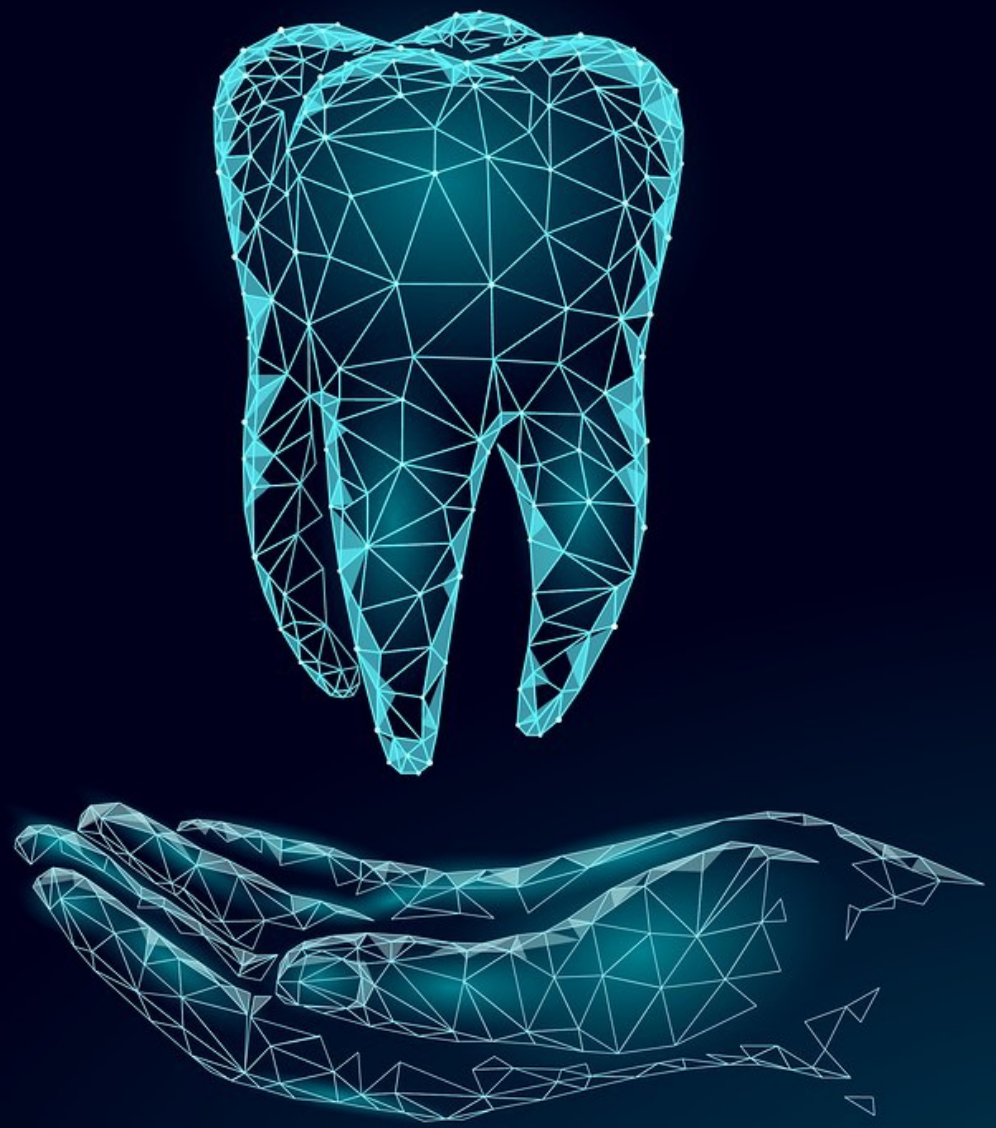
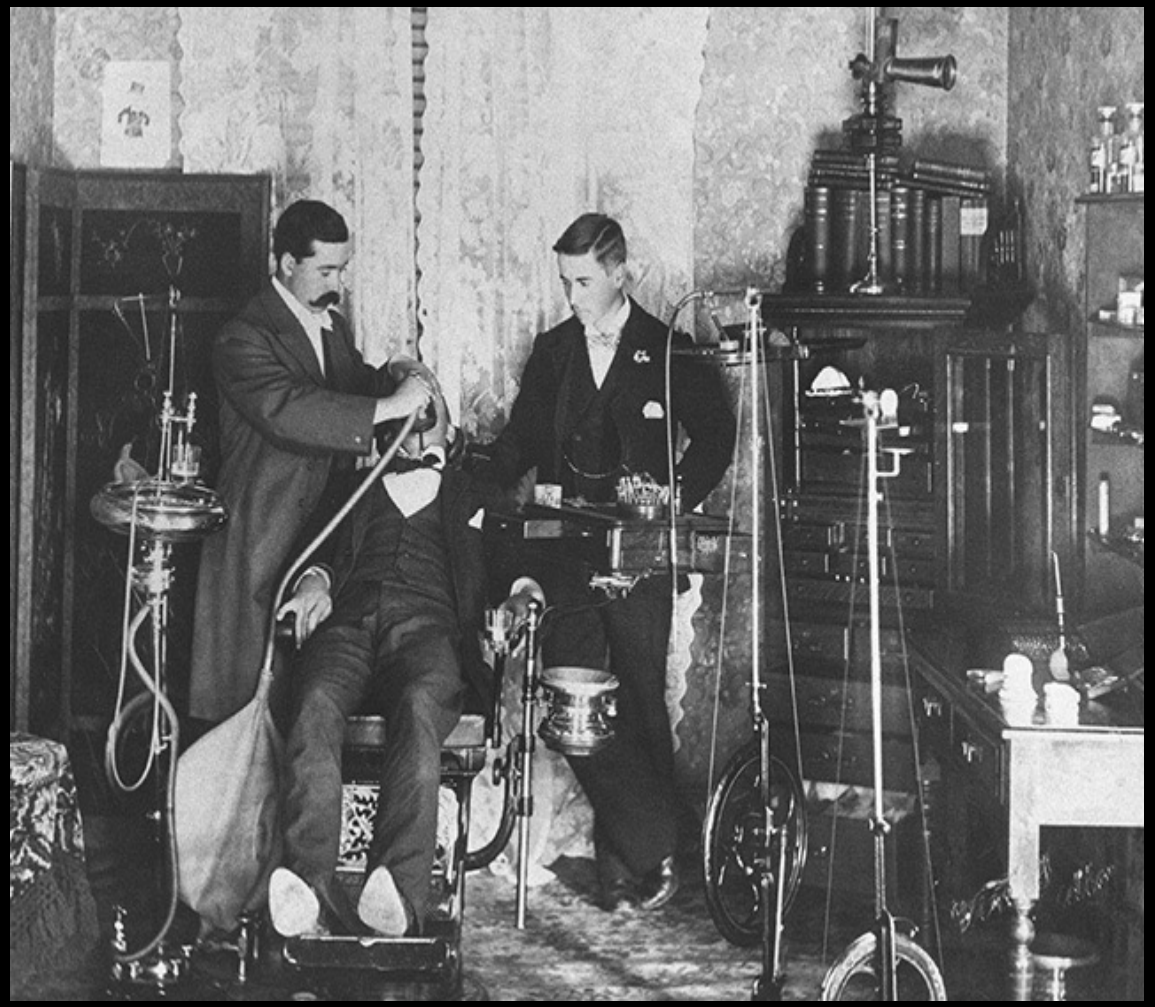
AI in Dentistry



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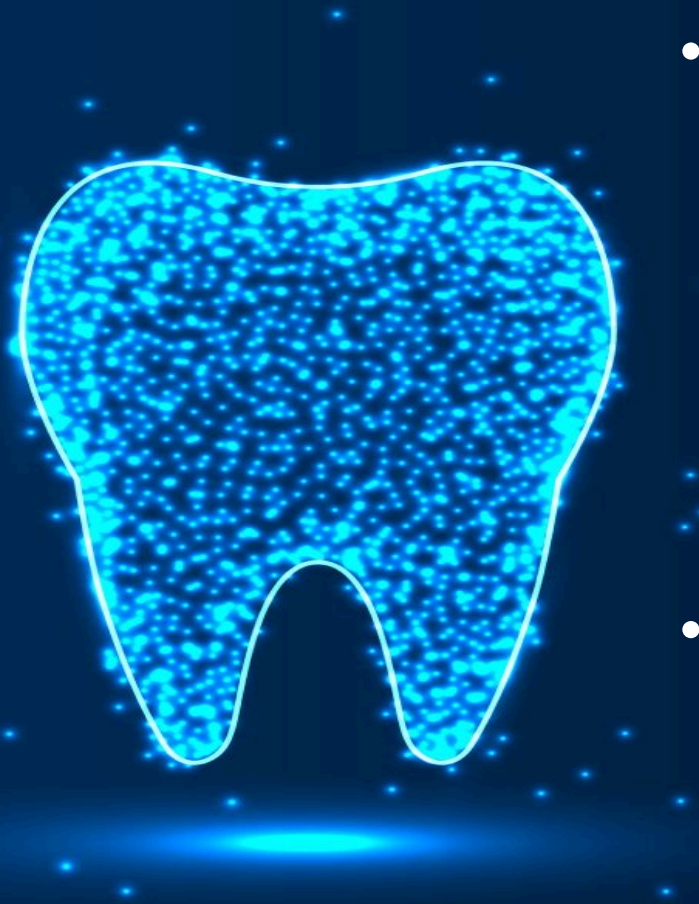
Introduction



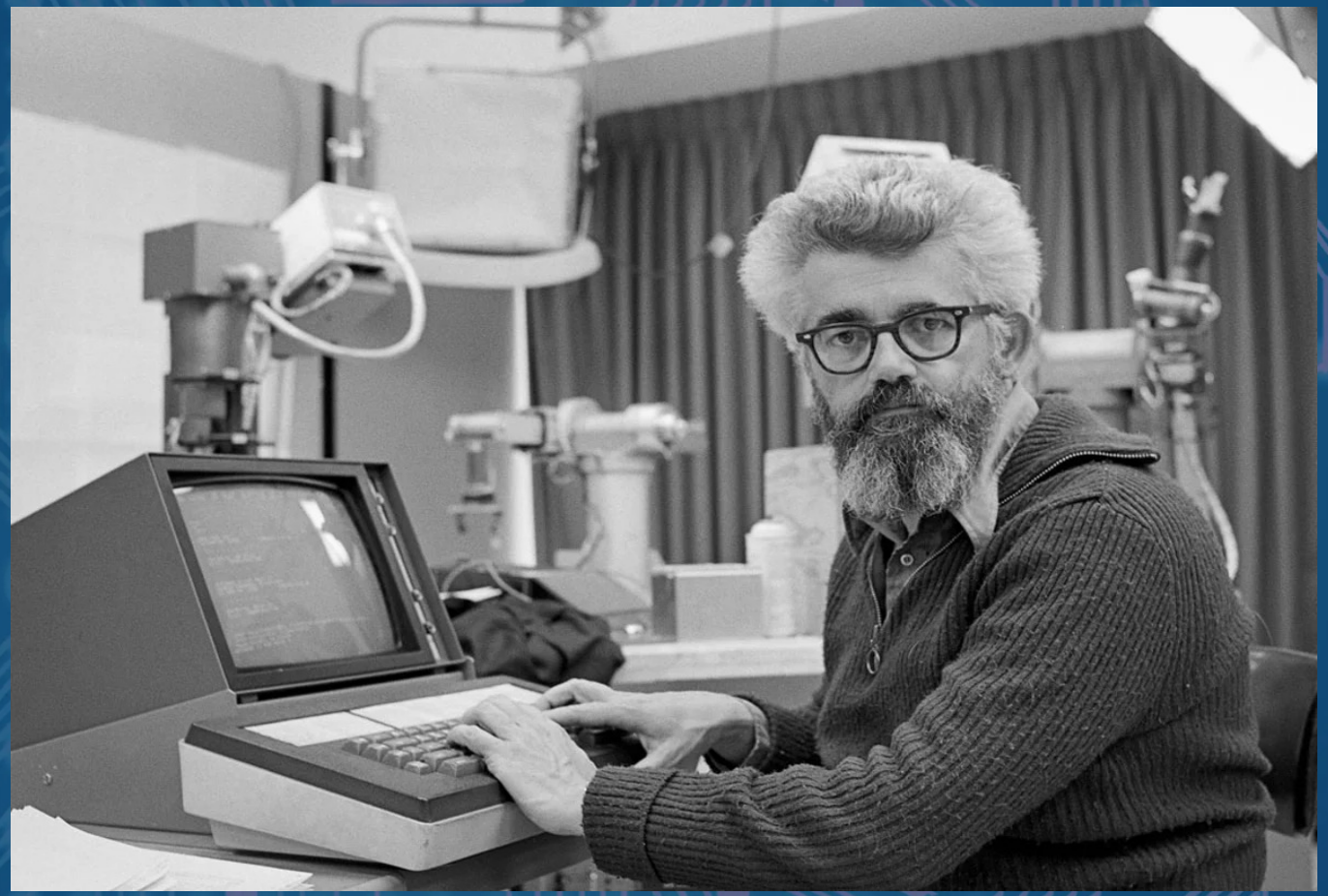
- As dental professionals, it is essential to stay updated with the latest advancements in the field to provide the best possible care to patients. Over the years, technology has played a significant role in revolutionizing dentistry, and one of the latest advancements is the use of artificial intelligence (AI) in dentistry.

- AI has been around for quite some time, but its application in dentistry is relatively new. AI technology involves the use of algorithms to perform tasks that typically require human intelligence. In dentistry, AI can help with a range of functions, from diagnosis and treatment planning to patient communication and education.

- Artificial Intelligence (AI) is the ability of machines to perform tasks that normally require human intelligence. such as visual perception, speech recognition, decision making, and translation between languages".

- The core component of artificial intelligence technology is a neural network that is designed like that of human brains, which can also simulate human thought.

AI is not a new term, the concept of AI can be dated back to 1956. However, it has not become a practical tool until two decades ago.



John McCarthy
Computer scientist
known as the father of AI

3 Types of Artificial Intelligence

Artificial Narrow Intelligence (ANI)

Stage-1

Machine Learning

- Specialises in one area and solves one problem


Siri


Alexa


Cortana

Artificial General Intelligence (AGI)

Stage-2

Machine Intelligence

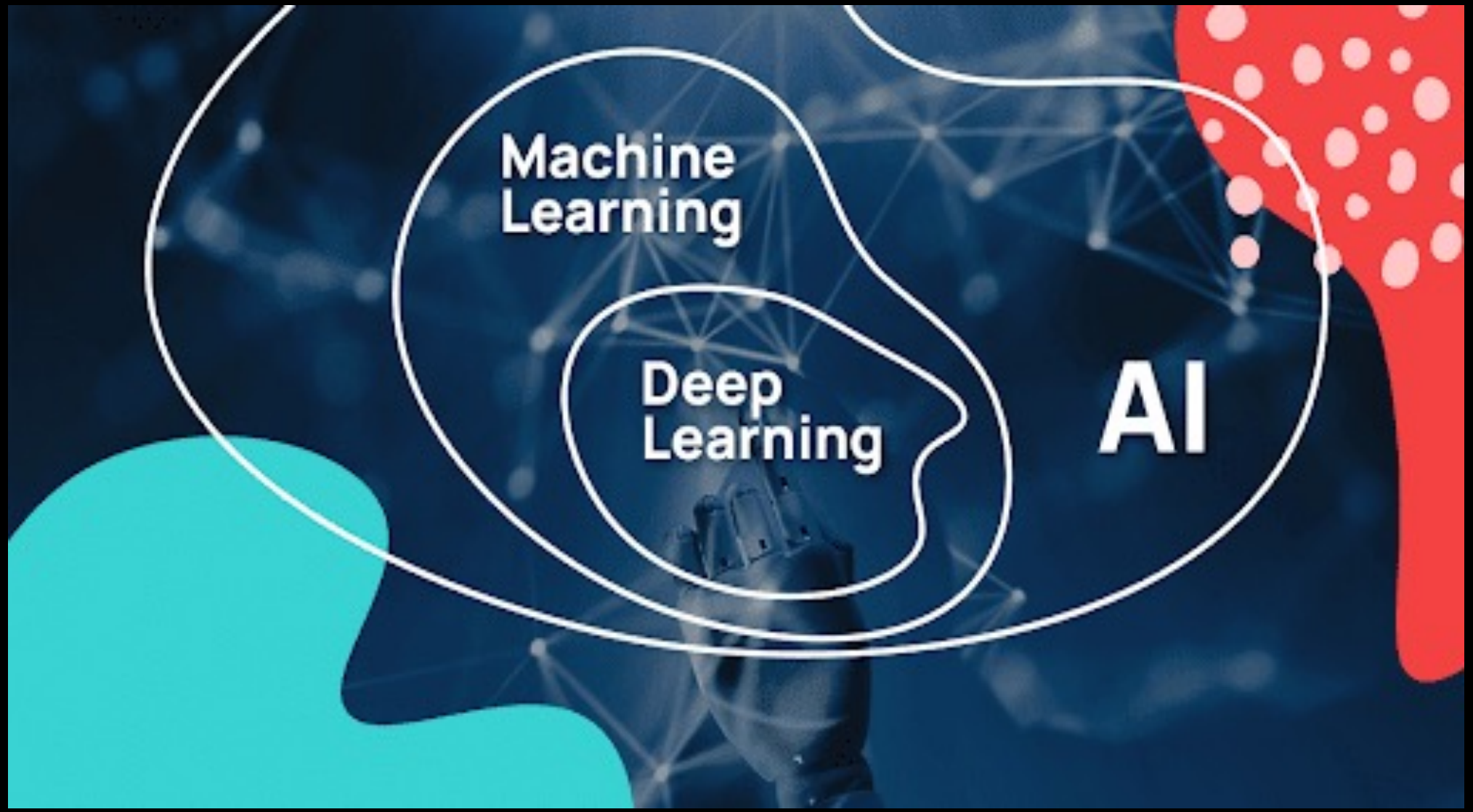
- Refers to a computer that is as smart as a human across the board

Artificial Super Intelligence (ASI)

Stage-3

Machine Consciousness

- An intellect that is much smarter than the best human brains in practically every field


Machine
Learning
Deep
Learning
AI

Machine learning (system identifies patterns from large database and learns to recognized them in future

Ex; child sees multiple photos of cat ---- child recognized cat.

Deep learning (hierarchy of composable patterns building each other)

Ex; child sees a couple photo of cats--- recognizes simple shape like ears and eyes--- start to recognizing image of cat.

Figure 2(a). The Black Box AI model classifies the image as "cat".

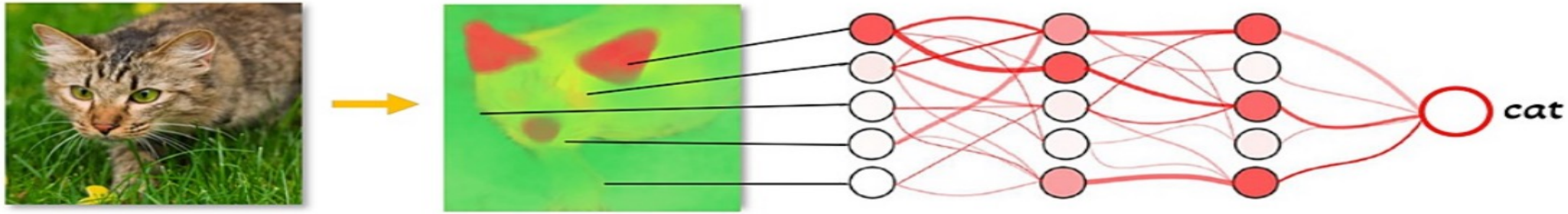
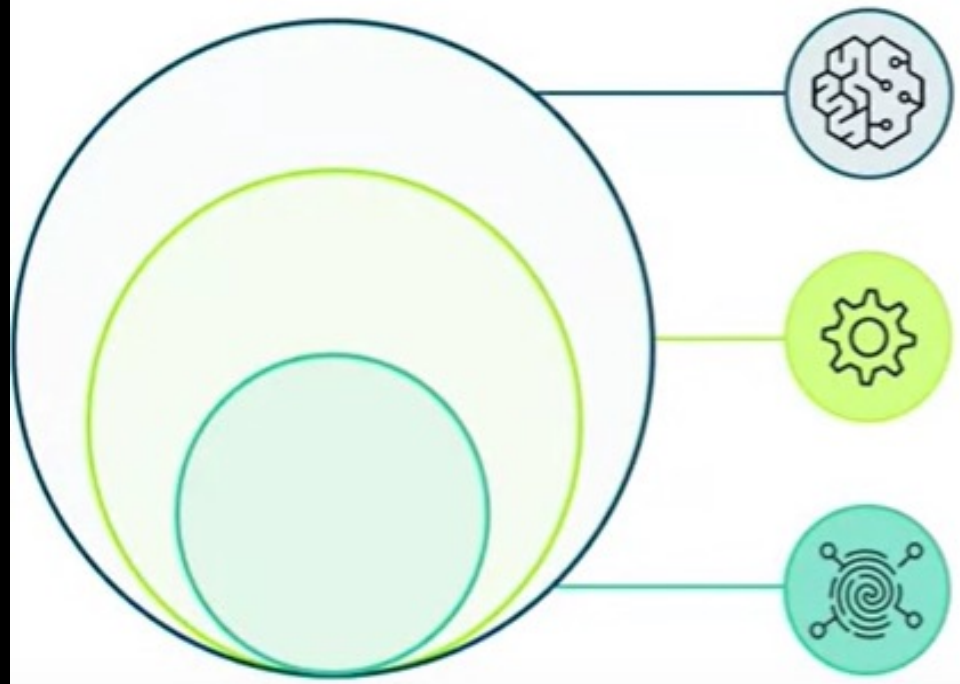


Figure 2(b). Image classified as "cat" because of cat's ears and nose.

FIGURE 2: Schematic representation of working of Artificial Intelligence models.

Artificial intelligence and its subsets



Artificial Intelligence (AI)

- A field of study that uses computers to do processes that mimic human behavior

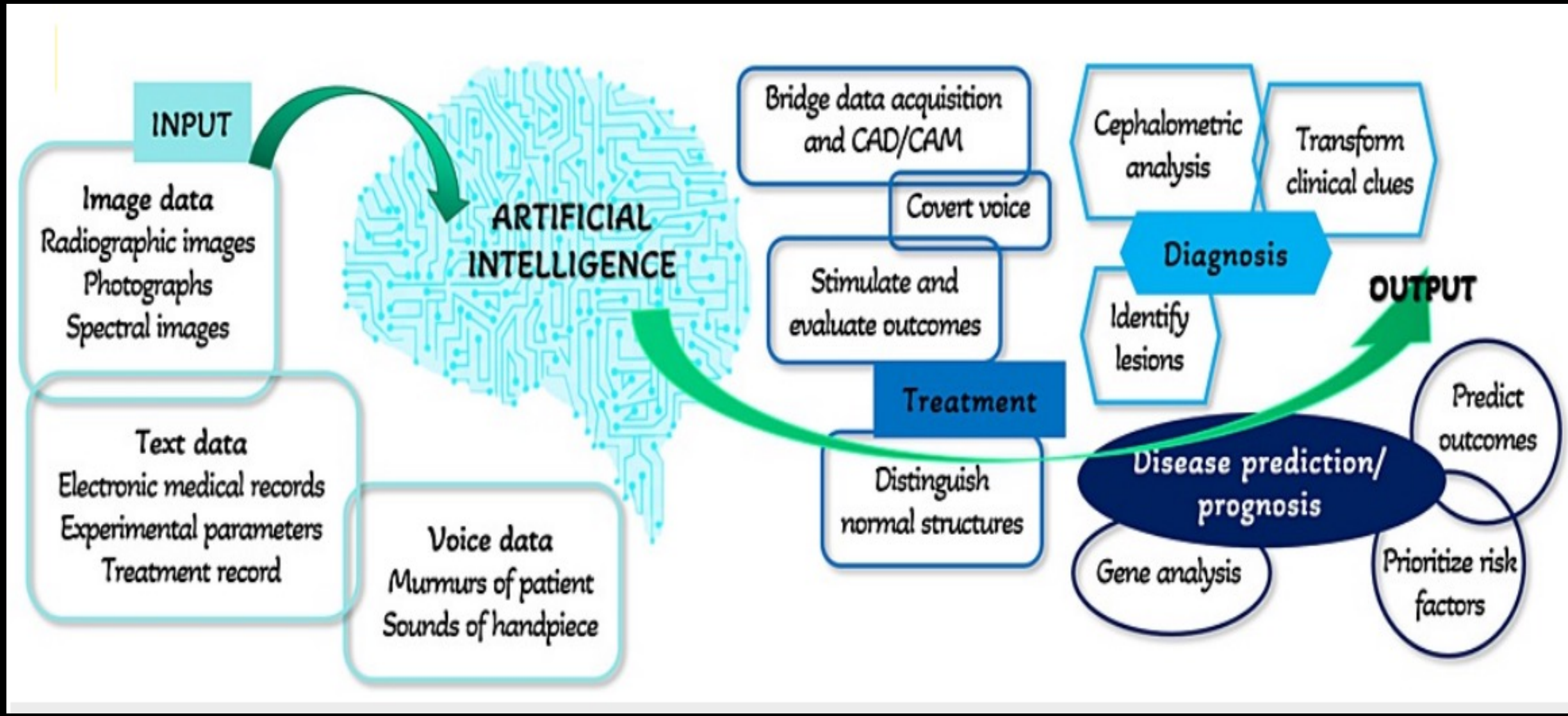
Machine Learning (ML)

- A subset of AI
- Uses algorithms to learn and improve from training data

Deep Learning (DL)

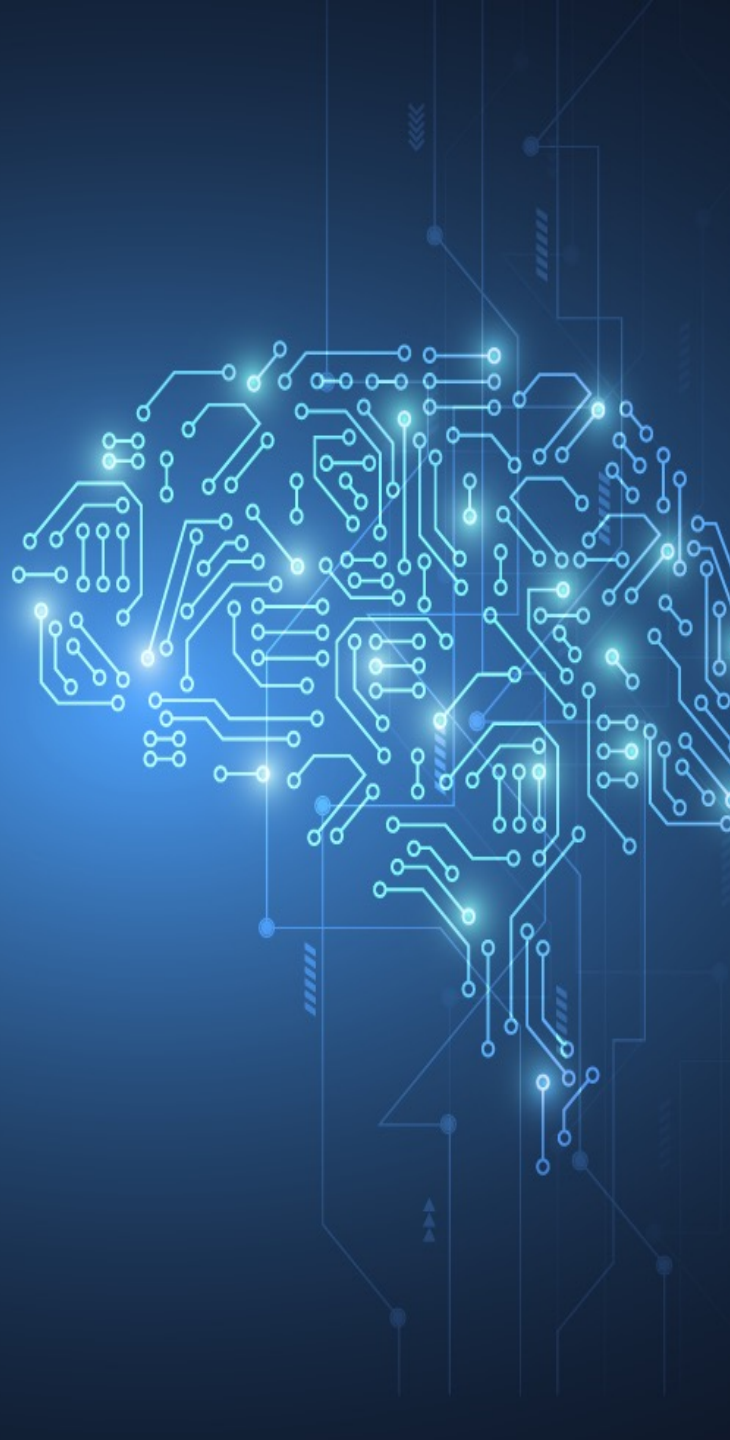
- A subset of ML
- Uses multilayer networks to build models that are inspired by the human brain

Hierarchy of AI system



Automation in dentistry

- Dental automation refers to the use of technology and software in the field of dentistry to improve efficiency, accuracy and patient experience. This can include the use of digital radiography, computerized appointment scheduling, electronic health records, and automated billing and insurance processing. The integration of technology in dentistry helps to streamline processes, reduce errors and improve patient care.



- Automation in dentistry has the potential to improve efficiency, accuracy, and patient experience.

automation in dentistry include:

- Digital dentistry: The use of computer-aided design (CAD) and computer-aided manufacturing (CAM) technology to create dental restorations, such as crowns, bridges, and implants.

Why customers love AutoDesign

SCALABILITY

Grow your business without needing more CAD technicians

RELIABILITY

Reduce remake rates by eliminating human error

SAVINGS

Decrease costs for CAD licenses and wages

SPEED

Design multiple cases in less than 5 minutes

SIMPLICITY

Can be operated without a CAD technician

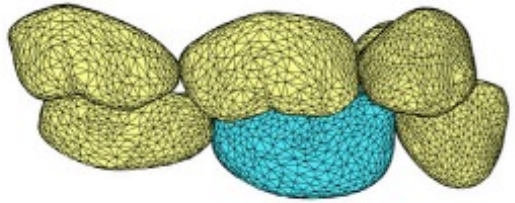
Automated diagnosis: AI can identify various dental problems by analyzing medical imaging techniques such as dental X-rays and images. For example, it can automatically detect conditions such as tooth decay, periodontal disease or dental anomalies. This can help dentists make a faster and more accurate diagnosis.

Automated Design of Dental Restorations

AI utilizes machine learning algorithms to create dental restoration, such as crowns, bridges, and dentures. These algorithms analyze extensive datasets and learn from experienced dental technicians to generate highly accurate and esthetic restoration designs. Using machine learning in dentistry saves time and minimizes the risk of human error for consistent, high-quality restorations.

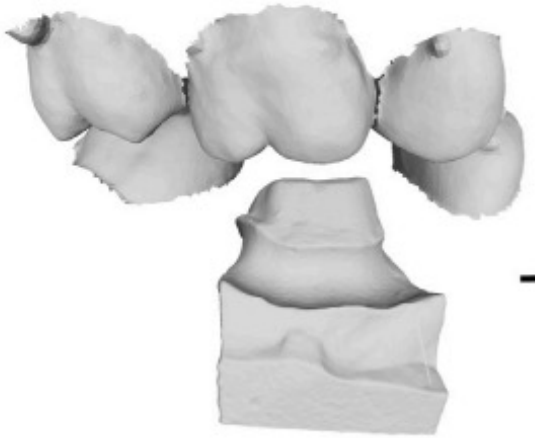
Algorithms are now being written for generation of custom designs that are not necessarily based on a library. Restorative AI technology is beginning to drive design in other aspects of prosthodontics as well as in the case of complete dentures, splints, implant restorations, implant superstructures, and substructures

Conditional Shape Model



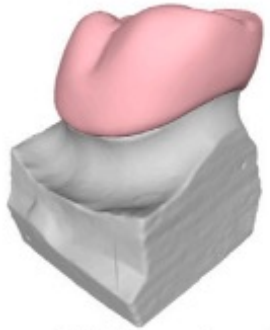
$$\mu = \mu_S + \Sigma_{SF}\Sigma_F^{-1}\left(F - \mu_F\right)$$
$$\Sigma = \Sigma_S - \Sigma_{SF}\Sigma_F^{-1}\Sigma_{FS}$$

Adjacent regions

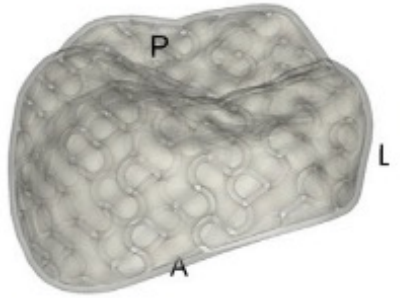


Preparation

Automatic crown design

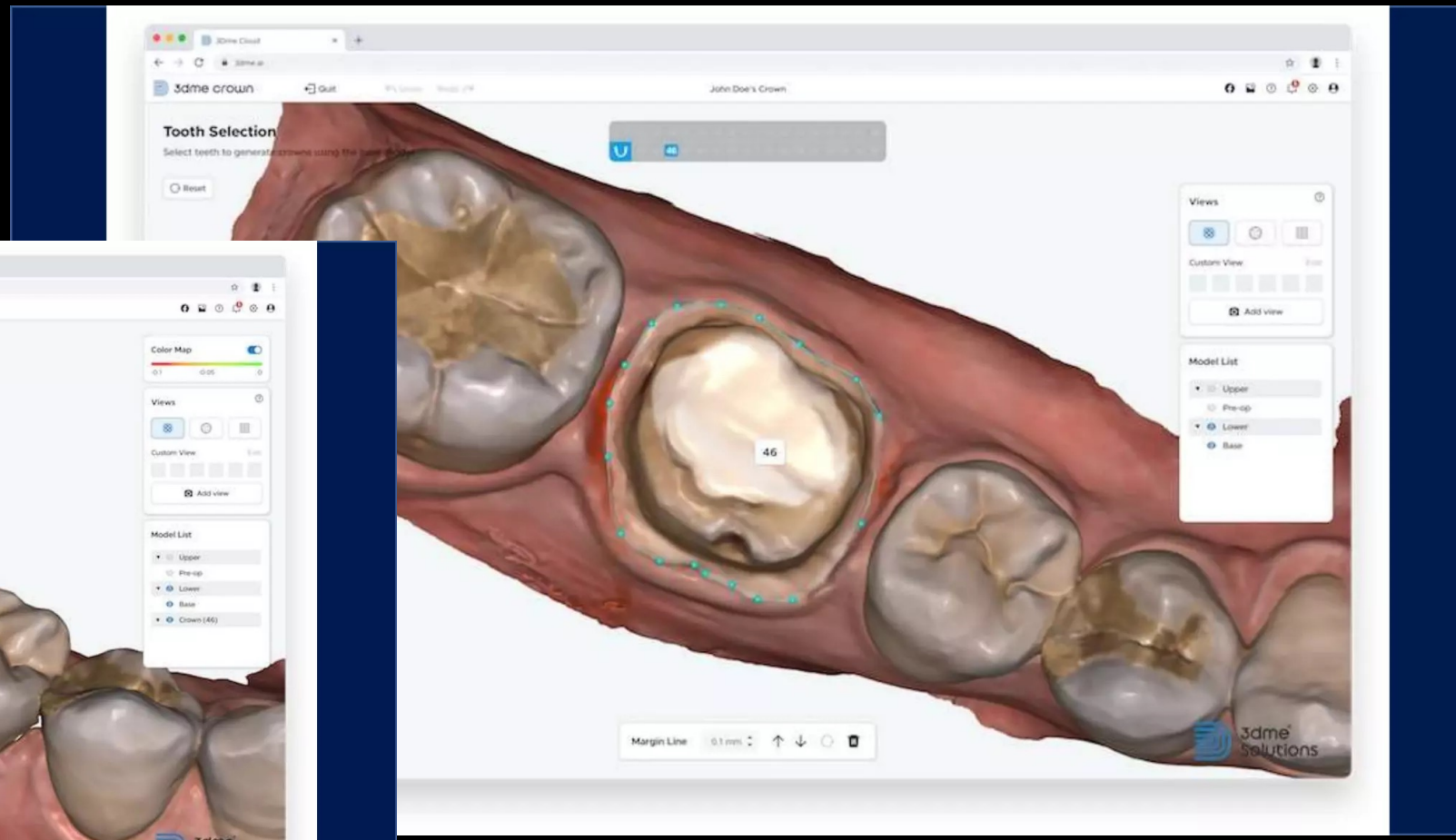


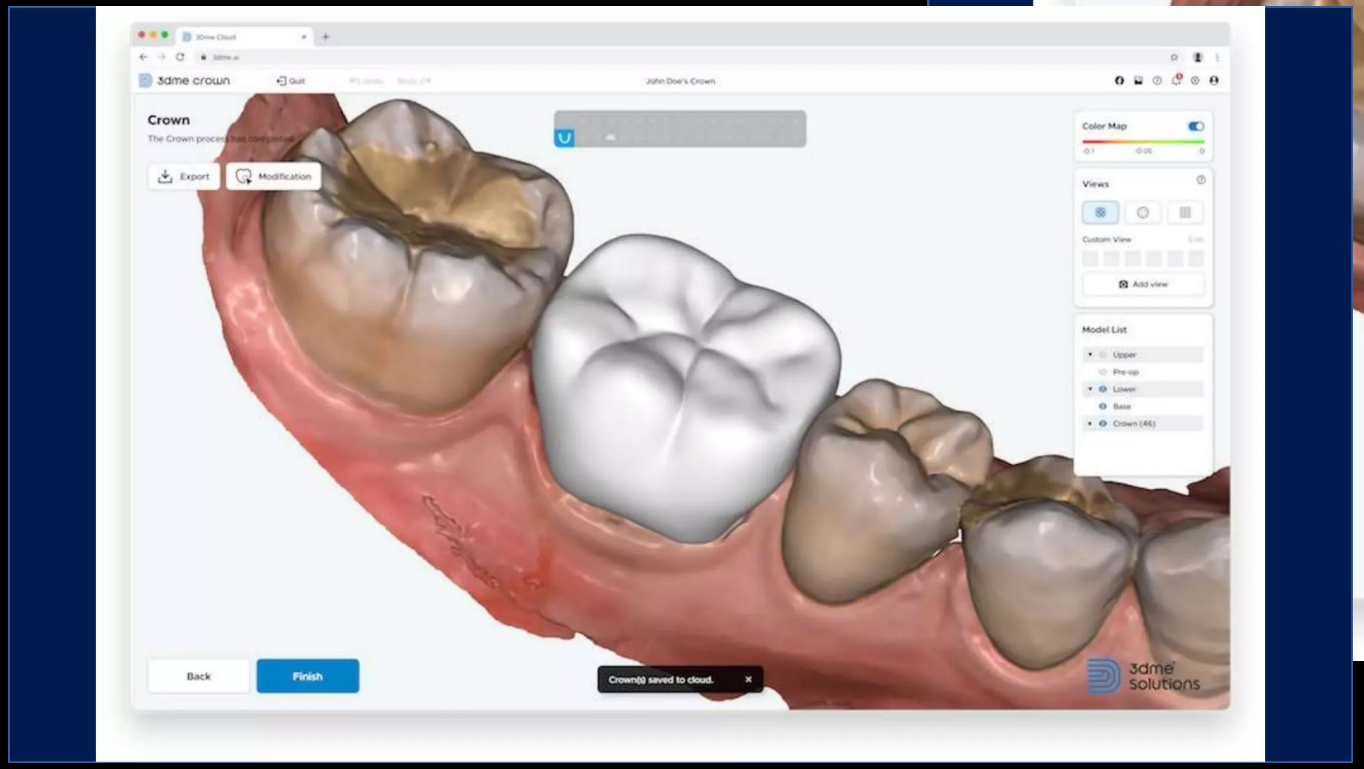
Close-fitting to the preparation



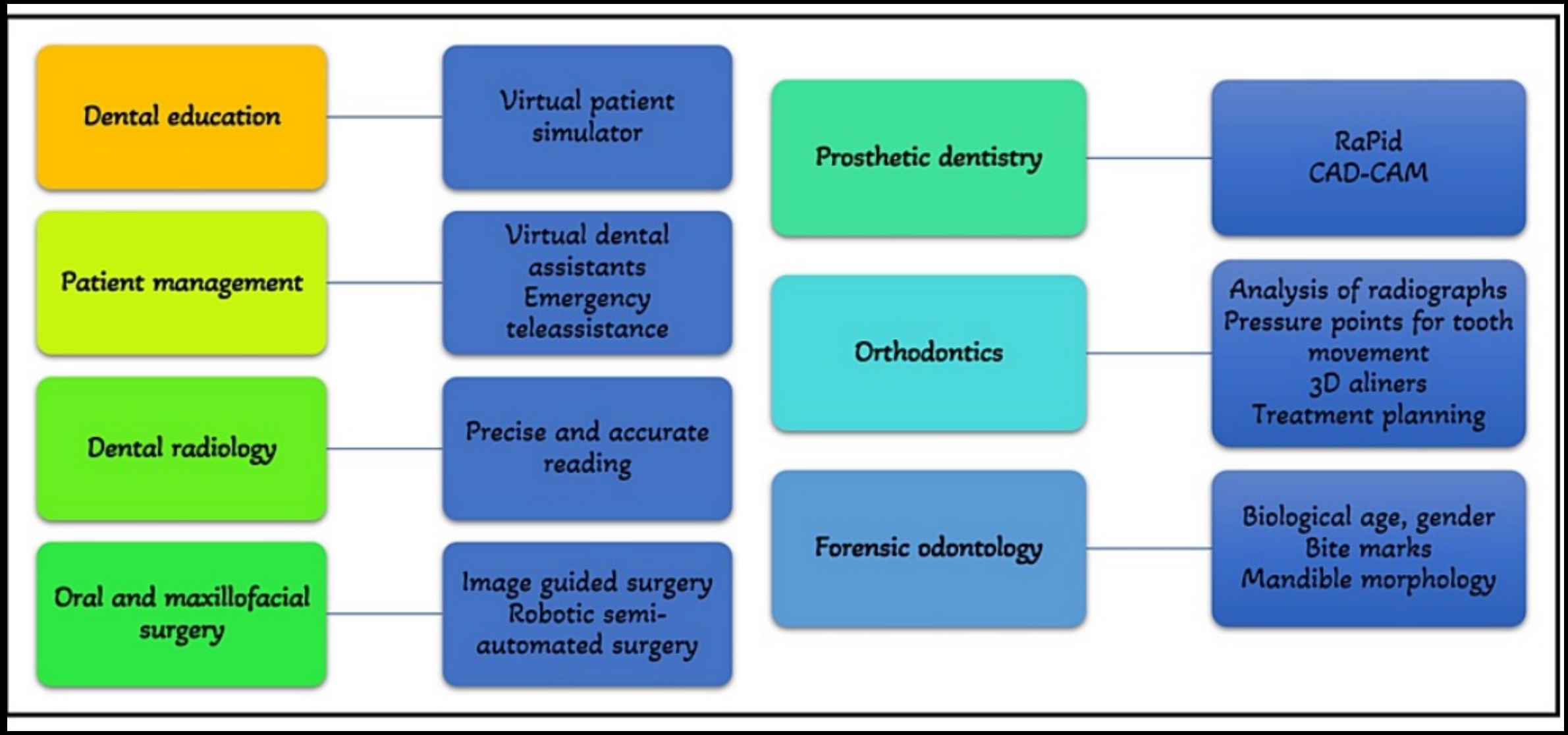
Internal supporting structure optimization

Crown design



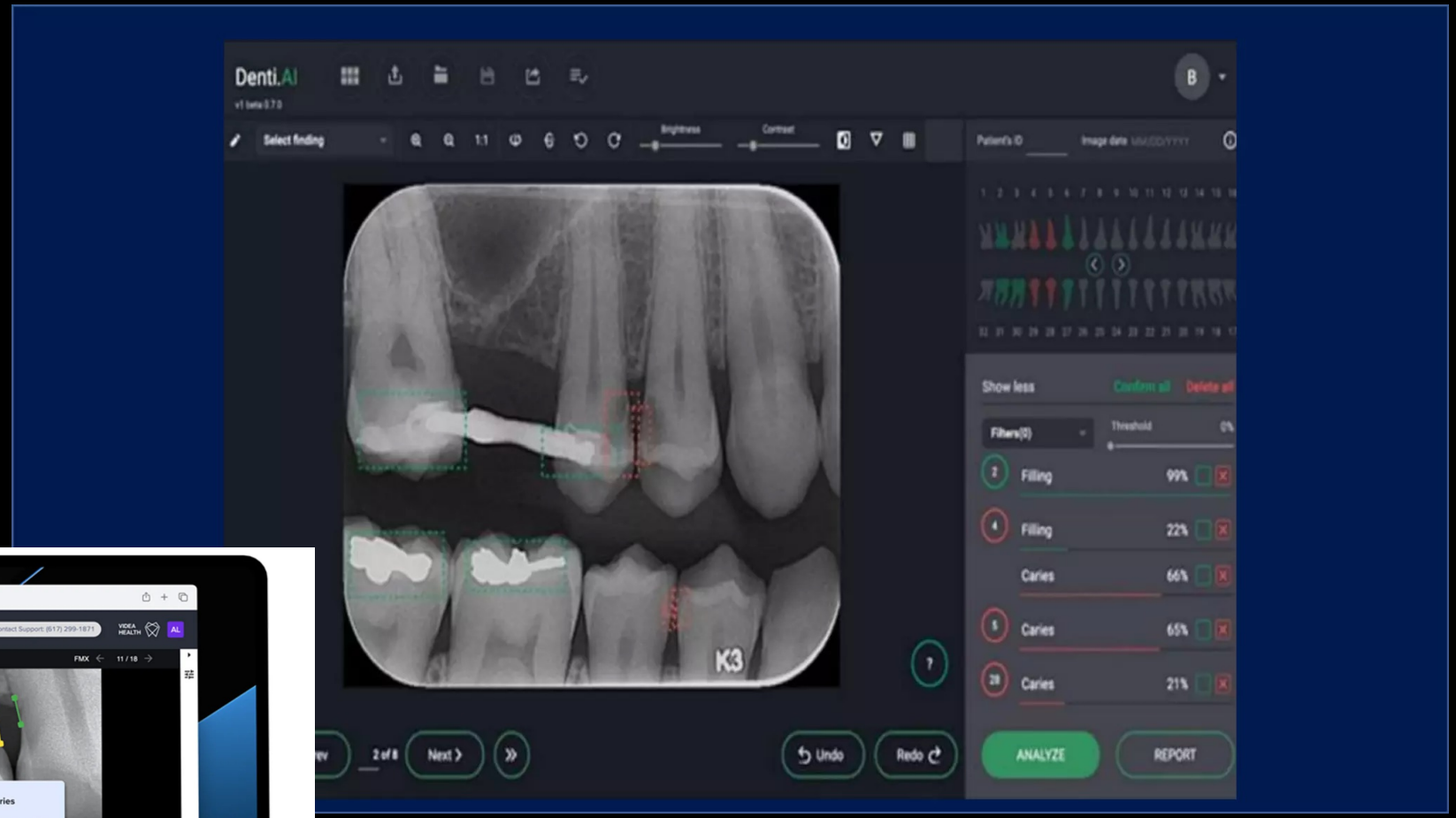


Dental applications of AI

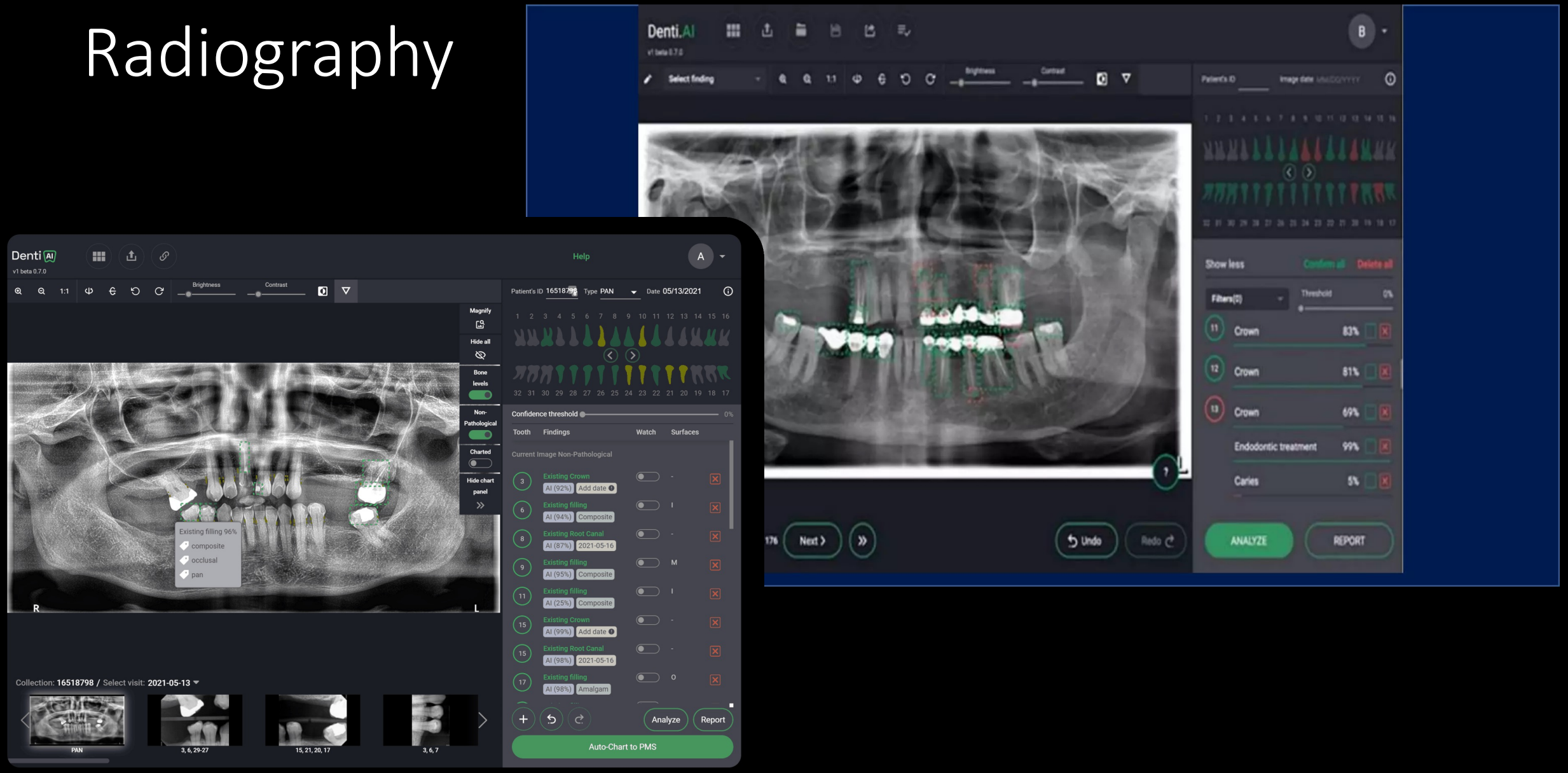


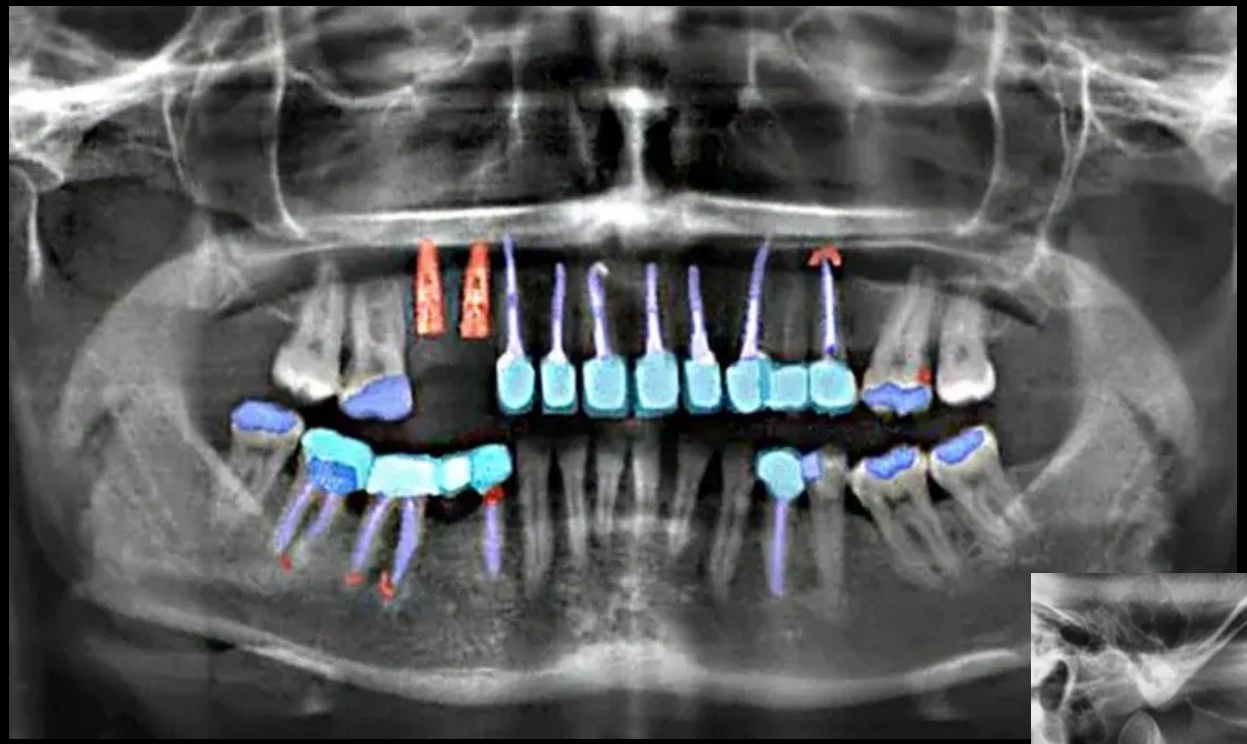

dentalXrai Pro
Detections
Caries
Apical lesion
Filling
Crown
Bridge
Implant
Root canal filling
Mandibular canal
Calculus
Bone loss
Generate report

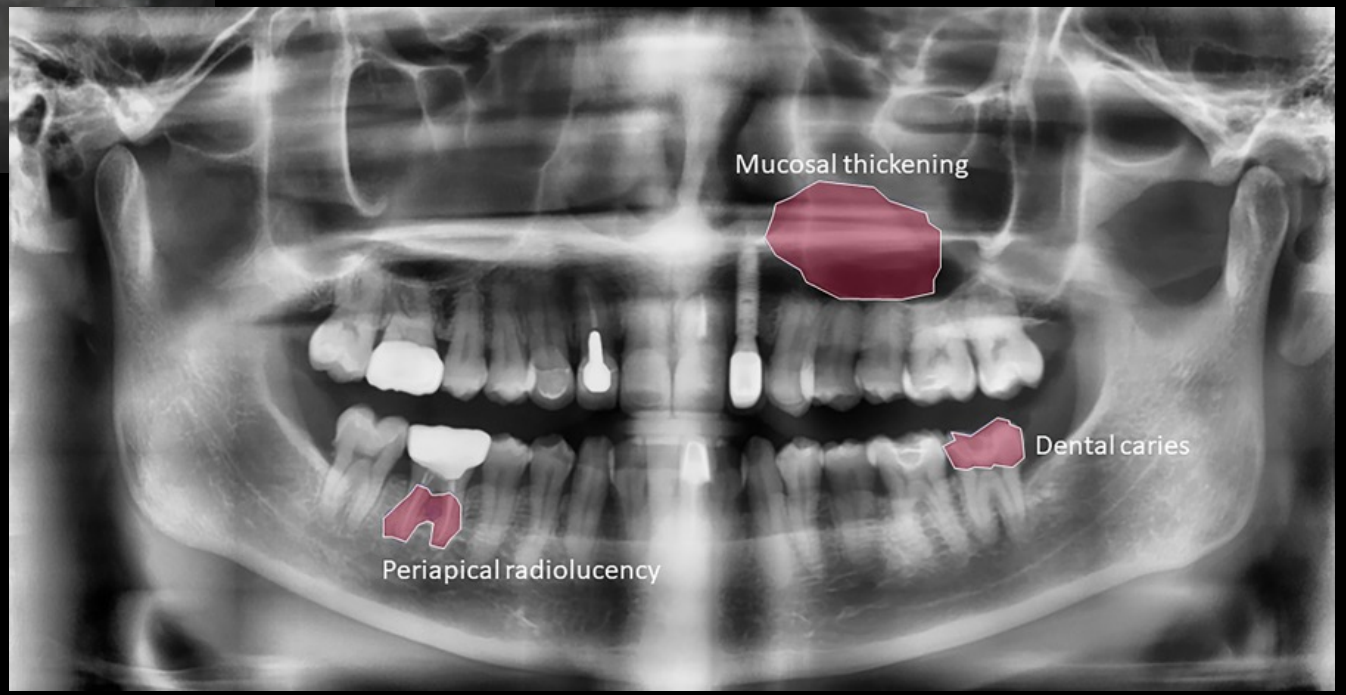

www.videa.ai
Center City Dental
Contact Support: (617) 299-1871
VIDEA HEALTH
AL
Patient Selection
Robert Brown
Image 11
Compare Visits
FMX
11 / 18
5 Caries
Total decay on crown: <25%
Depth: Into dentin

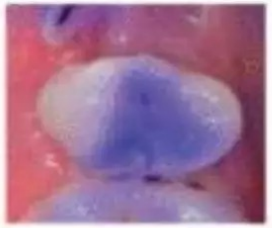
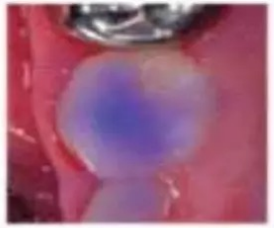
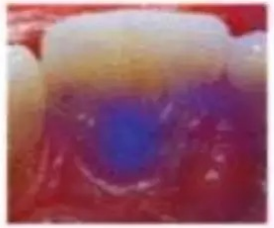
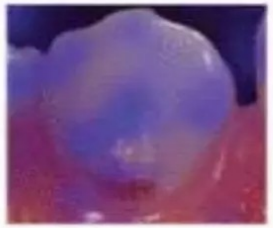
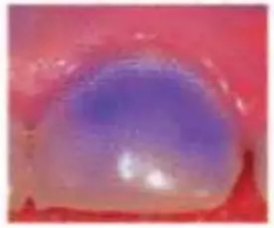

Denti.AI
v1 beta 0.7.0
B
Select finding
1:1
Brightness
Contrast
Patient's ID
Image date MM/DD/YYYY
K3
Show less
Confirm all
Delete all
Filters(0)
Threshold
0%
2 Filling 99%
4 Filling 22%
Caries 66%
5 Caries 65%
28 Caries 21%
2 of 8
Next
Undo
Redo
ANALYZE
REPORT

Radiography

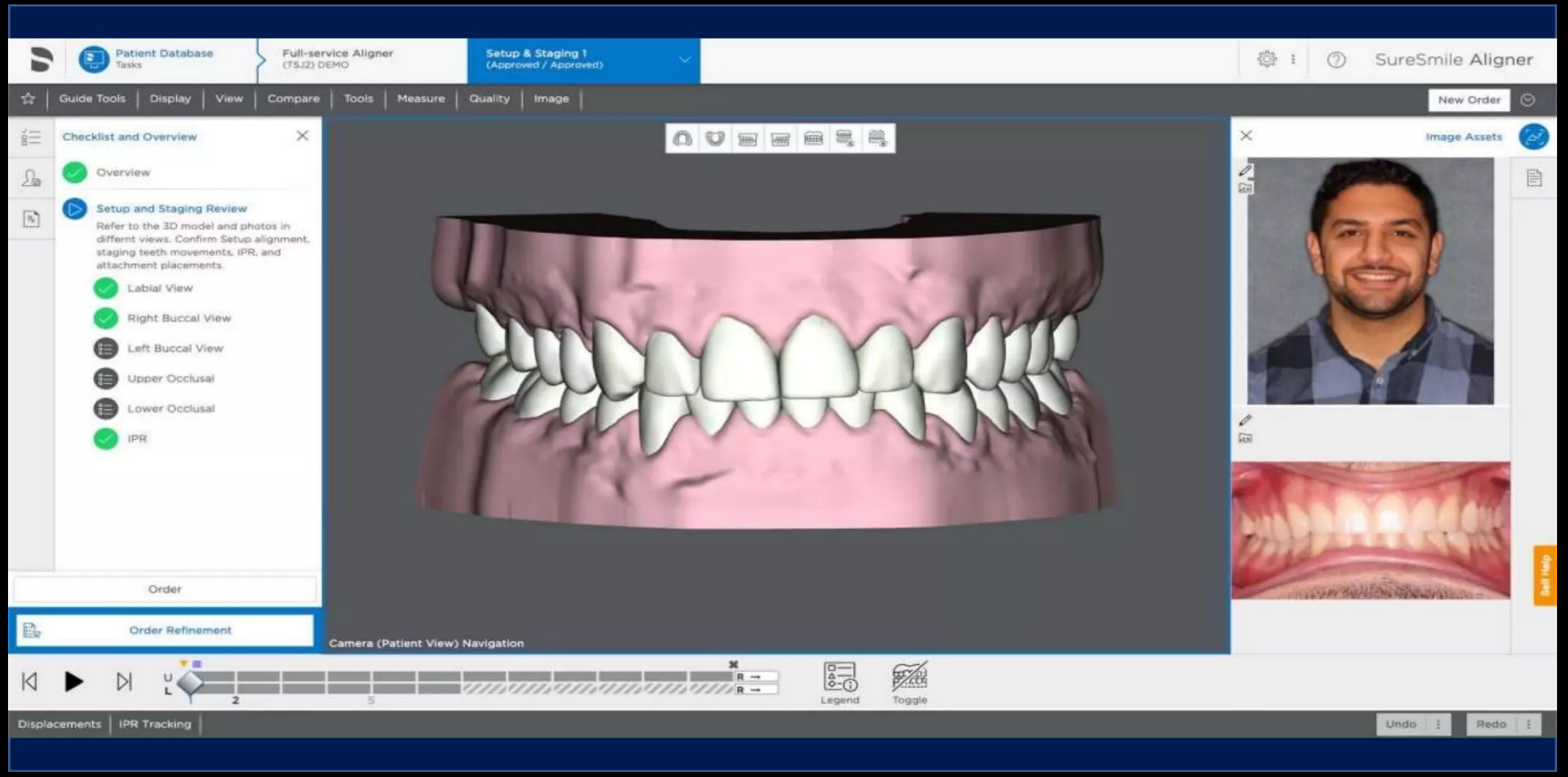




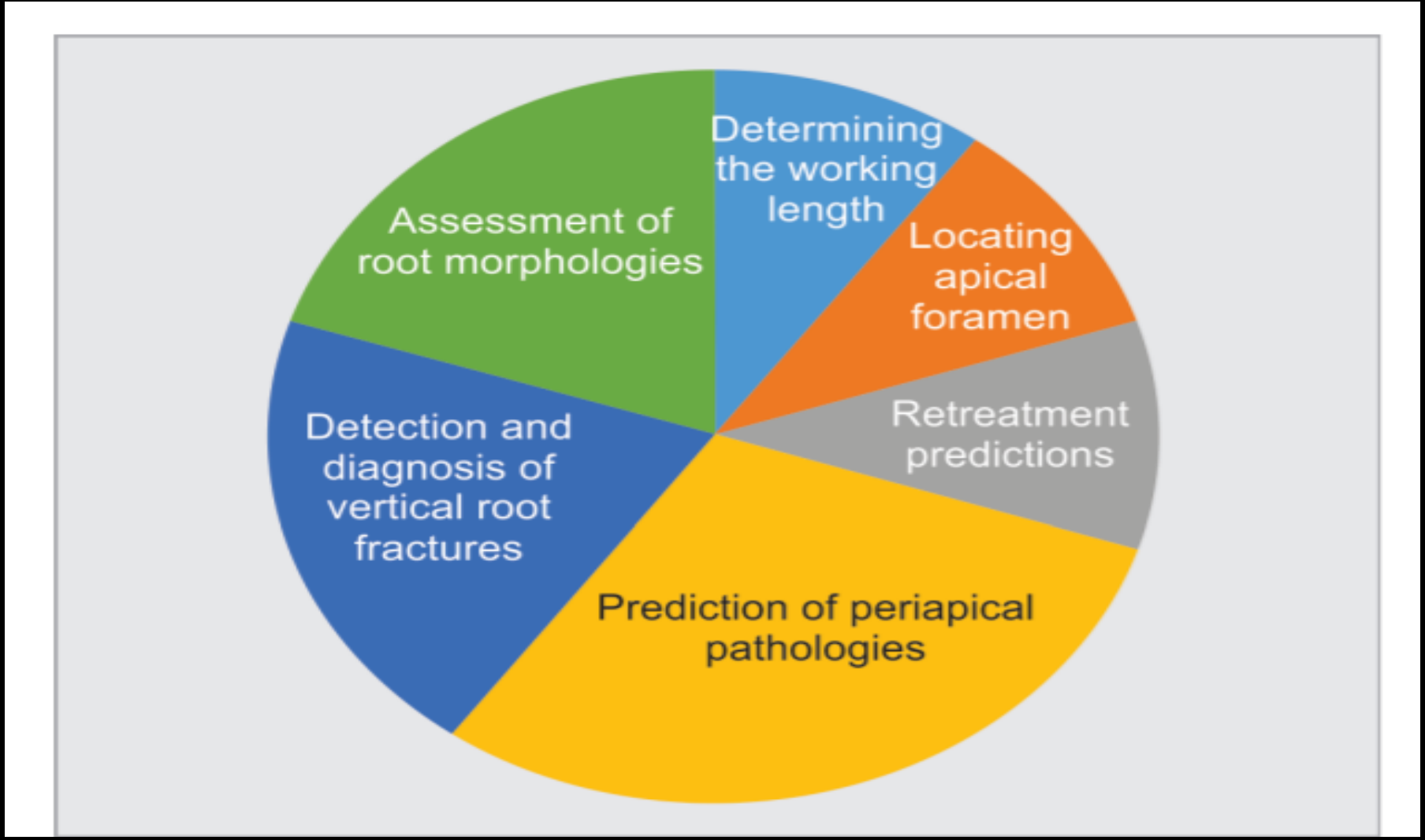

Mucosal thickening
Dental caries
Periapical radiolucency

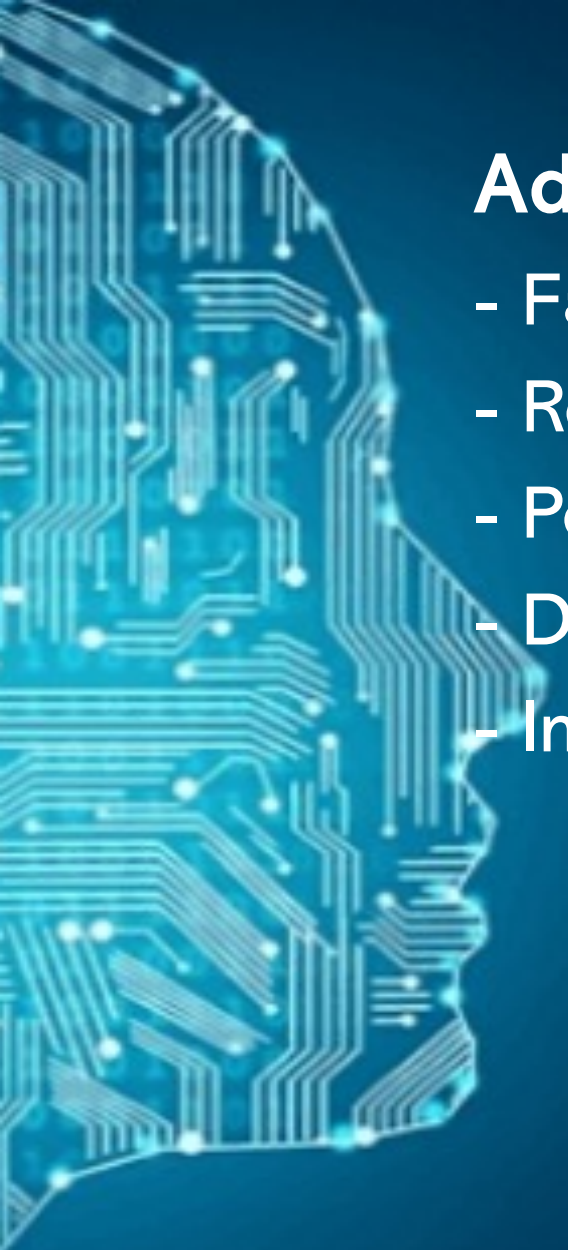
Expert diagnosis	AI diagnosis	Expert diagnosis	AI diagnosis
Cavitated caries	0.0%/ 3.2%/ 96.8% Cavitated caries	No caries	100.0%/ 0.0%/ 0.0% No caries
			
No caries	99.8%/ 0.2%/ 0.0% No caries	Non-cavitated caries	0.0%/ 98.3%/ 1.7% Non-cavitated caries
			
Cavitated caries	0.0%/ 0.0%/ 100.0% Cavitated caries	Non-cavitated caries	0.0%/ 100.0%/ 0.0% Non-cavitated caries
			

3D scan


Patient Database
Tasks
Full-service Aligner
(T5J2) DEMO
Setup & Staging 1
(Approved / Approved)
SureSmile Aligner
Guide Tools
Display
View
Compare
Tools
Measure
Quality
Image
New Order
Checklist and Overview
Overview
Setup and Staging Review
Refer to the 3D model and photos in different views. Confirm Setup alignment, staging teeth movements, IPR, and attachment placements.
Labial View
Right Buccal View
Left Buccal View
Upper Occlusal
Lower Occlusal
IPR
Order
Order Refinement
Camera (Patient View) Navigation
Image Assets
Legend
Toggle
Displacements
IPR Tracking
Undo
Redo

Application of AI in Endodontics





Advantages in dentistry

- Faster diagnosis and treatment processes.
- Reduction of errors and enhancement of treatment outcomes.
- Personalized treatment plans.
- Data analysis and patient tracking.
- Increased patient satisfaction.

Challenges in dentistry

1- Data privacy and security.

2- Use of insufficient or misleading data.

3- Adaptation to technology and the need for education.

4- Concerns about replacing human touch and expertise.

5- Costly setup.

6-The outcomes of AI in dentistry are not readily applicable.

Impact of artificial intelligence on dentists

Although there is plenty of talk about how AI can change dentistry, questions remain about whether it will ever completely replace dentists. Dentistry performed by machines and without human interaction does not represent clinical care.

Machines cannot provide clinical intuition, intangible perception, or empathy, which are essential to providing individualized healthcare and professionalism. The most fascinating aspect of human to human communication cannot be easily translated into computer language.

Conclusion

New technologies are developed and adopted rapidly in the dental field. AI is among the most promising ones, with features such as high accuracy and efficiency if unbiased training data is used and an algorithm is properly trained.

Dental practitioners can identify AI as a supplemental tool to reduce their workload and improve precision and accuracy in diagnosis, decision making, treatment planning, prediction of treatment outcomes, and disease prognosis.