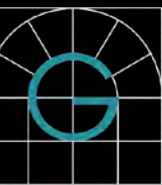




# Integration of Digital Technology in Multidisciplinary Dentistry





*Marjola Paloka*

*Slava Shimunov*

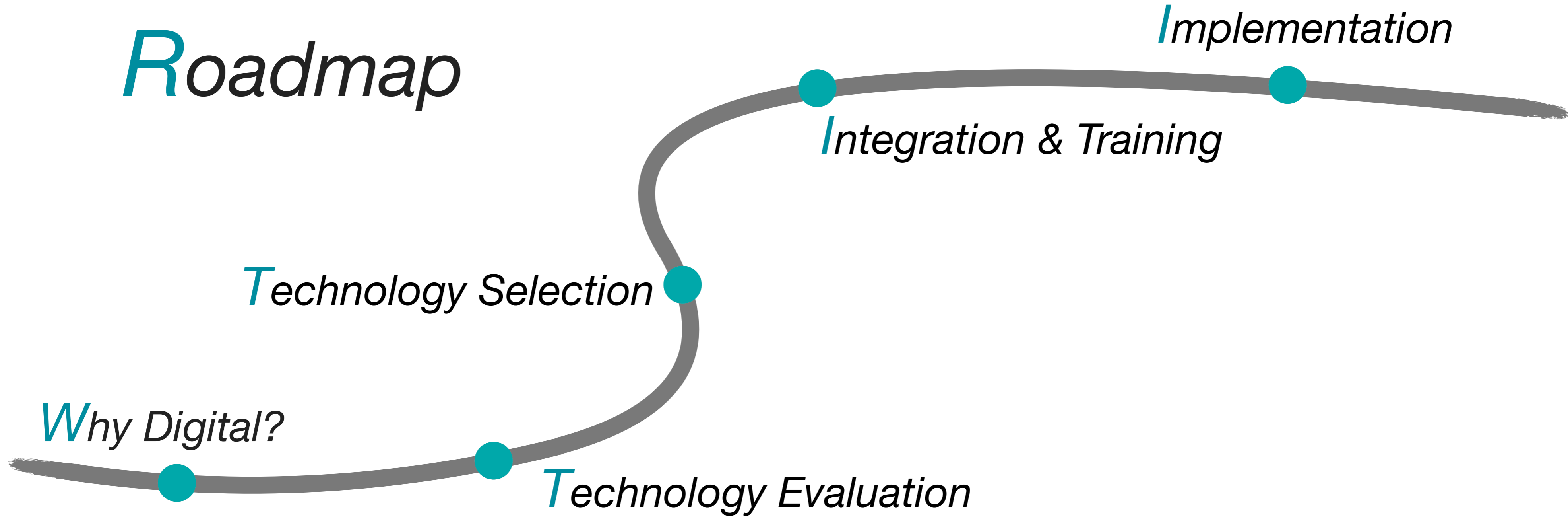
*Erika Ramirez*

*Shmuel Koenov*



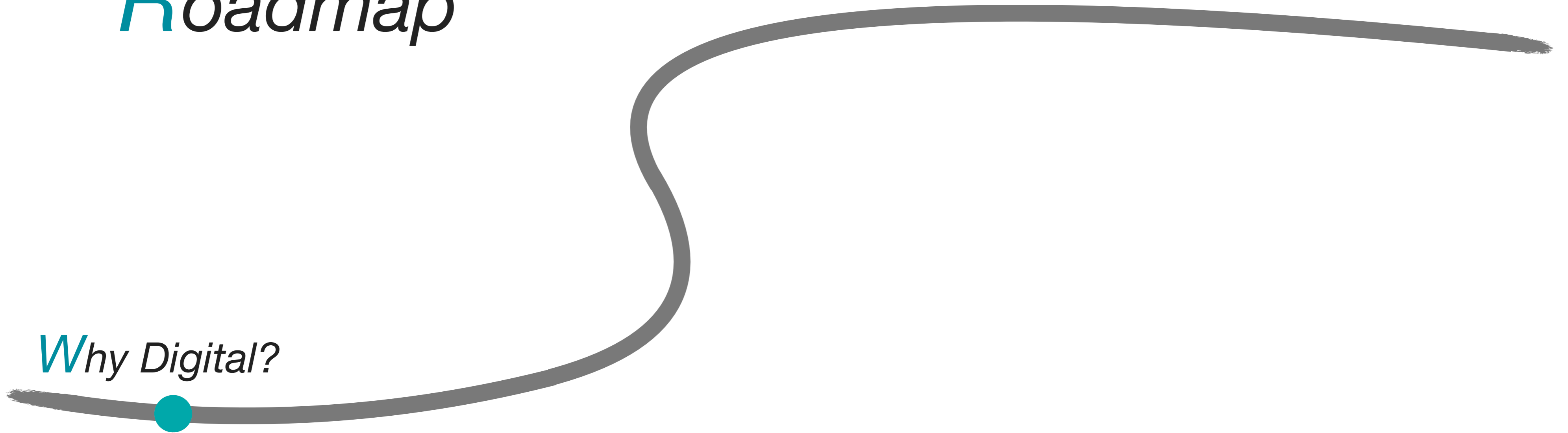


# Roadmap



# *Roadmap*

*Why Digital?*



# Intraoral scanners

An American Dental Association Clinical Evaluators Panel survey



ADA American Dental Association

## Survey Results

Data reflect the responses of 369 American Dental Association Clinical Evaluators (ACE) Panel member dentists in the United States.

Does your practice currently use an intraoral scanner (IOS)?



Top 3 reasons **FOR** starting to use an IOS\*\*†



Improve clinical efficiency



Transition from an analog to a digital practice



Improve laboratory communication

Top reason for **NOT** using an IOS\*



66%

Financial investment is too high or do not see a financial benefit

# 2020

# 16-26% of Dentists use Digital Impressions

Revilla-Leon, M, et al. Intraoral scanners: An American Dental Association Clinical Evaluators Panel survey, JADA 2021;152(8):669-670.

Touch



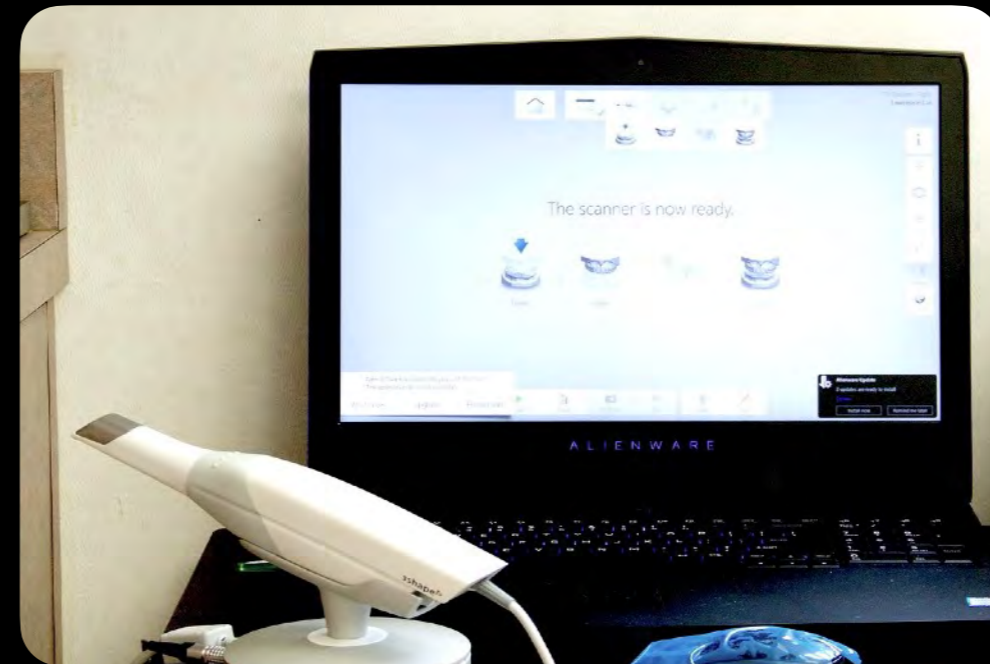
2003

Model



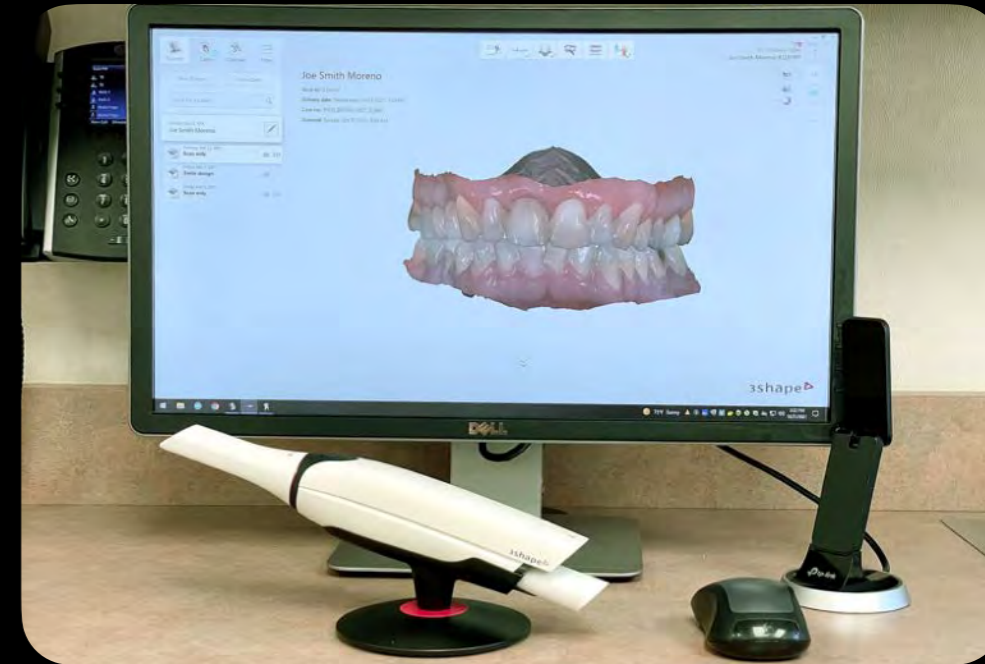
2006-2015

Intraoral



2016

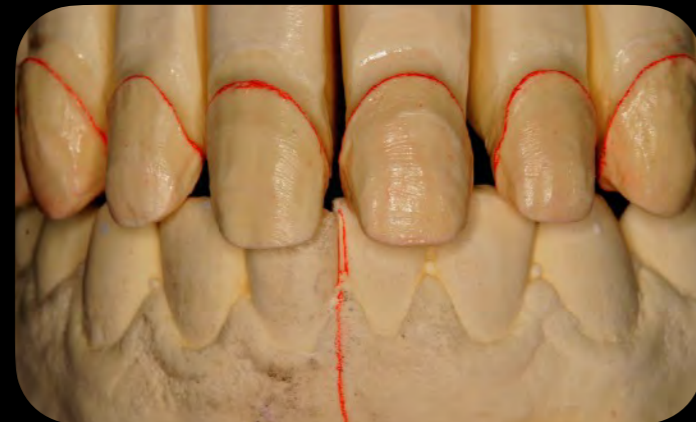
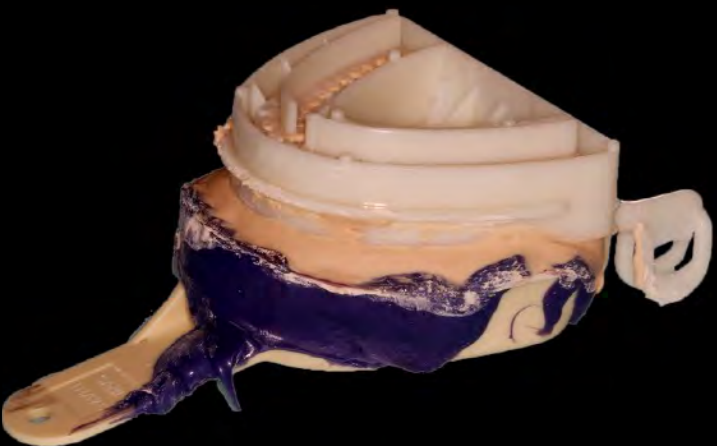
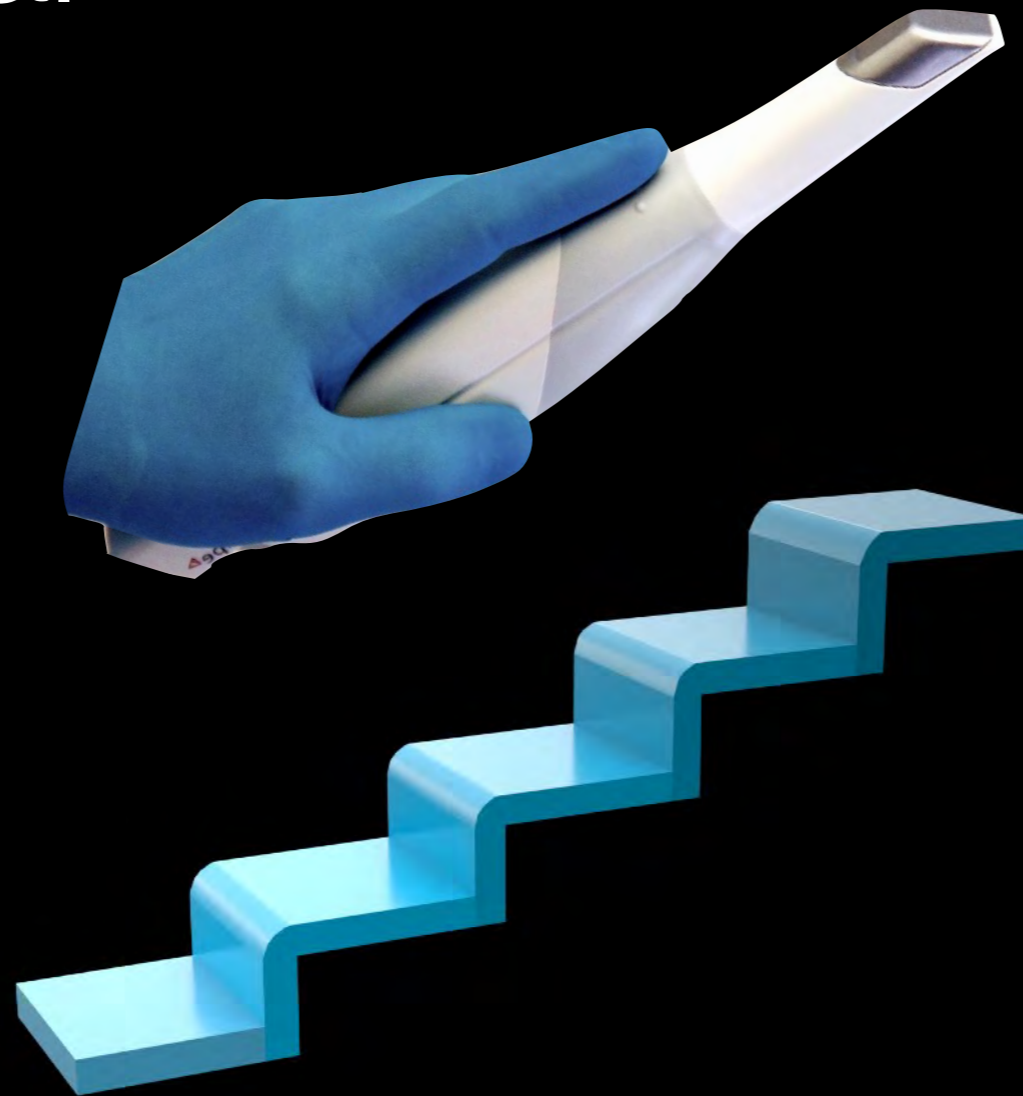
Wireless



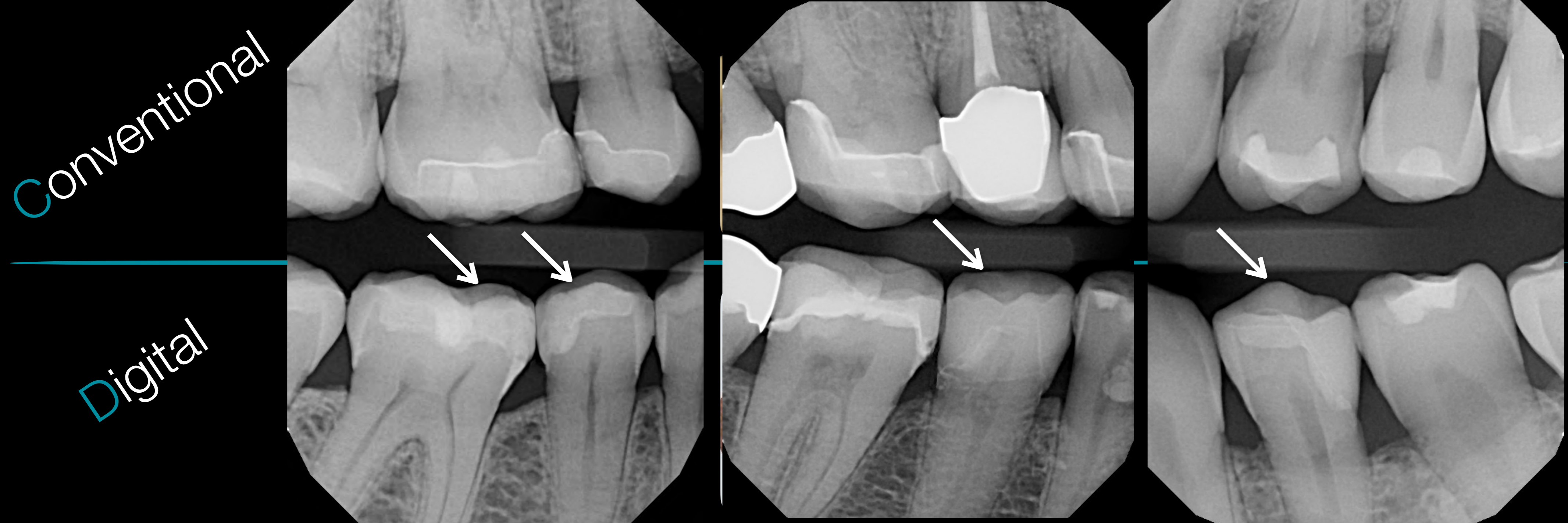
2020

# Conventional

# Digital











**Bidra, A et al. Complete arch fixed implant-supported zirconia prostheses: A retrospective study. JPD 2018;119(2):220-224.**

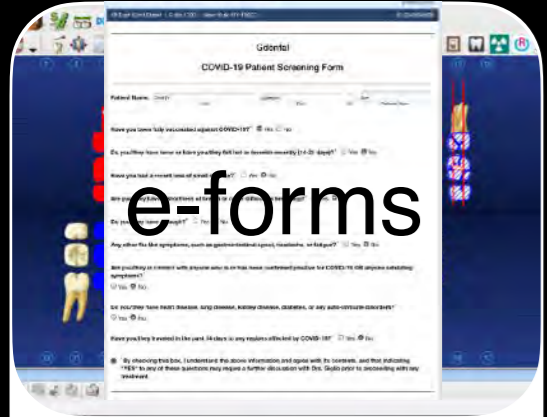
# Digital Spectrum

Analog

Digital



# Practice



e-forms

Management



X-rays



Caries



Photos



Videos

# Acquisition



CBCT



Intraoral

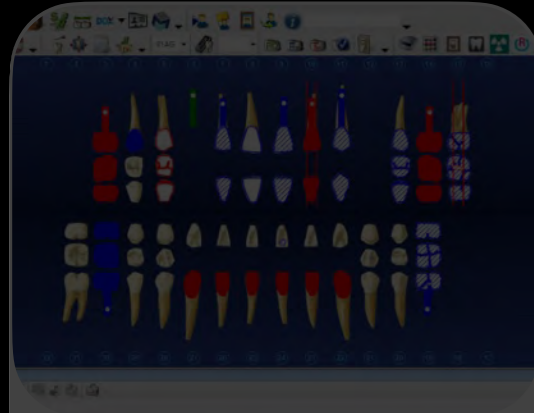


Model



Face

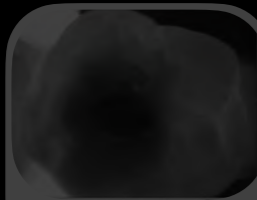
# Practice



Management



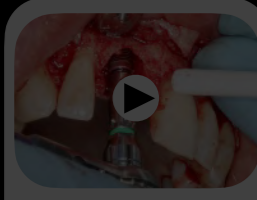
X-rays



Caries

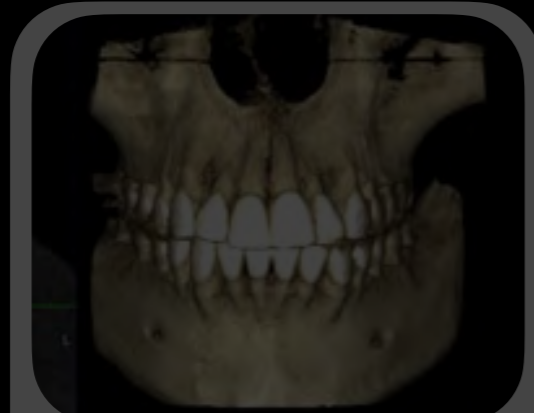


Photos

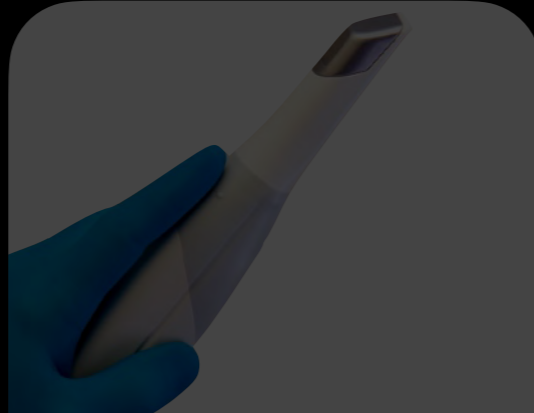


Videos

# Acquisition



CBCT



Intraoral

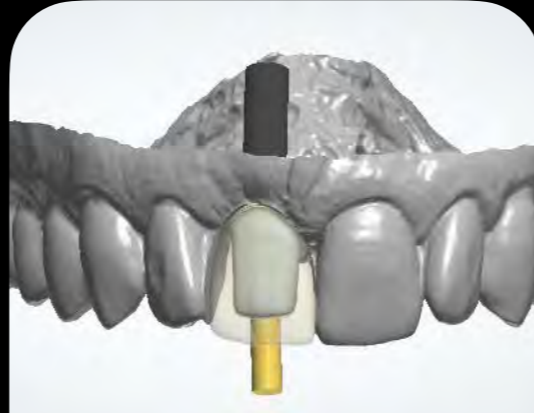


Model



Face

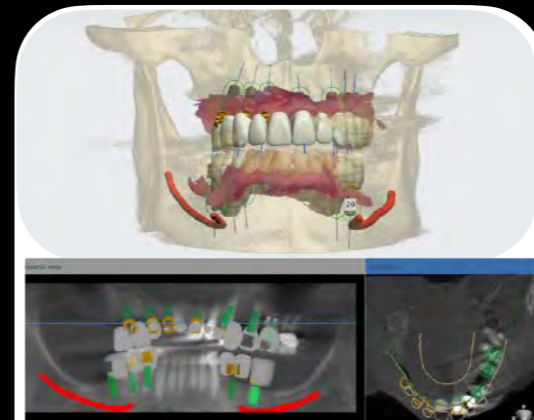
# CAD



Prosthetic



Smile



Planning

# CAM



3D Print



Mill

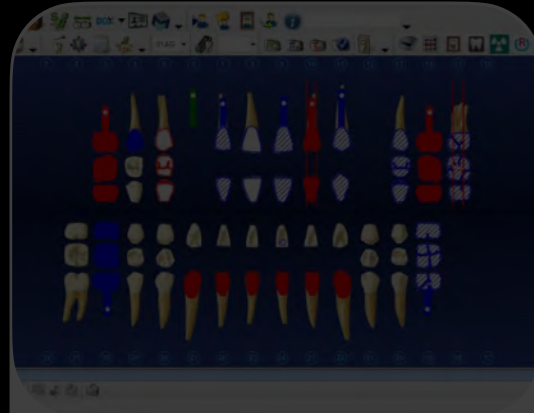


Assisted Surgery



Guided Prosthetics

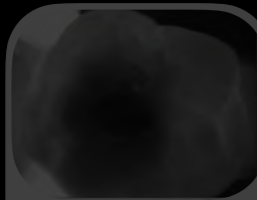
# Practice



Management



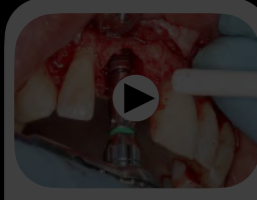
X-rays



Caries



Photos



Videos

# Acquisition



CBCT



Intraoral



Model



Face

# CAD



Prosthetic

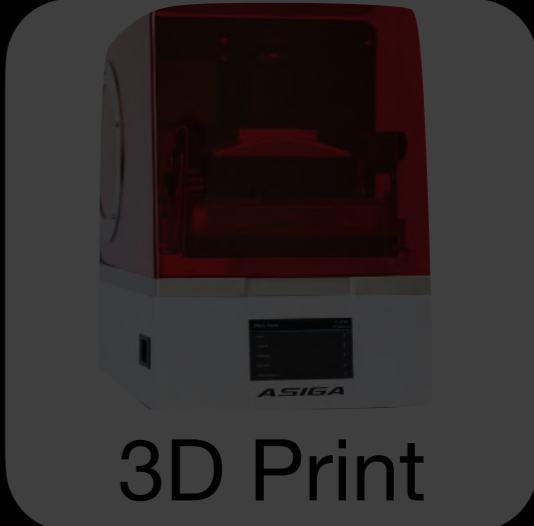


Smile



Planning

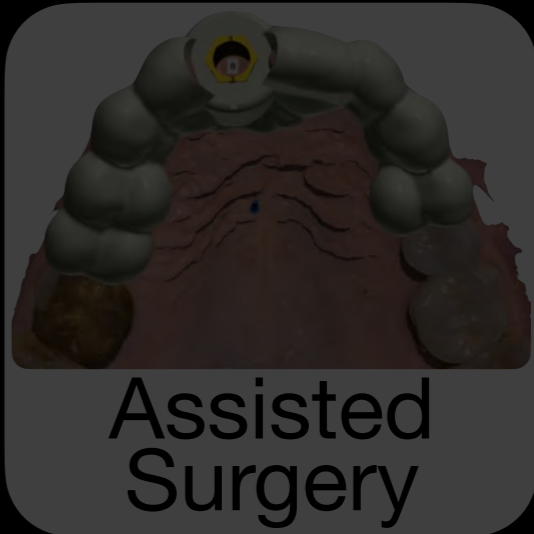
# CAM



3D Print



Mill



Assisted Surgery



Guided Prosthetics

Chairside

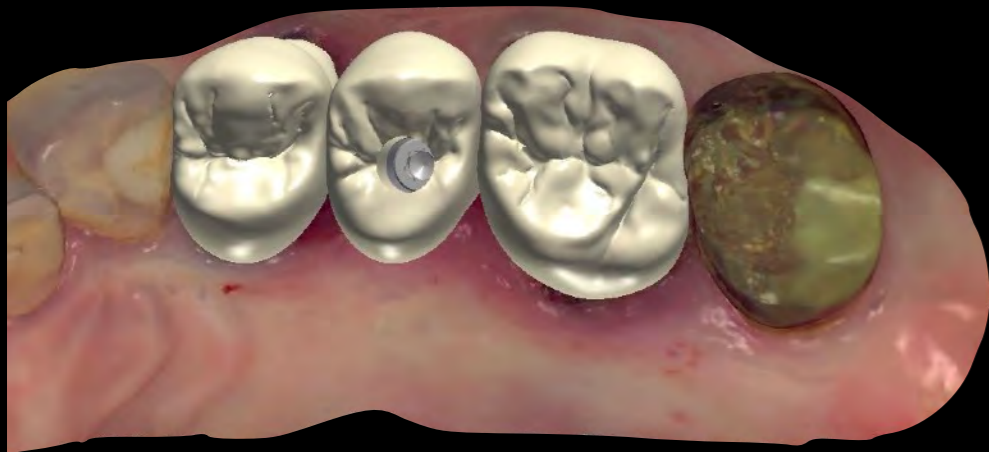
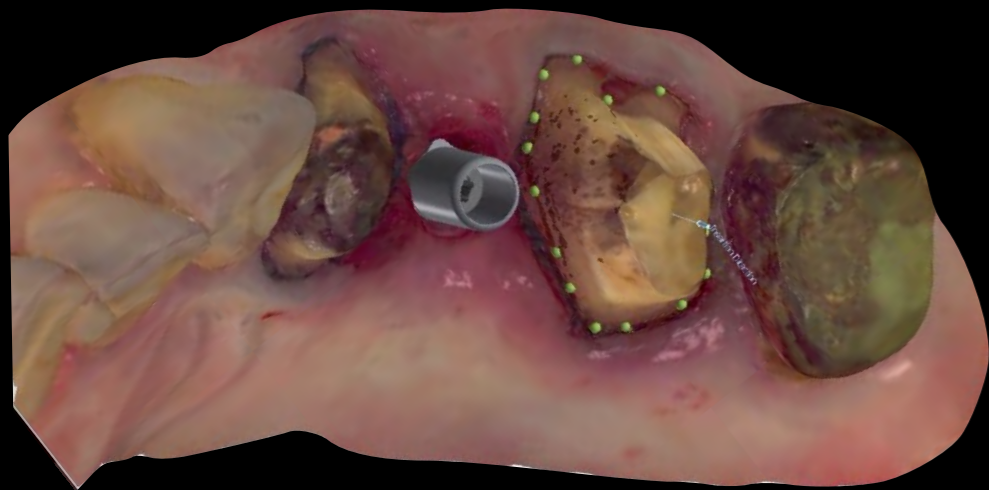
Digital Workflow

Laboratory





Scan



CAD



CAM

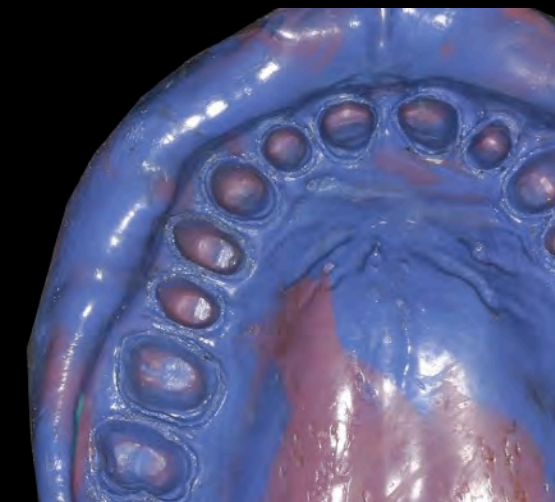


Chairside

+



Crystallize



# Advantages of Digital Technology

- Improve Patient Experience, Comfort, and Perception
- Accurate and Efficient
- No Messy Impressions and Model Work
- Better Patient, Laboratory, and Referral Communication
- Access to Archival System
- Reduce Supply Costs

# Disadvantages of Digital Technology

- Difficulty Detecting Deep Subgingival Margins
- Inaccurate for Long Span Restorations
- Steep Learning Curve
- Initial Investment and Software Licensing Costs

# Strategy

## Considerations

- Retirement
- Existing Digital Technology
- Computer Competence Level
- Delegation to Staff

## Building a Team

- Maven/Colleague
- IT Consultant
- Internal IT
- Vendor Support

# *Roadmap*

A stylized, thick grey road that starts at the bottom left, curves upwards and to the right, then loops back down and to the right, and finally curves upwards and to the right again, ending at the top right. Two teal dots are placed on the road: one at the start and one further along, labeled 'Technology Evaluation'. The word 'Roadmap' is written in a large, italicized font at the top left.

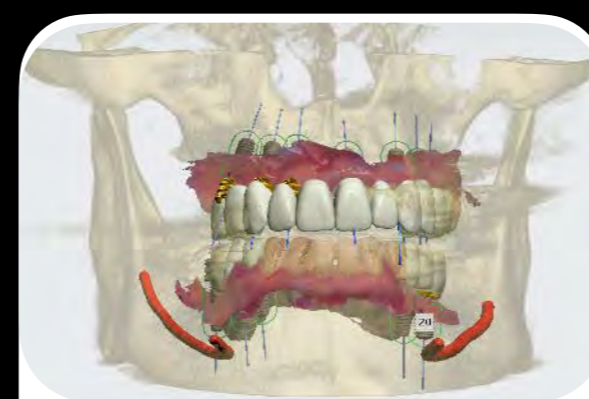
*Why Digital?*

*Technology Evaluation*

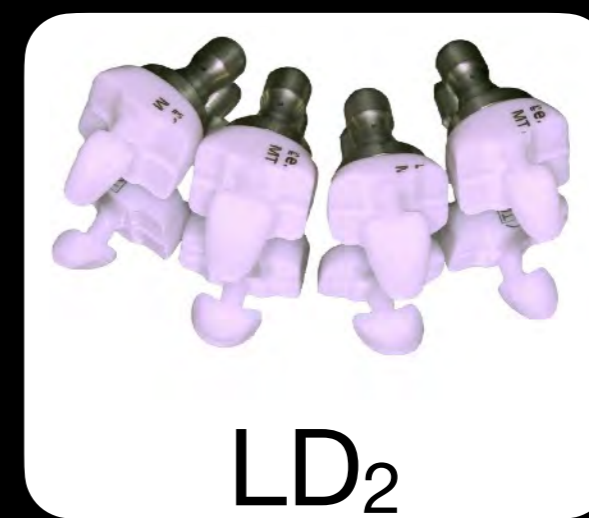
# Technology Evaluation



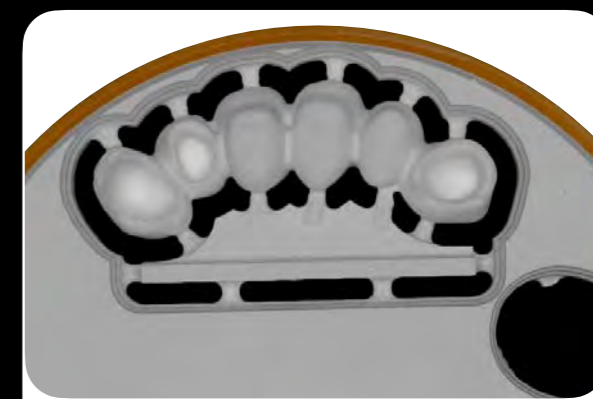
Acquisition



Planning



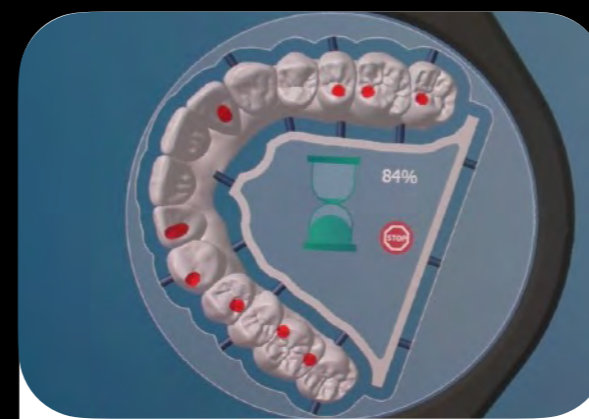
LD<sub>2</sub>



Zr



CAD



CAM



Ti



PMMA

Hardware

Software

Materials



# CBCT

- User Friendly
- Integrates w/ Management & Planning Software
- Monitor Resolution
- Scanner Resolution (100um)
- Low Dose Setting
- Volume Size

**Brullmann, D, et al.**  
Dentalmaxillofacial Radiology, 2015

**Samuel, DS, et al.** Cone-beam computer tomography and its applications in dentistry. Drug Invention Today 2019;12(1):1-4.



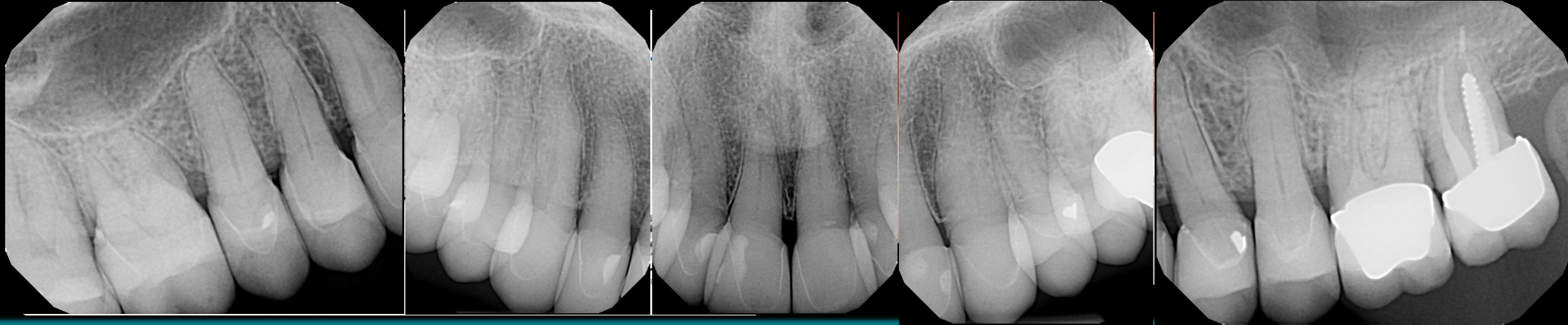


# Facial Scanners

- Value to Practice
- Integrates w/ Smile Design & Planning Software

Joda, T, et al. The virtual patient in dental medicine. Clin Oral Impl Res 2015;26:725–726.

# Intraoral Scanners



**Chochlidakis, K, et al.** Digital versus conventional impressions for fixed prosthodontics: A systematic review and meta-analysis of ceramic partial crown in vitro. *JPD* 2016;116(2):184–190.

**Imburgia, M, et al.** Accuracy of four intraoral scanners in oral implantology: a comparative in vitro study. *BMC Oral Health* 2017;17:1-30.



Sapna

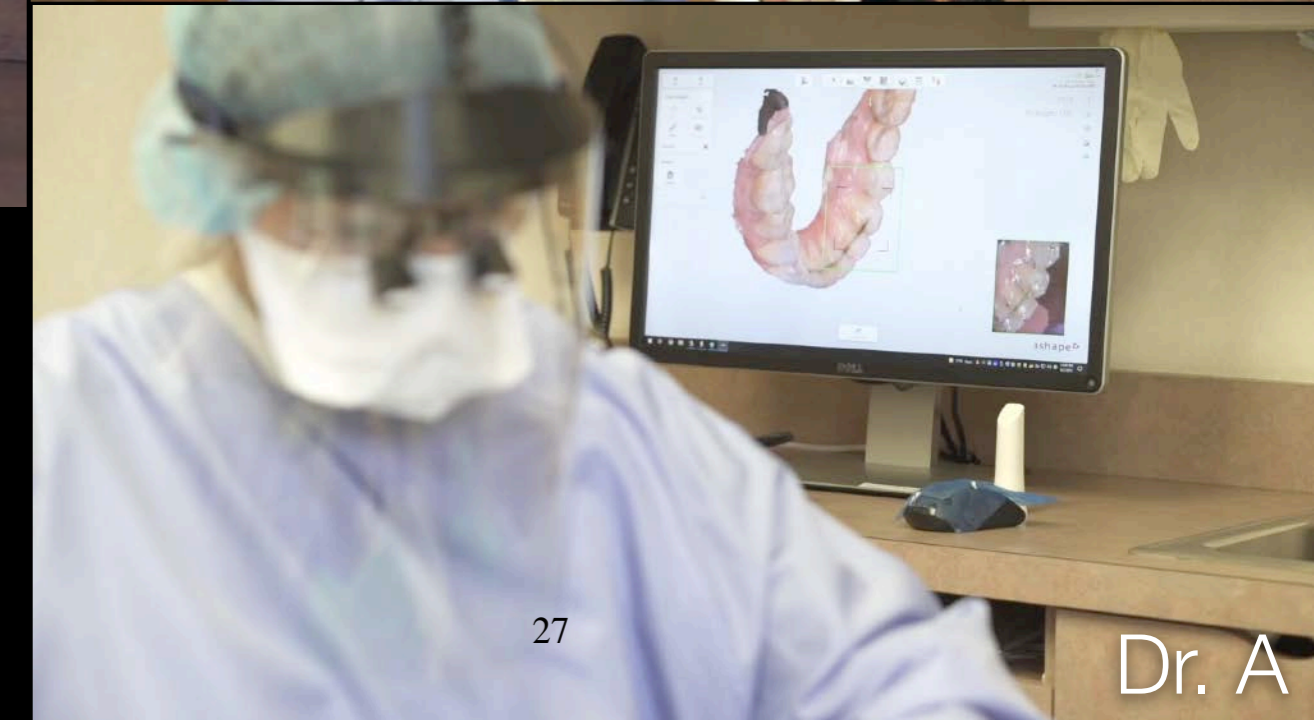


Lindsay



Chrissy

Scan from anywhere  
on the network



Dr. A



# Intraoral Scanners

- Open System
- STL, OBJ, PLY Files
- Small Wand
- Speed and Accuracy
- PC Requirements

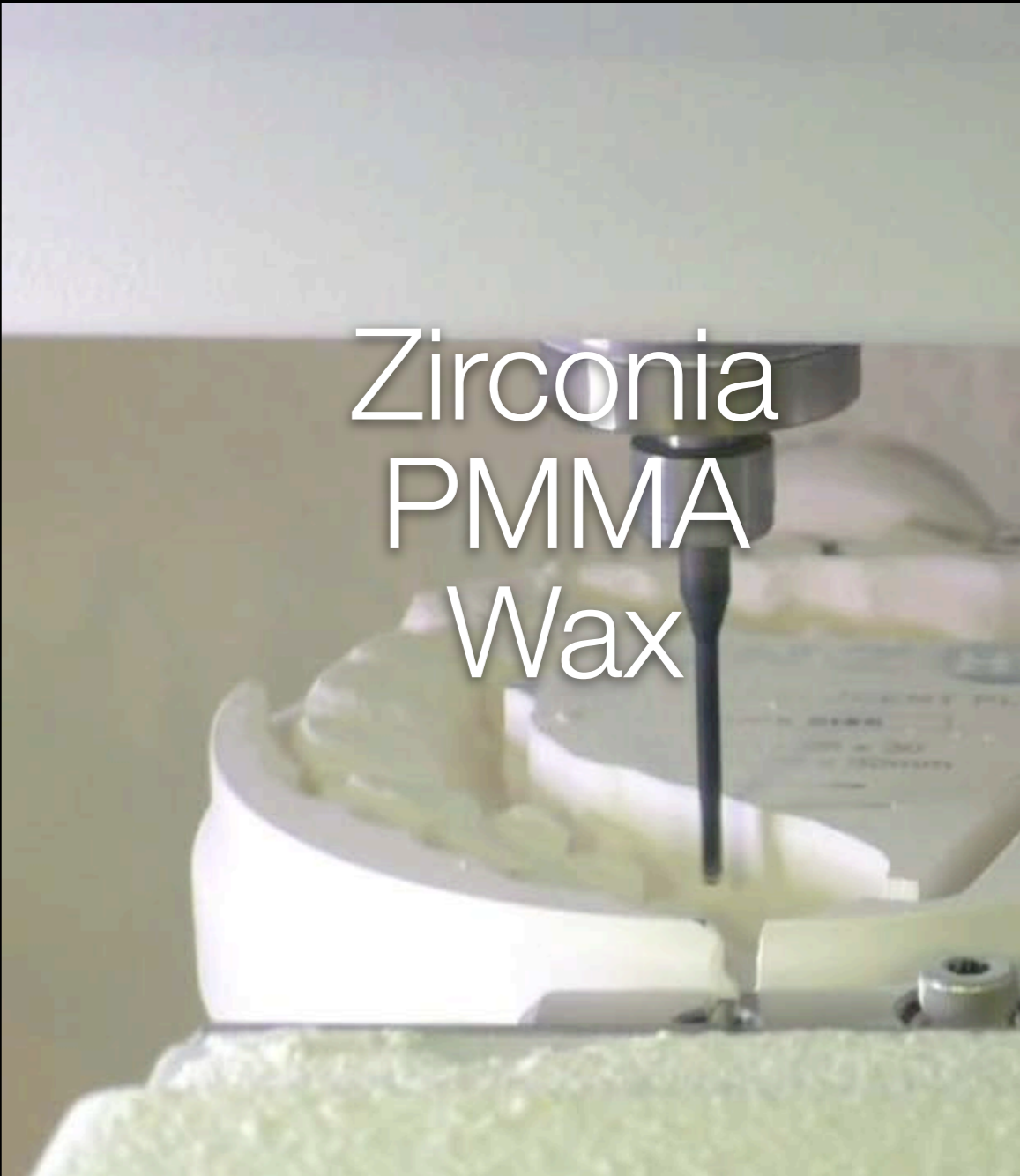
Lithium Disilicate  
Composite  
Ceramic Hybrid  
PMMA  
Ti

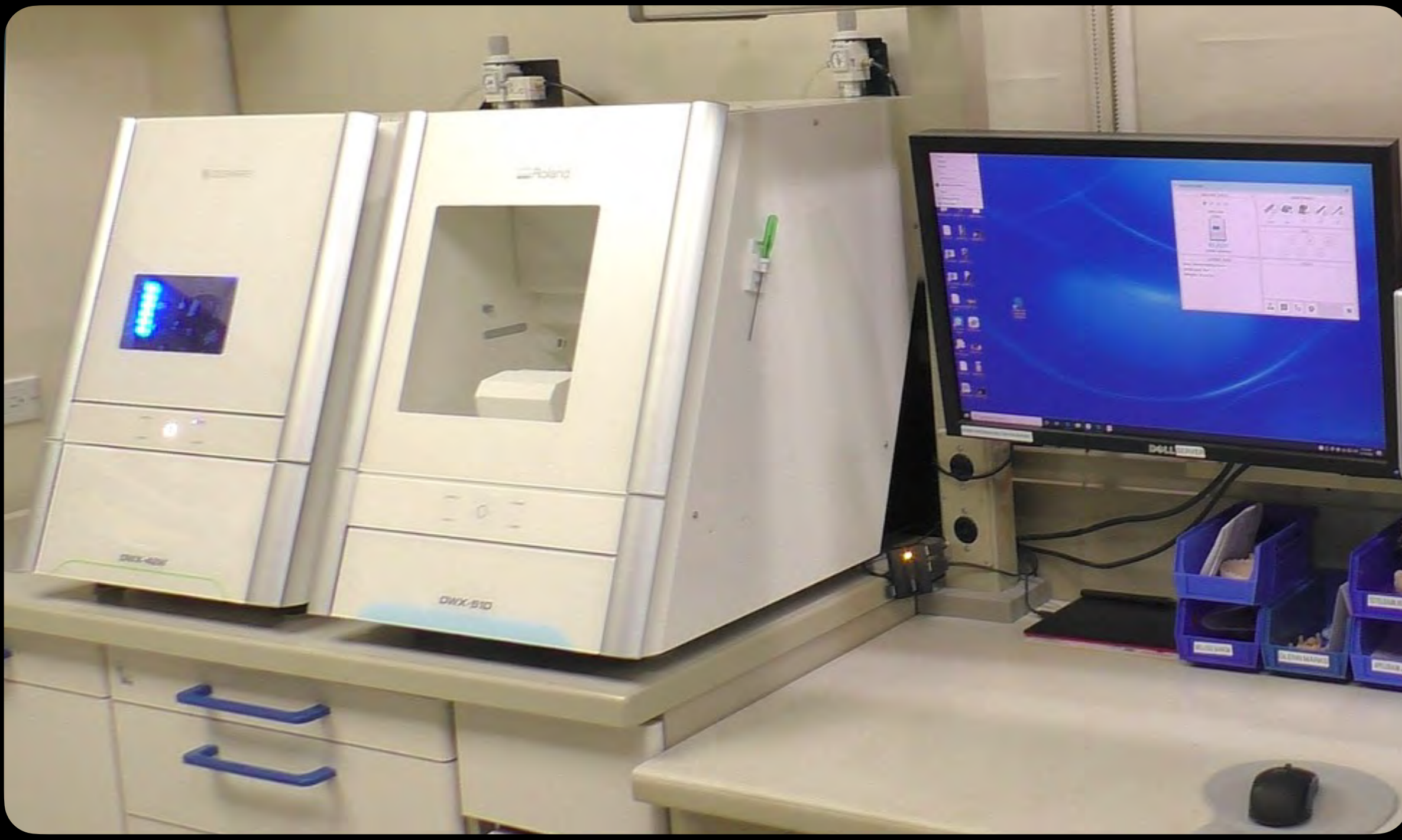
Wet

Dry



Zirconia  
PMMA  
Wax

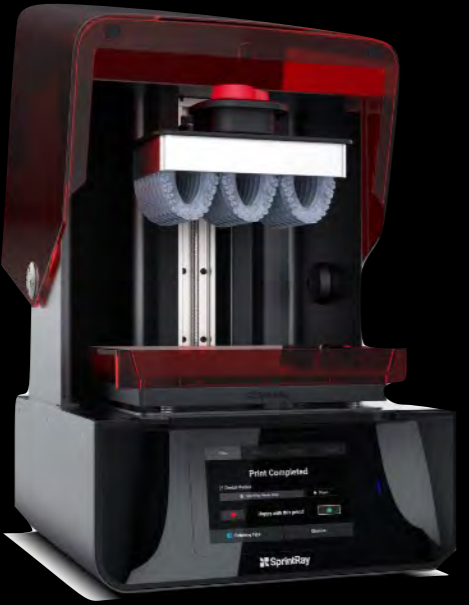




# Milling Machines

- Speed (Time/Unit)
- Marginal Accuracy
- Units/Run
- Maintenance
- Utilities Requirements

# 3D Printers



Resin Tray

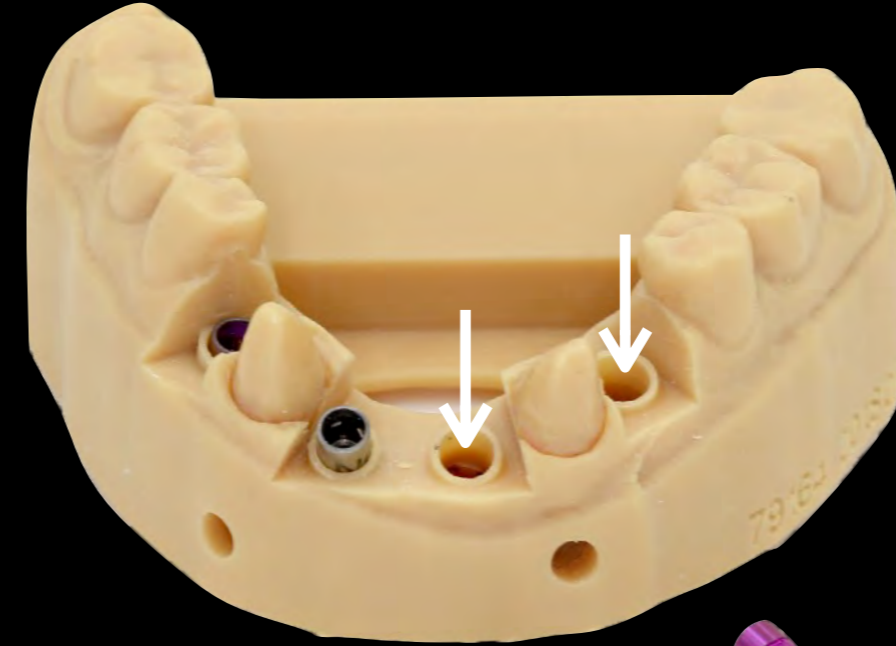


Light Source



Build Platform









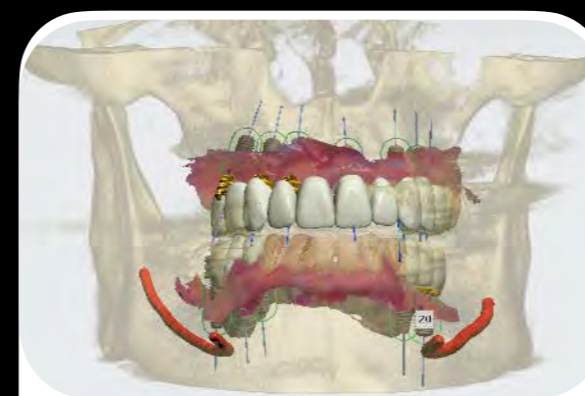
# 3D Printers

- Speed & Accuracy
- Print Resolution
- Open Material System
- Maintenance

# Technology Evaluation



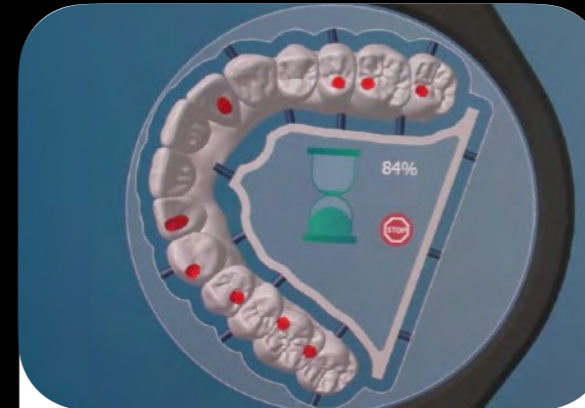
Acquisition



Planning



CAD



CAM



LD<sub>2</sub>



Zr



Ti

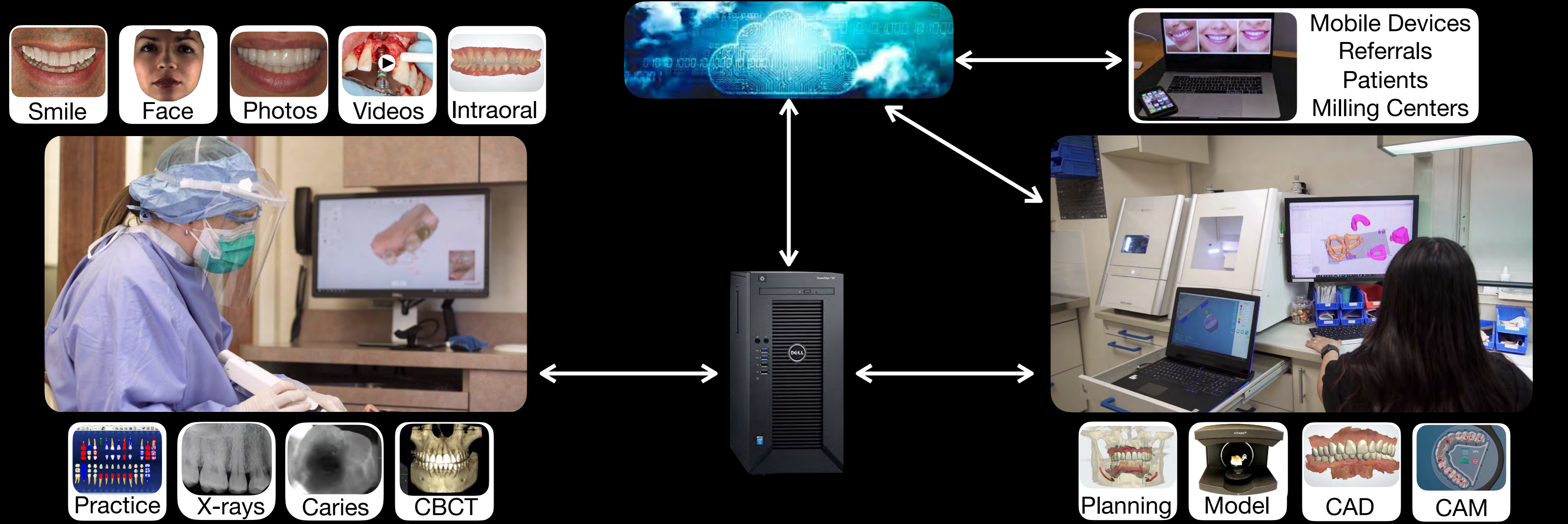


PMMA

Hardware

Software

Materials



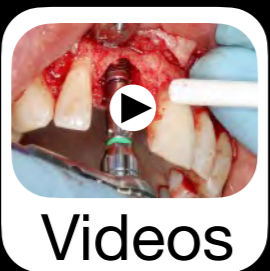
Smile



Face



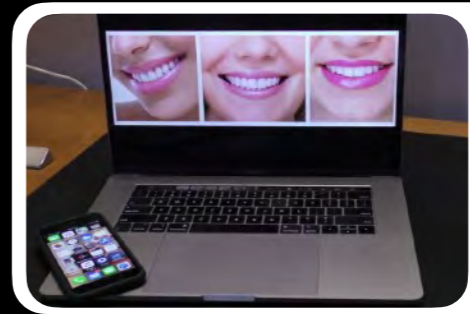
Photos



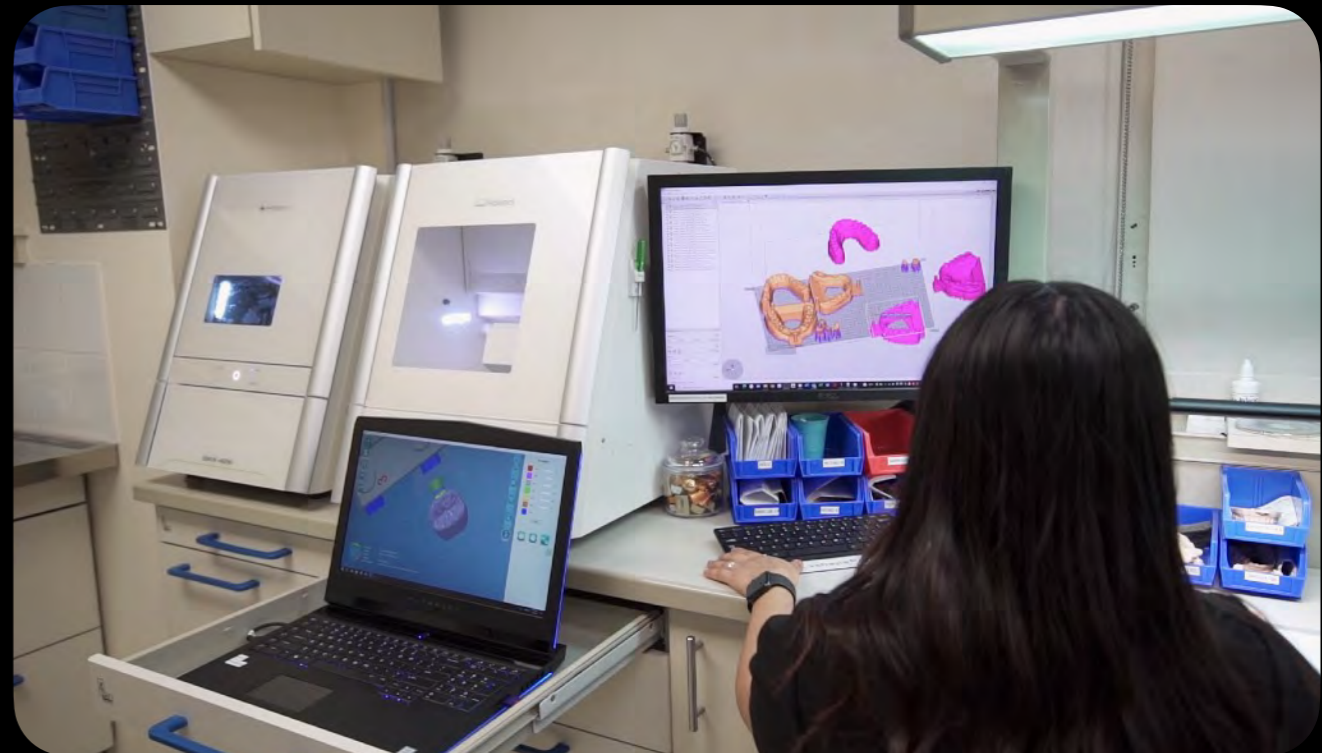
Videos



Intraoral



Mobile Devices  
Referrals  
Patients  
Milling Centers



Practice



X-rays



Caries



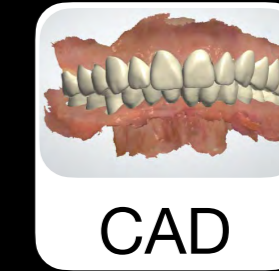
CBCT



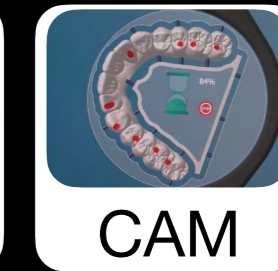
Planning



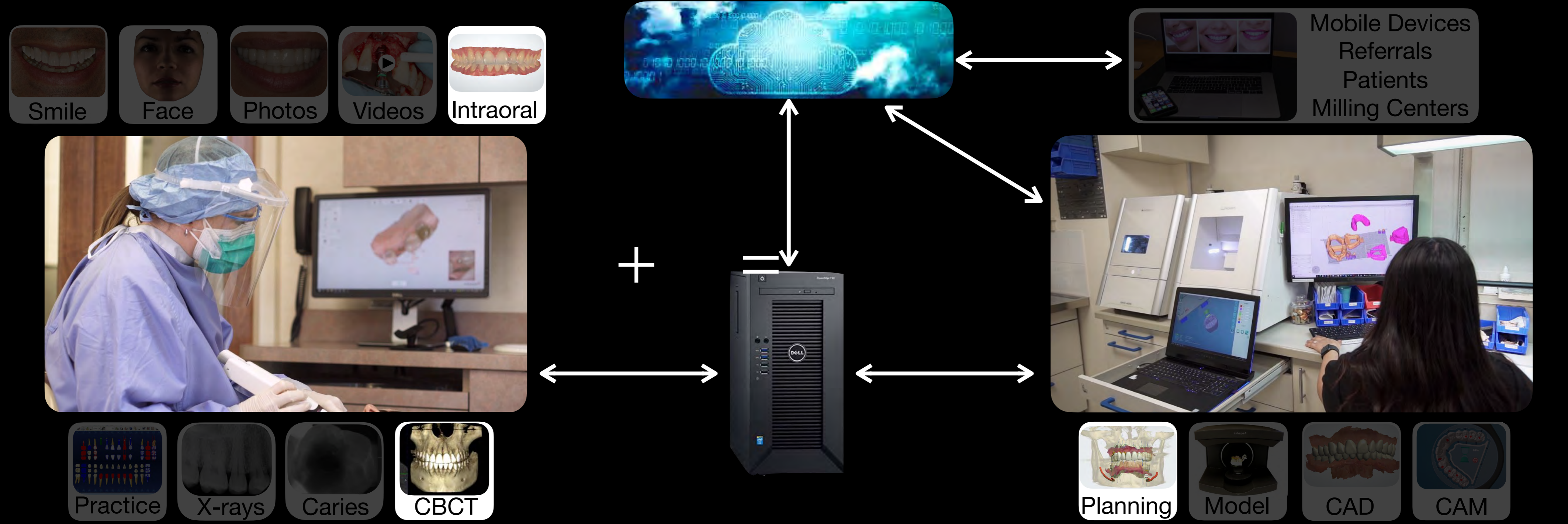
Model



CAD



CAM



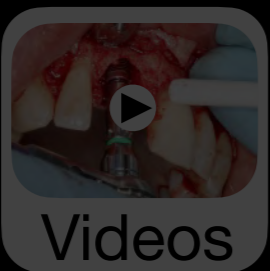
Smile



Face



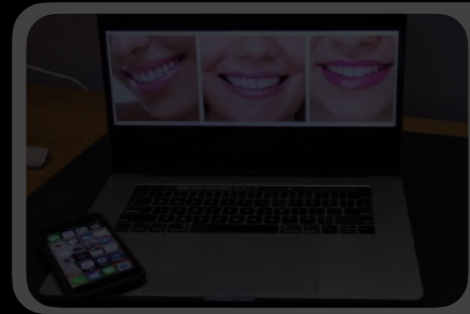
Photos



Videos



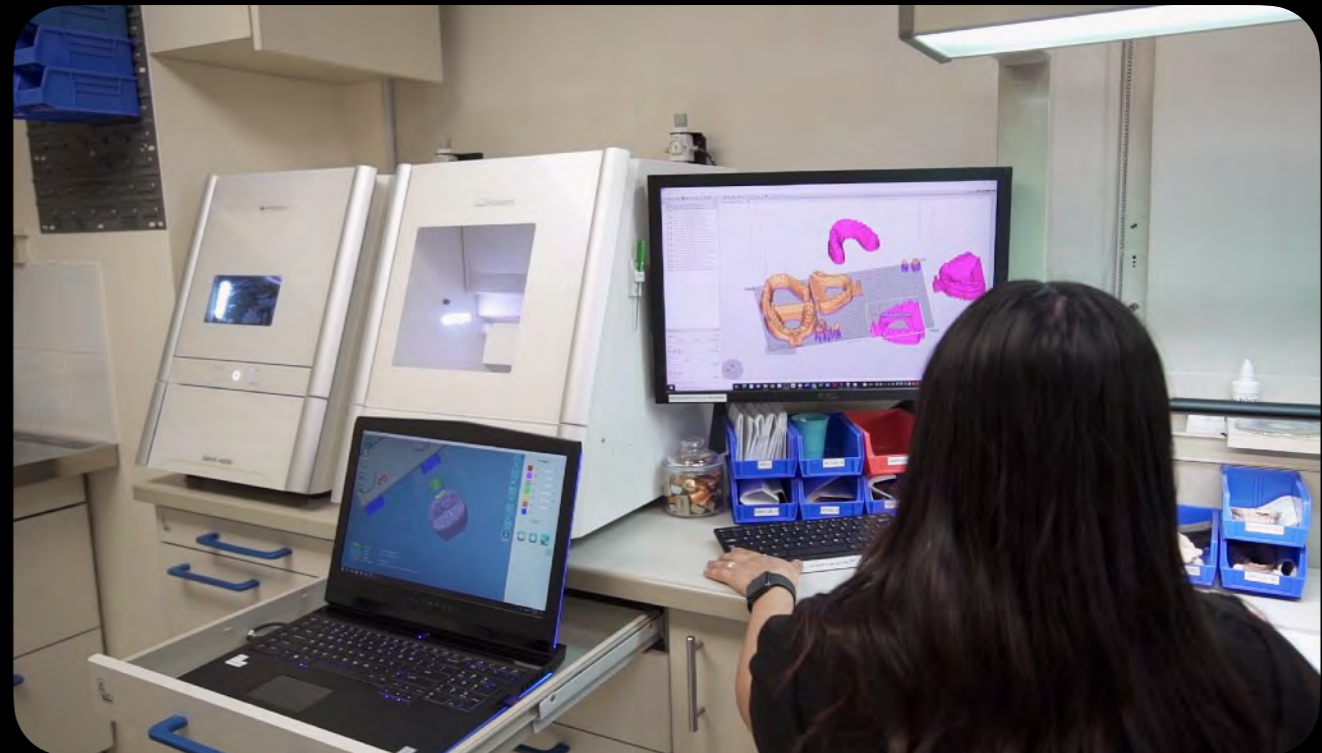
Intraoral



Mobile Devices  
Referrals  
Patients  
Milling Centers



+



Practice



X-rays



Caries



CBCT



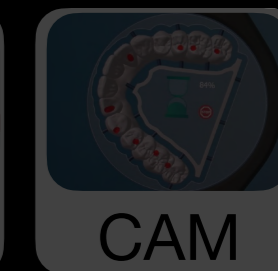
Planning



Model



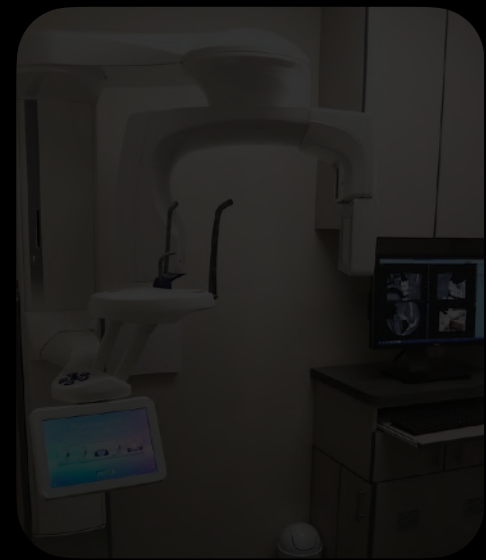
CAD



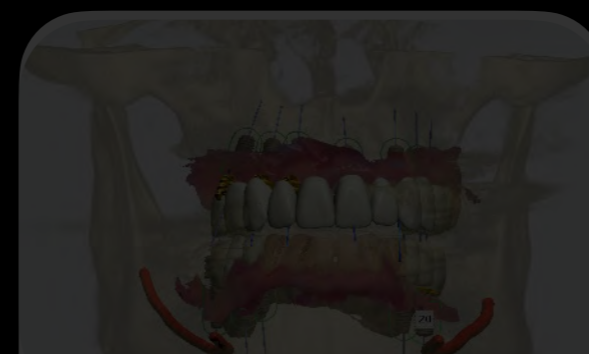
CAM



# Technology Evaluation



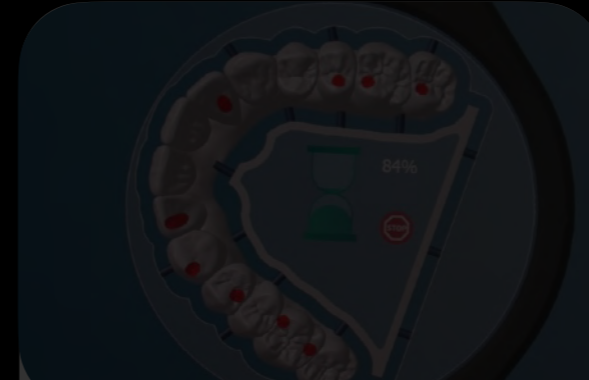
Acquisition



Planning



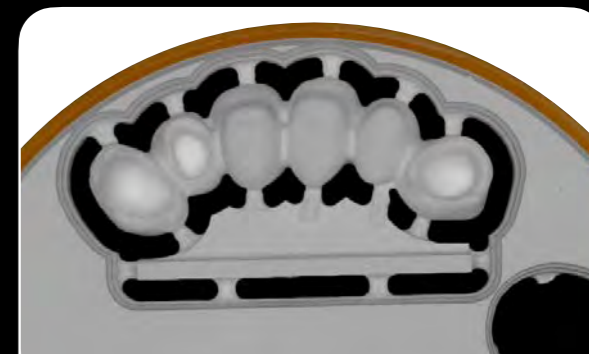
CAD



CAM



LD<sub>2</sub>



Zr



Ti



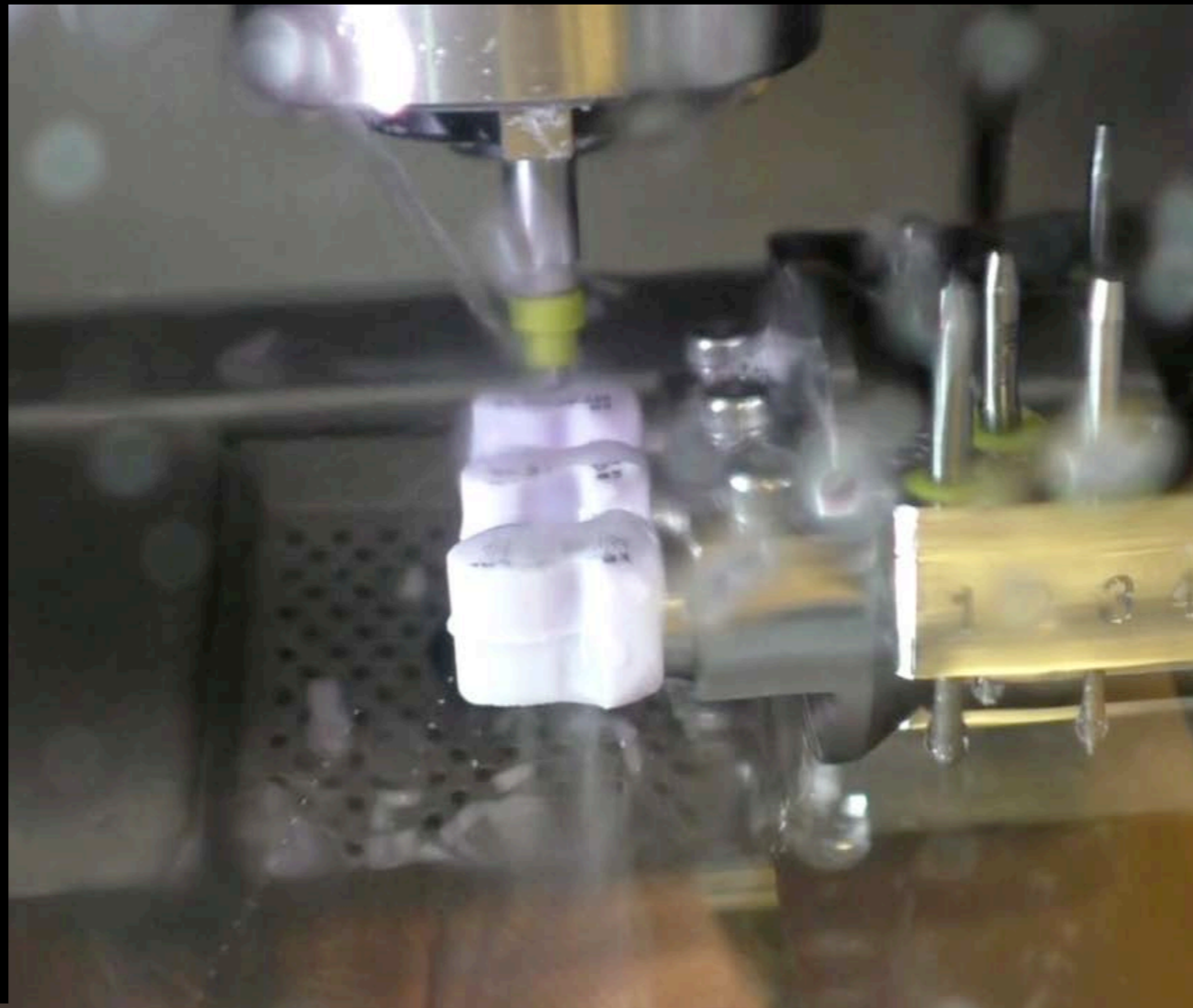
PMMA

Hardware

Software

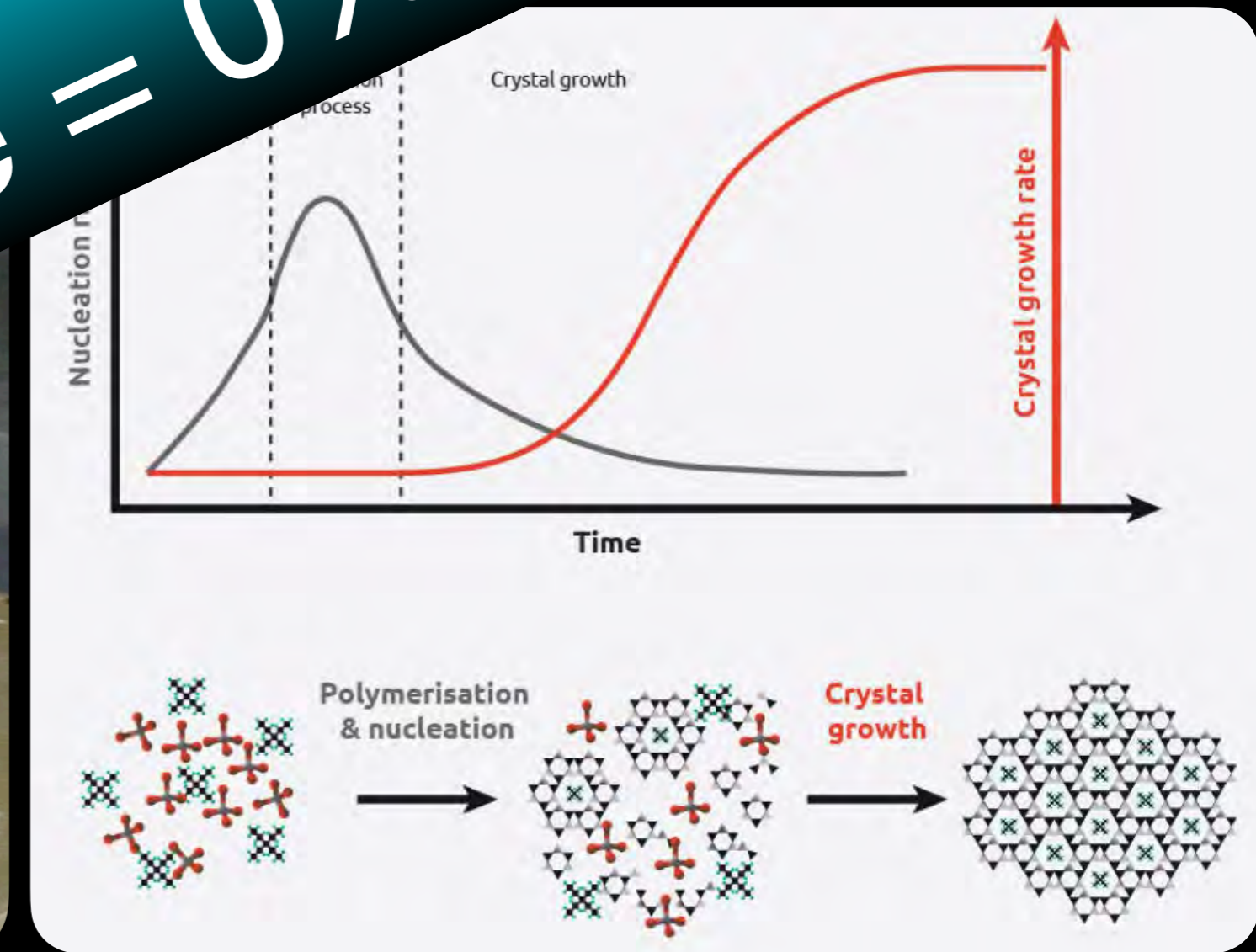
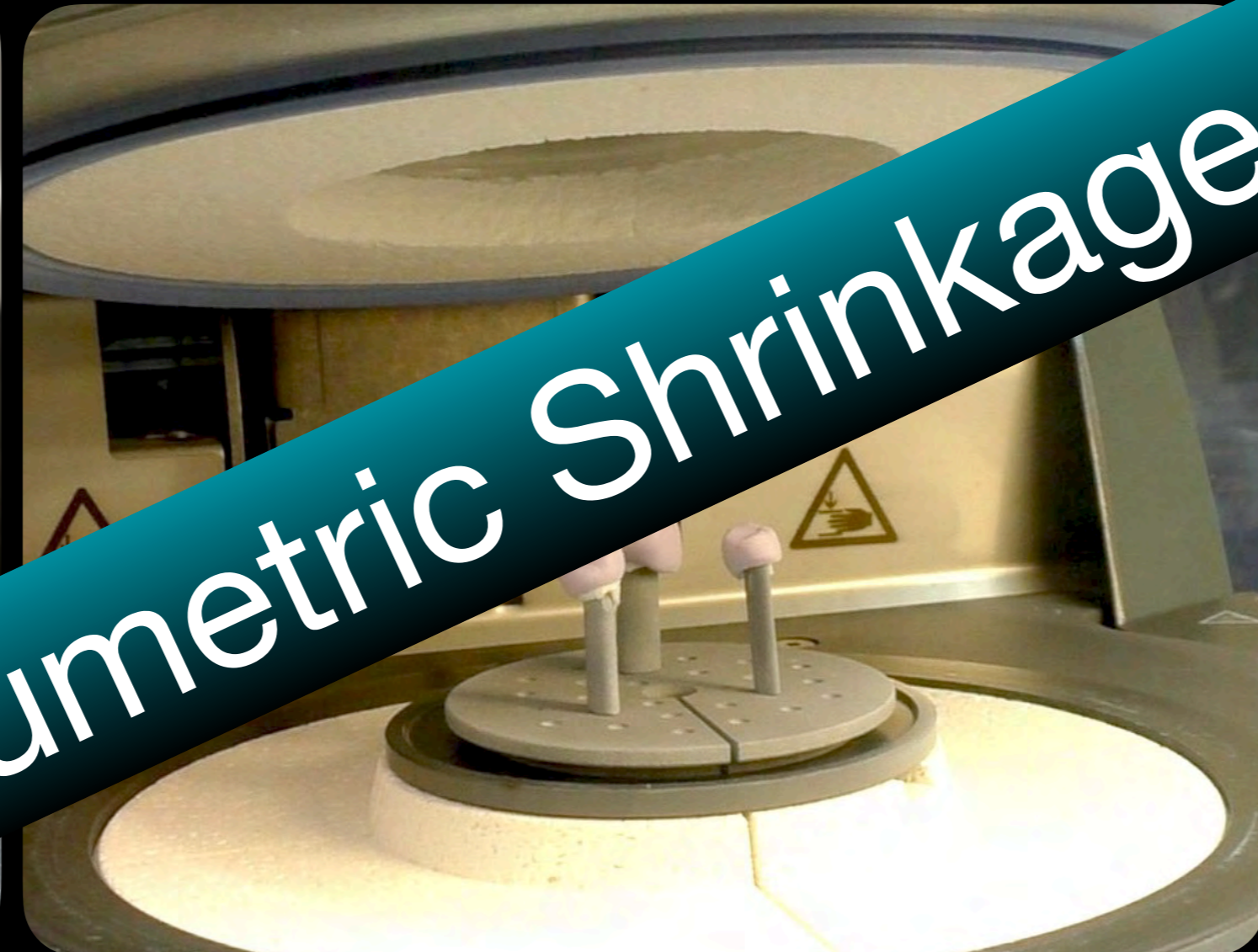
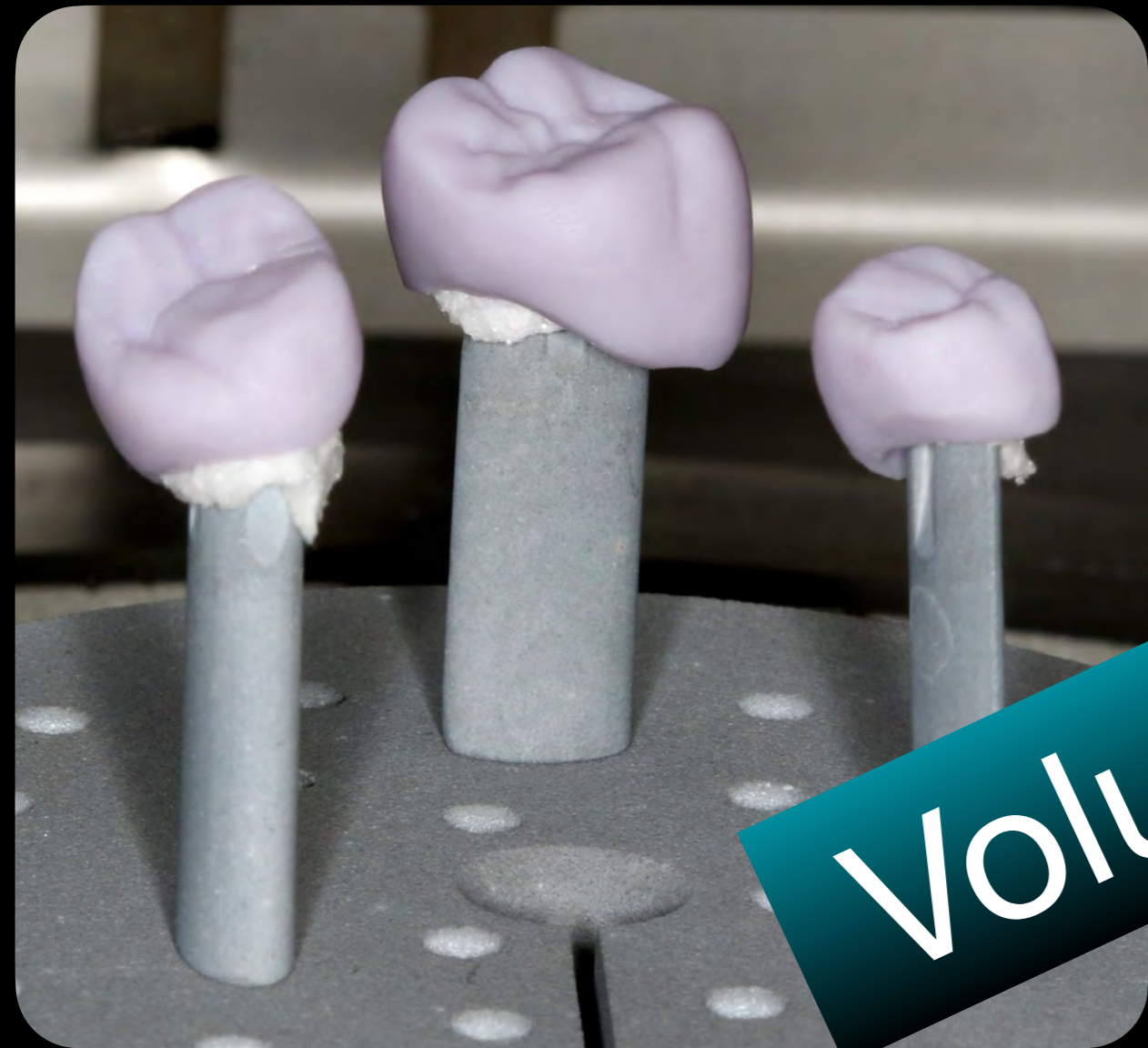
Materials

# Lithium Disilicate



# Crystallization

Volumetric Shrinkage = 0%



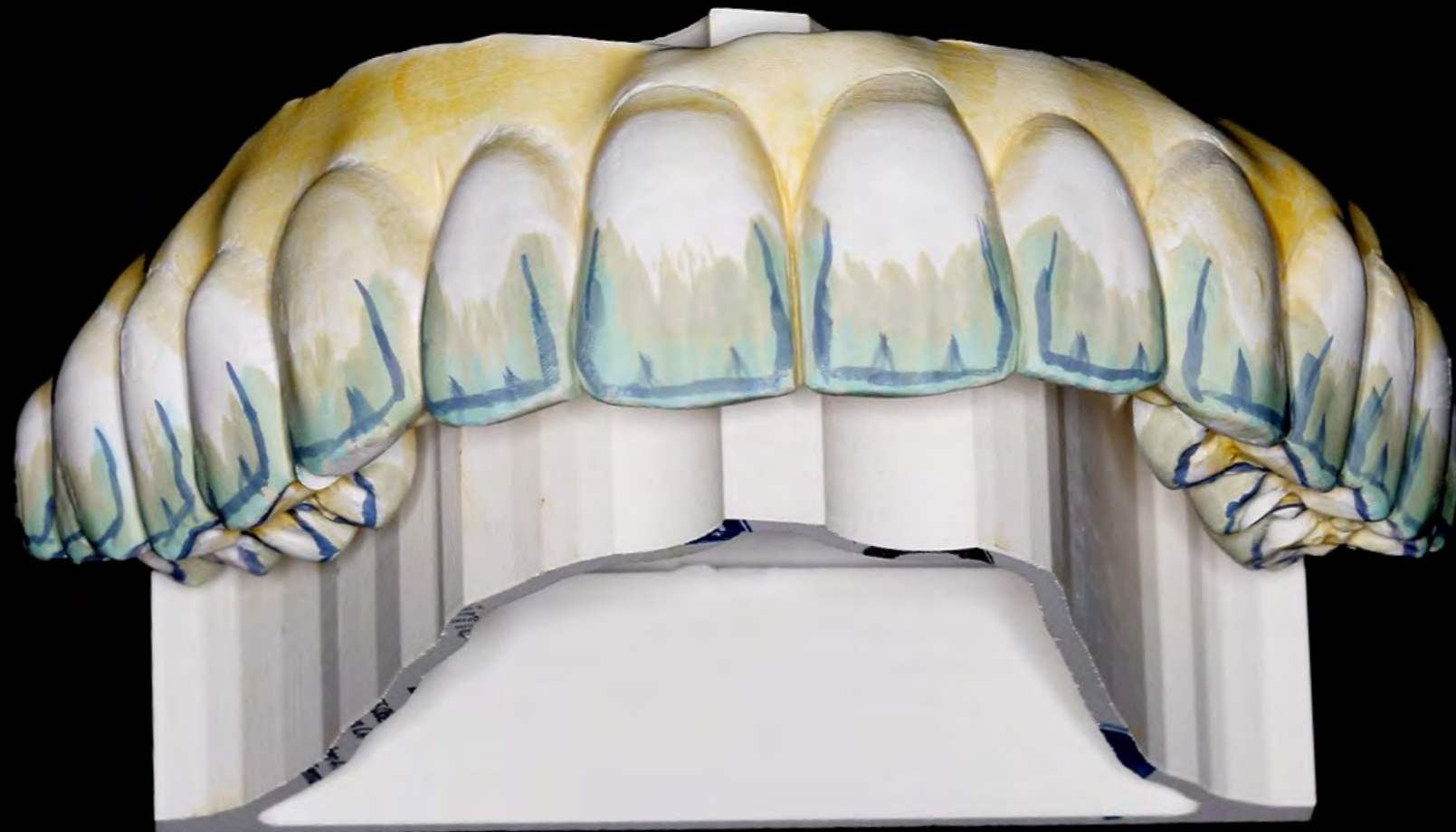




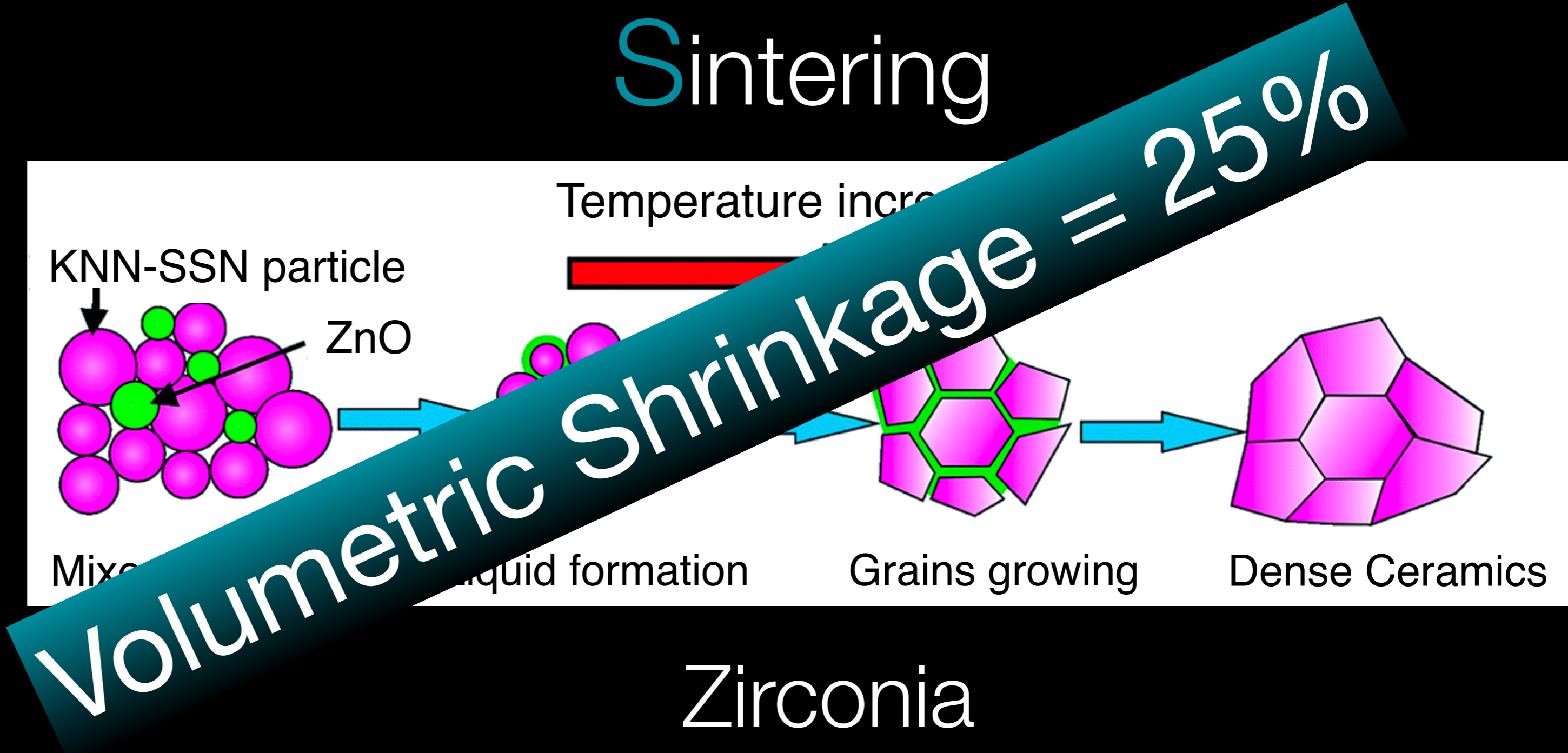


Veneered LD<sub>2</sub>

# Zirconia



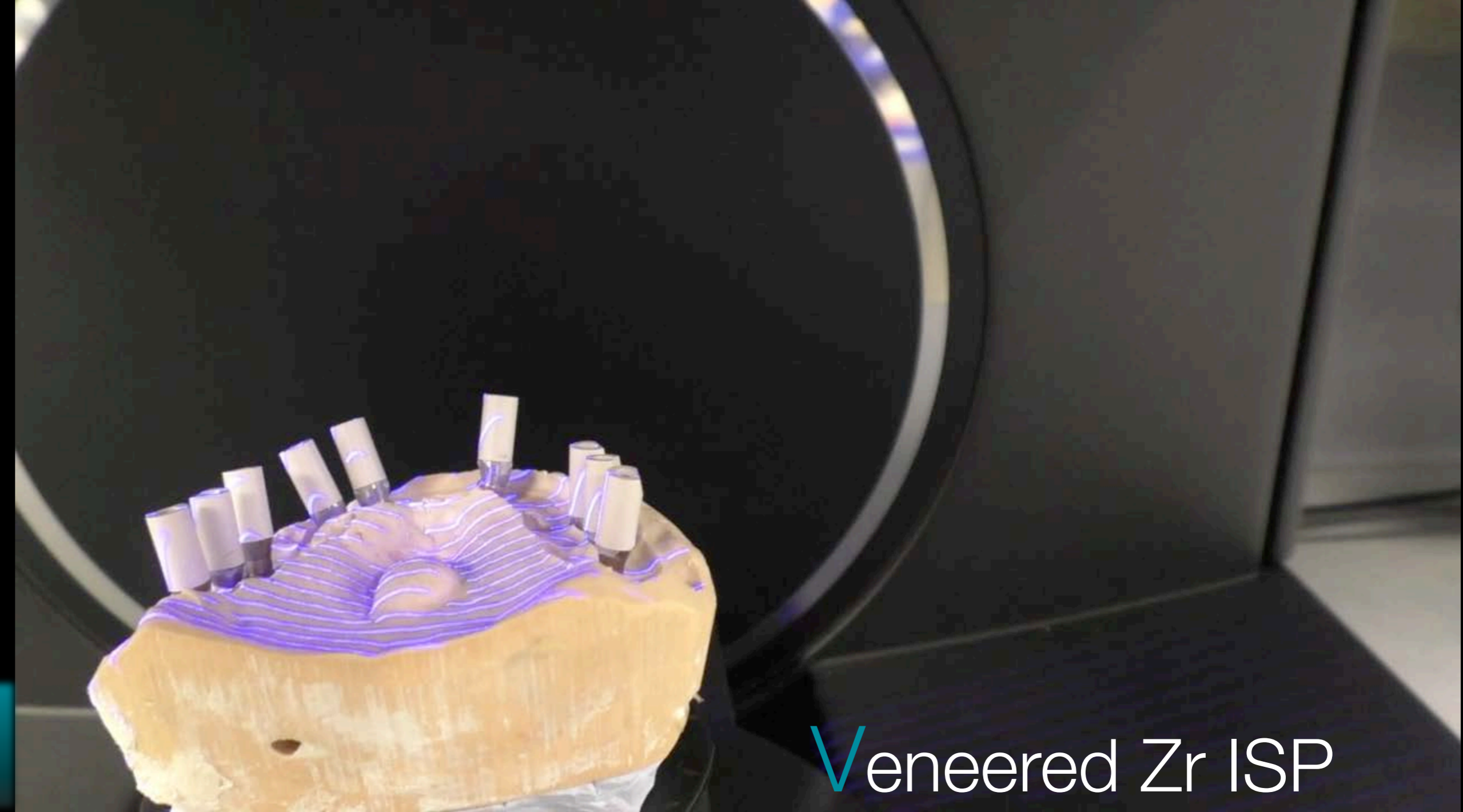
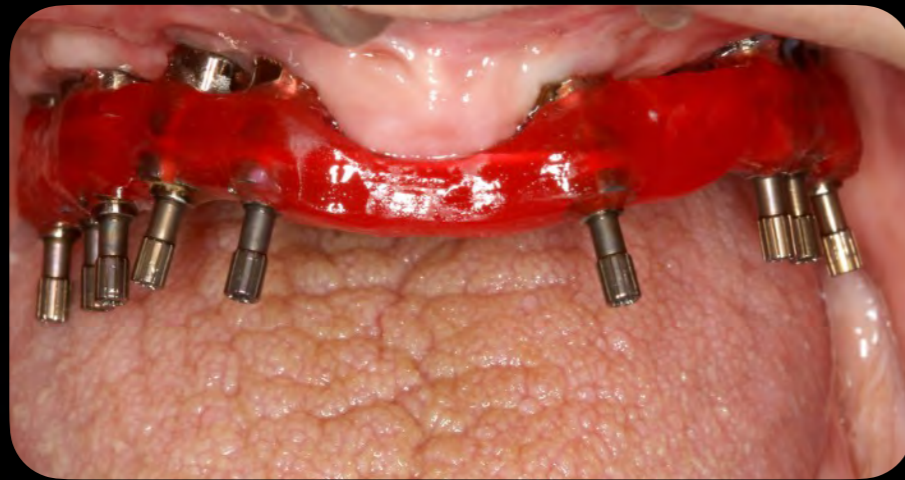
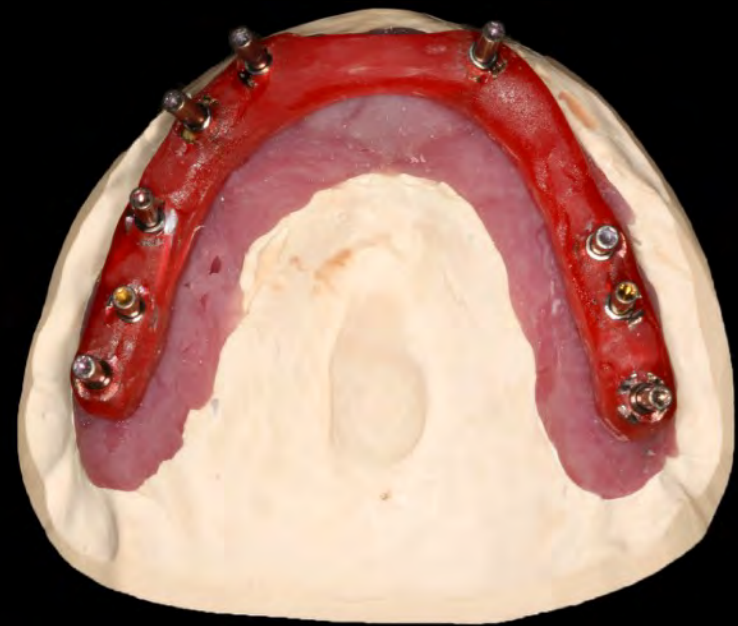
# Sintering



Zirconia

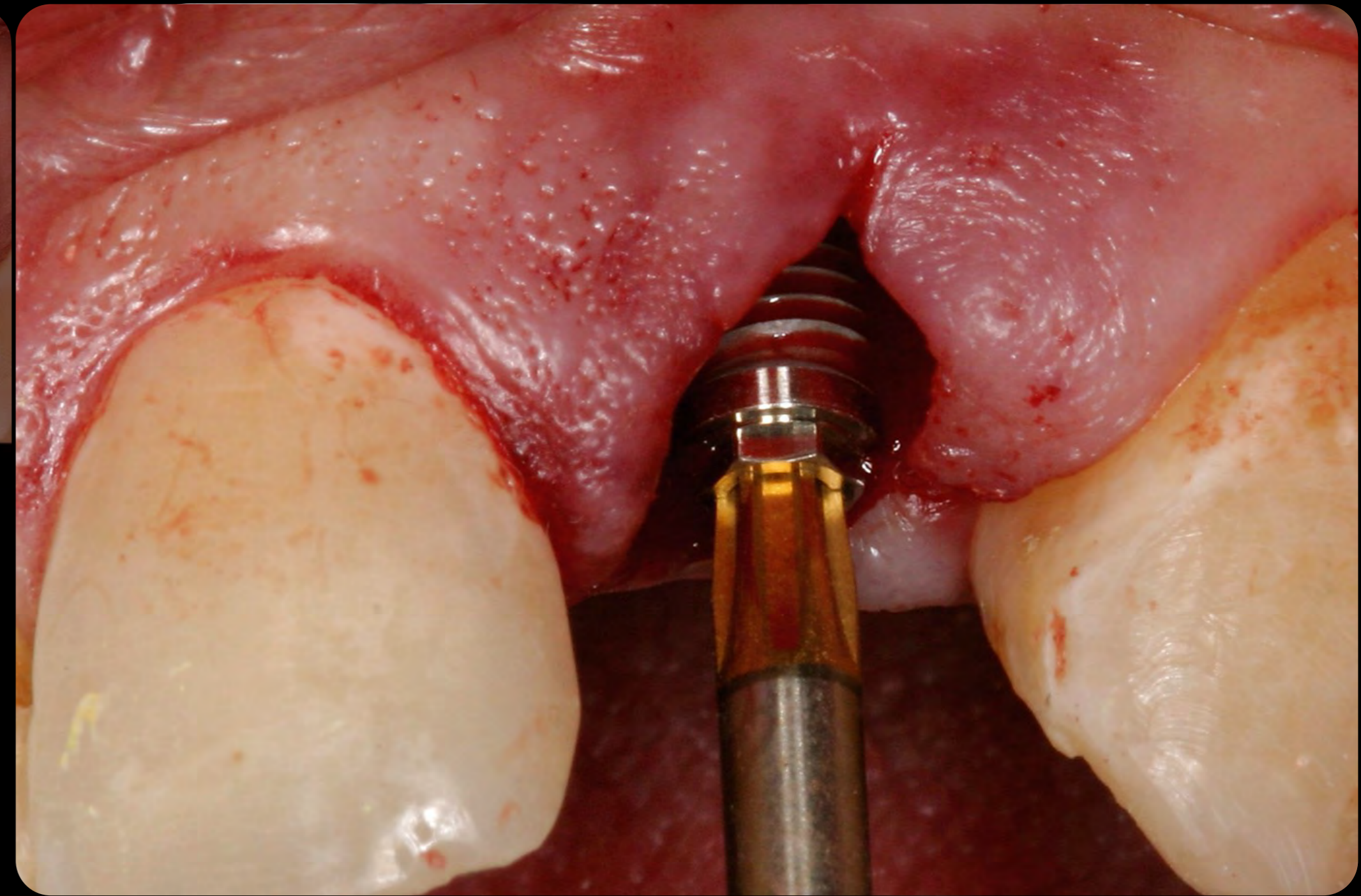


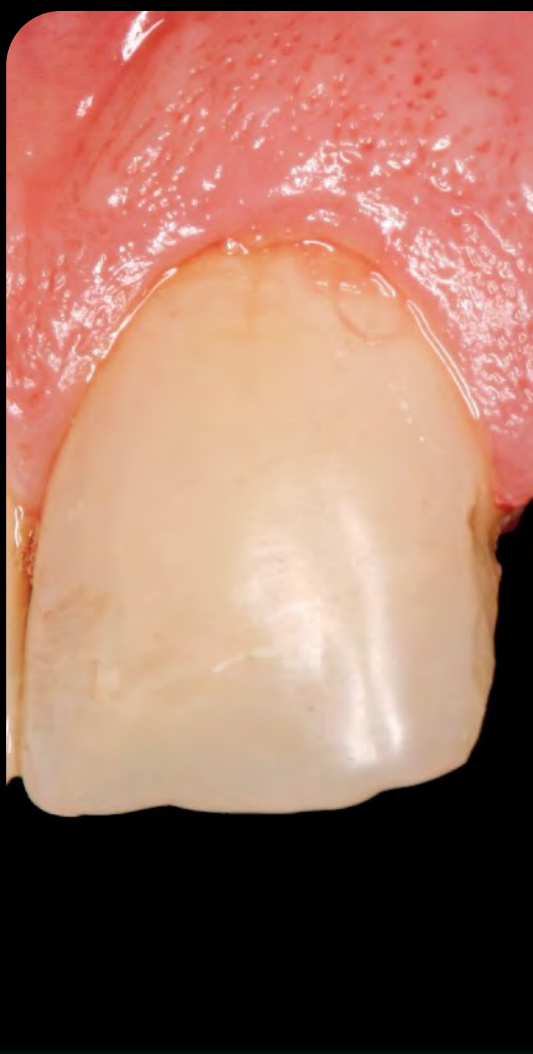
# Verification Jig



**Kim, KR, et al.** Conventional open-tray impression versus intraoral digital scan for implant-level complete arch impression. *J Prosthet Dent* 2019;122(6):543-549.

Veneered Zr ISP





**Tallarico, M, et al.** Definitive abutments placed at implant insertion and never removed: is it an effective approach? A systematic review and meta-analysis of randomized controlled trials. *J Oral Maxillofac Surg* 2018;76:316-324.

**Canullo, L, et al.** Clinical Considerations on Strategies That Avoid Multiple Connections and Disconnections of Implant Abutments. *Int J Periodontics Restorative Dent* 2020;40:9-17.





PMMA



# *Roadmap*



*Technology Selection*

*Why Digital?*

*Technology Evaluation*

# T Technology Selection Considerations

- 3-5 Year Lifecycle & Payoff
- Open System for Future Expansion & Flexibility
- Speed, Accuracy, Reliability, & Support
- Develop a More Efficient Workflow & Archival System
- Faster Laboratory Turnaround Time

# Investment

36 Month Lease at 3.5% Annual Interest

Monthly Payment = \$2,637

Technology Cost w/ Interest = \$94,939

Licensing Fees (\$2300/yr x 3 yrs) = \$ 6,900

Additional IT Cost (\$300/mo x 36 mos) = \$10,800

Hidden Expenses (\$500/mo x 36 mos) = \$18,000

**Total Investment = \$130,639**

Intraoral Scanner	\$35,000
3D Printer	\$10,000
Milling Machine	\$35,000
Ceramic Furnace	\$10,000
Technology Cost	\$90,000

# Income & Savings

Two Crowns/Month  
(2 @ \$2000 ea/mo x 36 mos) = \$144,000

Supply Costs Savings  
(\$500/mo x 36 mos) = \$ 18,000

---

Total Income & Savings = \$162,000

Total Investment = -\$130,639

Net Profit = \$ 31,361

# Return on Investment

=  $\frac{\text{Net Profit}}{\text{Total Investment}} \times 100\%$

=  $\frac{\$ 31,361}{\$130,639} \times 100\%$

ROI = 24%

# Roadmap



*Integration & Training*

*Technology Selection*

*Why Digital?*

*Technology Evaluation*

# IT Company

*Network  
Technology Consultant  
Cyber Security  
Back Up  
Maintenance  
HIPAA Compliance*

# Vendor

*Install, Training, & Support*

# Internal IT

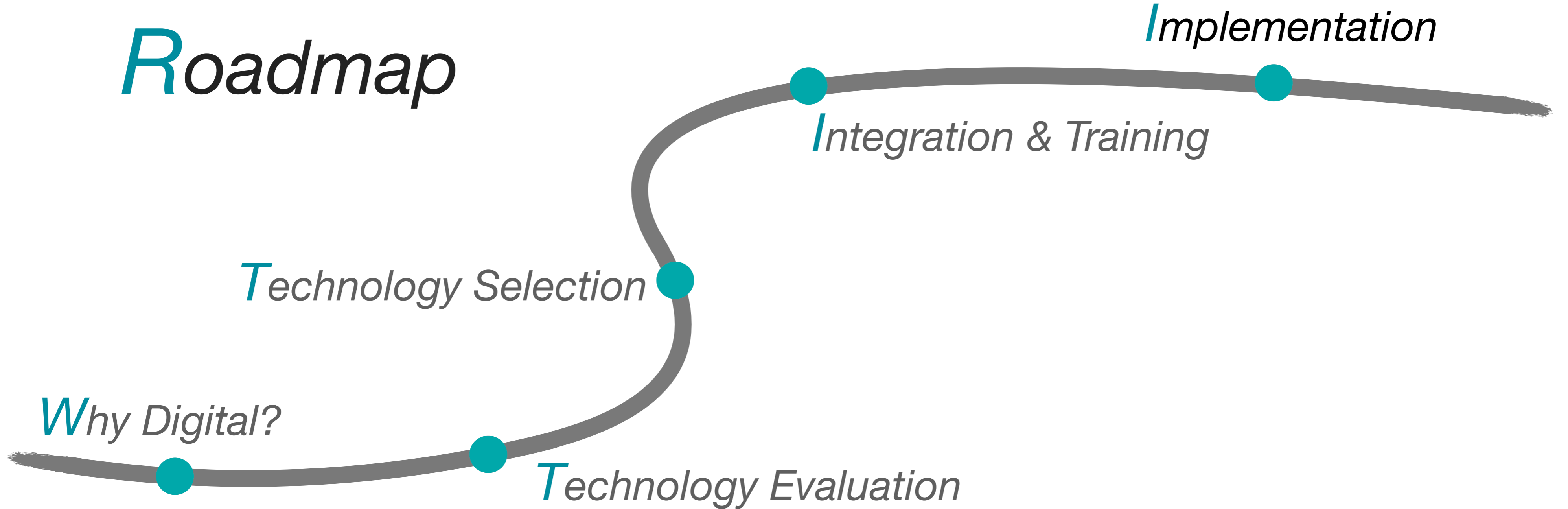
*Technology Manager  
Troubleshooting  
Staff Training*

# Integration & Training

*Laboratory/Milling Center  
Design, Planning, & Fabrication*



# Roadmap





Teeth

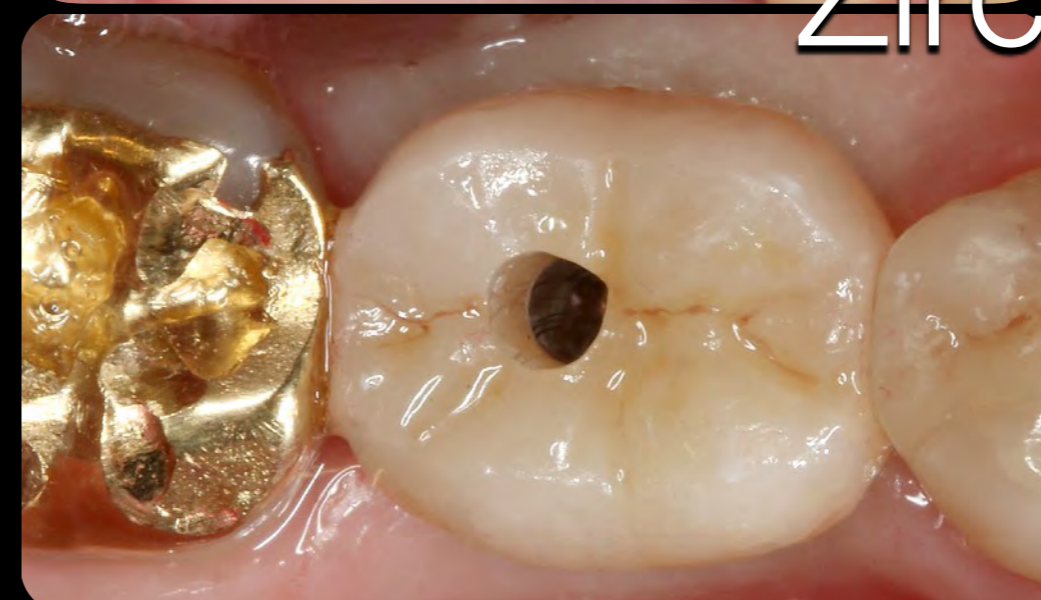
Posterior

Implants

Lithium Disilicate

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t  
h  
i  
c

Zirconia



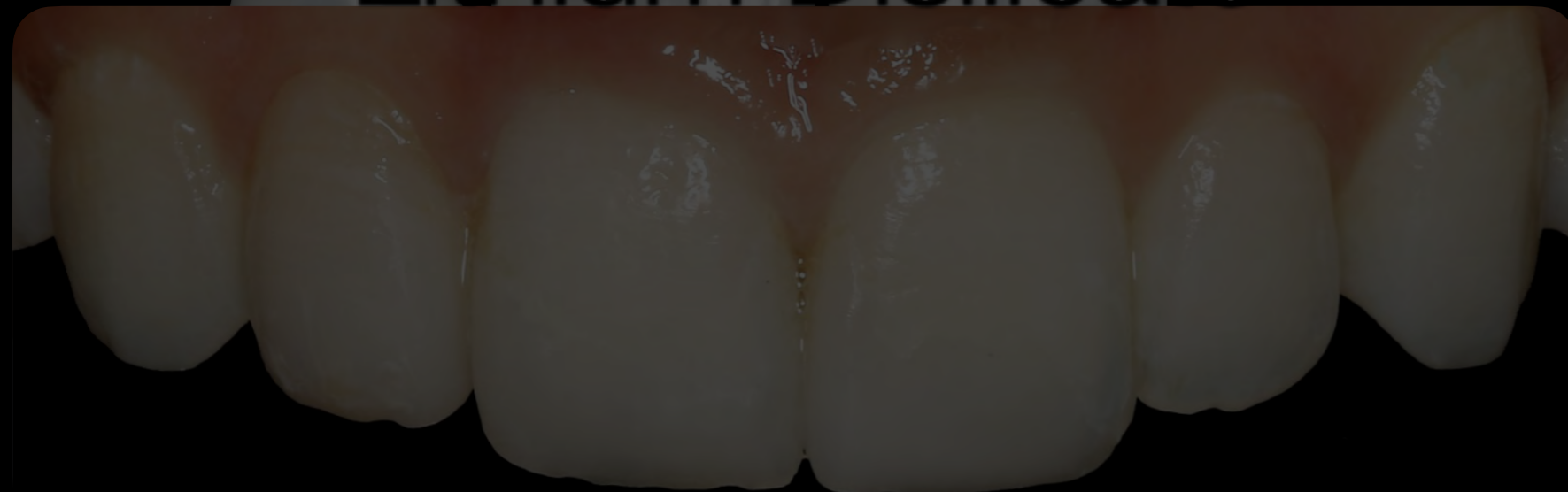
Teeth

Aesthetic Zone

Implants



Lithium Disilicate



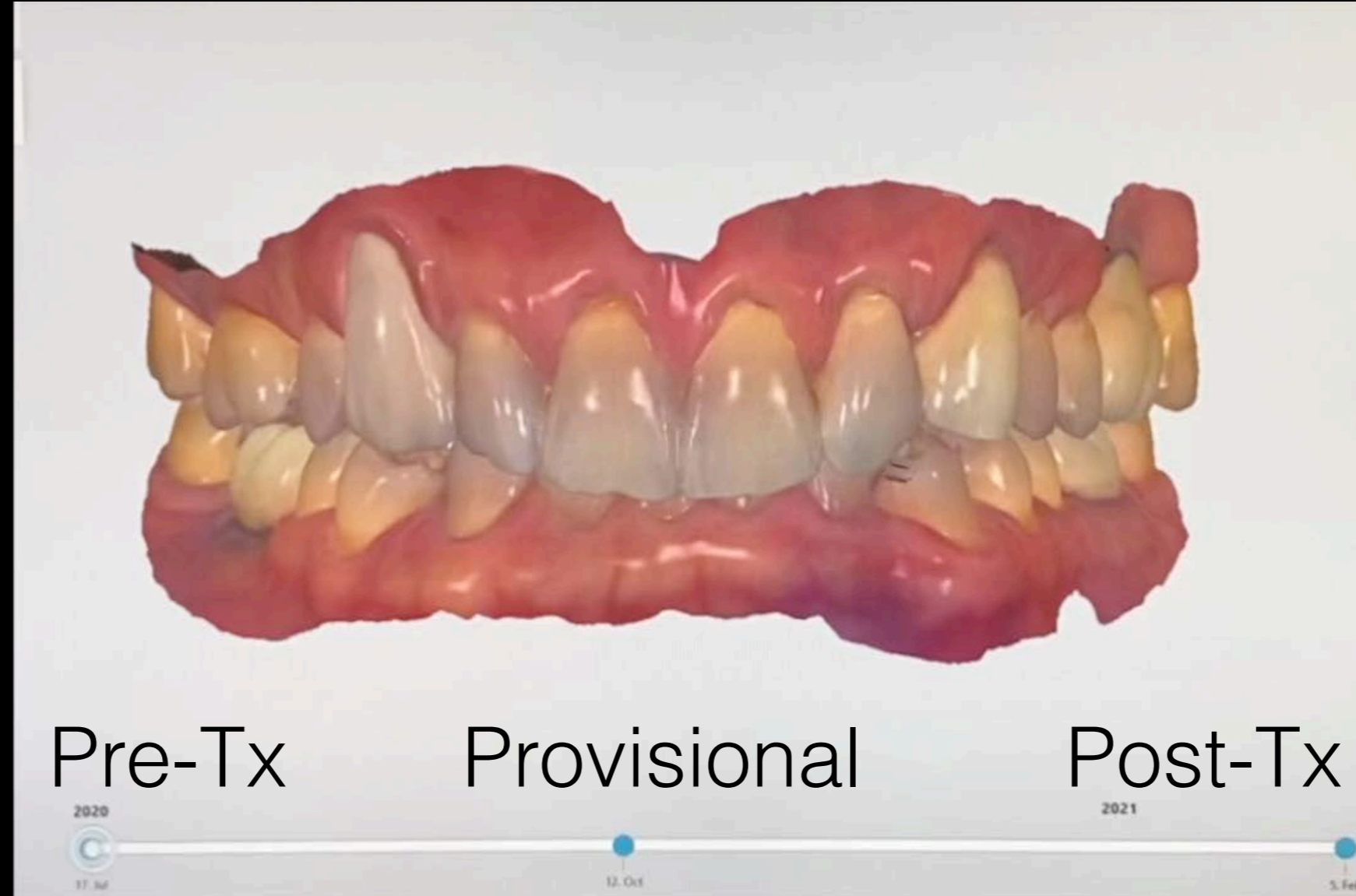
V  
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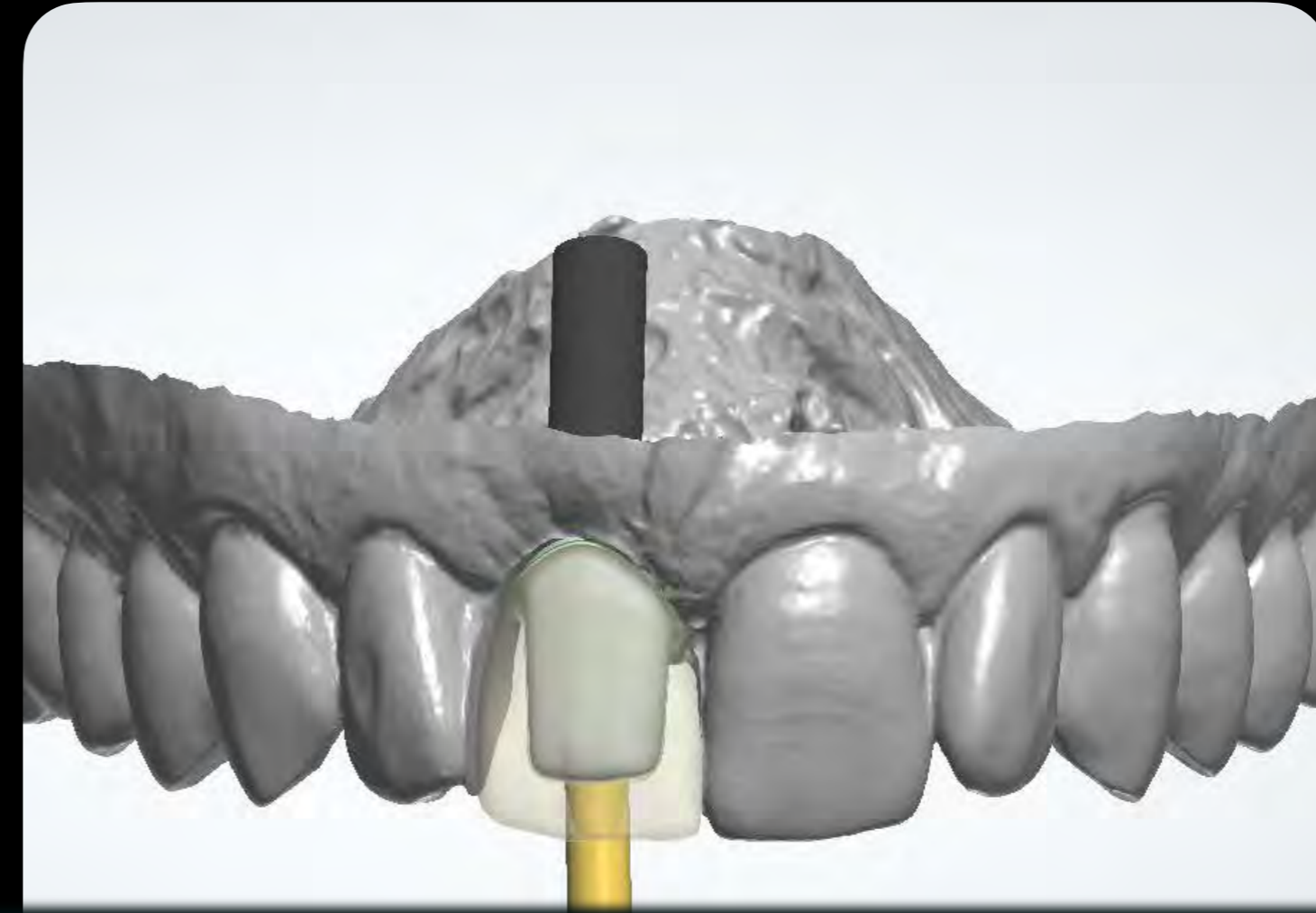
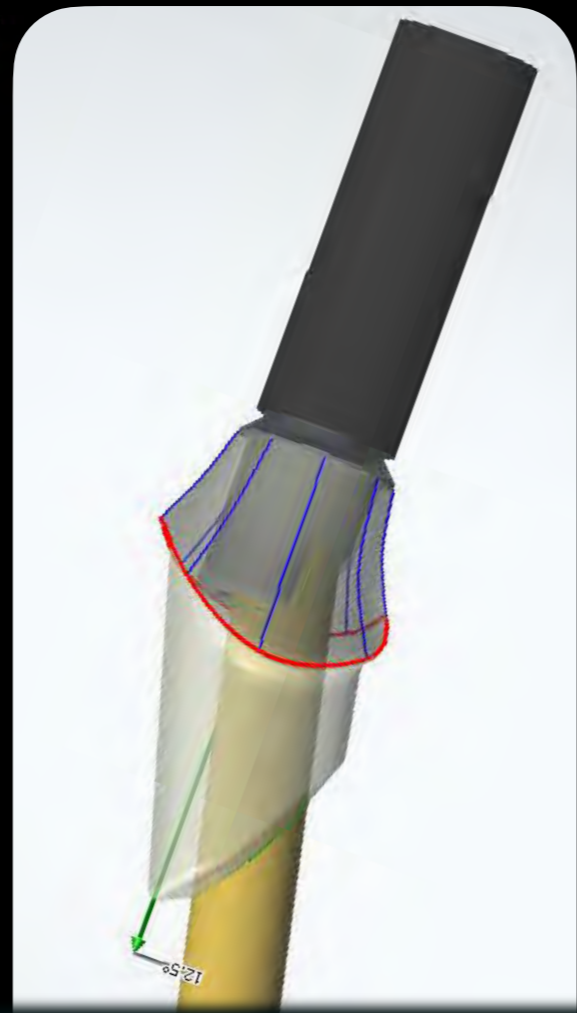
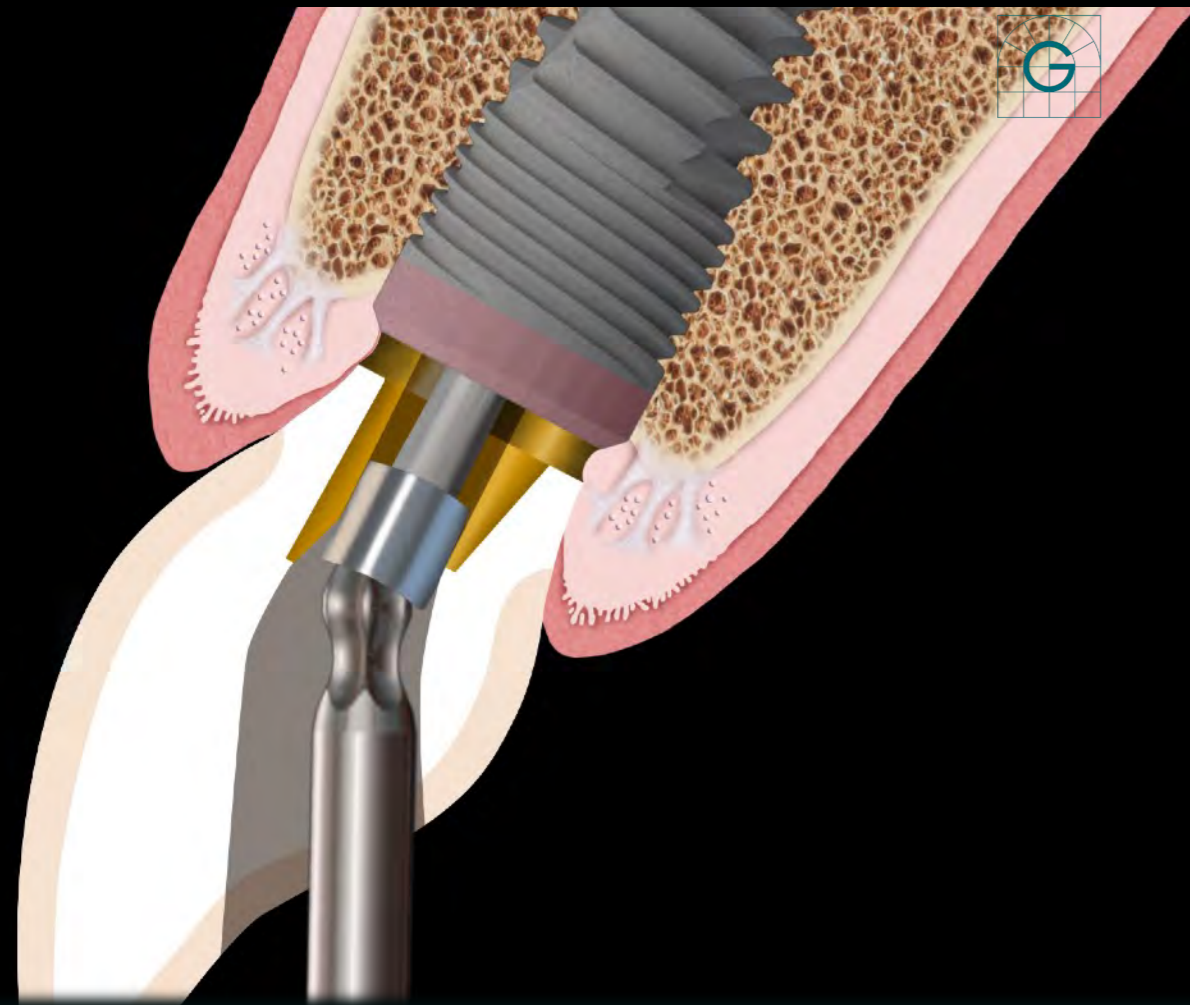
Zirconia



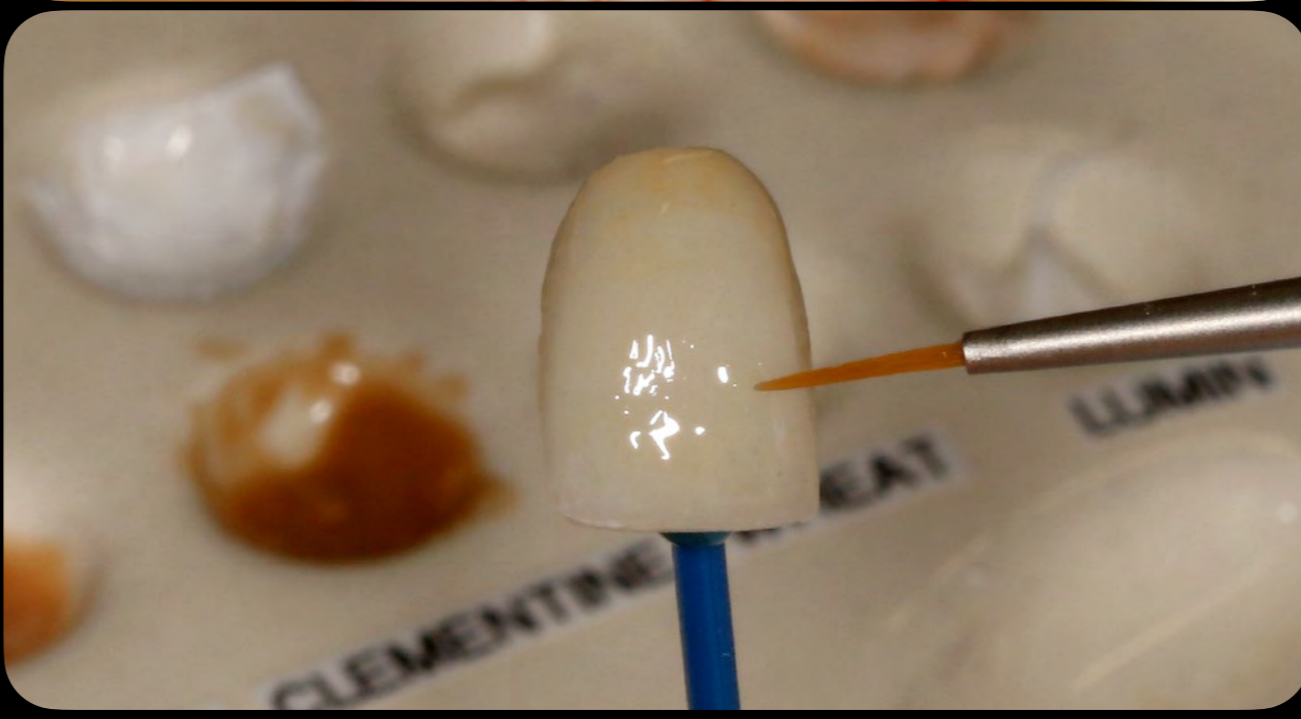
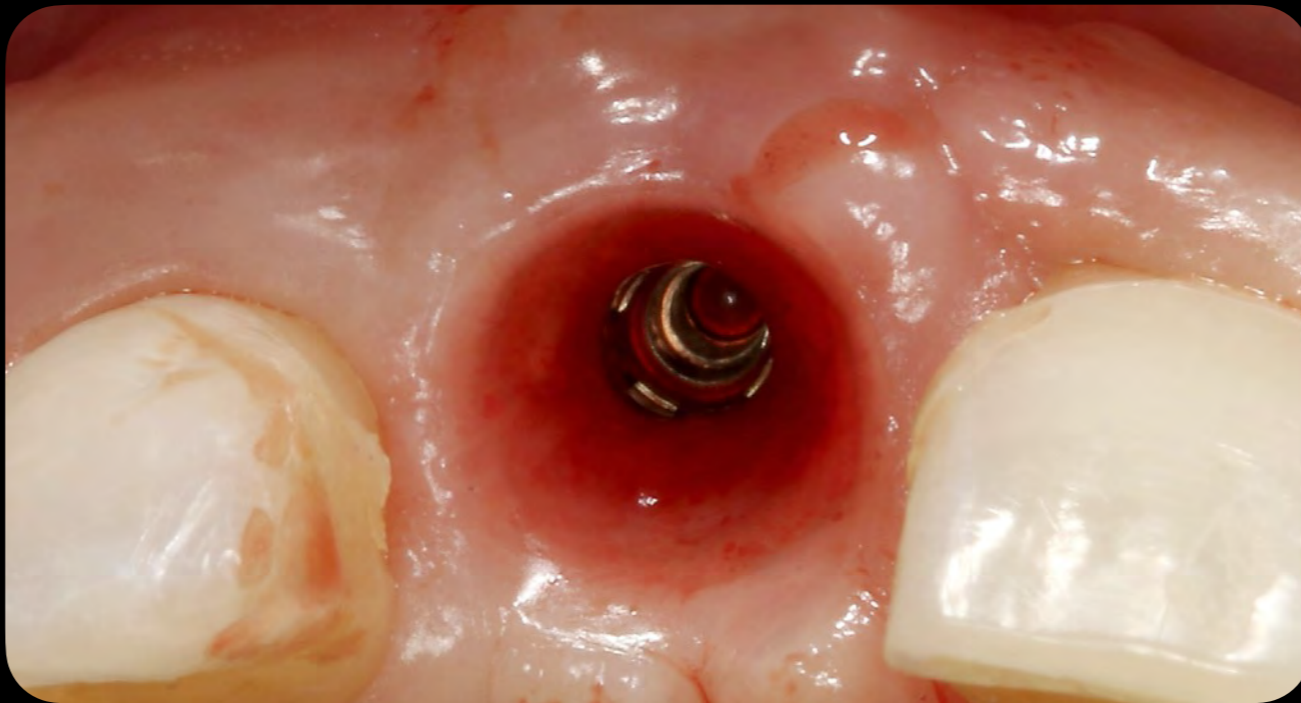
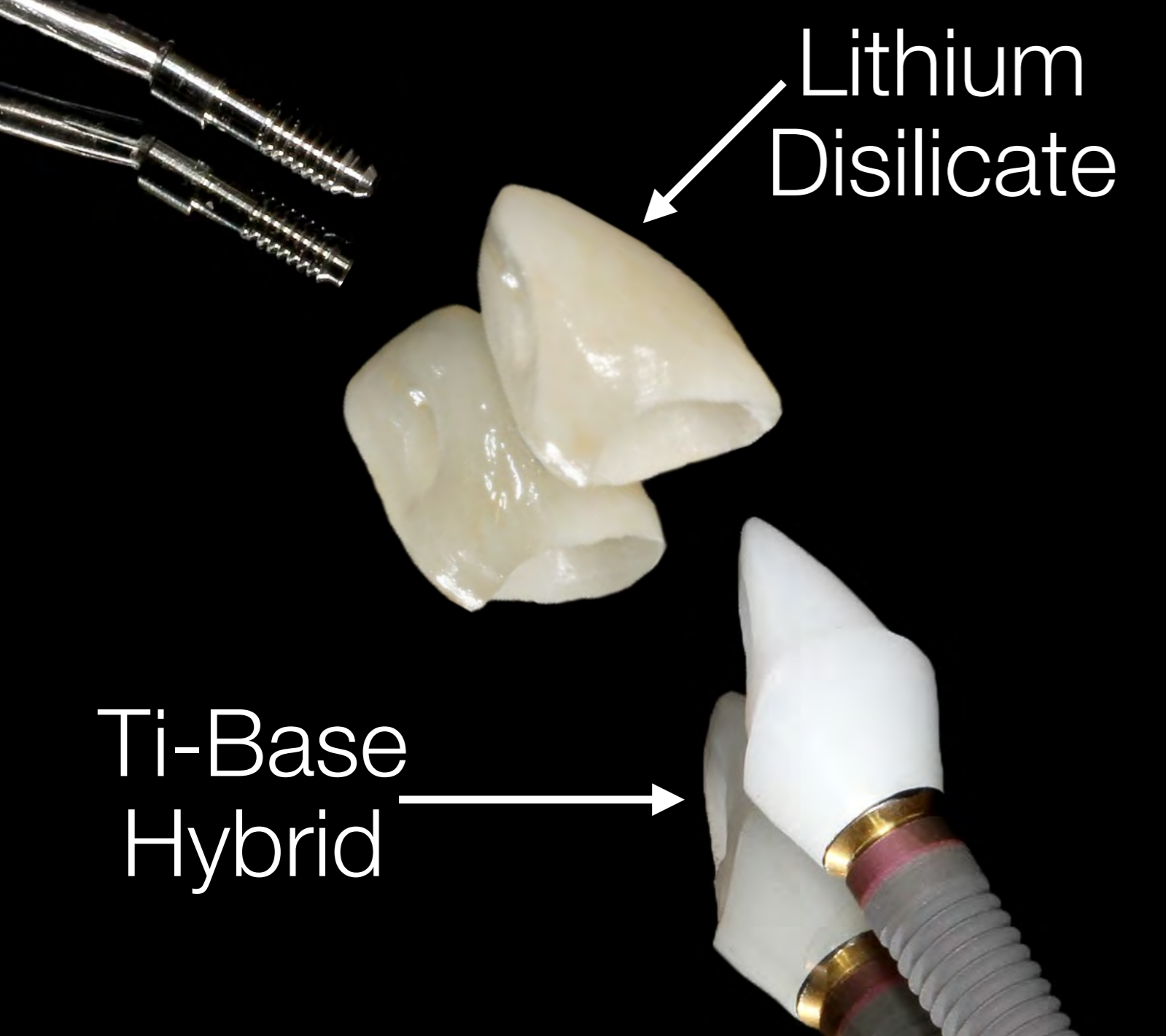
# Monitoring



# Angulated Screw

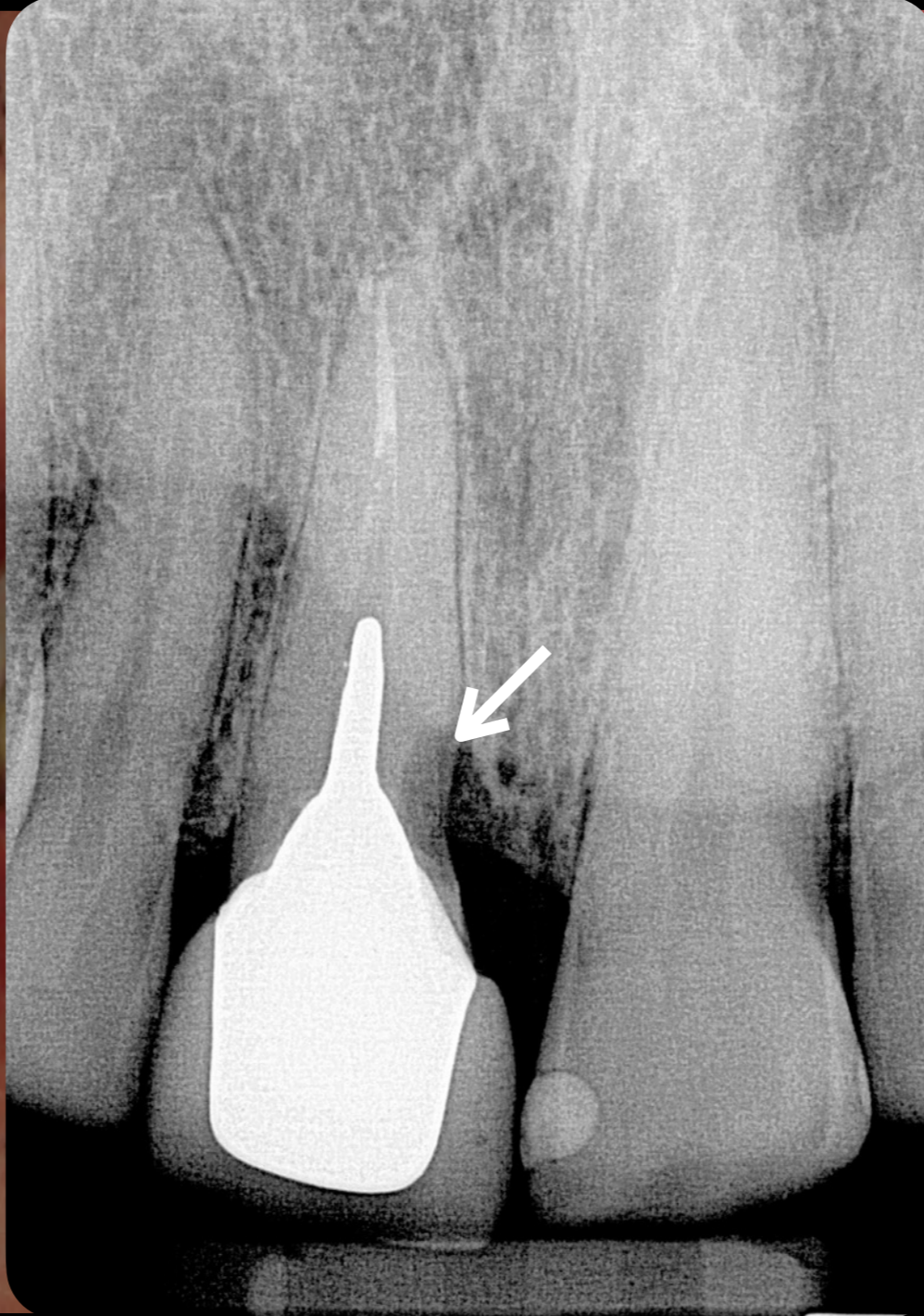


Hu E, et al. Effect of Screw Channel Angulation on Reverse Torque Values of Dental Implant Abutment Screws. J Prosthodont 2019;28(9):969-72.



← Prosthetic Screw









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Implant planning

Implant on tooth 8

Keystone | Select implant

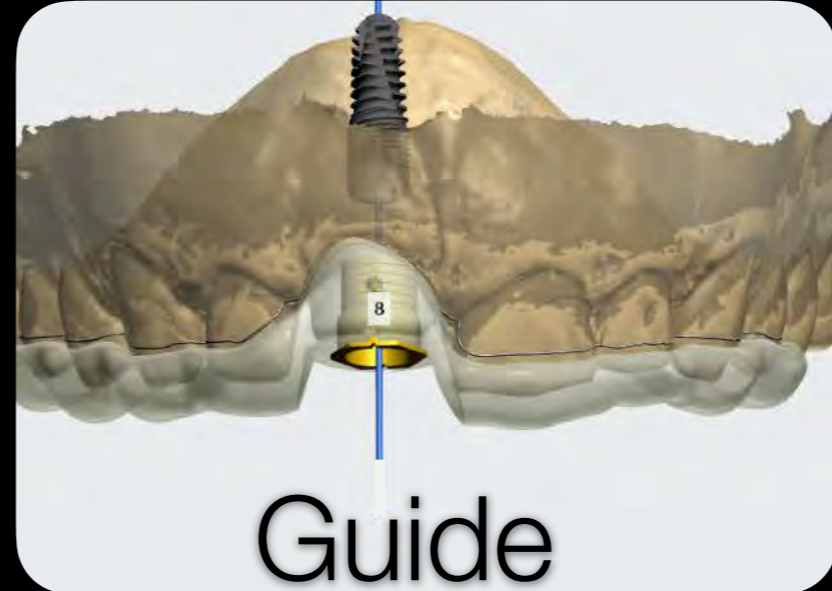
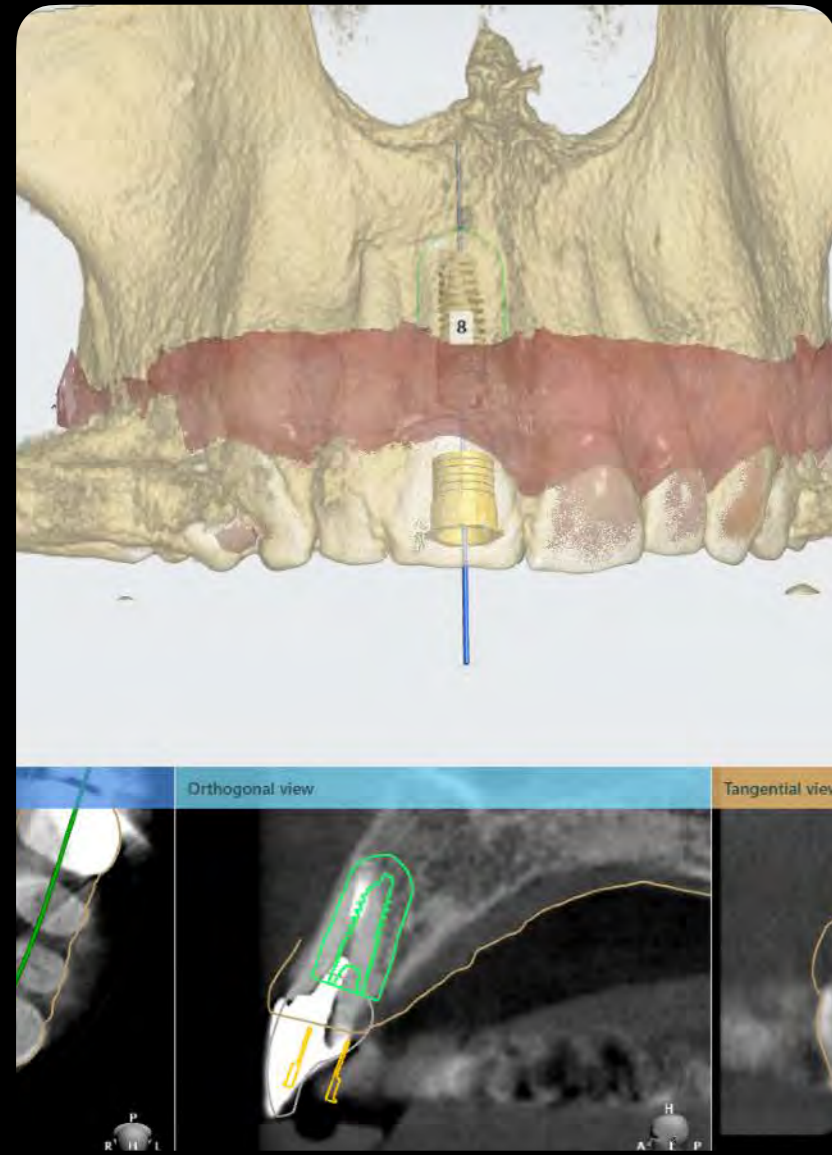
Implant

Genesis Tapered   Prima Plus   Prima Connex Tapered   Prima Connex TC Tapered   PrimaConnex Straight

Platform (P) / Diameter (Ø), mm						
	P	RD	SD	WD		
Length, mm	Ø	4.5	3.5	3.8	5.5	6.5
8.5	Ø			Ø	Ø	Ø
10.0	Ø	Ø	Ø	Ø	Ø	Ø
11.5	Ø	Ø	Ø	Ø	Ø	Ø
13.0	Ø	Ø	Ø	Ø	Ø	Ø
16.0	Ø	Ø	Ø			

Additional information:  
 Manufacturer: Keystone  
 System: Genesis Tapered  
 Implant length = 11.5 mm  
 Implant diameter = 3.8 mm  
 Platform: SD  
 Connection: Keystone\_Genesis\_SD  
 Order number: G21132

Orthogonal view   Tangential view

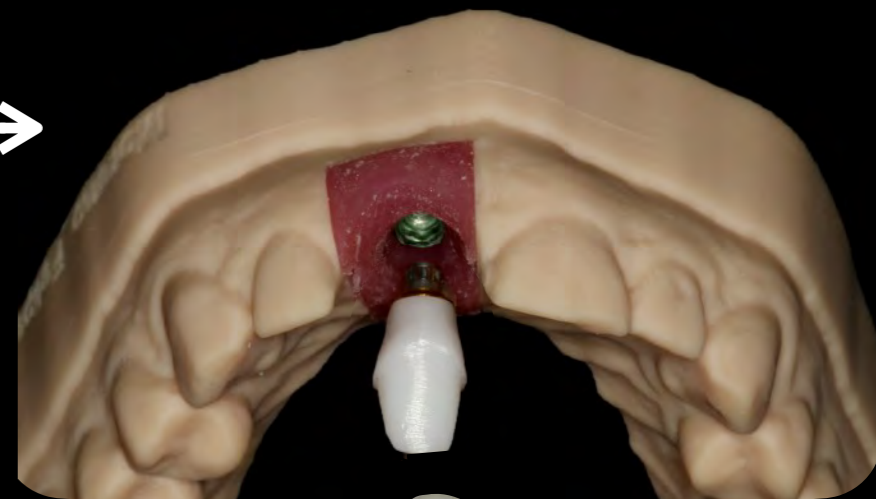


CAD



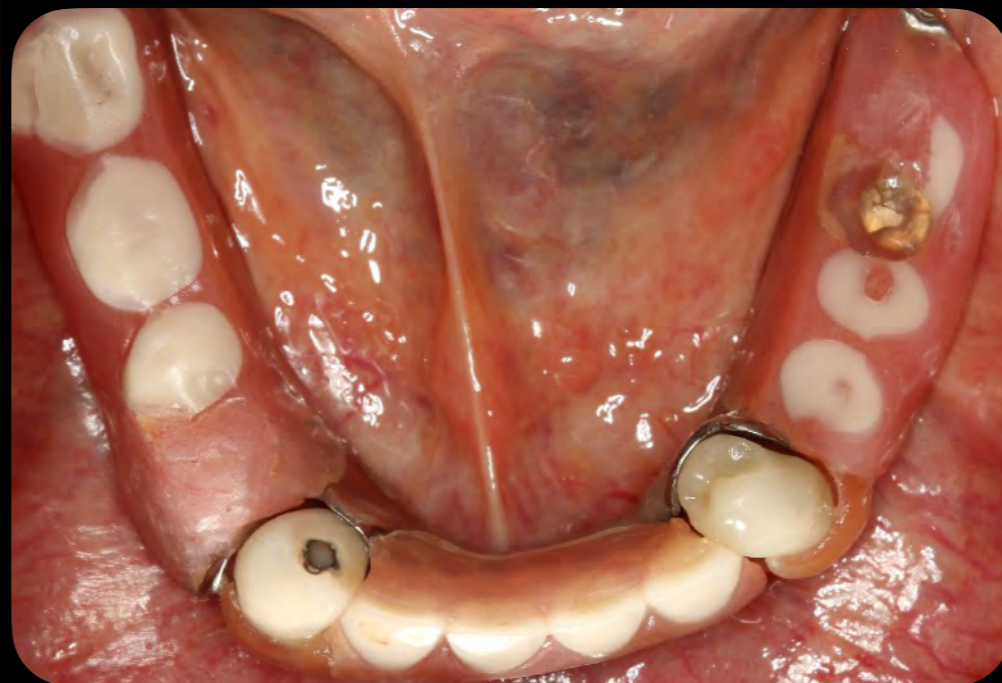
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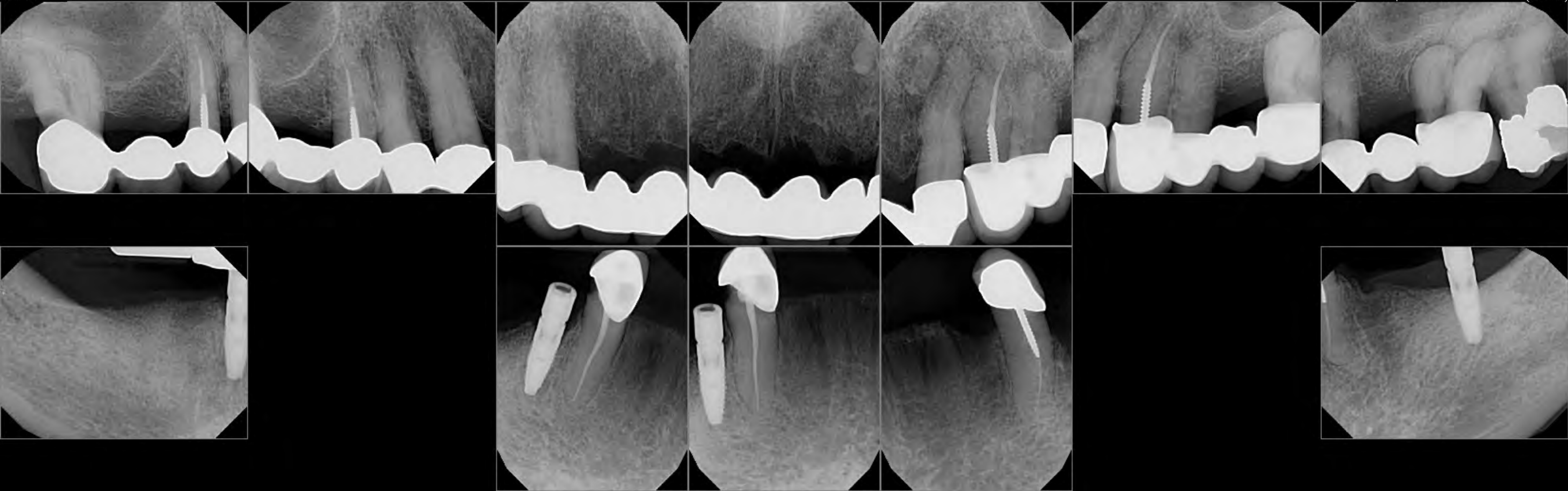
Mill

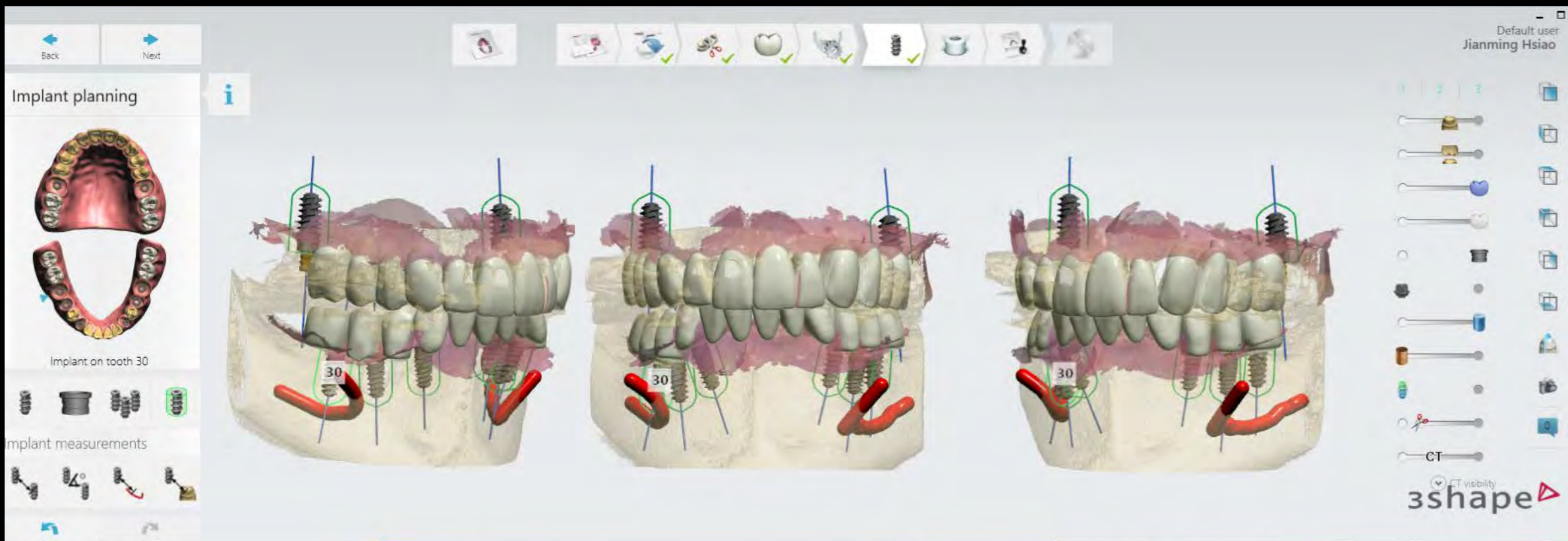




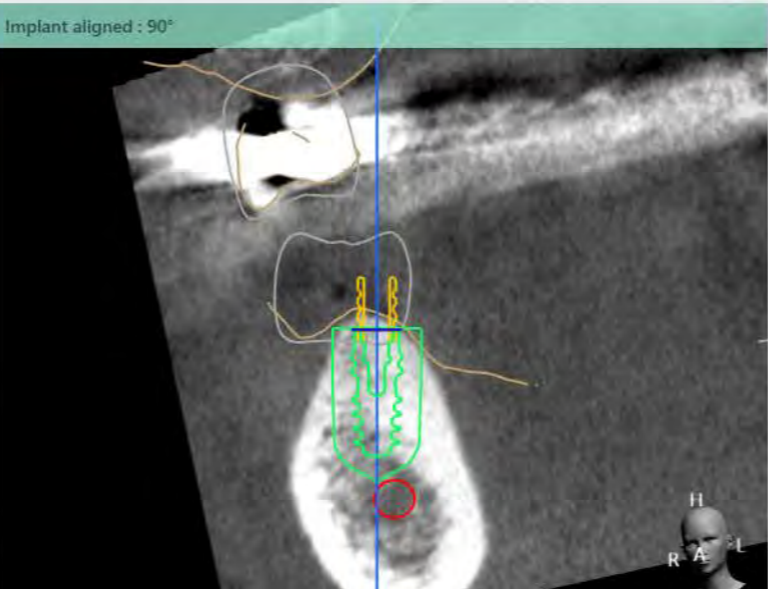
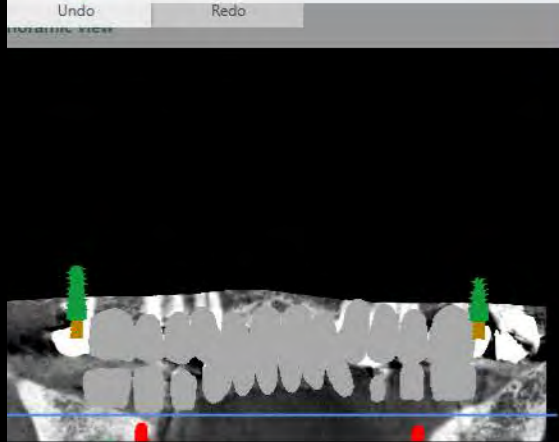
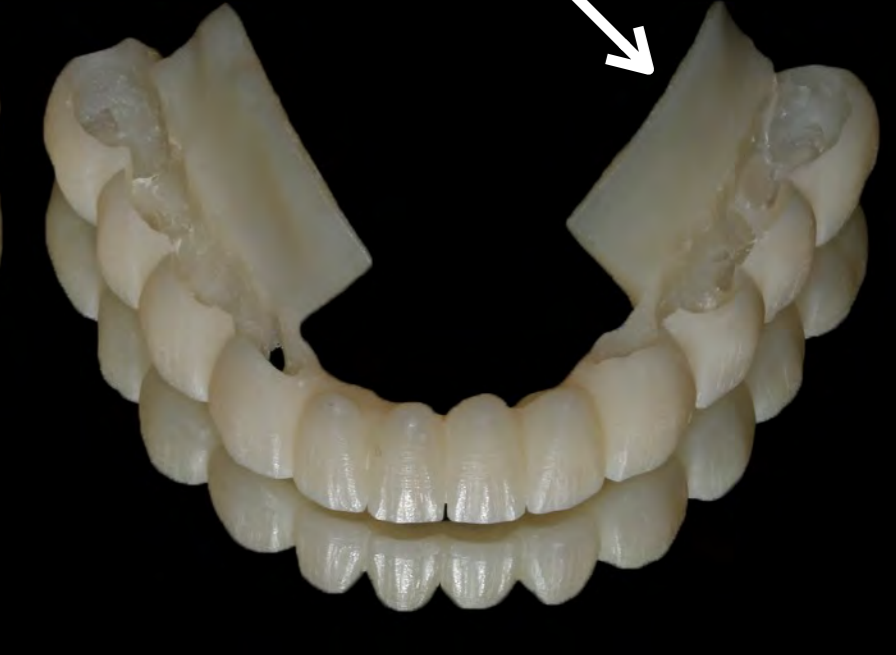






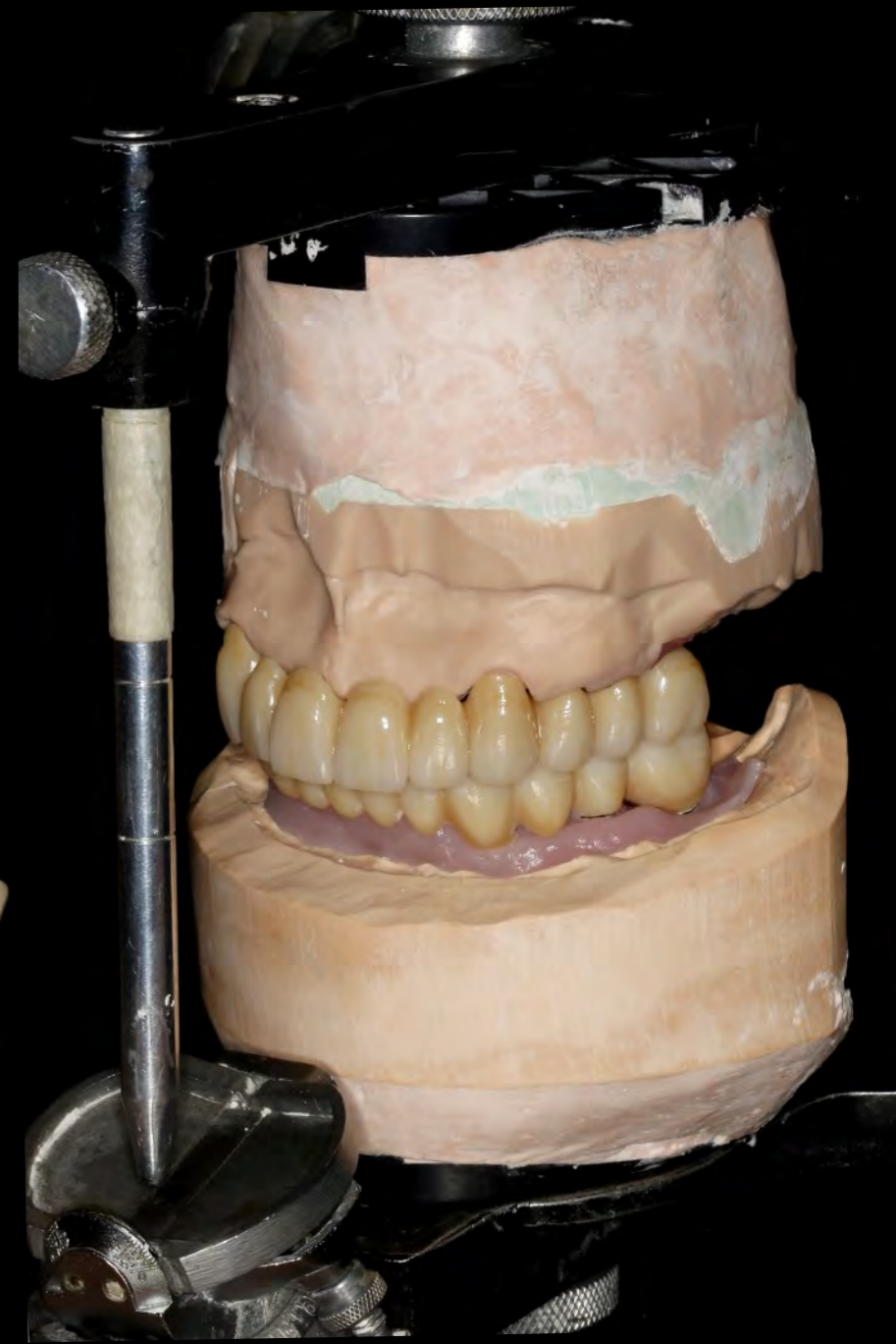


Seating Guides

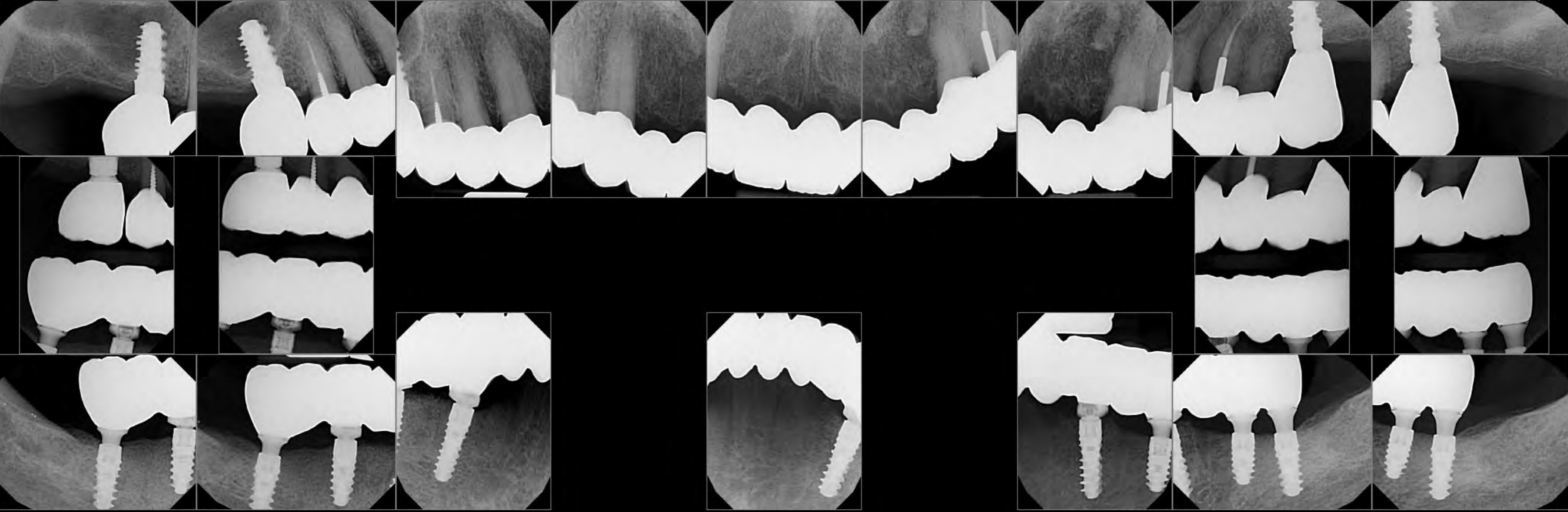












# Take Home Messages

- Convert to digital incrementally.
- Thoroughly research & evaluate the technology.
- Steep digital learning curve.
- Develop a team approach & delegate tasks.

The background is a collage of four images related to digital dentistry. Top-left: A dentist in a blue lab coat and mask works on a patient's teeth. Top-right: A dentist in a blue lab coat and mask uses a handheld device. Bottom-left: A dentist in a blue lab coat and mask works on a patient's teeth. Bottom-right: A dentist in a blue lab coat and mask works on a patient's teeth. The text is overlaid on these images.

*Digital dentistry **will not** replace dentists.*

*Dentists who embrace digital dentistry **will** replace those who don't.*



<https://www.gdental.com/events/>

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