologies, occlusion, soft-tissue volume, lip support, and aesthetics, and gain understanding of the desired outcome. A decision tree can be established based upon sound prosthodontics and surgical protocols to maximize success when a full-arch, implant-supported reconstruction is contemplated. Technological innovations can only enhance the diagnostic, treatment planning, communication, surgical, and restorative aspects for each patient. Three-dimensional imaging modalities afforded by current cone beam computed tomography (CBCT) provides the foundation for all that follows¹ (Figure 1). The native DICOM (Digital Imaging and Communications in Medicine) data, once imported into an interactive treatment planning software application, allows for careful inspection of the existing anatomical presentation to identify potential implant receptor sites that will aid in realistic implant placement simulations and avoid potential complications (Roxane Software [MegaGen]) (Figure 2).² Regardless of the eventual surgical protocol, the authors believe that the diagnostic phase must be based on a complete and thorough review of the CBCT scan data.³

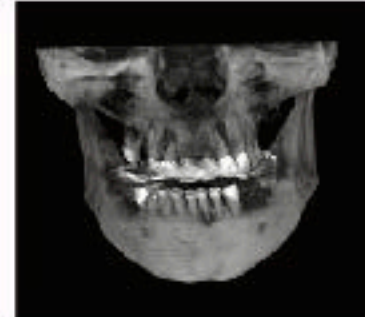


Figure 1. Three-dimensional imaging modalities, such as cone beam computed tomography (CBCT), are essential for proper diagnosis and treatment planning.



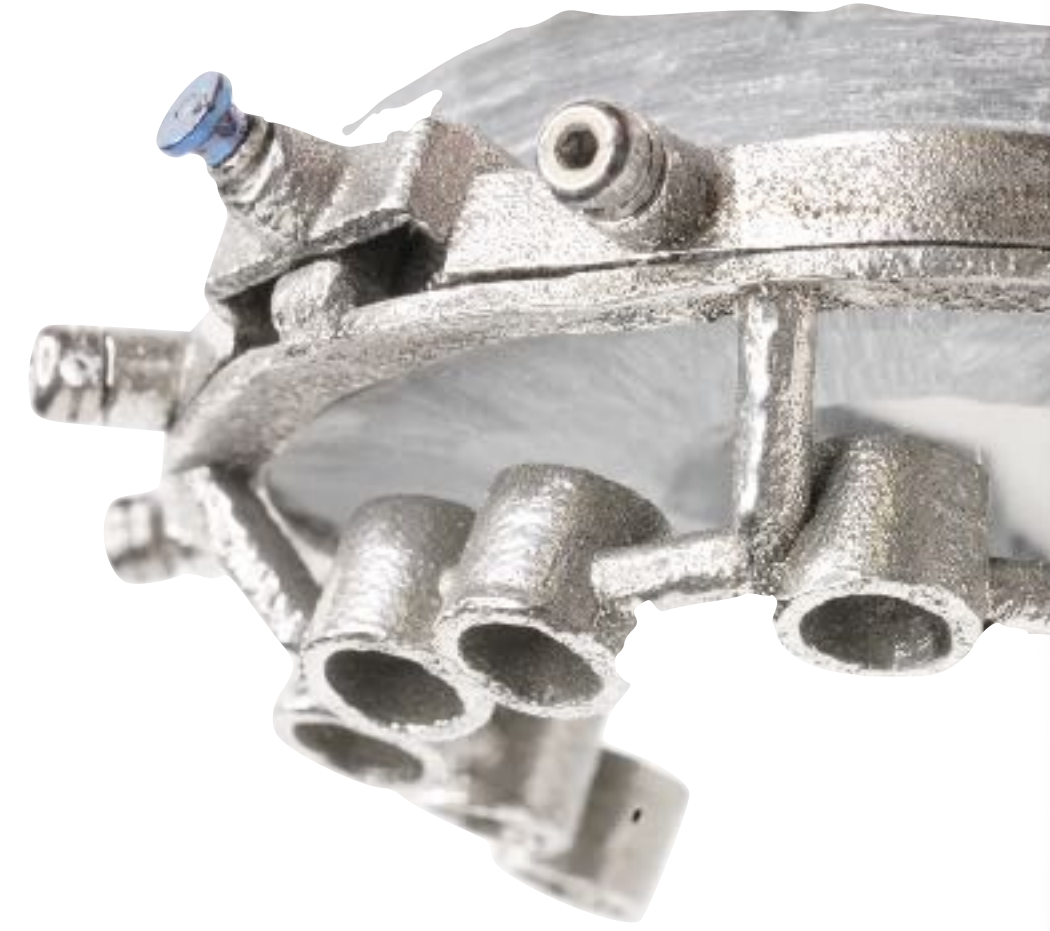
Figure 2. Interactive treatment planning software, such as the Roxane Software (MegaGen), helps clinicians identify potential implant receptor sites to aid in realistic implant placement simulations.

CASE REPORT

A failing maxillary and mandibular dentition exhibited mobile teeth, a poor bite, mal-aligned teeth, and bone loss (Figure 3). The CBCT data were analyzed to determine the most appropriate treatment alternatives based upon bone quality, bone density, and an appreciation of the patient's desires. Utilizing advanced software applications (Blue Sky Plan [Blue Sky Bio]), the diagnostic information for implant planning can be fully appreciated in all of the necessary views, including cross-sectional, coronal, sagittal and axial, and in 3-D reconstructed surface models. Implant receptor sites can be identified, and virtual implants can be positioned with each of the previously mentioned views, as no single view can provide all of the necessary information to achieve success (Figure 4). Placing an implant into a cross-sectional slice is only the beginning of the process of helping to visualize the thickness and opacity of the buccal and palatal cortical plates and the quality of the inter-medial bone to determine whether an implant can be placed that has an appropriate length and diameter to fit the remaining alveolus, based upon the "Triangle of Bone" protocol⁴ (Figures 4b and 4c). Additionally, virtual implant simulation plays a significant role in managing the desired restorative outcomes based upon tooth position and the choice of screw or cement retention (Blue Sky Bio). In the authors' opinion, the most efficient manner to facilitate the process is on page



Figure 3. A failing maxillary and mandibular dentition exhibiting mobile teeth, a poor bite, mal-aligned teeth, and bone loss.



PLANNING

SCALLOP

FEATURES



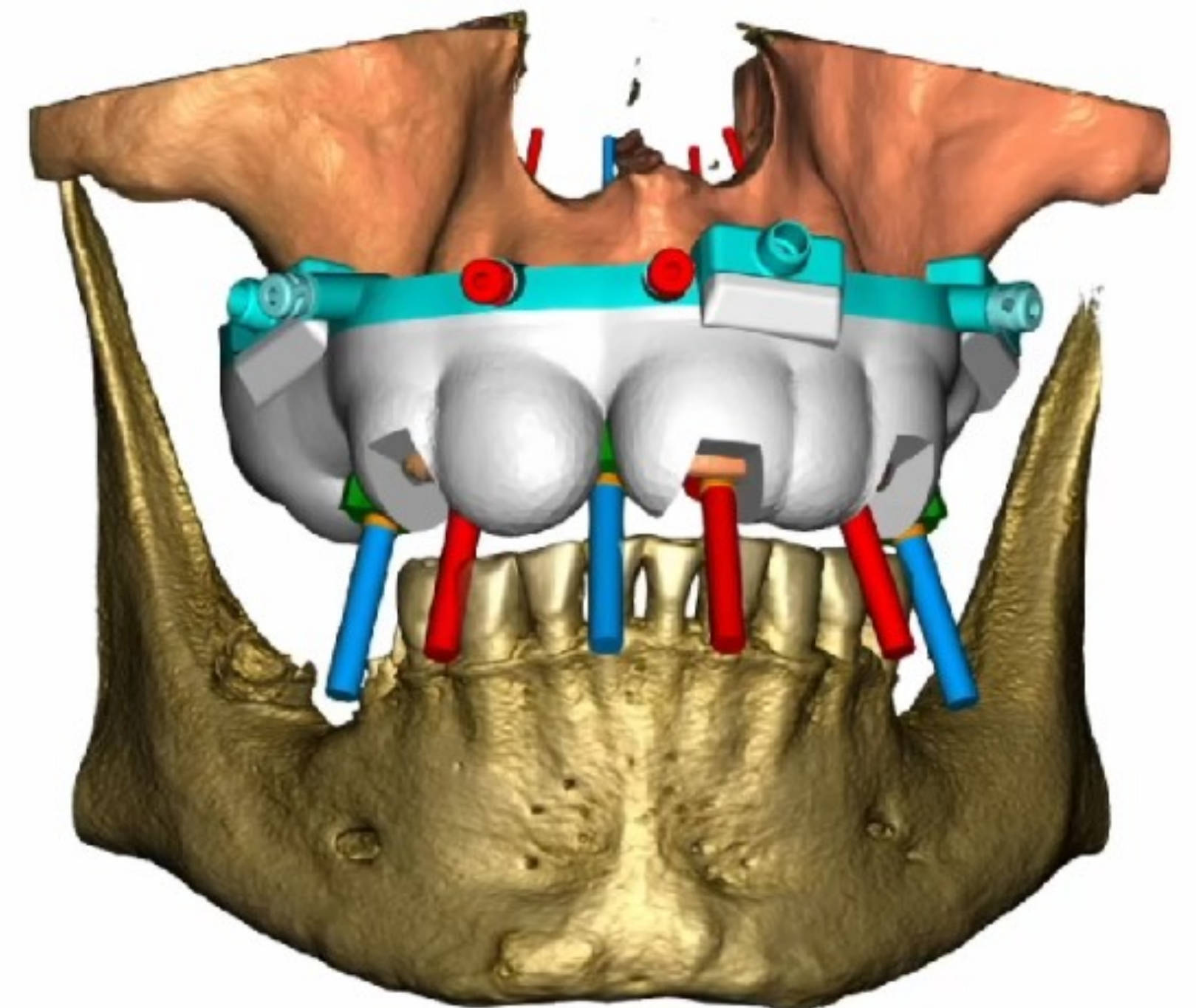
SMILE LINE

SYMMETRY

GUIDANCE

PRECISION

PRE-FABRICATED SURGICAL GUIDANCE



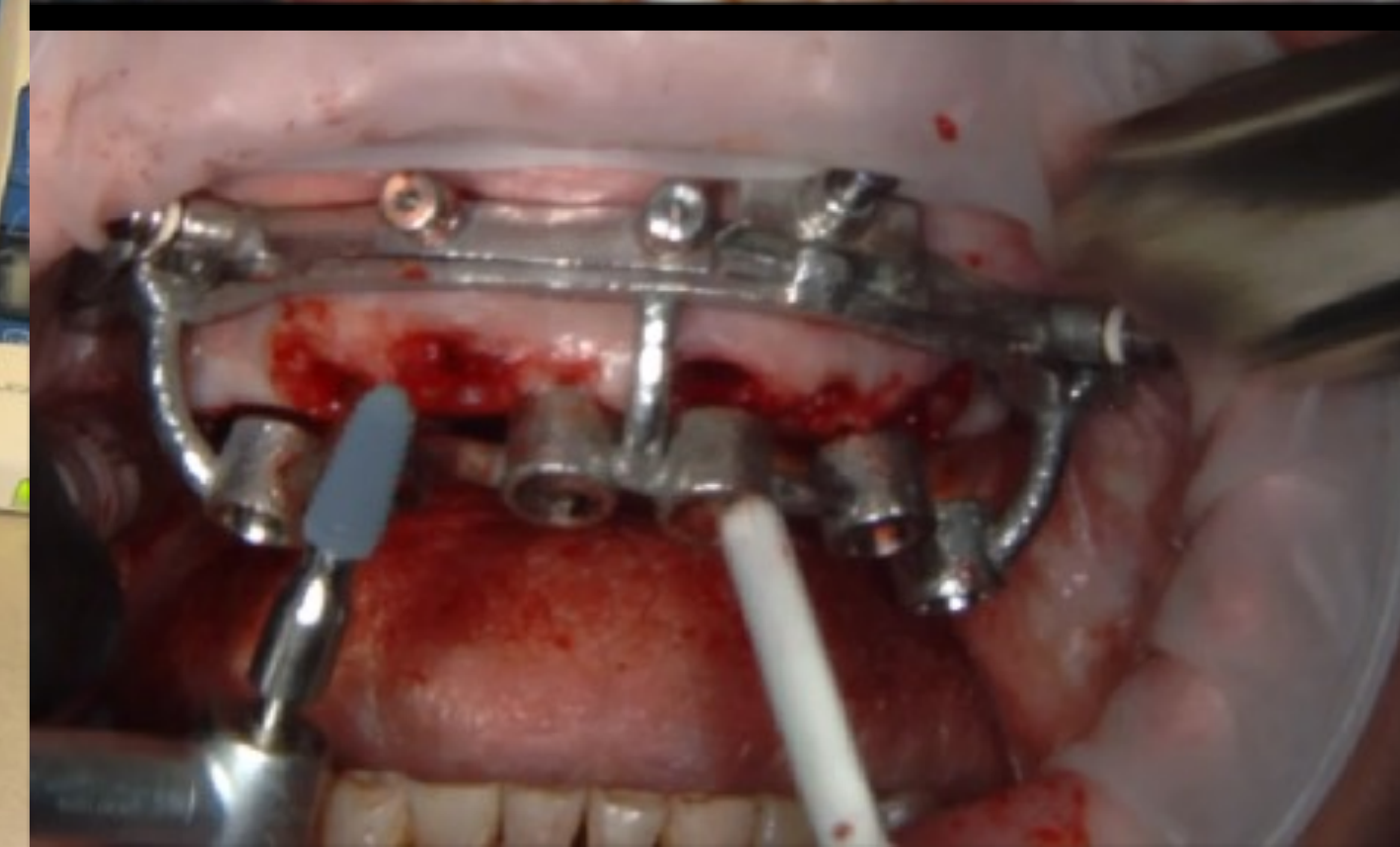
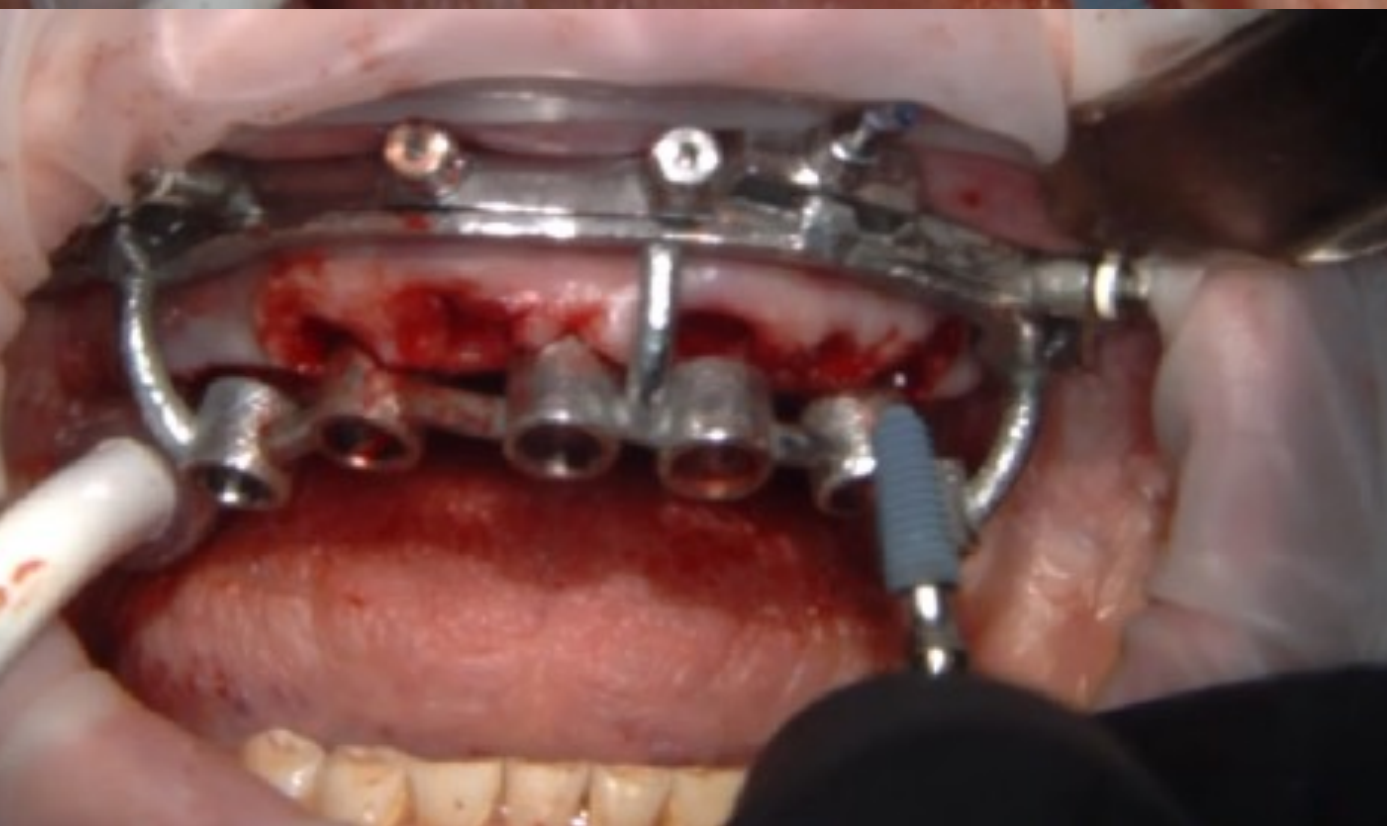
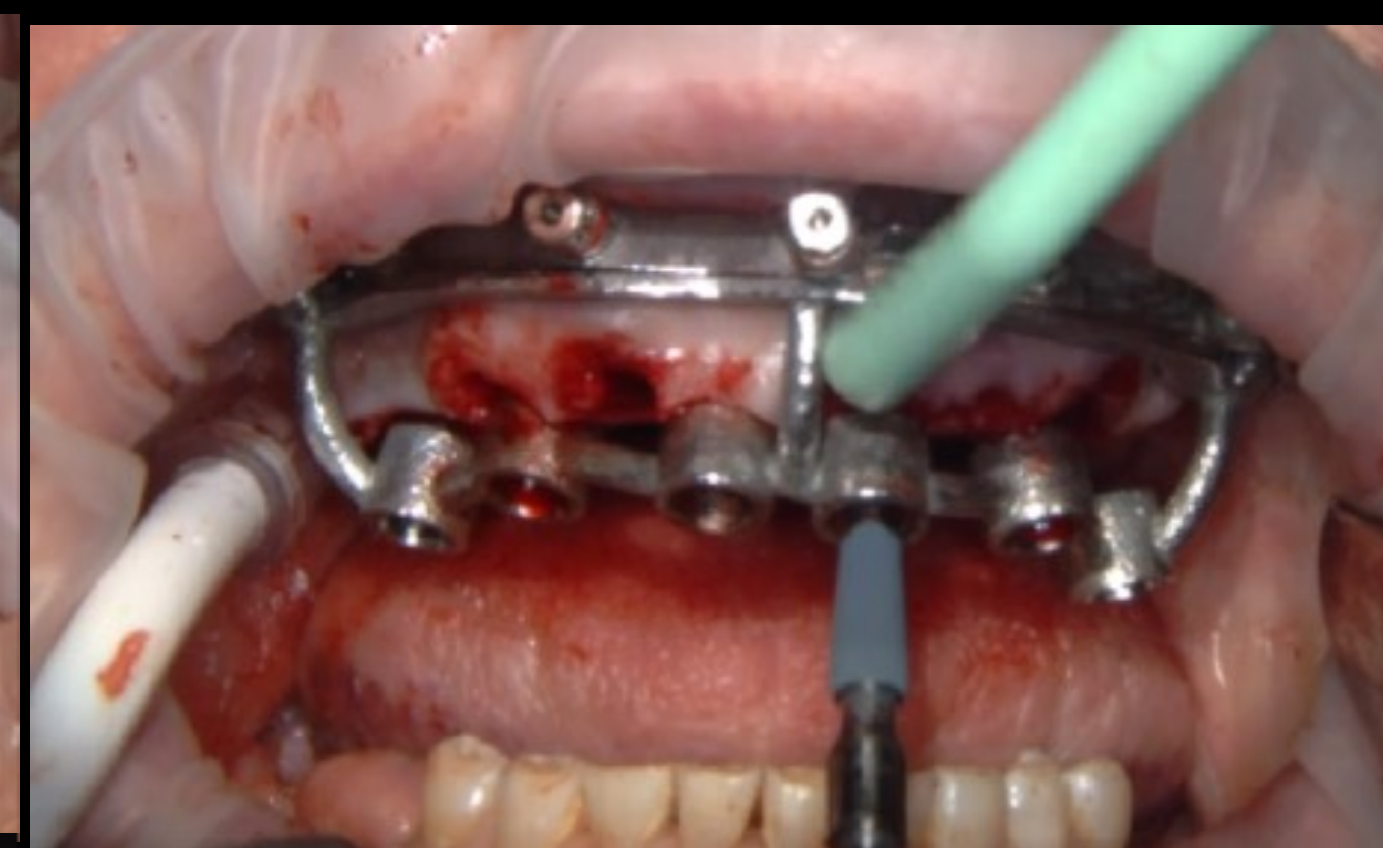
SURGICAL GUIDANCE



PRE-FABRICATED

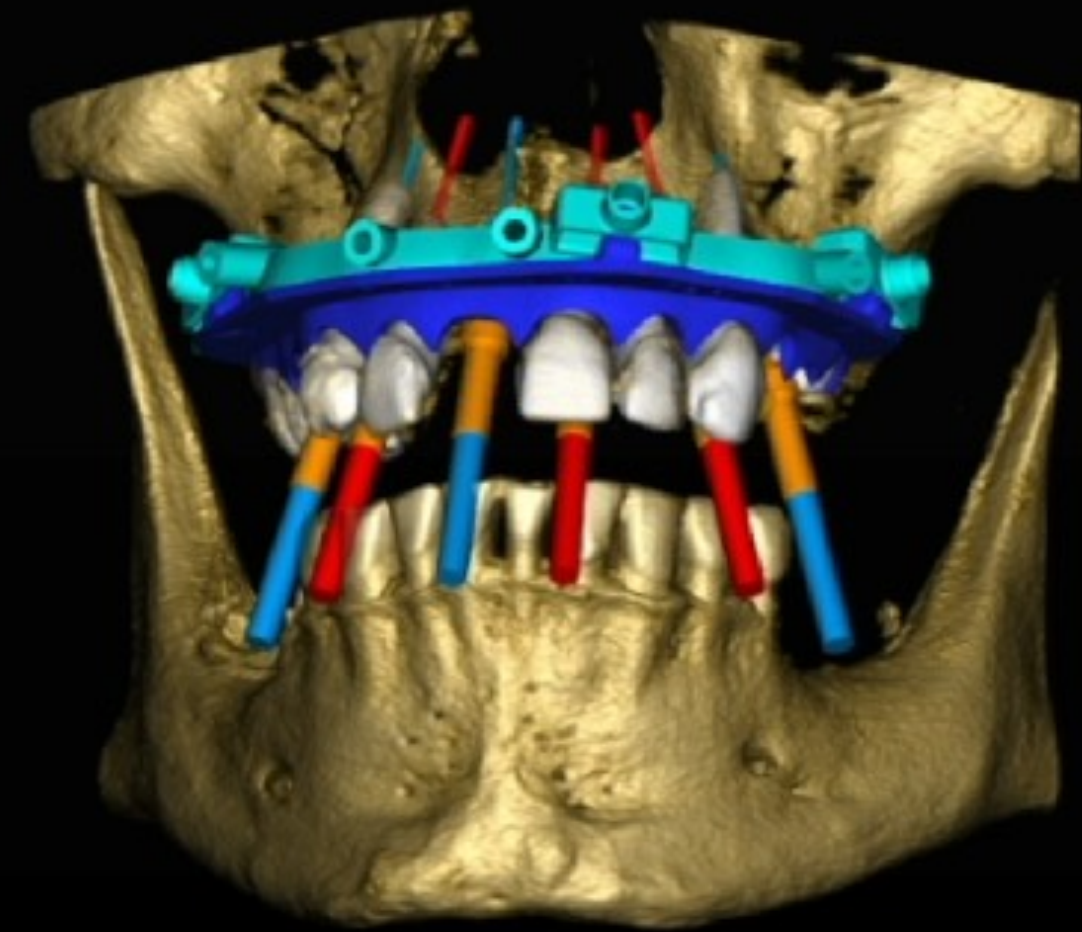
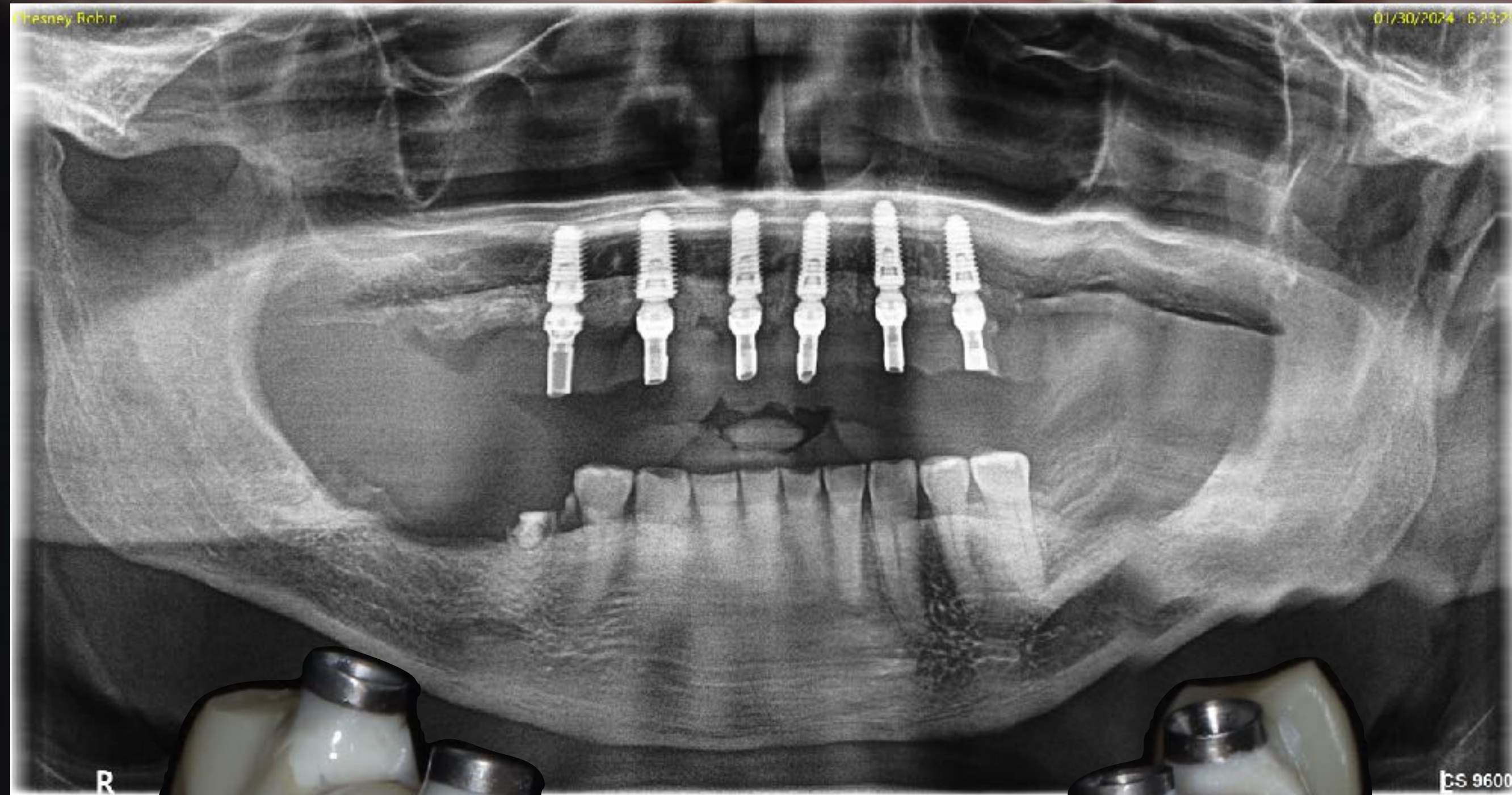
IMPLANTS

PLASMA-X



PRE-FABRICATED

PRE-FABRICATED PROVISIONAL



PRE-FABRICATED

**Where do we go
from here?**



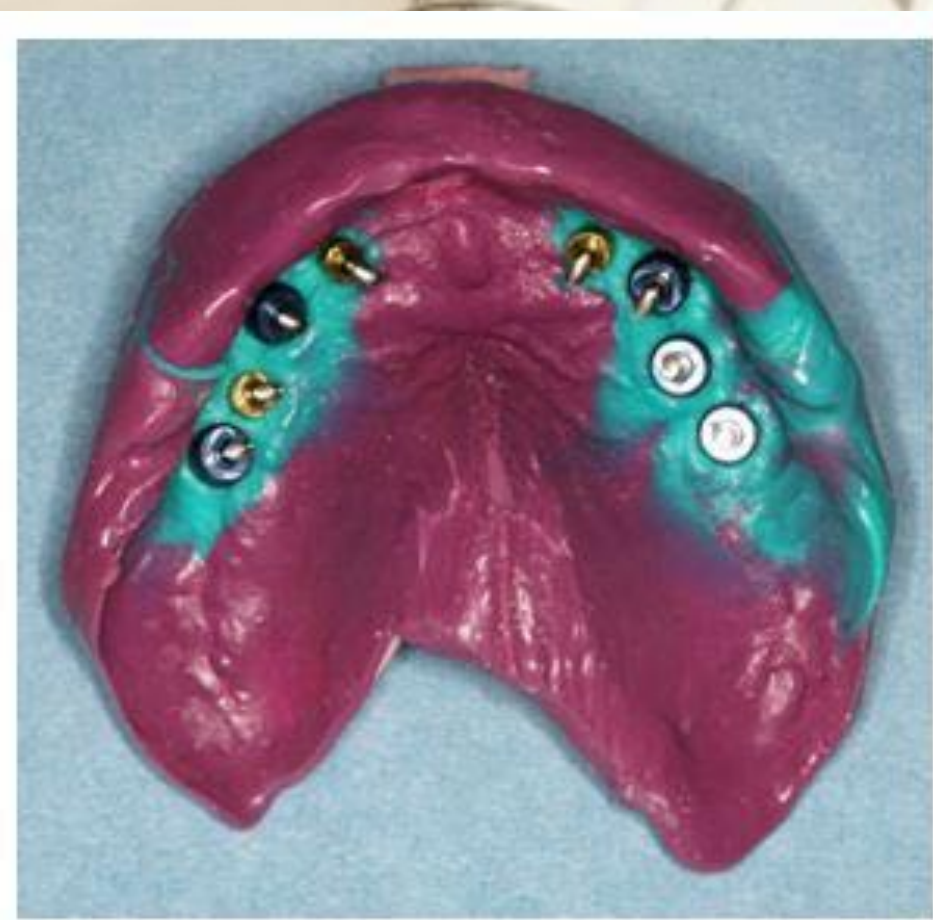
REPAIR



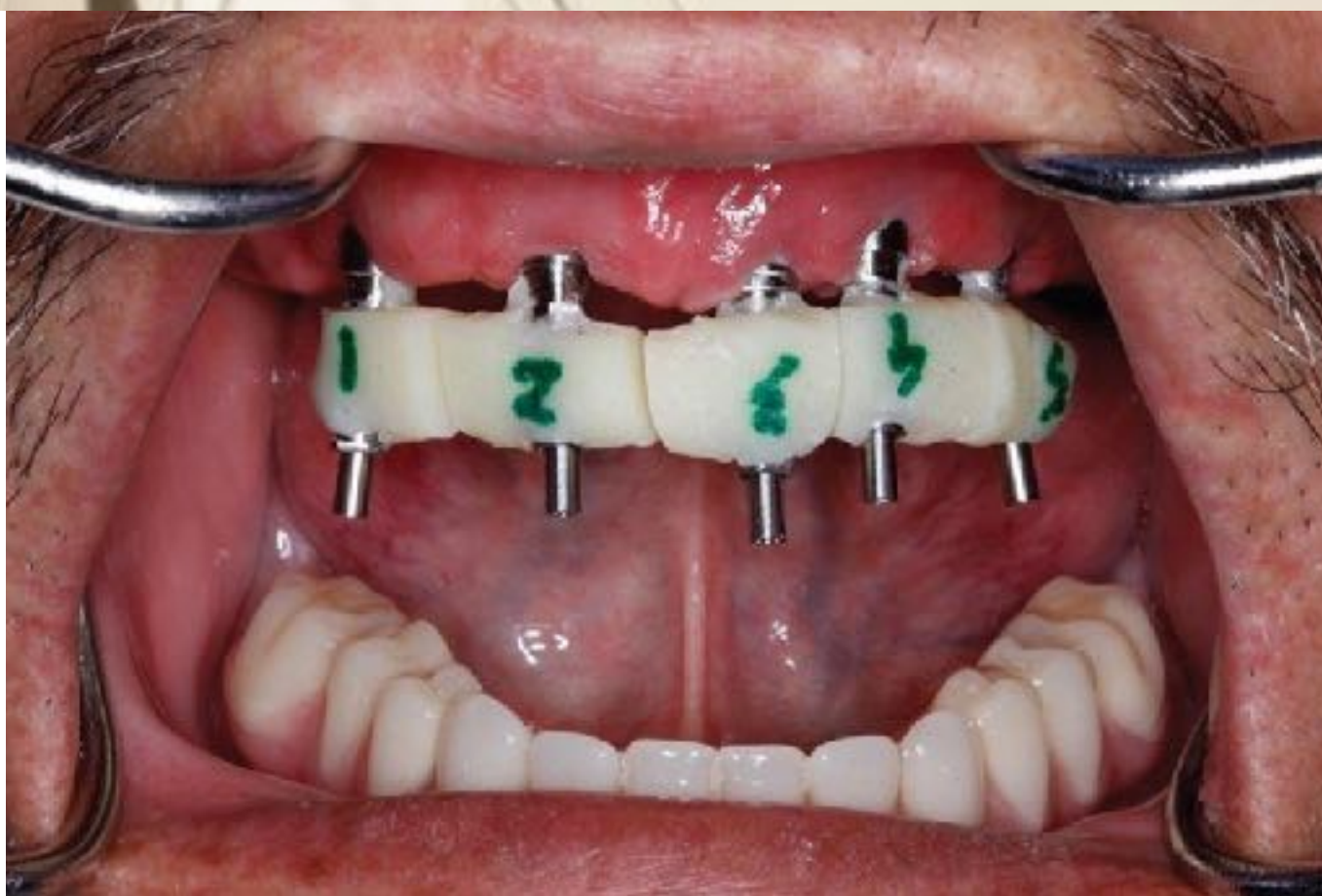
Traditional Method is 7 appointments over 2 1/2 - 3 1/2 Months



Appt 1 Stock Tray



Appt 2 Implant Impression



Appt 3 Fit Gig & Bite Block



Appt 4 Screw Down Set-up



Appt 5 Screw Down Set-up on Ti Bar



Appt 6 Reset



Appt 7 Final Seating

FULL ARCH - ESTHETIC PARAMETERS

MACRO MICRO ESTHETIC

PROBLEM

SOLUTION



FULL ARCH - ESTHETIC PARAMETERS

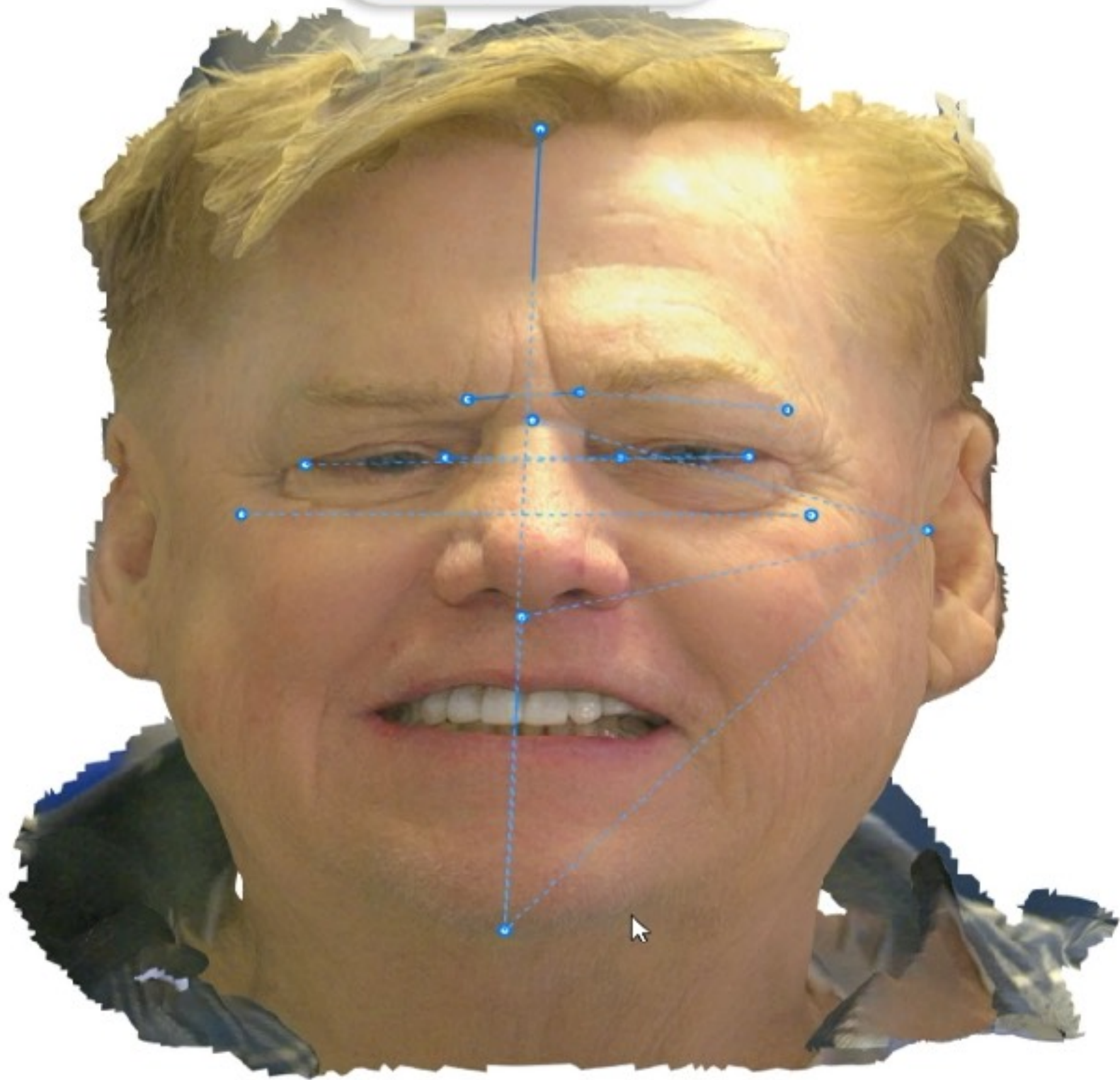
MACRO - MICRO ESTHETIC

SOLUTION

Create the Dental Avatar

MEASUREMENTS

en ratio			
Measurement	Marking points	Measurements (mm)	Reference (mm)
Upper facial ...	Tr-M-M	63.56 ↑	53.64±4.9
Lower facial...	Sn-M-M	52.59 ↓	70.81±3.55
Upper facial h...	Tr-Me	186.92	187.05±8.2
Lower facial ...	Sn-Me	71.23 ↑	62.60±4.27
Size between...	M-M	23.39	-
Bizygomatic ...	Zy-Zy	119.35 ↓	136.9±0
Horizontal le...	M-M'	42.02	-
Intercanthal ...	En-En	36.79	36.29±3.1
Biocular width	Ec-Ec	92.82 ↑	88.81±4
Horizontal le...	En-Ec	26.29	26.26±1.5



MEASUREMENTS



How do we
capture/implant



position?



2023

Research



In vivo trueness and precision of full-arch implant scans using intraoral scanners with three different acquisition

Robert Nedelcu^{a,b,c,*}, Pontus Olsson^{b,d}, Måns Thulin^a

^a Department of Hospital Dentistry, Maxillofacial Surgery, Uppsala University
^b Department of Information Technology, Centre for Image Analysis, Uppsala University, SE
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Clinical significance

ARTICLE INFO

Keywords:
Trueness
Precision
Full-arch
Implant
Scanning

ABSTRACT

Background: The trueness and precision of full-arch implant scans is controversial. The modified protocol for non-attached tissues when a modified scanning pattern was used. However, other IOS may show varying results *in vivo*. A completed scan does not necessarily equate to an accurate scan.

1. Introduction

To produce an implant fixed denture (IFD) by Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM), the three-dimensional (3D) space requires a digitisation process. The conventional method for nearly two decades has been an indirect digitisation of models deriving from conventional impressions [1]. Methods for direct in vivo digitisation are available through stereo-photogrammetry (SPG) and intraoral scanners (IOS). Evaluation

for cross-arch fixed restorations [6–11]. Although manufacturers of implants and frameworks for IFDs do not recommend this type of acquisition based on limited clinical evidence, the dental industry is aware of the occurrence.

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E-mail address: robert.nedelcu@hugger.se (R. Nedelcu).

UNSTABLE SCAN PATHS



Desktop
Scanner

Intraoral
Scanner

IOS Requires Geometry

Problem becomes layering

Desktop Scanner takes

large FOV picks up details

IMPLANTS

Fully Digital Full Arch?

Continued Advancements in Full-Arch Implant Restorations

INTRODUCTION

Full-arch, implant-supported reconstruction continues to provide stable solutions to restore and improve function, enhance aesthetics, and change the quality of life for our patients. All-on-X implant reconstruction has been the focus of numerous articles and technical innovations. In this current edition, the authors continue the journey by updating through new developments that impact the full-arch analog and digital workflows. Our previous articles introduced several elements to aid the clinician in both the surgical and restorative phases of full-arch replacement, including the use of CBCT-guided surgical applications and how they have greatly improved the assessment for implant placement relative to the desired restorative positions for preliminary and definitive restorations while also reducing implant complications. The authors have previously described an ancillary surgical protocol that utilizes extracted teeth as an autogenous extender¹ to bone grafting. This has greatly enhanced healing and long-term skeletal stability and provided ample graft volume with a significantly reducing financial costs. Subsequent publications also reported on improving the restorative time and treatment outcomes utilizing 3D technology² and employing small block technology (GB) to enhance the physical integrity and anatomy of milled or 3D printed provisional restorations³ and improving inter-arch alignment and occlusion. The goal of these articles has been to improve time, efficiency, costs, and long-term results for the betterment of clinicians, laboratory technicians, and patients. This latest article endeavors to provide updates in the acquisition of data necessary to complete the restoration with an emphasis on addressing improvements in scan-retained full arches for monolithic restorations that incorporate multi-unit abutments.



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Daniel D. Domingue, DDC

requiring additional applications to achieve fully digital solutions.

All-on-X, fixed surgical and restorative protocols require the placement of 4 or more implants with a favorable anterior-posterior spread to achieve the necessary long-term support. Capturing the position of these implants with accurate cross-arch intraoral scanning, especially in the mandible, has been one of the major struggles for clinicians and dental laboratory technicians to overcome. IOS technology requires a stable environment for data to be stitched and captured accurately. Several techniques have

emerged with a variety of different use of intraoral scanners for digital acquisition. However, the use of intraoral scanners for digital acquisition of full-arch data remains a challenge. The use of intraoral scanners for digital acquisition of full-arch data remains a challenge. The use of intraoral scanners for digital acquisition of full-arch data remains a challenge.

alternative workflow. Photogrammetry is a technique that has been used for diagnostic and restorative purposes. The goal of these articles has been to improve time, efficiency, costs, and long-term results for the betterment of clinicians, laboratory technicians, and patients. This latest article endeavors to provide updates in the acquisition of data necessary to complete the restoration with an emphasis on addressing improvements in scan-retained full arches for monolithic restorations that incorporate multi-unit abutments.

Data Acquisition

As the dental industry continues to strive for fully digital solutions, the development and improvement of intraoral data devices and acquisition technology has continued to evolve. Intraoral scanning (IOS) speed and accuracy have become a viable solution for replacing direct analog impressions. Native IOS software applications now provide several impressive features that enhance and streamline complete digital protocols. However, due to inherent logistical limitations, the difficulty and accuracy of IOS technology used for full-arch dental implant restorations has presented major obstacles



Desktop Scanner



Intraoral Scanner



CONTINUING EDUCATION

Navigating the Complexities of Digital Full-Arch Implant Treatment

Strategies to improve accuracy and deliver optimal outcomes

Isaac Tanil, DDS, MC | Daniel Domingue, DDC

Learning Objectives

- Discuss the use of intraoral scanning in full-arch implant treatment, including the challenges related to accuracy, the use of photogrammetry, and the use of splinted and scan-beds.
- Summarize some of the prosthetic considerations for fixed full-arch restorations using the Misch classification system.
- Explain the benefits of facial scanning over 2D photography in digital treatment planning and how facial scans can be integrated with intraoral and CBCT scans.
- Identify some of the considerations related to the surgical and restorative approaches selected, including the use of stable surgical guides and 3D printers to enable immediate positioning.



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STABLE SCAN PATH

5. Conclusions

With the results of the present in vivo study, the following conclusions are drawn:

1. The system that obtained better precision was PIC, followed by TD, and then T.
2. The precision of T and TD decreased as the distance between the implants increased;

however, this variable did not affect the PIC system. The accuracy of the PIC system was better than the TD system, and the TD system was better than the T system.

the mandibular arch.

Citation: Onjau-Perez, J.; Garza-Gonzalez, B.; Ortiz-Collado, L.; Thijssen, S.; Sarmiento-Lacort, A. In Vivo Comparison of Three Optical Impression Systems: Comparison of the Precision of Three Optical Impression Systems. *Int. J. Environ. Res. Public Health* **2022**, *19*, 4300. <https://doi.org/10.3390/ijerph19074300>

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Keywords: optical impression; intraoral scanners; edentulous; complete arch; dental implants; precision

1. Introduction

Studies help to develop protocols and to analyze parameters that are not possible with accuracy [6–8]. The heterogeneity of these study designs makes the interpretation of the conclusions and clinical recommendations difficult [1,9–11].

The different IOSs in the market compete to achieve the best accuracy, defined as how closely the obtained measurements resemble the real arch measurements, and the best precision, defined as how similar the obtained measurements of the repeated scans are (ISO 5725) [12]. Evaluating the precision in vivo is key, because there are many factors that can affect the result in the clinical setting, making the outcomes inconsistent and therefore difficult to predict. A large challenge is that there is no consensus regarding the range of acceptable misfit and the way to correctly measure the misfit clinically [9,13–17]. When the number of implants in the same structure increases, the tolerance of the error in the axis (X, Y, Z) and the angulations decrease [18]. Furthermore, we must consider the manufacturing

Photogrammetry Linear Scanning of known object

What is Photogrammetry?

Photogrammetry is a digital imaging technique that uses multiple photographs to create virtual 3D models of a known objects. It's a non-invasive alternative to traditional dental impressions and is used in dentistry for a variety of purposes, including:

Implant dentistry

Photogrammetry is used to precisely capture dental implant positions. It can capture the exact position and angulation of implants with unmatched accuracy. This helps ensure that the prosthesis fits properly and doesn't put too much stress on the implants.

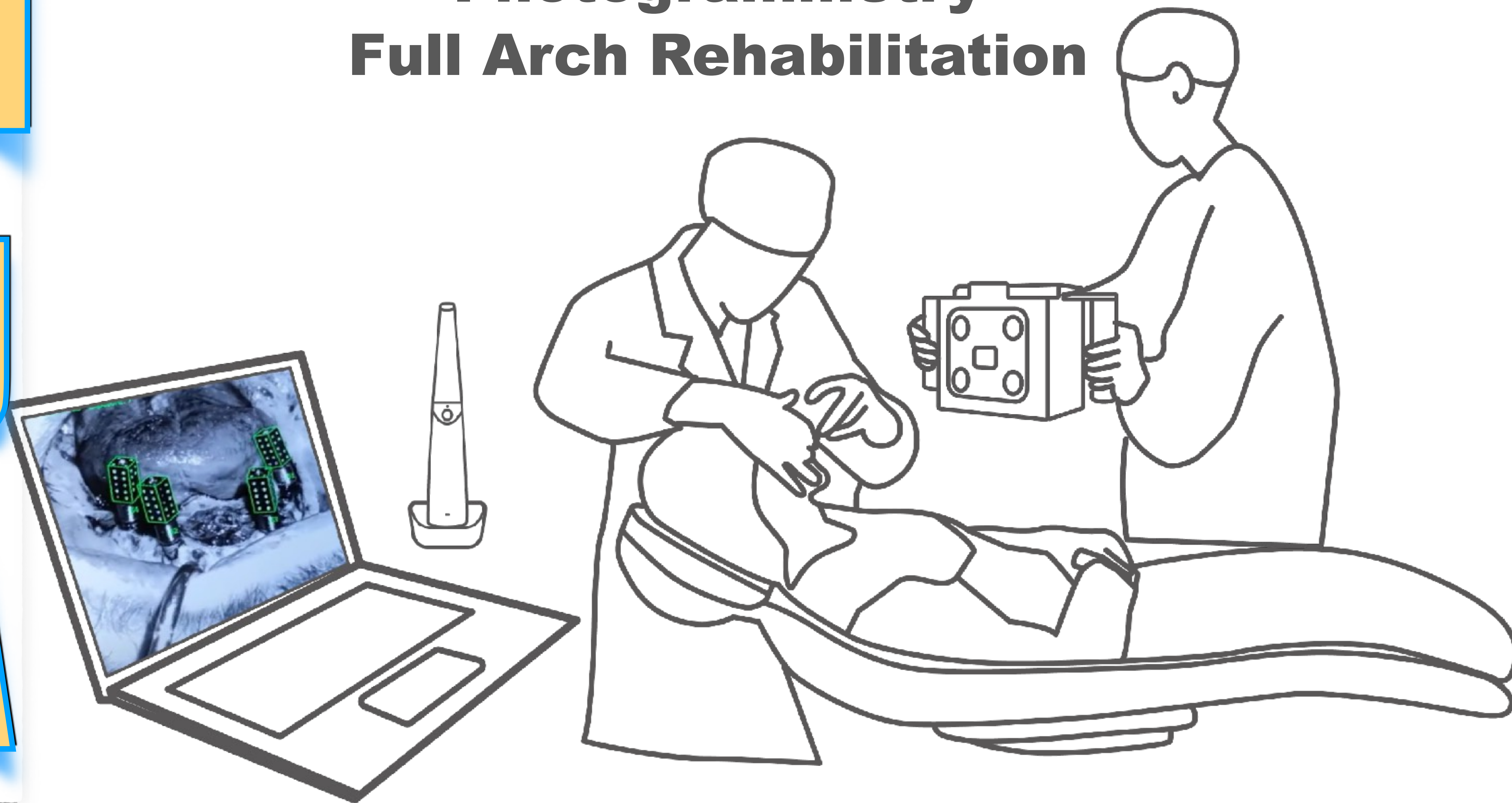
Photogrammetry works by taking multiple high-resolution overlapping photographs of the dental area from different angles. The images are then processed using specialized software to create a virtual 3D model.

M

EPG - Extraoral Photogrammetry Full Arch Rehabilitation

U

A



M

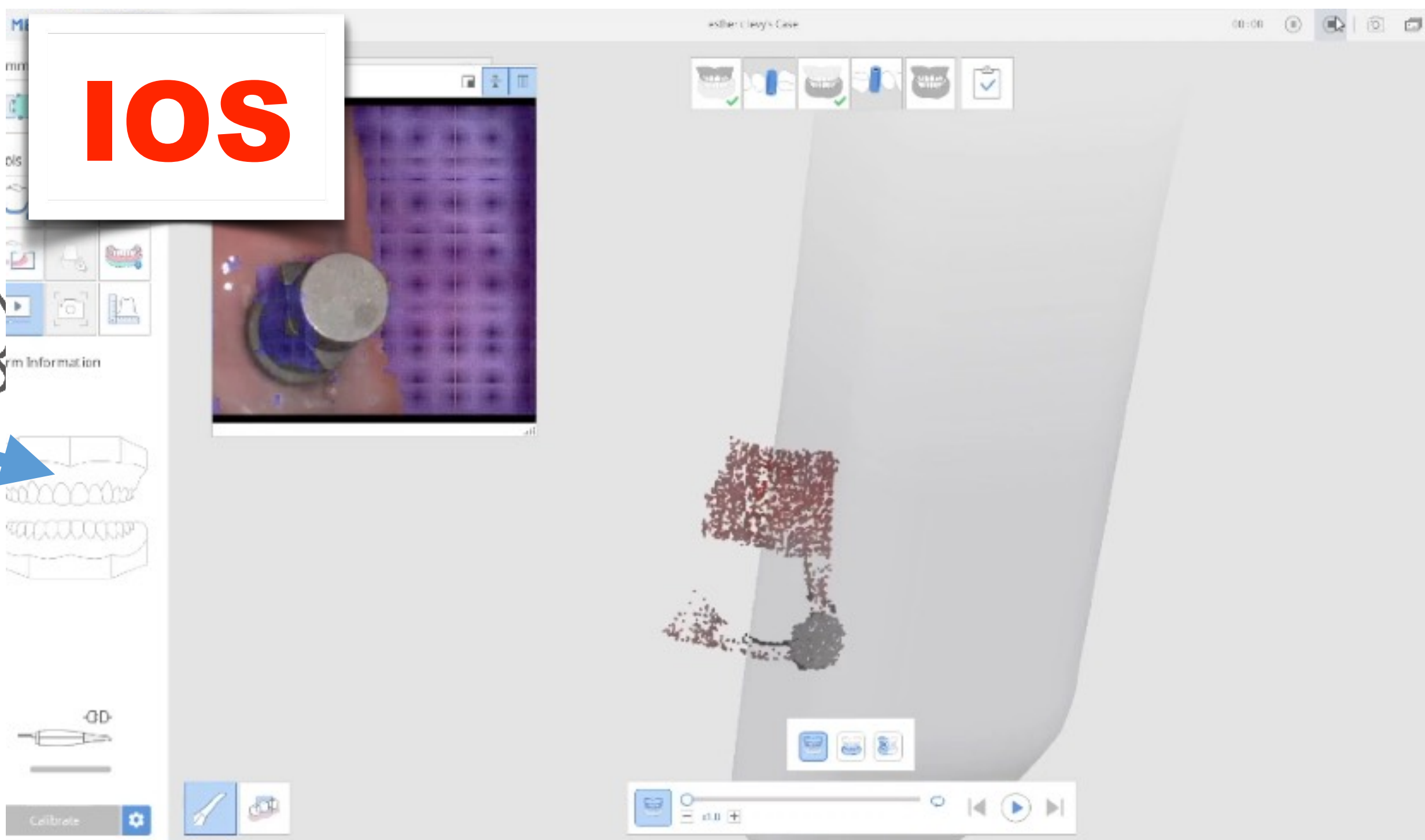
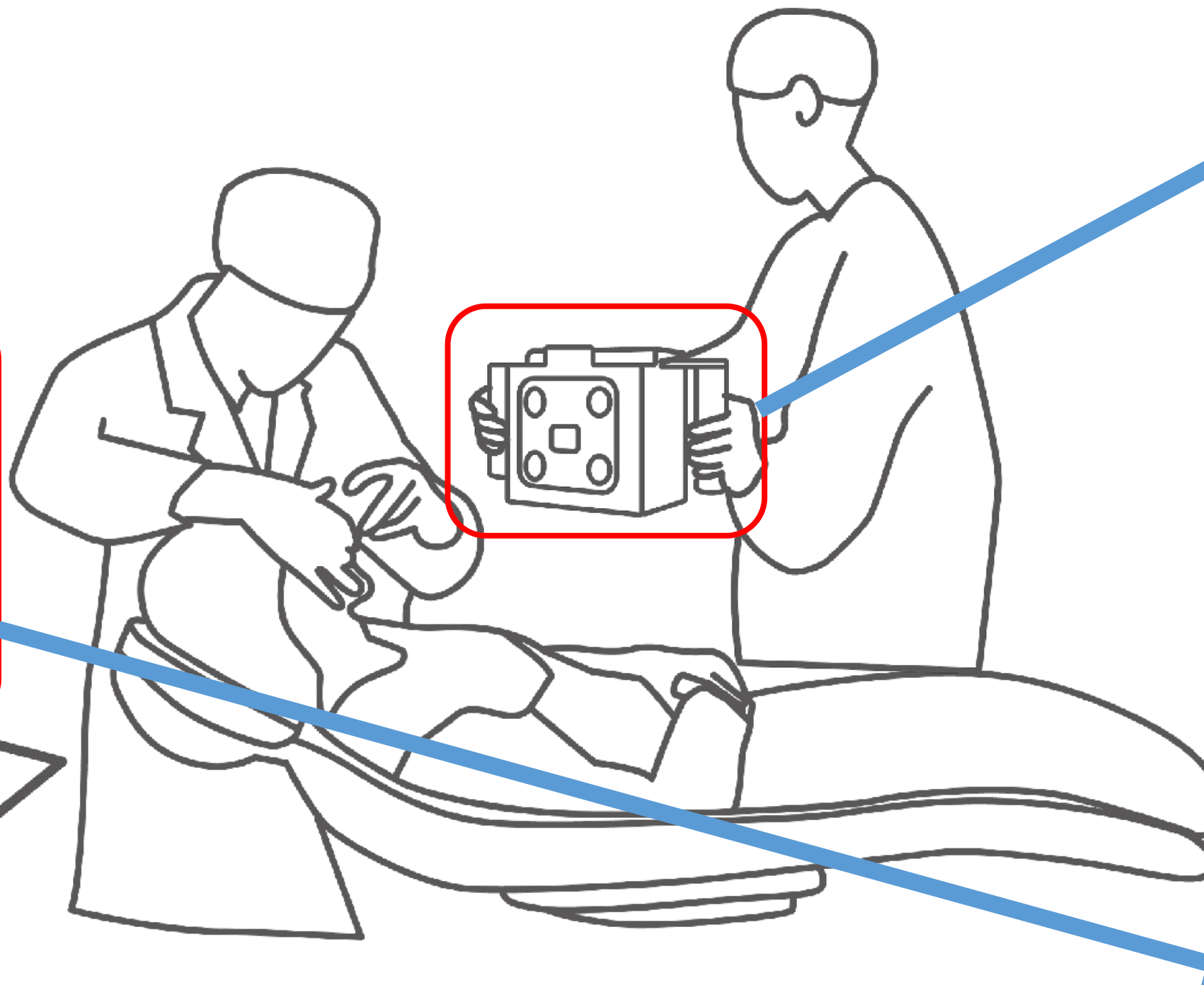
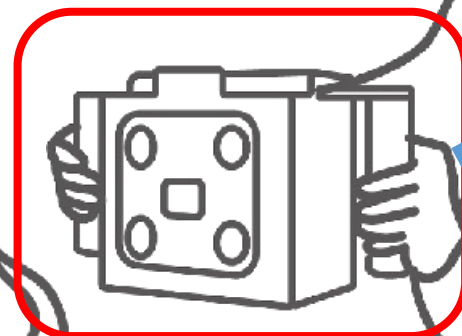
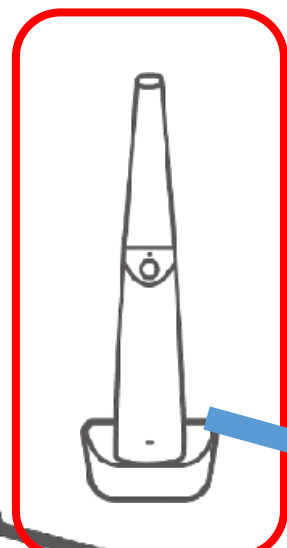
U

A

- ↑ **Passivity**
- ↑ **Angle correction**
- ↓ **S. Tissue Disturbance**
- ↑ **Retrievability**
- ↑ **Long tem Maintenance**



EPG - Extraoral Photogrammetry Full Arch Rehabilitation



**Requires 2 Devices
IOS AND EPG**

PHOTOGRAMMETRY

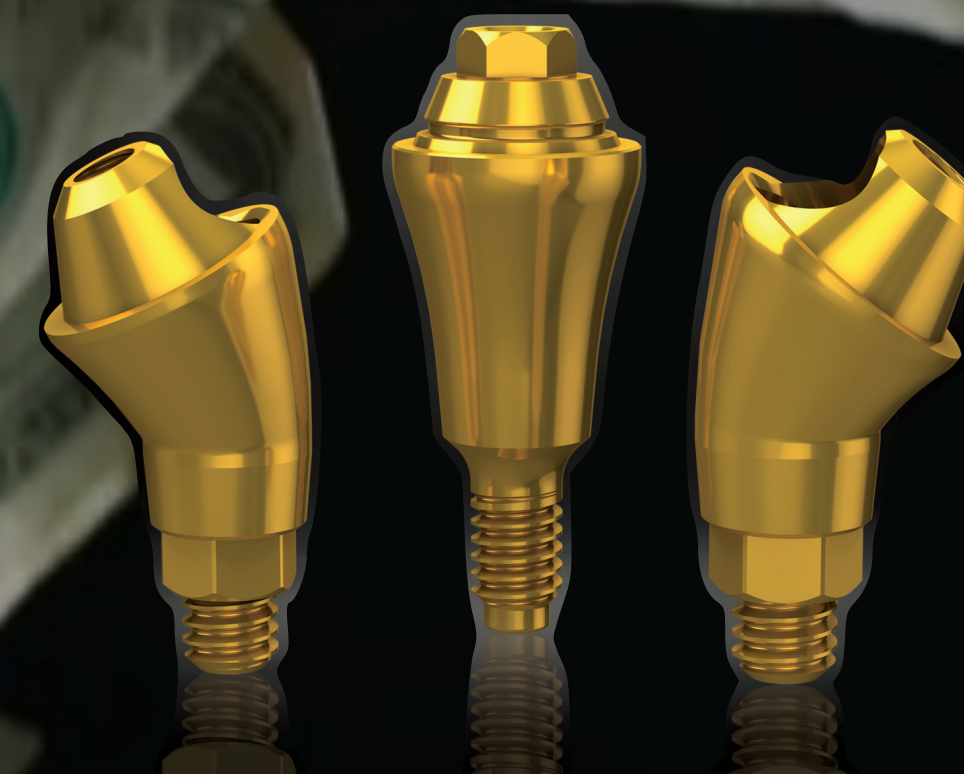




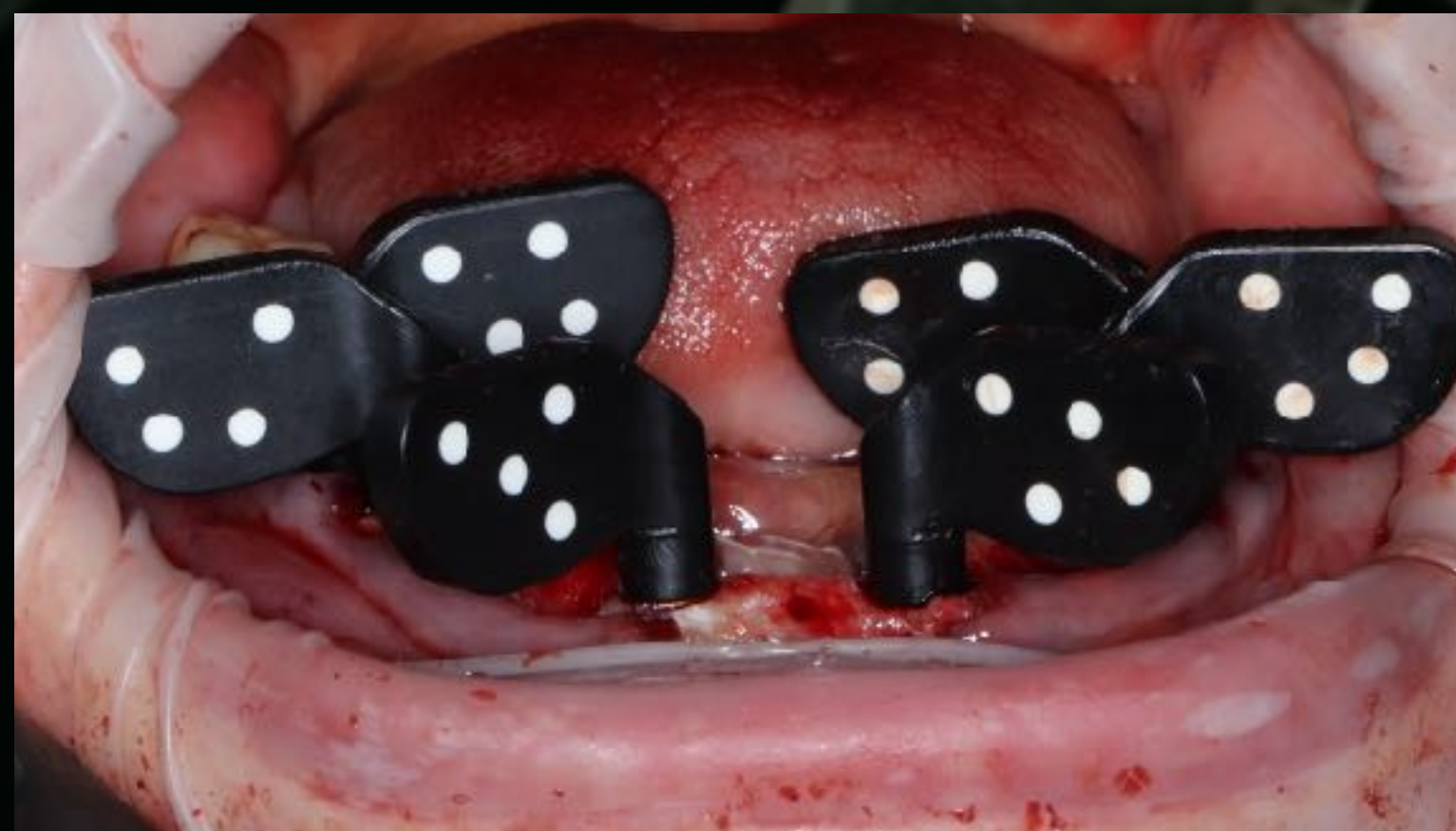
Imetric4D

PHOTOGRAMMETRY

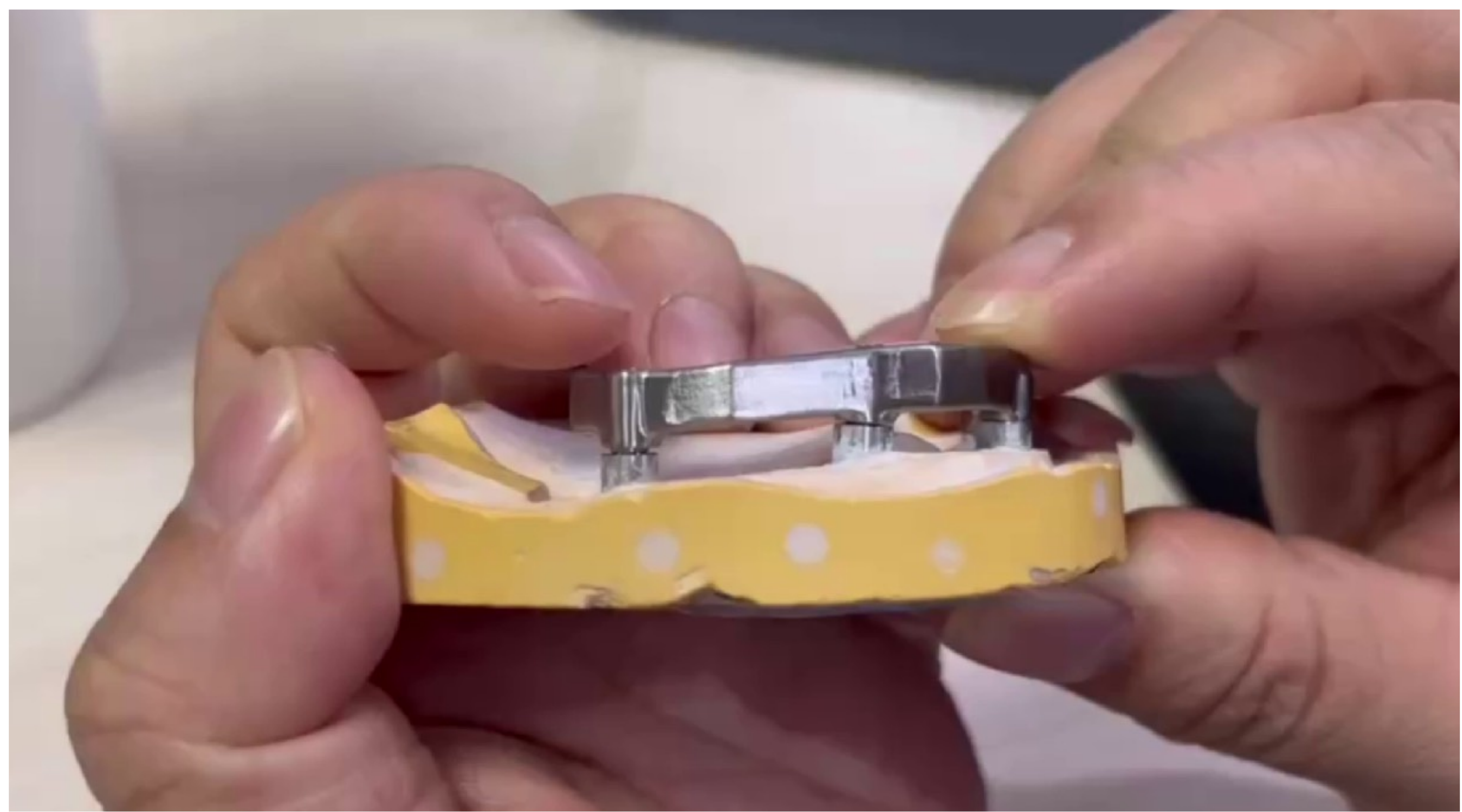
PIC dental®
PRECISE IMPLANTS CAPTURE



MICRON MAPPER



EPG - Stacking Errors when matching scans



hiding scans



ALTERNATIVES

ALTERNATIVES

EPG

- **Matching several scan bodies**
- **Stacking Errors**
- **Increased time for design**
- **Increased time for same day prints**



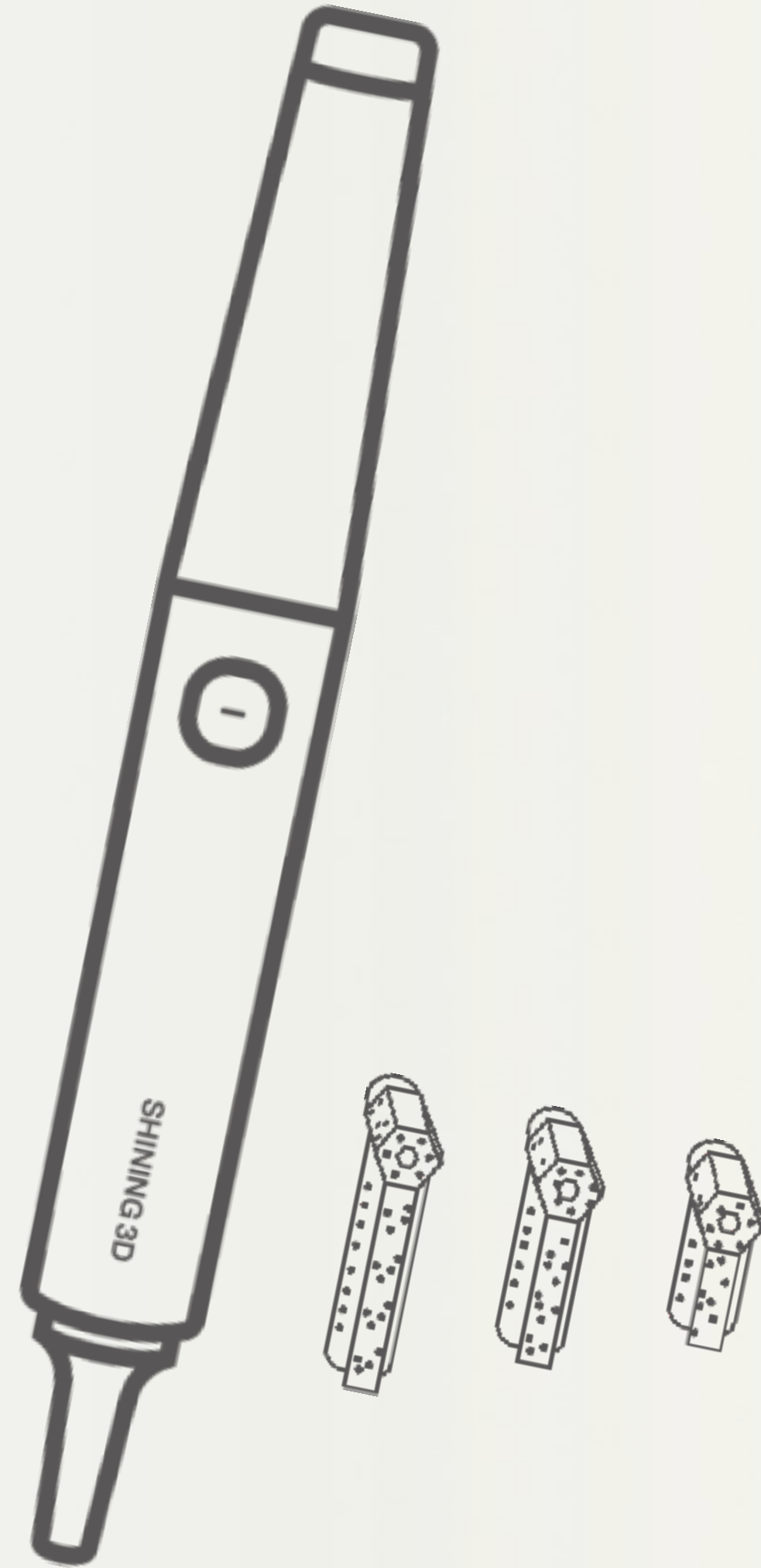
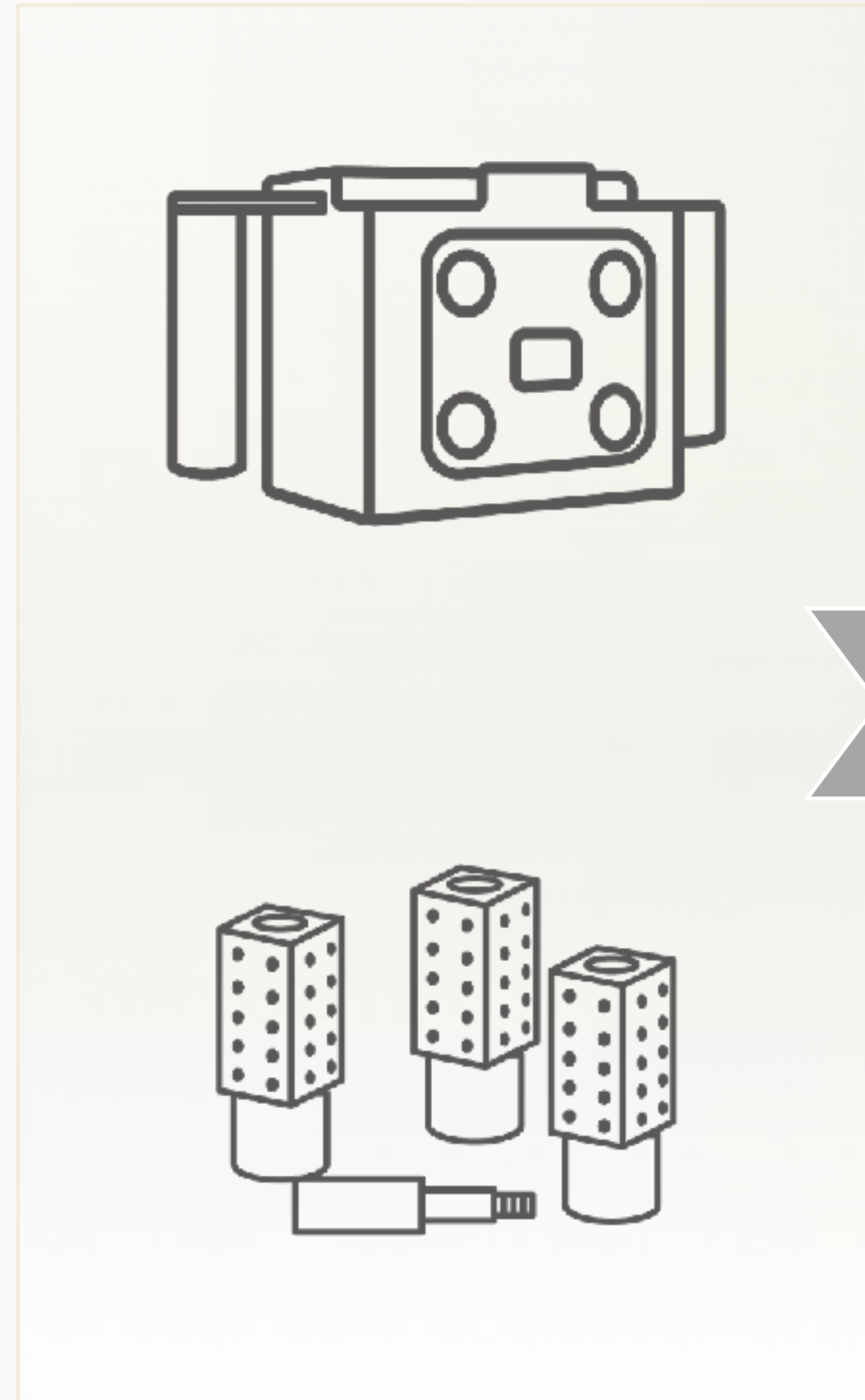
IPG

**Intraoral
Photogrammetry**

M

U

A



Two-in-One System

Compatible Implant System

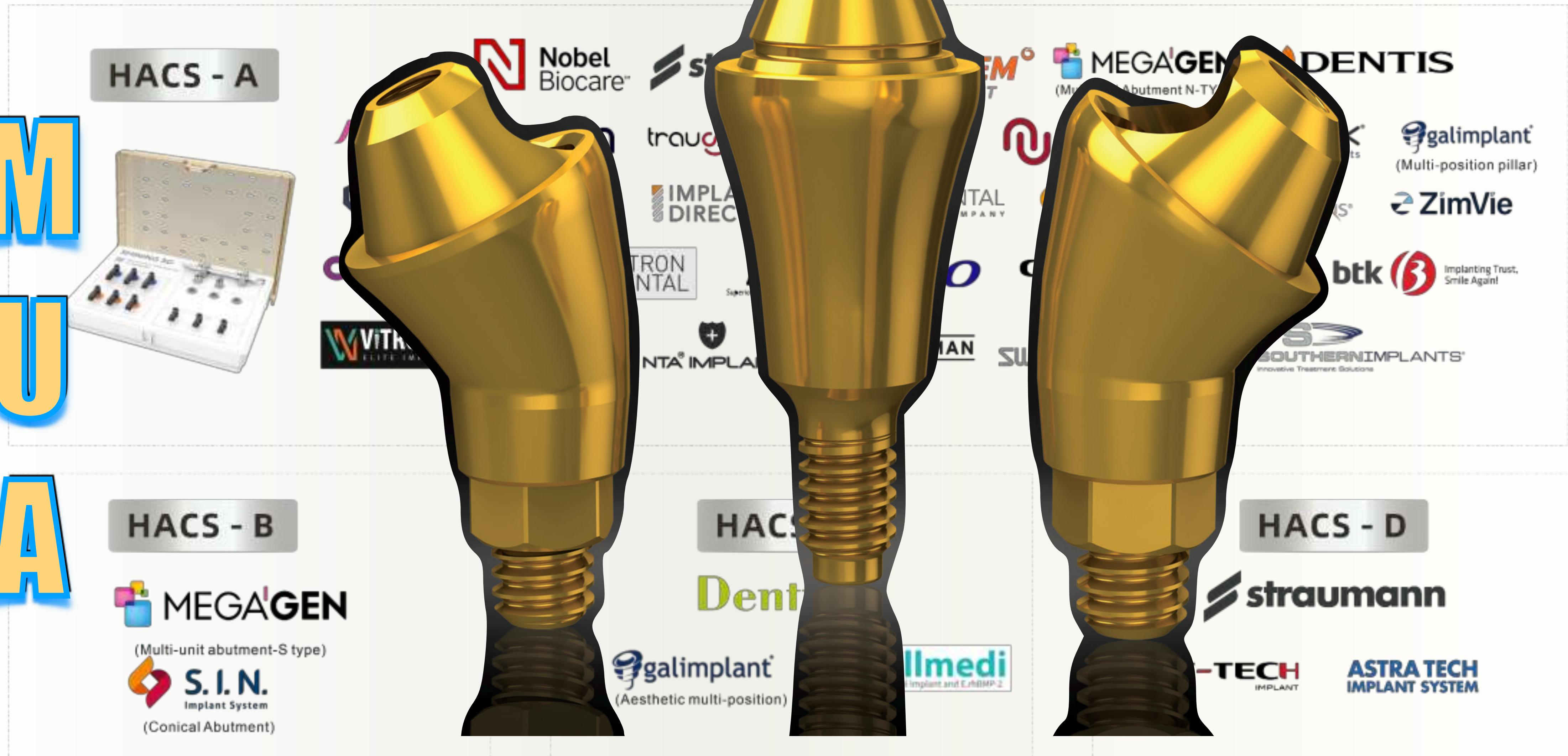
SHINING 3D
DENTAL

M
U

M
U

A

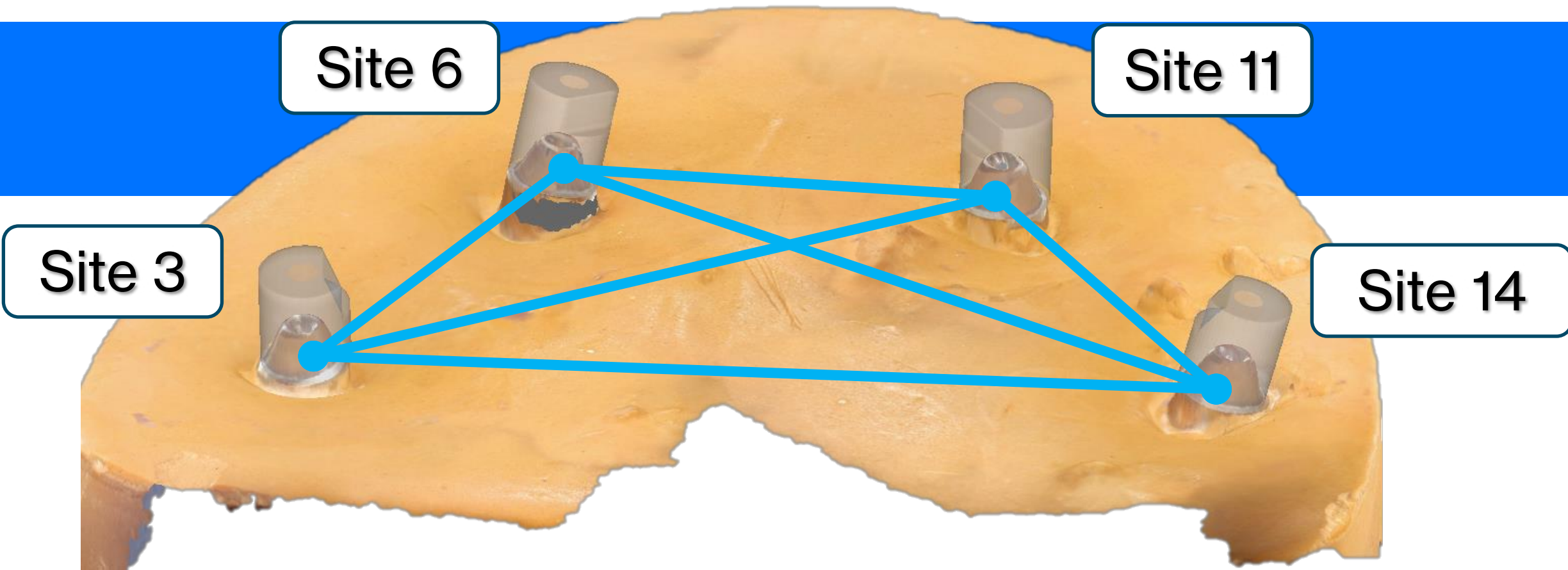
A



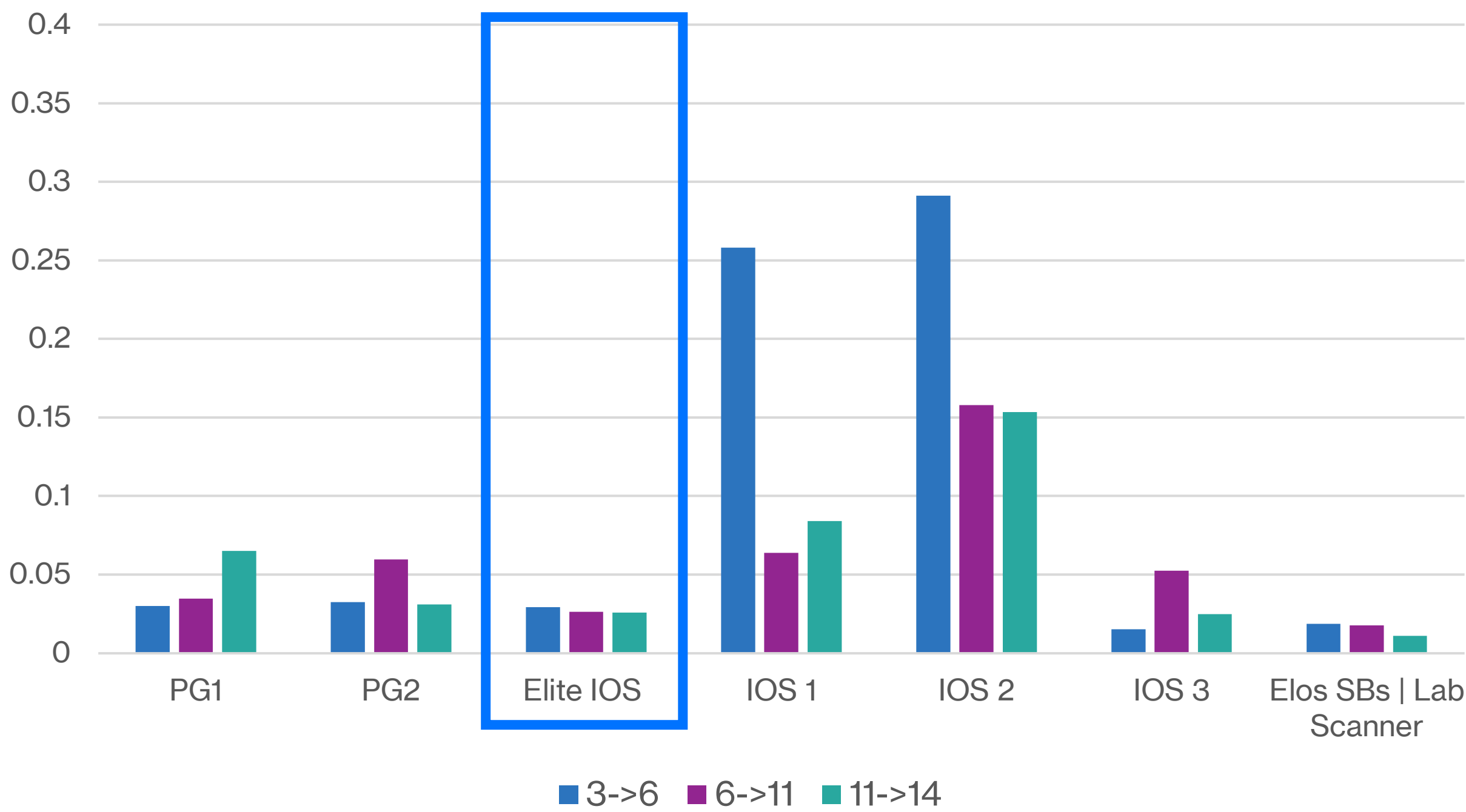
More implant systems are being tested for compatibility, with continuous updates in progress.

Accuracy Results – 4-unit model

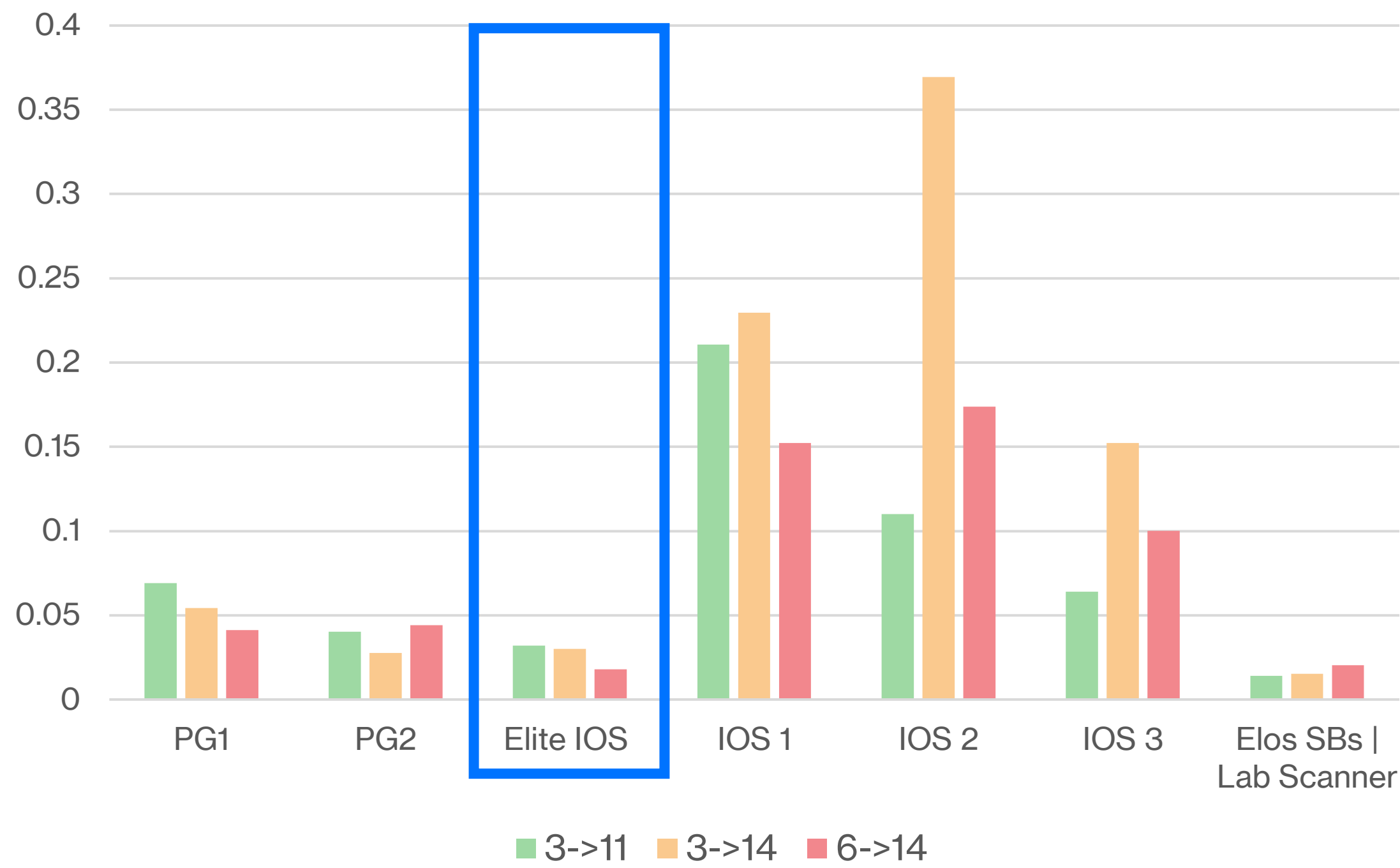
PG = photogrammetry system
IOS = IOS based capture method



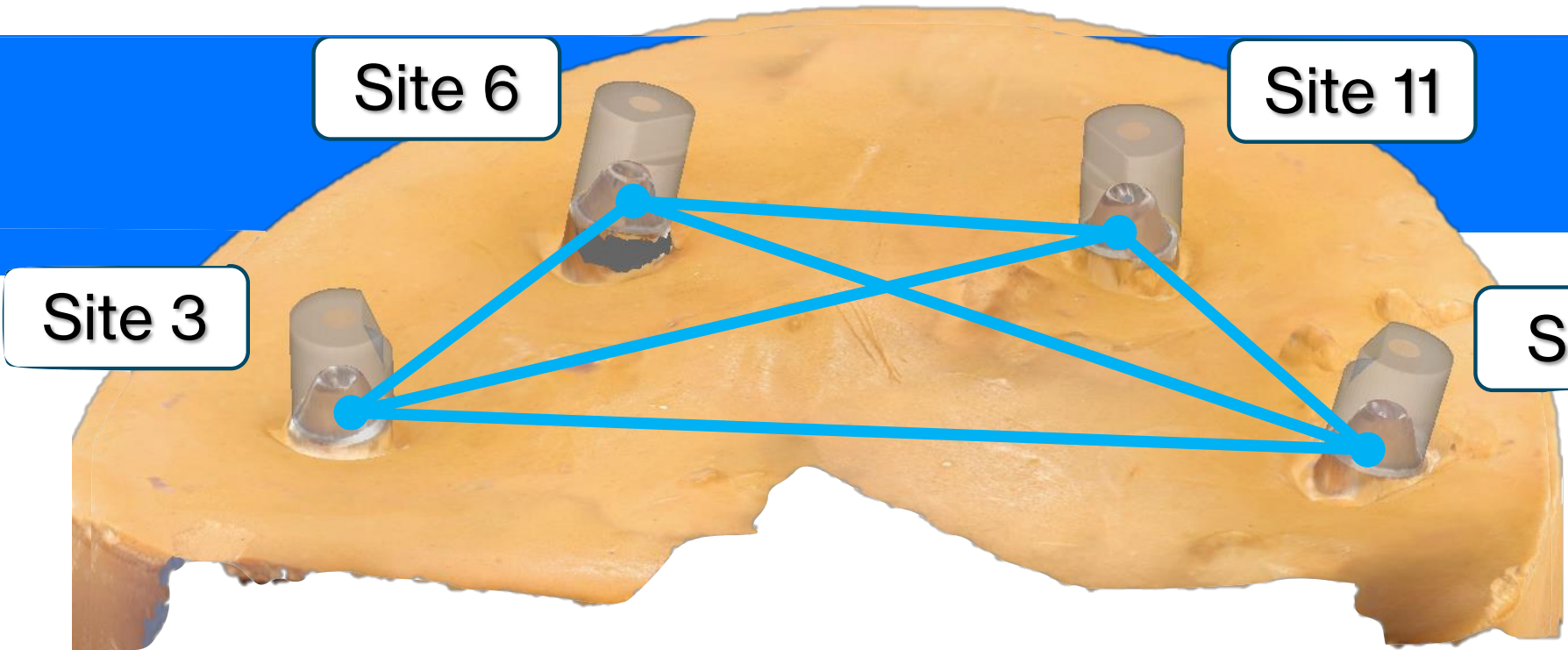
RMSE – Vector Distance (mm)
Adjacent Sites



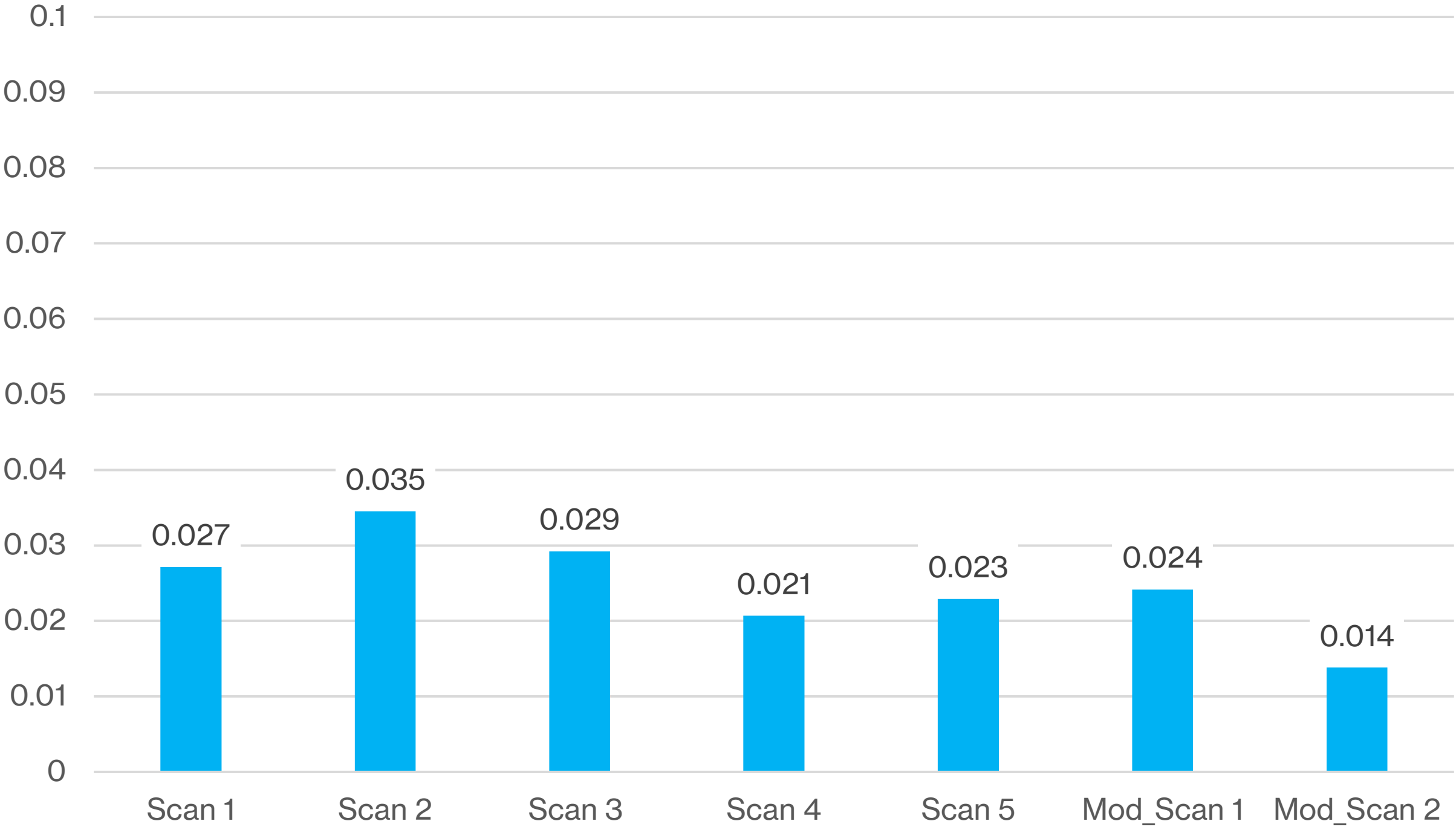
RMSE – Vector Distance (mm)
Cross-Arch



Accuracy Results – 4-unit model

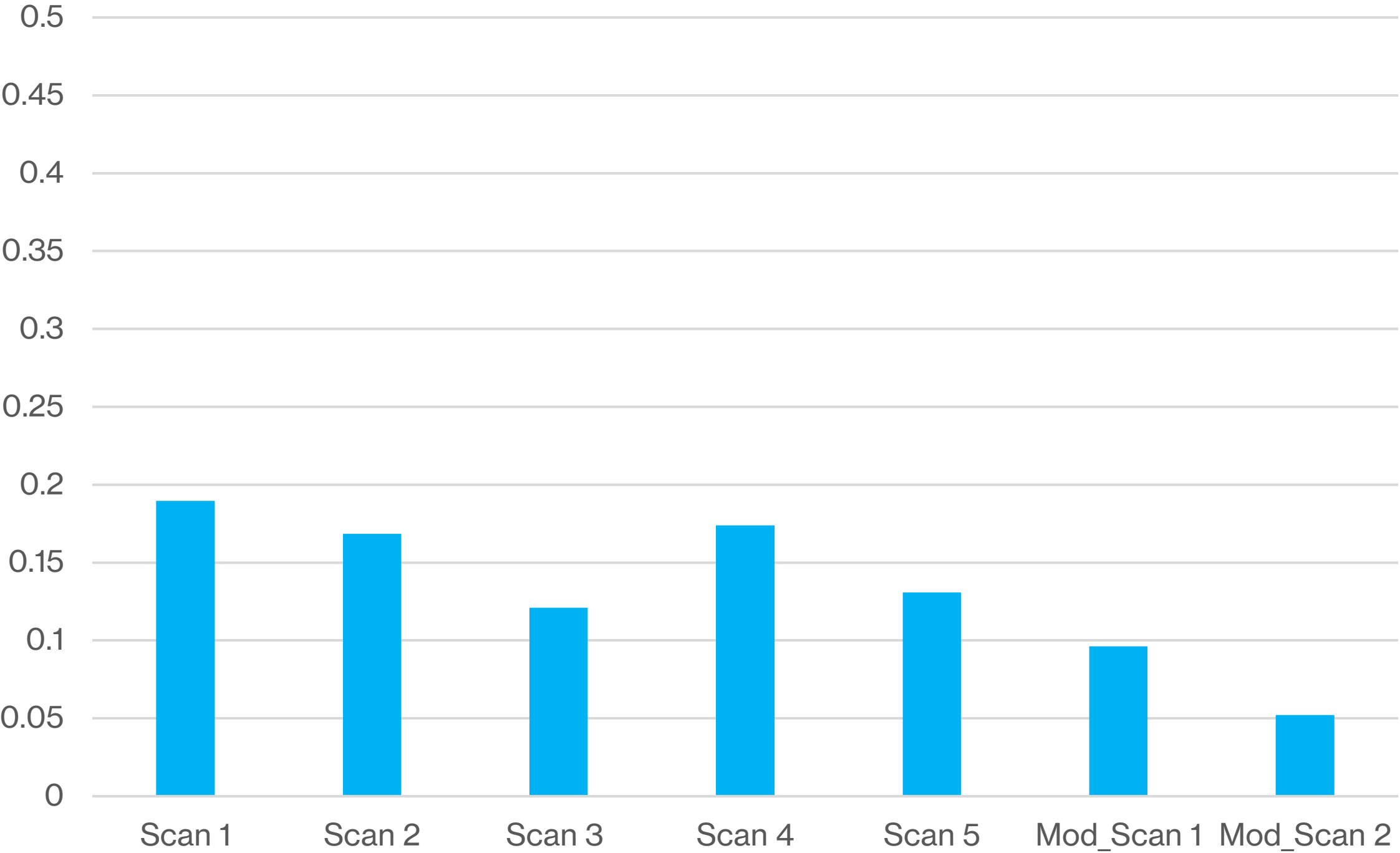


Elite IOS
RMSE – Vector Distance (mm)



Standard Deviation 0.005mm (5 microns)
*excludes Mod scan data

Elite IOS
RMSE – Insertion Angle (degrees)



Standard Deviation: 0.026°
*excludes Mod scan data

IPG - Intra Oral Photogrammetry A Novel Approach for Full Arch Implant Capture
Accepted for Publication



Tawil



Pozzi

Name	Result Name	Ref. Value	The International Journal of Periodontics & Restorative Dentistry The Academy of Osseointegration			
Angular Dim.1	Result Data - Elite	0.3	A E U G			
Angular Dim.2	Result Data - Elite	0.3				
Angular Dim.3	Result Data - Elite	0.24				
Angular Dim.4	Result Data - Elite	0.1				
Angular Dim.5	Result Data - Elite	0.2				
Linear Dim.1	Result Data - Elite	0.0	2	0.035	0.0411	
Linear Dim.2	Result Data - Elite	0.0	1	0.0024	0.0324	
Linear Dim.3	Result Data - Elite	0.06	71	0.0473	0.0004	
Linear Dim.4	Result Data - Elite	0.0404	0.0246	0.0286	0.0145	
Linear Dim.5	Result Data - Elite	0.0342	0.0273	0.0153	0.0066	
			IPG > EPG vs DS			
Name	Result Name	Ref. Value	Meas. Value			
Angular Dim. 1	Result Data - Elos	0.0				
Angular Dim. 2	Result Data - Elos	0.2391				
Angular Dim. 3	Result Data - Elos	0.1448				
Angular Dim. 4	Result Data - Elos	0.033				
Angular Dim. 5	Result Data - Elos	0.1723				
Linear Dim. 1	Result Data - Elos	0.0604	0.0252	0.0266	0.048	
Linear Dim. 2	Result Data - Elos	0.0586	0.0904	0.7283	7.9171	
Linear Dim. 3	Result Data - Elos	0.0725	0.0376	0.0554	0.028	
Linear Dim. 4	Result Data - Elos	0.0237	0.0034	0.0143	0.0187	
Linear Dim. 5	Result Data - Elos	0.0214	0.0121	0.0025	0.0175	



Accepted for Publication

Provisional prosthesis outcome when using photogrammetry for complete arch oral implants: A report of 111 complete arch patient treatments.

Jensen, Tawil I, Ross DM, Jivraj S,



IPG > EPG

What is **IPG** Intraoral
Photogrammetry

TWO CAMERAS
1 DEVICE

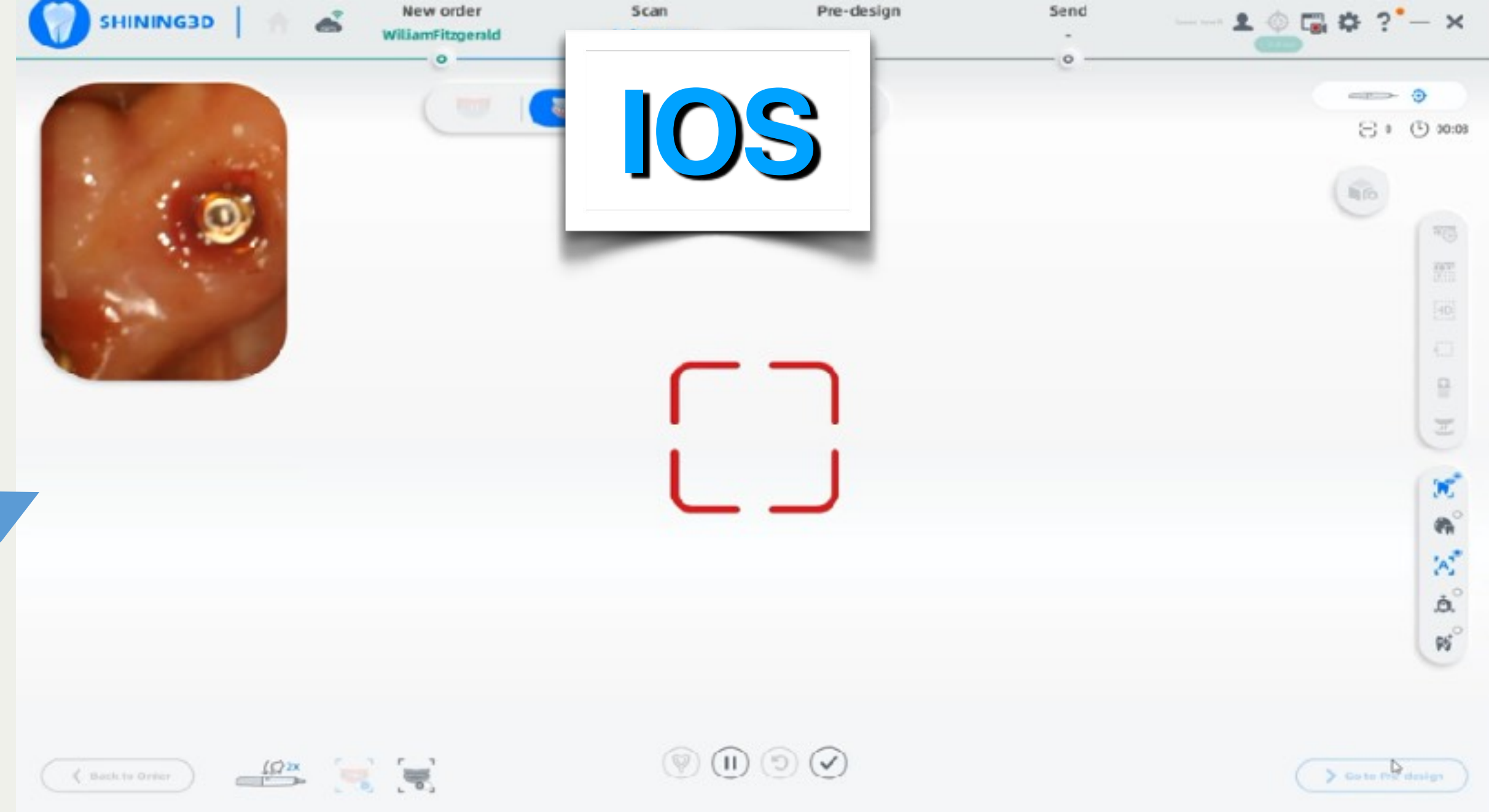
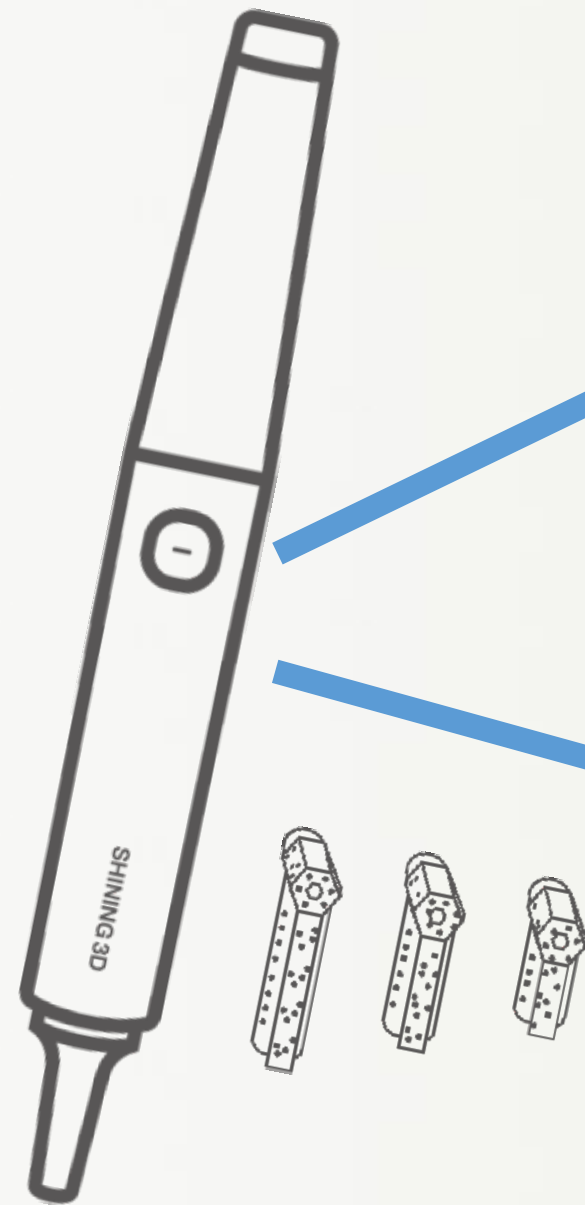
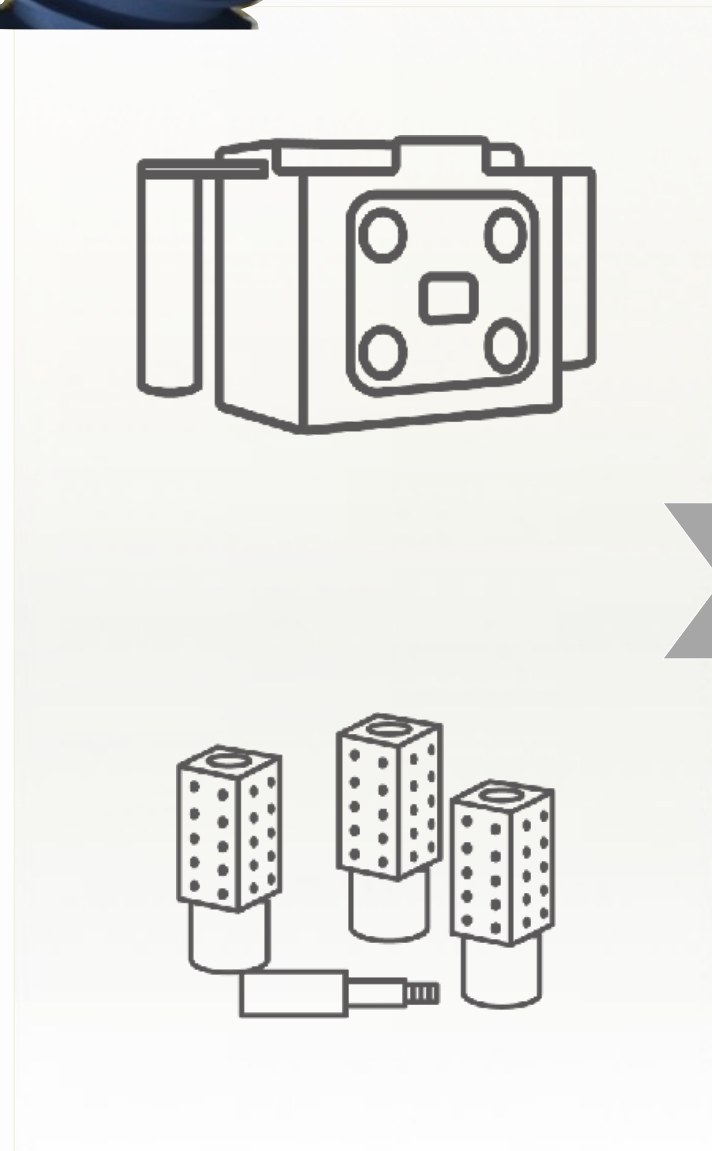
IOS



IPG

IPG

Intraoral Photogrammetry



IOS

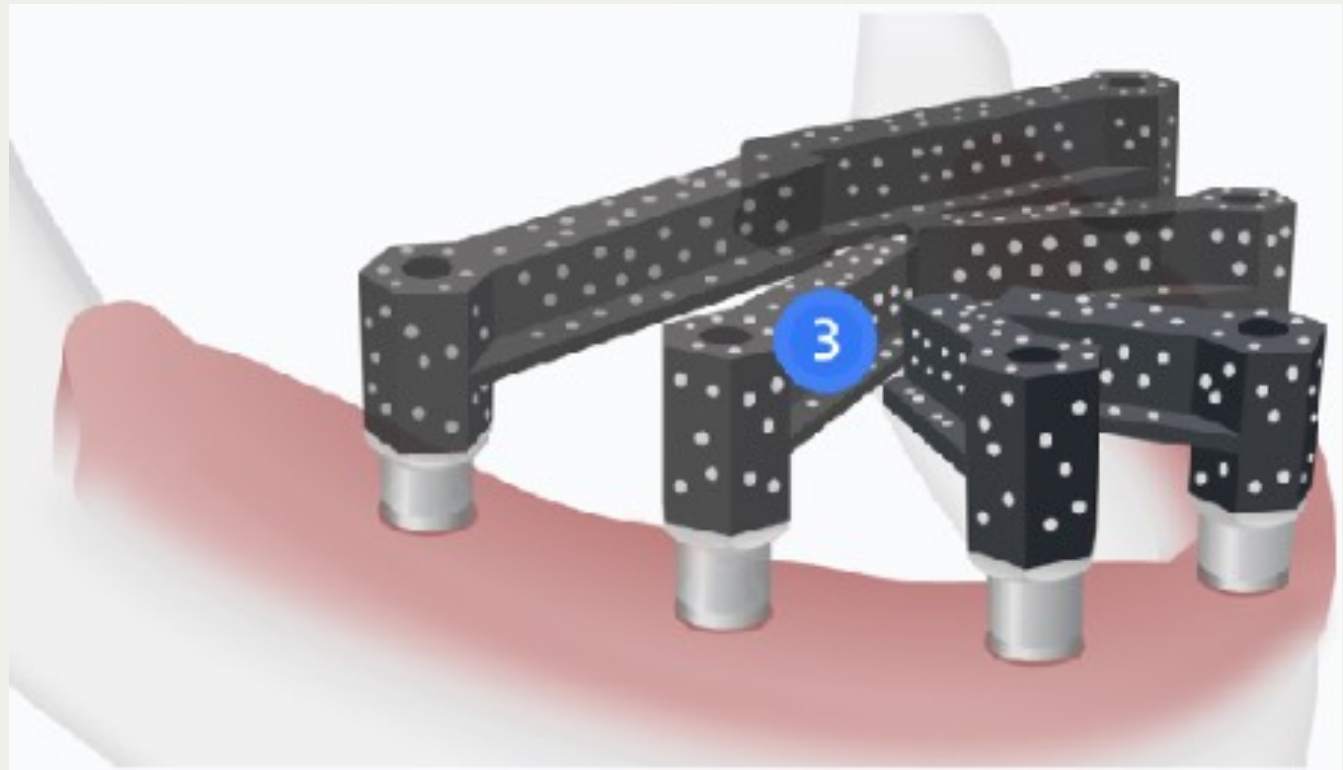
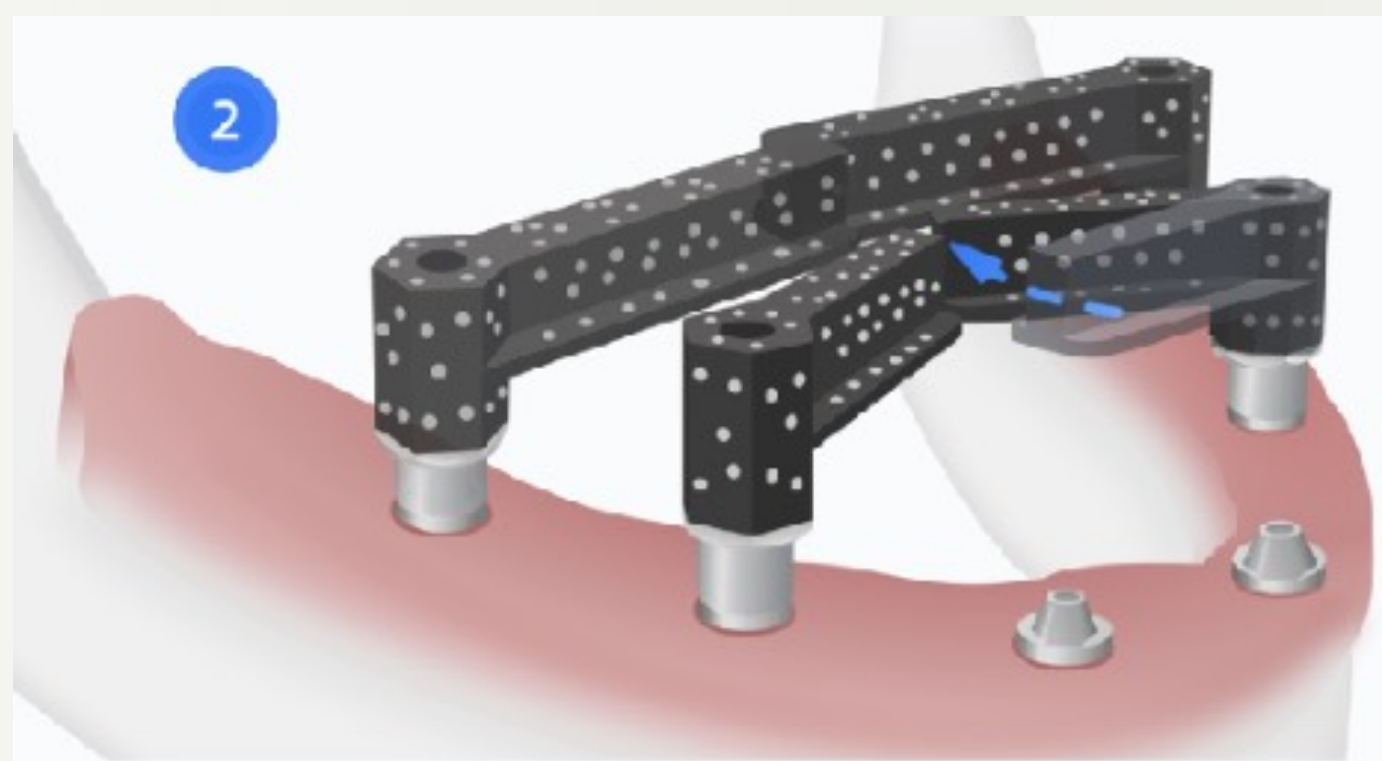
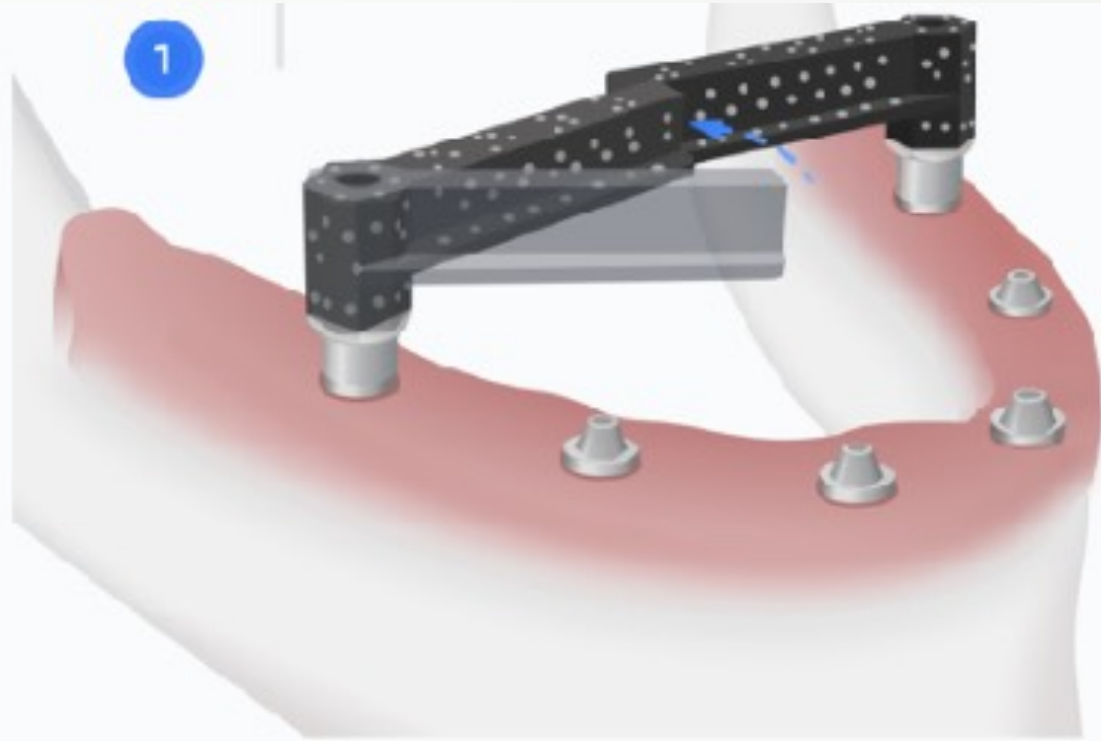
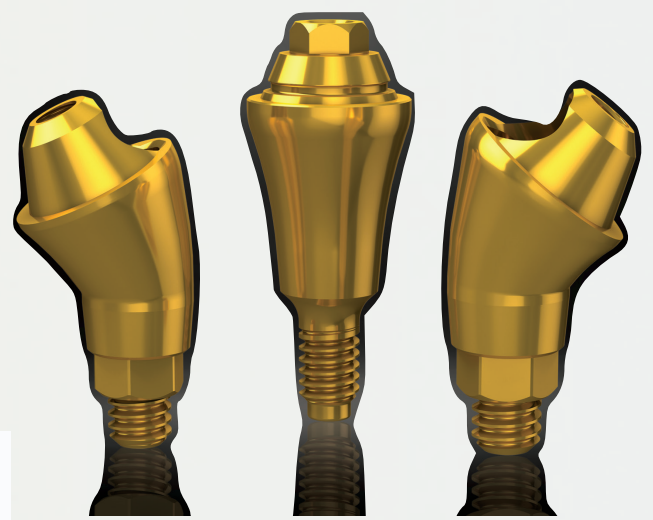


IPG

Two Cameras -in- One System IOS & IPG



IPG Intraoral Photogrammetry



HACS - HIGH ACCURACY CODED SCANBODIES



HORIZONTAL SEATING = PERPENDICULAR TO THE CAPTURE DEVICE

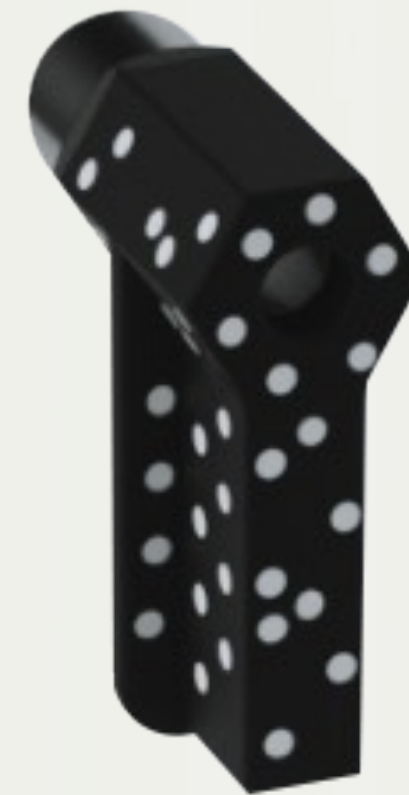
How **IPG** Intraoral Photogrammetry Works?

For intraoral photogrammetry, the distance between the object and the camera is significantly reduced, allowing for highly precise measurements. This proximity enhances the accuracy of the wide ~~single photogrammetry window camera~~, enabling it to effectively capture detailed data without the need for supplementary cameras or complex setups. Moreover, this design minimizes the need for frequent recalibration, as the system is optimized for the controlled ~~intraoral environment~~. By streamlining the workflow and reducing equipment requirements, this approach not only ensures reliable measurements but also improves efficiency and ease of use in clinical applications.



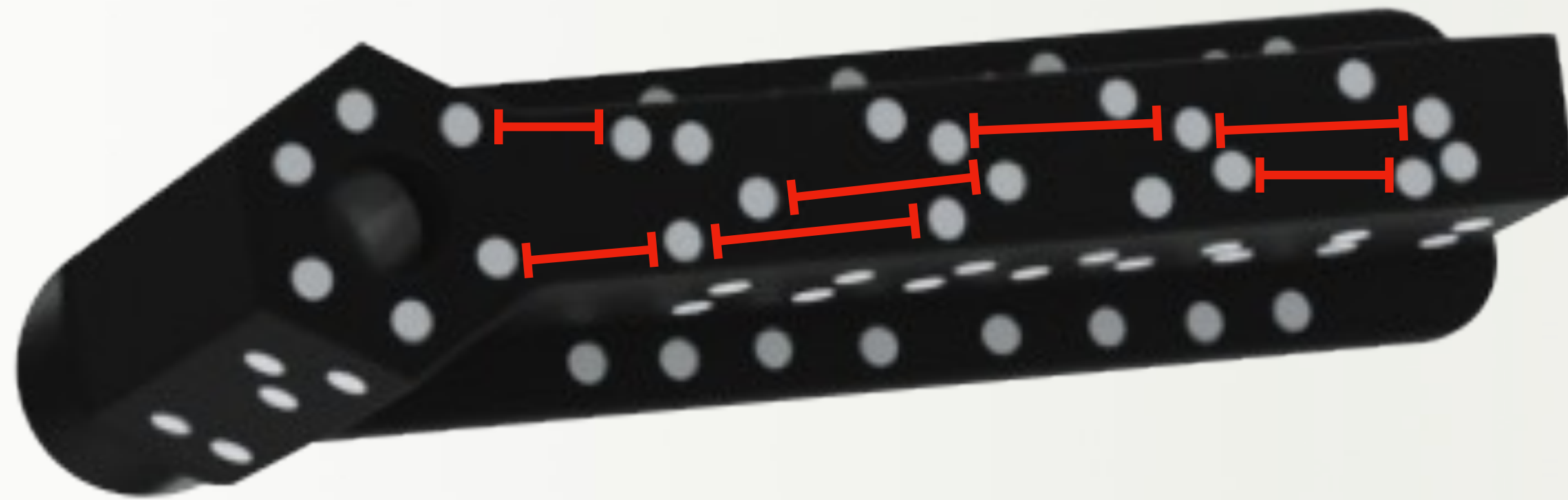
How **IPG** Intraoral Photogrammetry Works?

Measures the distances between markings to precisely capture the known object



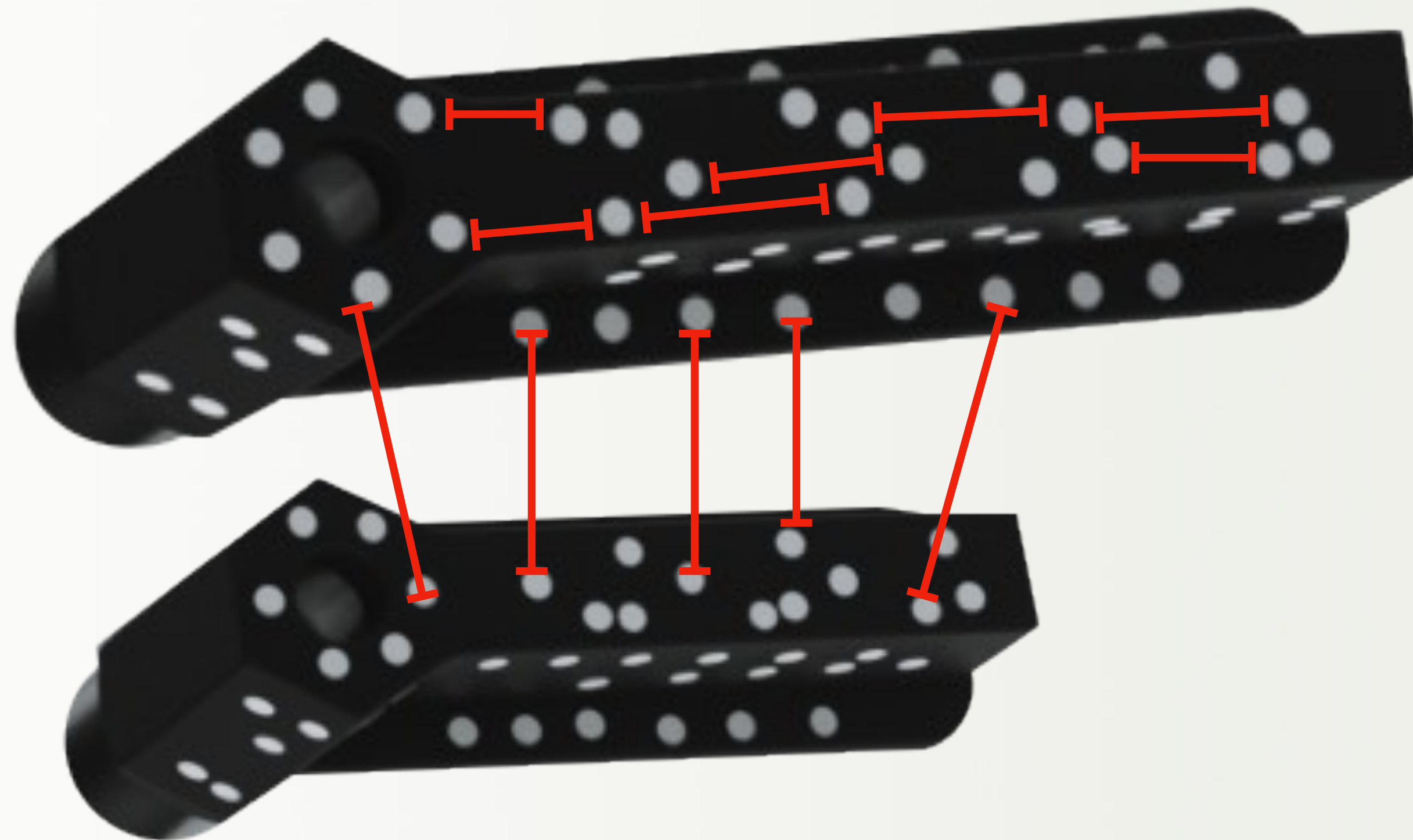
How **IPG** Intraoral Photogrammetry Works?

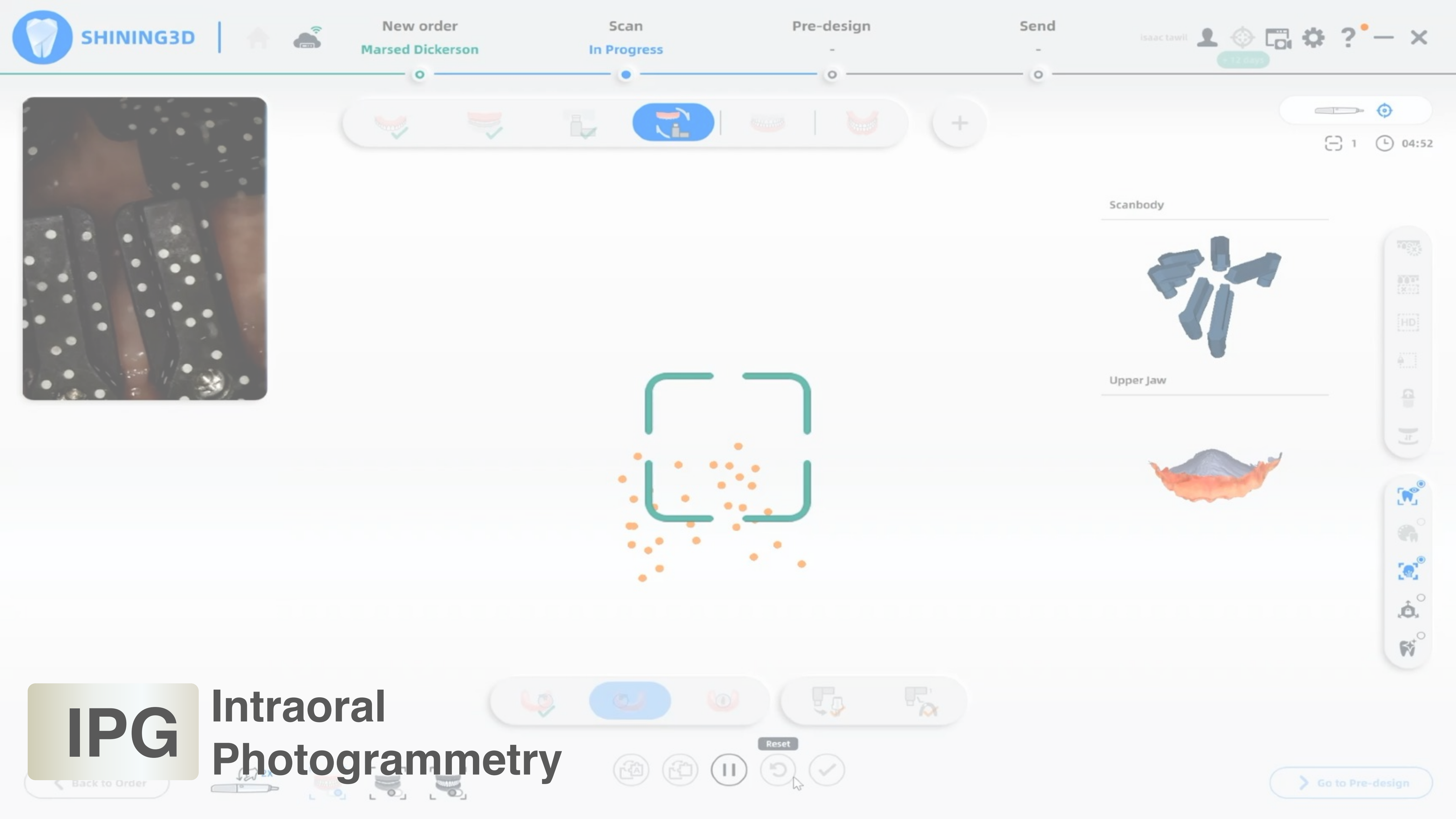
Measures the distances between markings to precisely capture the known object



How **IPG** Intraoral Photogrammetry Works?

Measures the distances between markings to precisely capture the known object



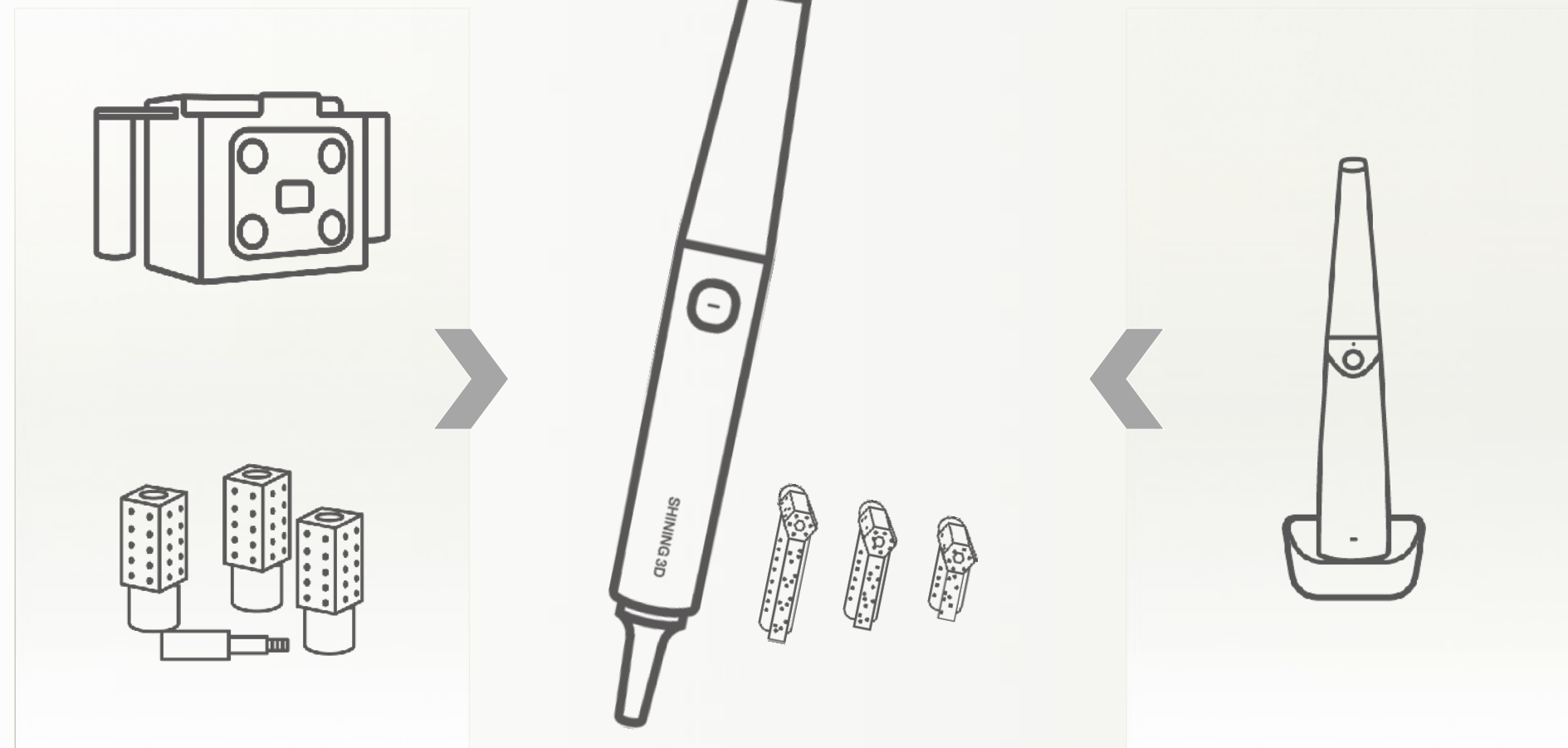


IPG

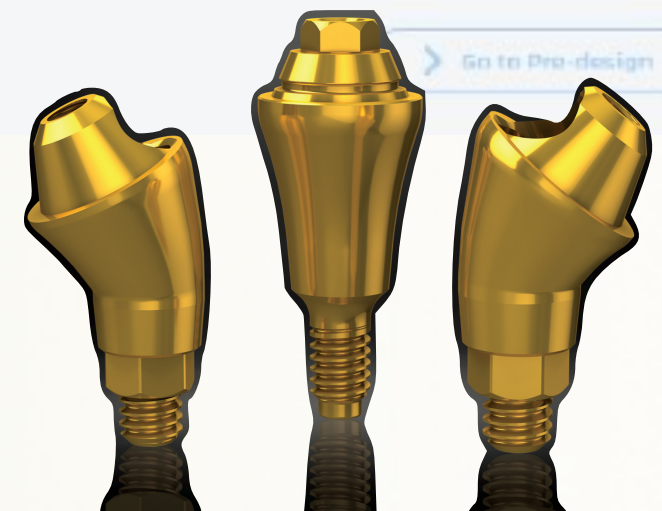
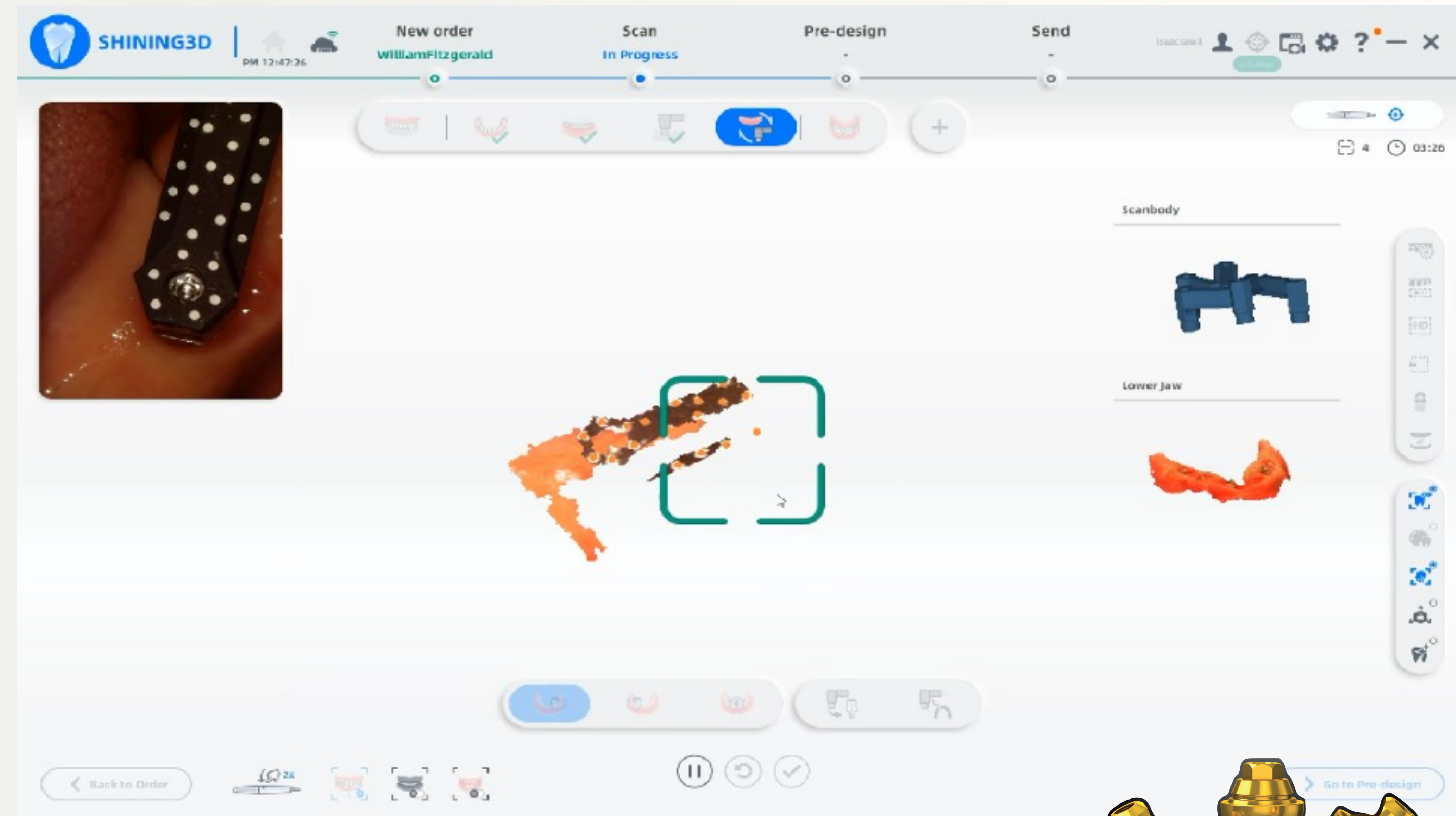
Intraoral
Photogrammetry

IPG

Intraoral Photogrammetry

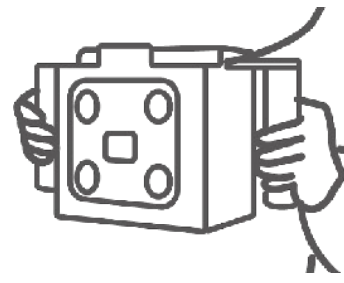


SCAN MATCHING



EPG

Extraoral Photogrammetry



VS

IPG

Intraoral Photogrammetry



- 2 devices IOS + EPG
- Additional software for Matching Scan-flag to Scan-body to Tissue
- Increased time for conversion of Scan-flag to implant position
- Separate files require manual matching in CAD Software ie: Exocad, 3Shape, Dental Wings
- Expensive Scan flag/body

- One Device IOS + IPG
- Simplified Matching Scan-flag to Tissue
- Efficient Conversion of Scan-flag implant position
- All in one file CAD file population
- Affordable Scan flag/body

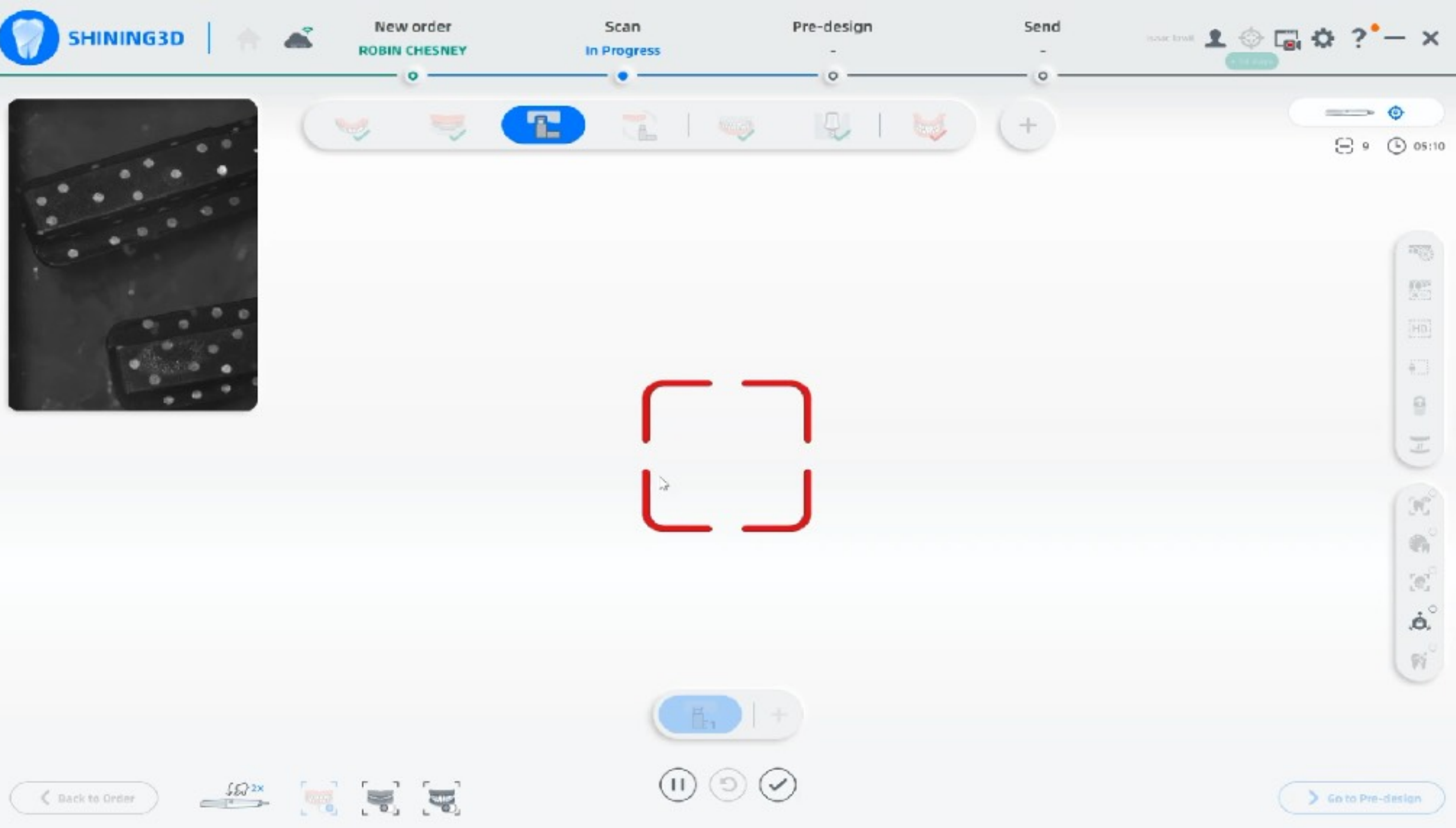


PRE-FABRICATED

**Where do we go
from here?**

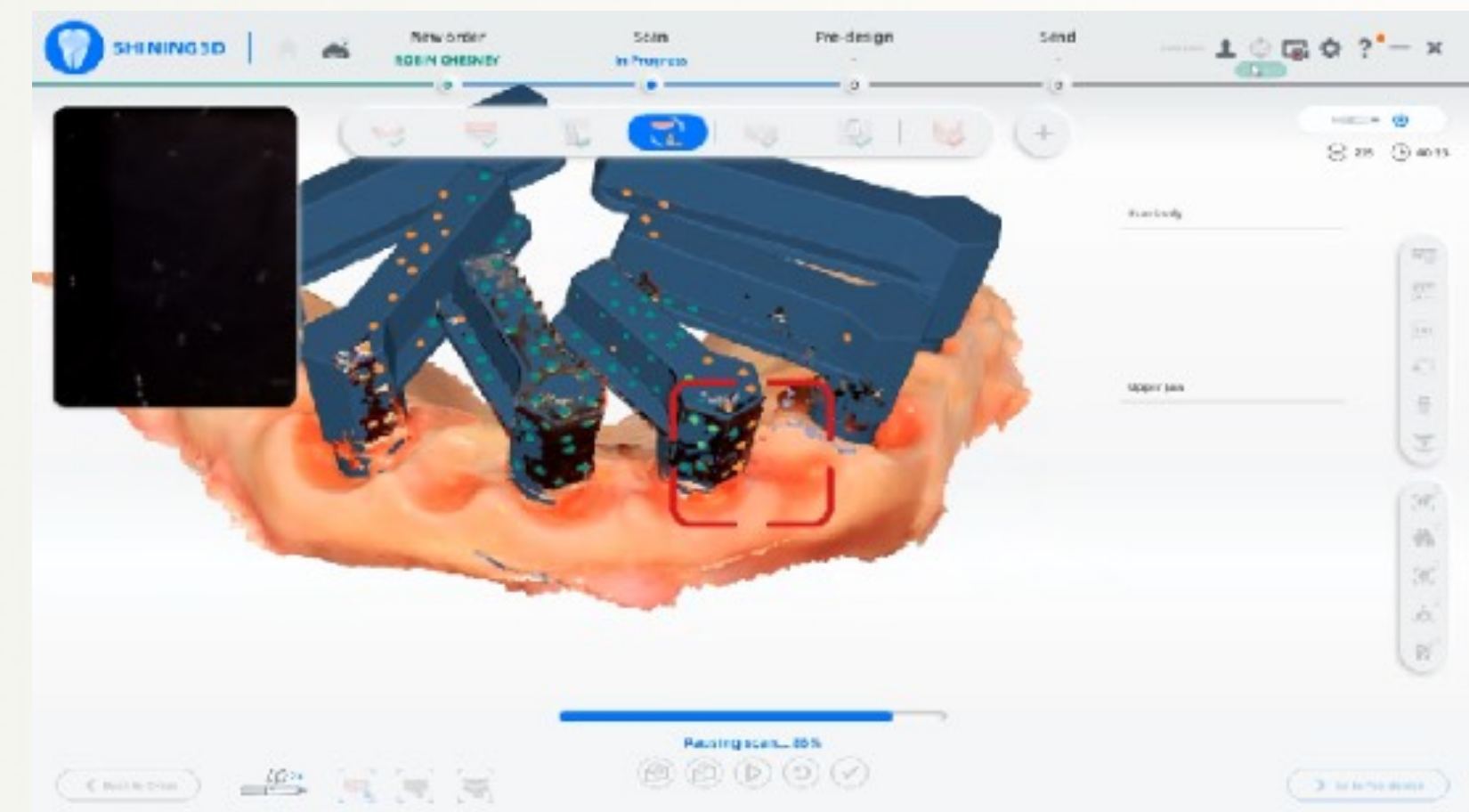
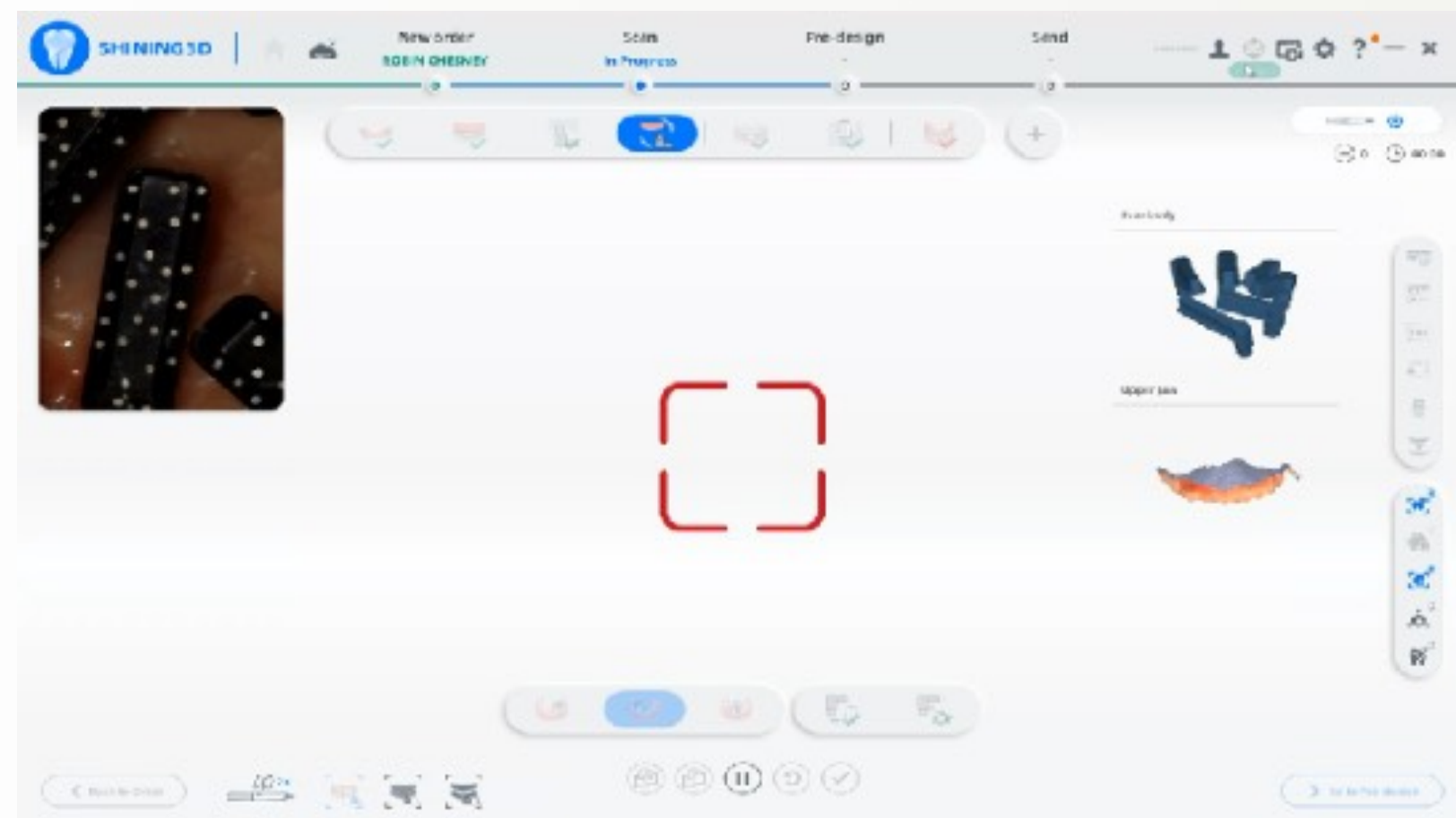


Intra-Oral PhotoGrammetry

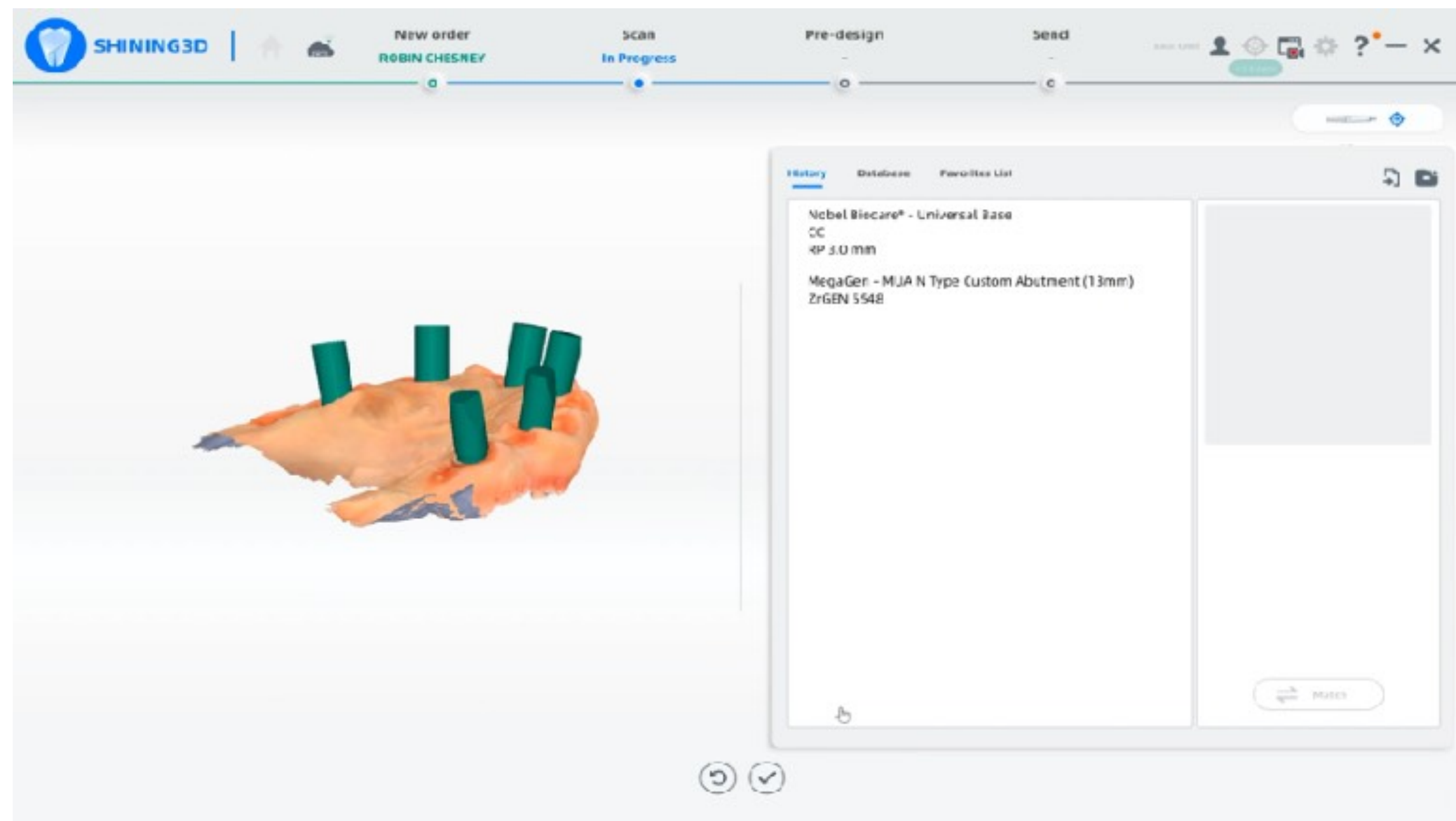


IPG

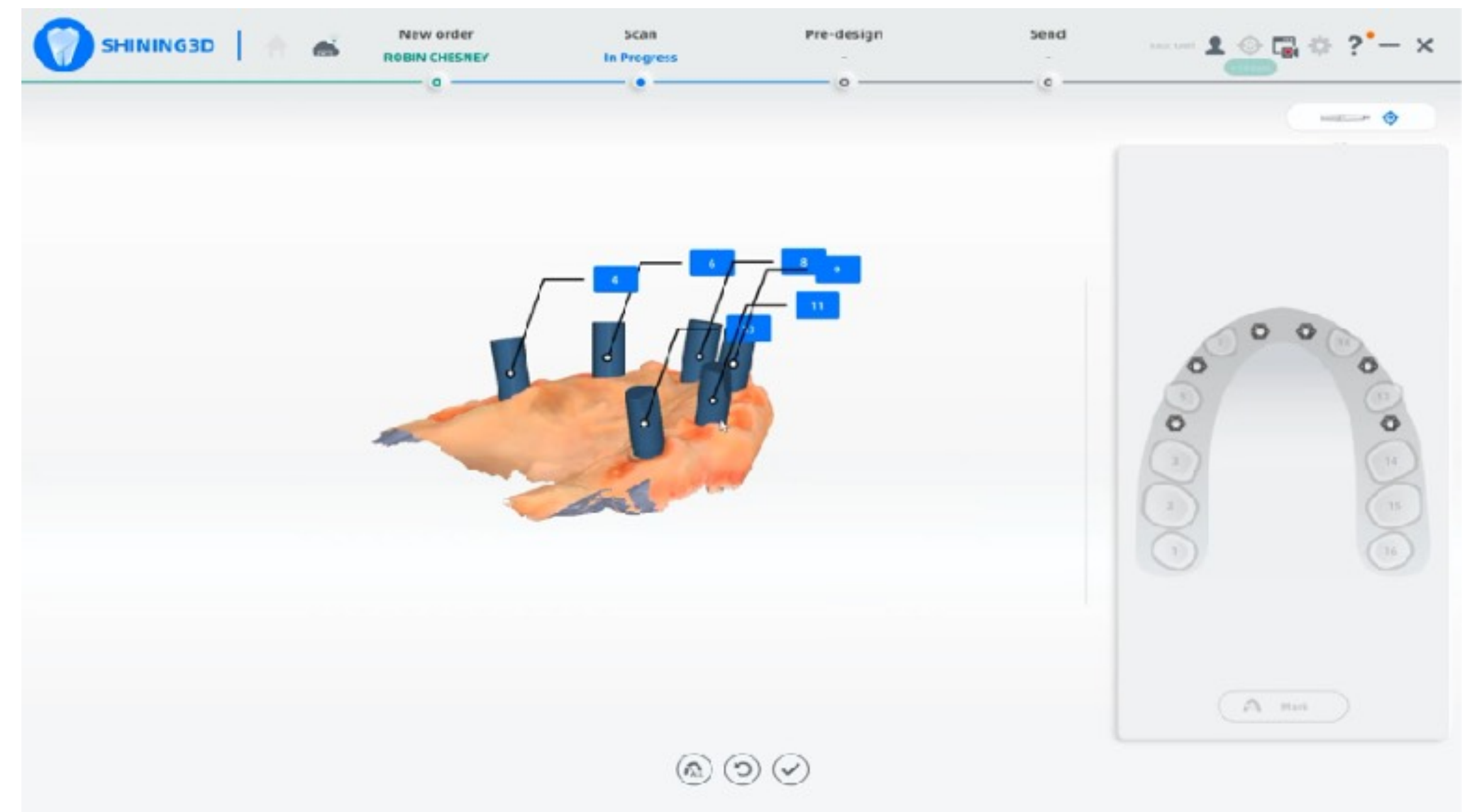
Tissue Matching



Scan Body Conversion



Tooth Identification



All in One

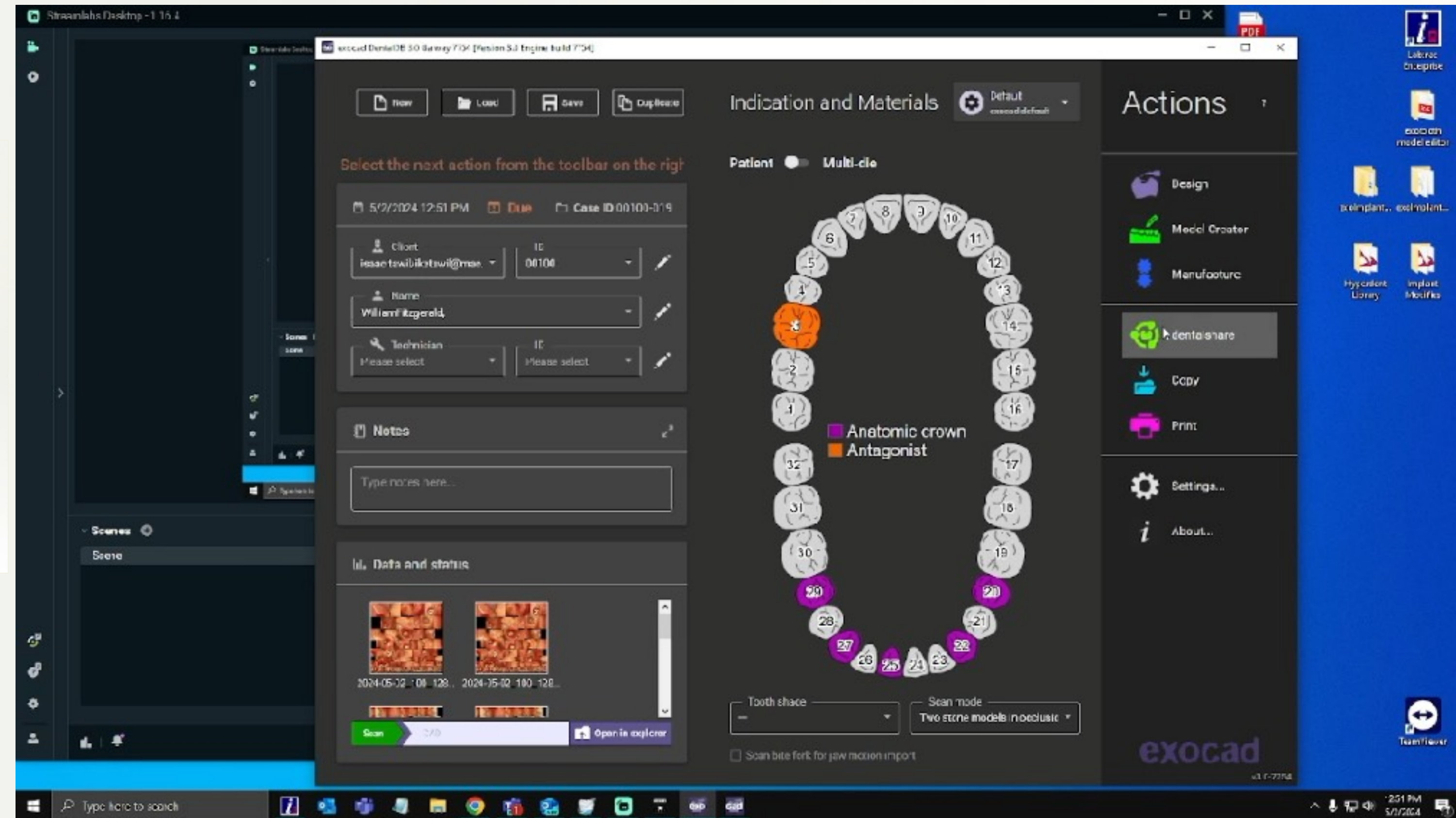
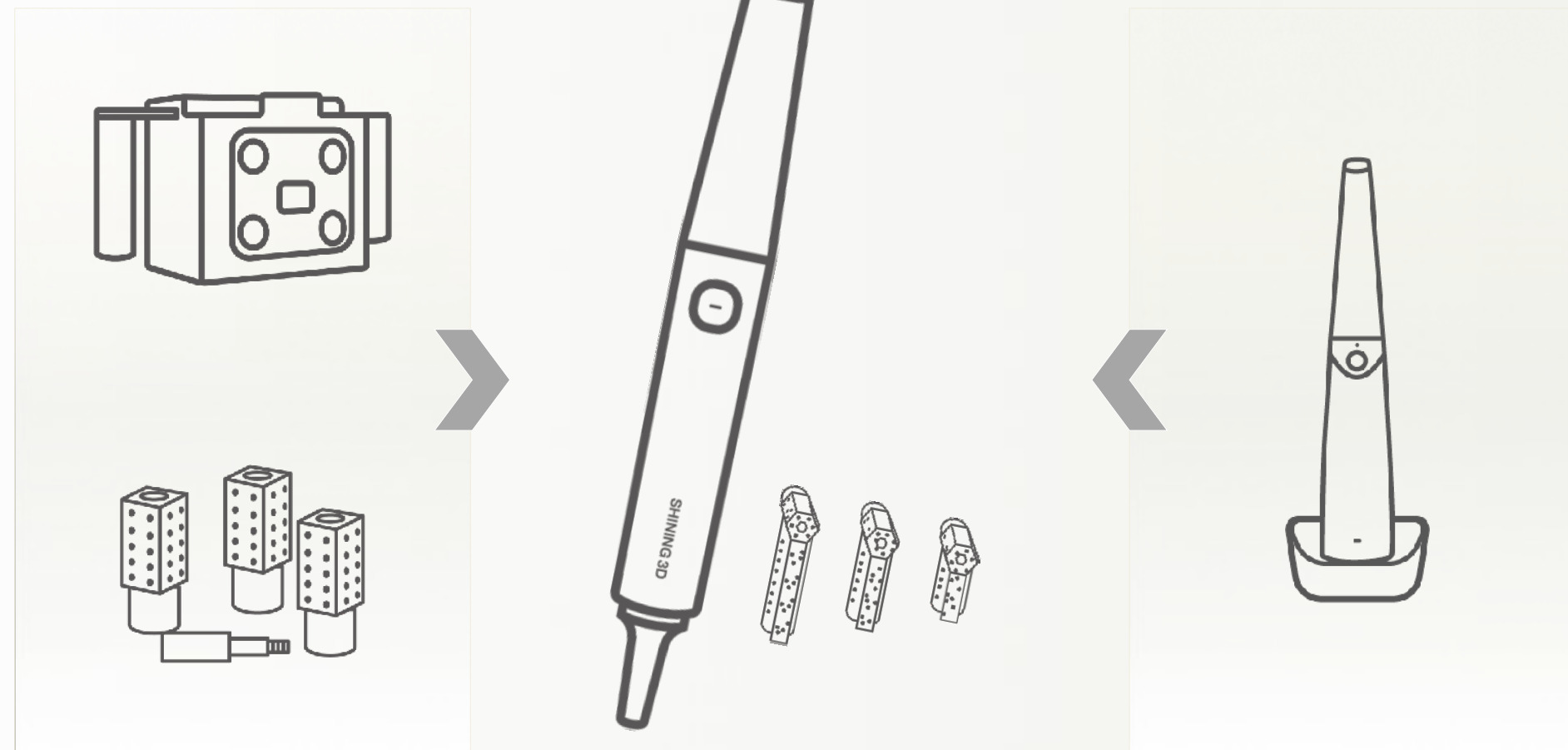


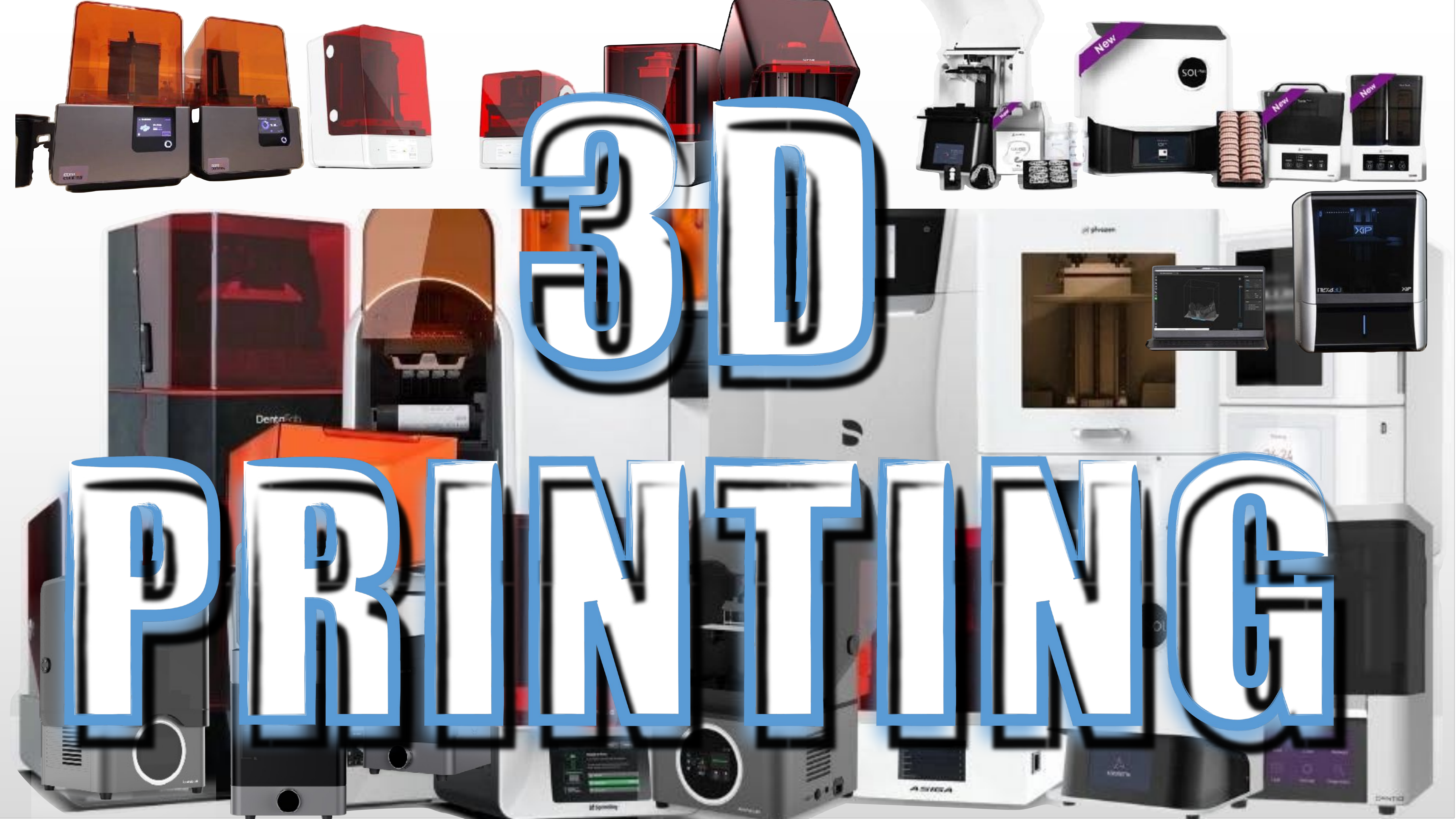
Project File

IPG

Intraoral Photogrammetry

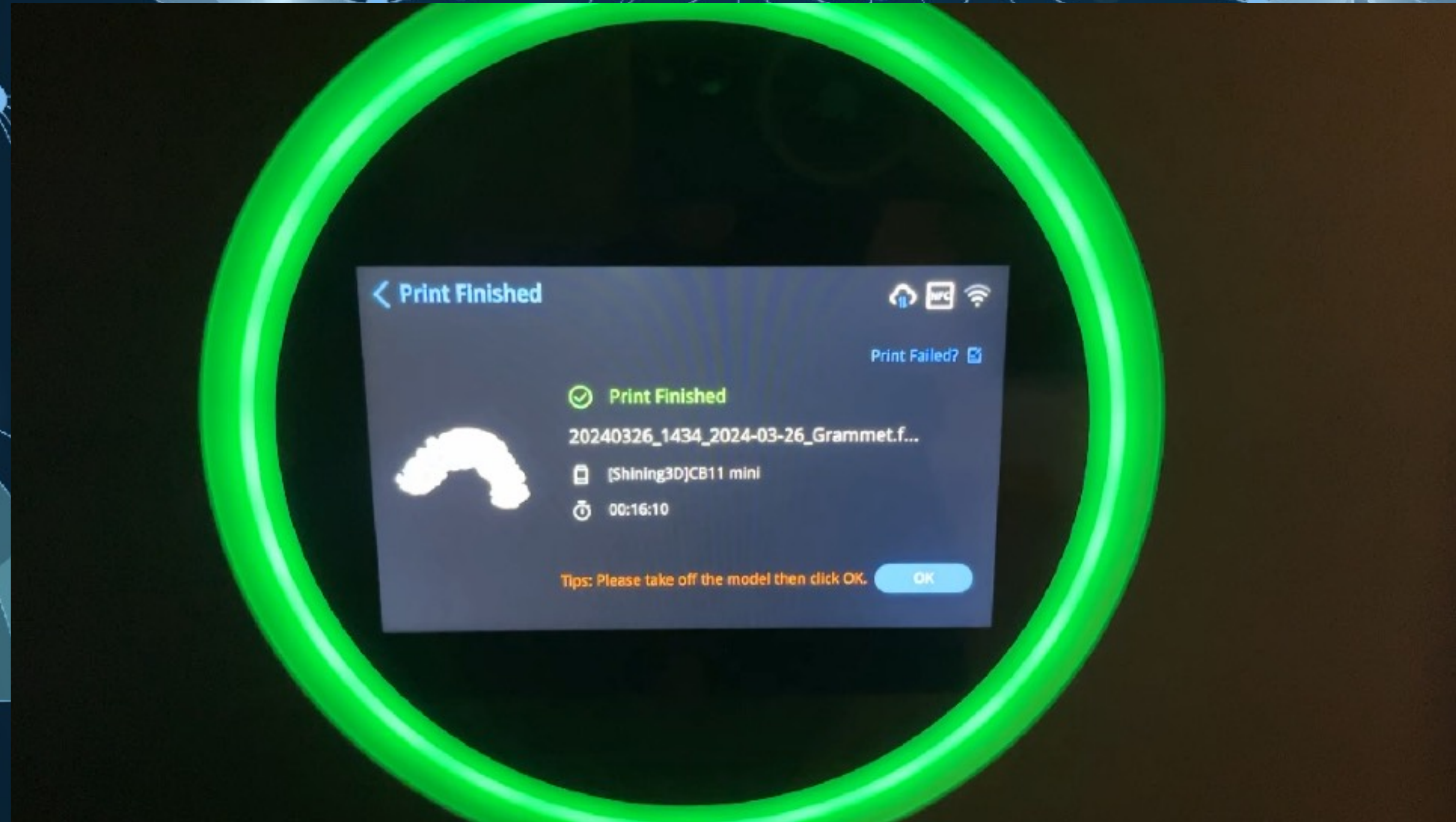
All in One Project File





PRINT

AccuFab-CEL



CUT/WASH

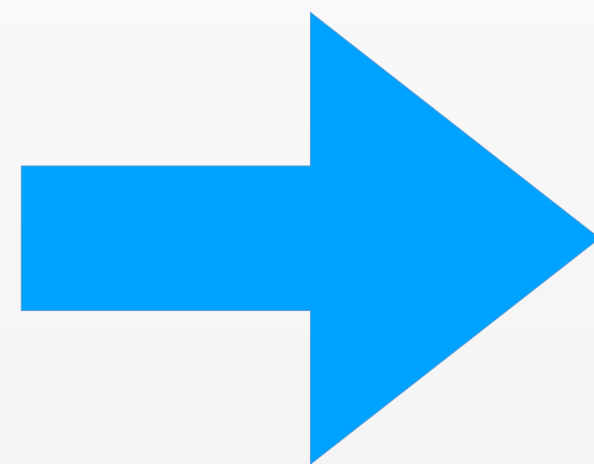
AccuFab-CEL



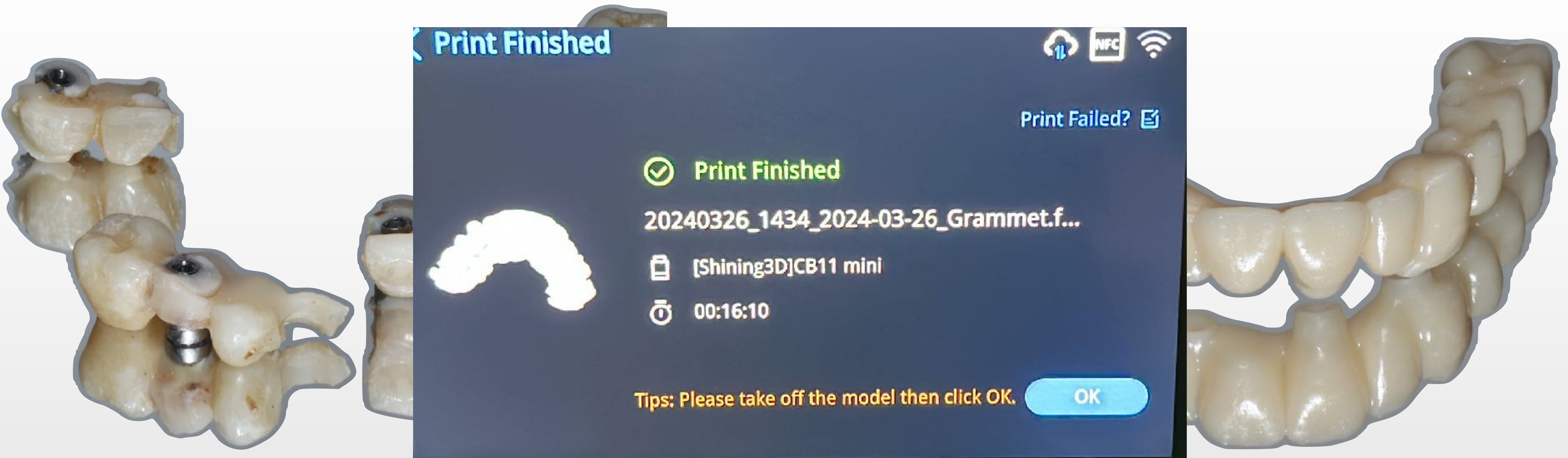
CURE

AccuFab-CEL

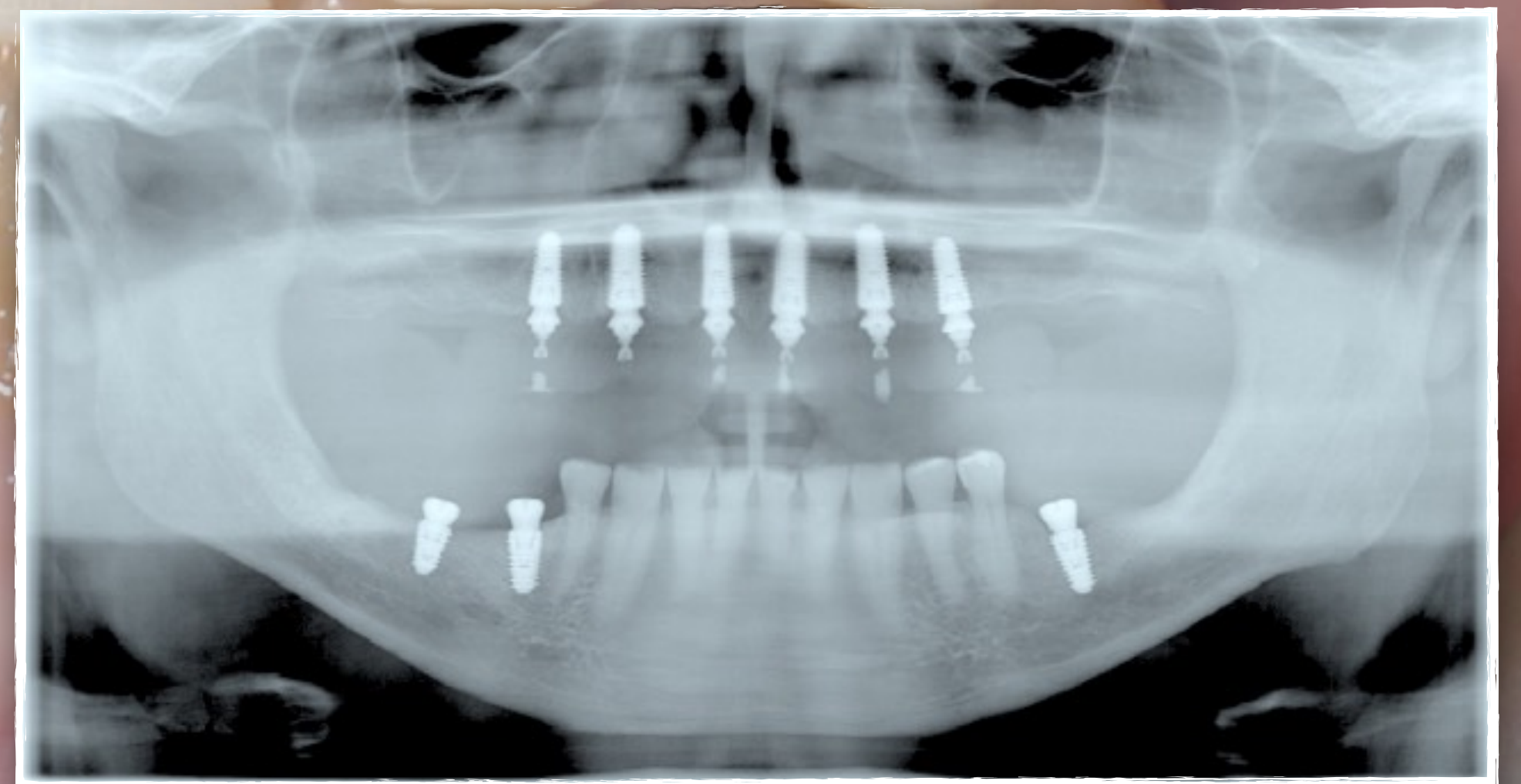


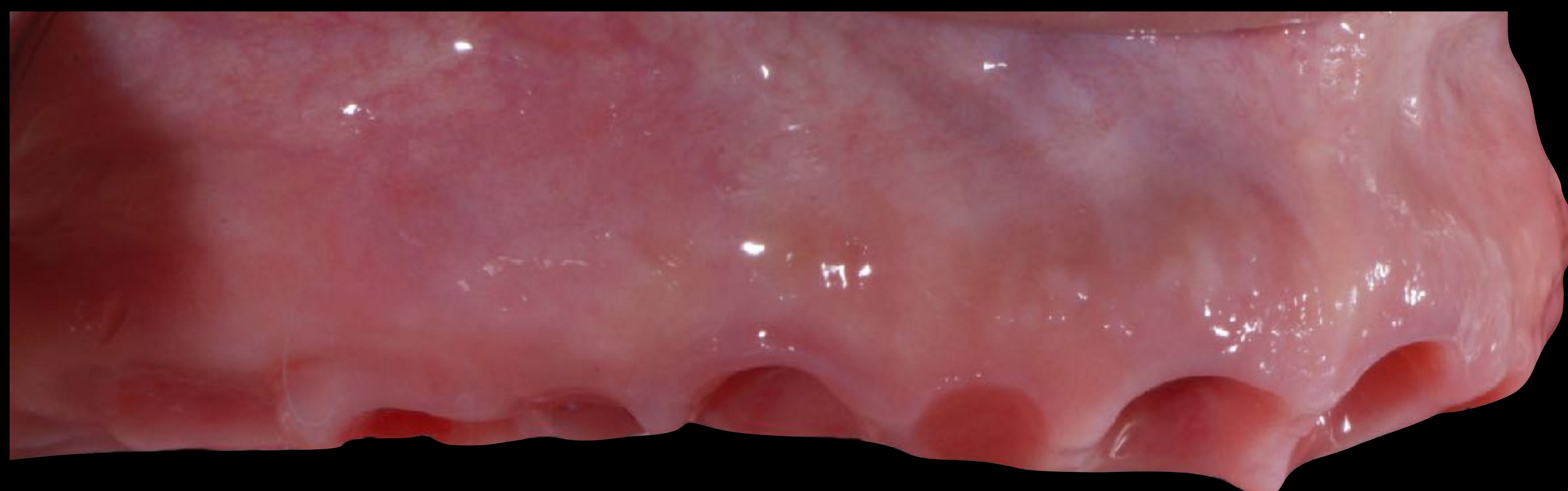


16min PRINT



INSERTION Under 1 Hr





Tissue response



Zirconia Finals



Zirconia Finals



Zirconia Final

Changing lives one smile at a time



Healed Ridge Workflow

- Scan Existing Restoration intra orally
- Scan Opposing Arch
- Scan Occlusion
- Remove Restoration- Capture MUA/Soft tissue
- IPG - Capture Coded Scan Flags
- Match Coded Scan Flags to Soft Tissue x 2+
- Covert Scan Flags to the appropriate Scan Bodies
- Identify tooth numbers
- Export All in One File - Send to Designer

POST-FABRICATED

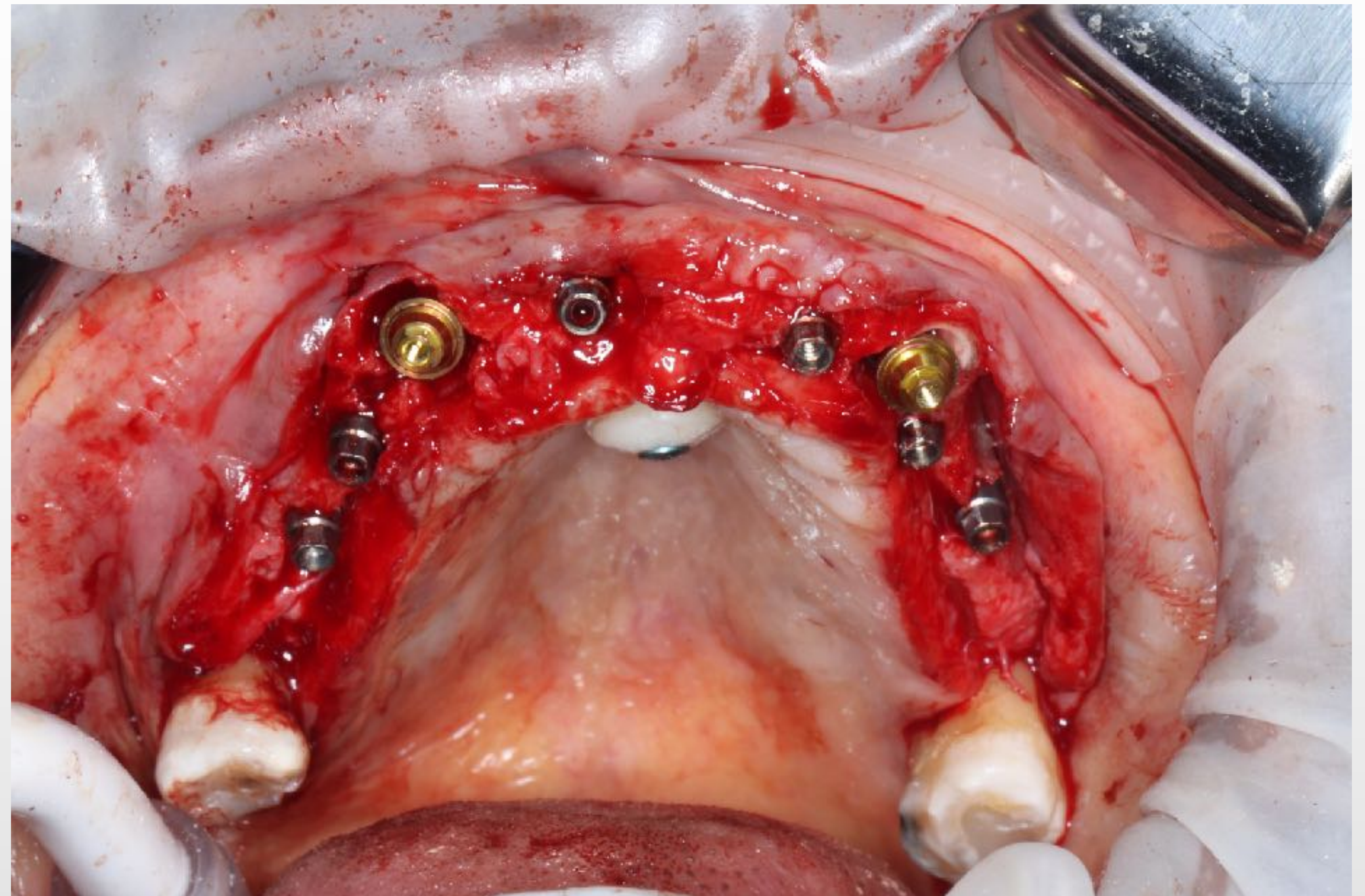
**SURGERY
AND**

**SAME DAY
PRINT?**



TRIAD

**SHOWING BODY
WE MATCH
SAME DAY
PRINTING?**

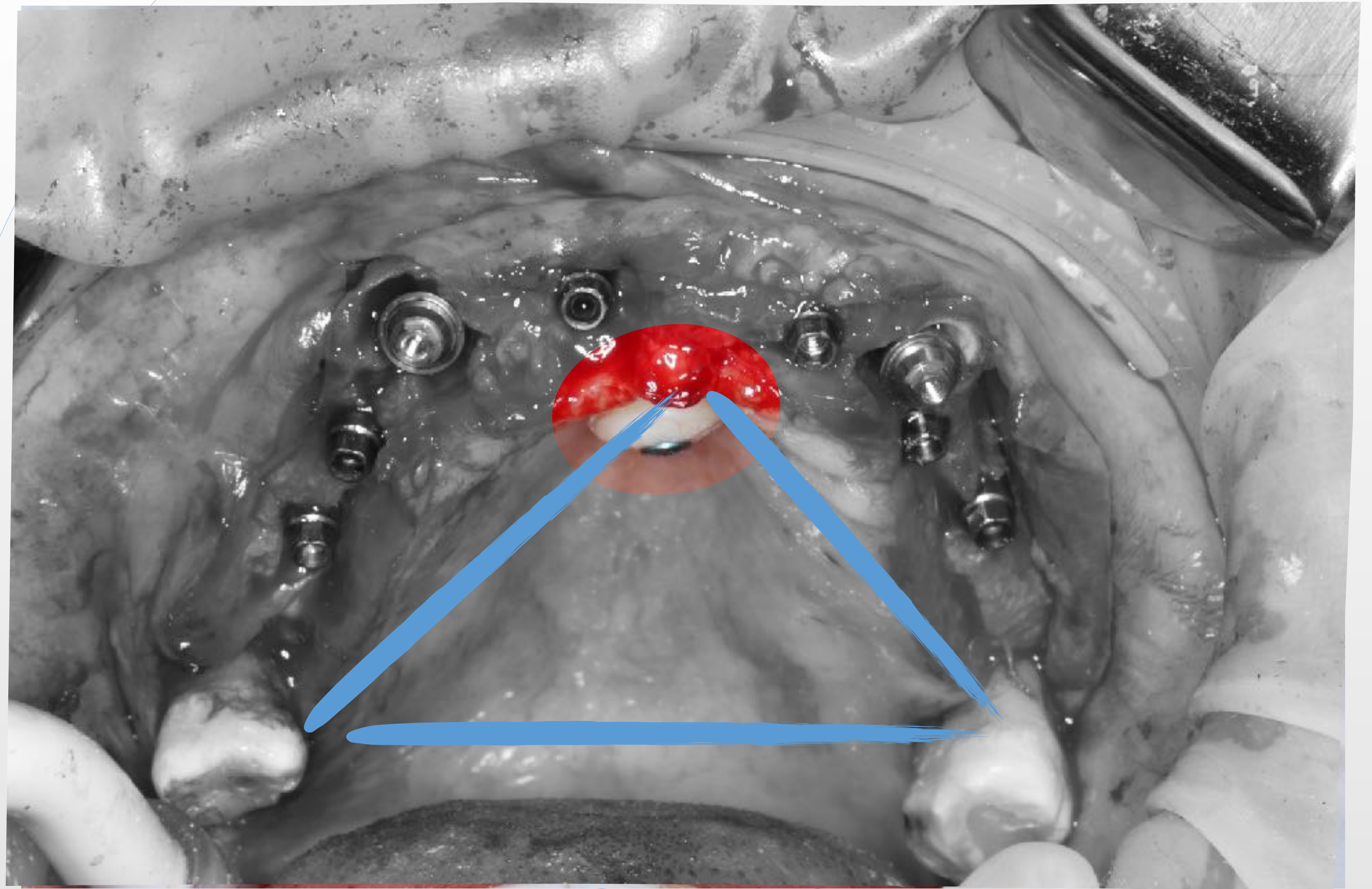


TRIANGULATION

FIDUCIAL MARKERS

- **TISSUE**
- **TEETH**
- **BONE SCREWS**
- **TRACERS**
- **GUIDES**
- **PRINTED OBJECTS**

TRIAD

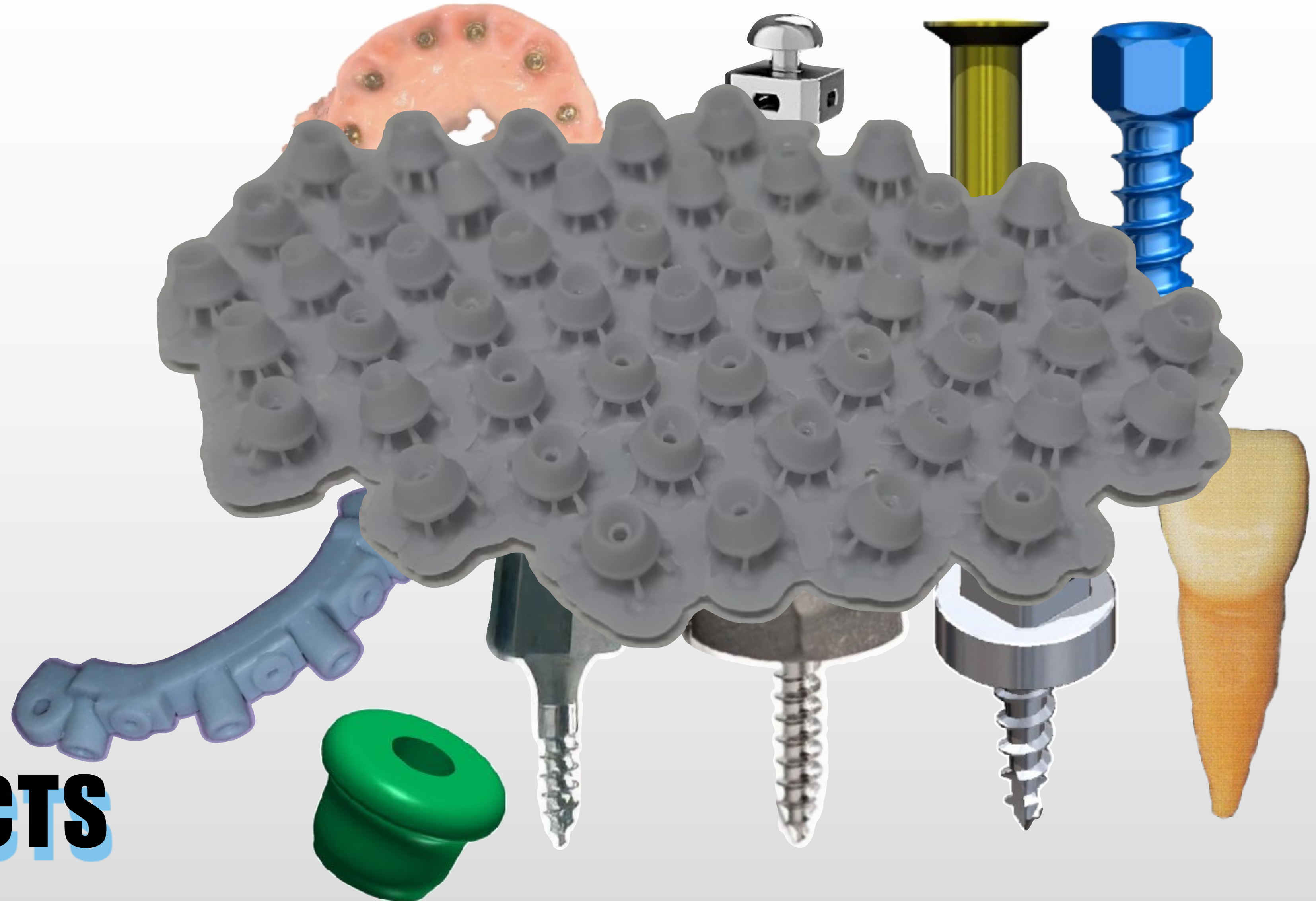


TRIANGULATION

FIDUCIAL MARKERS

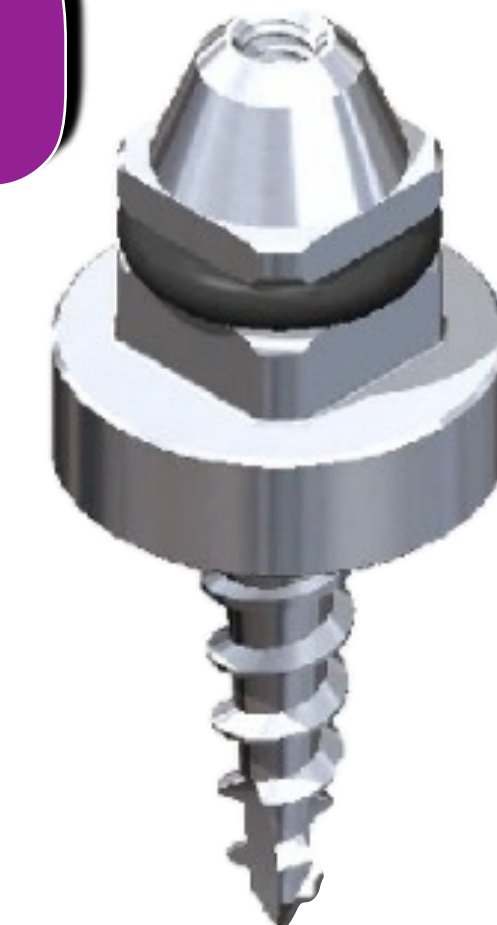
TRIANGULATION

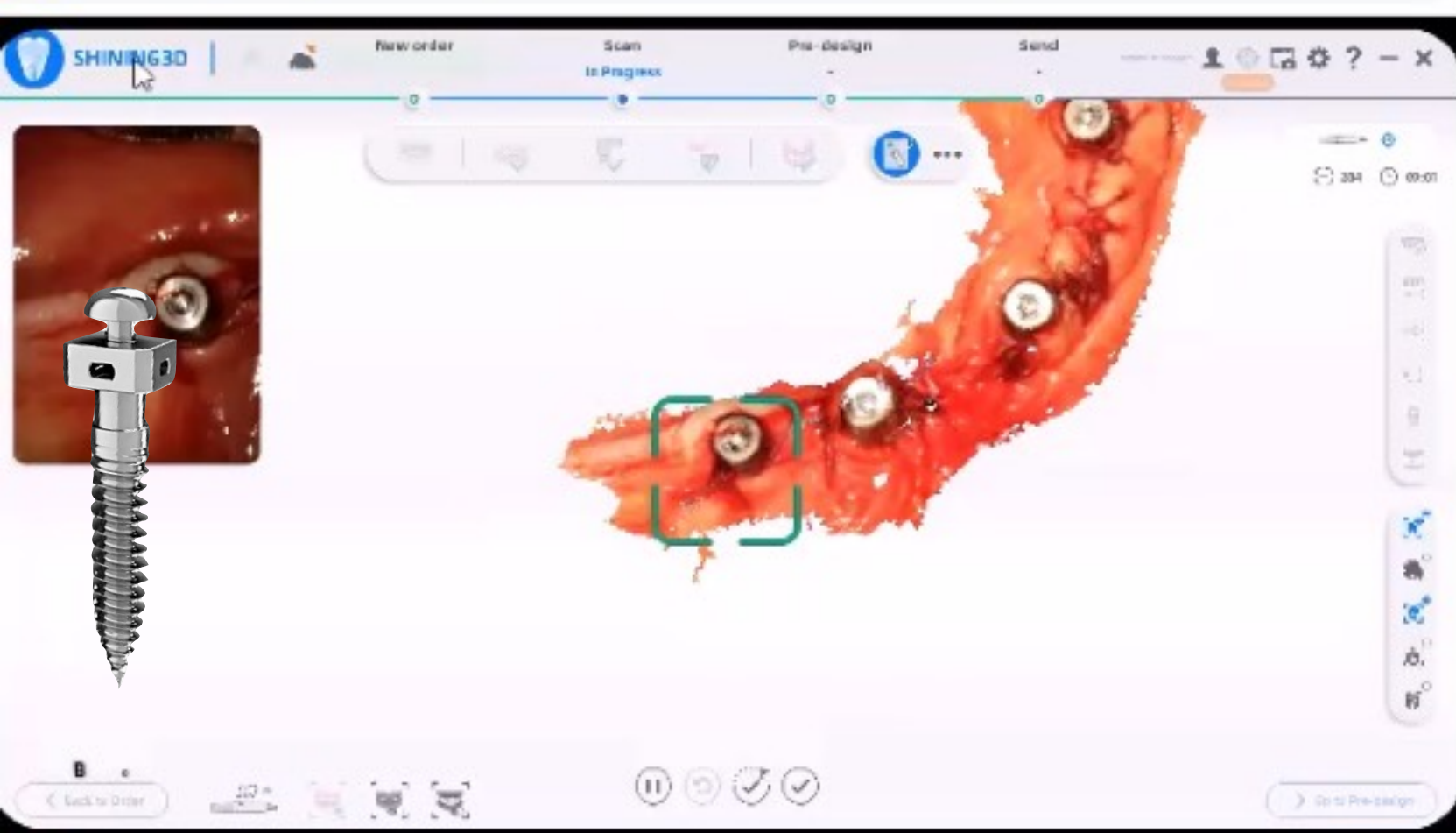
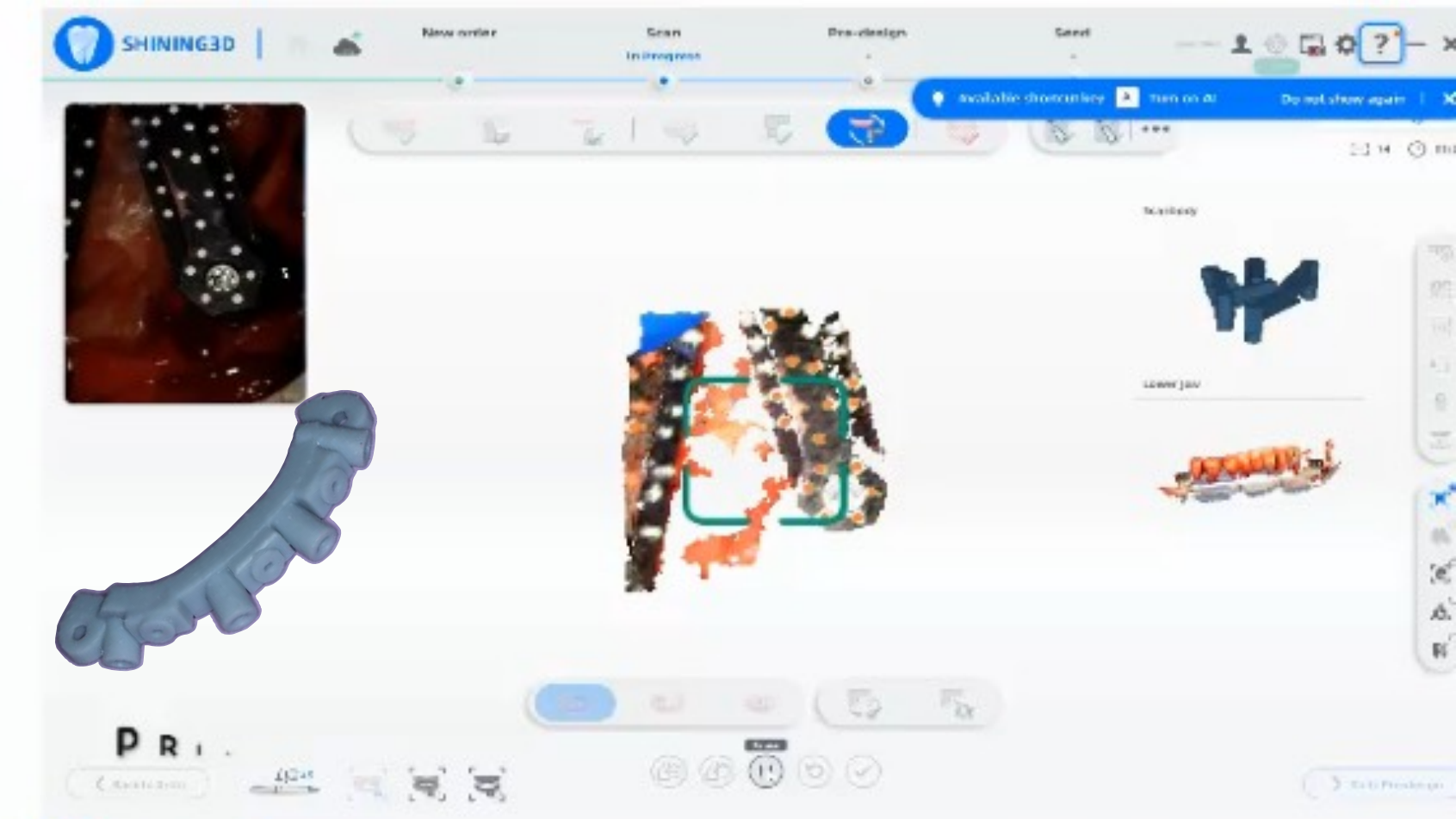
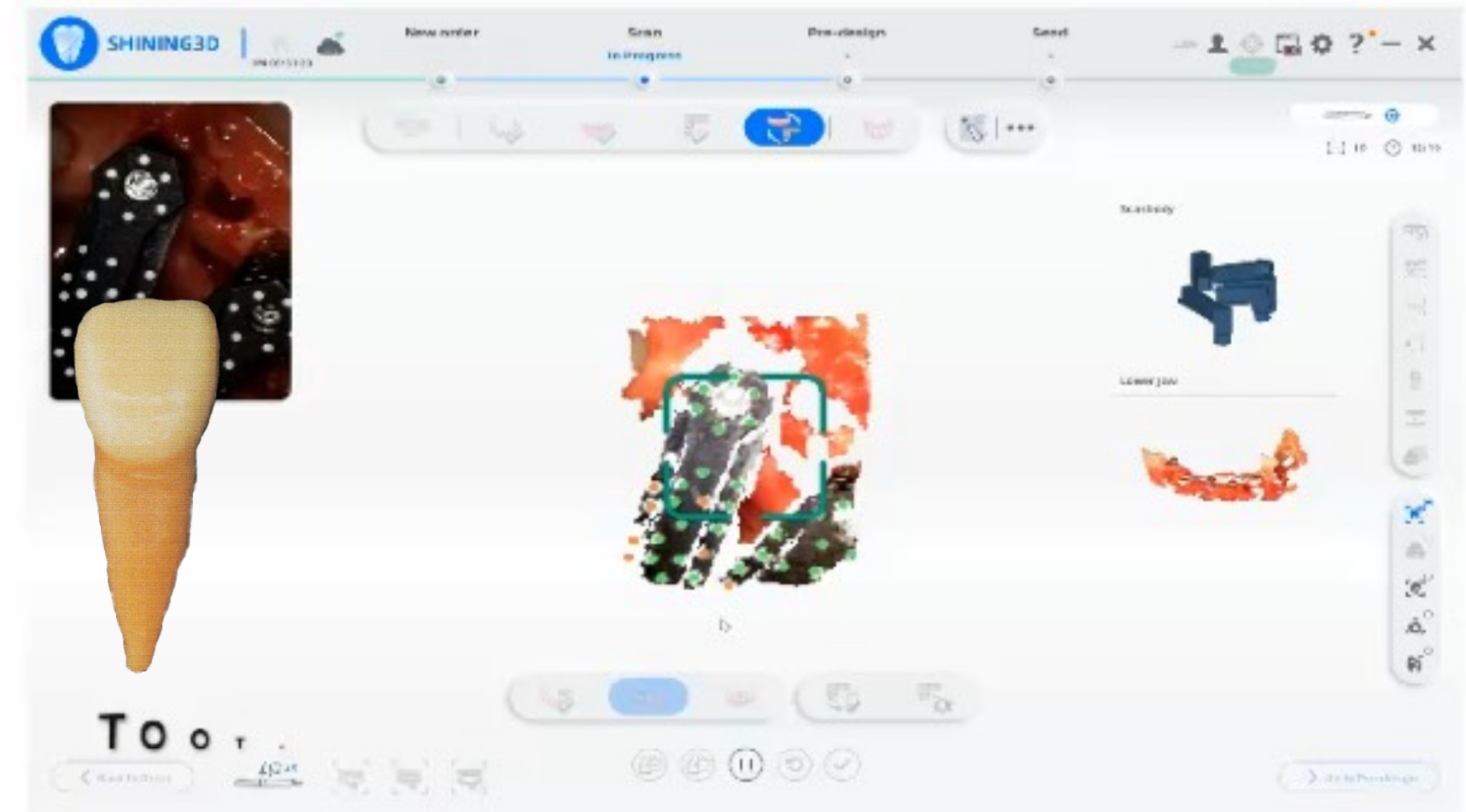
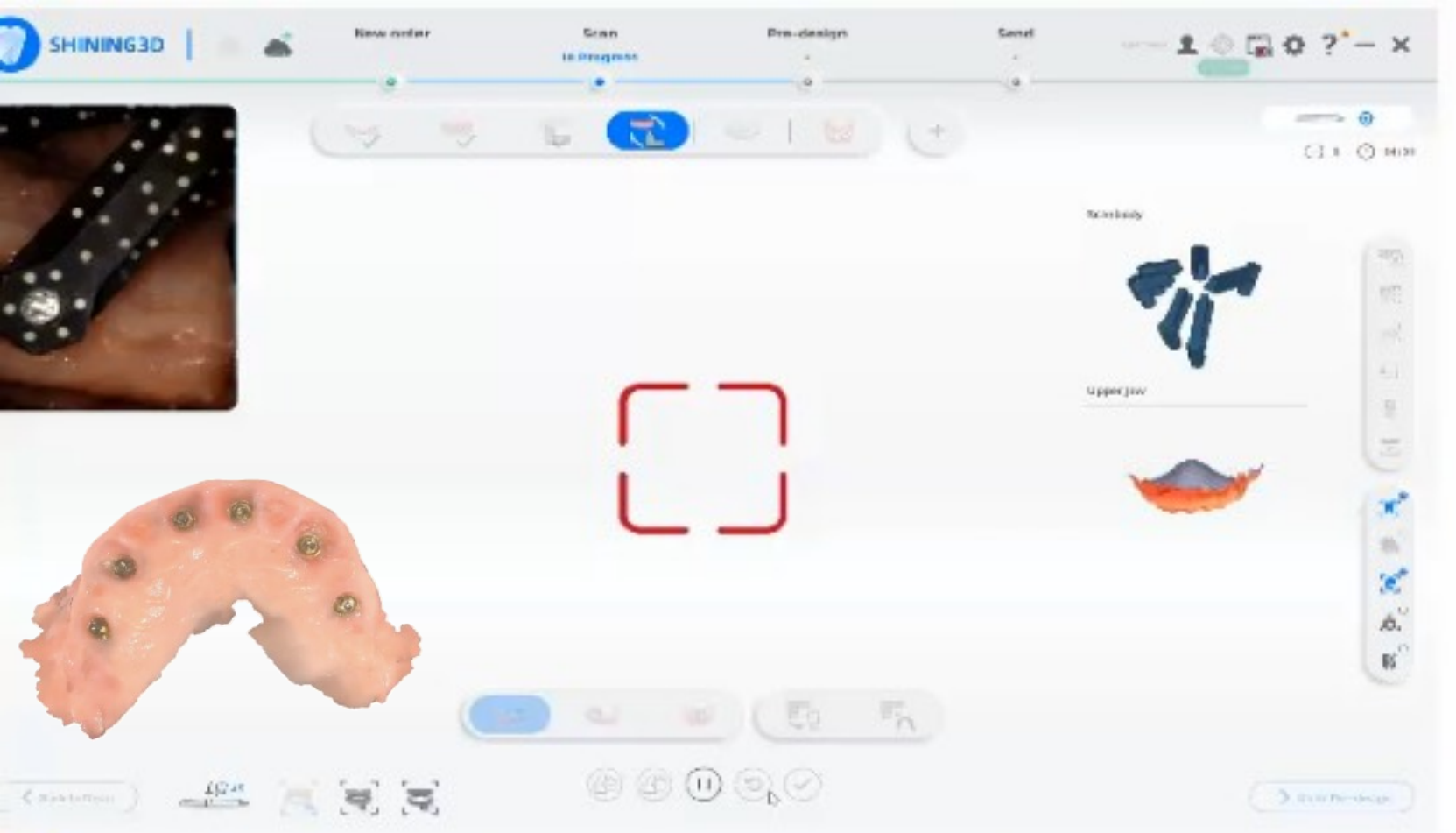
- **TISSUE**
- **TEETH**
- **BONE SCREWS**
- **TRACERS**
- **GUIDES**
- **PRINTED OBJECTS**



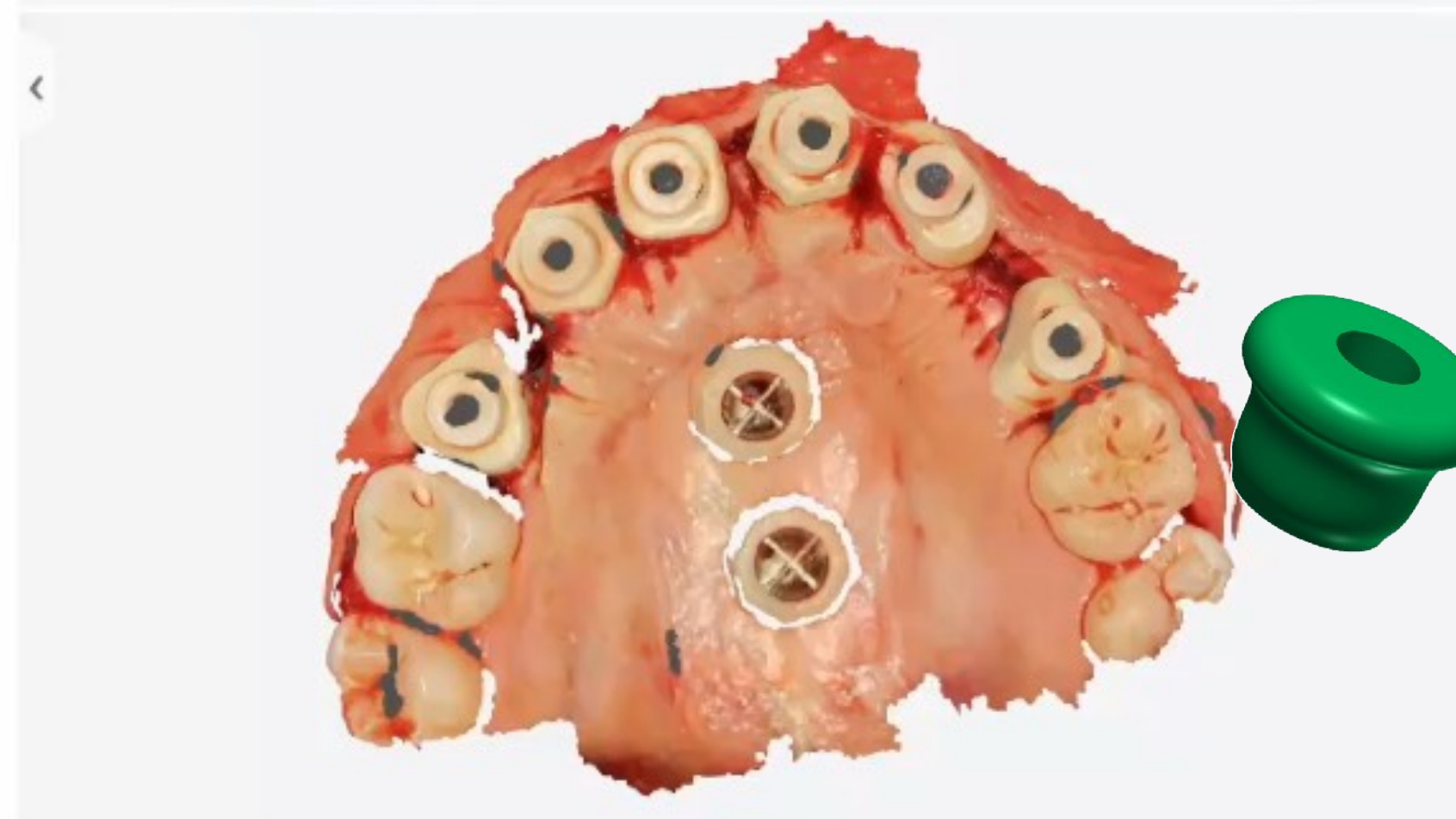
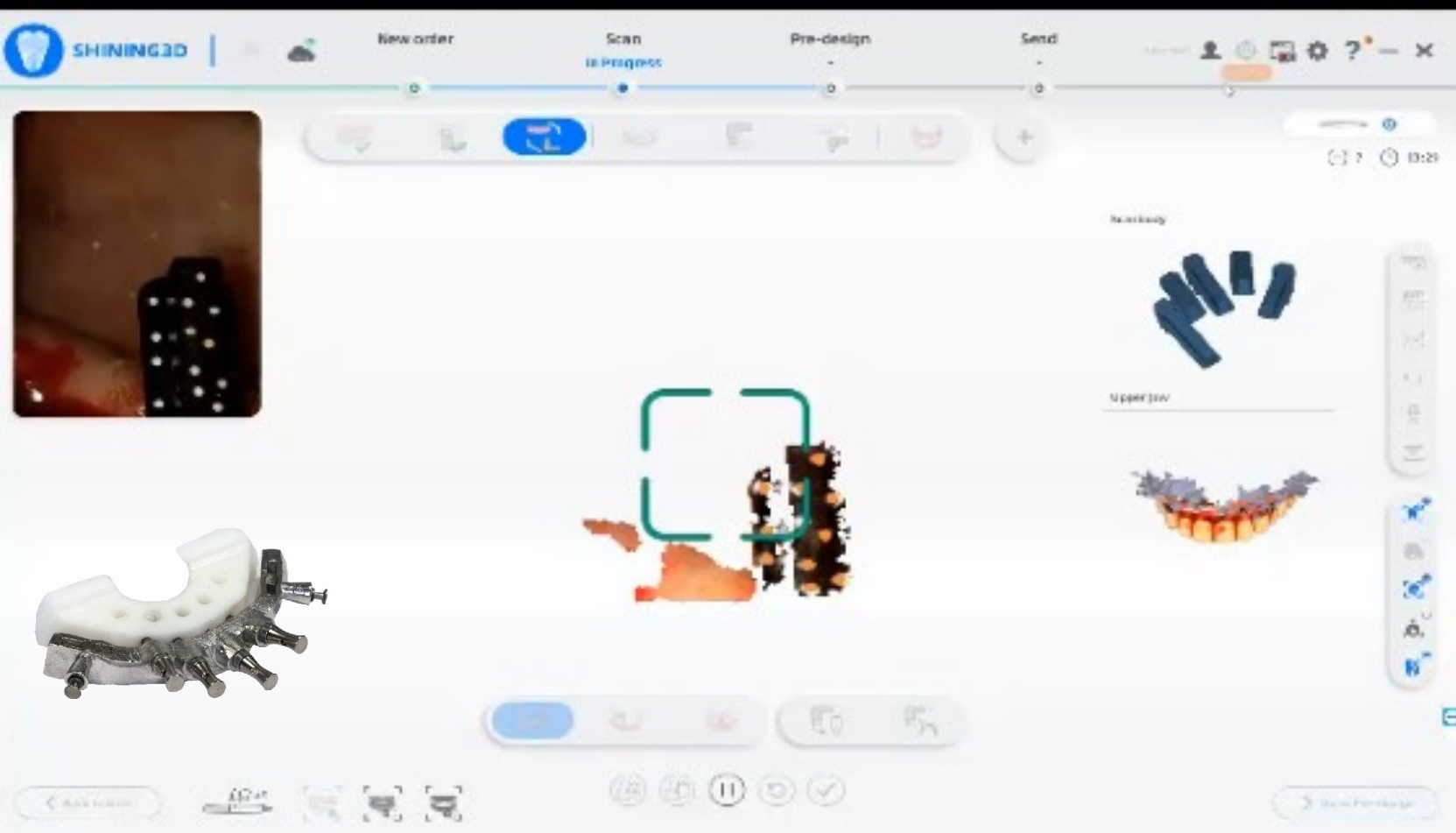
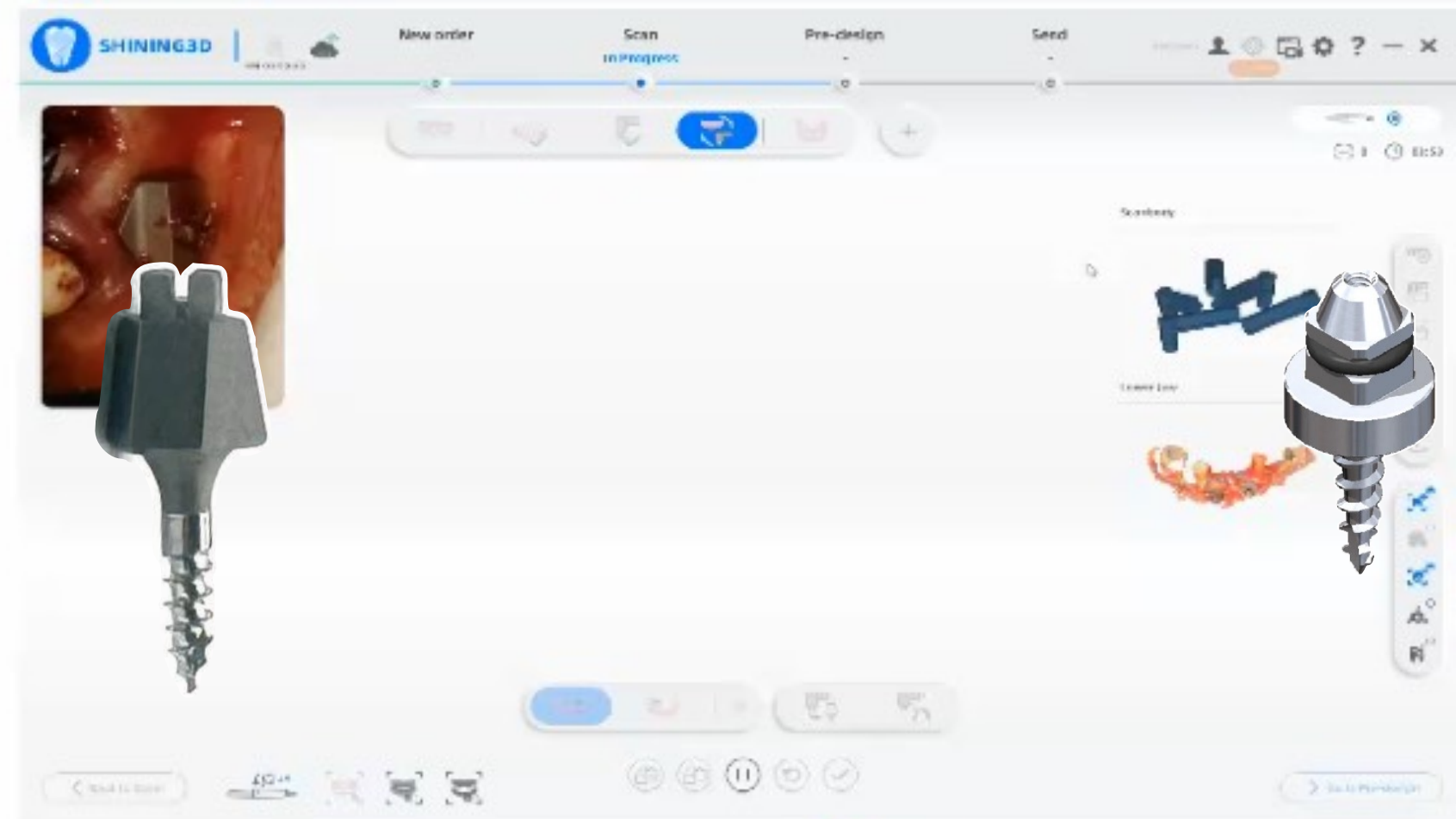


WHAT CAN WE
MATCH TO FOR
SURGERY?





MATCH



A woman's face is the central focus, with her eyes looking upwards. Her skin is covered in several splatters of red blood. In the top left corner, there is a small white webcam on a tripod. In the bottom left corner, there is a small medical syringe. In the bottom right corner, there is a black electronic device with a glowing blue circular light on its front. The background is dark and out of focus.

SURGERY IS BLOODY

IOS DO NOT LIKE BLOOD

THEY ARE CONDITIONED

TO BLOCK OUT OBJECTS

THAT AREN'T HEALTHY

PINK OR WHITE



SURGERY IS BLOODY

TIPS

TURN AI - OFF

TURN ALL ON X - ON





SHINING3D



New order
CARLO NOTO

Scan
In Progress

Pre-design

Send

isaac tawil



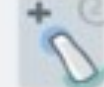
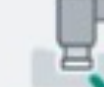
+ 0 days

Scanbody



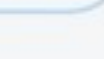
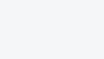
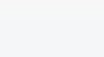
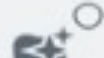
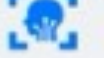
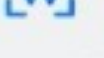
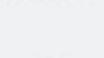
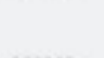
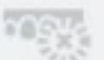
TIPS

Scan the connection between the coded scanbody and the gingiva to complete the splice of them



Scanbody

Lower jaw

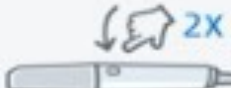


TURN ALL ON X - ON

TURN AI - OFF

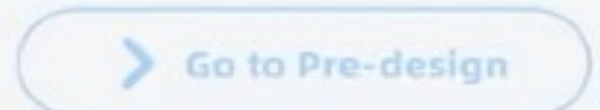


Back to Order

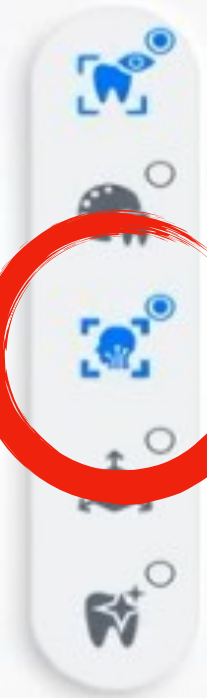
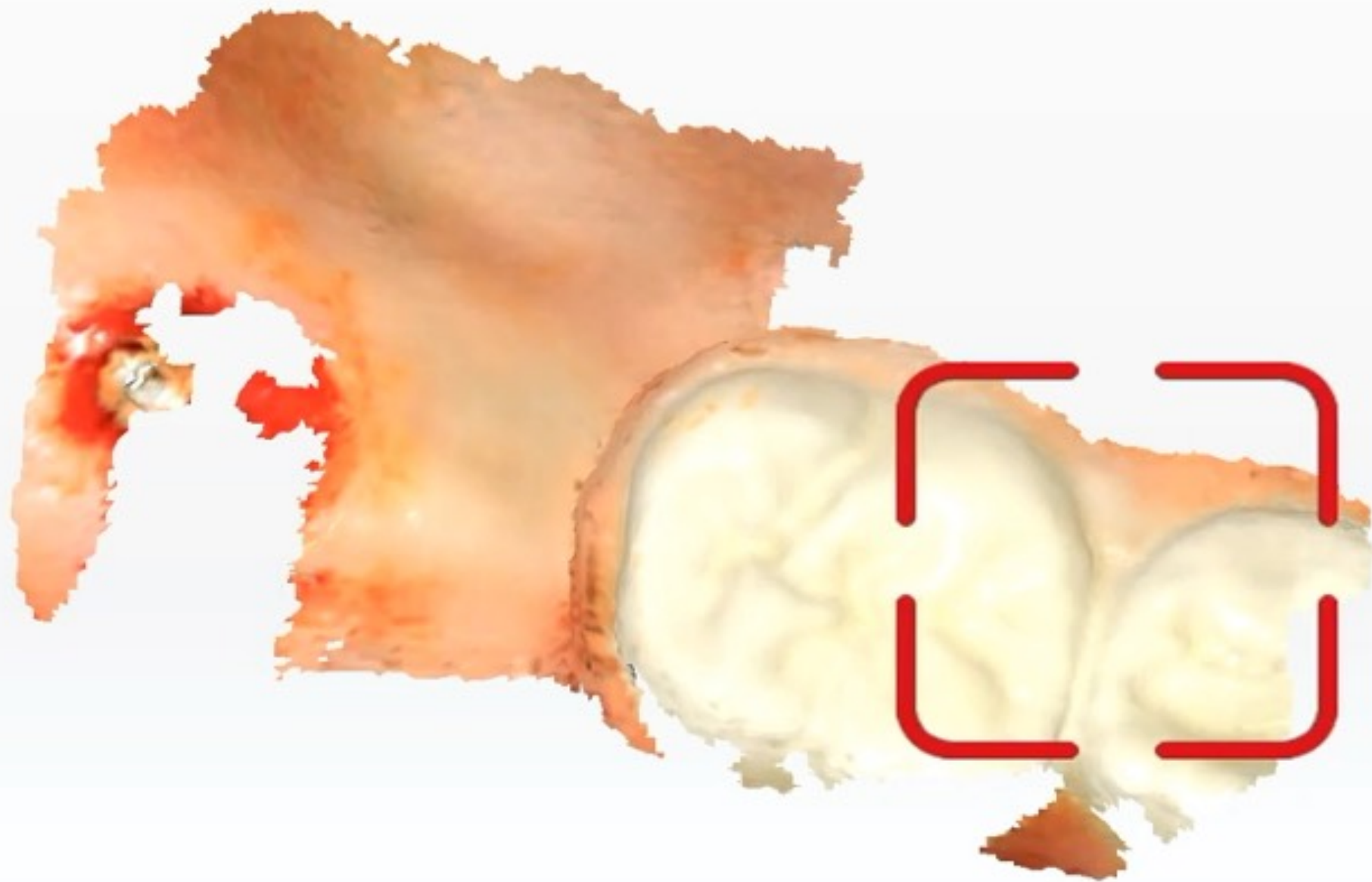
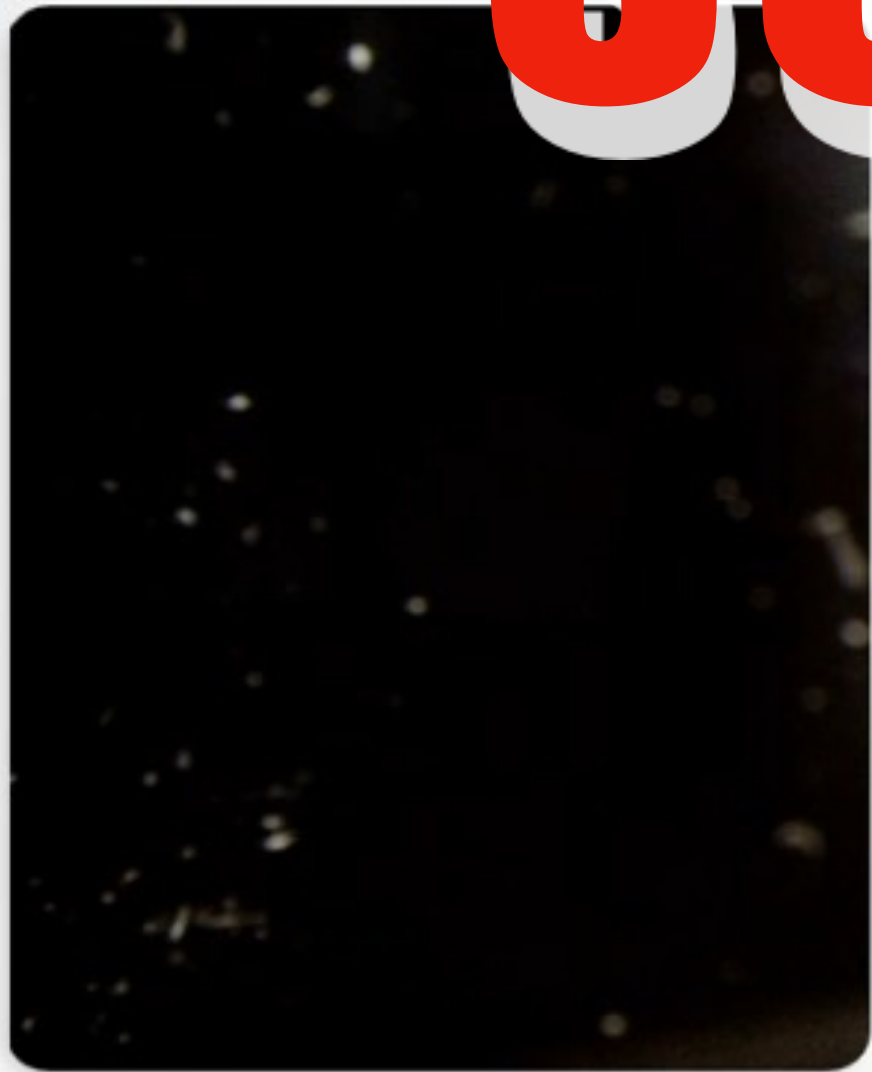


Go to Pre-design

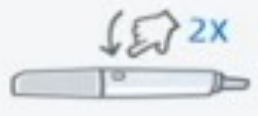
SURGERY IS BLOODY



SURGERY IS BLOODY



[Back to Order](#)



All-on-X Pro Scanning



[Go to Pre-design](#)

POST-FABRICATED

**SURGERY
AND**

**SAME DAY
PRINT?**



Surgical Protocol

- Insert Fiducial Marker with dentition (unless keeping teeth until end of surgery scans)
- Scan Existing Dentition With Fiducal Marker (ie teeth, Screws, Tracers, Guides)
- Scan Opposing Arch
- Scan Occlusion
- Extract Teeth/place implant/ insert MUA-Scan MUA Level
- Match Coded Scan Flags to Fiducial Marker x 2+
- Covert Scan Flags to the appropriate Scan Bodies
- Identify tooth numbers
- Optional Scan of Tissue with Healing Abutments
- Export All in One File - Send to designer



IMPORT

**Create the
Avatar**

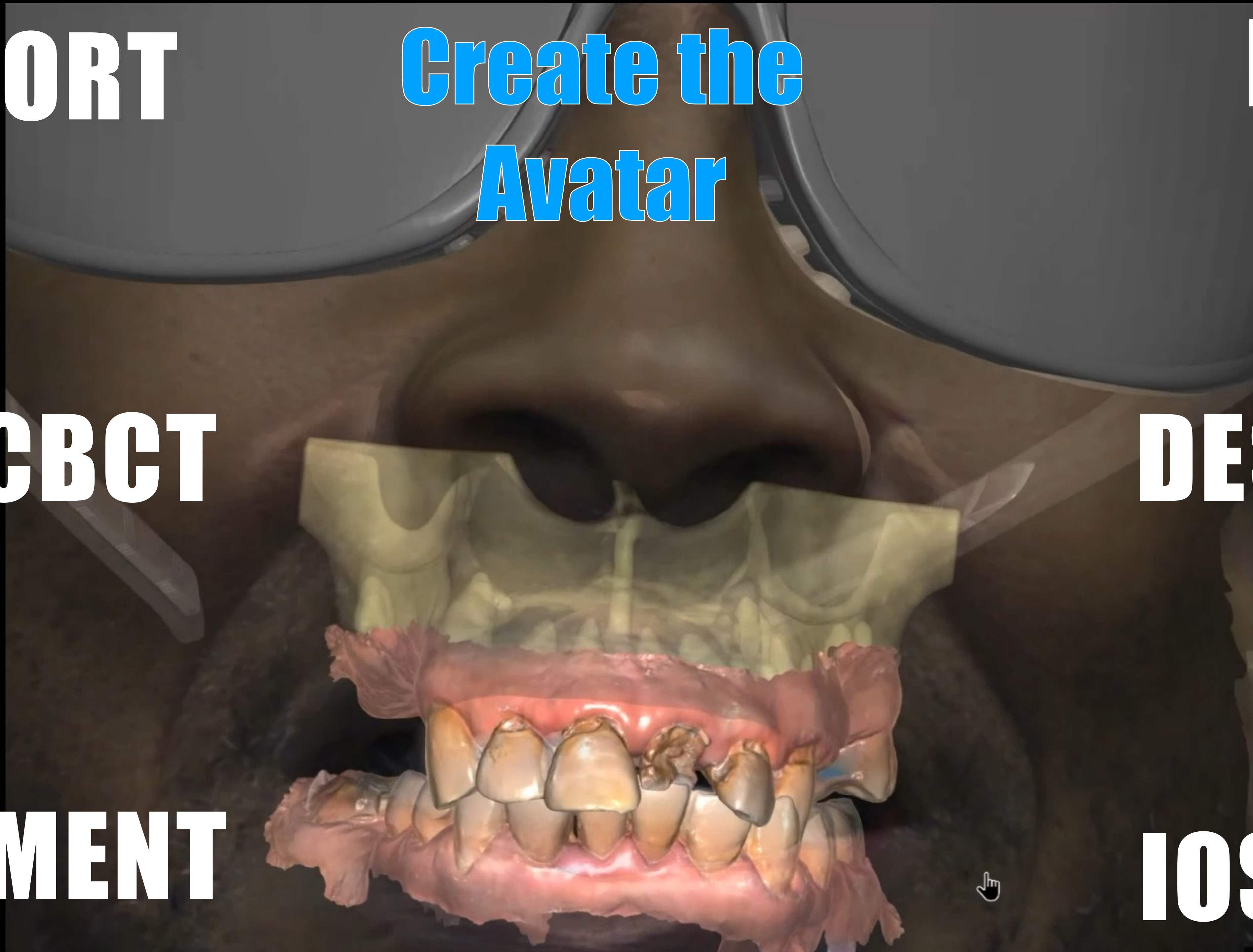
PLAN

FS/CBCT

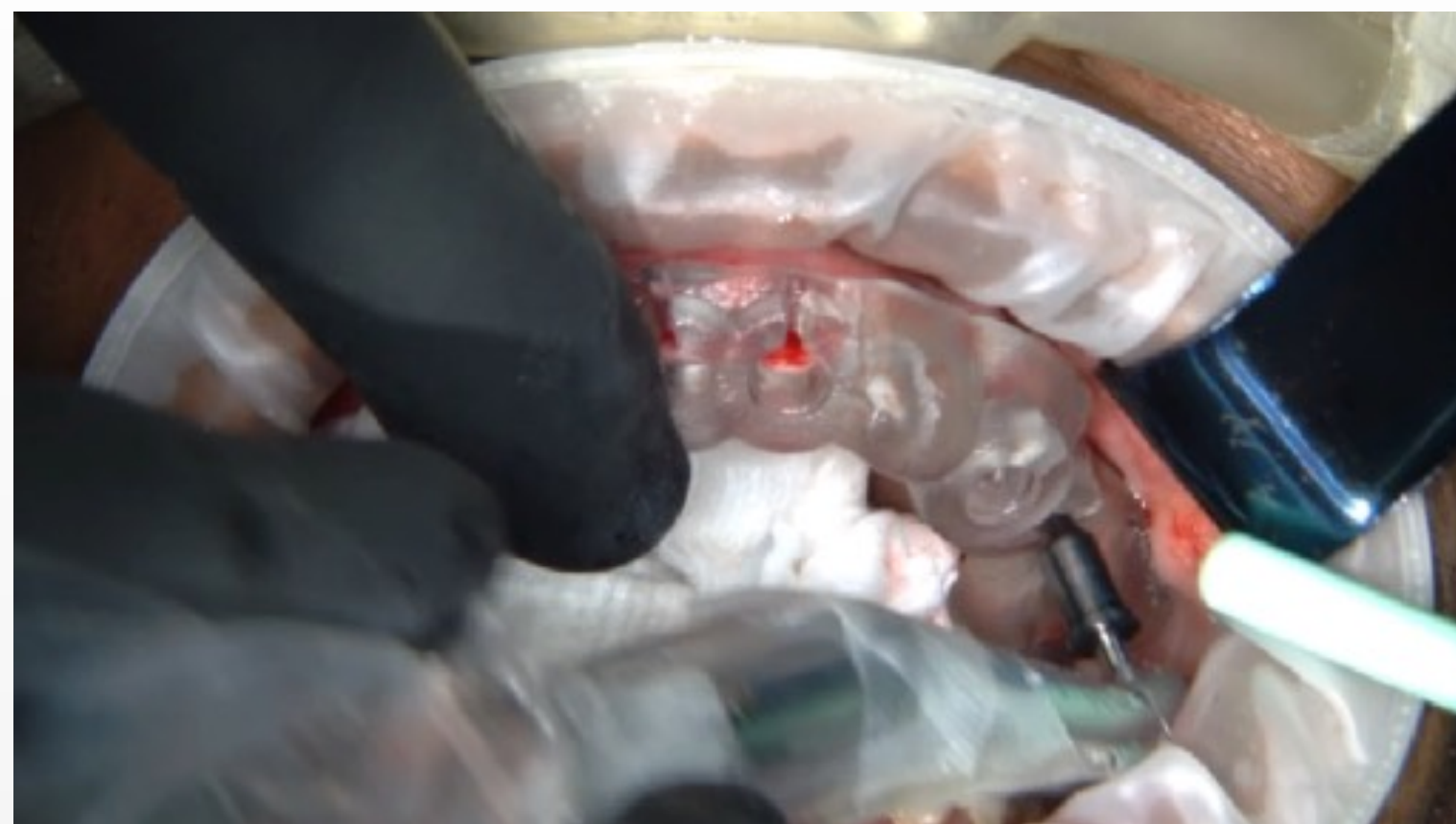
DESIGN

SEGMENT

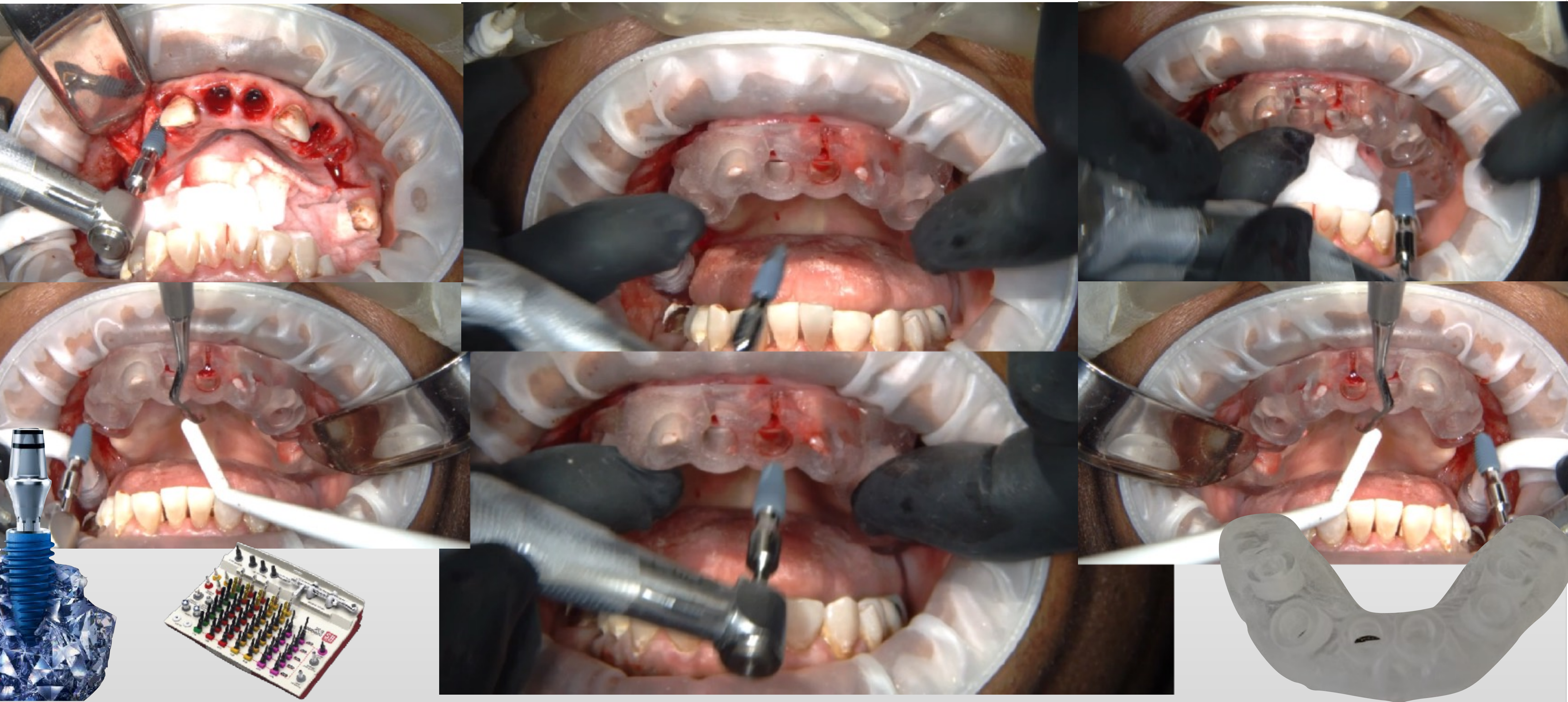
IOS/SG



SURGICAL GUIDANCE



GUIDED OR FREEHAND



OR FREEHAND



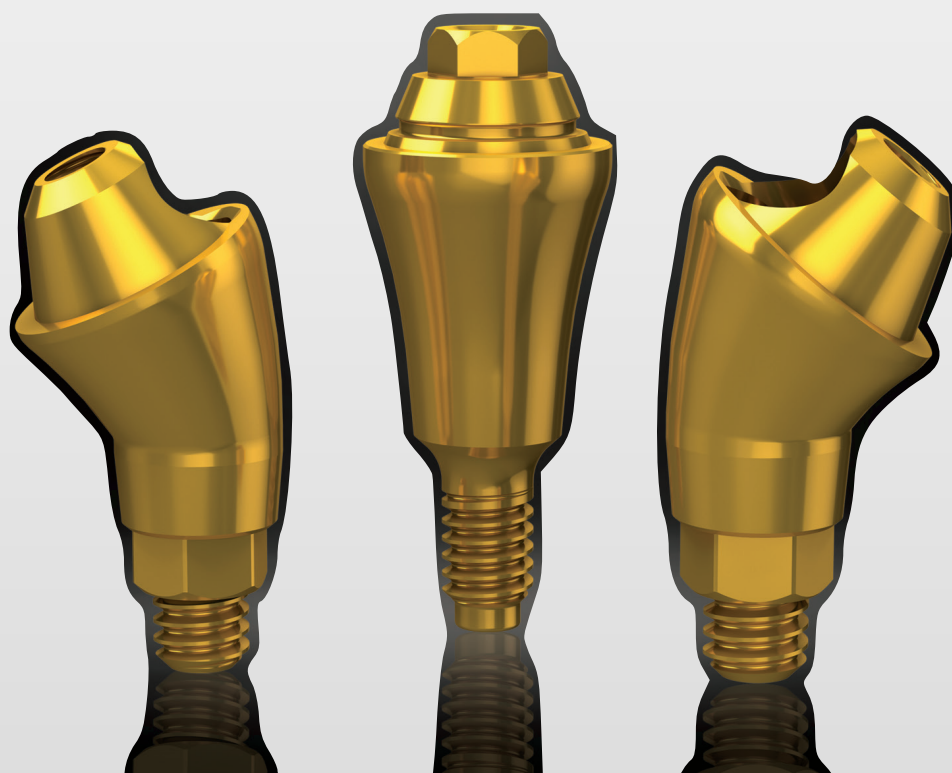
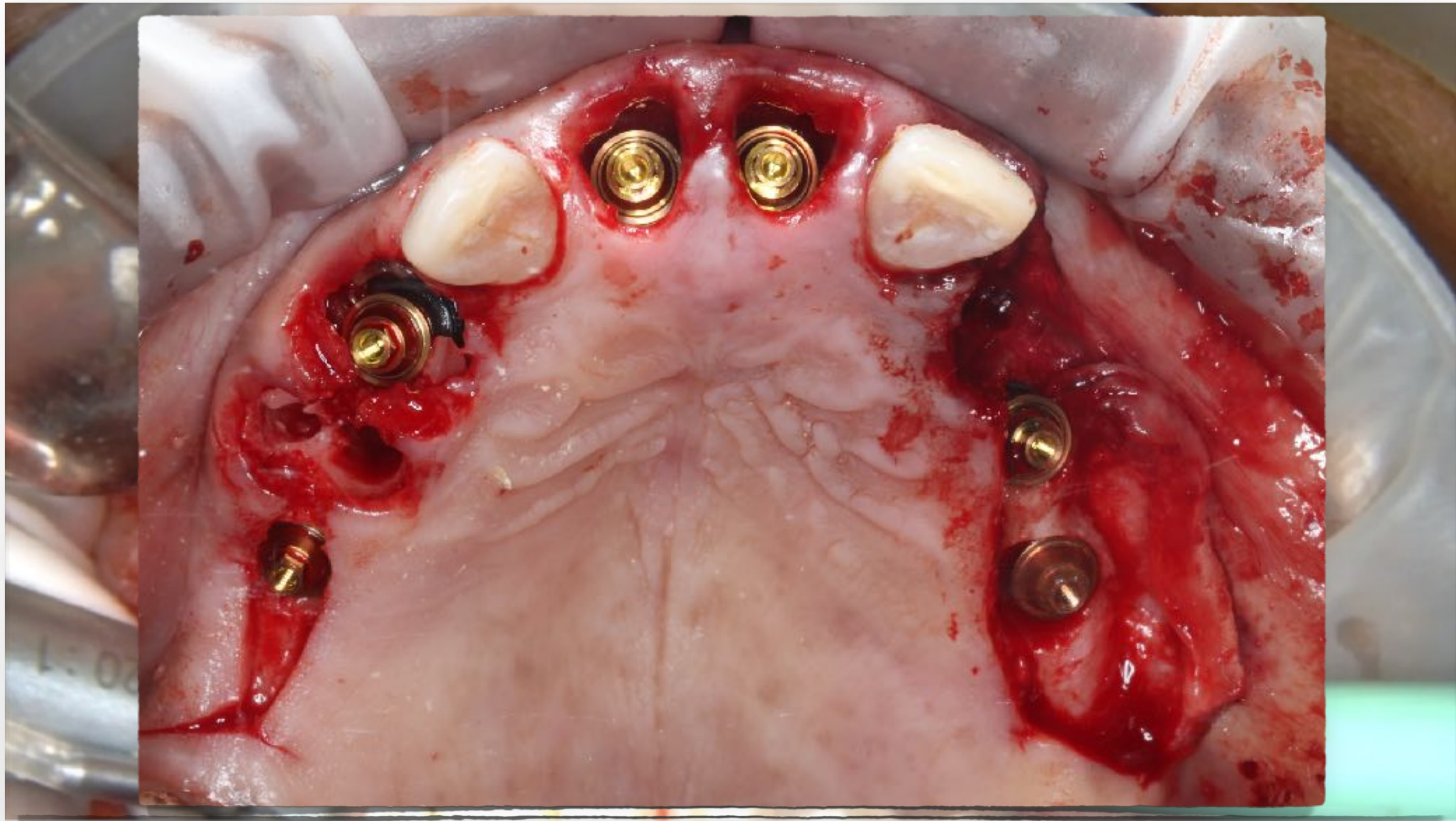


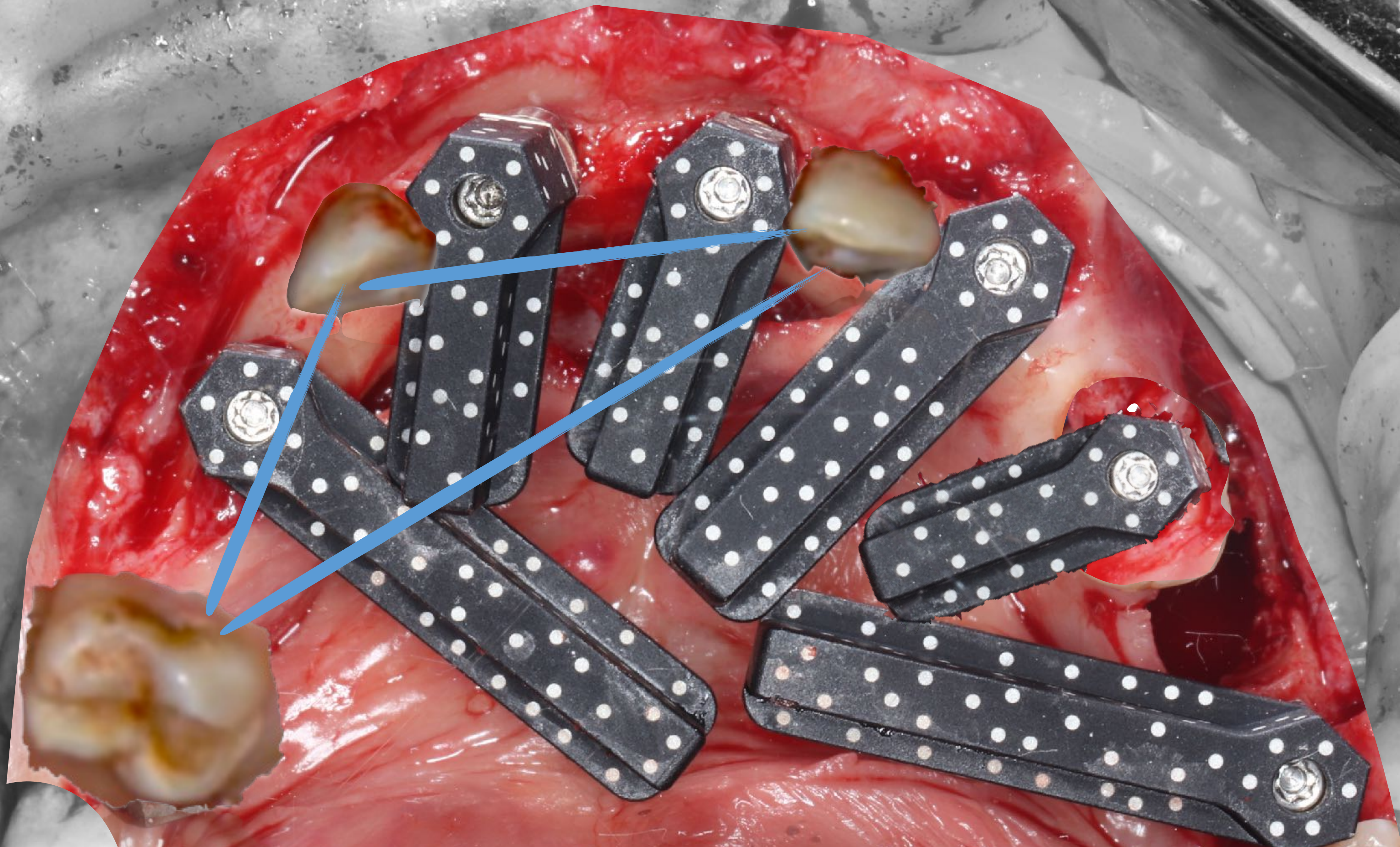
UN  VERSAL
SHAPERS

M

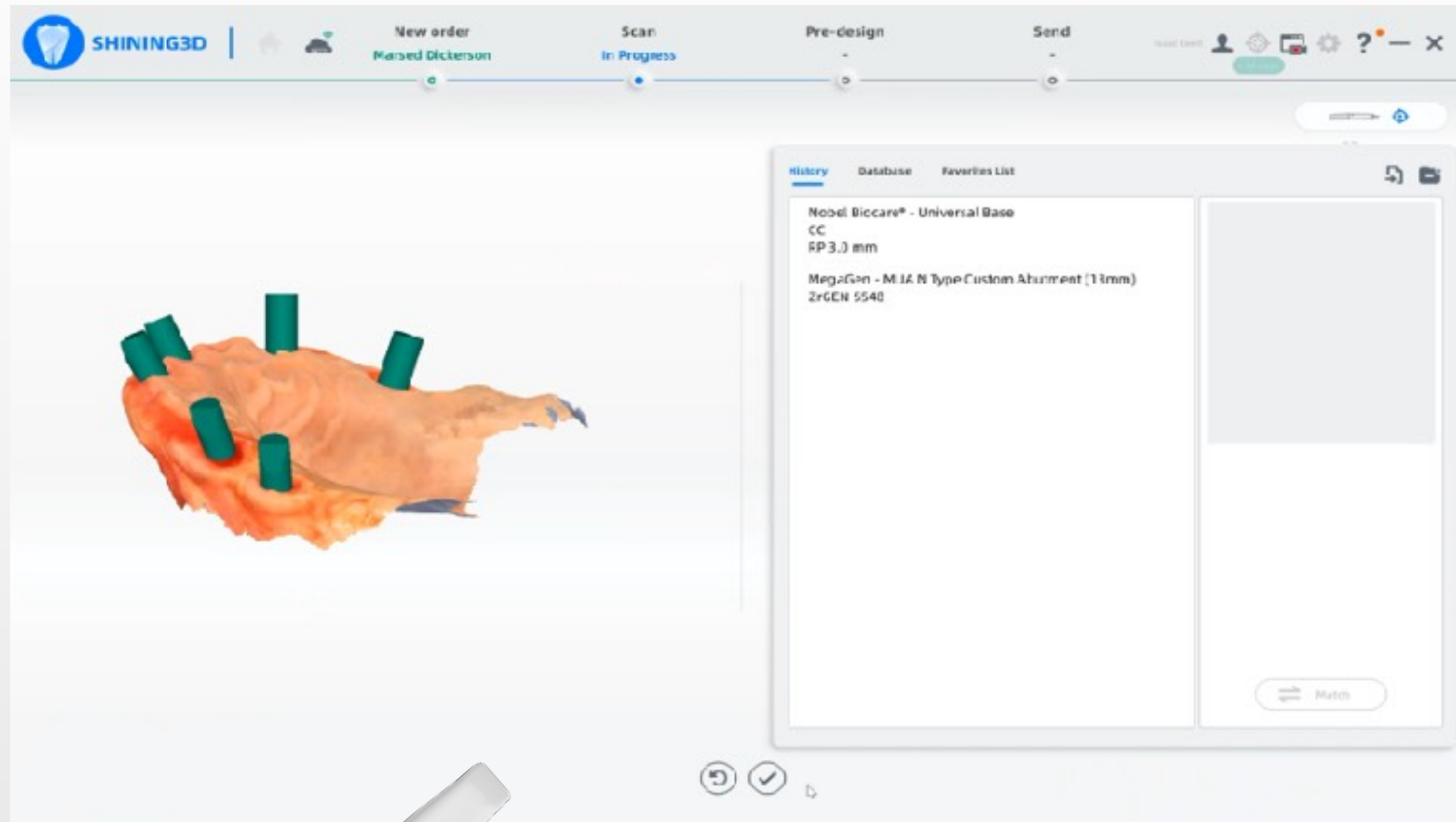
U

A

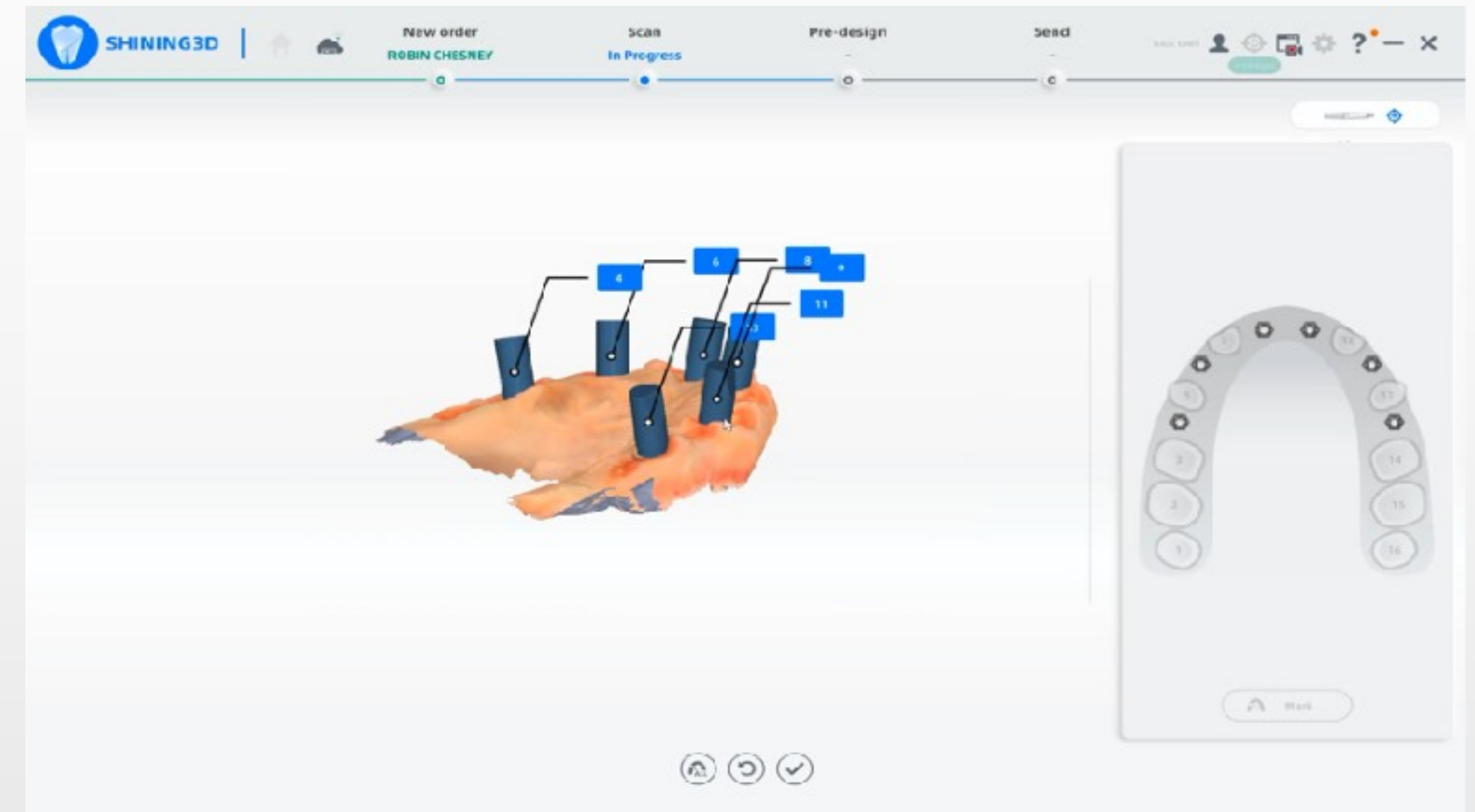




Scan Body Conversion



Tooth Identification



Autologous Tooth Structure as an Adjunct Grafting Modality

INTRODUCTION

Autologous tooth structure (ATS) is a novel grafting modality that utilizes extracted teeth as a source of bone graft material. This technique is based on the principle that teeth contain a significant amount of bone tissue, which can be used to augment the alveolar bone structure. The process involves extracting teeth from a patient, processing them to remove pulp and root material, and then using the remaining crown and root portions as graft material. This method is particularly useful in cases of severe alveolar bone loss, where traditional bone grafting techniques may be limited. The use of ATS offers several advantages, including the availability of a patient's own bone, the preservation of natural tooth structure, and the potential for improved healing and integration with the surrounding bone.

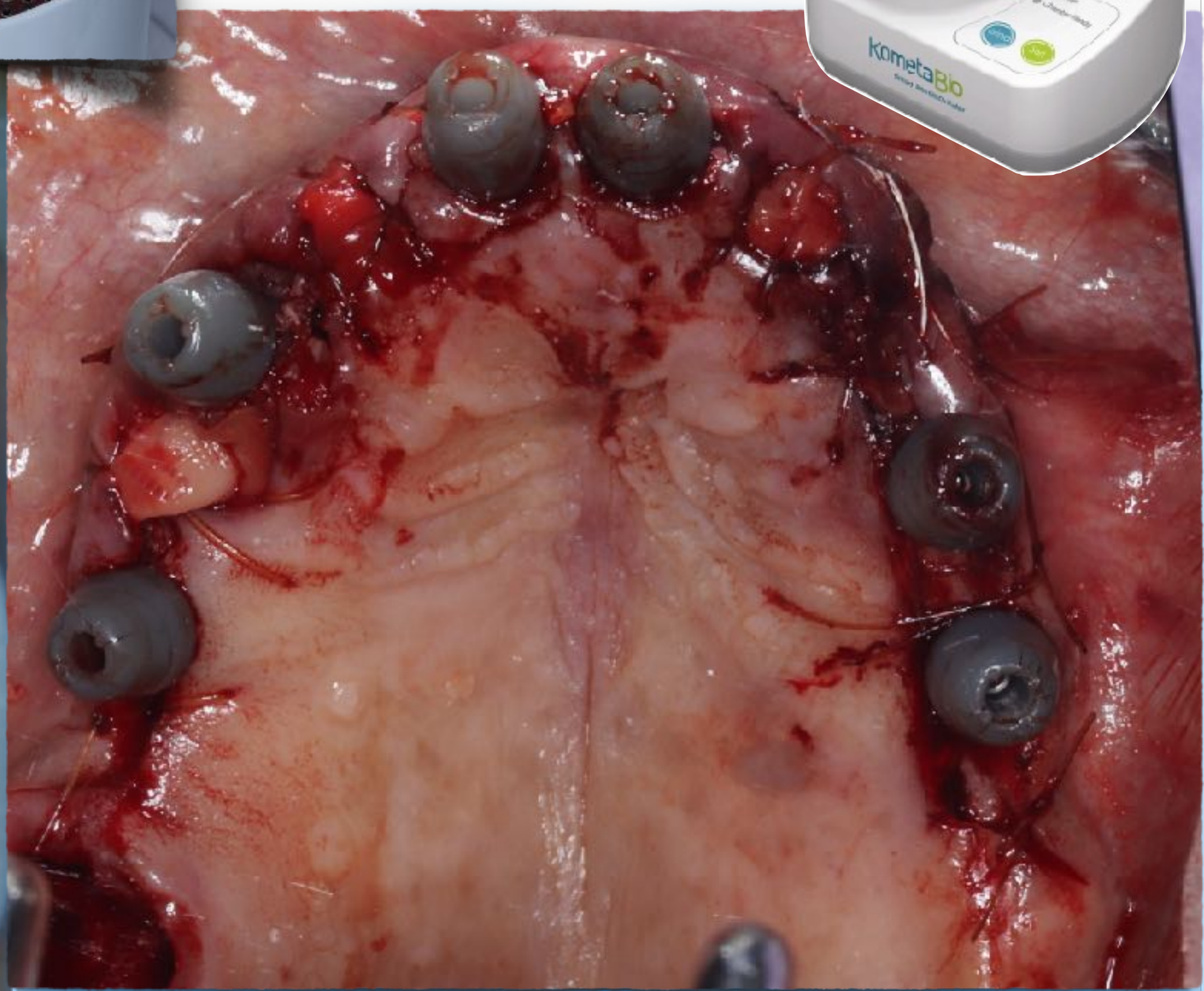
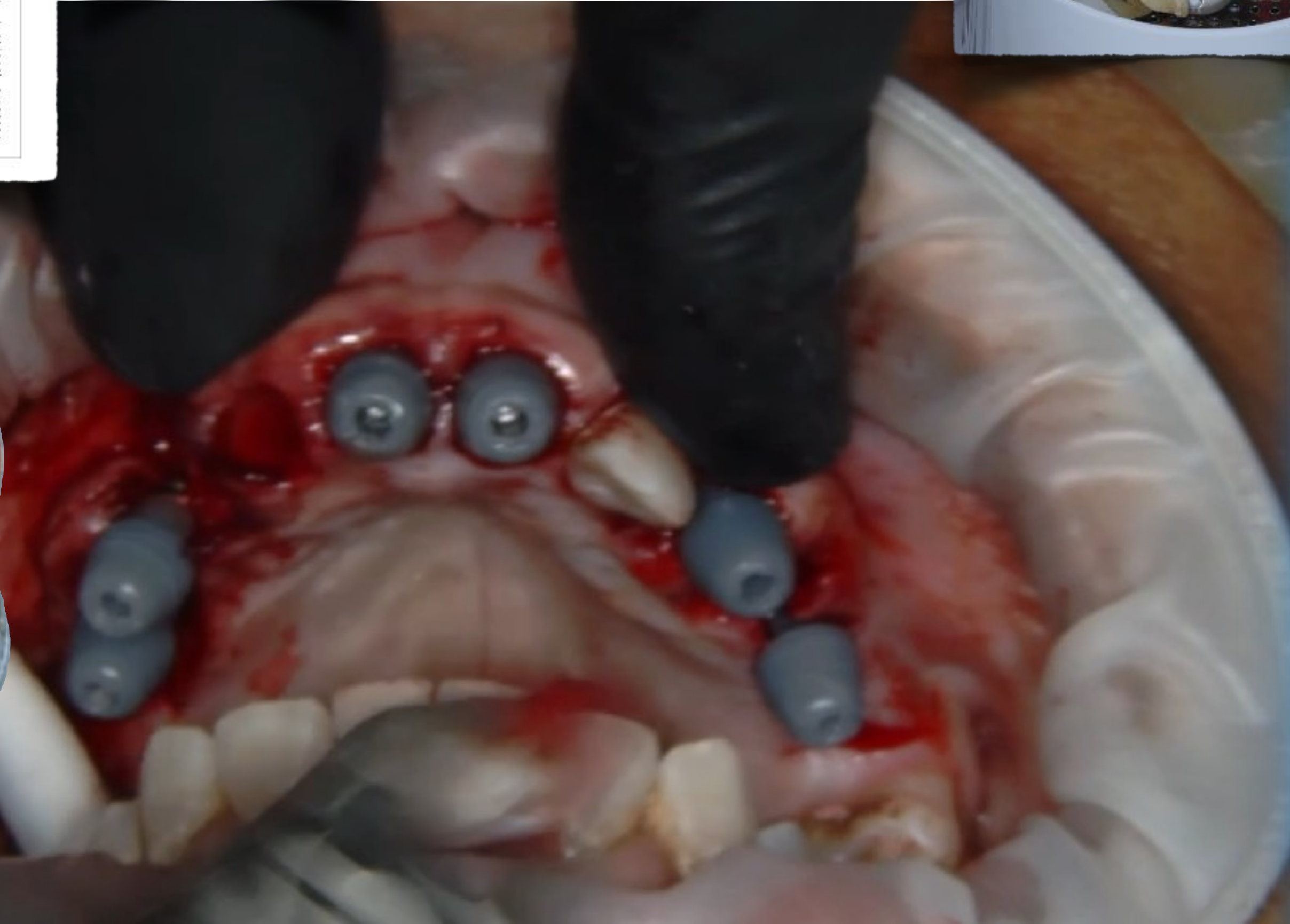
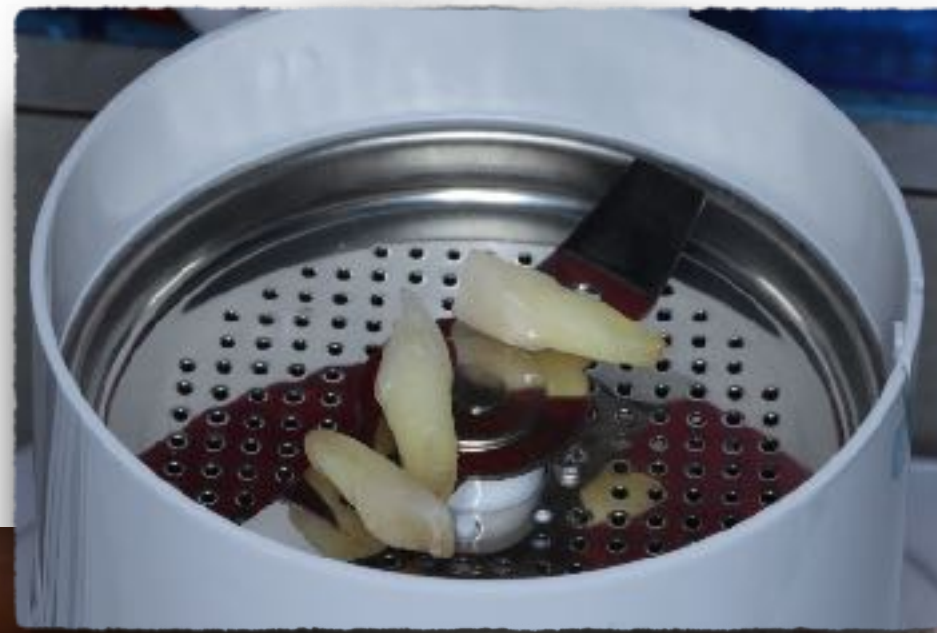


The purpose of this study was to evaluate the effectiveness of ATS as a grafting modality in the treatment of alveolar bone loss. The study involved a retrospective analysis of 50 patients who had undergone ATS grafting procedures. The patients were divided into two groups: a control group that received traditional bone grafting and a study group that received ATS grafting. The primary outcome measure was the percentage of bone volume gain over a 12-month period. The results showed that the ATS group achieved a significantly higher percentage of bone volume gain compared to the control group. This finding suggests that ATS is a viable and effective grafting modality for the treatment of alveolar bone loss.

CONCLUSION

Autologous tooth structure (ATS) is a novel grafting modality that utilizes extracted teeth as a source of bone graft material. This technique is based on the principle that teeth contain a significant amount of bone tissue, which can be used to augment the alveolar bone structure. The process involves extracting teeth from a patient, processing them to remove pulp and root material, and then using the remaining crown and root portions as graft material. This method is particularly useful in cases of severe alveolar bone loss, where traditional bone grafting techniques may be limited. The use of ATS offers several advantages, including the availability of a patient's own bone, the preservation of natural tooth structure, and the potential for improved healing and integration with the surrounding bone.

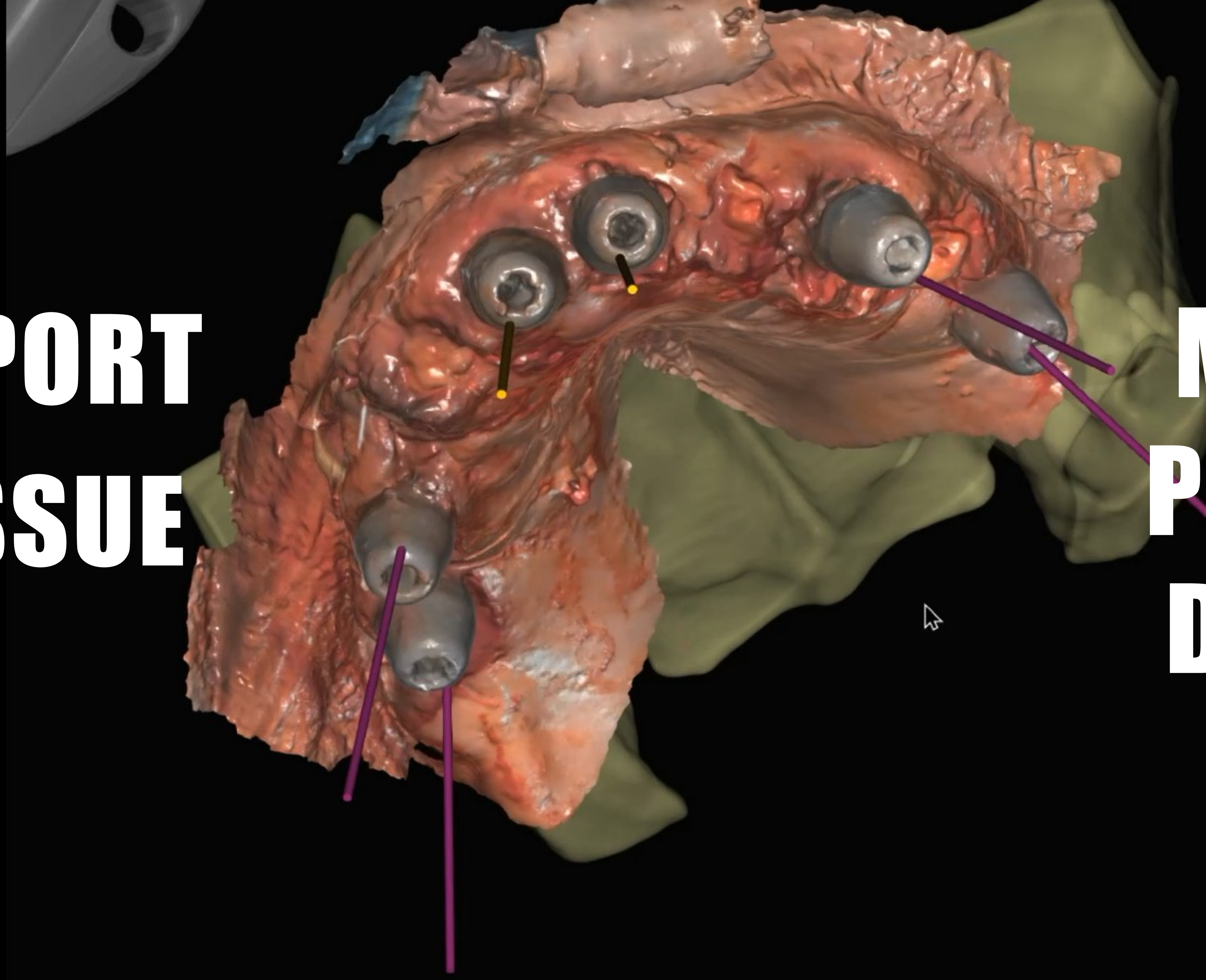
The purpose of this study was to evaluate the effectiveness of ATS as a grafting modality in the treatment of alveolar bone loss. The study involved a retrospective analysis of 50 patients who had undergone ATS grafting procedures. The patients were divided into two groups: a control group that received traditional bone grafting and a study group that received ATS grafting. The primary outcome measure was the percentage of bone volume gain over a 12-month period. The results showed that the ATS group achieved a significantly higher percentage of bone volume gain compared to the control group. This finding suggests that ATS is a viable and effective grafting modality for the treatment of alveolar bone loss.



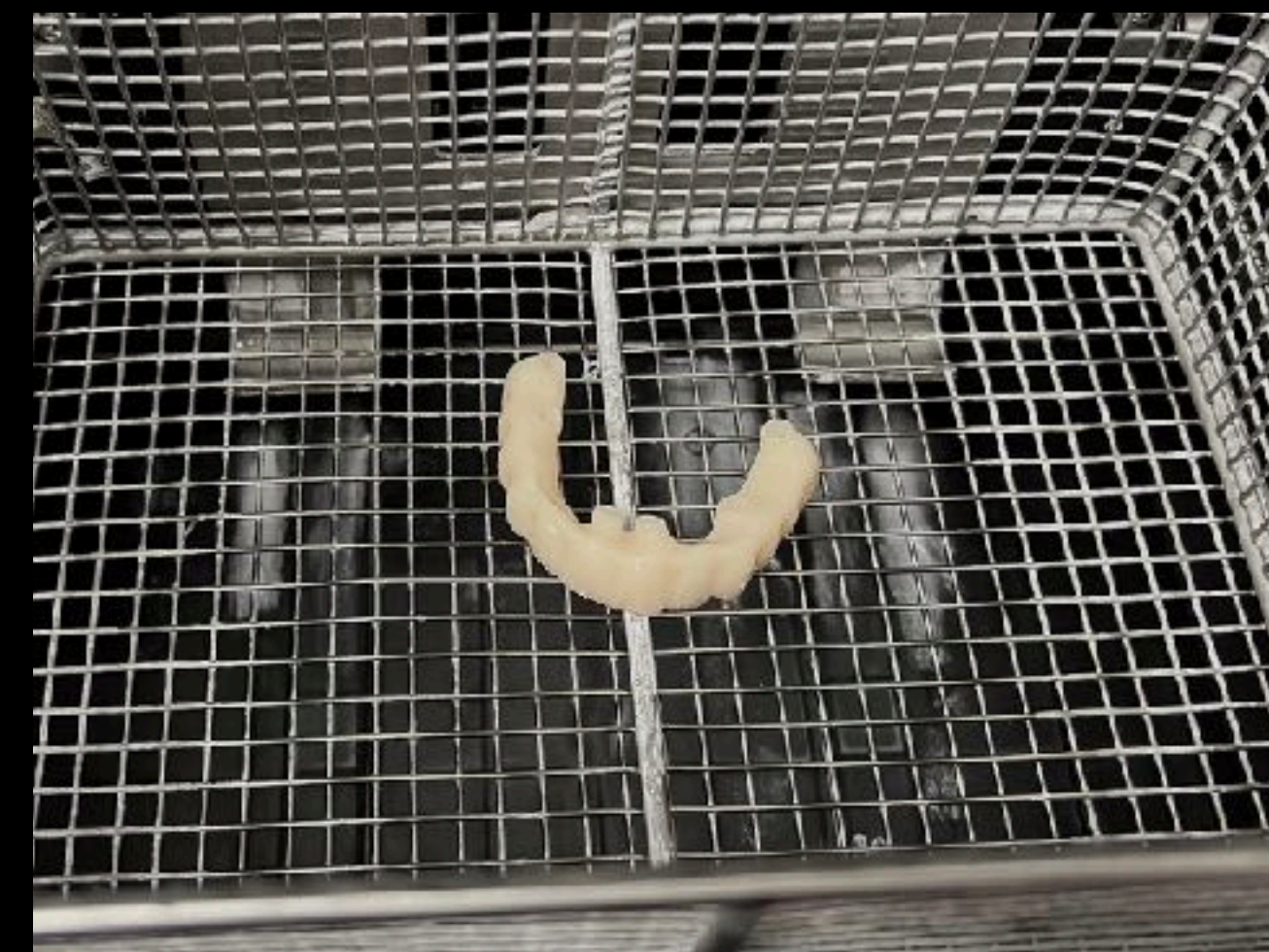
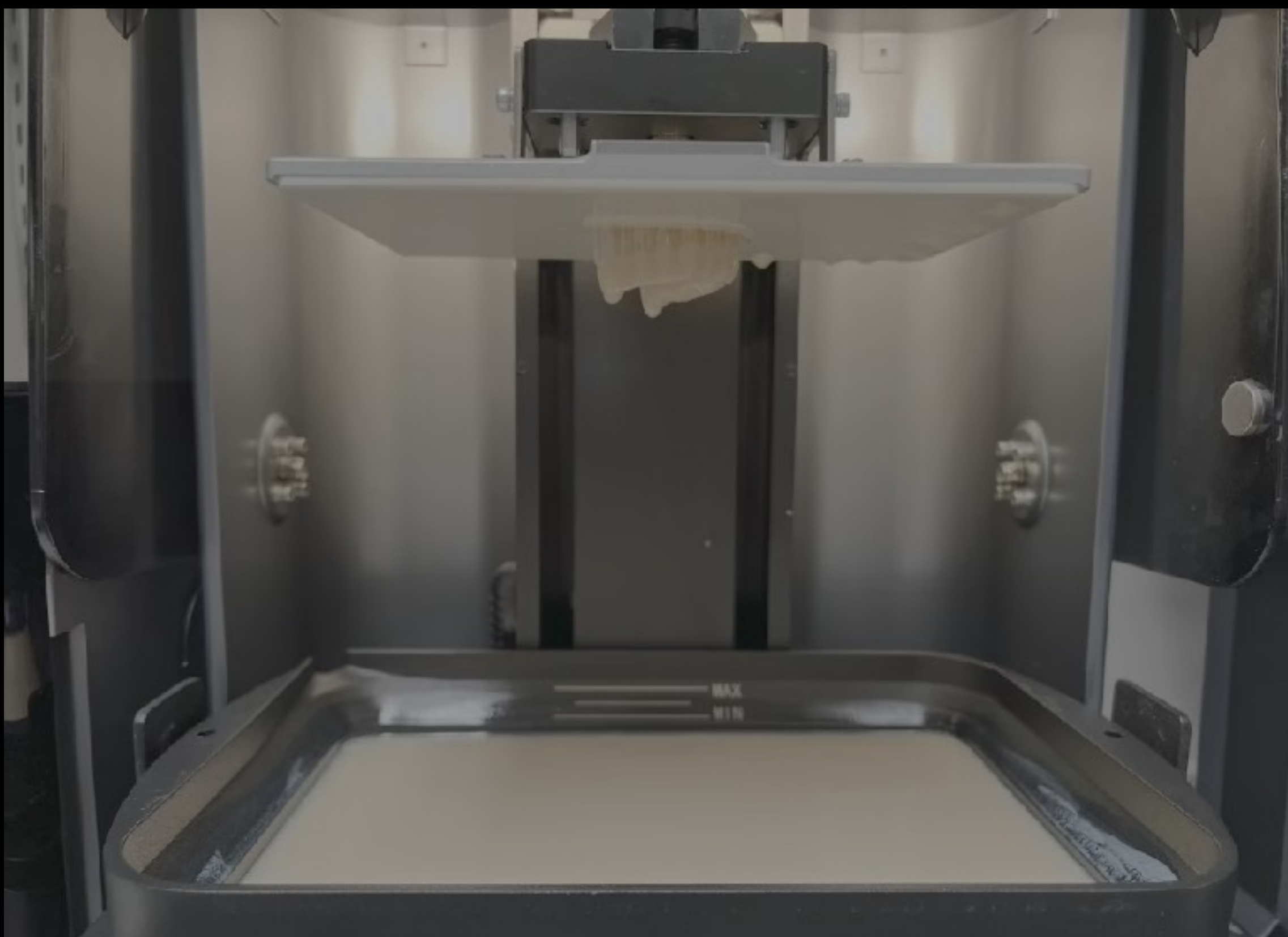
EXTRACT-DENTIN-GRAFT

**IMPORT
TISSUE**

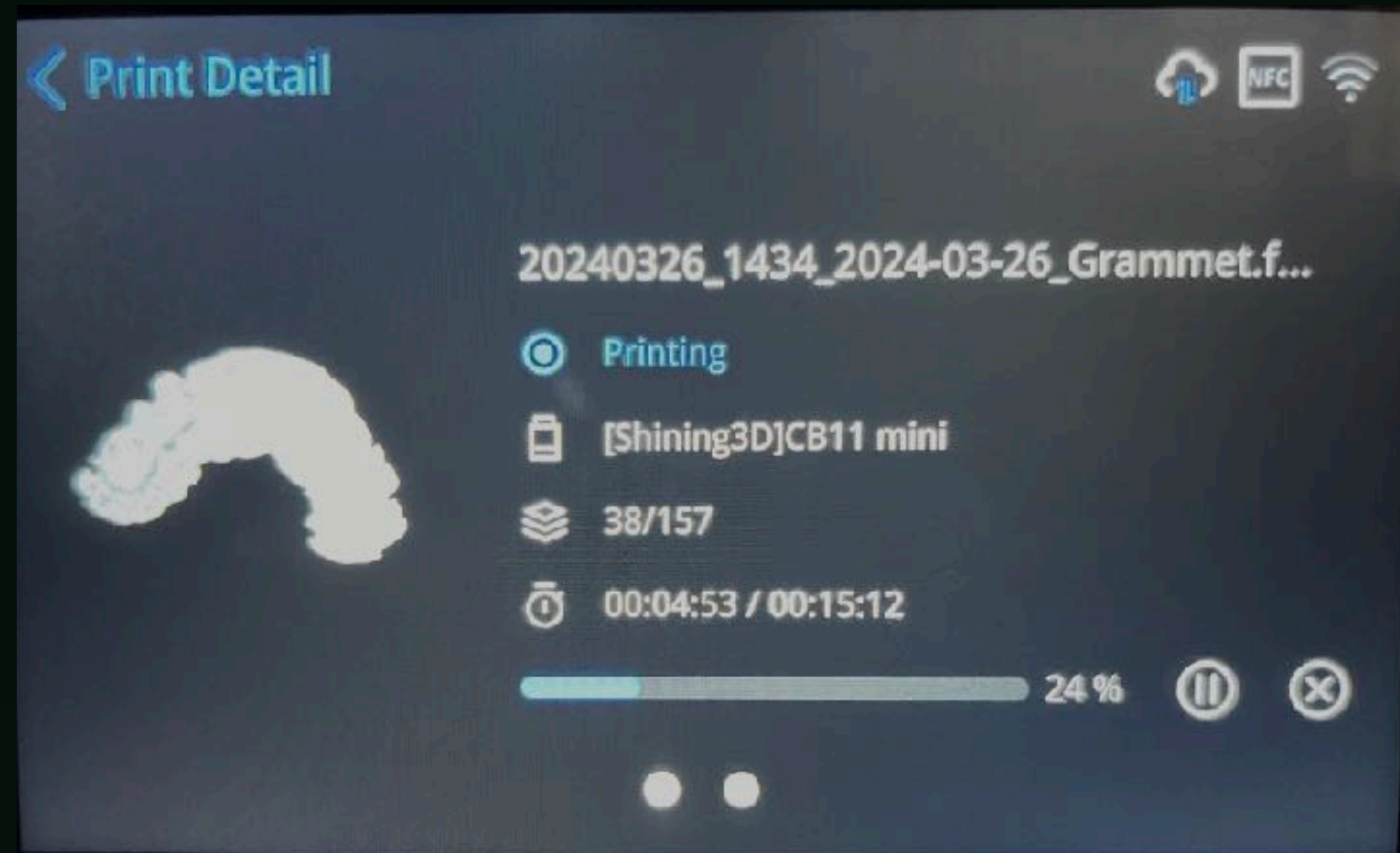
**MATCH
PRE-FAB
DESIGN**



PRINT-WASH



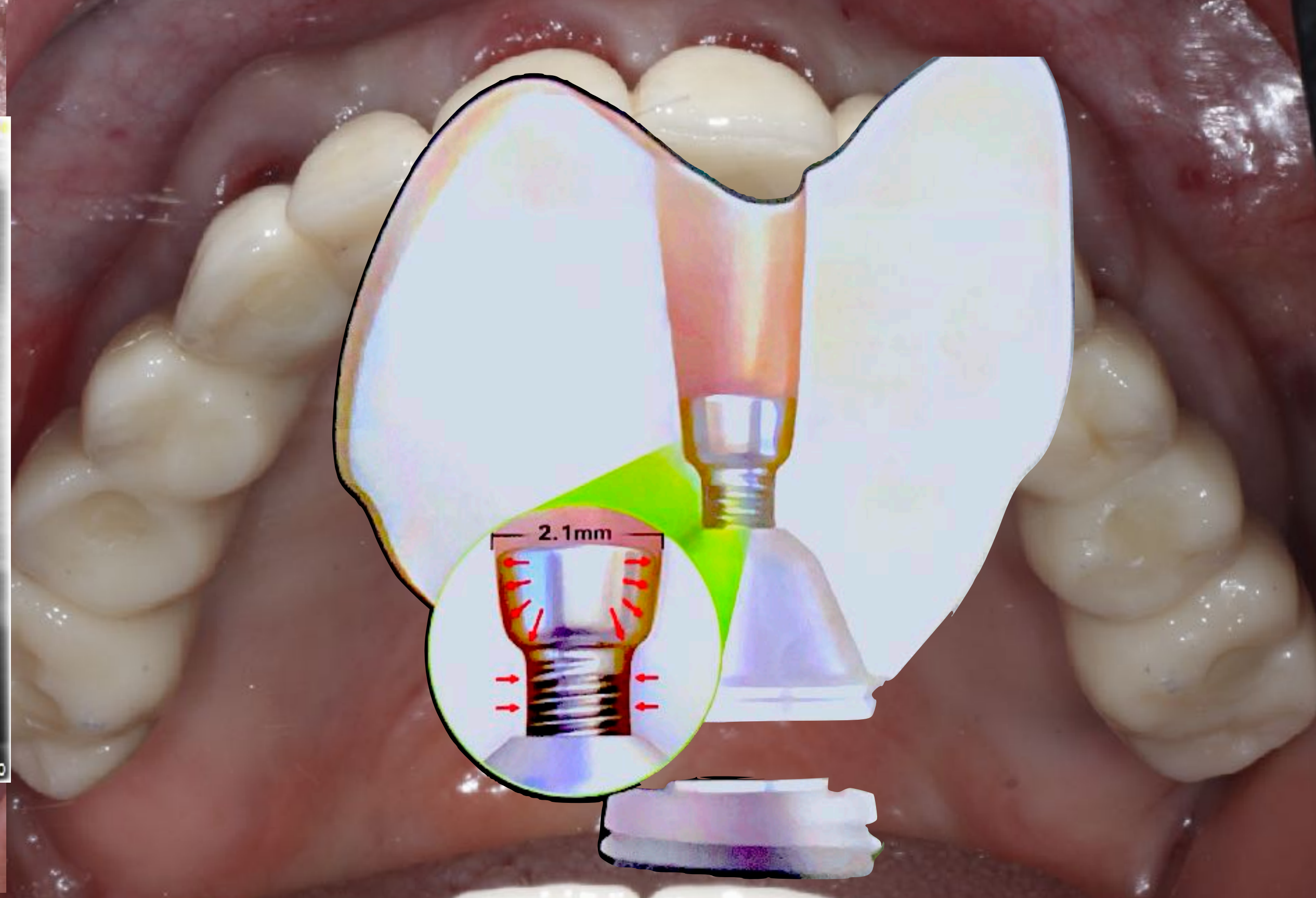
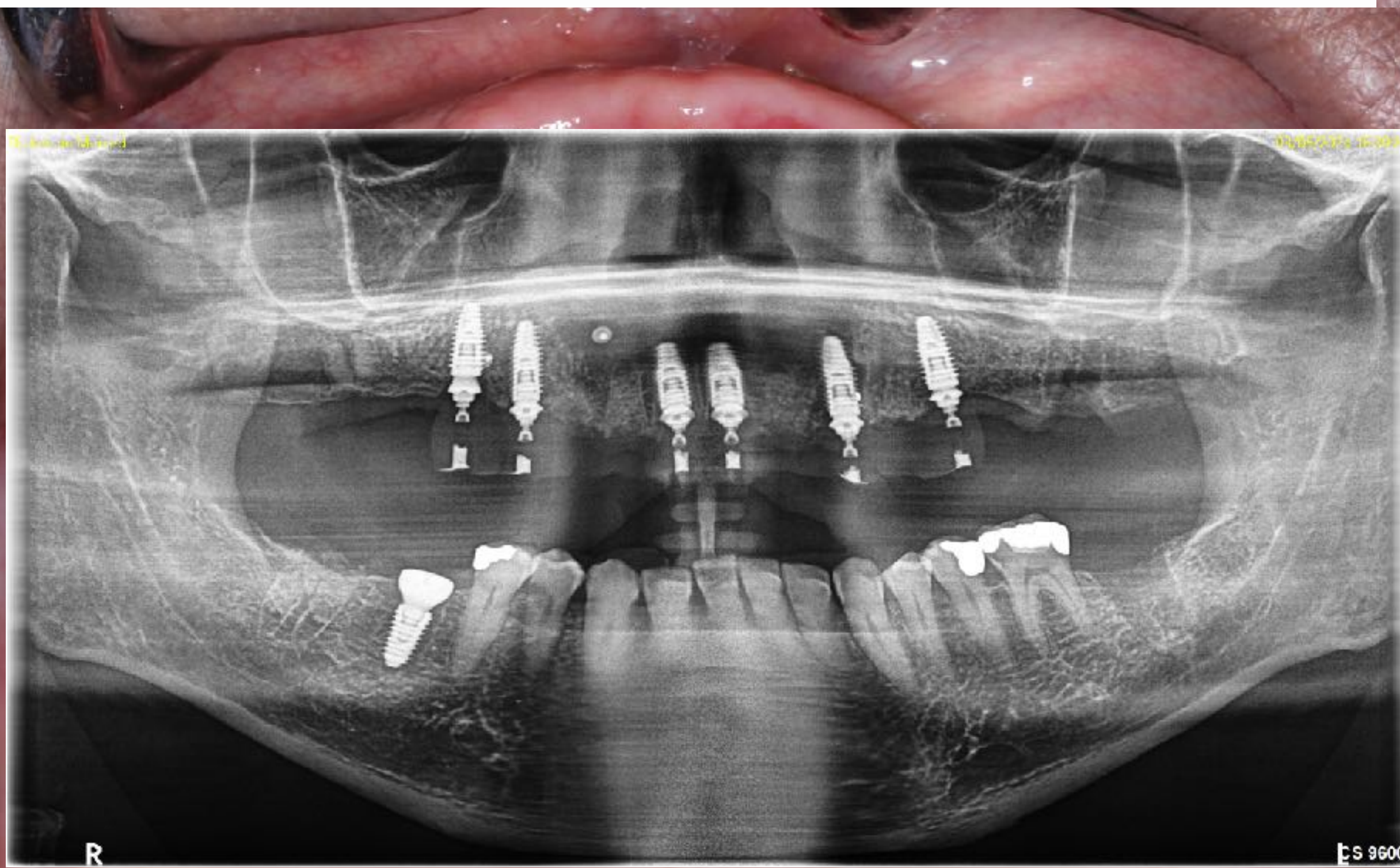
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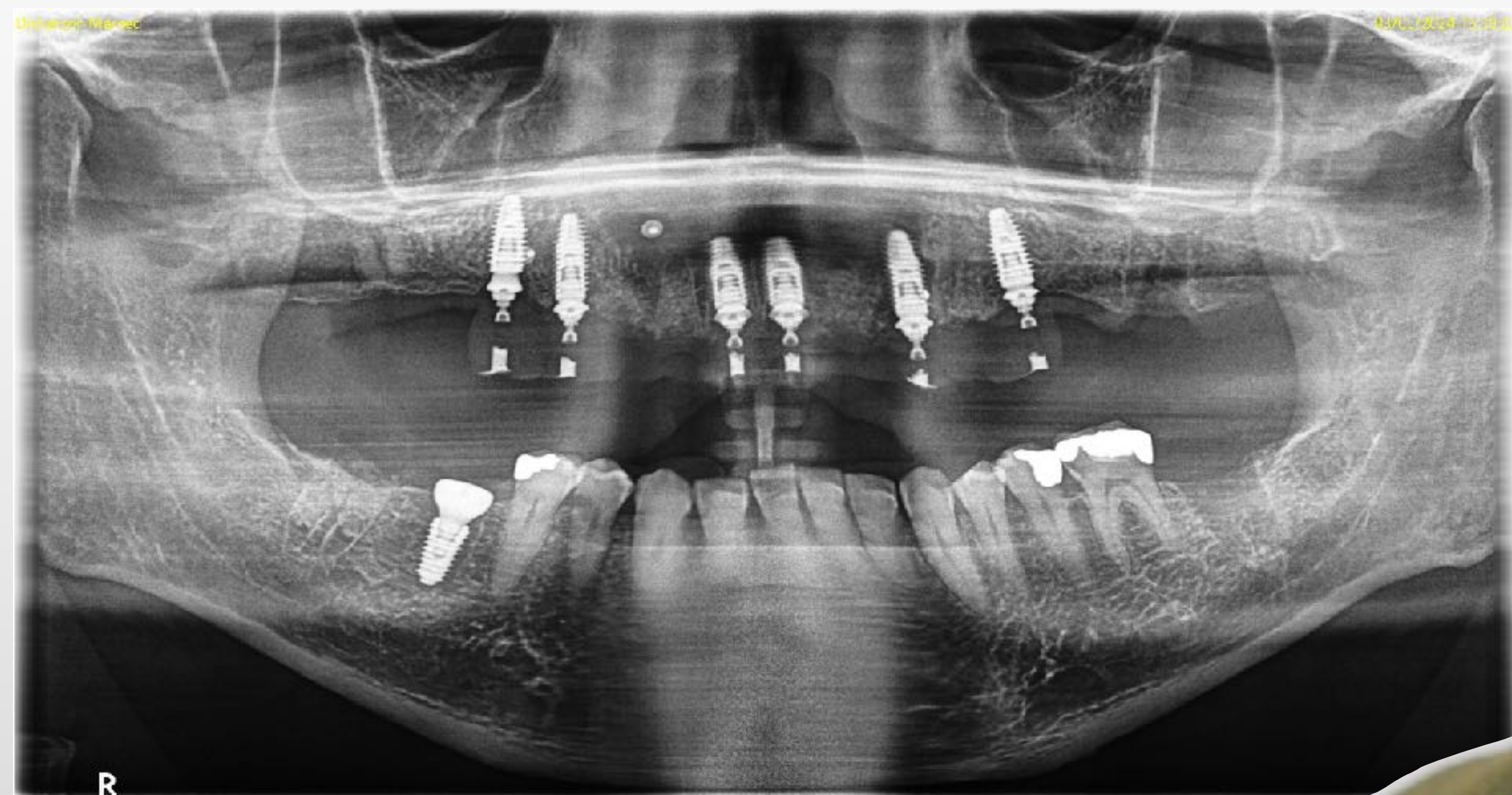
15min Print

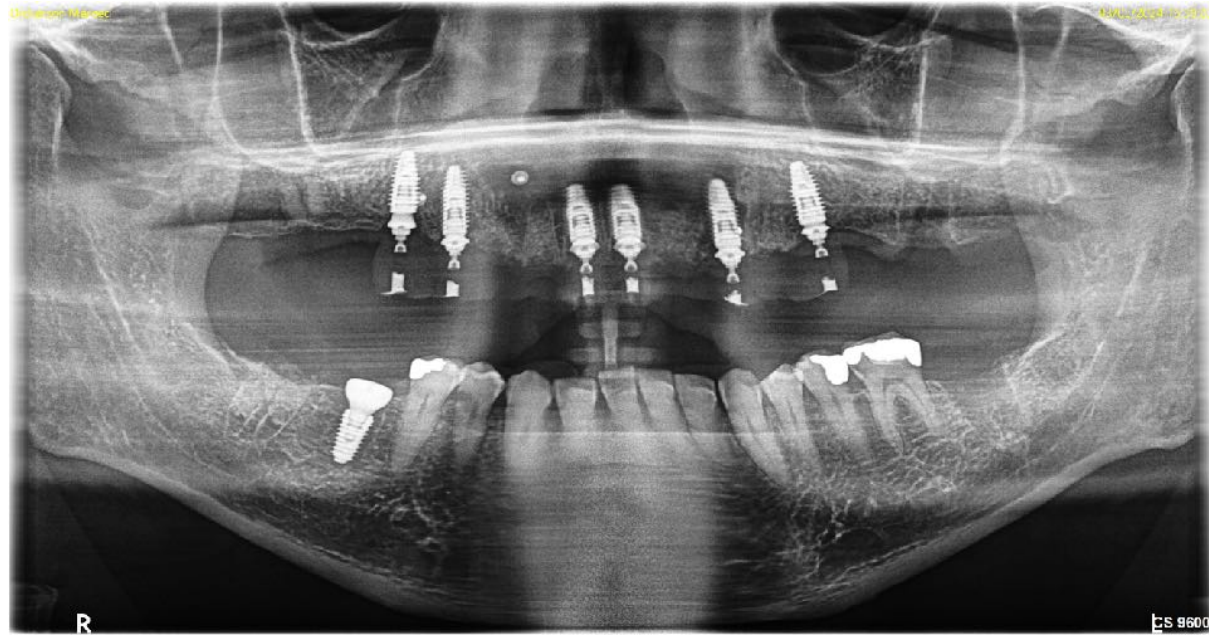


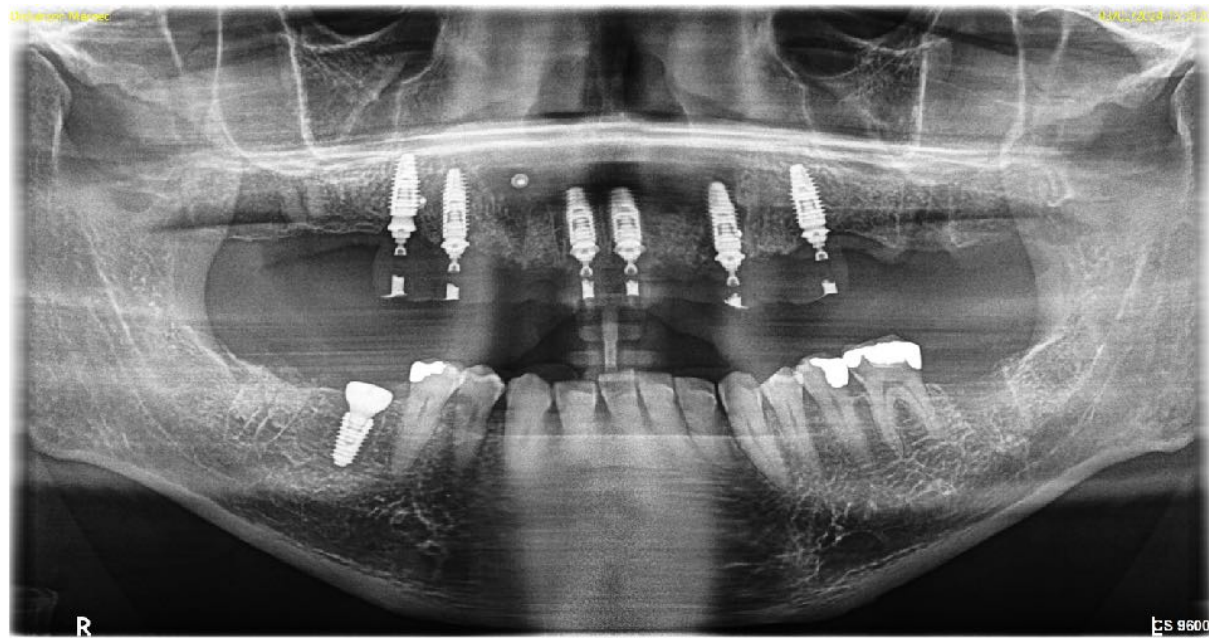
VORTEX- Metal Free



Post OP

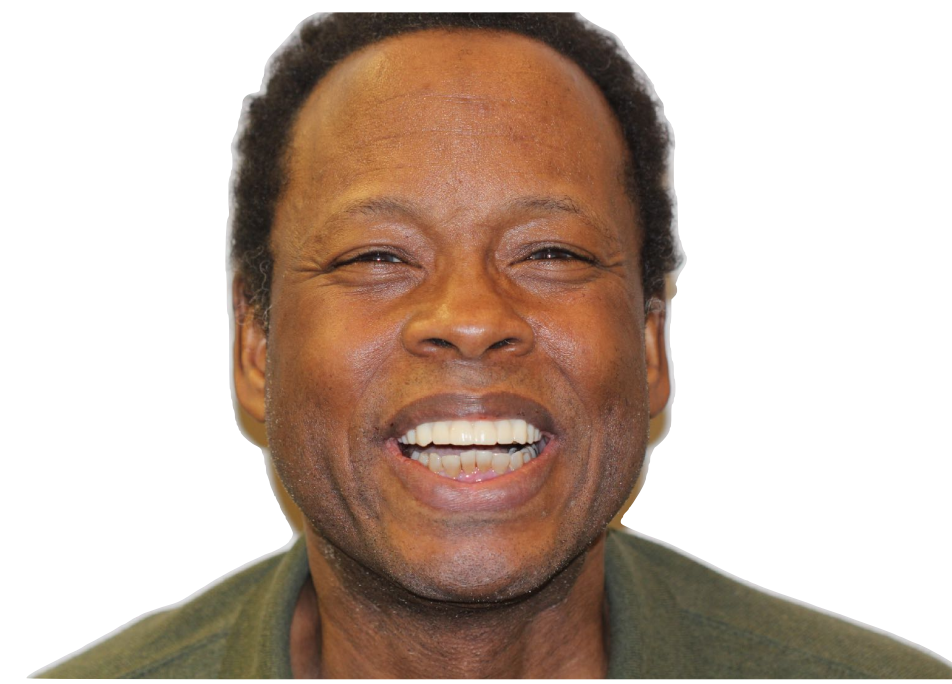
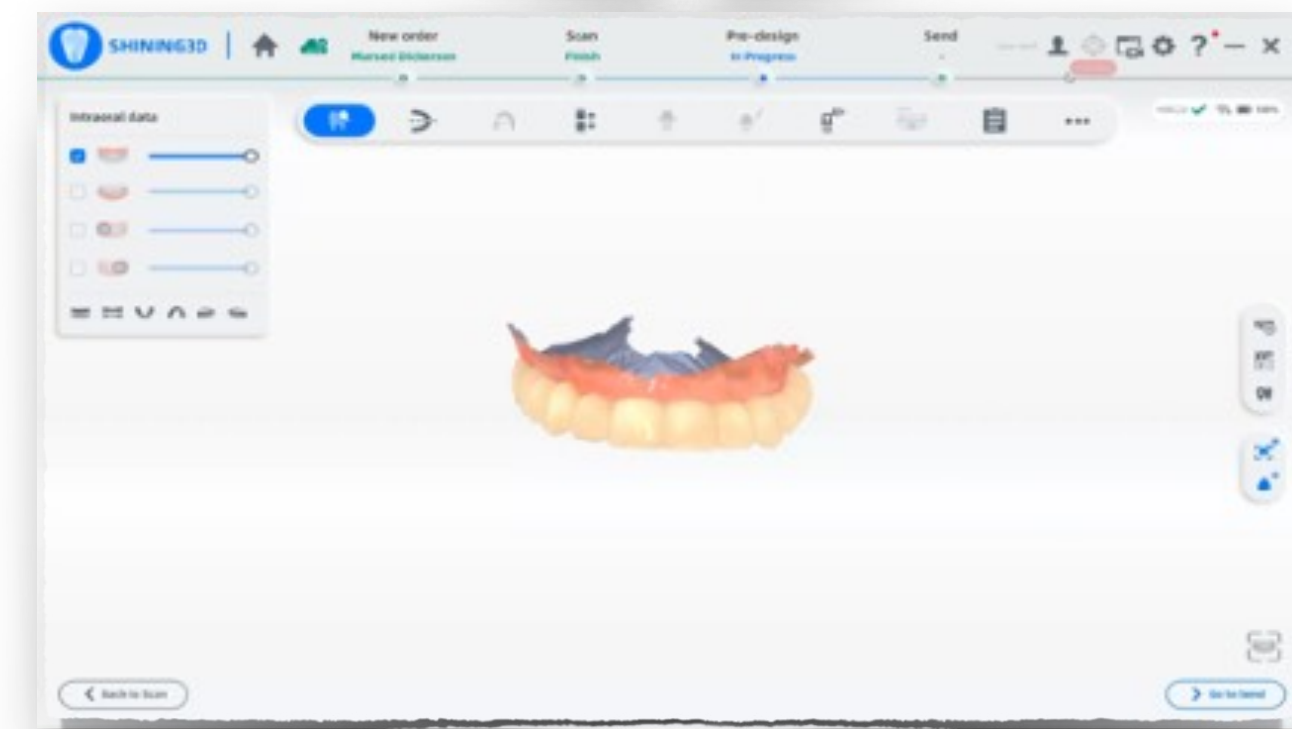
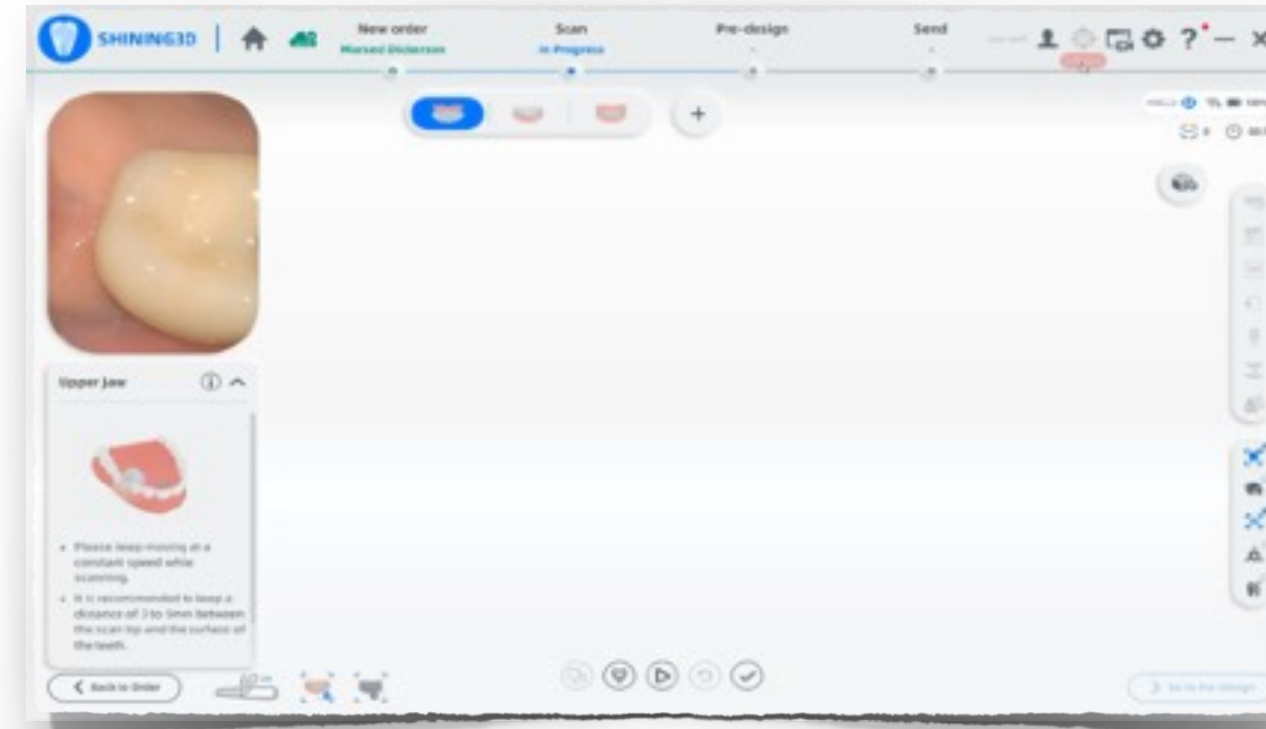






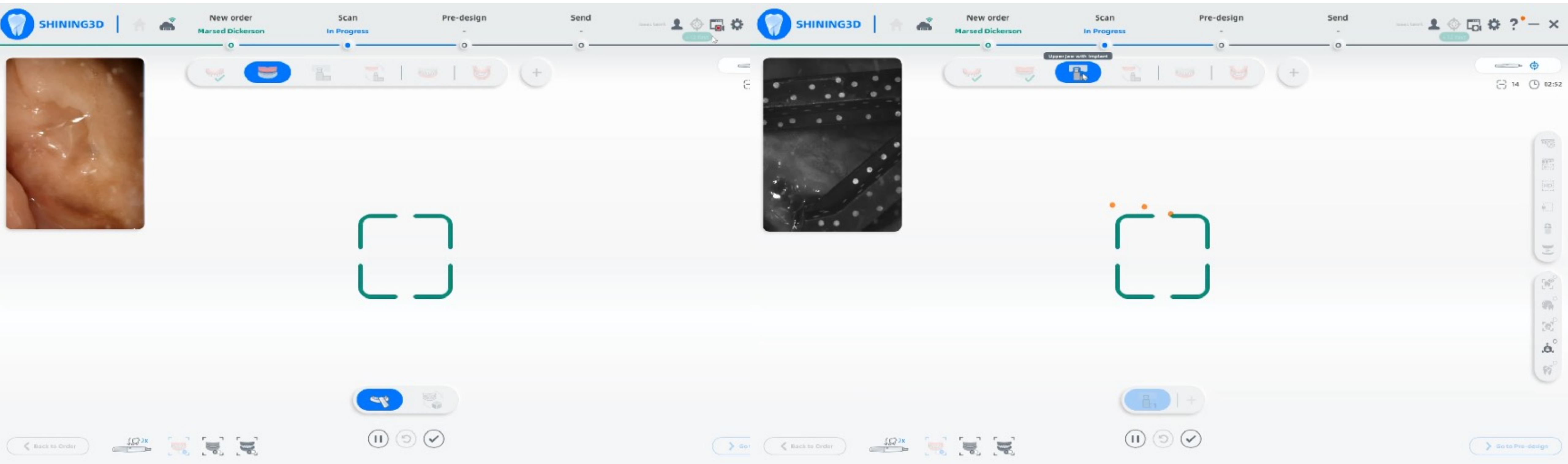
TEMPS

Opposing

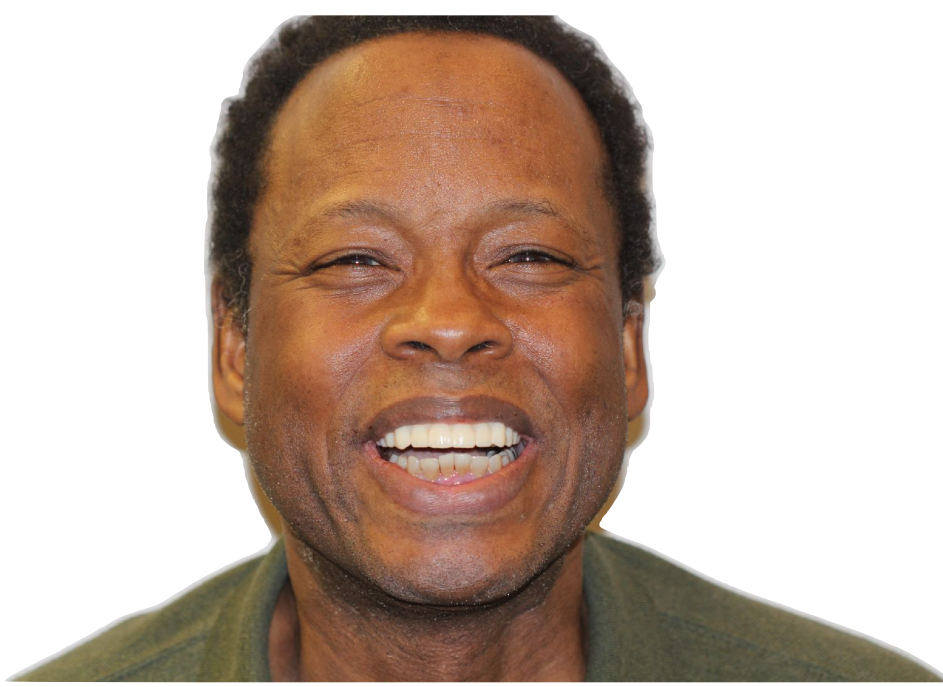
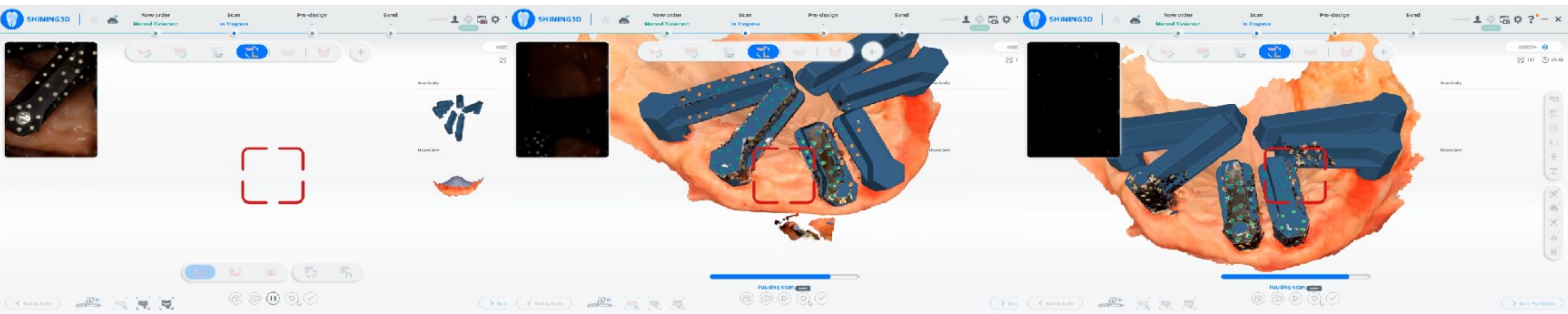


Tissue

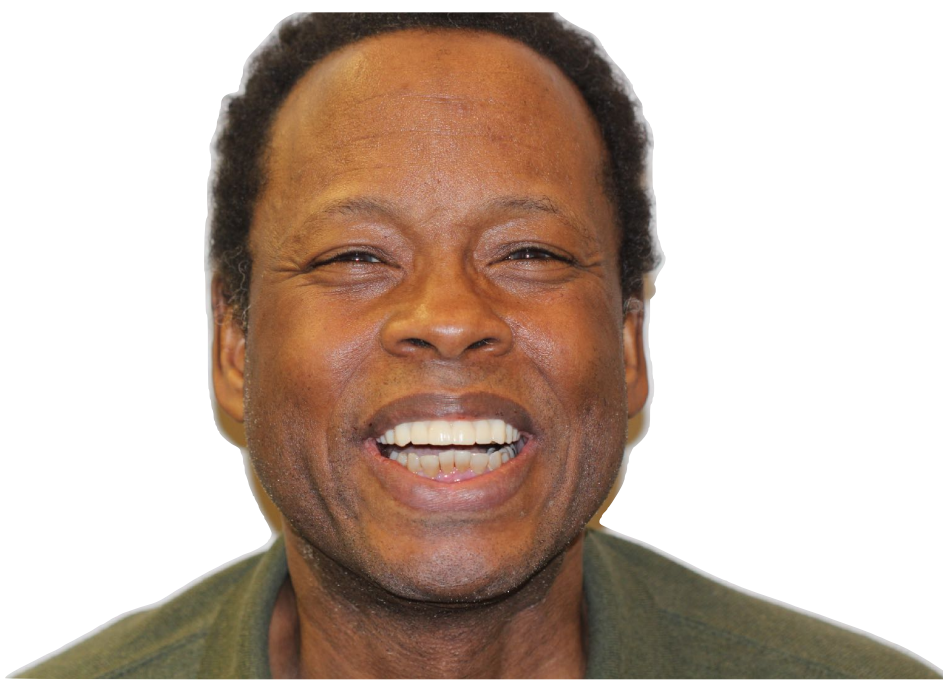
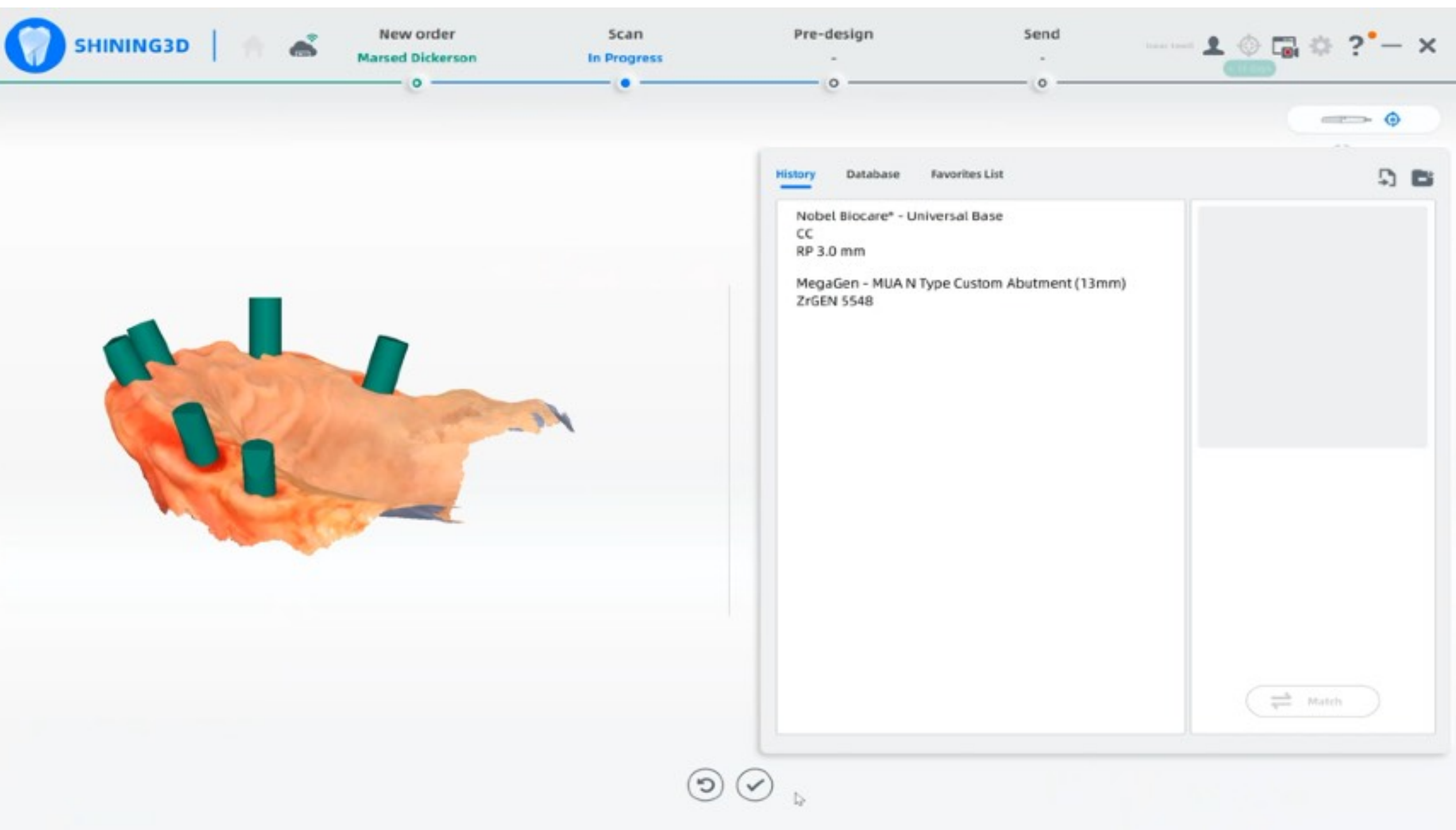
IPG



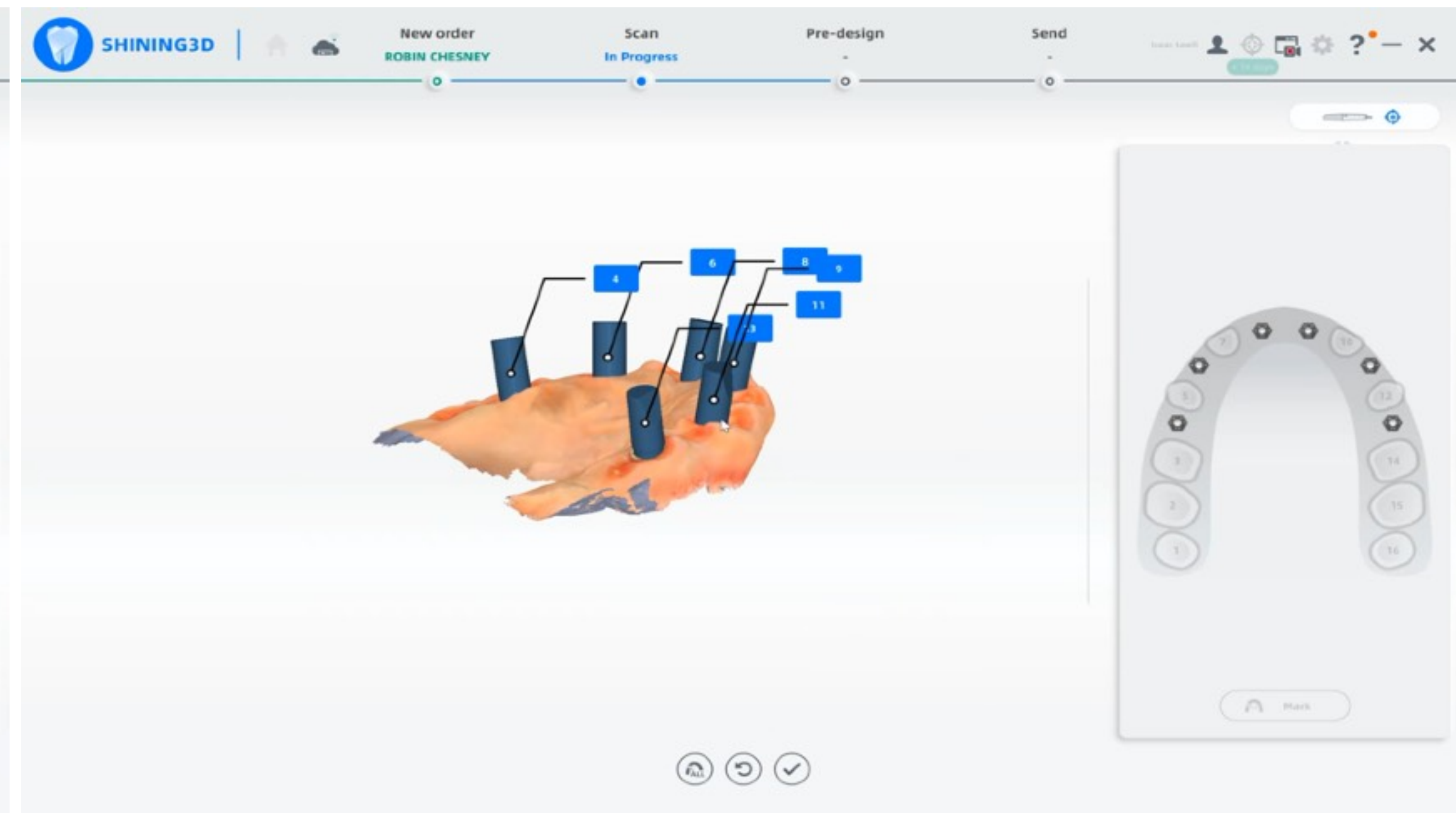
Tissue Matching



Scan Body Conversion



Tooth Identification



All in One



Project File



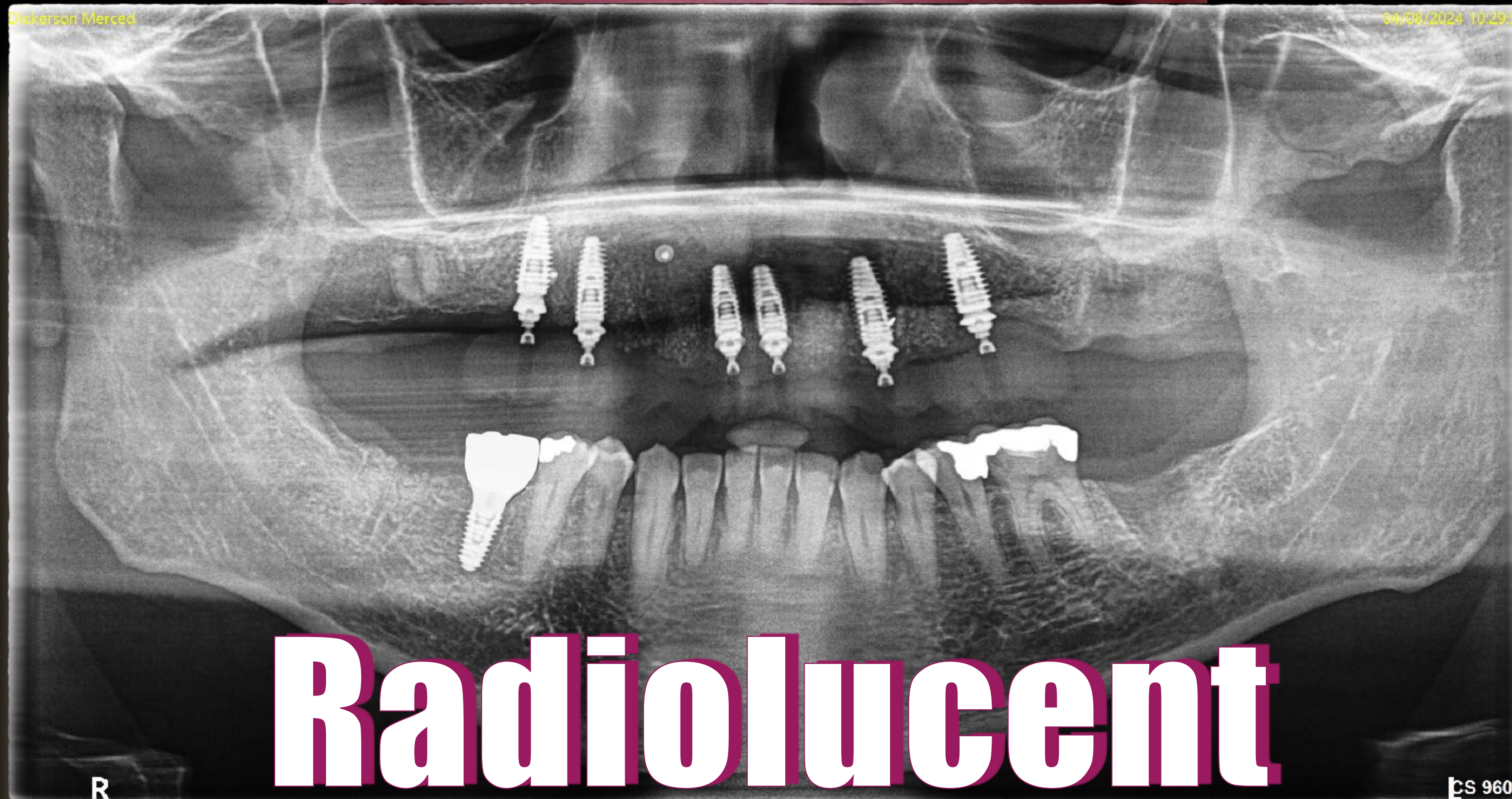
Facial Scan

Create the Avatar

Final G-GAM

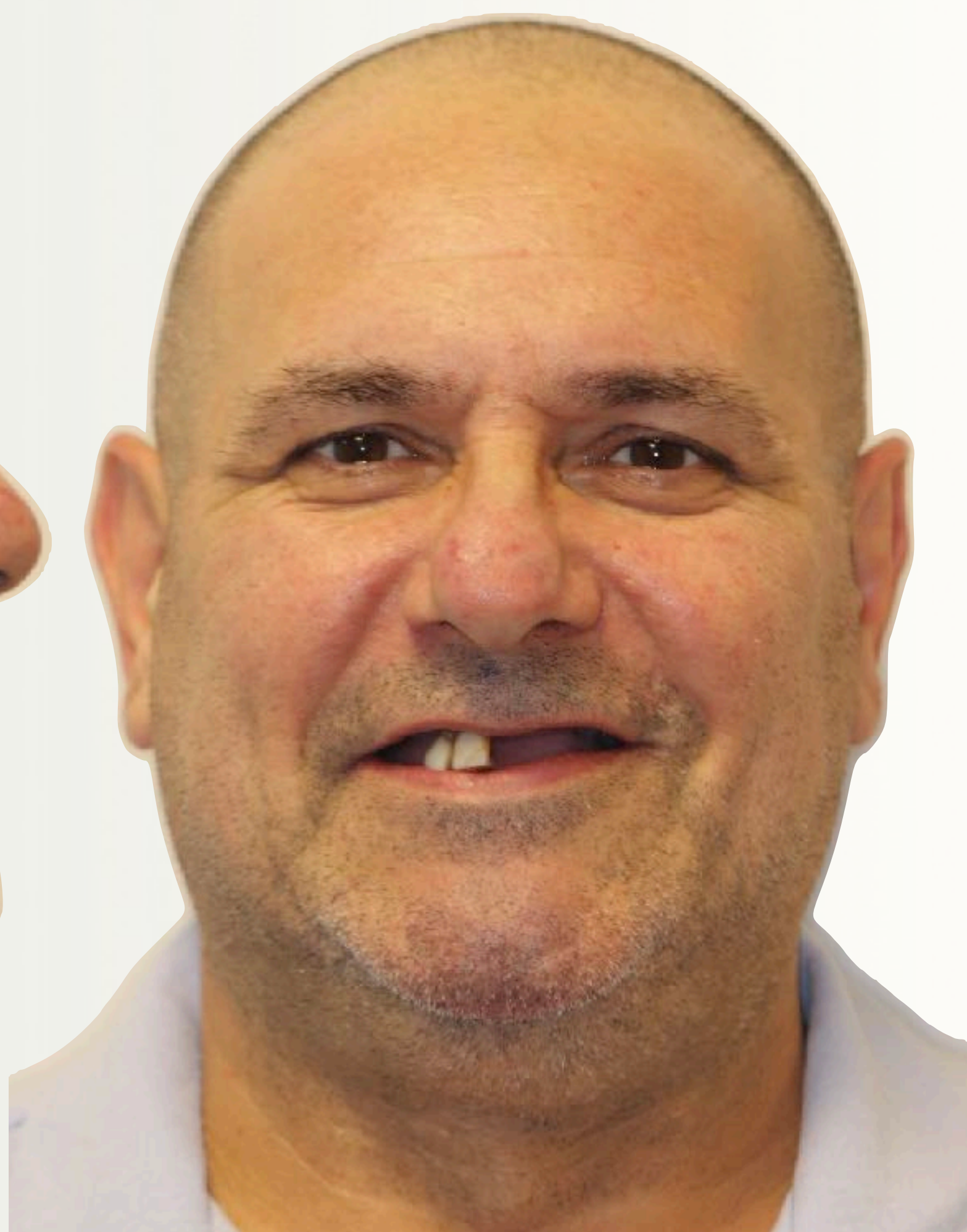


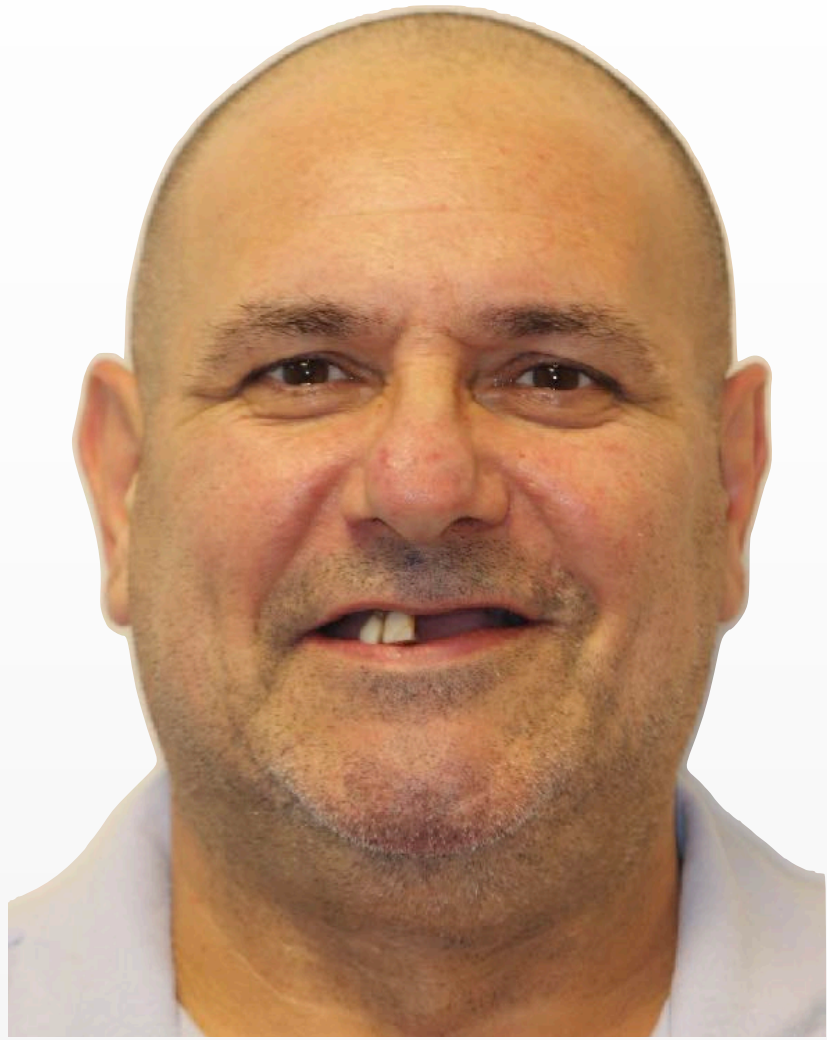
Final G-GAM

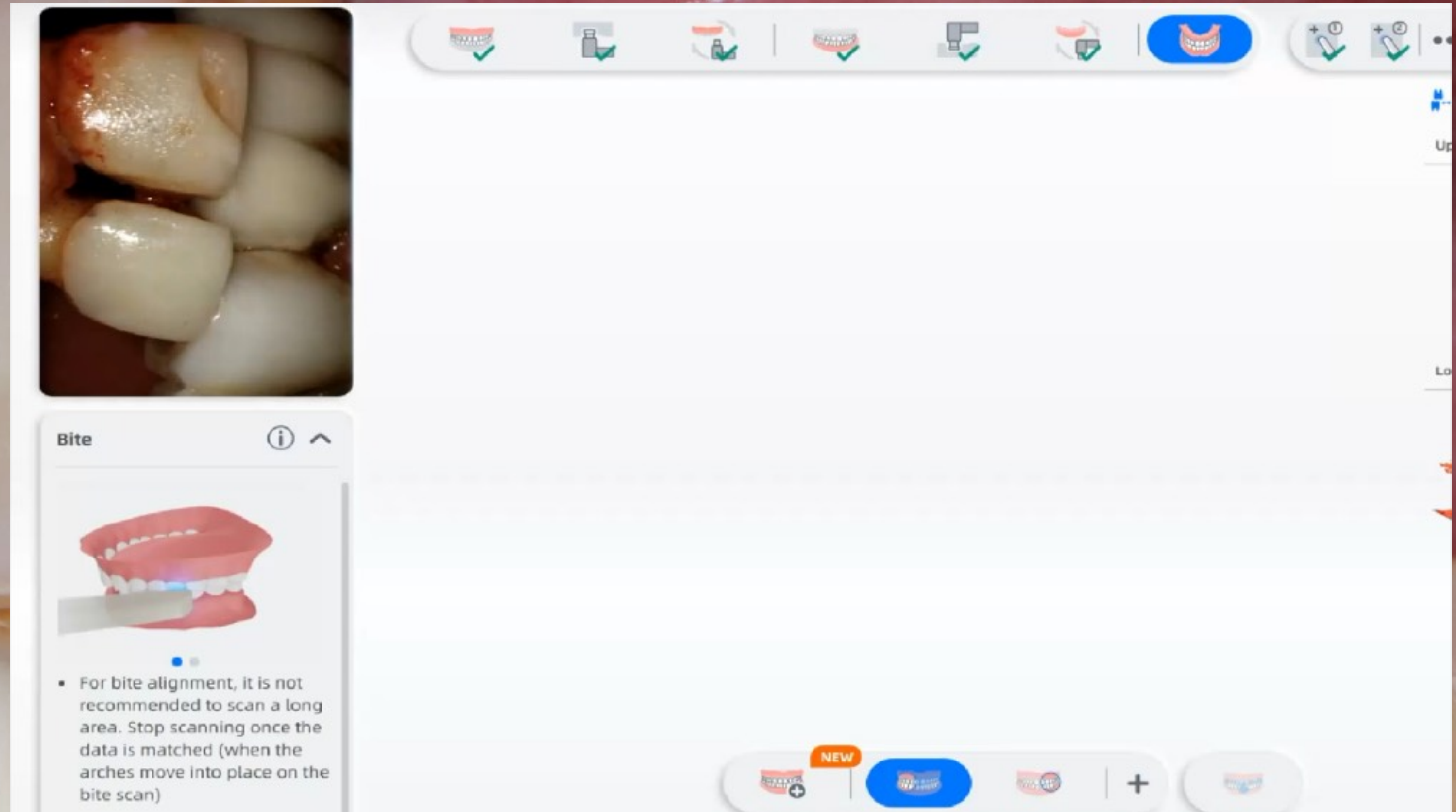


Changing lives one smile at a time

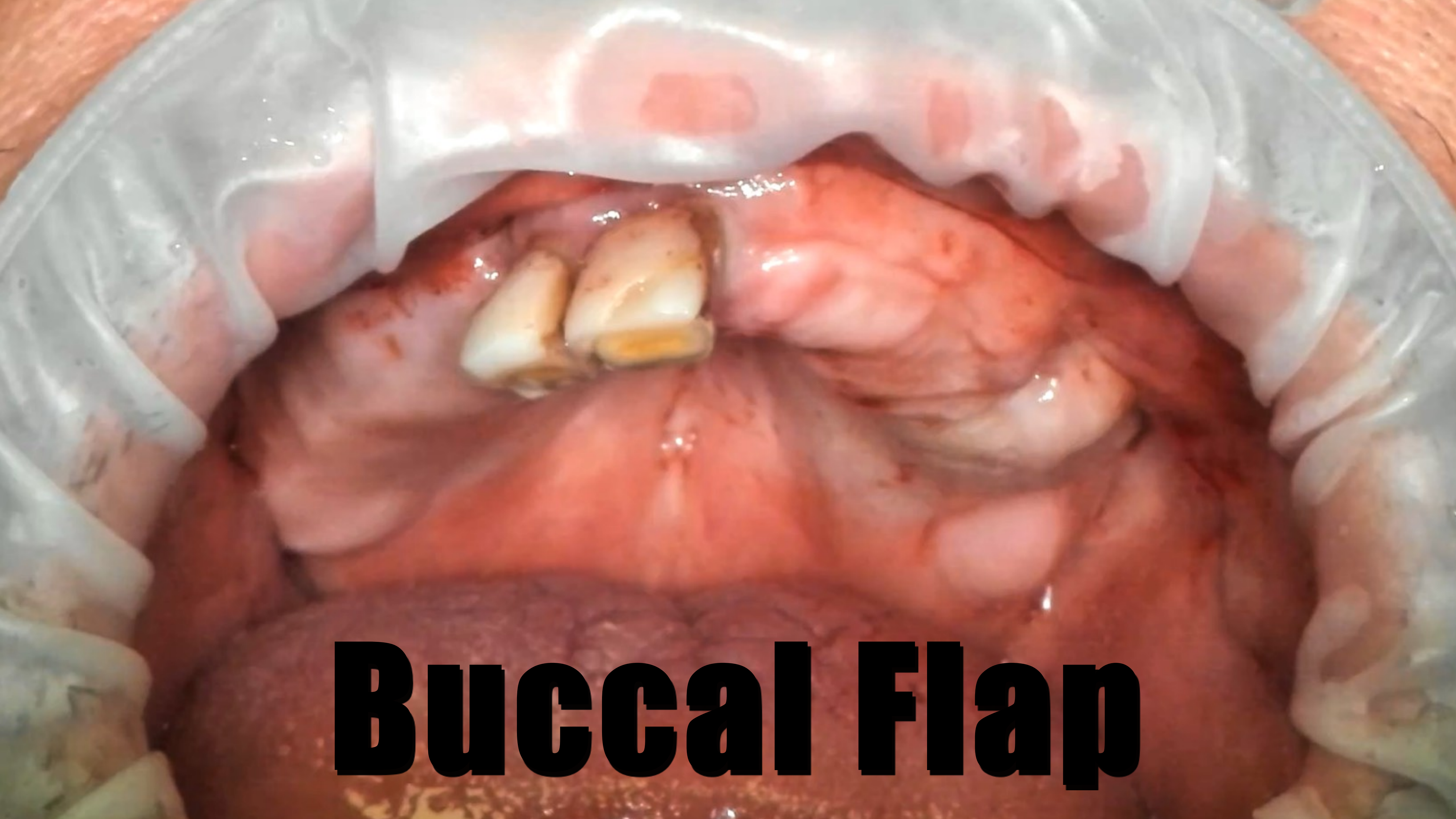








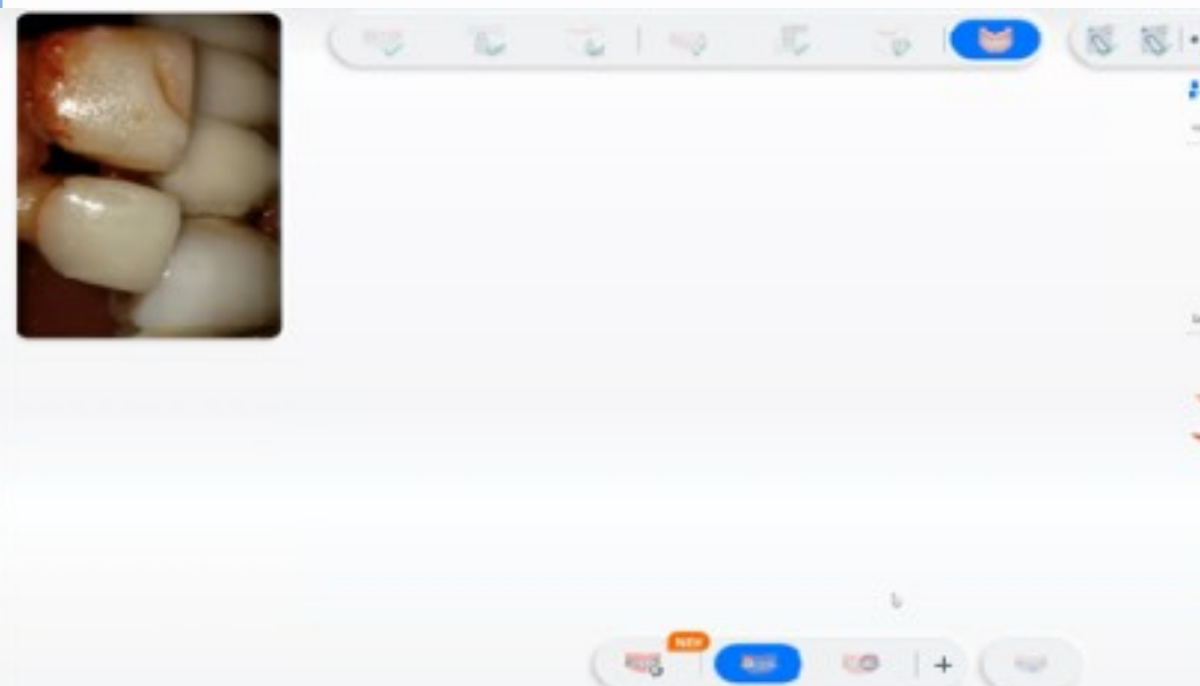
Keep the occlusion



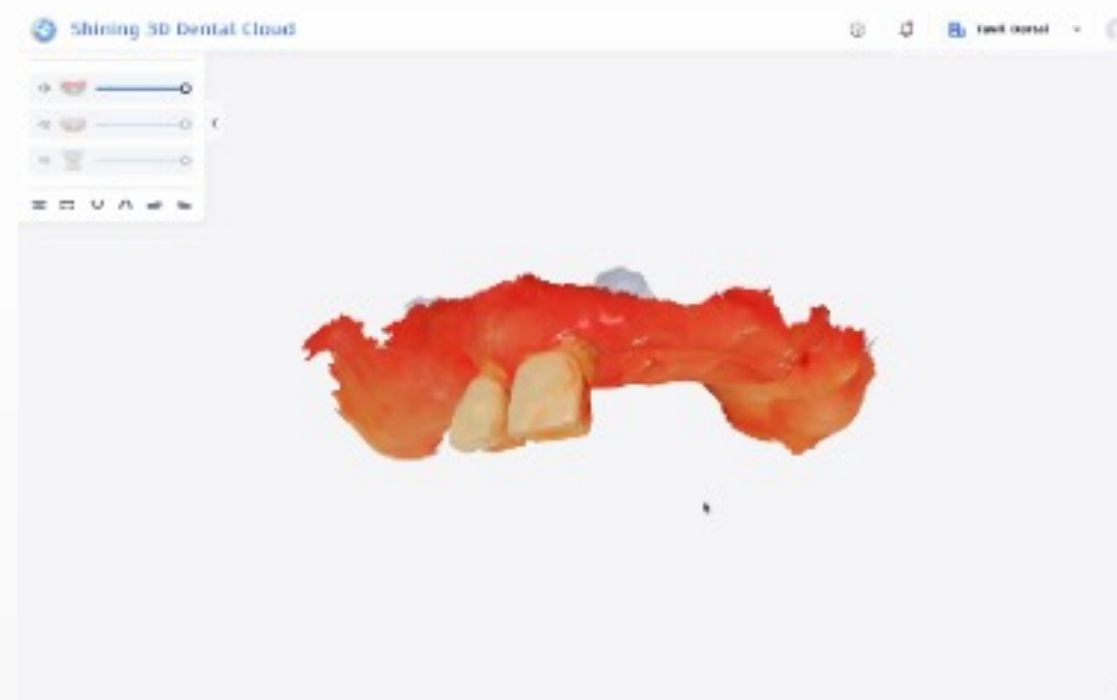
Buccal Flap

**M
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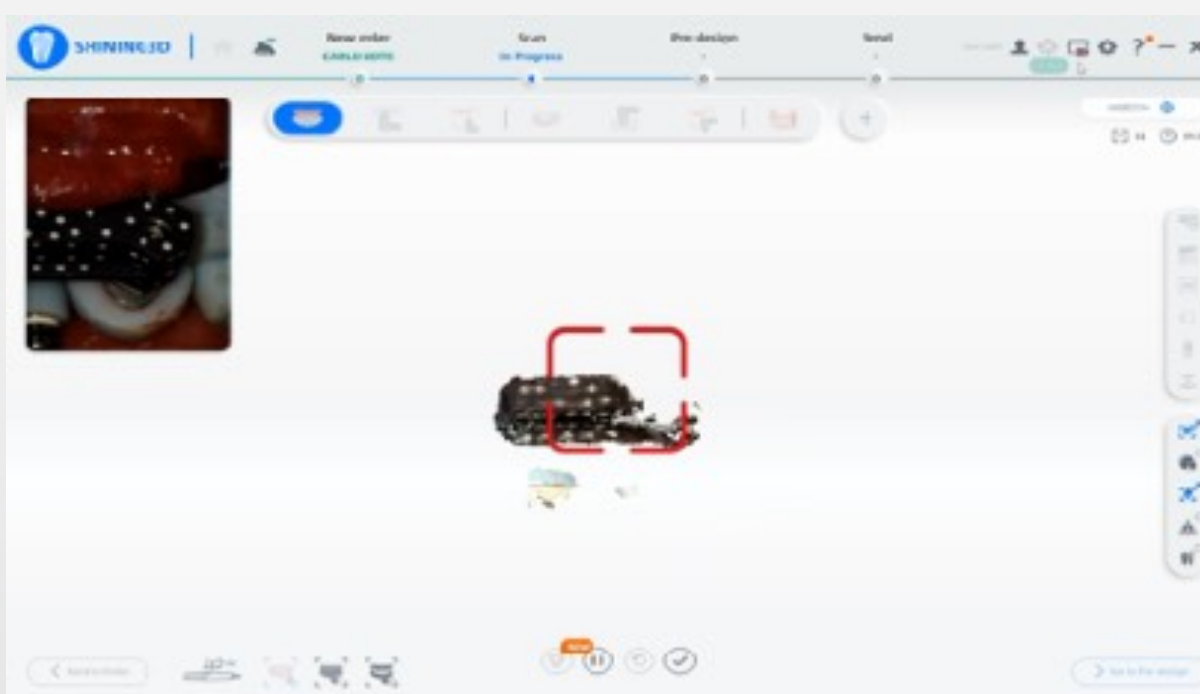
OCCCLUSION



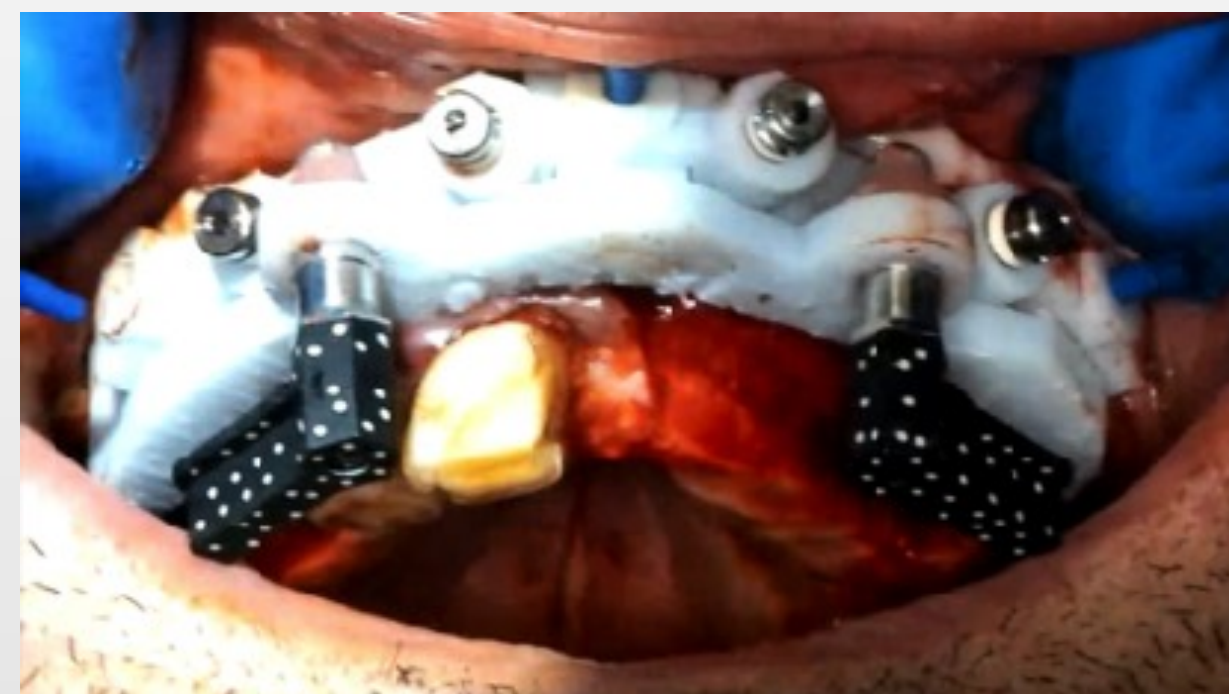
IOS



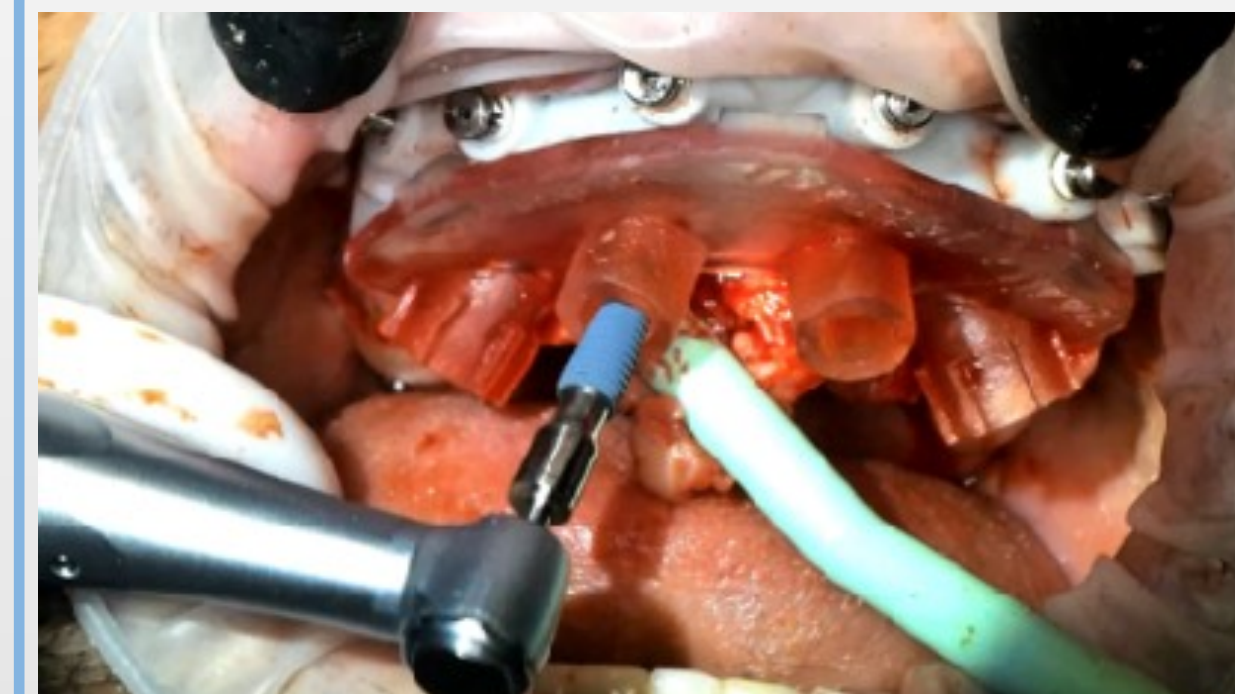
FS



MATCH

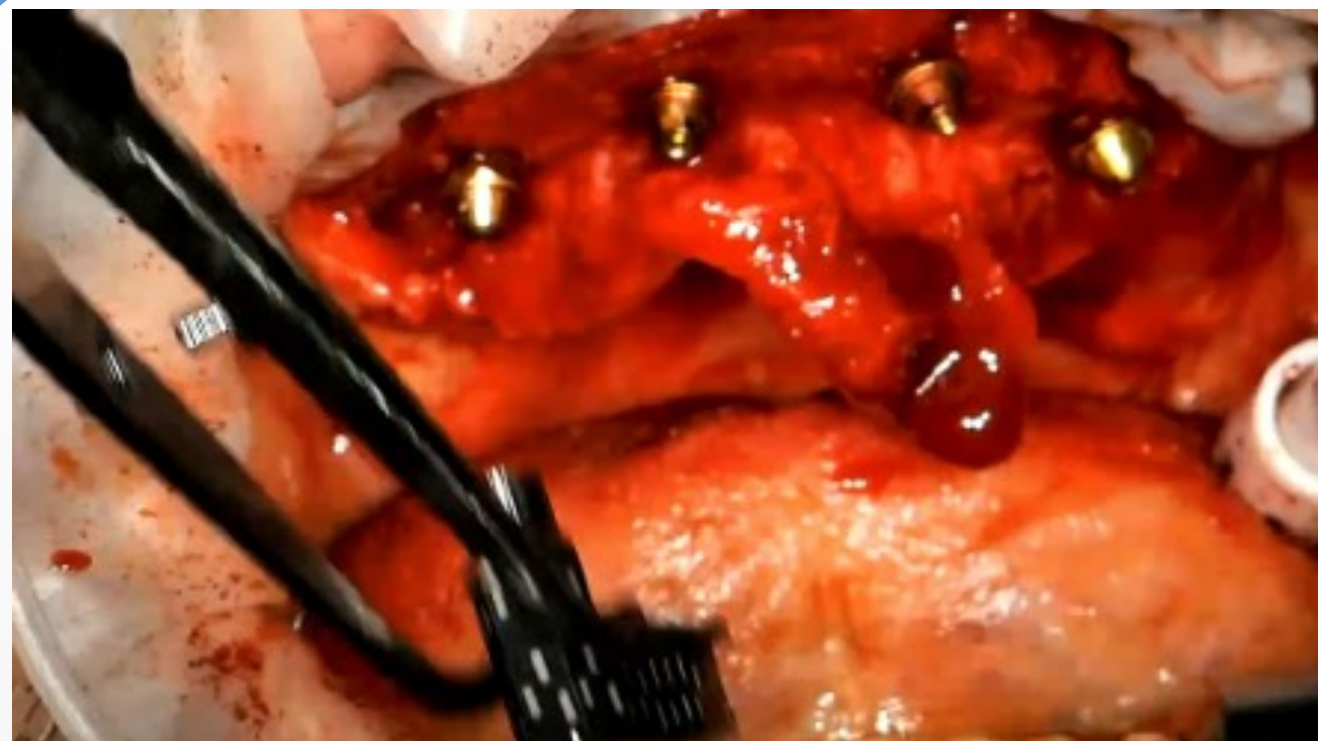


GUIDE

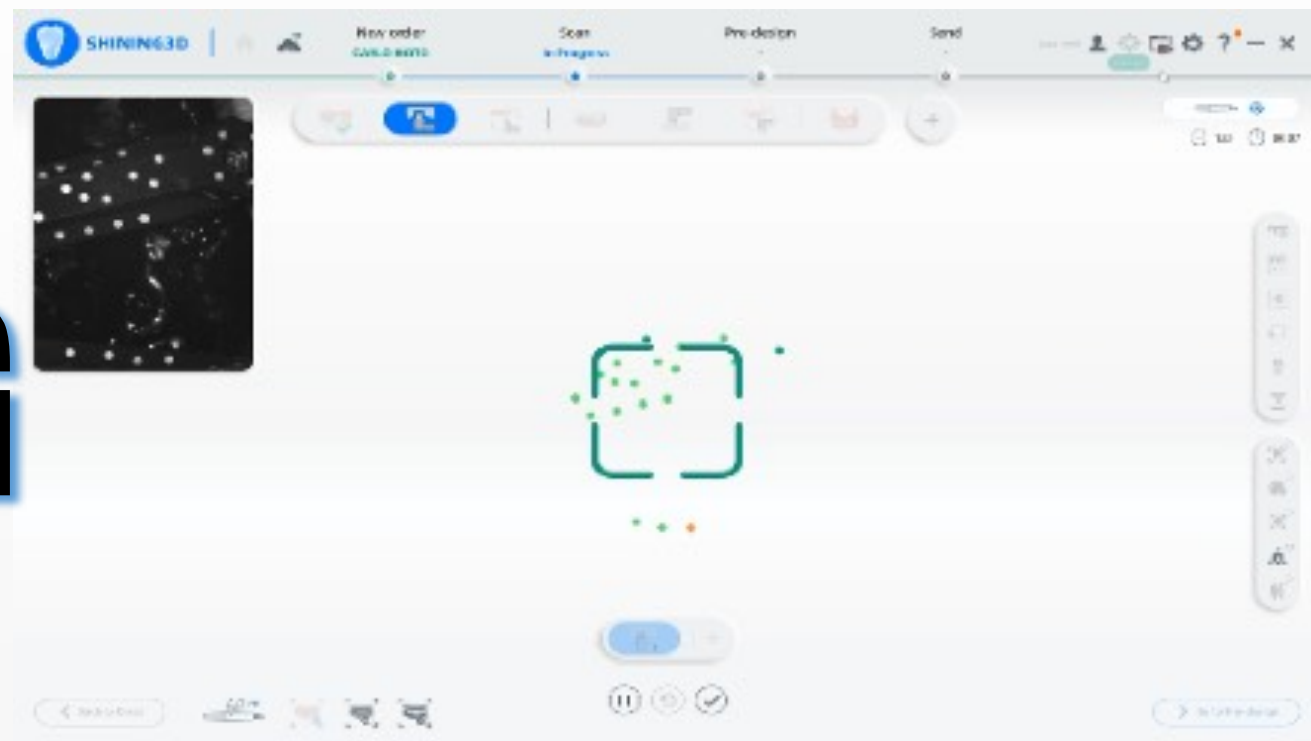


IMPLANTS

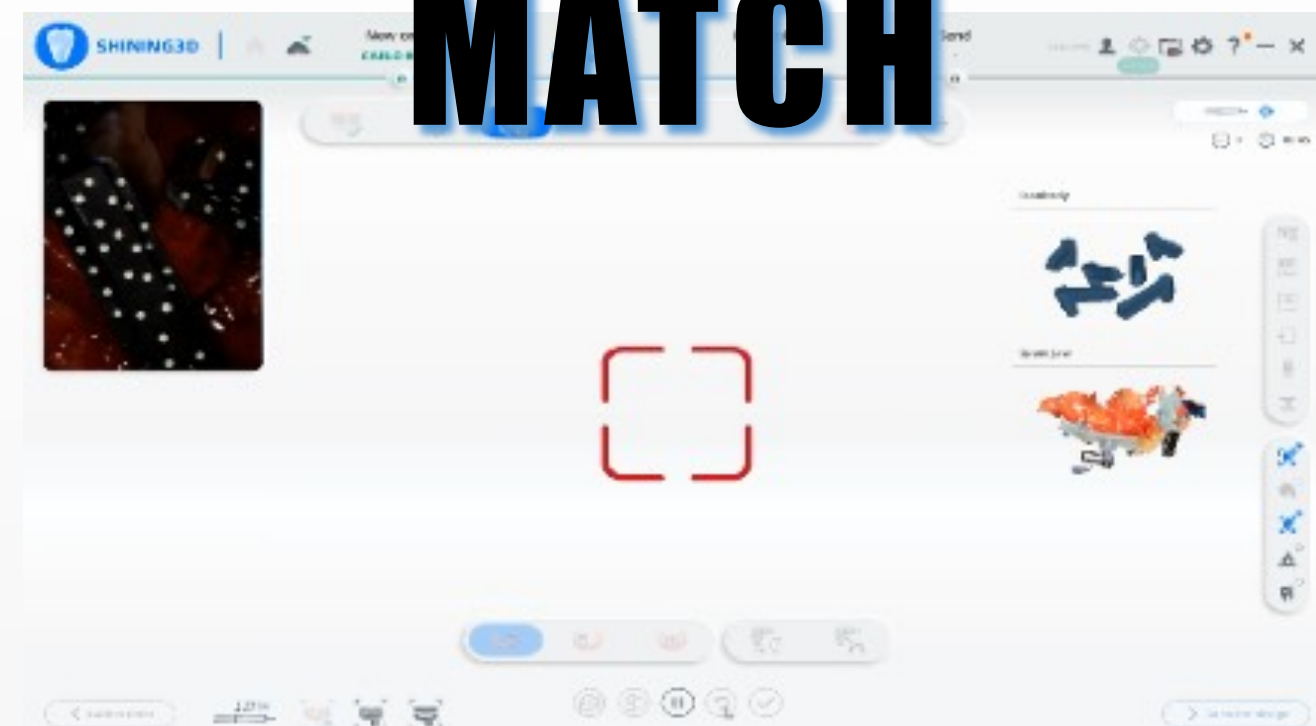
MAXILLA



IPG



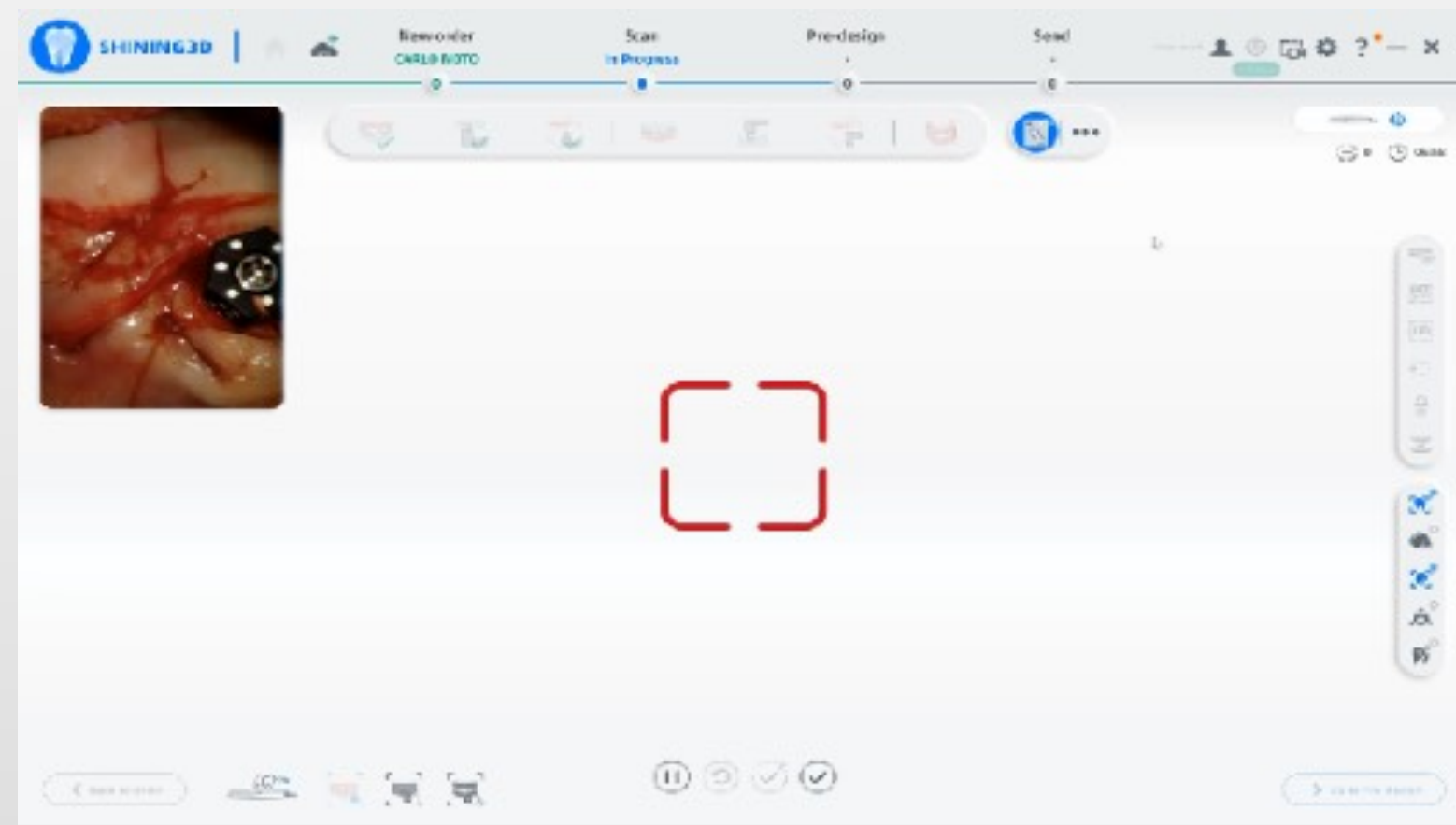
MATCH



BETA



CODED
HEALING
CAPS

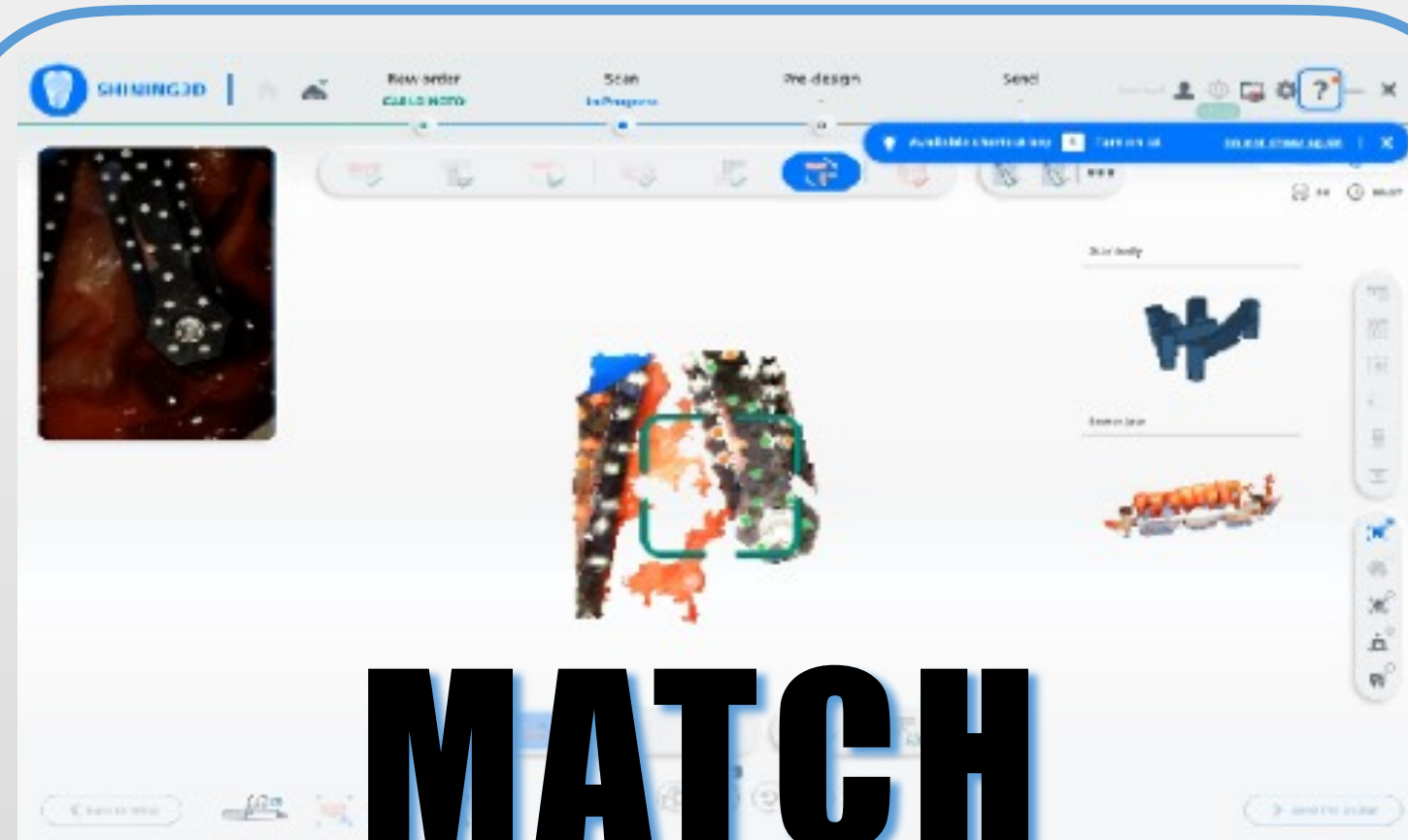
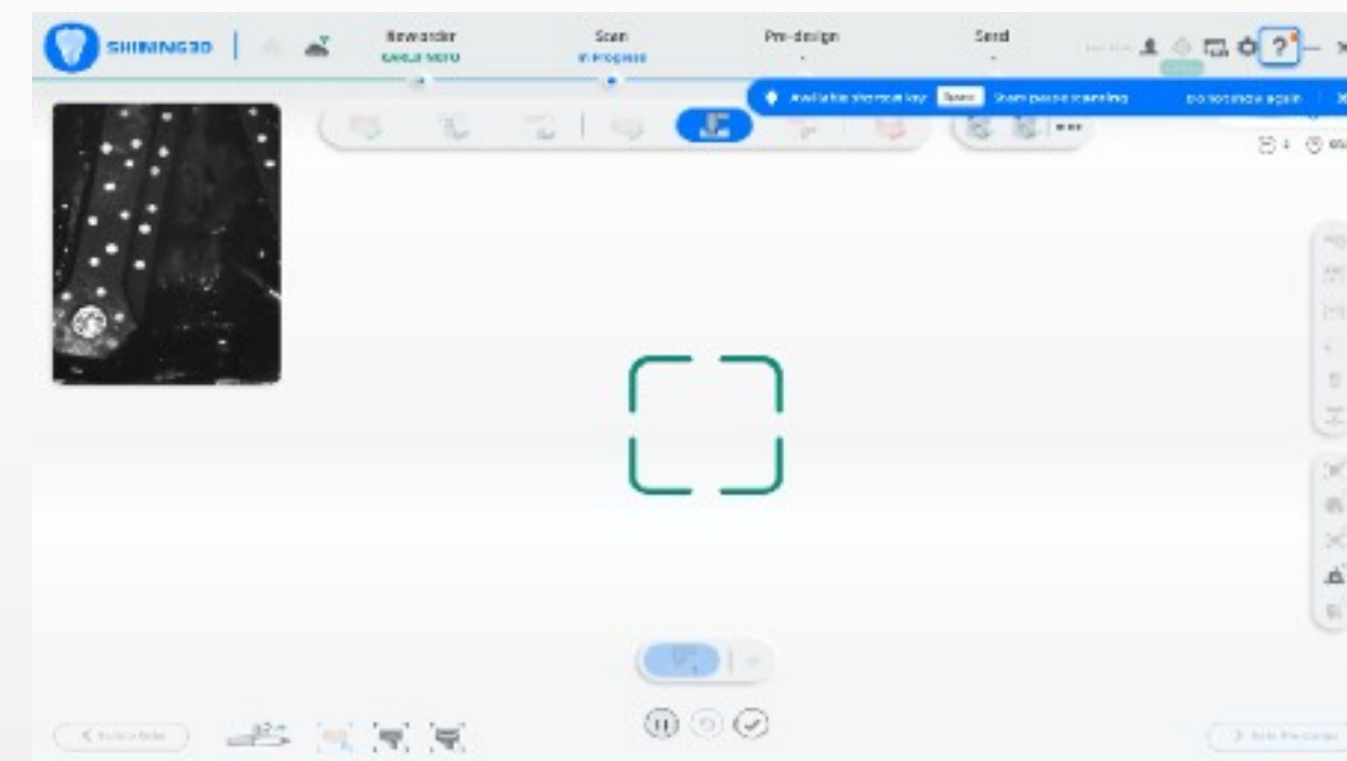


M
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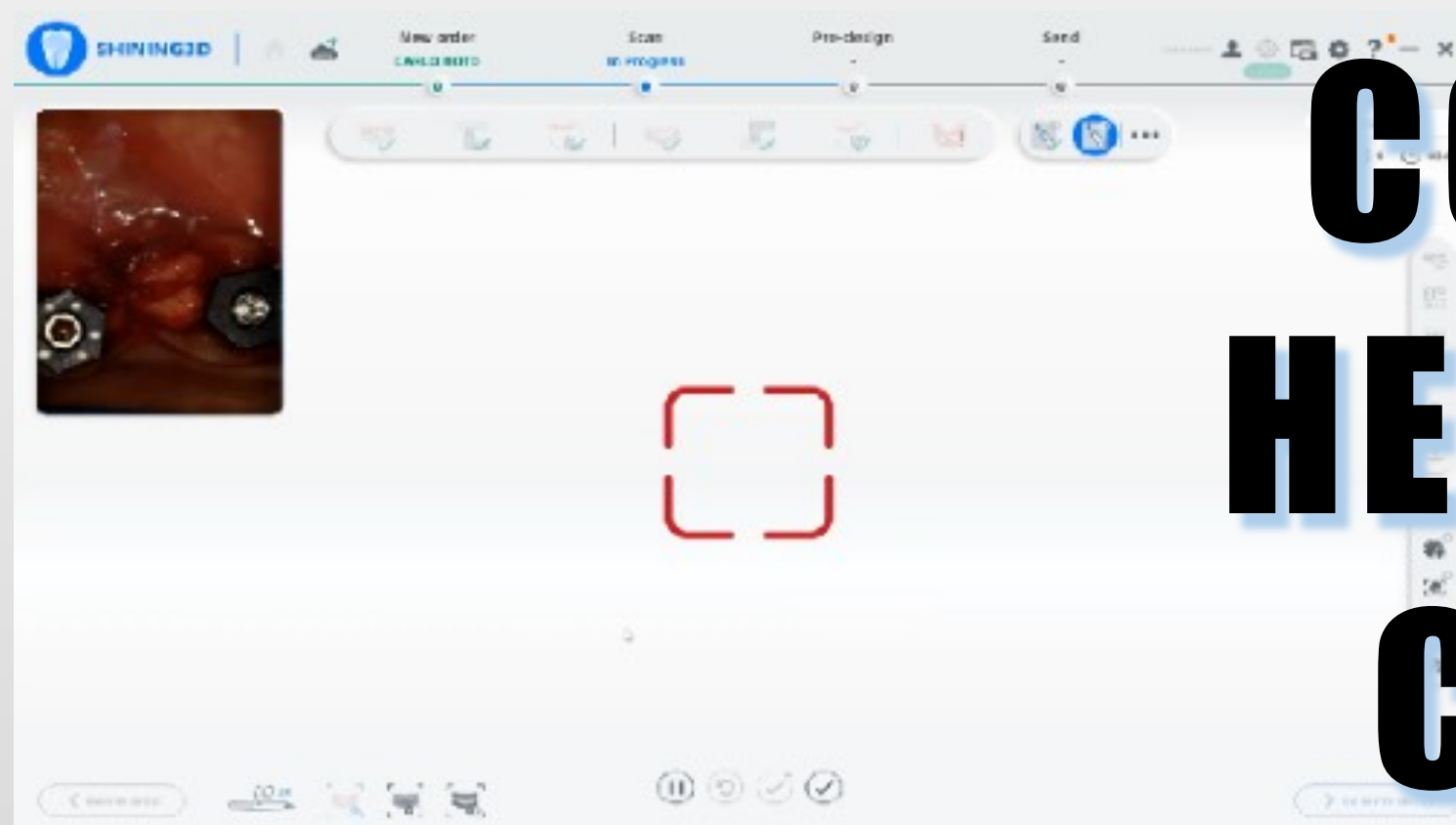
IMPLANTS



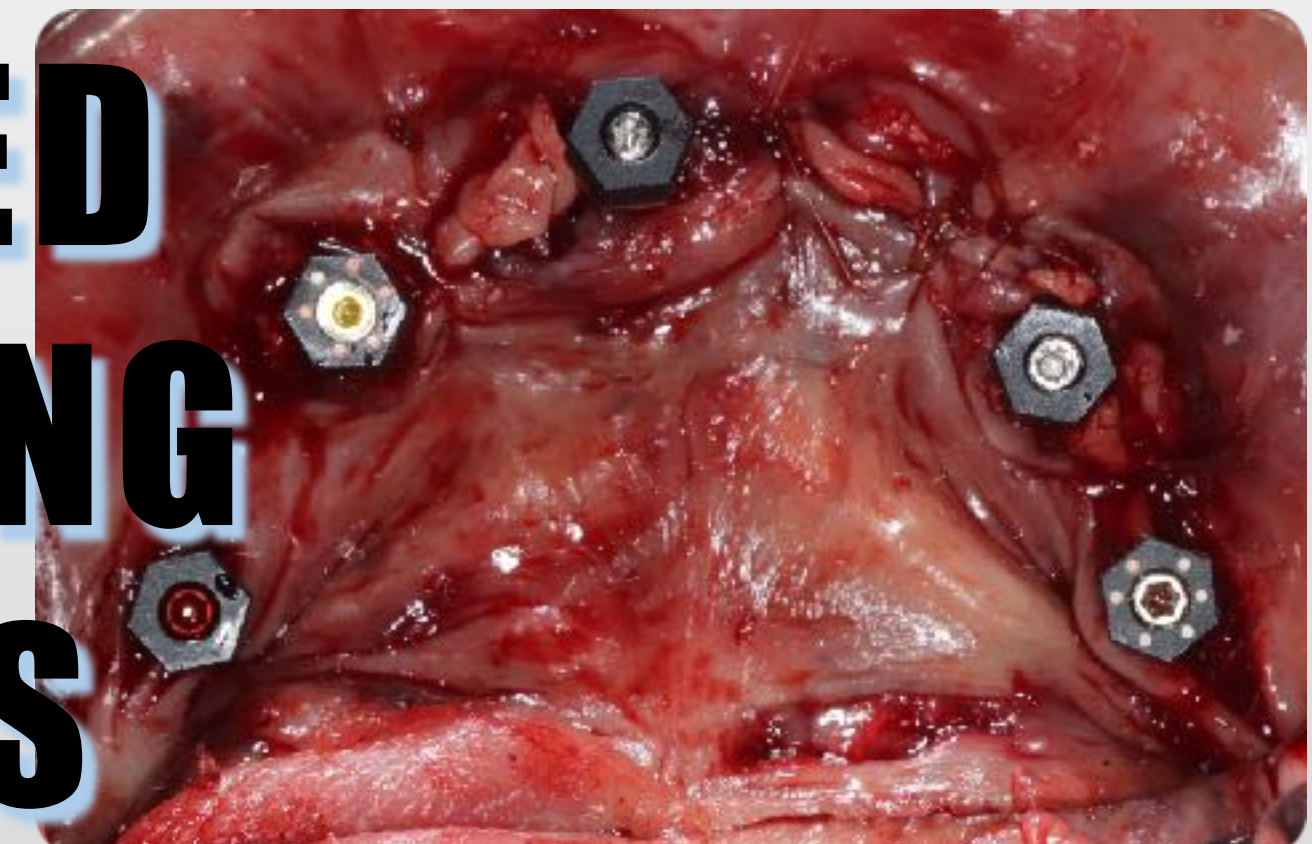
IPG



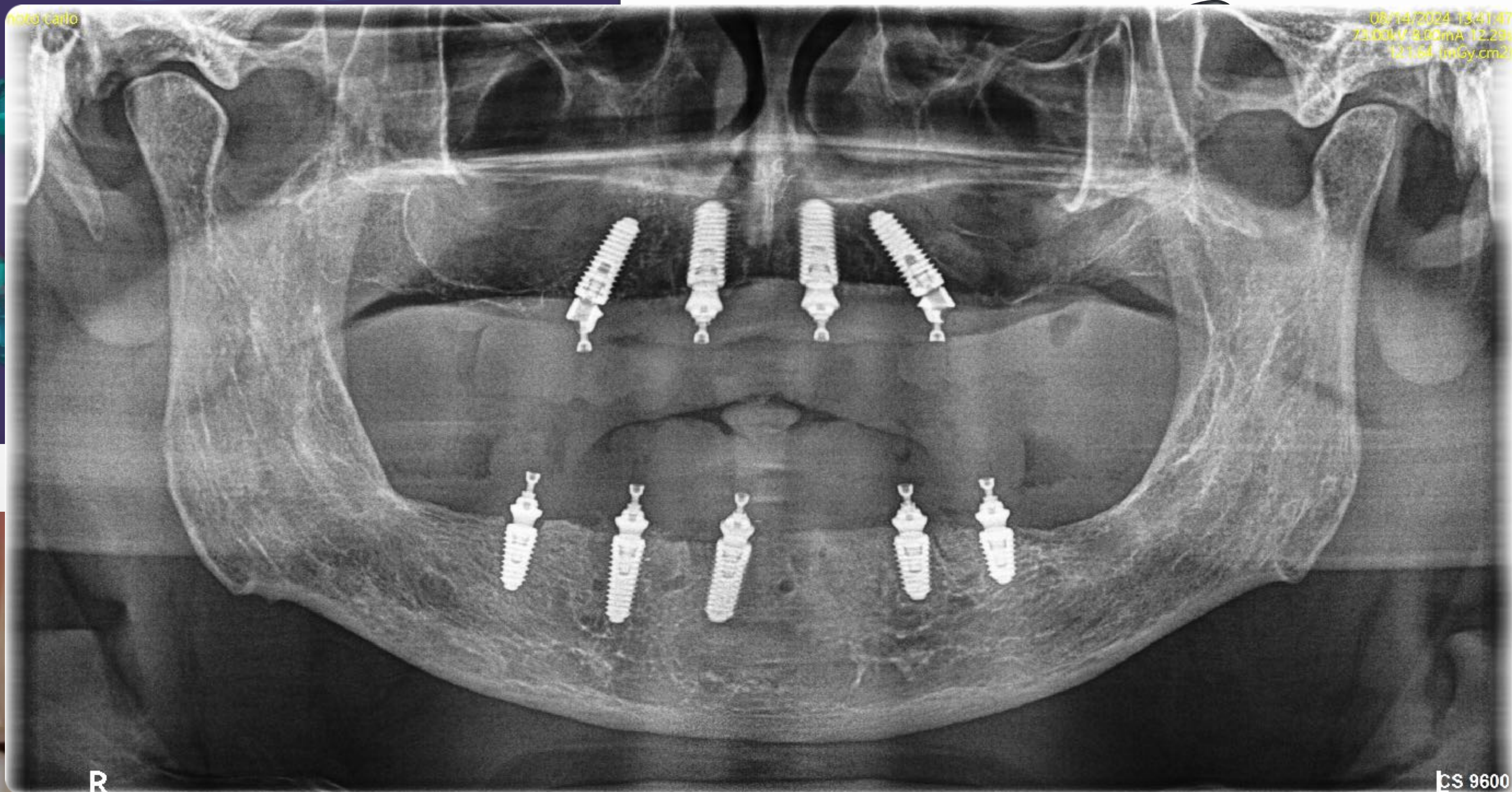
MATCH



CODED HEALING CAPS



DESIGN PRINT



MAXILLA

IPG



FINALIZE

MANDIBLE IPG

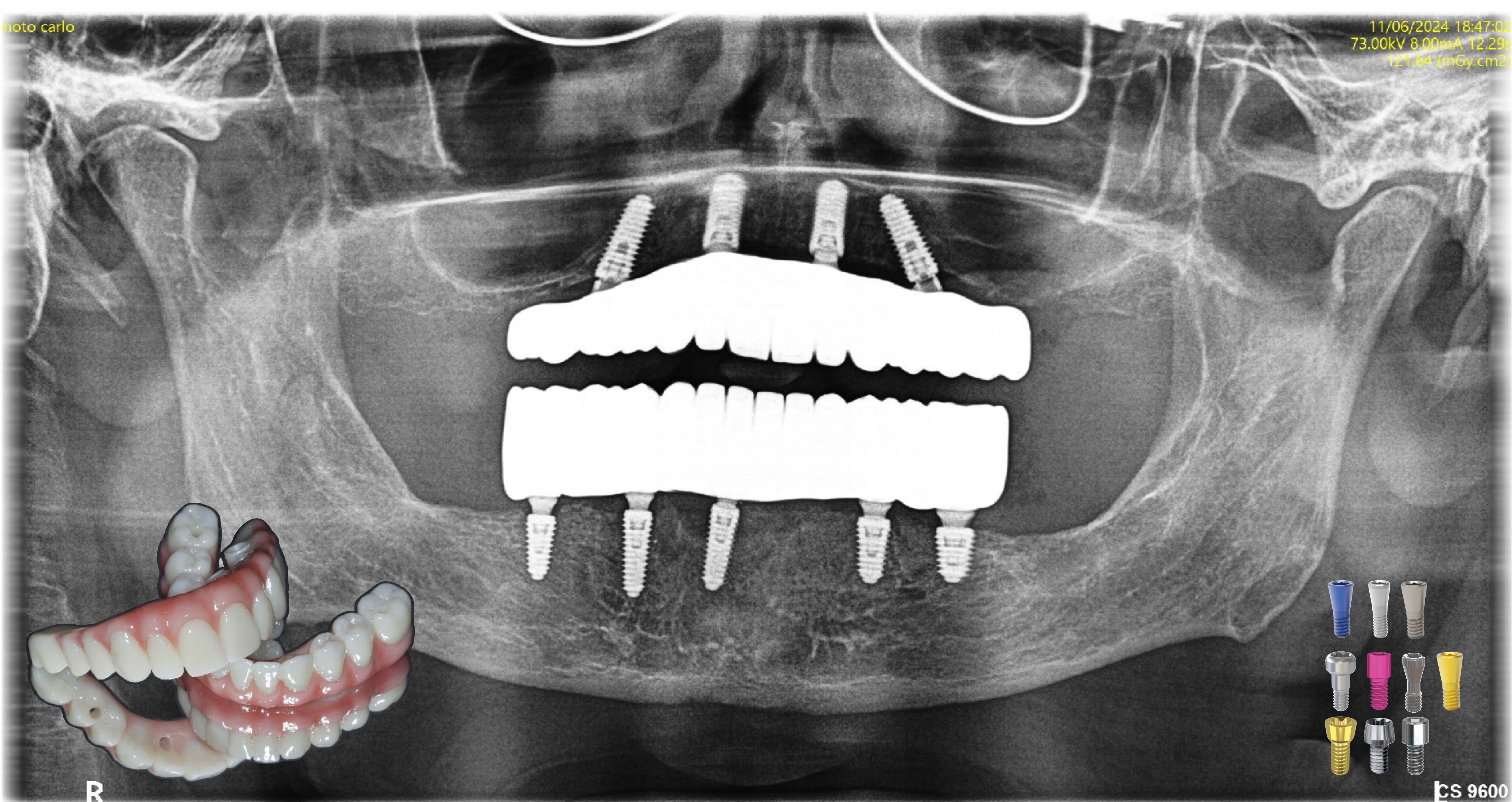


FINALIZE

Metal-Free







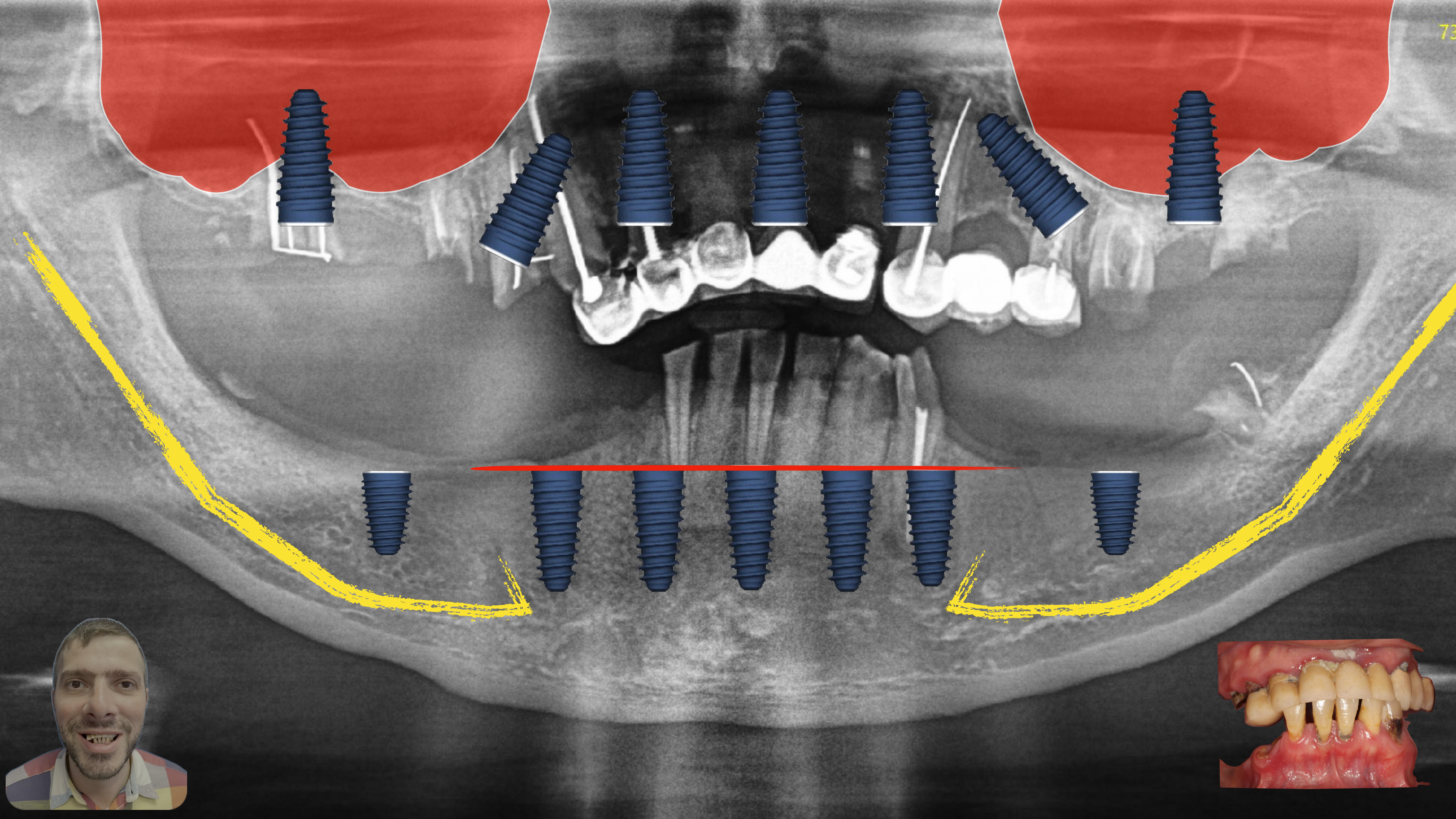
R

CS 9600

Changing lives one smile at a time

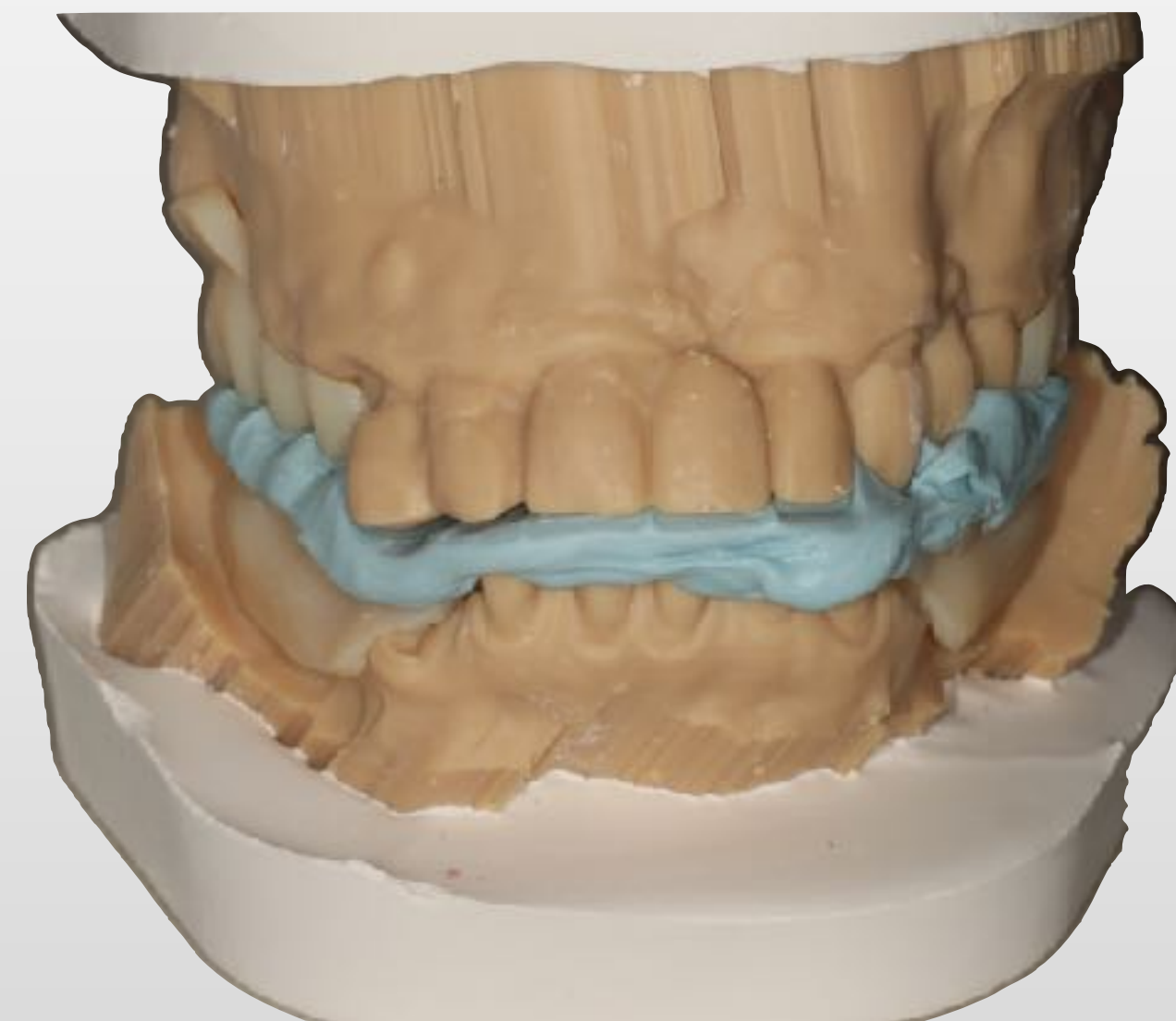
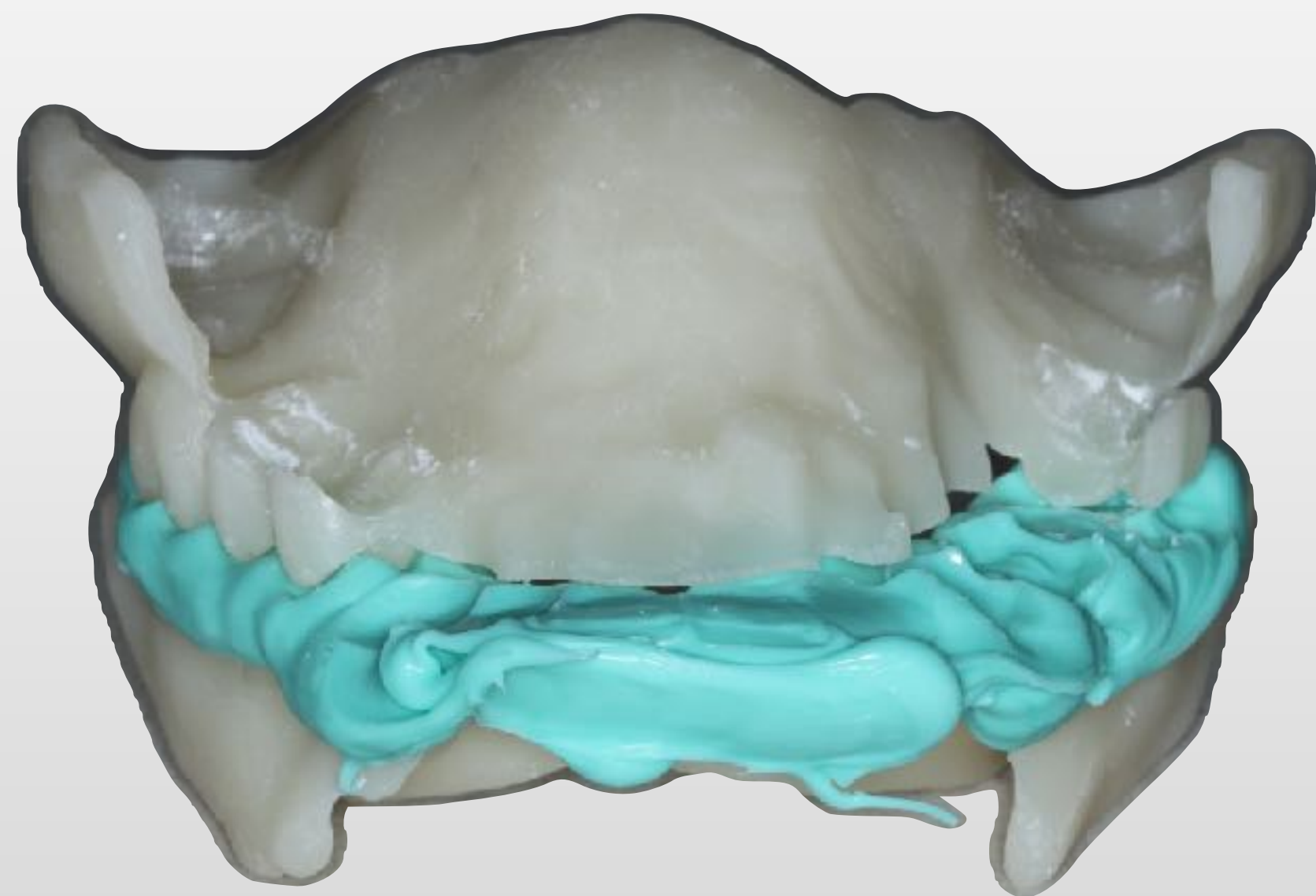




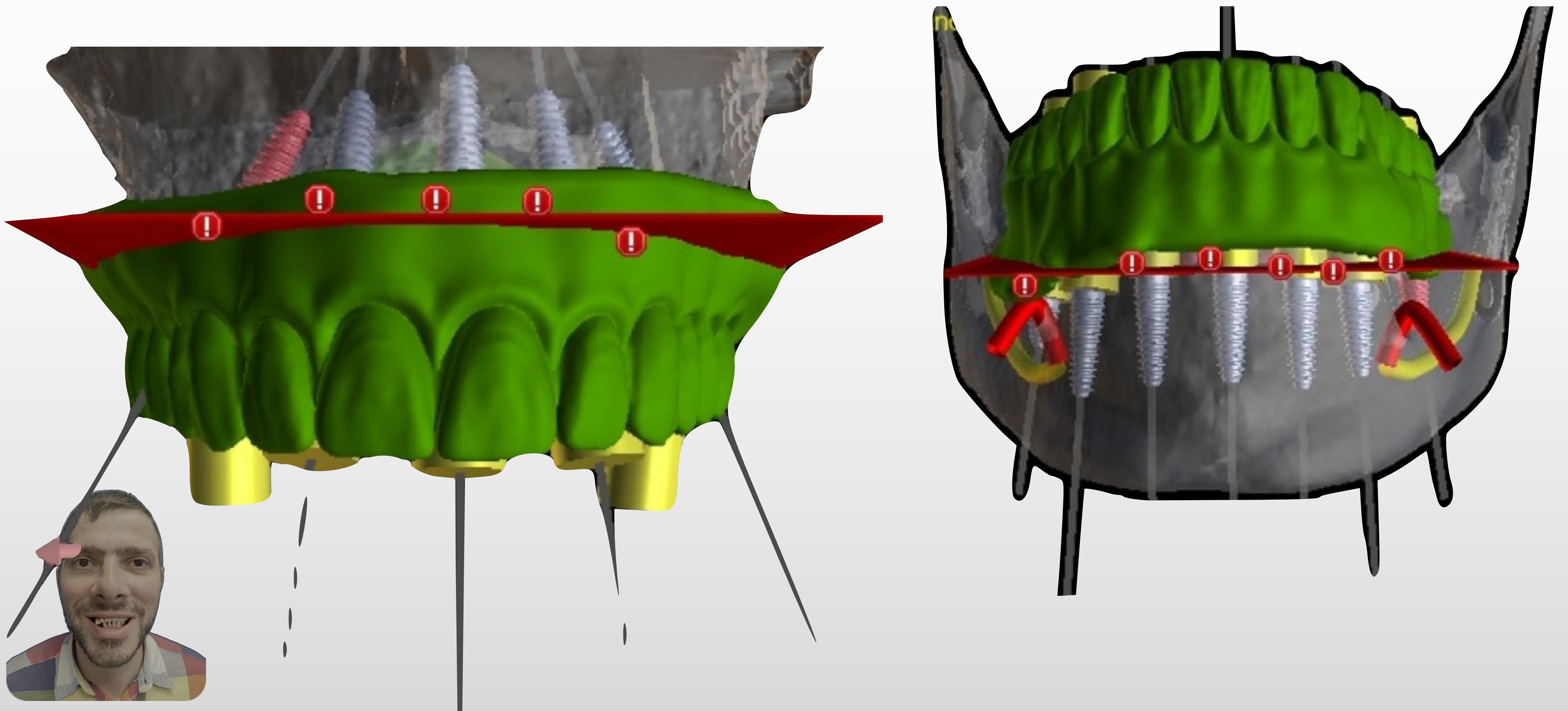




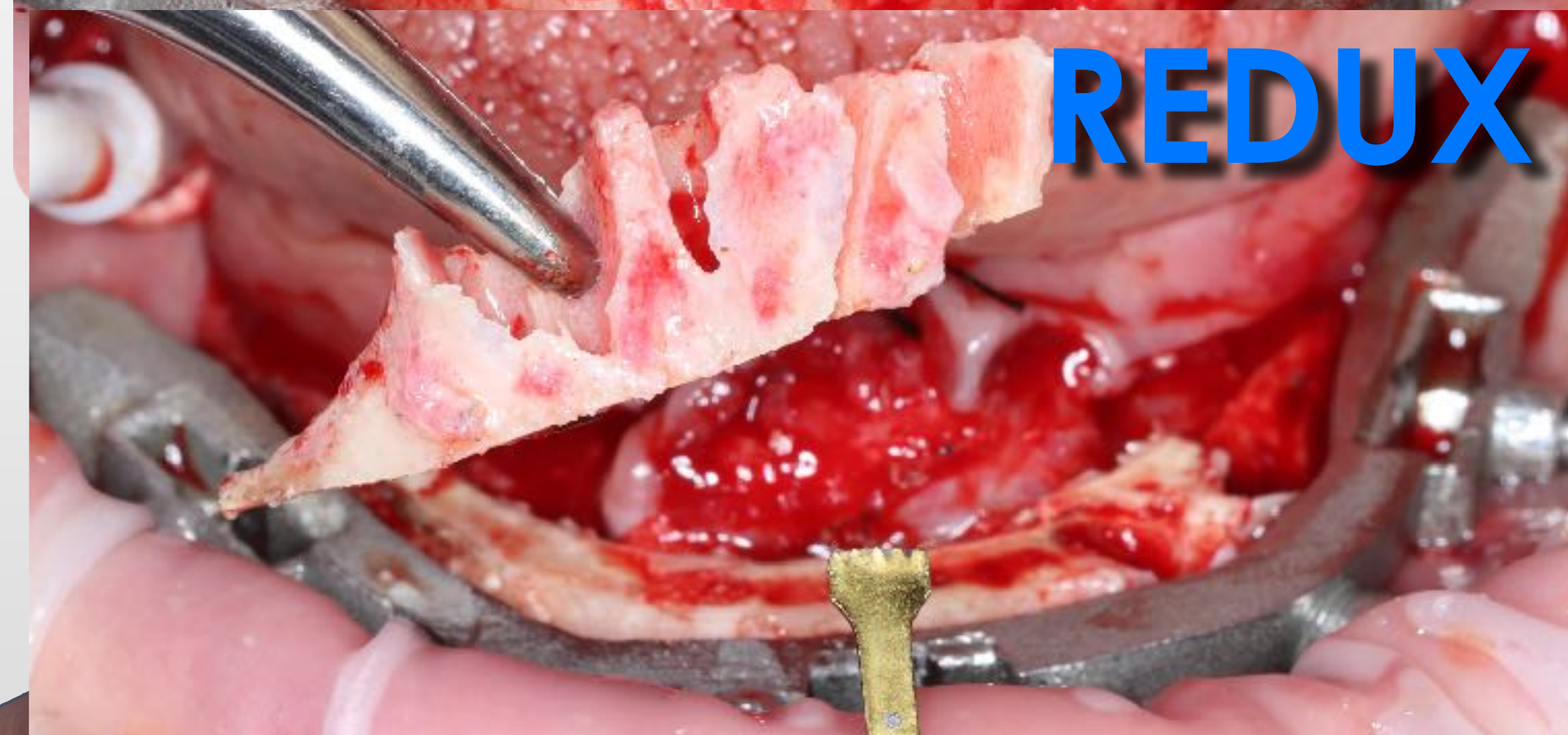
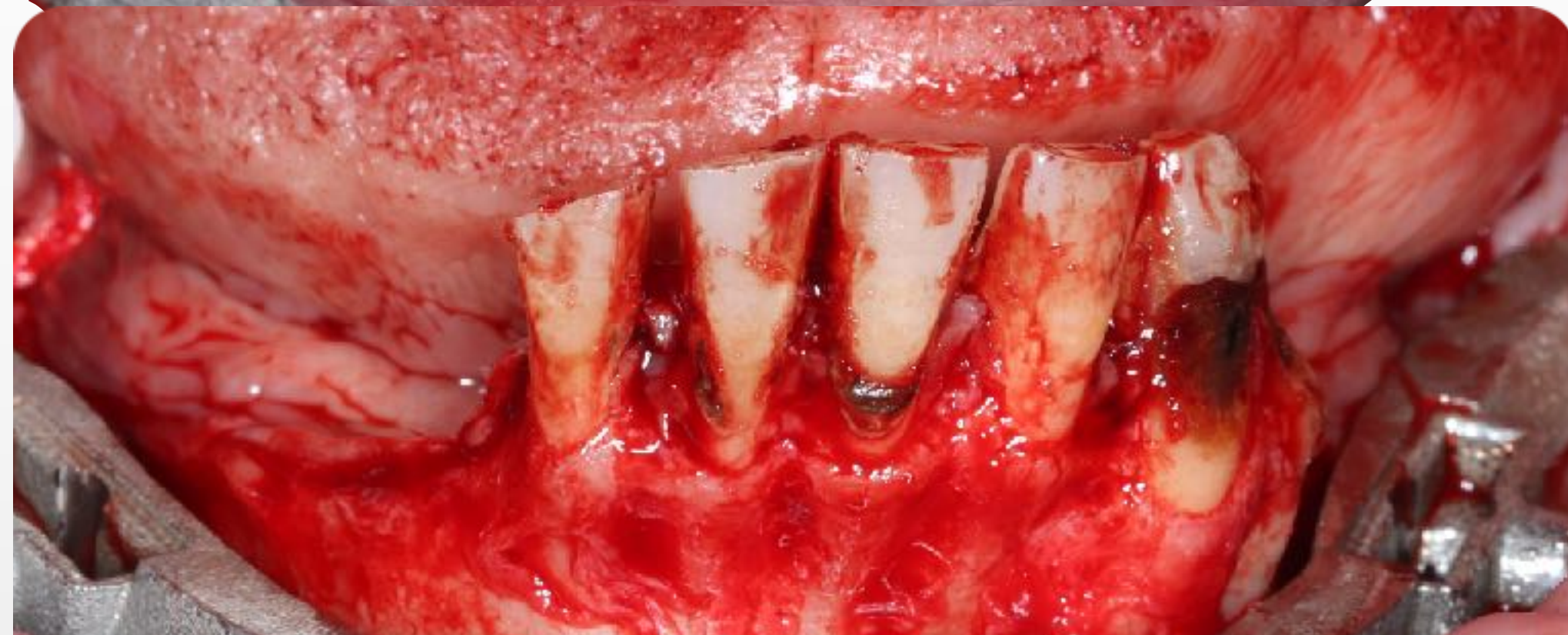
JC TRY IN



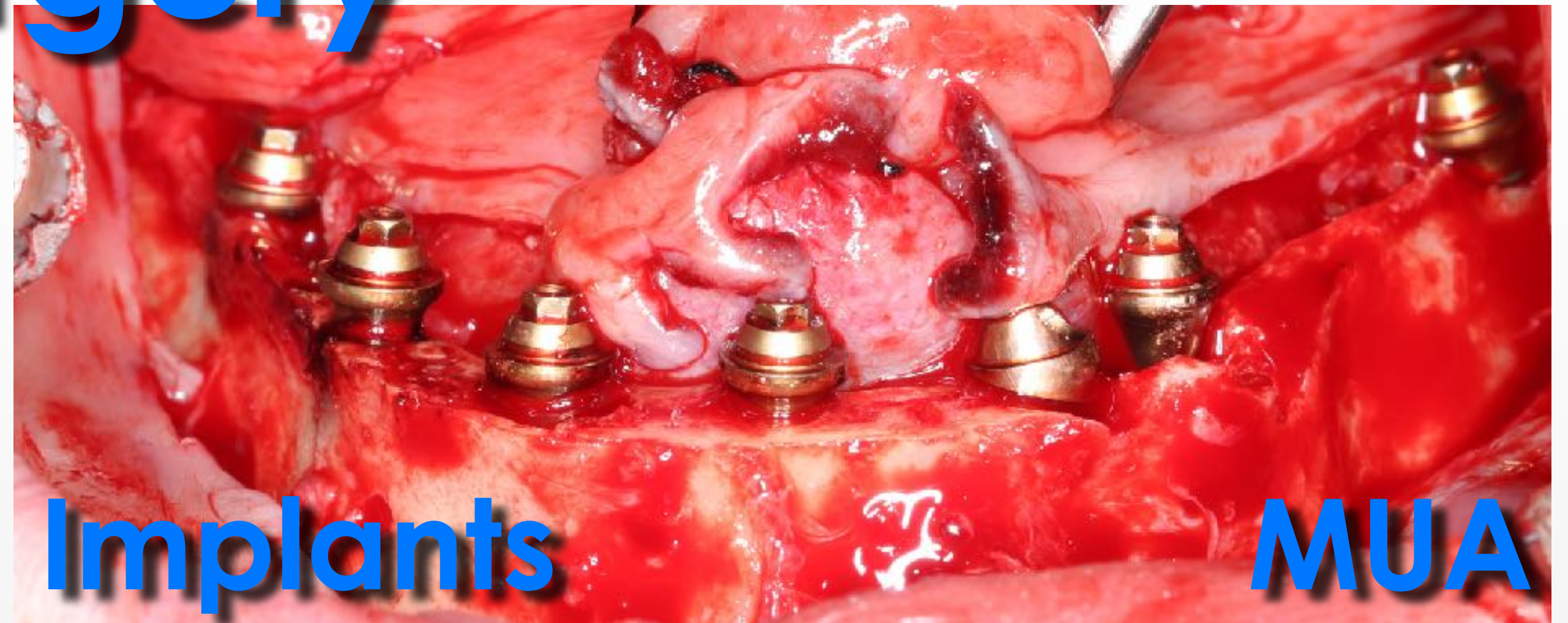
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Pin Guide Surgery



REDUX



Implants

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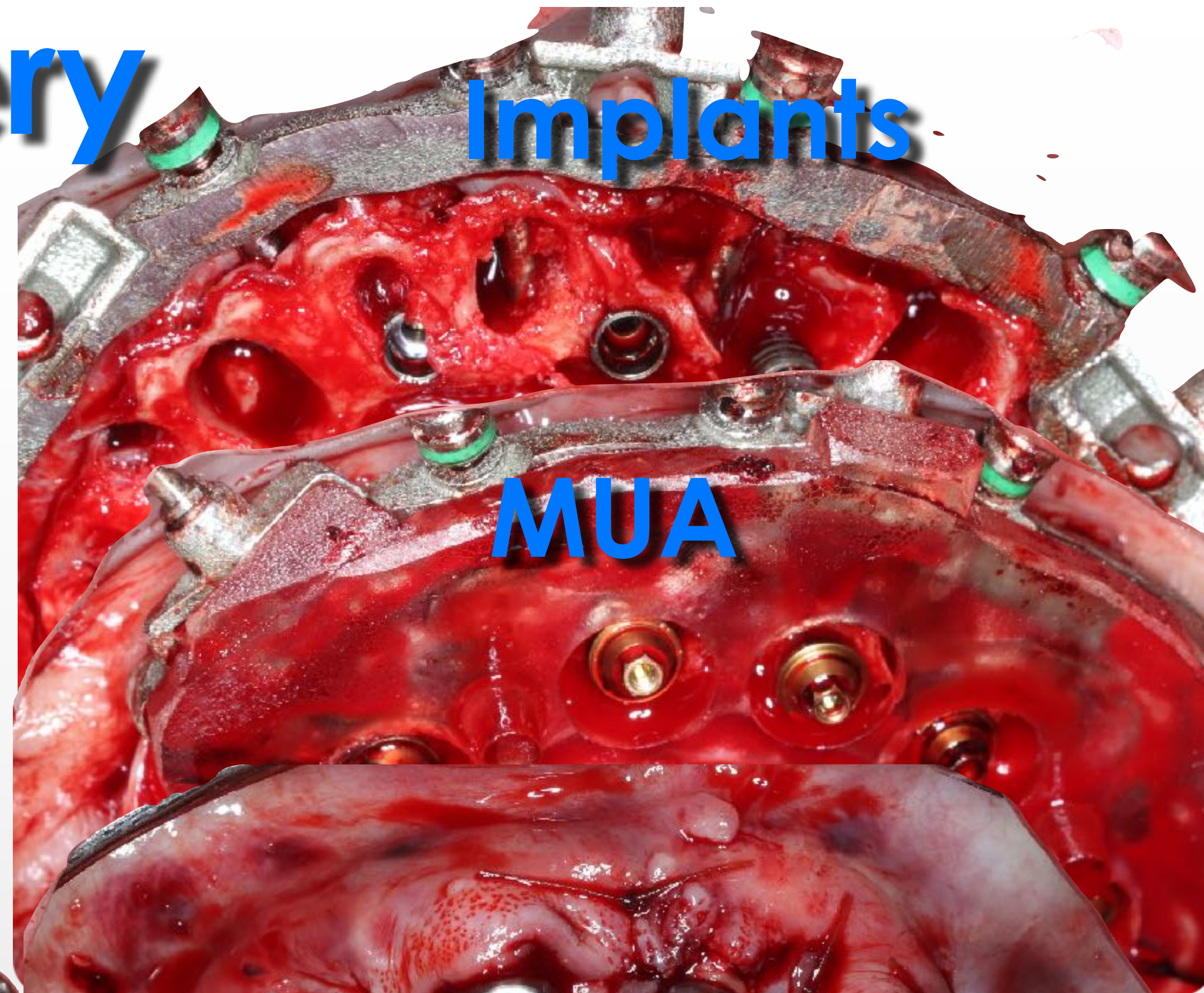


Healing Abutments

Surgery

Pin Guide

Implants



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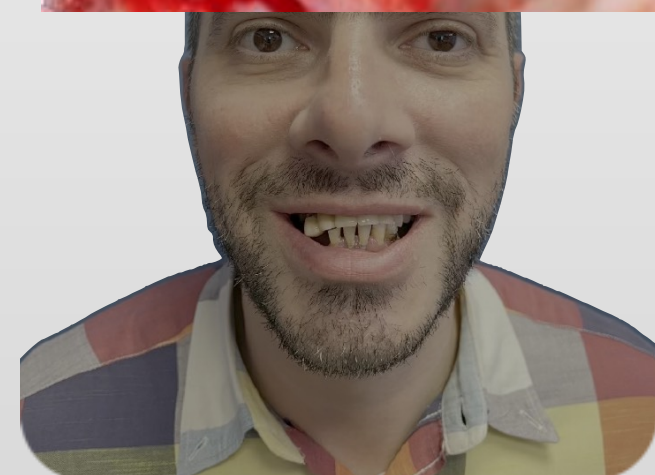
Redux



Osteotomy
Guide



Healing
Abutments



Dentin Graft





RESTORATIVE
Dr. Nathaniel Lawson
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Dr. Michael Sonick
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ENDODONTICS
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ENDODONTICS
Dr. John D. West
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26th FALL SHOW Page PRO Elec Page

IMPLANTS

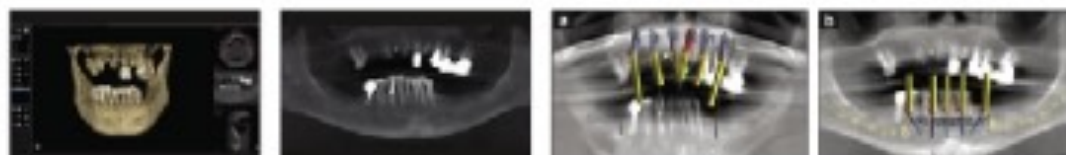


Figure 1. CBCT imaging of maxilla and mandible showing implant sites.

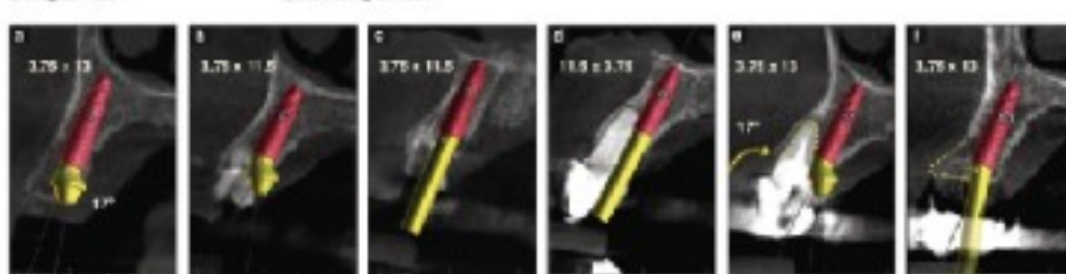


Figure 2. Panoramic radiograph showing implant sites.

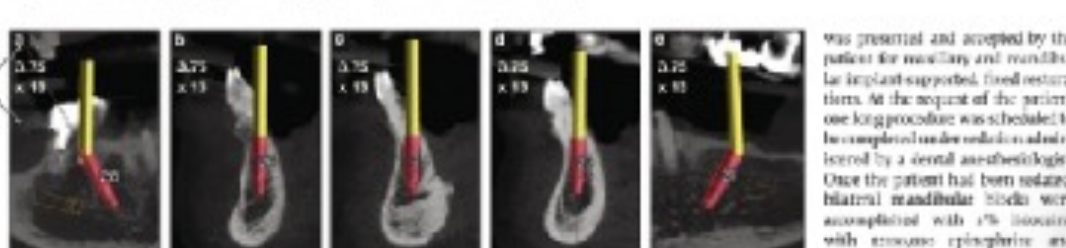


Figure 3. CBCT imaging of maxilla and mandible showing implant sites.



Figure 4. Cross-sectional planning for maxillary implants and angulated abutments (MAAs).



Figure 5. Simplest design for the mandibular arch with straight and angled MAAs.

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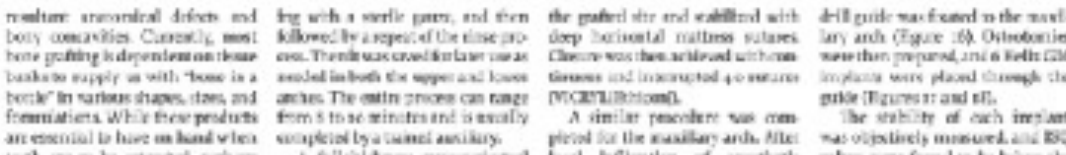


Figure 6. CBCT imaging of maxilla and mandible showing implant sites.



Figure 7. Cross-sectional planning for maxillary implants and angulated abutments (MAAs).



Figure 8. Simplest design for the mandibular arch with straight and angled MAAs.



Figure 9. CBCT imaging of maxilla and mandible showing implant sites.



Figure 10. Cross-sectional planning for maxillary implants and angulated abutments (MAAs).

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IMPLANTS

Autologous Tooth Structure as an Adjunct Grafting Modality

INTRODUCTION



Dr. Scott Ganz, DMD



Dr. Isaac Tawil, DMD



Dr. Michael Sonick, DMD

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Figure 1. CBCT imaging of maxilla and mandible showing implant sites.



Figure 2. Panoramic radiograph showing implant sites.



Figure 3. CBCT imaging of maxilla and mandible showing implant sites.

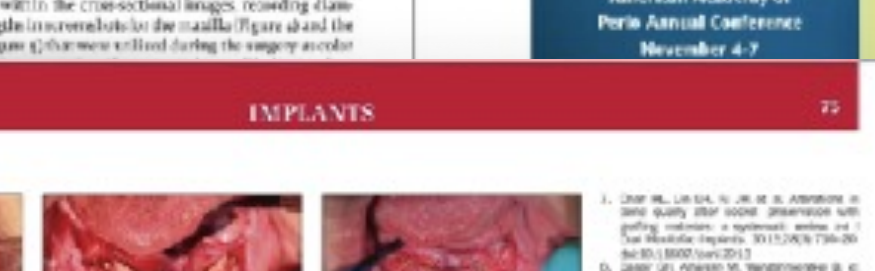


Figure 4. Cross-sectional planning for maxillary implants and angulated abutments (MAAs).



Figure 5. Simplest design for the mandibular arch with straight and angled MAAs.

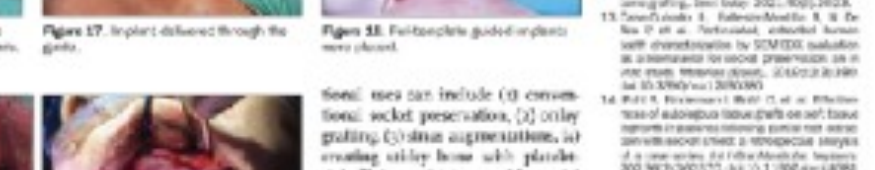


Figure 6. CBCT imaging of maxilla and mandible showing implant sites.

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The Optimal Solution for Full Arch Grafting



Smart Dentin Grinder[®] GENESIS

The Smart Dentin Grinder converts extracted teeth into the highest quality and most effective and predictable AUTOLOGOUS graft.

RECYCLE the extracted tooth into bioactive, osteoinductive dentin graft within 10 minutes.

What to expect:

- High predictability every time
- Excellent new bone regeneration
- Slow resorption / bioactive scaffold
- Contains GFs and BMPs
- Minimal inflammation
- Excellent for diabetic / medicated / slow healing patients.

Go the extra mile for your patients' best outcome.



For more information: www.kometabio.com

info@kometabio.com (866) 772-2871

Visit us at Booth #235 American Academy of Periodontology November 4-7

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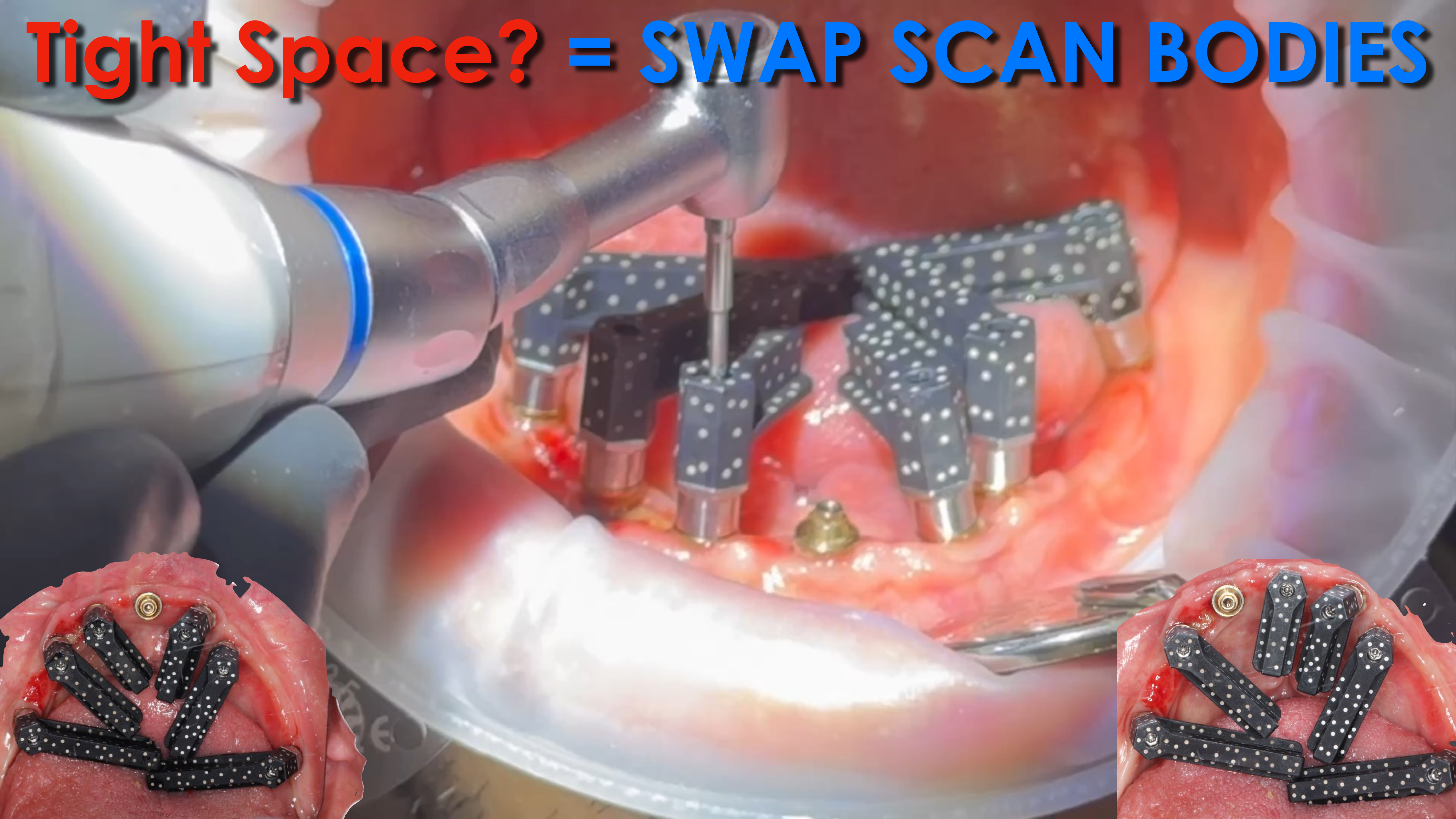
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MANDIBLE



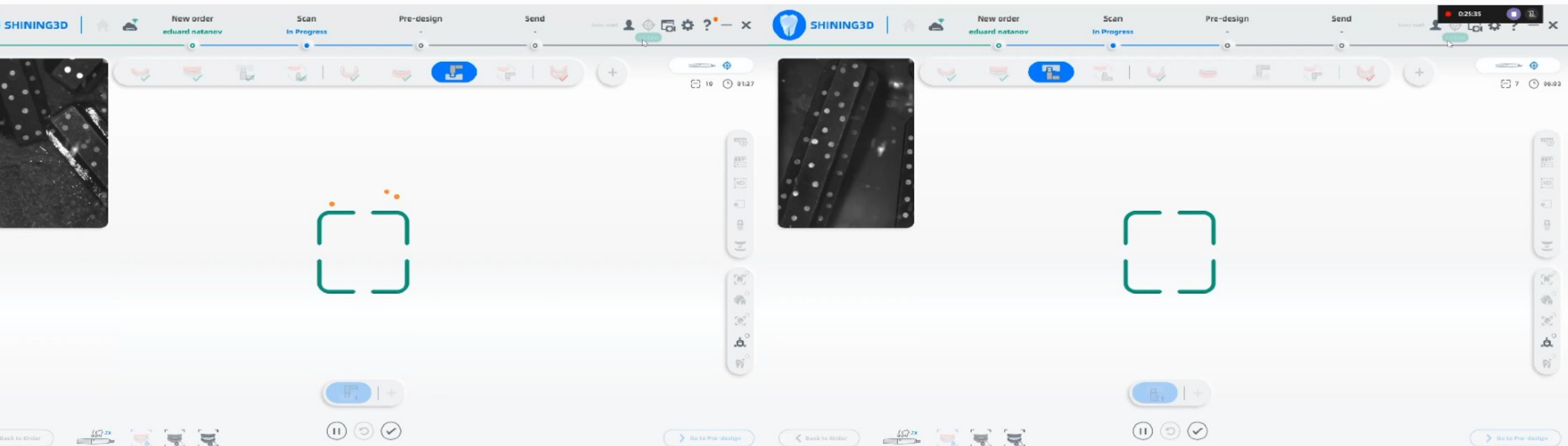


Tight Space? = SWAP SCAN BODIES

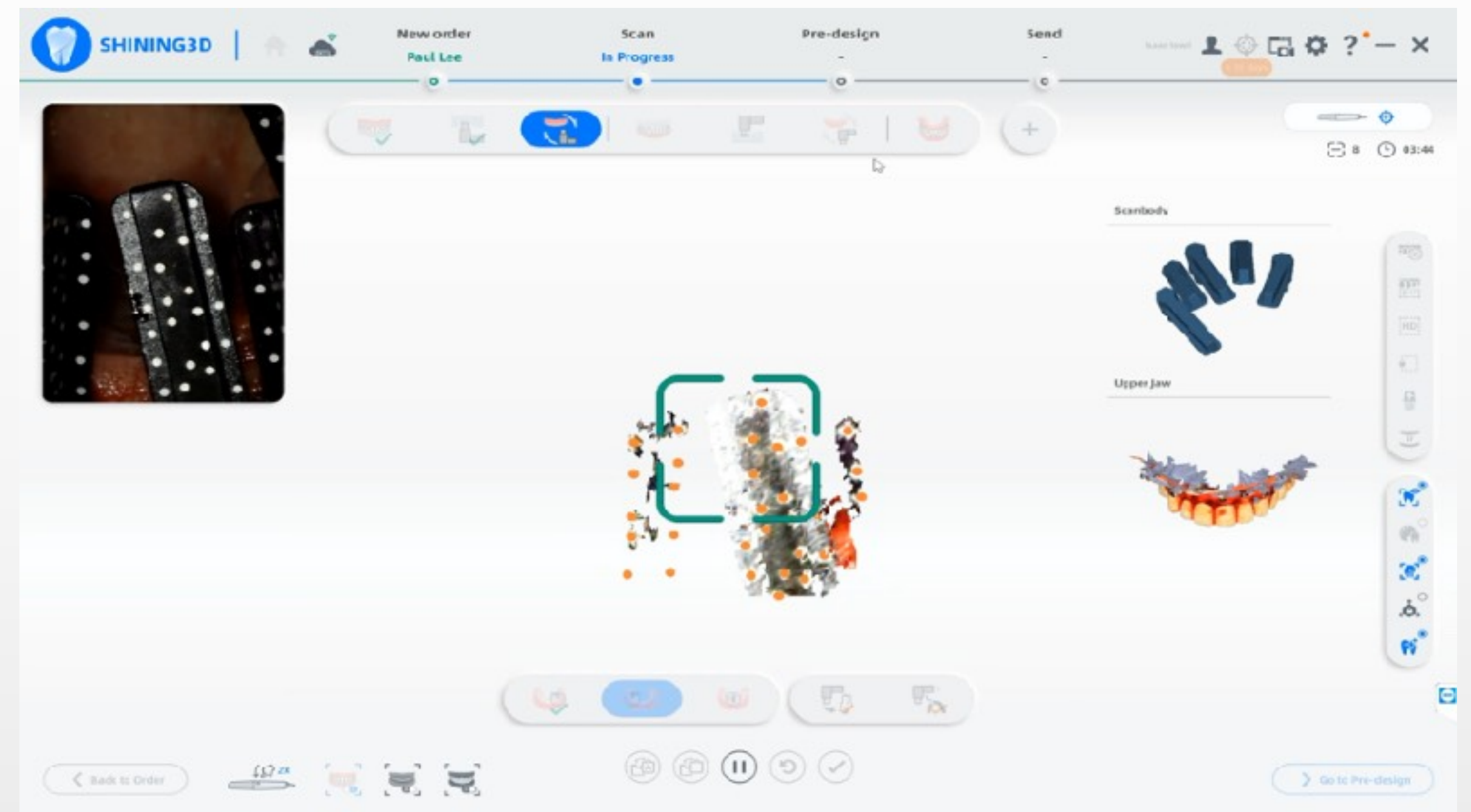
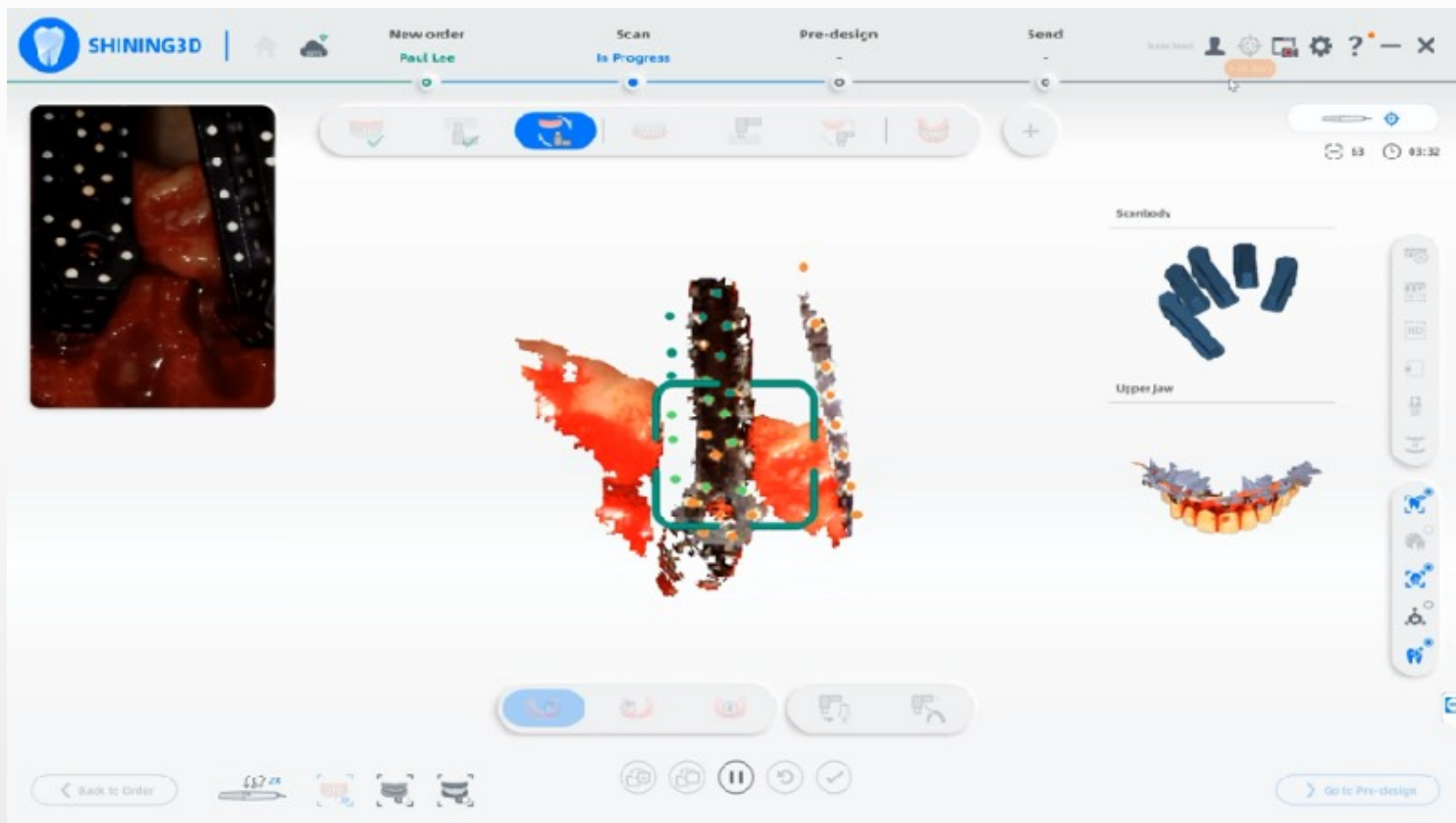
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MATCHING



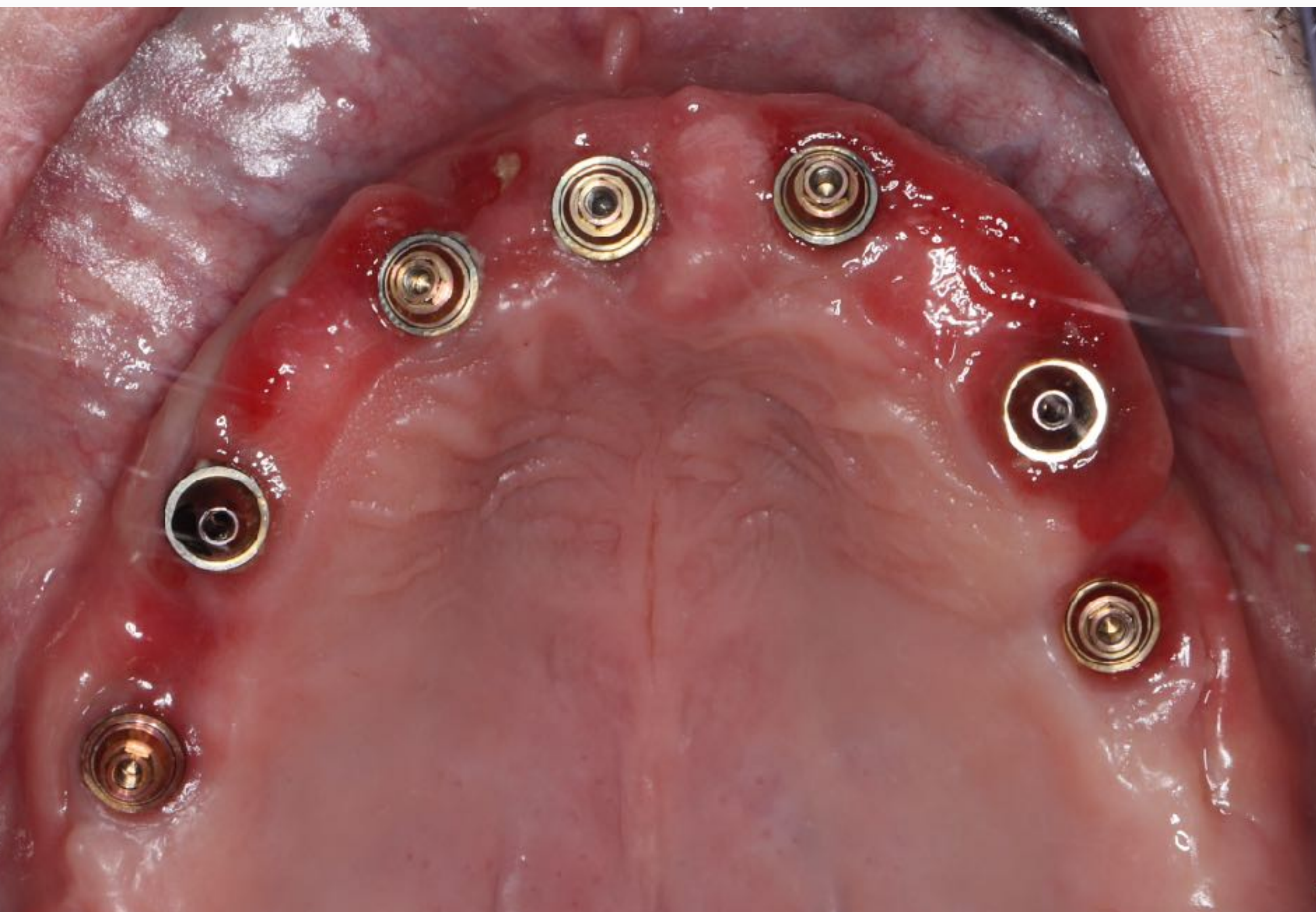
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MAXILLA

**12 week
Post OP**

Mandible





Finalize with IOS/FS



- ☐
- ☐
- ☐
- ☒
- ☐
- ☐
- ☐
- ☐

Suitable



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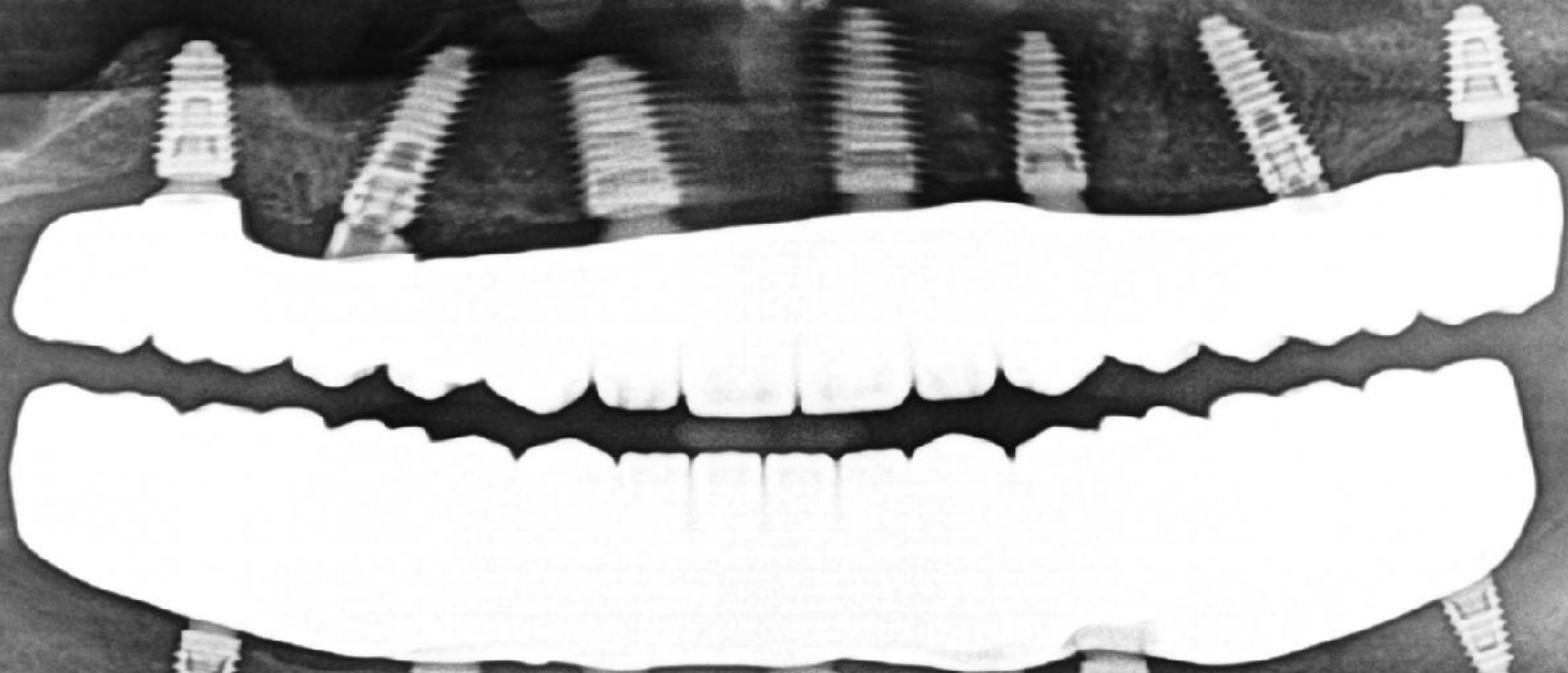


Finals





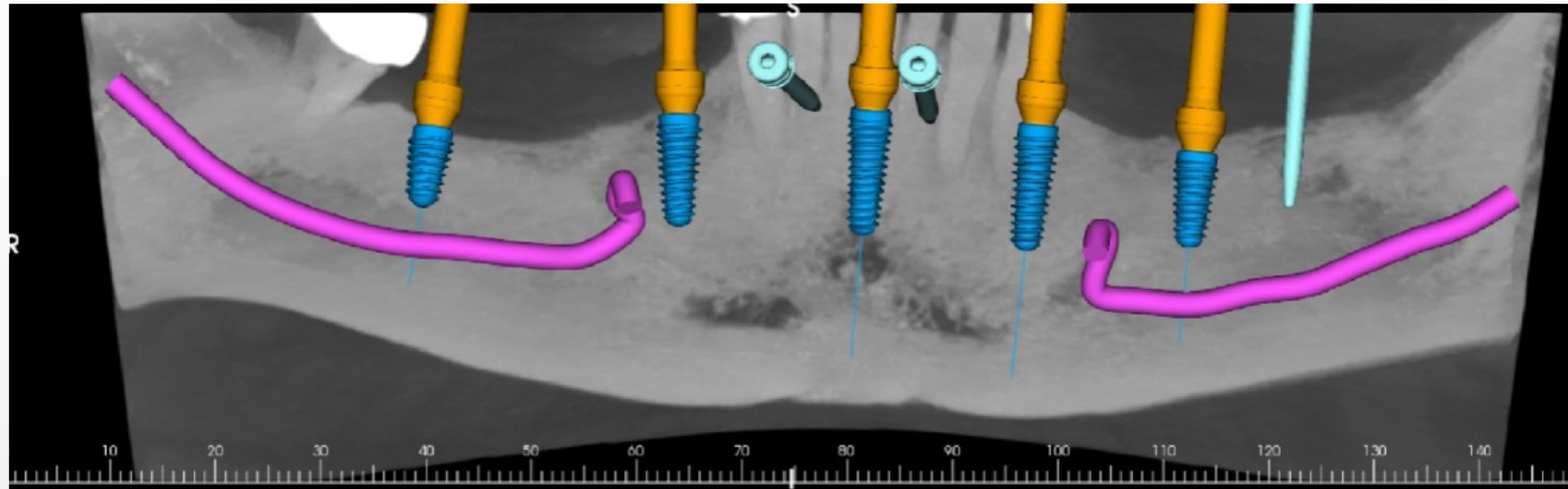
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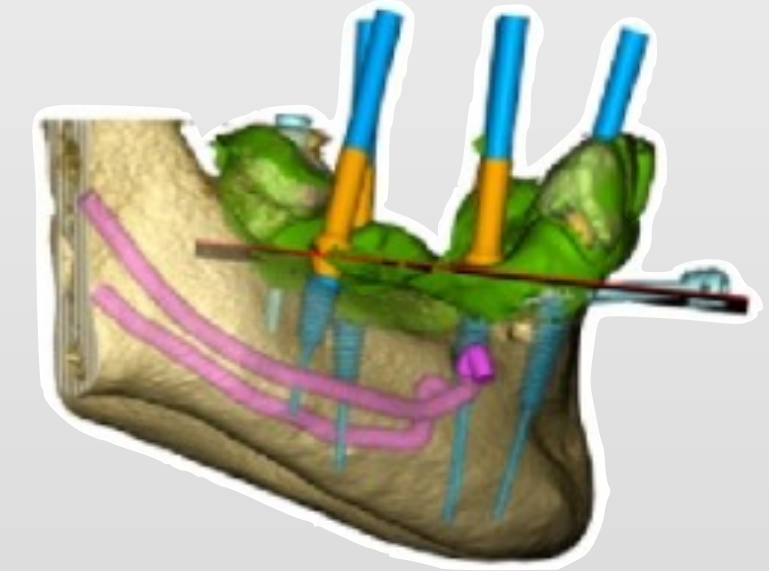
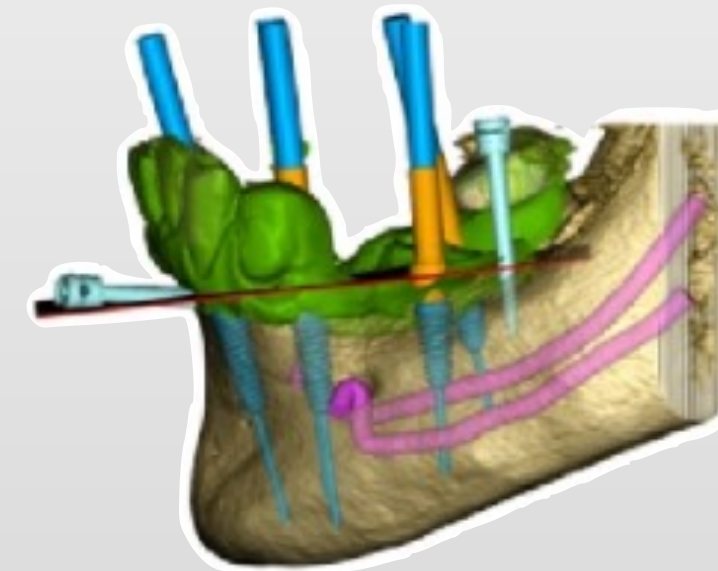
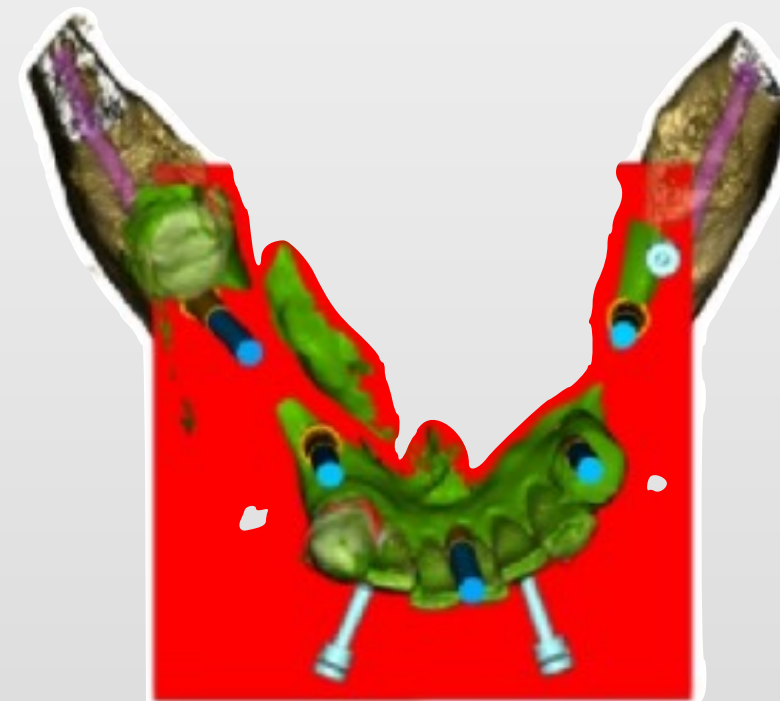
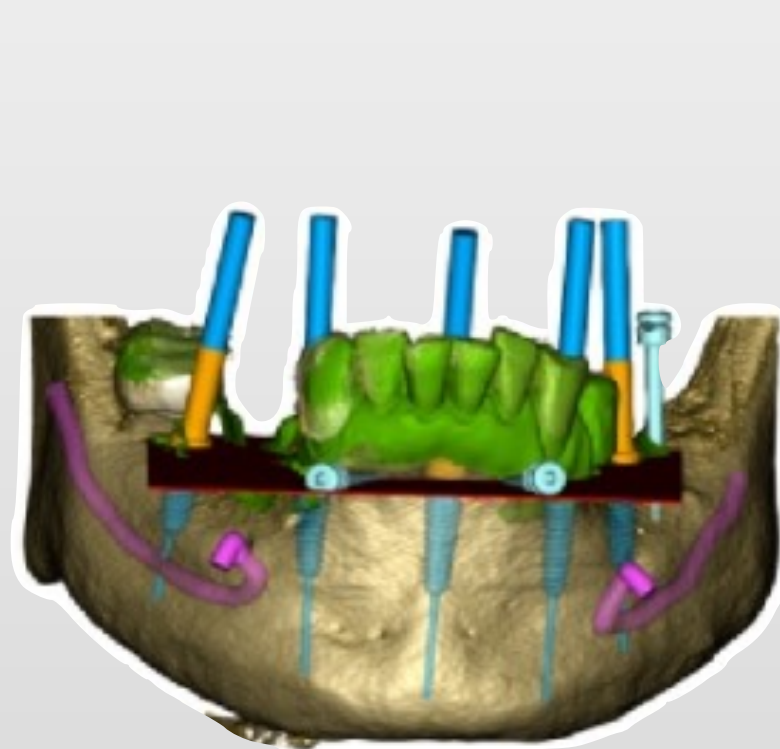
Changing lives one smile at a time



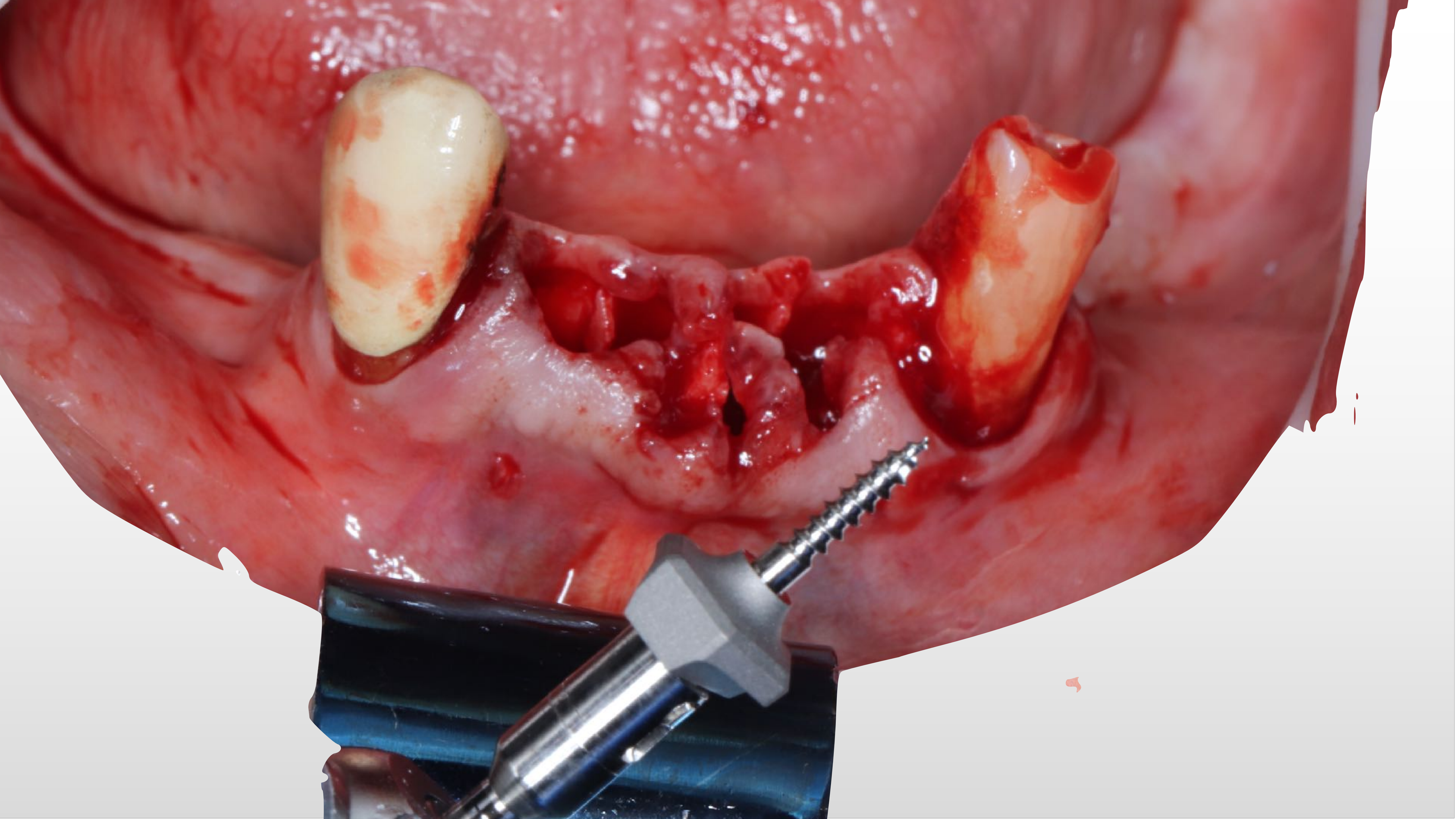
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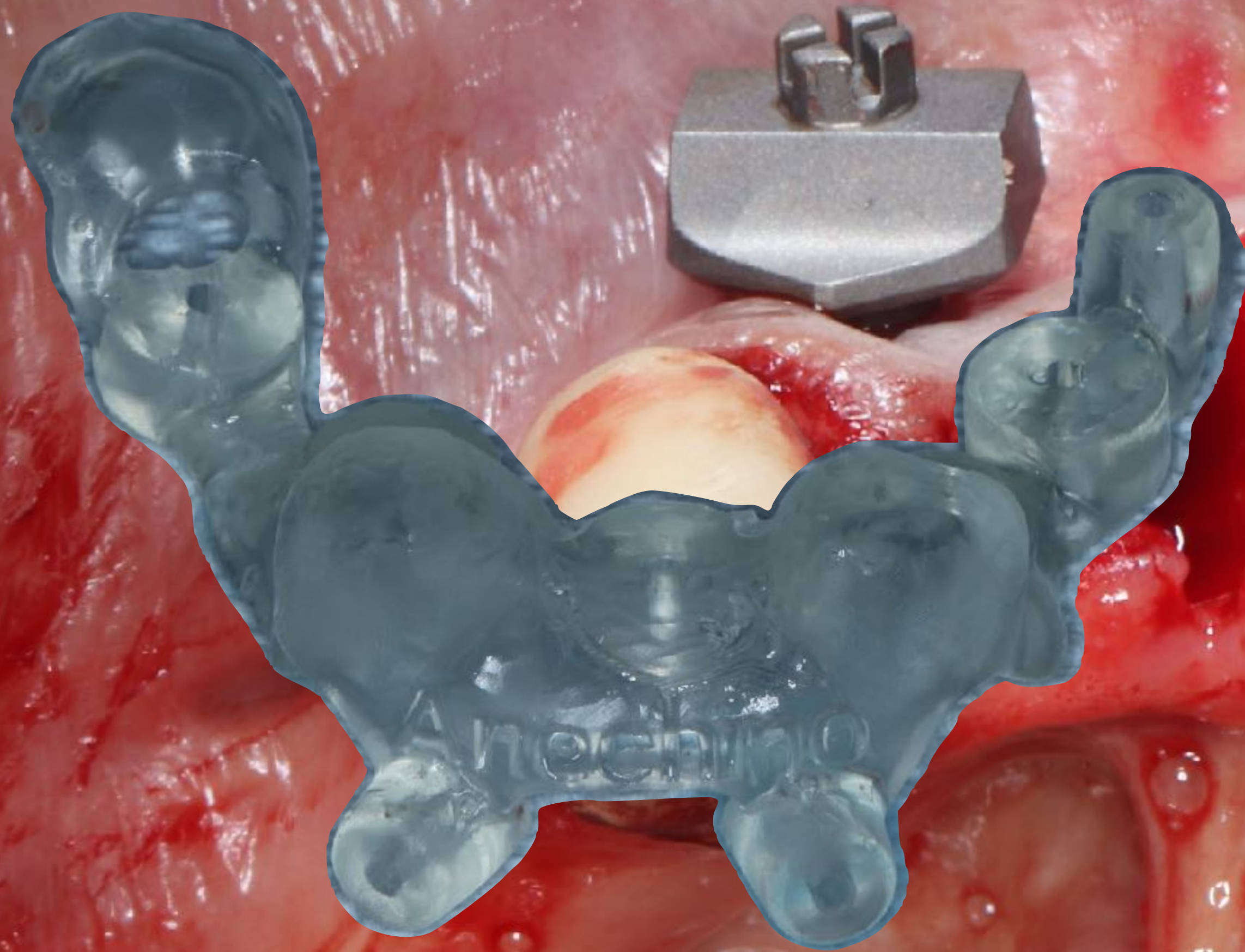
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2.0mm Pilot Guide
Extract all teeth except 22, 27, & 32 prior to
guide placement



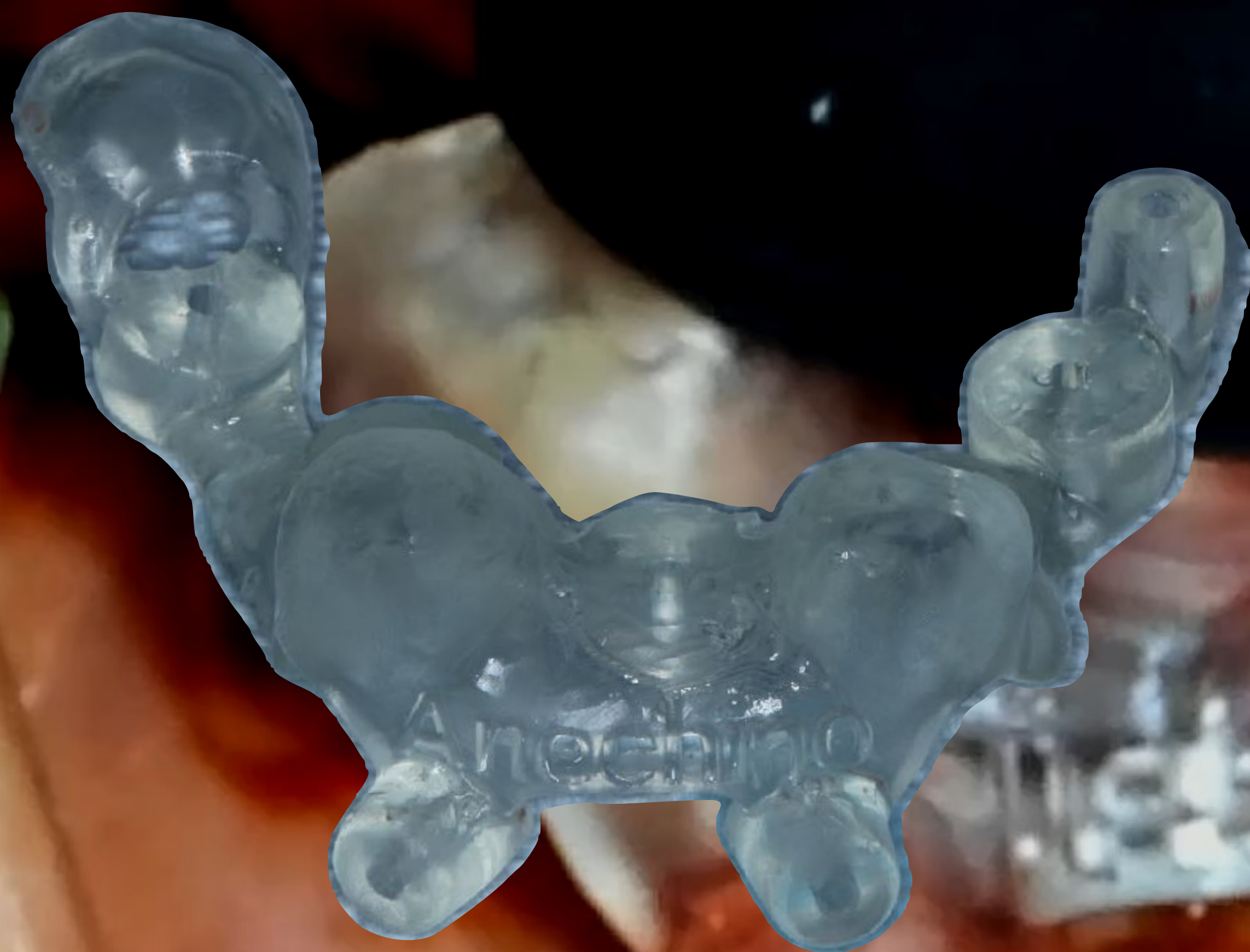




Guided Fiducial Placement



Guided Fiducial Placement





IPG





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New order
Fred Anechino

Scan
In Progress

Pre-design
-

Send
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isaac tawil



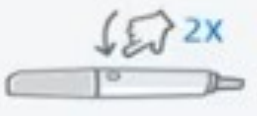
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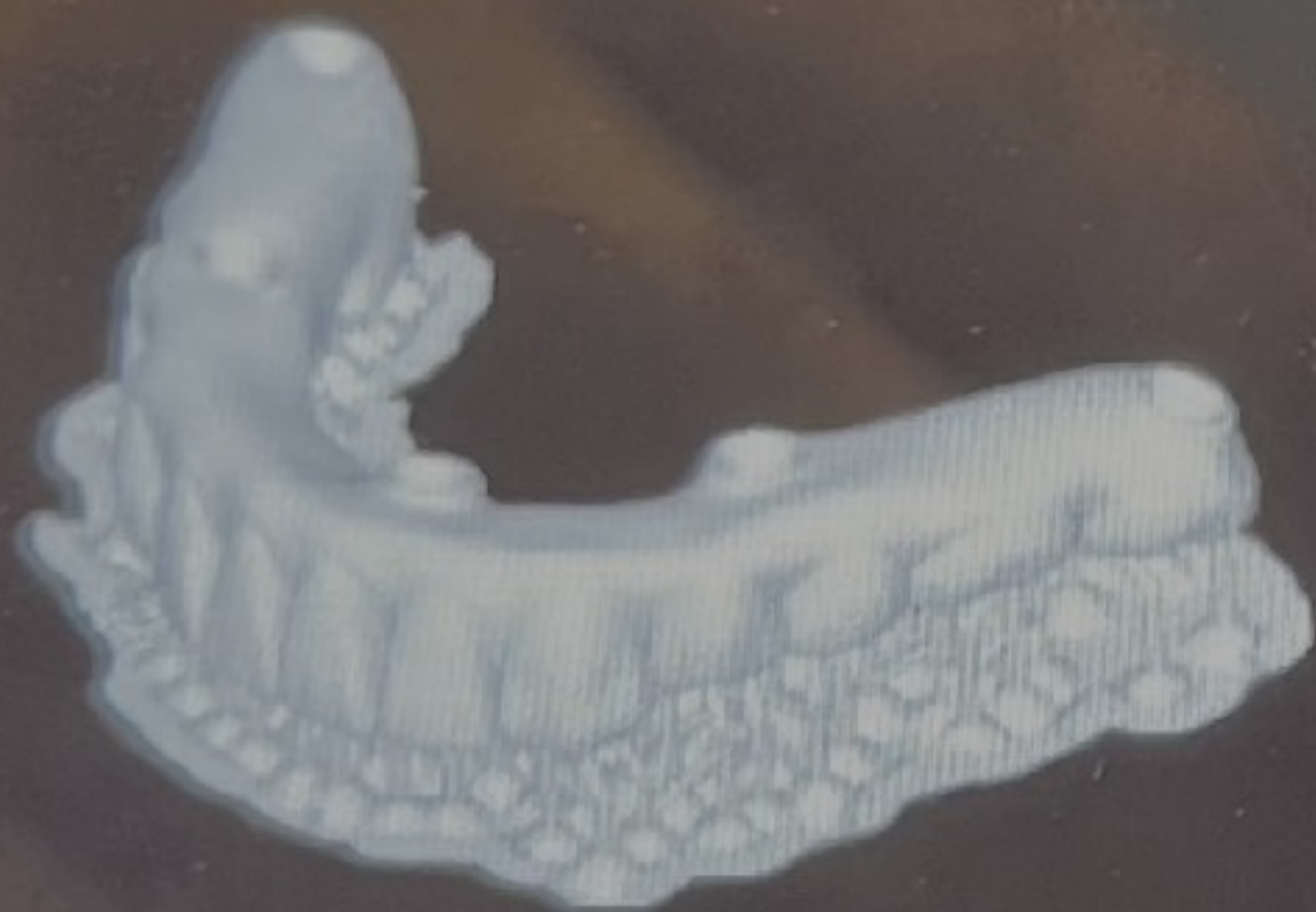


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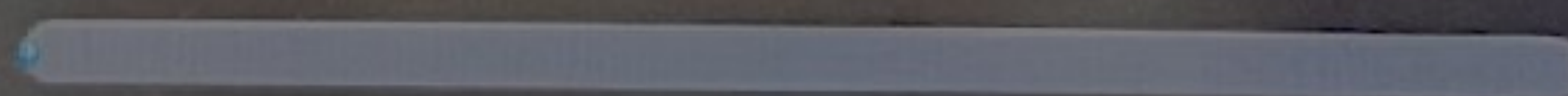
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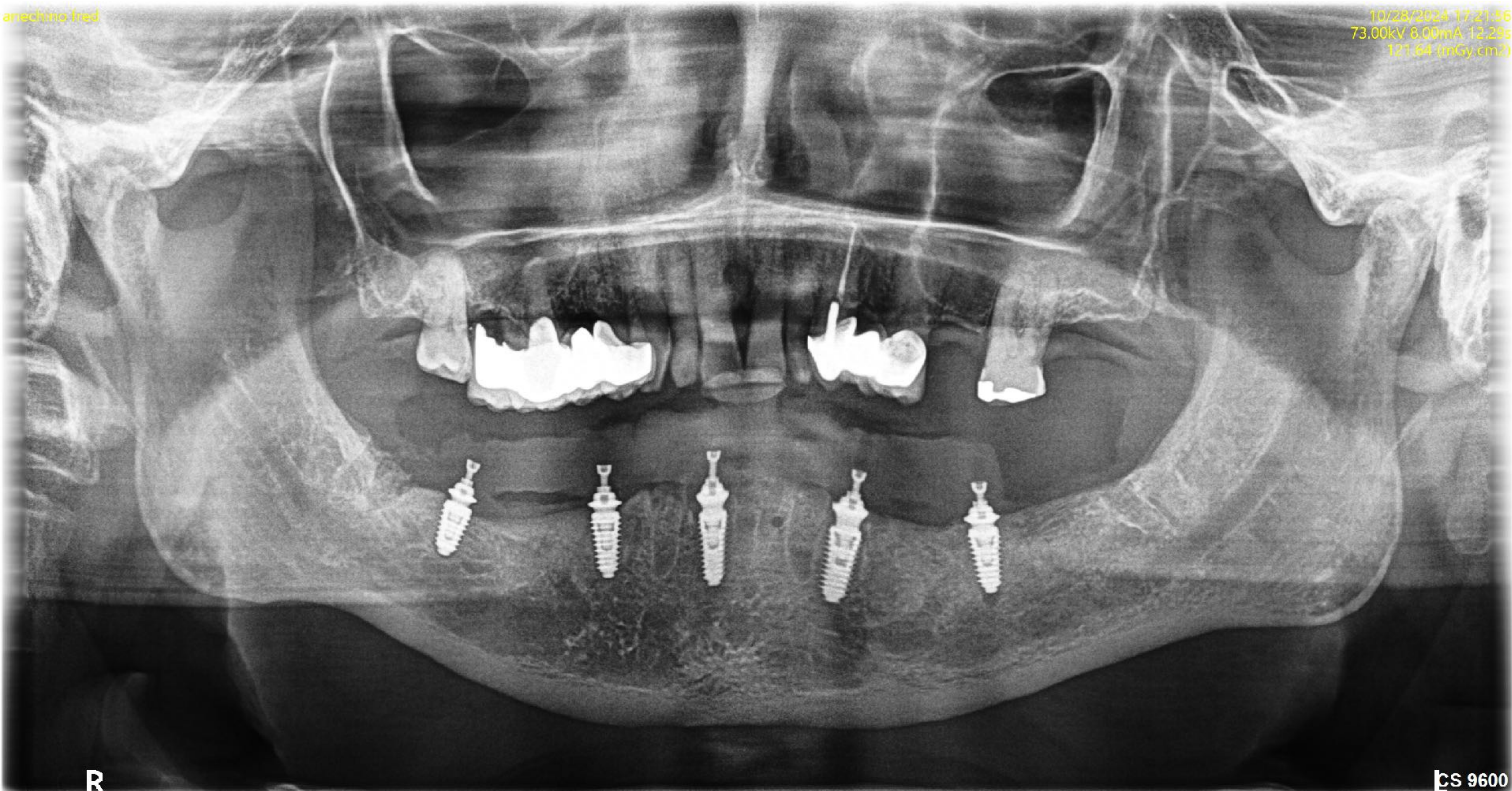


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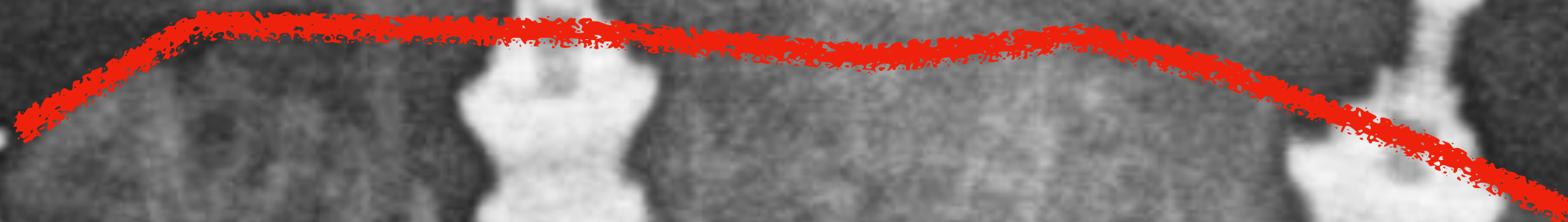


Try in before Pink addition





NOT SEATED



Added Pink







SEATED



R

CS 9600

FULL ARCH

PRE-FABRICATED  **POST-FABRICATED**

PROSTHETIC CHOICE? (FP1,2,3)

FABRICATION TIME?

SURGERY LENGTH?

COMMITMENT TO IMPLANT

POSITION?

QUALITY OF TEMPORIZATION?

BACK UP PROVISIONAL?

CASE ACCEPTANCE?

ALL OPTIONS

UNDER 1HR

REDUCED

CHOOSE GUIDED OR

FREEHAND

INCREASED

INCREASED



PROBLEM



SOLUTION





**WITH THE RIGHT
INSTRUMENTATION
CHANGE IS NOT ONLY
POSSIBLE
IT'S EXPECTED**

SHINING 3D
DENTAL

**Create
Your
Avatar**



Isaac D Tawil DDS MS

info@aiedental.com