22.11.2024

Moderne Rekonstruktive Zahnmedizin

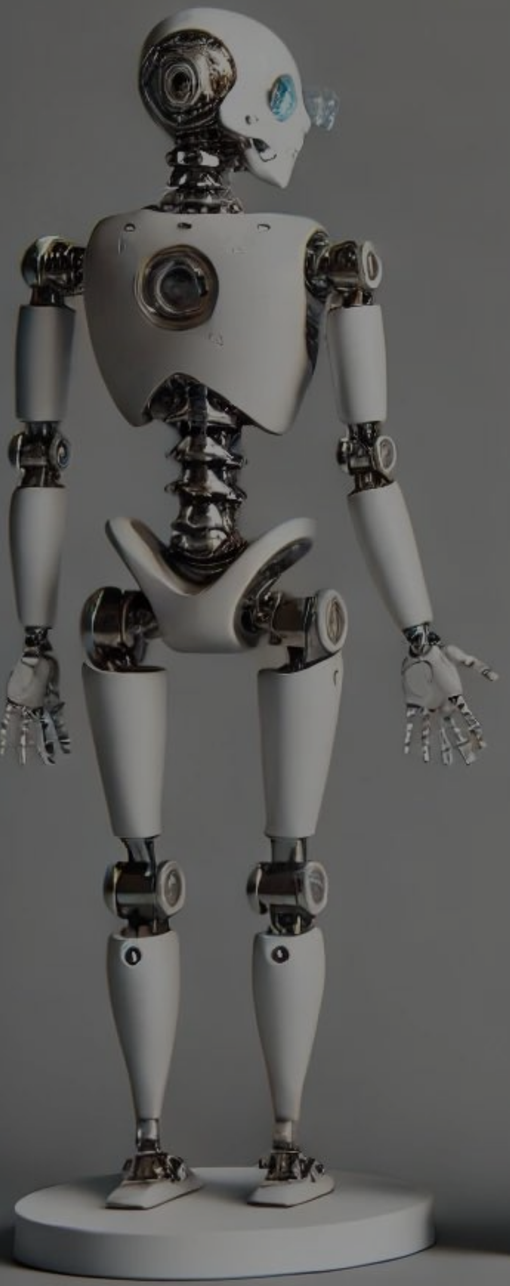
KI, Robotics und so. …

Dr. M. Balmer

Zentrum für Zahnmedizin
Klinik für Rekonstruktive Zahnmedizin

Universität Zürich[UZH]


MODERNE REKONSTRUKTE
ZAHN MUSHIAM
DR. MARC BALMER
3D
SVDA KONGRESS
3D DIGITAL DENTISTTY
SVDA
KONGRESS



Erstelle ein Gemälde im Renaissance-Stil

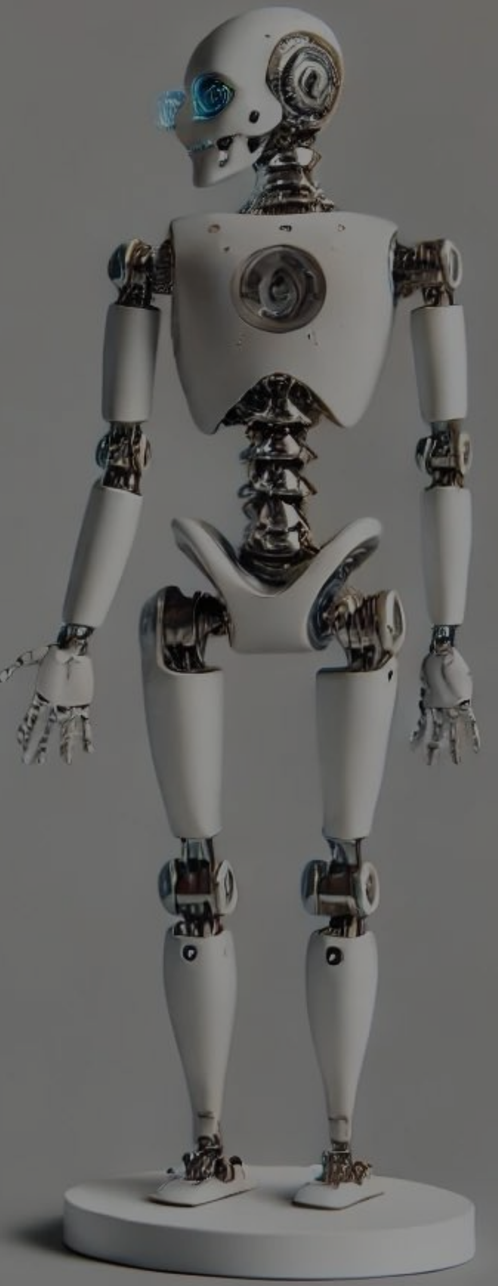
Frage nach antiken Zivilisationen

Danke meinem Interviewpartner

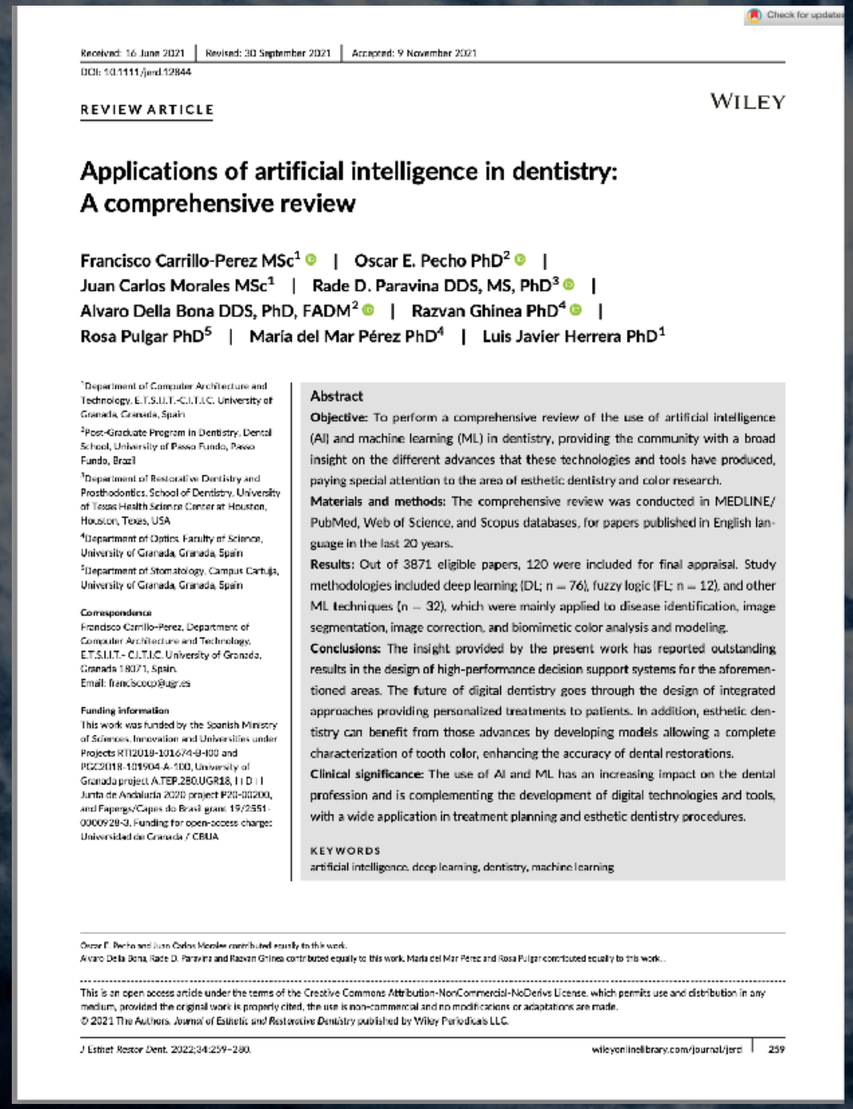
Plane einen Entspannungstag

Sende eine Nachricht an ChatGPT

ChatGPT kann Fehler machen. Überprüfe wichtige Informationen.



Für was kann man 2024 die künstliche Intelligenz in der **Zahnmedizin** bereits anwenden?



Received: 16 June 2021 | Revised: 30 September 2021 | Accepted: 9 November 2021
DOI: 10.1111/jerd.12844

REVIEW ARTICLE

WILEY

Applications of artificial intelligence in dentistry: A comprehensive review

Francisco Carrillo-Perez MSc[1] | Oscar E. Pecho PhD[2] | Juan Carlos Morales MSc[1] | Rade D. Paravina DDS, MS, PhD[3] | Alvaro Della Bona DDS, PhD, FADM[2] | Razvan Ghinea PhD[4] | Rosa Pulgar PhD[5] | María del Mar Pérez PhD[4] | Luis Javier Herrera PhD[1]

[1]Department of Computer Architecture and Technology, E.T.S.I.I.T.-C.I.T.I.C. University of Granada, Granada, Spain
[2]Post-Graduate Program in Dentistry, Dental School, University of Passo Fundo, Passo Fundo, Brazil
[3]Department of Restorative Dentistry and Prosthodontics, School of Dentistry, University of Texas Health Science Center at Houston, Houston, Texas, USA
[4]Department of Optics, Faculty of Science, University of Granada, Granada, Spain
[5]Department of Stomatology, Campus Cartuja, University of Granada, Granada, Spain

Correspondence
Francisco Carrillo-Perez, Department of Computer Architecture and Technology, E.T.S.I.I.T.- C.I.T.I.C. University of Granada, Granada 18071, Spain.
Email: franciscocp@ugr.es

Funding information
This work was funded by the Spanish Ministry of Sciences, Innovation and Universities under Projects RTI2018-101674-B-I00 and PGC2018-101904-A-100, University of Granada project ATEP.280.UGR18, I i D i Junta de Andalucía 2020 project P20-00200, and Fapergs/Capes do Brasil grant 19/2551-0000928-3. Funding for open-access charge: Universidad de Granada / CBUA

Abstract

Objective: To perform a comprehensive review of the use of artificial intelligence (AI) and machine learning (ML) in dentistry, providing the community with a broad insight on the different advances that these technologies and tools have produced, paying special attention to the area of esthetic dentistry and color research.

Materials and methods: The comprehensive review was conducted in MEDLINE/PubMed, Web of Science, and Scopus databases, for papers published in English language in the last 20 years.

Results: Out of 3871 eligible papers, 120 were included for final appraisal. Study methodologies included deep learning (DL; n = 76), fuzzy logic (FL; n = 12), and other ML techniques (n = 32), which were mainly applied to disease identification, image segmentation, image correction, and biomimetic color analysis and modeling.

Conclusions: The insight provided by the present work has reported outstanding results in the design of high-performance decision support systems for the aforementioned areas. The future of digital dentistry goes through the design of integrated approaches providing personalized treatments to patients. In addition, esthetic dentistry can benefit from those advances by developing models allowing a complete characterization of tooth color, enhancing the accuracy of dental restorations.

Clinical significance: The use of AI and ML has an increasing impact on the dental profession and is complementing the development of digital technologies and tools, with a wide application in treatment planning and esthetic dentistry procedures.

KEYWORDS
artificial intelligence, deep learning, dentistry, machine learning

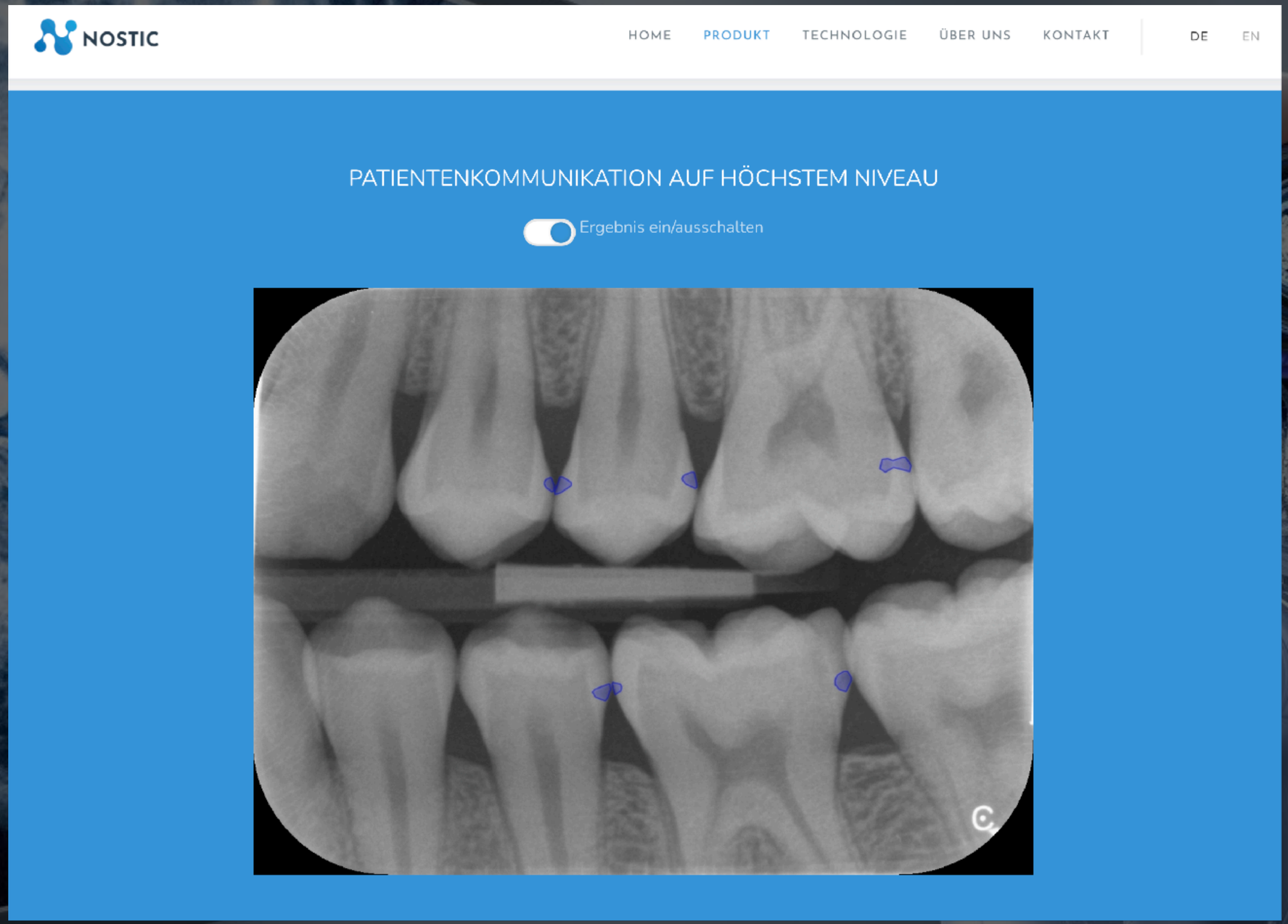
Oscar E. Pecho and Juan Carlos Morales contributed equally to this work.
Alvaro Della Bona, Rade D. Paravina and Razvan Ghinea contributed equally to this work. María del Mar Pérez and Rosa Pulgar contributed equally to this work.

120 Studien eingeschlossen

- Bilderkennung
- Bildsegmentierung
- Identifizierung von Krankheiten (auf Röntgenbilder)
- Farbanalyse

Applications of artificial intelligence in dentistry: A comprehensive review.
Carrillo-Perez F, Pecho OE, Morales JC, Paravina RD, Della Bona A, Ghinea R, Pulgar R, Pérez MDM, Herrera LJ.
J Esthet Restor Dent. 2022 Jan

Für was kann man 2024 die künstliche Intelligenz in der **Zahnmedizin** bereits anwenden?



Für was kann man 2024 die künstliche Intelligenz in der **Implantologie** bereits anwenden?

THE JOURNAL OF PROSTHETIC DENTISTRY

SYSTEMATIC REVIEW

Artificial intelligence applications in implant dentistry: A systematic review

Marta Revilla-León, DDS, MSD,[a] Miguel Gómez-Polo, DDS, PhD,[b] Shantanu Vyas,[c] Basir A. Barmak, MD, MSc, EdD,[d] German O. Galluci, DMD, PhD,[e] Wael Att, DDS, Dr Med Dent, PhD,[f] and Vinayak R. Krishnamurthy, PhD[g]

Several domains of science and engineering have been influenced by artificial intelligence (AI) and machine learning. While AI is a general term that is used for the study, development, and investigation of any computer system that exhibits "intelligent behavior,"[1,2] machine learning is a special branch of AI where the system learns specific statistical patterns in a given data set to predict the behavior of new data samples. In AI, typically, one is concerned with "intelligent agents" or agents that have both flexibility and autonomy of action.[3] Examples of AI systems such as expert systems, methods for dimensionality reduction, and probabilistic models capture some important aspect of the data set. Of those, machine learning systems offer a rich variety of algorithms and

ABSTRACT

Statement of problem. Artificial intelligence (AI) applications are growing in dental implant procedures. The current expansion and performance of AI models in implant dentistry applications have not yet been systematically documented and analyzed.

Purpose. The purpose of this systematic review was to assess the performance of AI models in implant dentistry for implant type recognition, implant success prediction by using patient risk factors and ontology criteria, and implant design optimization combining finite element analysis (FEA) calculations and AI models.

Material and methods. An electronic systematic review was completed in 5 databases: MEDLINE/PubMed, EMBASE, World of Science, Cochrane, and Scopus. A manual search was also conducted. Peer-reviewed studies that developed AI models for implant type recognition, implant success prediction, and implant design optimization were included. The search strategy included articles published until February 21, 2021. Two investigators independently evaluated the quality of the studies by applying the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Quasi-Experimental Studies (nonrandomized experimental studies). A third investigator was consulted to resolve lack of consensus.

Results. Seventeen articles were included: 7 investigations analyzed AI models for implant type recognition, 7 studies included AI prediction models for implant success forecast, and 3 studies evaluated AI models for optimization of implant designs. The AI models developed to recognize implant type by using periapical and panoramic images obtained an overall accuracy outcome ranging from 93.8% to 98%. The models to predict osteointegration success or implant success by using different input data varied among the studies, ranging from 62.4% to 80.5%. Finally, the studies that developed AI models to optimize implant designs seem to agree on the applicability of AI models to improve the design of dental implants. This improvement includes minimizing the stress at the implant-bone interface by 36.6% compared with the finite element model; optimizing the implant design porosity, length, and diameter to improve the finite element calculations; or accurately determining the elastic modulus of the implant-bone interface.

Conclusions. AI models for implant type recognition, implant success prediction, and implant design optimization have demonstrated great potential but are still in development. Additional studies are indispensable to the further development and assessment of the clinical performance of AI models for those implant dentistry applications reviewed. (J Prosthet Dent 2023;129:293-300)

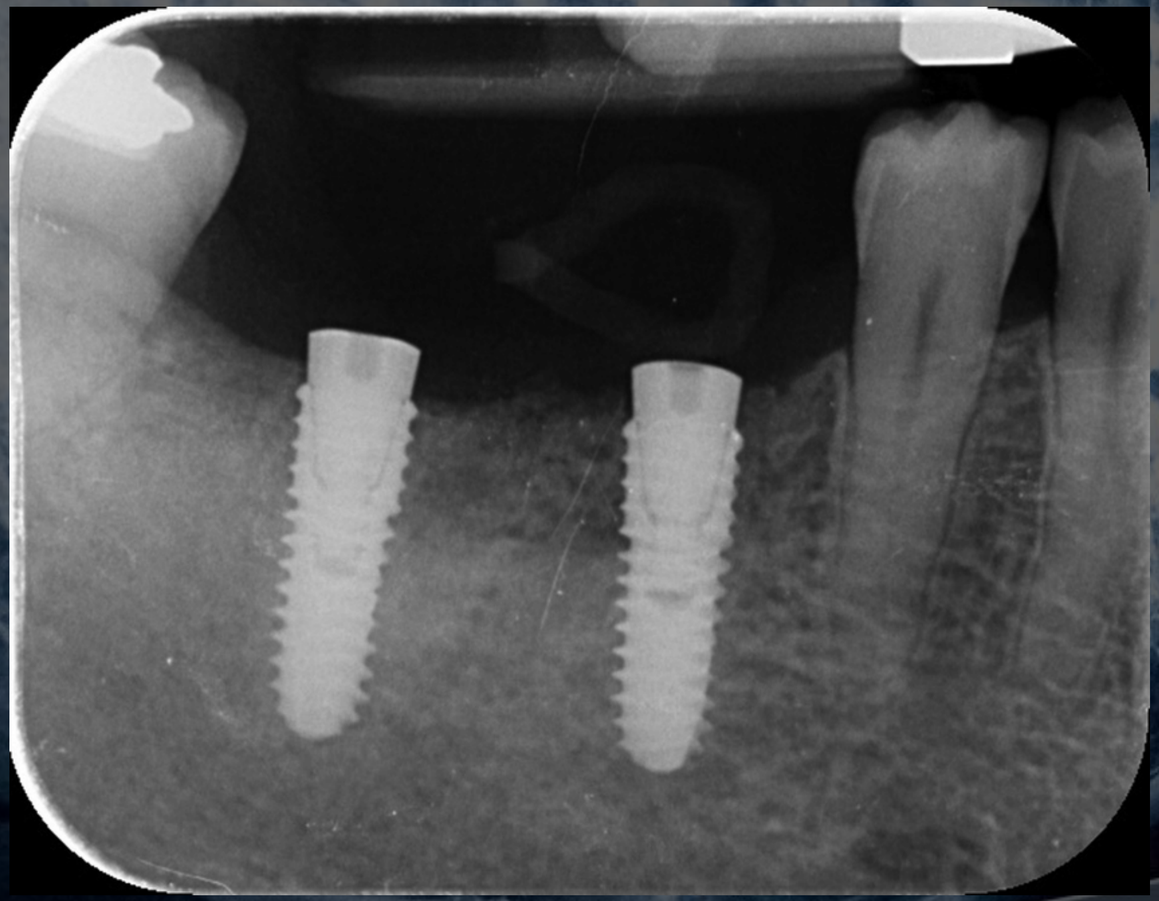
[a]Affiliate Assistant Professor, Graduate Prosthodontics, Department of Restorative Dentistry, School of Dentistry, University of Washington, Seattle, Wash and Faculty and Director of Research and Digital Dentistry, Kois Center, Seattle, Wash; Adjunct Professor, Department of Prosthodontics, School of Dental Medicine, Tufts University, Boston, MA.
[b]Associate Professor Department of Conservative Dentistry and Prosthodontics, School of Dentistry, Complutense University of Madrid, Madrid, Spain.
[c]Graduate Research Assistant, J. Mike Walker '66 Department of Mechanical Engineering, Texas A&M University, College Station, Texas.
[d]Assistant Professor Clinical Research and Biostatistics, Eastman Institute of Oral Health, University of Rochester Medical Center, Rochester, NY.
[e]Raymond J. and Eva Pomfret Nagle Associate Professor of Restorative Dentistry and Biomaterials Sciences and Chair of the Department of Restorative Dentistry and Biomaterials Science, Harvard School of Dental Medicine, Boston, Mass.
[f]Professor and Chair Department of Prosthodontics, Tufts University School of Dental Medicine, Boston, Mass.
[g]Assistant Professor, J. Mike Walker '66 Department of Mechanical Engineering, Texas A&M University, College Station, Texas.

17 Artikel

- Erkennung des Implantatsystems
- Prognose / Diagnose einer erfolgreichen Osseointegration (mbl)
- Optimierung des Implantatdesings mit Finite-Element-Analyse

Artificial intelligence applications in implant dentistry: A systematic review.
Revilla-León M, Gómez-Polo M, Vyas S, Barmak BA, Galluci GO, Att W, Krishnamurthy VR.
J Prosthet Dent. 2023

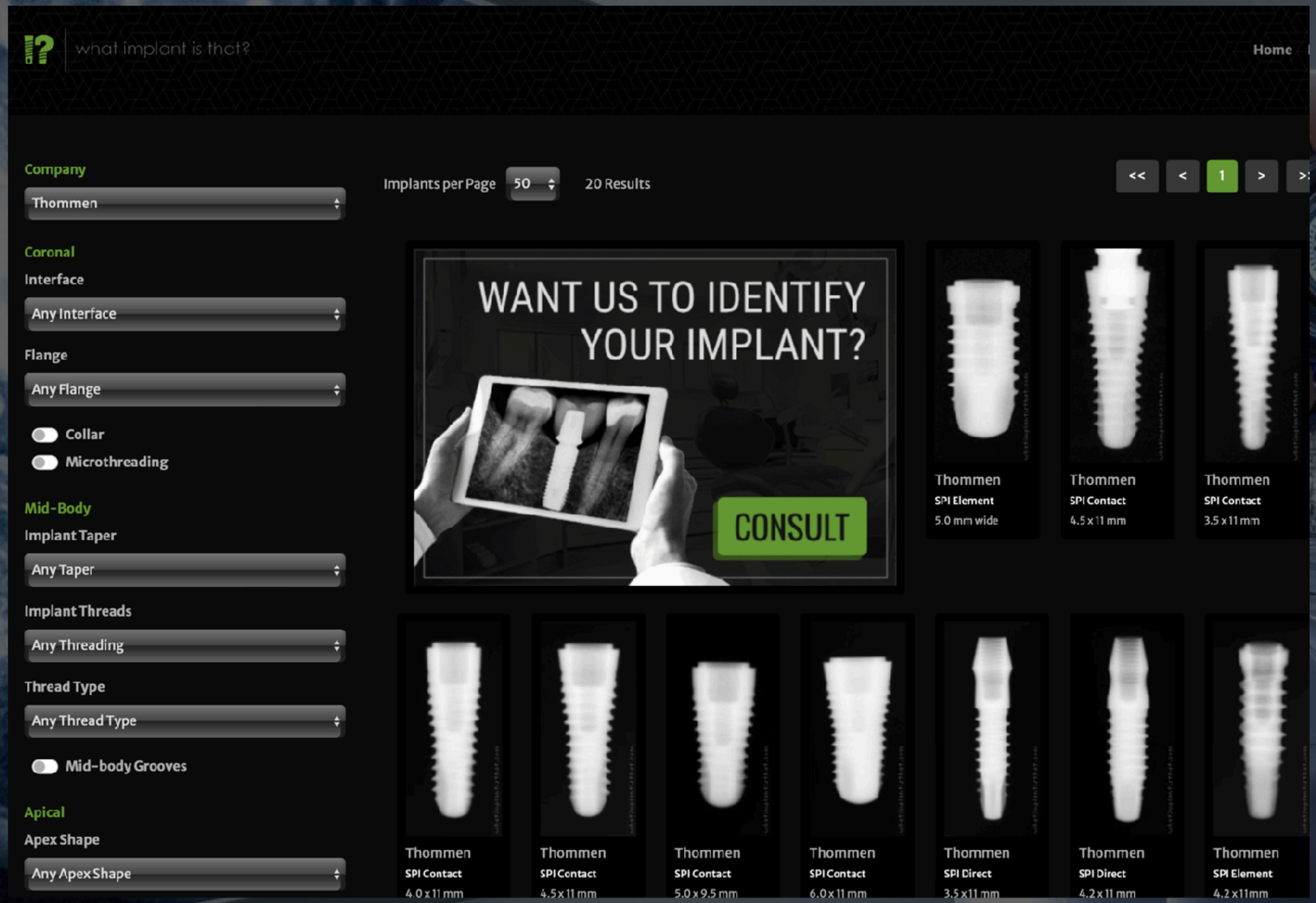
Für was kann man 2024 die künstliche Intelligenz in der **Implantologie** bereits anwenden?



Unbekannte Implantate

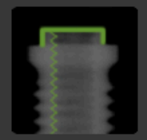
- Keine prothetischen Teil bestellbar
- können nicht versorgt werden
- Explantation

Für was kann man 2024 die künstliche Intelligenz in der **Implantologie** bereits anwenden?



Für was kann man 2024 die künstliche Intelligenz in der **Implantologie** bereits anwenden?

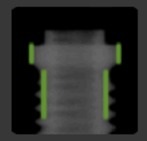
Abutment Interface



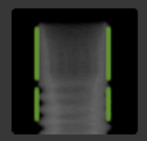
External
External connections, radiographically, appear as a protrusion at the shoulder of the implant. You might also notice that the internal threads begin more coronally.

Internal
The internal connection is flat at the shoulder of the implant. you will see a thin wall surrounding the coronal portion of the implant. Threads often start more apically.

Flange

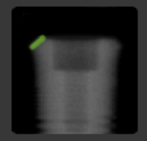


Wider
The flange is wider than the implant body. There is an abrupt transition from the body to the flange.



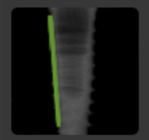
Straight
The flange is the same width as the implant body, with a straight transition between the two.

Collar



Apical Collar
This is where the implant shoulder angles inward toward the abutment interface.

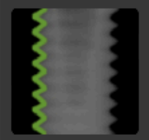
Implant Taper



Tapered
The implant body is wider at the coronal portion and narrower at the apex.

Non-tapered
The width of the implant is the same at the coronal portion and the apex.

Implant Threads



Threaded
The implant body has threads somewhere along it's body, often along the entire length of its body.

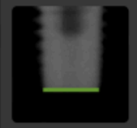
Thread Type

V-shaped Threads
The threads are pointed with both lengths being equal (as opposed to reverse buttress threads).

Square Threads
The threads are not pointed, but square in profile.

Apex Shape

V-shaped Apex
The apex has two flat sides forming a point, whether it is pointed or blunted.



Flat Apex
The apex is flat when viewed in profile.

Open Apex

Open Apex
An open apex refers to a hole through the underside of the implant. Radiographically, it appears as a more radiolucent band that touches the apex.

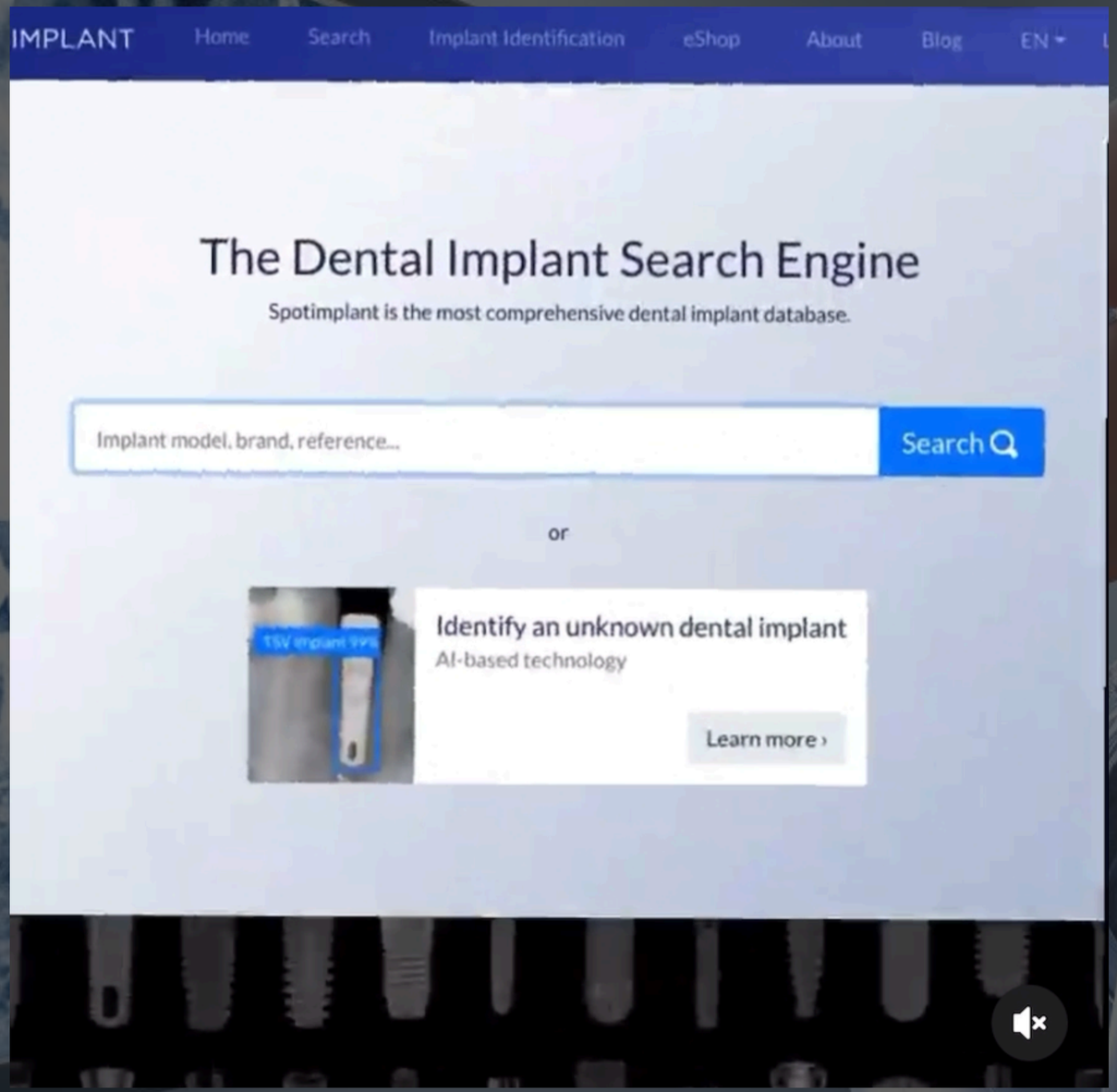
Round Hole

Round Hole
Holes appear in various ways radiographically, they can appear as radiolucent circles when the radiograph is taken perpendicular to the circle or as a radiolucent band if taken parellel to it.

Apical Chamber

Apical Chamber
Refers to there being space inside the implant (hollow space). Seen radiographically as radiolucent areas. these chambers are connected to holes.

Für was kann man 2024 die künstliche Intelligenz in der **Implantologie** bereits anwenden?




Künstliche
Intelligenz
digitale Daten
in der
Zahnmedizin

Künstliche
Intelligenz

digitale Daten
in der
Zahnmedizin

Wie bringe ich die künstliche Intelligenz in die Praxis?

Wie bringe ich die künstliche Intelligenz in die Praxis?

Ich mach mich selbst künstlich intelligent

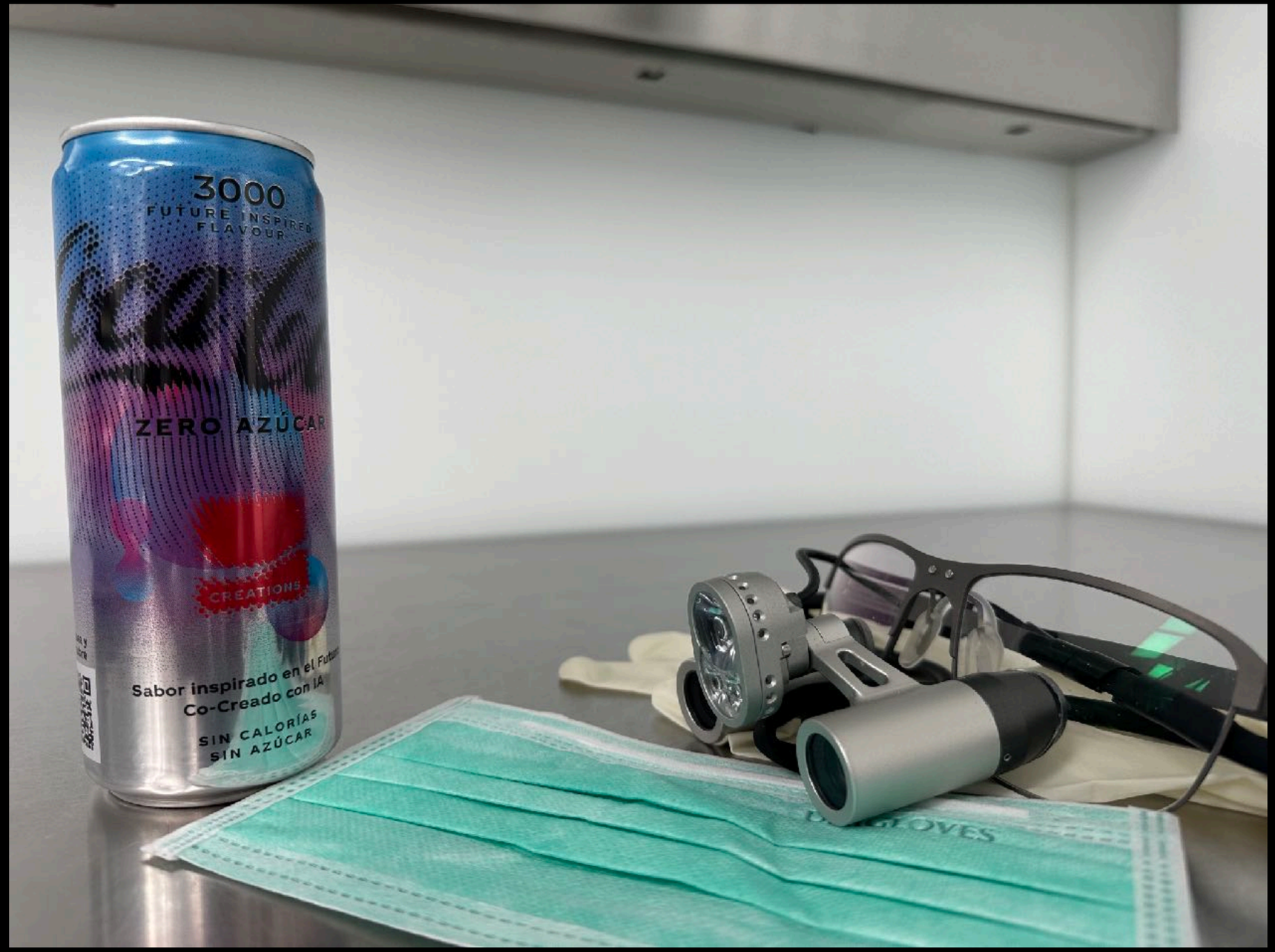
Methode vor 2024

Ich verwende smarte Geräte und Roboter

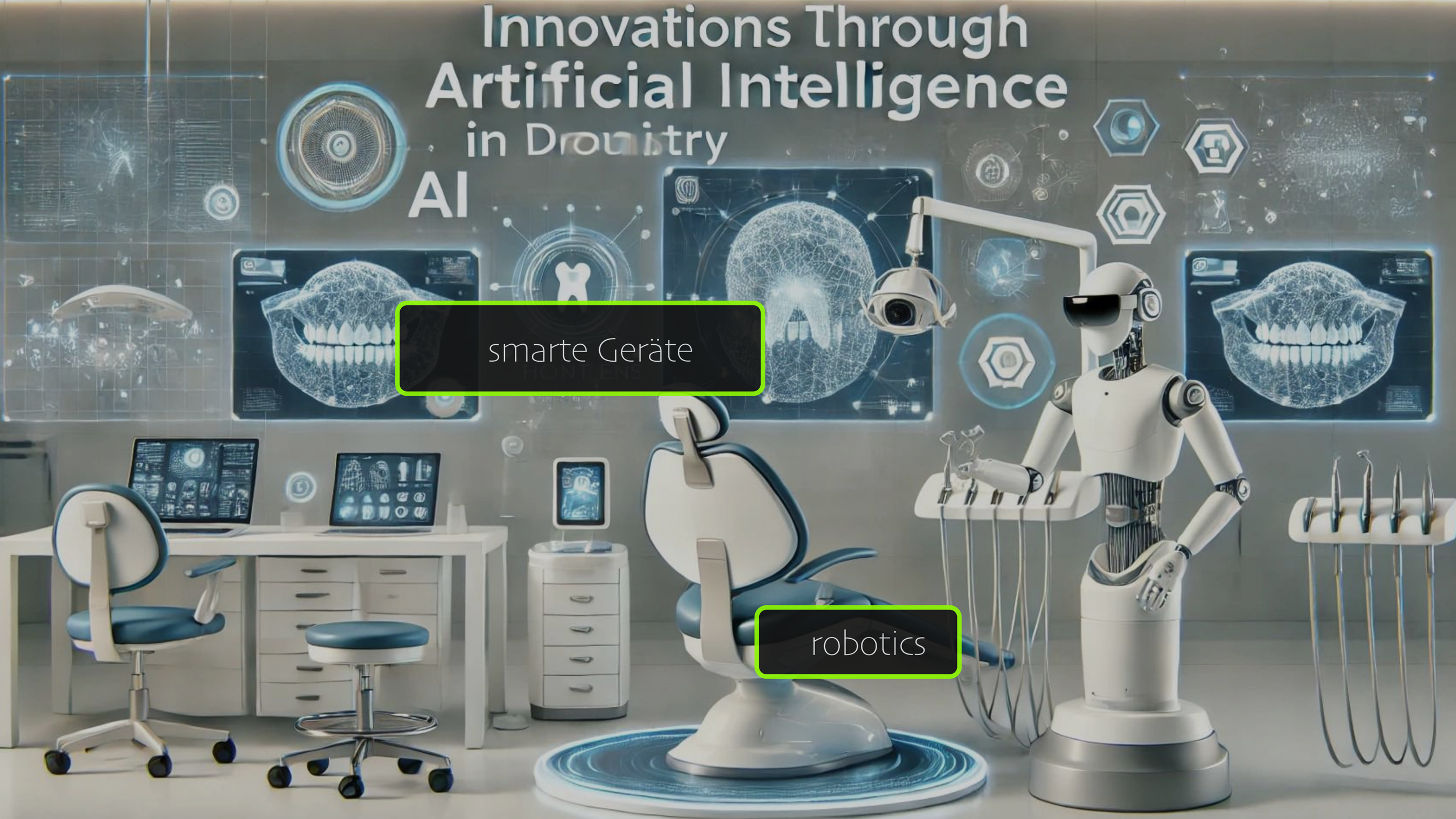
Methode seit 2024

Ich mach mich selbst künstlich intelligent

Methode vor 2024

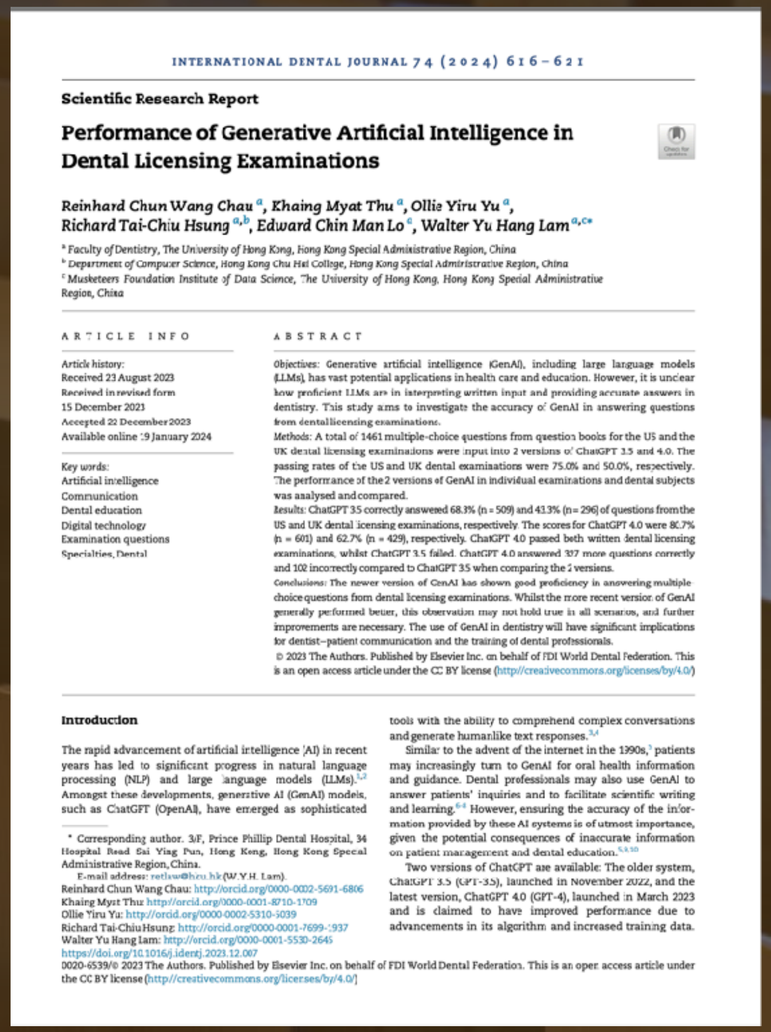


mach die selbst künstlich intelligenter


Innovations Through
Artificial Intelligence
in Dentistry
AI
smarte Geräte
robotics

Ausbildung und Lehre

Ausbildung und Lehre



INTERNATIONAL DENTAL JOURNAL 74 (2024) 616–621

Scientific Research Report

Performance of Generative Artificial Intelligence in Dental Licensing Examinations

Reinhard Chun Wang Chau [a], *Khaing Myat Thu* [a], *Ollie Yiru Yu* [a], *Richard Tai-Chiu Hsung* [a,b], *Edward Chin Man Lo* [a], *Walter Yu Hang Lam* [a,c*]

[a] Faculty of Dentistry, The University of Hong Kong, Hong Kong Special Administrative Region, China
[b] Department of Computer Science, Hong Kong Chu Hai College, Hong Kong Special Administrative Region, China
[c] Musketeers Foundation Institute of Data Science, The University of Hong Kong, Hong Kong Special Administrative Region, China

ARTICLE INFO

Article history:
Received 23 August 2023
Received in revised form
15 December 2023
Accepted 22 December 2023
Available online 19 January 2024

Key words:
Artificial intelligence
Communication
Dental education
Digital technology
Examination questions
Specialties, Dental

ABSTRACT

Objectives: Generative artificial intelligence (GenAI), including large language models (LLMs), has vast potential applications in health care and education. However, it is unclear how proficient LLMs are in interpreting written input and providing accurate answers in dentistry. This study aims to investigate the accuracy of GenAI in answering questions from dental licensing examinations.

Methods: A total of 1461 multiple-choice questions from question books for the US and the UK dental licensing examinations were input into 2 versions of ChatGPT 3.5 and 4.0. The passing rates of the US and UK dental examinations were 75.0% and 50.0%, respectively. The performance of the 2 versions of GenAI in individual examinations and dental subjects was analysed and compared.

Results: ChatGPT 3.5 correctly answered 68.3% (n = 509) and 43.3% (n = 296) of questions from the US and UK dental licensing examinations, respectively. The scores for ChatGPT 4.0 were 87.7% (n = 601) and 62.7% (n = 429), respectively. ChatGPT 4.0 passed both written dental licensing examinations, whilst ChatGPT 3.5 failed. ChatGPT 4.0 answered 337 more questions correctly and 102 incorrectly compared to ChatGPT 3.5 when comparing the 2 versions.

Conclusions: The newer version of GenAI has shown good proficiency in answering multiple-choice questions from dental licensing examinations. Whilst the more recent version of GenAI generally performed better, this observation may not hold true in all scenarios, and further improvements are necessary. The use of GenAI in dentistry will have significant implications for dentist–patient communication and the training of dental professionals.

Introduction

The rapid advancement of artificial intelligence (AI) in recent years has led to significant progress in natural language processing (NLP) and large language models (LLMs).[1,2] Amongst these developments, generative AI (GenAI) models, such as ChatGPT (OpenAI), have emerged as sophisticated tools with the ability to comprehend complex conversations and generate humanlike text responses.[3,4]

Similar to the advent of the internet in the 1990s,[5] patients may increasingly turn to GenAI for oral health information and guidance. Dental professionals may also use GenAI to answer patients' inquiries and to facilitate scientific writing and learning.[6–8] However, ensuring the accuracy of the information provided by these AI systems is of utmost importance, given the potential consequences of inaccurate information on patient management and dental education.[5,9,10]

Two versions of ChatGPT are available: The older system, ChatGPT 3.5 (GPT-3.5), launched in November 2022, and the latest version, ChatGPT 4.0 (GPT-4), launched in March 2023 and is claimed to have improved performance due to advancements in its algorithm and increased training data.

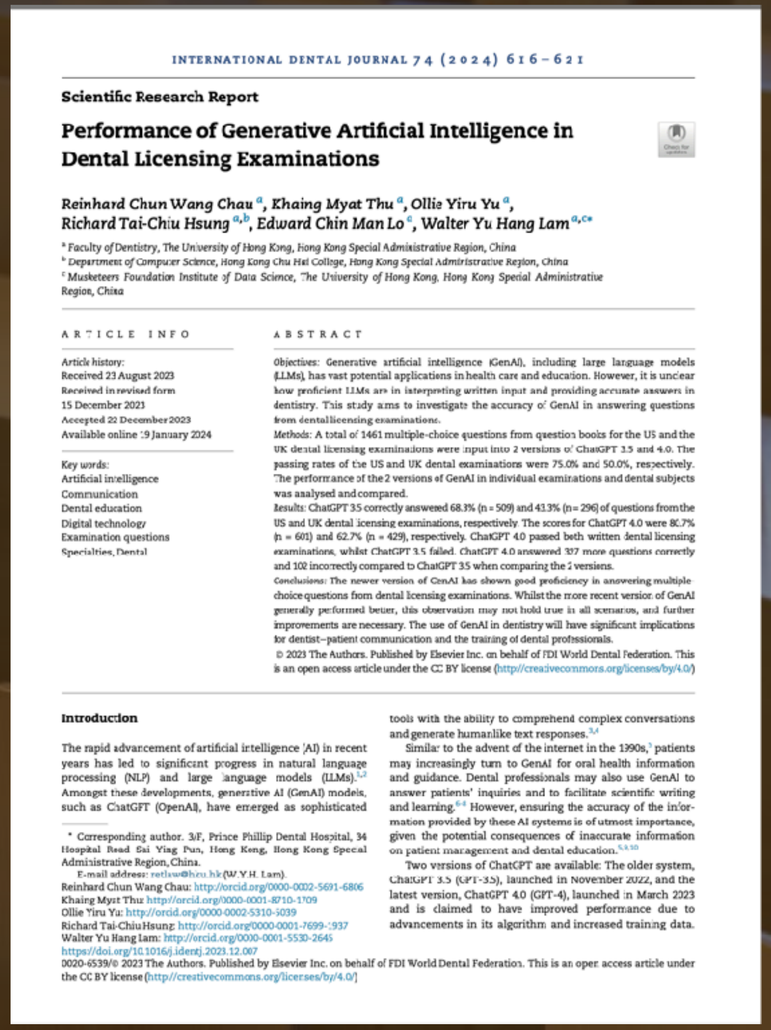
* Corresponding author. 3/F, Prince Phillip Dental Hospital, 34 Hospital Road Sai Ying Pun, Hong Kong, Hong Kong Special Administrative Region, China.
E-mail address: retlaw@hku.hk (W.Y.H. Lam).
Reinhard Chun Wang Chau: http://orcid.org/0000-0002-5691-6806
Khaing Myat Thu: http://orcid.org/0000-0001-8710-1709
Ollie Yiru Yu: http://orcid.org/0000-0002-5310-5039
Richard Tai-Chiu Hsung: http://orcid.org/0000-0001-7699-7937
Walter Yu Hang Lam: http://orcid.org/0000-0001-5530-2645
https://doi.org/10.1016/j.identj.2023.12.007

Zahnärztliche Approbationsprüfung UK und USA

- Bestehensquote: USA (75%), UK (50%)
- ChatGPT 3.5: 68% (USA), 43% (UK) richtige Antworten *nicht bestanden*

Performance of Generative Artificial Intelligence in Dental Licensing Examinations.
Chau RCW, Thu KM, Yu OY, Hsung RT, Lo ECM, Lam WYH.
Int Dent J. 2024 Jun;74

Ausbildung und Lehre



INTERNATIONAL DENTAL JOURNAL 74 (2024) 616–621

Scientific Research Report

Performance of Generative Artificial Intelligence in Dental Licensing Examinations

Reinhard Chun Wang Chau [a], Khaing Myat Thu [a], Ollie Yiru Yu [a], Richard Tai-Chiu Hsung [a,b], Edward Chin Man Lo [c], Walter Yu Hang Lam [a,c]*

[a] Faculty of Dentistry, The University of Hong Kong, Hong Kong Special Administrative Region, China
[b] Department of Computer Science, Hong Kong Chu Hai College, Hong Kong Special Administrative Region, China
[c] Musketeers Foundation Institute of Data Science, The University of Hong Kong, Hong Kong Special Administrative Region, China

ARTICLE INFO

Article history:
Received 23 August 2023
Received in revised form
15 December 2023
Accepted 22 December 2023
Available online 19 January 2024

Key words:
Artificial intelligence
Communication
Dental education
Digital technology
Examination questions
Specialties, Dental

ABSTRACT

Objectives: Generative artificial intelligence (GenAI), including large language models (LLMs), has vast potential applications in health care and education. However, it is unclear how proficient LLMs are in interpreting written input and providing accurate answers in dentistry. This study aims to investigate the accuracy of GenAI in answering questions from dental licensing examinations.

Methods: A total of 1461 multiple-choice questions from question books for the US and the UK dental licensing examinations were input into 2 versions of ChatGPT 3.5 and 4.0. The passing rates of the US and UK dental examinations were 75.0% and 50.0%, respectively. The performance of the 2 versions of GenAI in individual examinations and dental subjects was analysed and compared.

Results: ChatGPT 3.5 correctly answered 68.3% (n = 509) and 43.3% (n = 296) of questions from the US and UK dental licensing examinations, respectively. The scores for ChatGPT 4.0 were 87.7% (n = 601) and 62.7% (n = 429), respectively. ChatGPT 4.0 passed both written dental licensing examinations, whilst ChatGPT 3.5 failed. ChatGPT 4.0 answered 337 more questions correctly and 102 incorrectly compared to ChatGPT 3.5 when comparing the 2 versions.

Conclusions: The newer version of GenAI has shown good proficiency in answering multiple-choice questions from dental licensing examinations. Whilst the more recent version of GenAI generally performed better, this observation may not hold true in all scenarios, and further improvements are necessary. The use of GenAI in dentistry will have significant implications for dentist–patient communication and the training of dental professionals.

Introduction

The rapid advancement of artificial intelligence (AI) in recent years has led to significant progress in natural language processing (NLP) and large language models (LLMs).[1,2] Amongst these developments, generative AI (GenAI) models, such as ChatGPT (OpenAI), have emerged as sophisticated tools with the ability to comprehend complex conversations and generate humanlike text responses.[3,4]

Similar to the advent of the internet in the 1990s,[5] patients may increasingly turn to GenAI for oral health information and guidance. Dental professionals may also use GenAI to answer patients' inquiries and to facilitate scientific writing and learning.[6–8] However, ensuring the accuracy of the information provided by these AI systems is of utmost importance, given the potential consequences of inaccurate information on patient management and dental education.[5,9,10]

Two versions of ChatGPT are available: The older system, ChatGPT 3.5 (GPT-3.5), launched in November 2022, and the latest version, ChatGPT 4.0 (GPT-4), launched in March 2023 and is claimed to have improved performance due to advancements in its algorithm and increased training data.

* Corresponding author. 3/F, Prince Phillip Dental Hospital, 34 Hospital Road Sai Ying Pun, Hong Kong, Hong Kong Special Administrative Region, China.
E-mail address: retlaw@hku.hk (W.Y.H. Lam).
Reinhard Chun Wang Chau: http://orcid.org/0000-0002-5691-6806
Khaing Myat Thu: http://orcid.org/0000-0001-8710-1709
Ollie Yiru Yu: http://orcid.org/0000-0002-5310-5039
Richard Tai-Chiu Hsung: http://orcid.org/0000-0001-7699-7937
Walter Yu Hang Lam: http://orcid.org/0000-0001-5530-2645

https://doi.org/10.1016/j.identj.2023.12.007

Studie zu Künstlicher Intelligenz

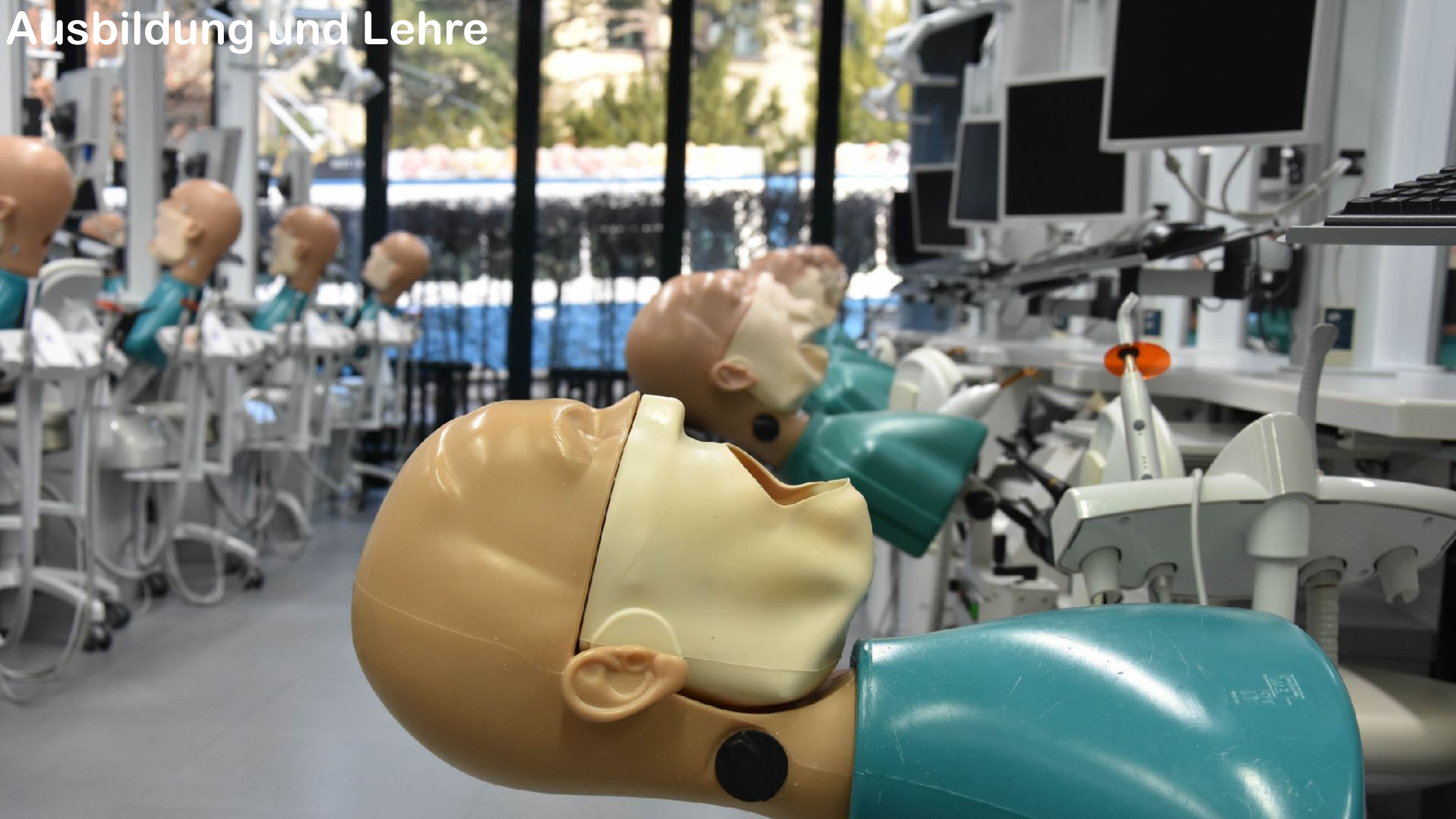
ChatGPT 4.0 besteht zahnärztliche Approbationsprüfungen

Zahnärztliche Approbationsprüfung UK und USA

- Bestehensquote: USA (75%), UK (50%)
- ChatGPT 3.5: 68% (USA), 43% (UK) richtige Antworten *nicht bestanden*
- ChatGPT 4.0: 81% (USA), 60% (UK) richtige Antworten *bestanden*

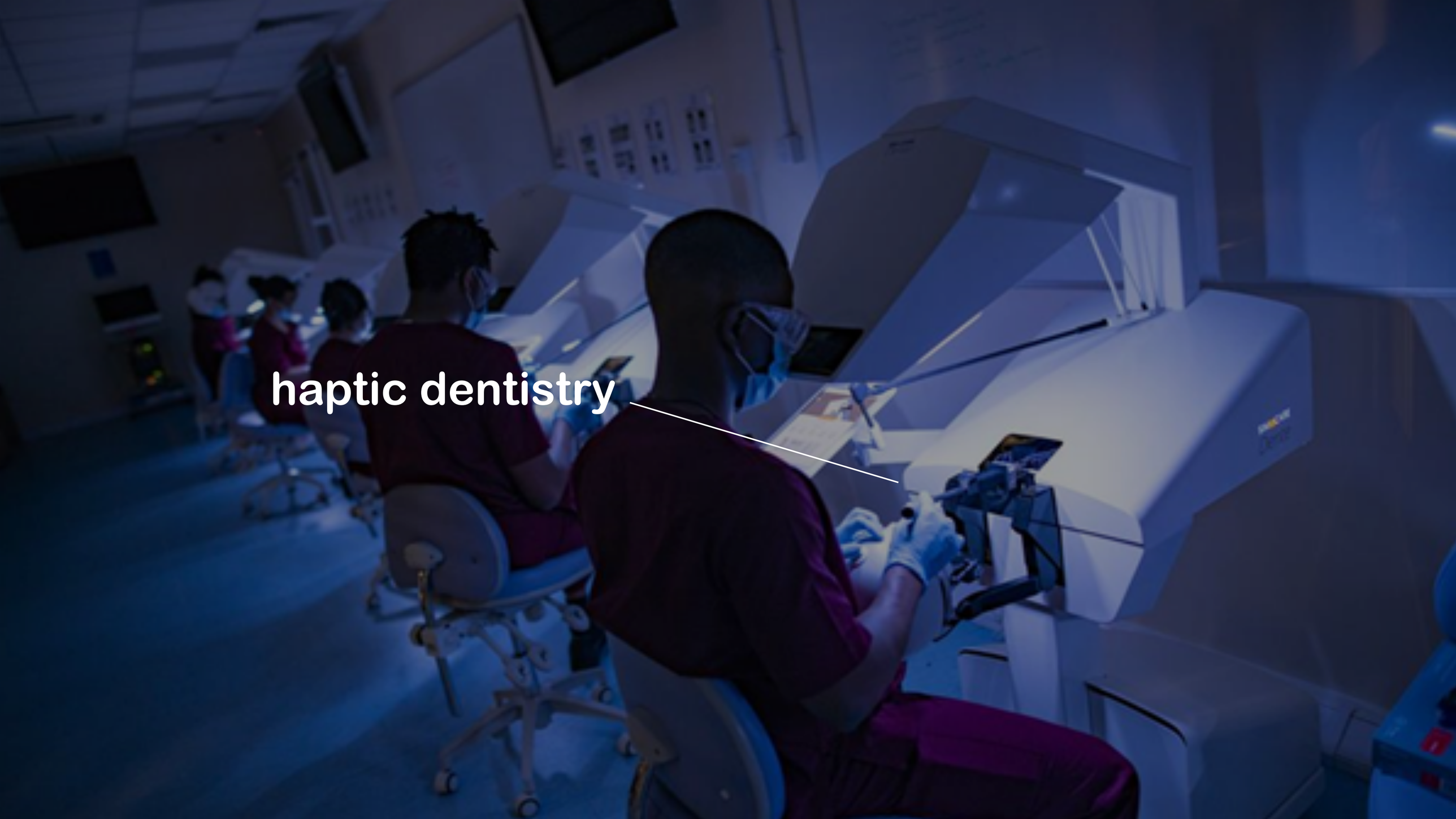
Performance of Generative Artificial Intelligence in Dental Licensing Examinations.
Chau RCW, Thu KM, Yu OY, Hsung RT, Lo ECM, Lam WYH.
Int Dent J. 2024 Jun;74

Ausbildung und Lehre



Nissin / Frasaco

- mangelnde Individualität
  (kein Bezug zum Patienten)
- idealisierte Situation
- Materialverschleiss
- unrealistische Materialien
- keine automatisiertes Feedback
- kein Zugang zur digitalen Welt / keine KI


haptic dentistry

haptic dentistry

Haptisches ÜBEN

- Individualität
  (direkter Bezug zum Patienten)
- reale Situation
- wiederholbar
- kein Materialverschleiss
- automatisiertes Feedback
- automatisiert evaluierbar
- Zugang zur digitalen Welt / KI

haptic dentistry

Study plan

Conventional learning

Conventional learning

Virtual learning

JK 4 Propädeutischer Kurs

Prüfung I

Semesterferien

1 Woche

Prüfung II
2 Woche

2 Wochen

4h

1.5 h

1.5 h

Comparison of the learning effect between training on conventional typodonts and novel haptic 3D simulators for the preparation of fixed restorations: a randomized study in dental educationC
M. Balmer; A. Pulver, A. Mehl, R. Jung, A. Zürcher
ongoing


RUTURE
TEETH
PREDICTLY
YOUR TEETH
HEALTHY
HEALTHY
THERAPY
DENTAL
DENTAL
SUCCELTHY
Diagnostik

Diagnostik

Diagnostik

Diagnostik

Diagnostik

2D

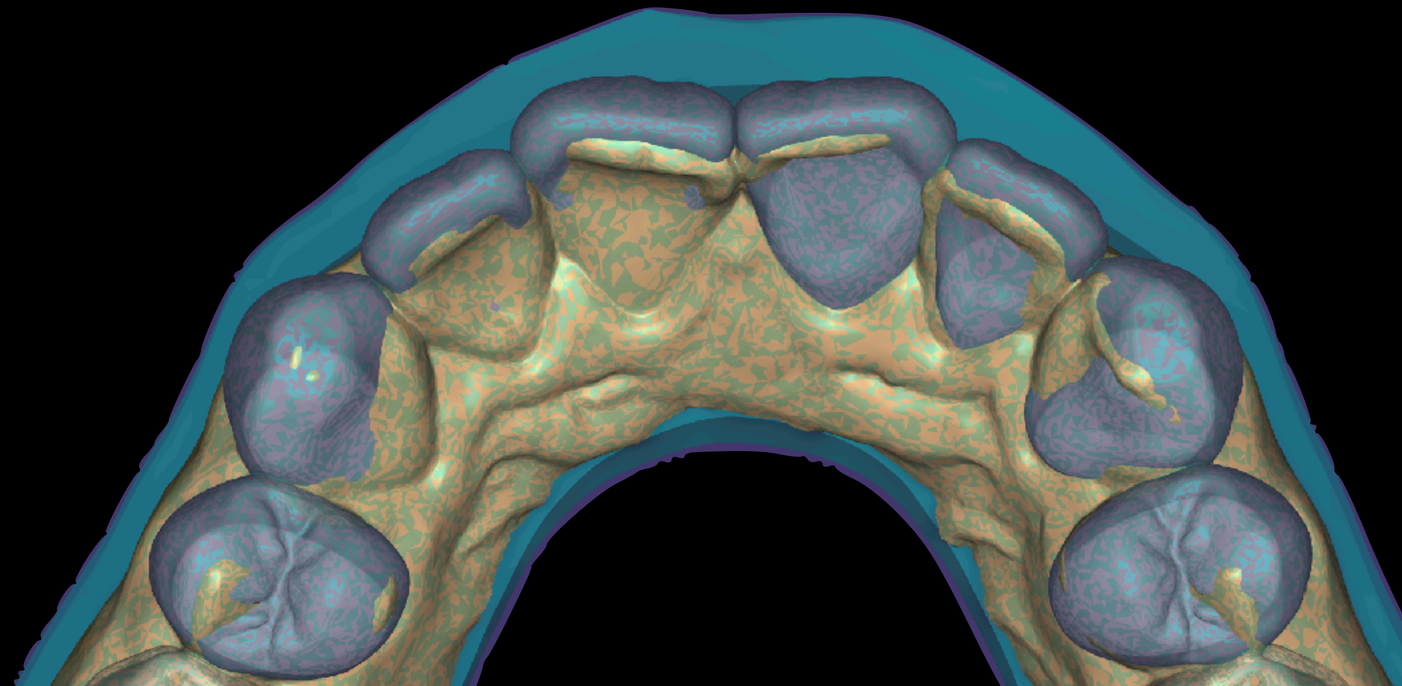
Diagnostik

2D

Diagnostik

in courtesy of PD Dr. Ioannidis

3: diagnostic wax-up




Implantologie

Abweichung

Fully Guided Versus Half-Guided and Freehand Implant Placement:
Systematic Review and Meta-analysis.
Gargallo-Albiol J, Barootchi S, Marqués-Guasch J, Wang HL.
Int J Oral Maxillofac Implants. 2020 Nov/Dec

Abweichung

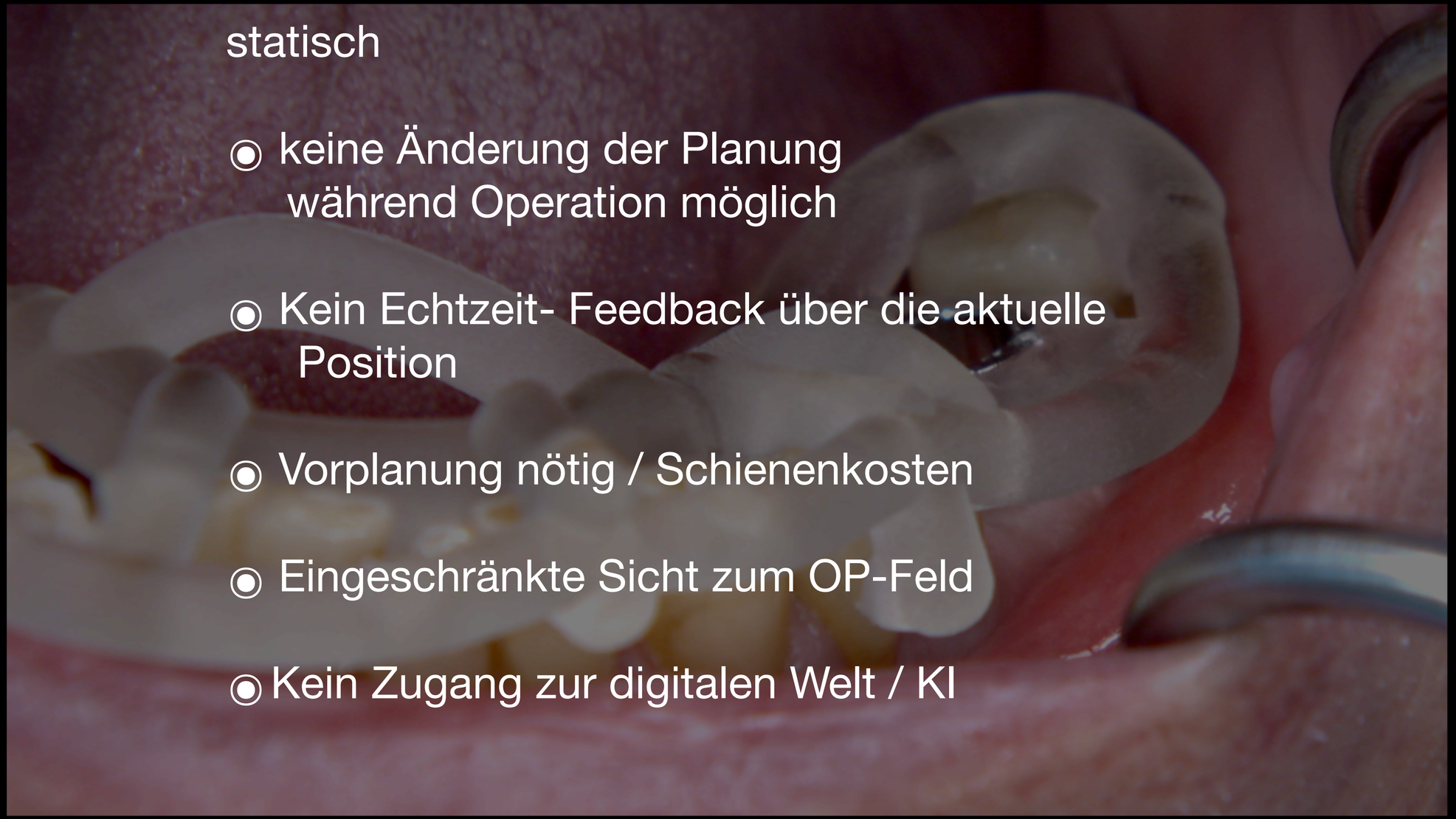
	mittlerer Fehler
Einstiegspunkt	1.8mm
Spitze	1.97 mm
Winkel	7°
Versenktiefe	1.25 mm

Fully Guided Versus Half-Guided and Freehand Implant Placement: Systematic Review and Meta-analysis.
Gargallo-Albiol J, Barootchi S, Marqués-Guasch J, Wang HL.
Int J Oral Maxillofac Implants. 2020 Nov/Dec

geführte Implantologie

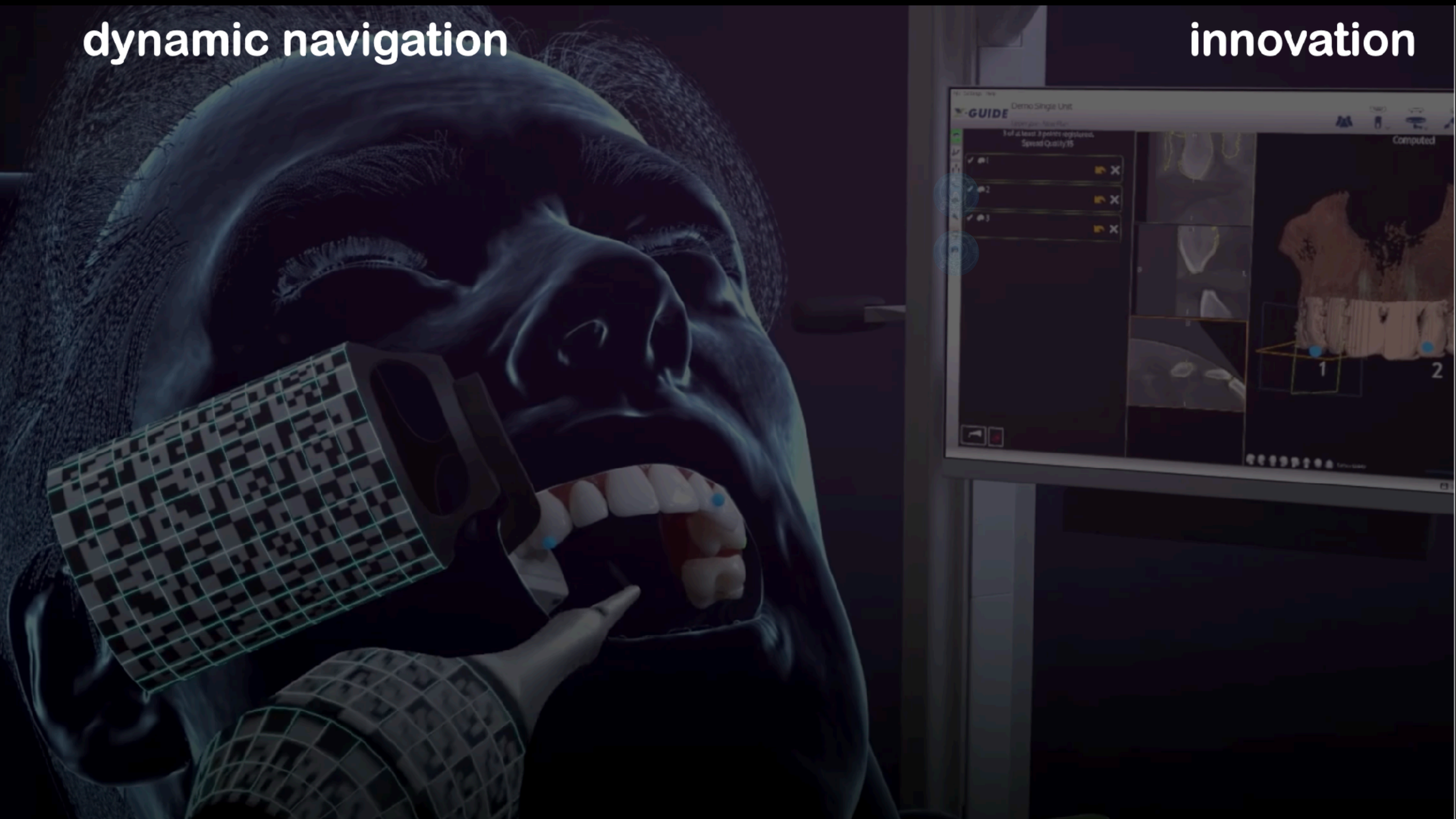
geführte Implantologie

geführte Implantologie



statisch

- keine Änderung der Planung während Operation möglich
- Kein Echtzeit- Feedback über die aktuelle Position
- Vorplanung nötig / Schienenkosten
- Eingeschränkte Sicht zum OP-Feld
- Kein Zugang zur digitalen Welt / KI

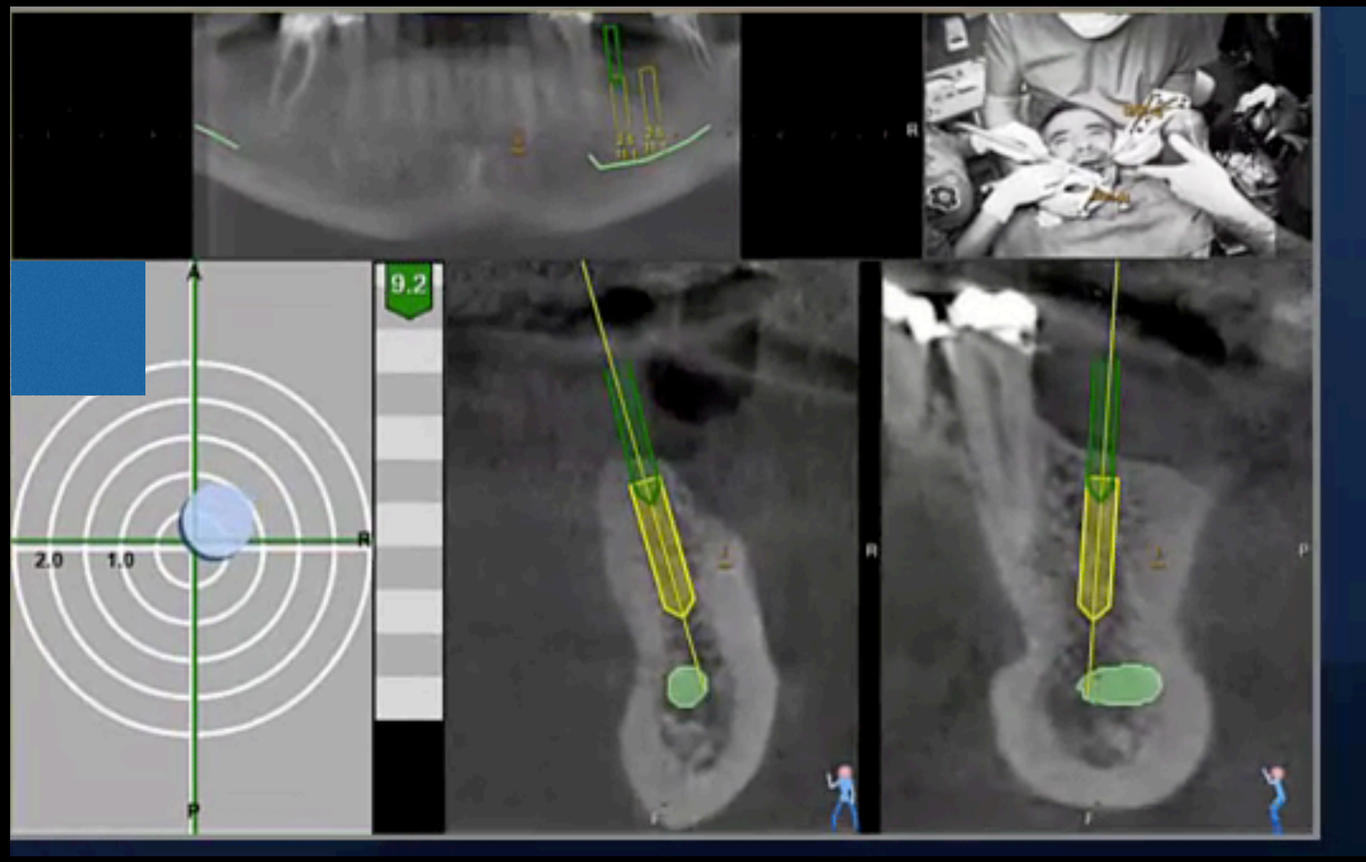

dynamic navigation
innovation
GUIDE
Demo Singia Unit
Computed
1
2

dynamic navigation

dynamic navigation

dynamic navigation

dynamic navigation

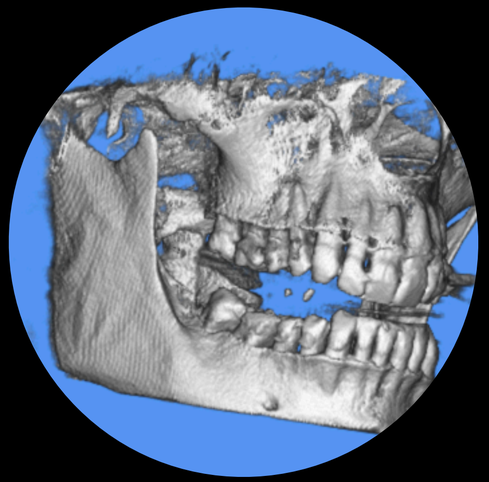


dynamic navigation

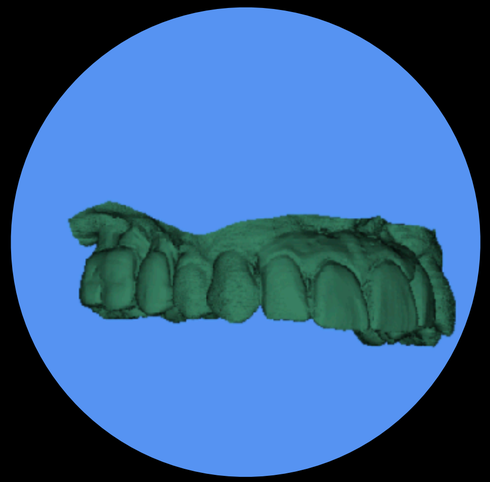
dynamic navigation

Workflow

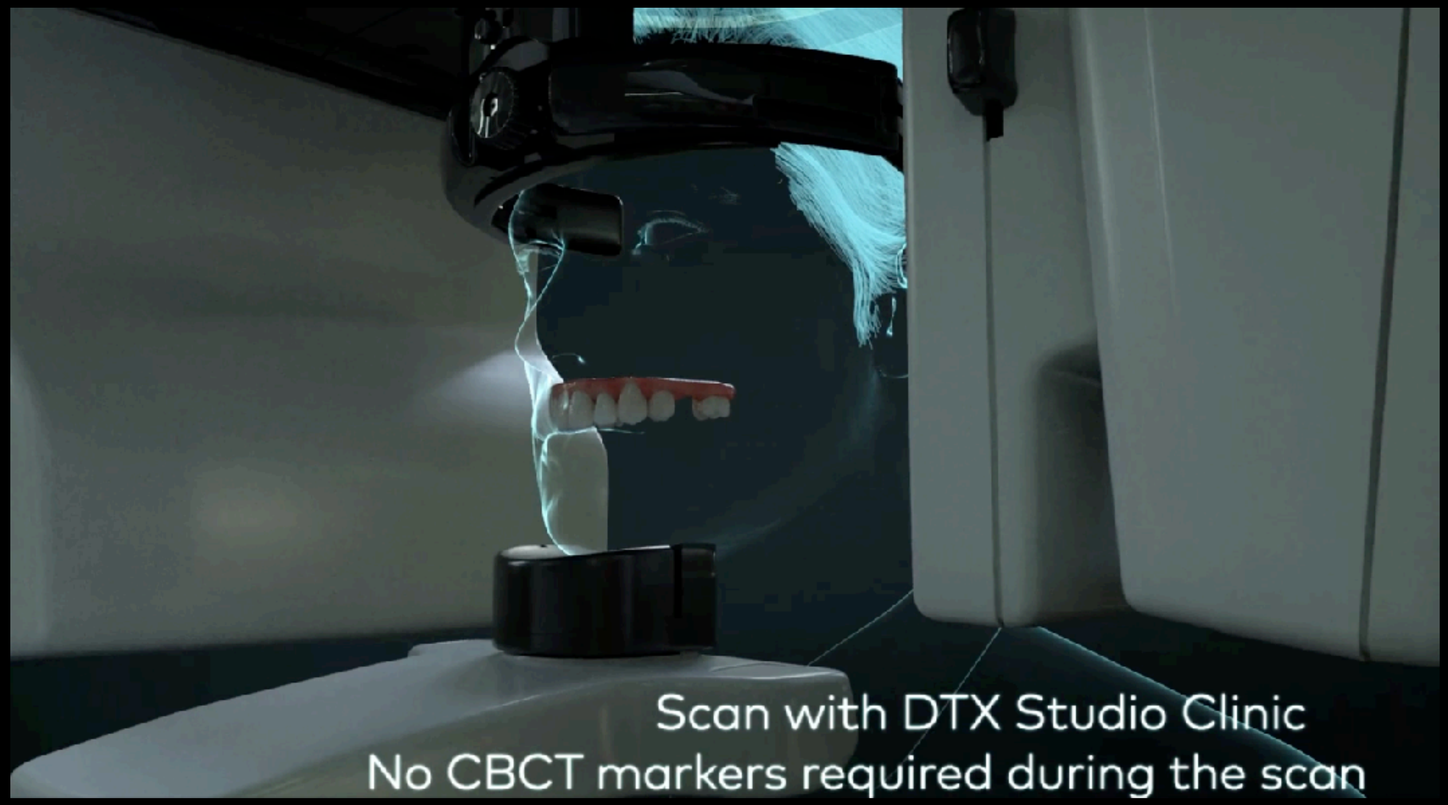
Data acquisition



CBCT
(DICOM)



digital Waxup
(STL)

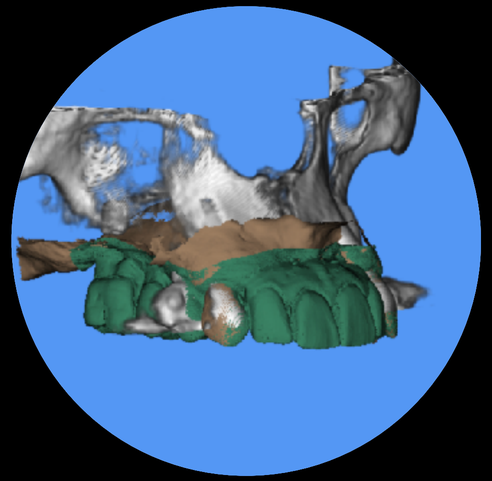


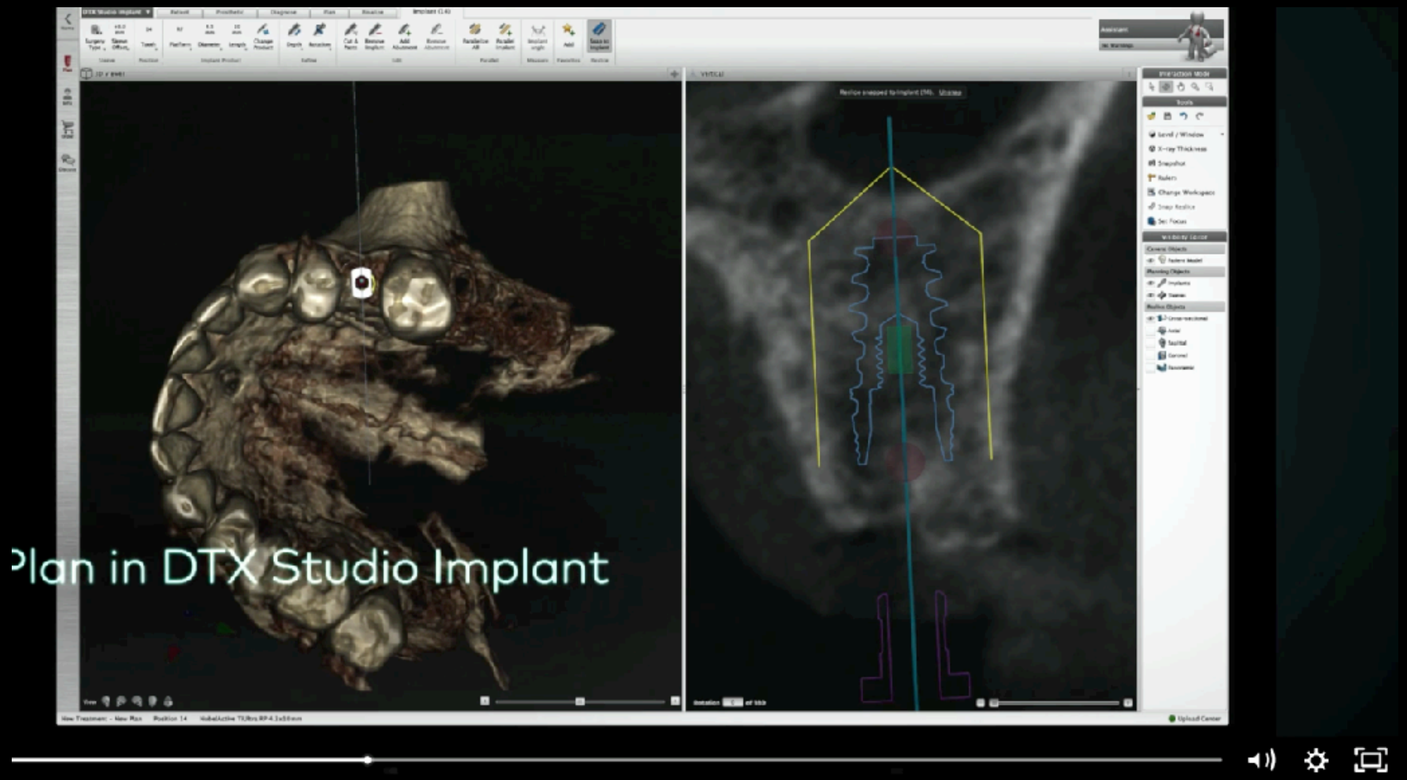
dynamic navigation

Workflow

Data import into planning software

3D / virtual implant planning

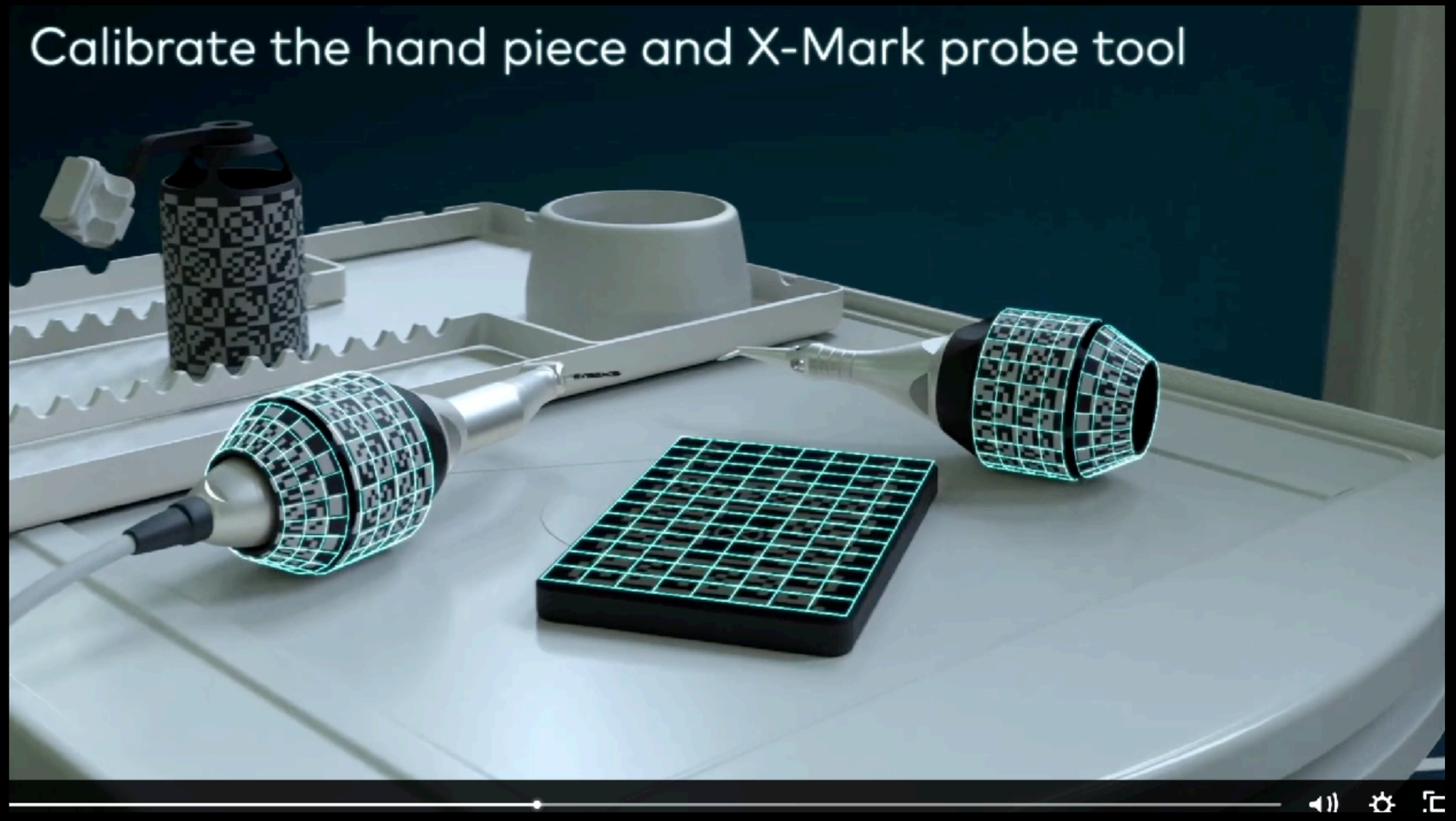




dynamic navigation

Workflow

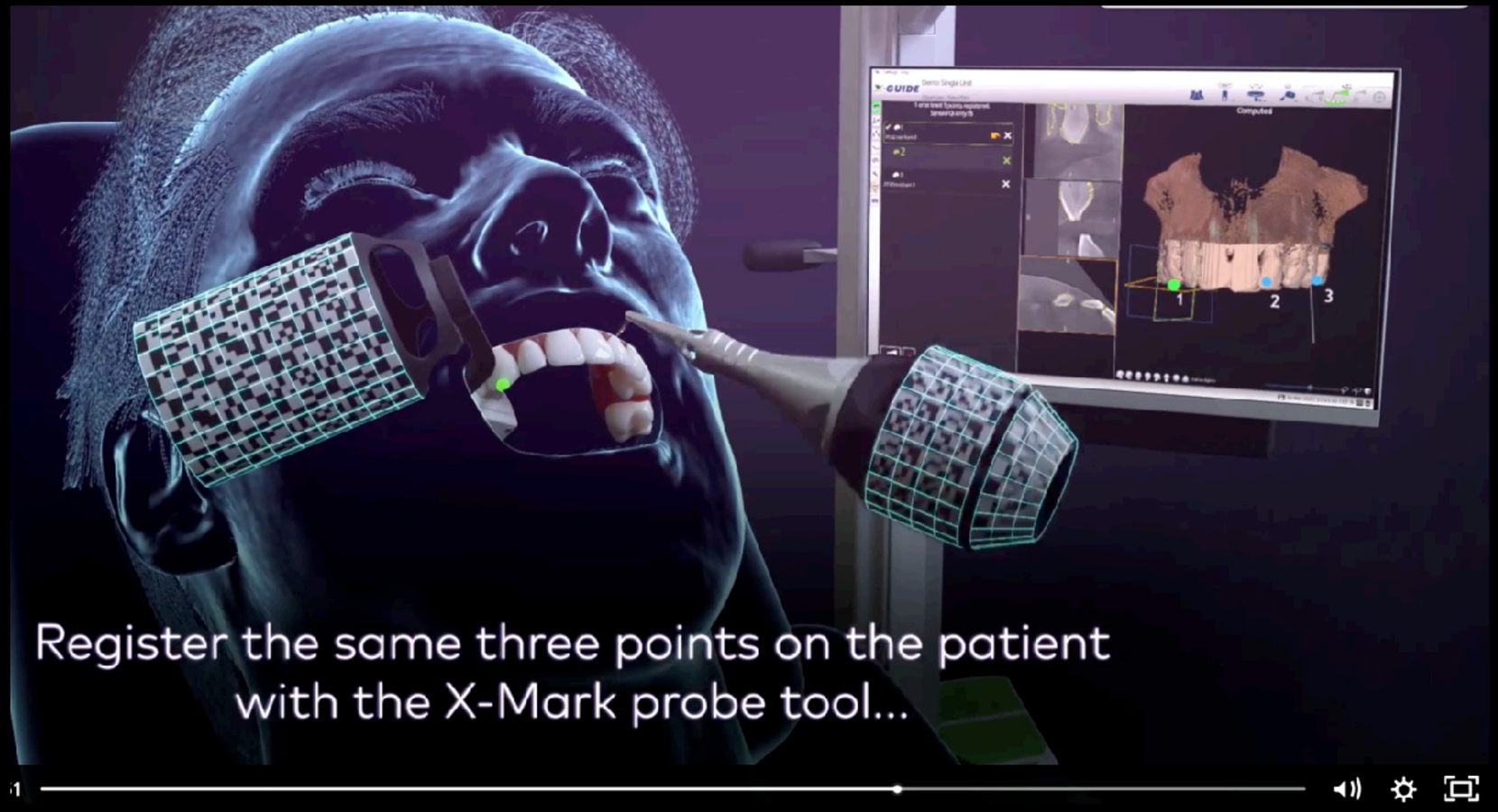
tracing
calibration



dynamic navigation

Workflow

tracing
calibration

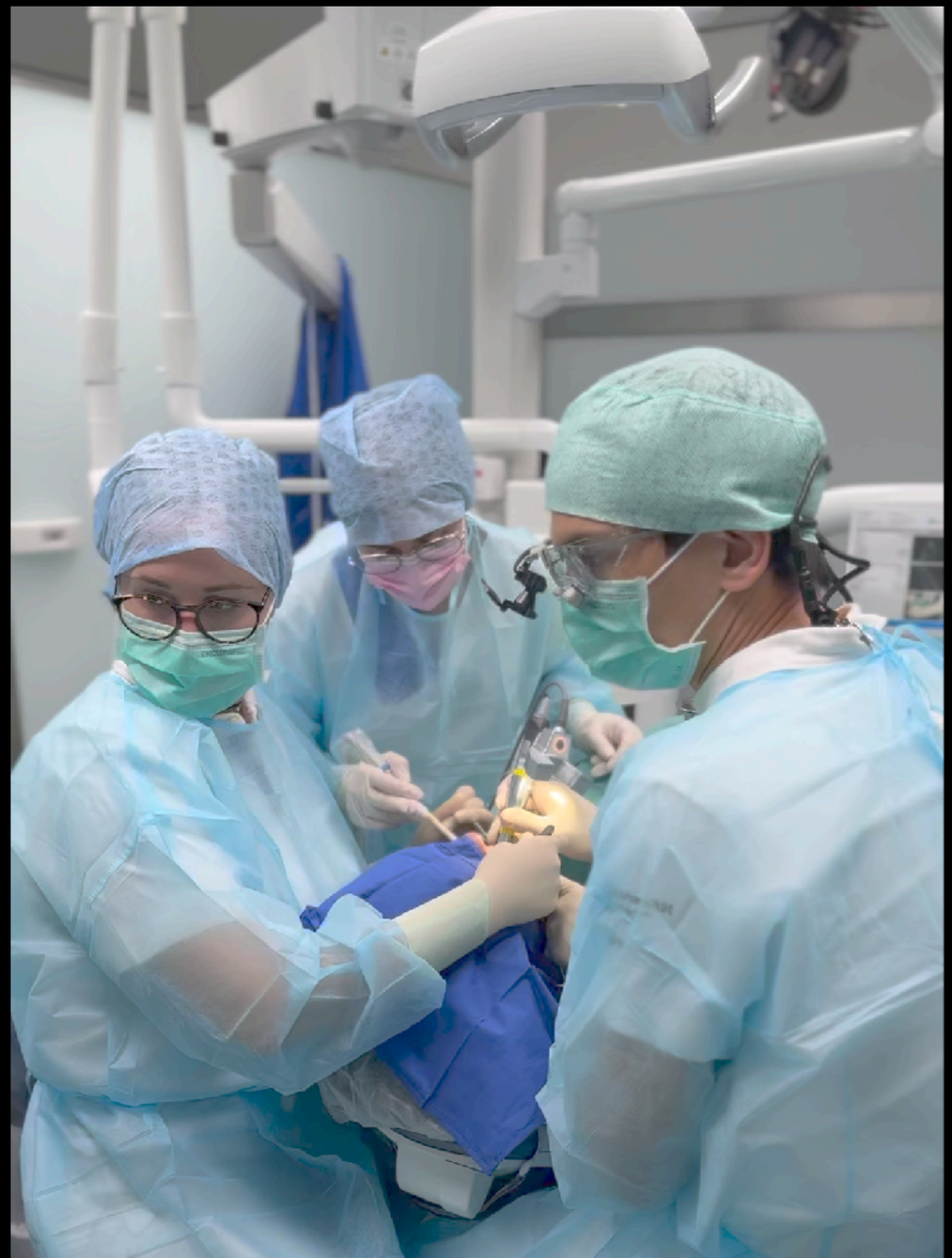


dynamic navigation

Workflow

surgery

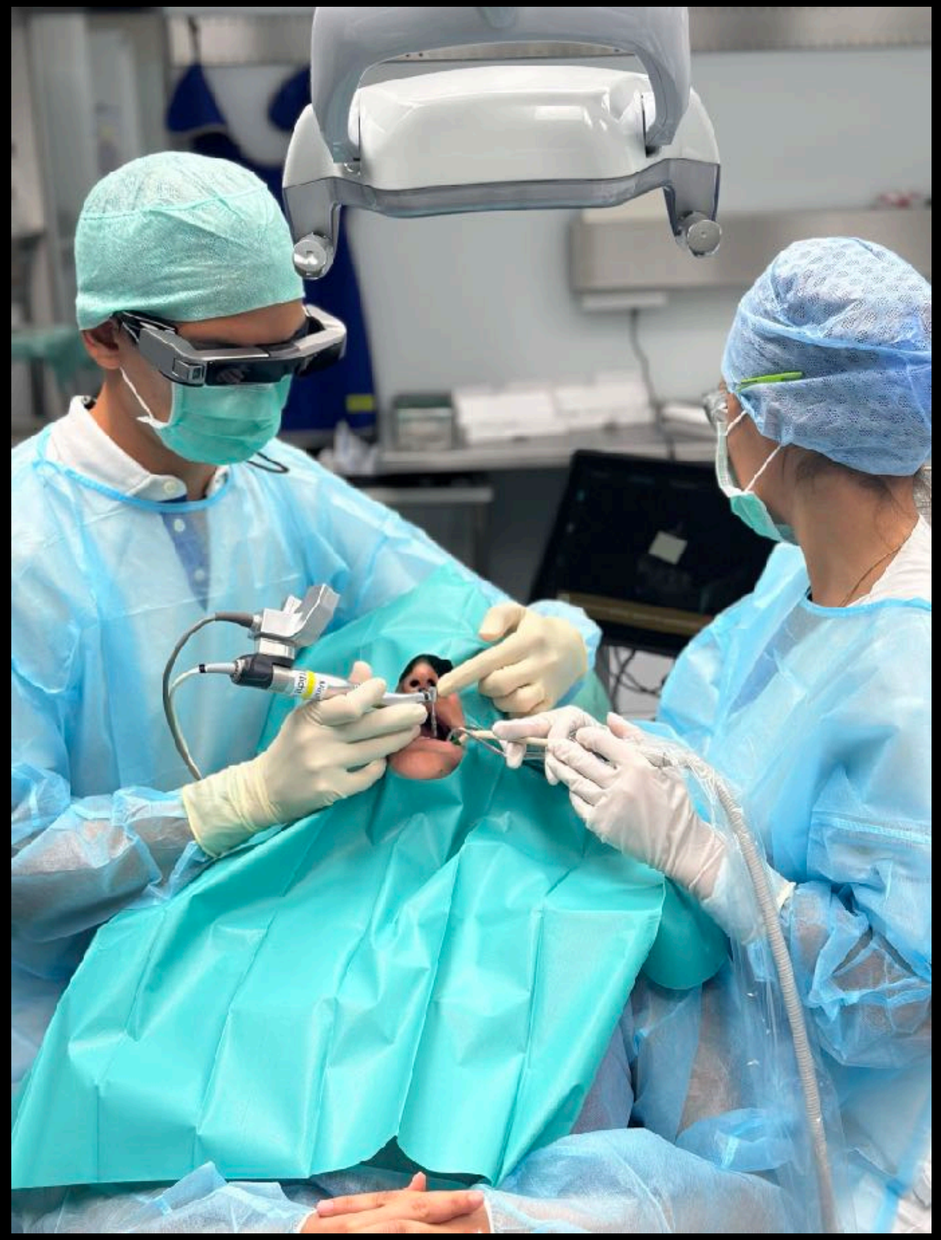
dynamic navigation



dynamic navigation

dynamic navigation

dynamic navigation



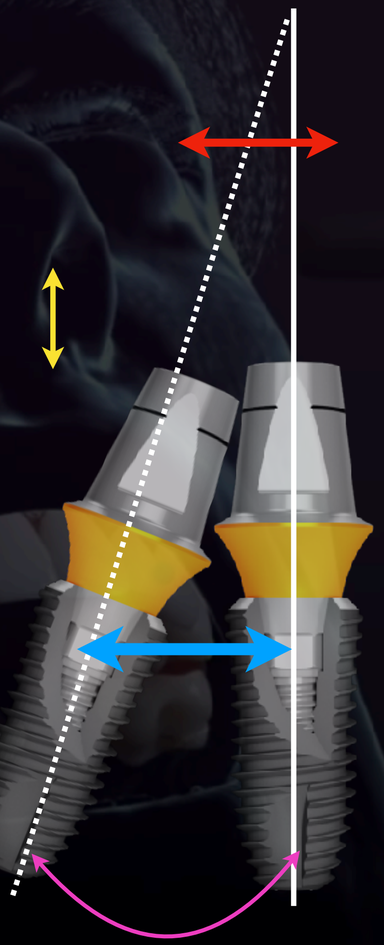
Genauigkeit

Genauigkeit

1.02 mm (95% CI (0.83, 1.21))

1. 33mm (95% CI (0.98, 1.67))

3.59° (95%CI (2.09, 5.09))



- No significant difference for:
  - jaw
  - systems used

Accuracy of dynamic navigation in implant surgery: A systematic review and meta-analysis
Wei SM, Zhu Y, Wei JX, Zhang CN, Shi JY, Lai HC.
Clin Oral Implants Res. 2021 Apr

dynamic navigation

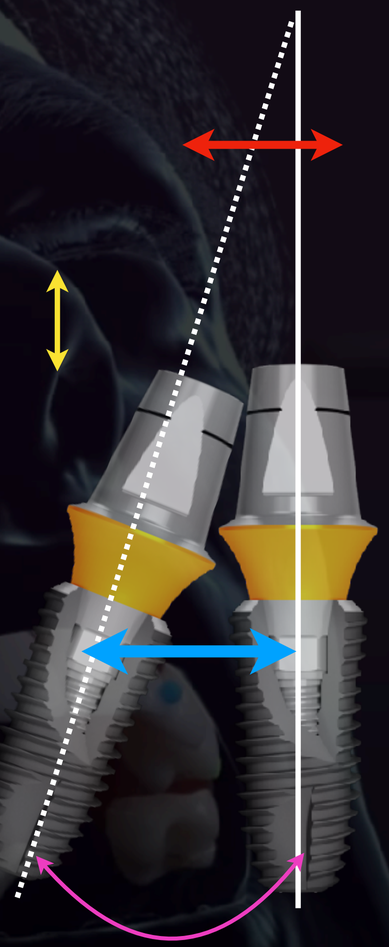
dynamisch

- Änderung der Planung
  während Operation möglich
- Echtzeit- Feedback über die aktuelle
  Position
- direkte Interaktion mit digitalen Daten
- Zugang zum OP-Feld nicht eingeschränkt
- Zugang zur digitalen Welt / KI

dynamic navigation

innovation

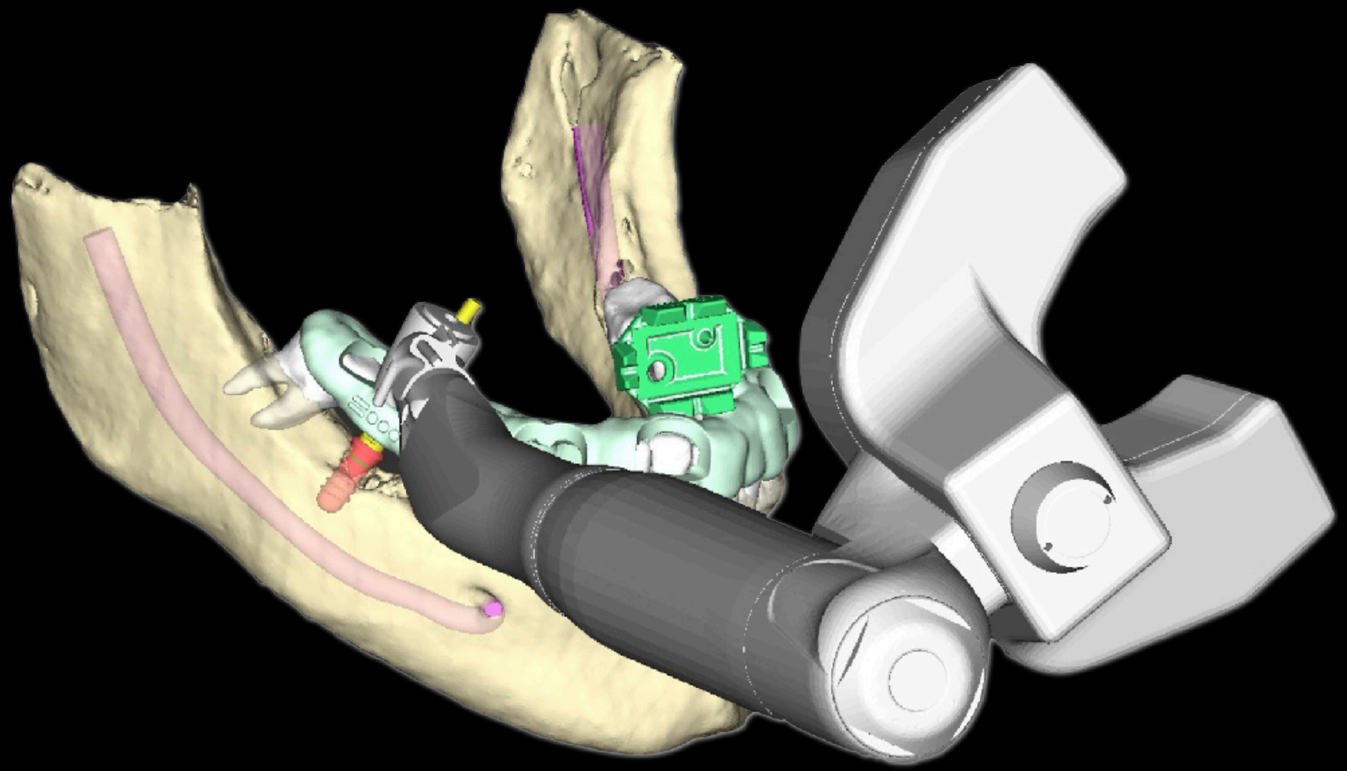
x̄ first 50 implants
0.94mm
1.19mm
3.48˚

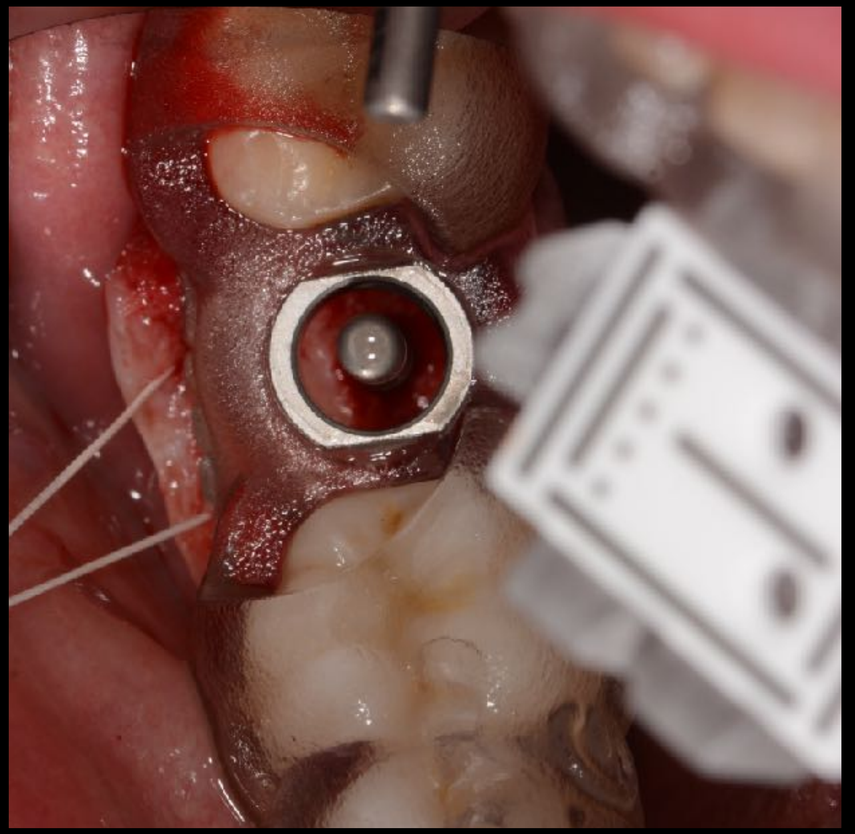


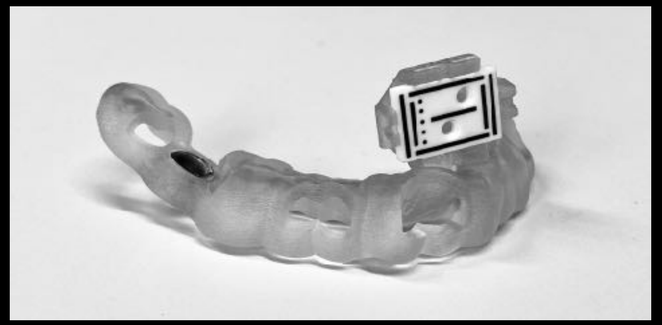
x̄ last 50 implants
0.59mm
0.85mm
1.98˚

Accuracy of a Dynamic Dental Implant Navigation System in a Private Practice
Stefanelli LV, DeGroot BS, Lipton DI, Mandelaris GA
Int J Oral Maxillofac Implants. 2019 January/February;34(1):205–213

dynamic navigation





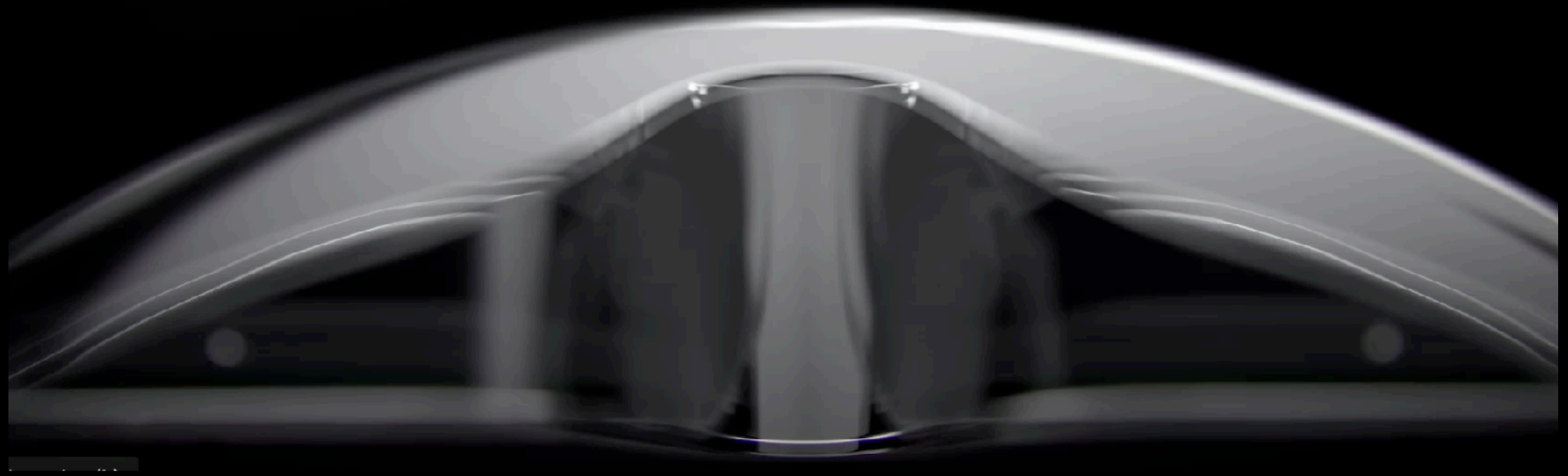



hololens
augmented / mixed / virtual reality

augmented / mixed / virtual reality

Augmented Reality

Microsoft Hololens 2



augmented / mixed / virtual reality

SCIENCE DOI: 10.3290/j.ijcd.b5394865, PubMed-ID: 38801193 27. MAI 2024, SEITEN: 1-35, SPRACHE: ENGLISCH
Sadilina, Sofya / Strauss, Franz J. / Jung, Ronald E. / Joda, Tim / Balmer, Marc

Use of optical see-through head-mounted devices in dentistry - a scoping review

Aim: The aim of this scoping review was to identify the scientific evidence related to the utilization of Optical See- Through Head-Mounted Display (OST-HMD) in dentistry, and to determine future research needs.

Methods: The research question was formulated using the "Population" (P), "Concept" (Cpt), and "Context" (Cxt) framework for scoping reviews. Existing literature was designated as P, OST-HMD as Cpt, and Dentistry as Cxt. An electronic search was conducted in PubMed, Embase, Web of Science, and CENTRAL. Two authors independently screened titles and abstracts and performed the full-text analysis.

Results: The search identified 286 titles after removing duplicates. Nine studies, involving 138 participants and 1760 performed tests were included in this scoping review. Seven of the articles were preclinical studies, one was a survey, and one was a clinical trial. The included manuscripts covered various dental fields: three studies in orthodontics, two in oral surgery, two in conservative dentistry, one in general dentistry, and the remaining one in prosthodontics. Five articles focused on educational purposes. Two brands of OST-HMD were used: in eight studies HoloLens Microsoft was used, while Google Glass was utilized in one article.

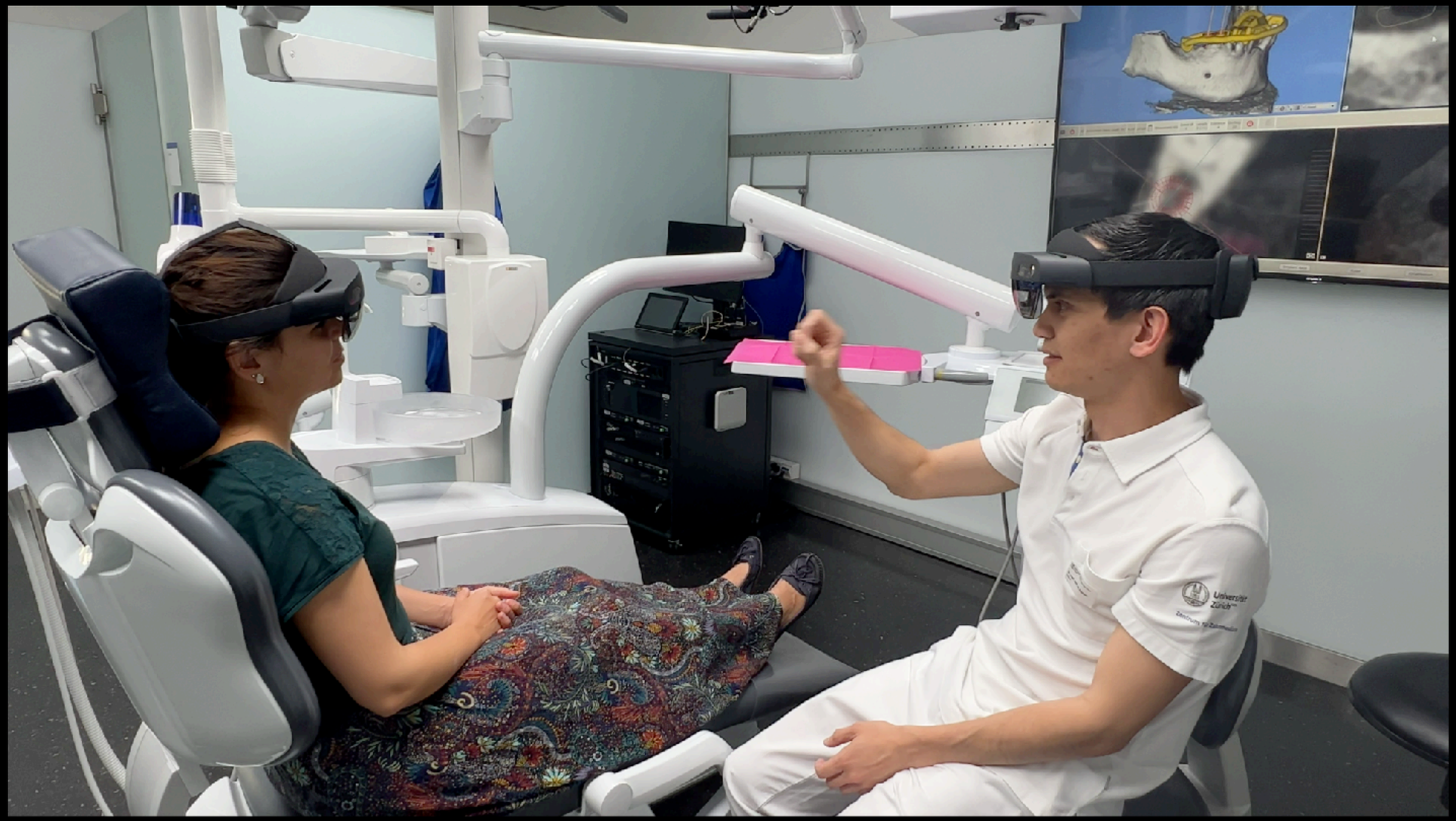
Conclusions: The overall number of included studies was low; therefore, the available data from this review cannot yet support an evidence-based recommendation for the clinical use of OST-HMDs. However, the existing preclinical data indicate a significant capacity for clinical and educational implementation. Further adoption of these devices will facilitate more reliable and objective quality and performance assessments, as well as more direct comparisons with conventional workflows. More clinical studies must be conducted to substantiate the potential benefits and reliability for patients and clinicians.

Use of optical see-through head-mounted devices in dentistry - a scoping review.
Sadilina S, Strauss FJ, Jung RE, Joda T, Balmer M.
Int J Comput Dent. 2024

augmented / mixed / virtual reality

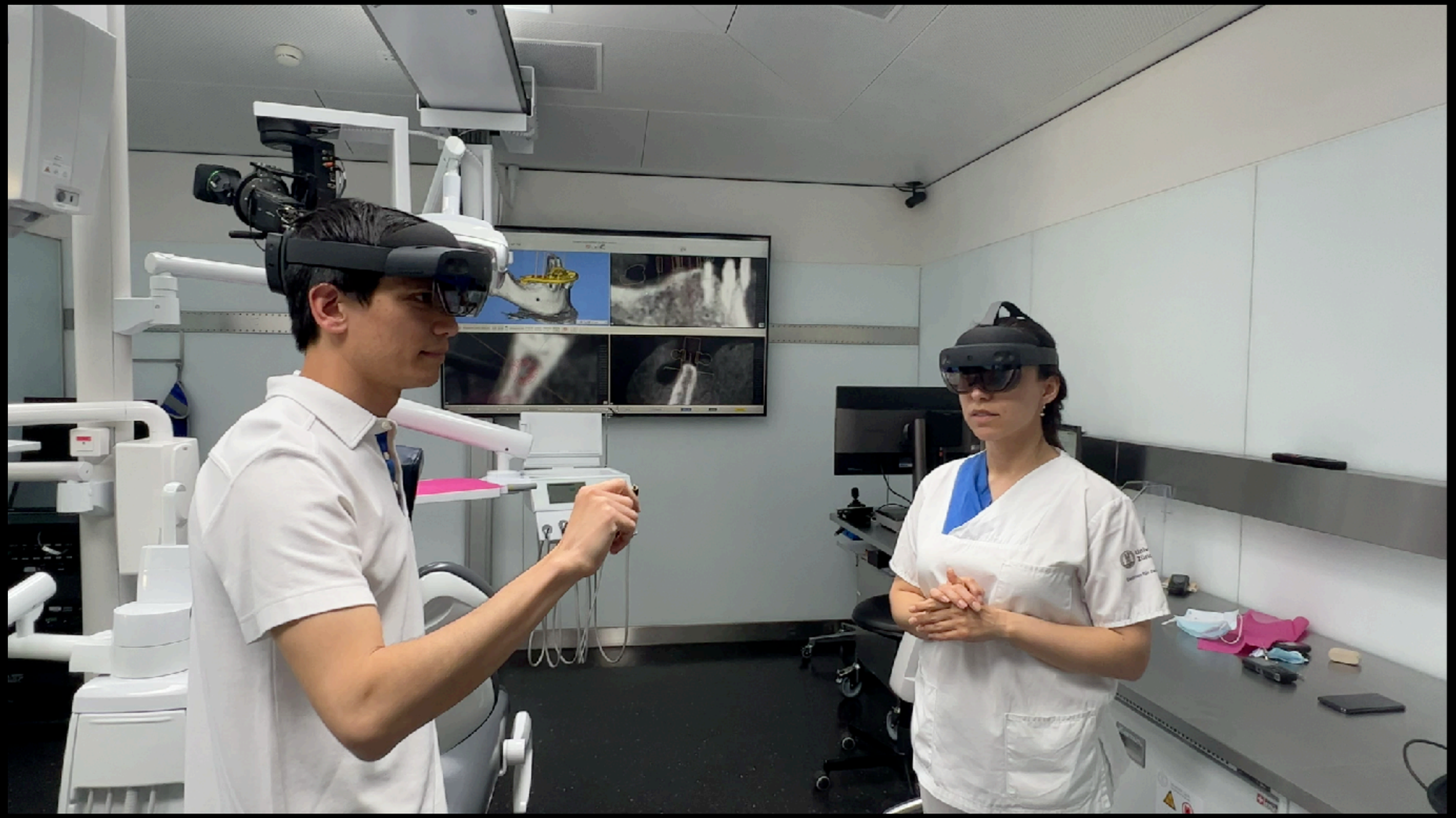
Use of optical see-through head-mounted devices in dentistry - a scoping review.
Sadilina S, Strauss FJ, Jung RE, Joda T, Balmer M.
Int J Comput Dent. 2024

augmented / mixed / virtual reality



Use of optical see-through head-mounted devices in dentistry - a scoping review.
Sadilina S, Strauss FJ, Jung RE, Joda T, Balmer M.
Int J Comput Dent. 2024

augmented / mixed / virtual reality

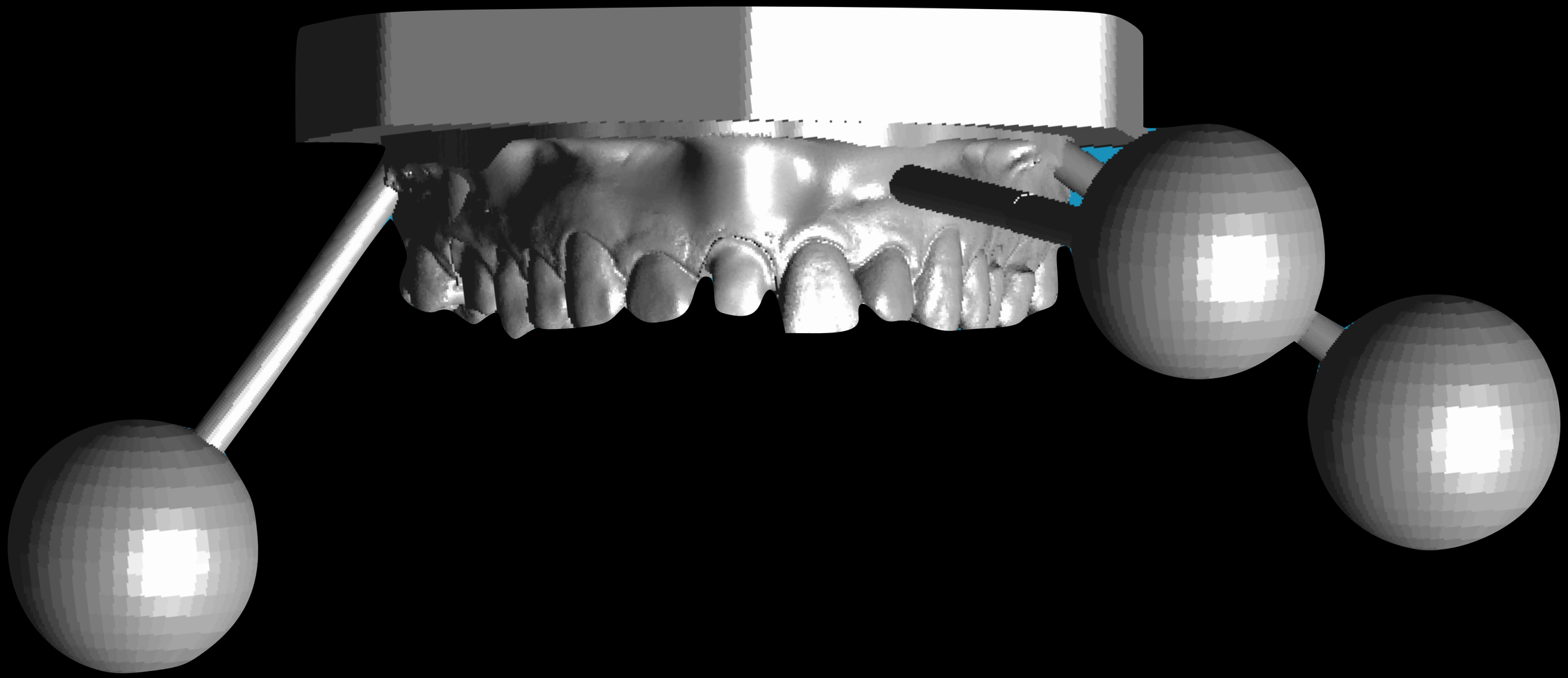


augmented / mixed / virtual reality






augmented / mixed / virtual reality



augmented / mixed / virtual reality

augmented / mixed / virtual reality

innovation

robotic dentistry

robotic dentistry

Non-autonomous robots

yomi® BY NEOCIS

robotic dentistry

Non-autonomous robots

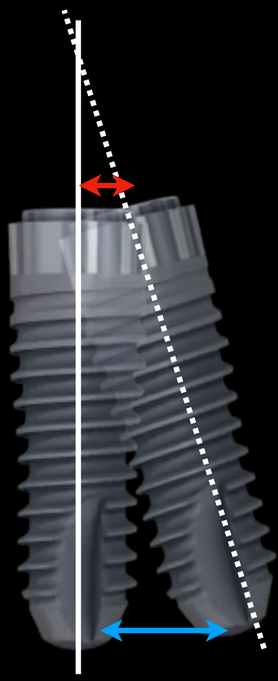
Accuracy and Deviation Analysis of Static and Robotic Guided Implant Surgery: A Case Study
Mozer PS
Int J Oral Maxillofac Implants. 2020 Sep/Oct;35(5):e86-e90

Materials and Methods:

- Same patient
- Same clinician
- 2 implants (1 static, 1 robotic)

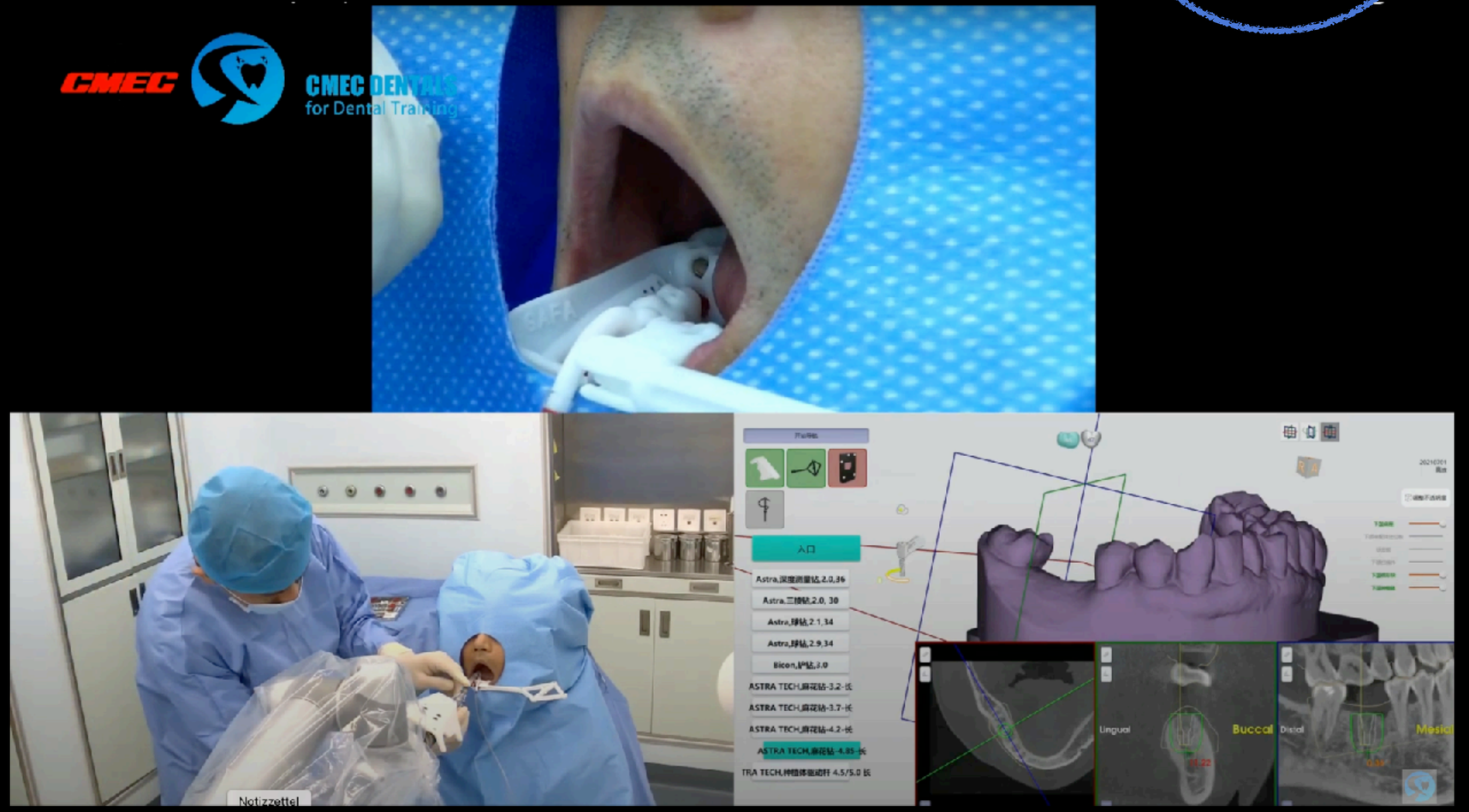
yomi® BY NEOCIS

Static	Robotic
0.1mm	0.4mm
0.55mm	0.5mm
4.5°	0.5°
0mm	0.4mm



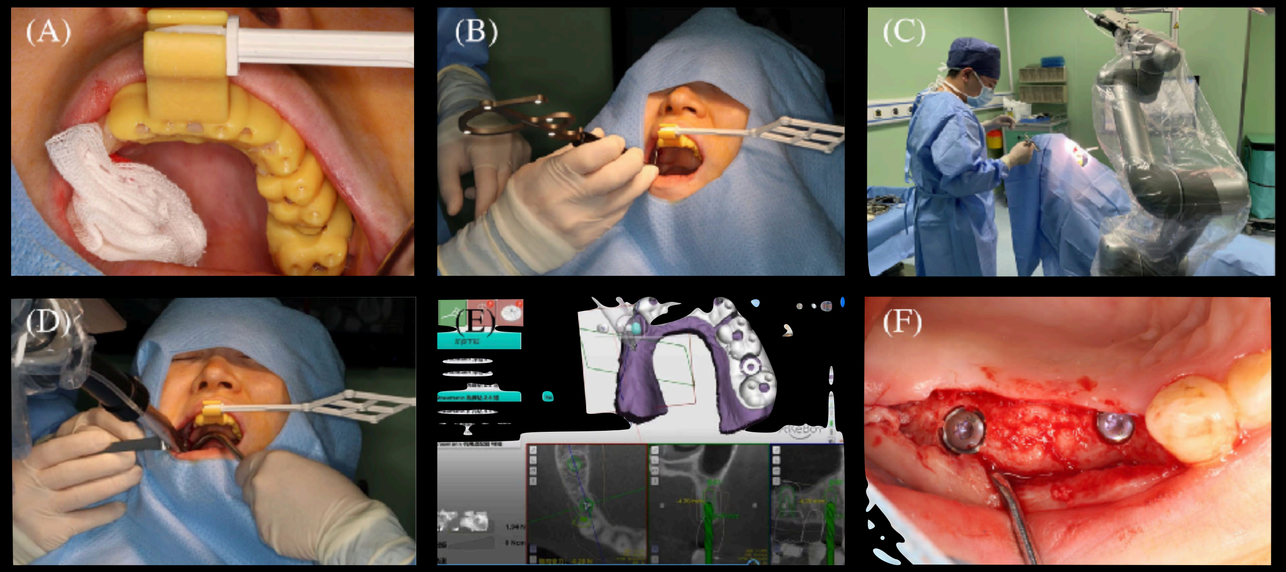
robotic dentistry

Autonomous robots

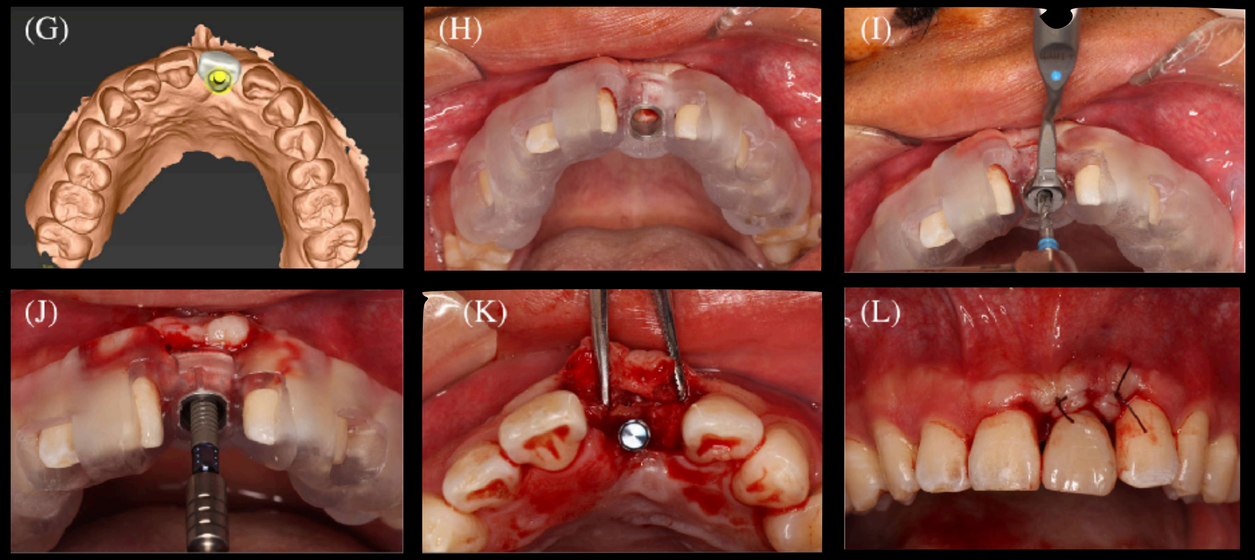


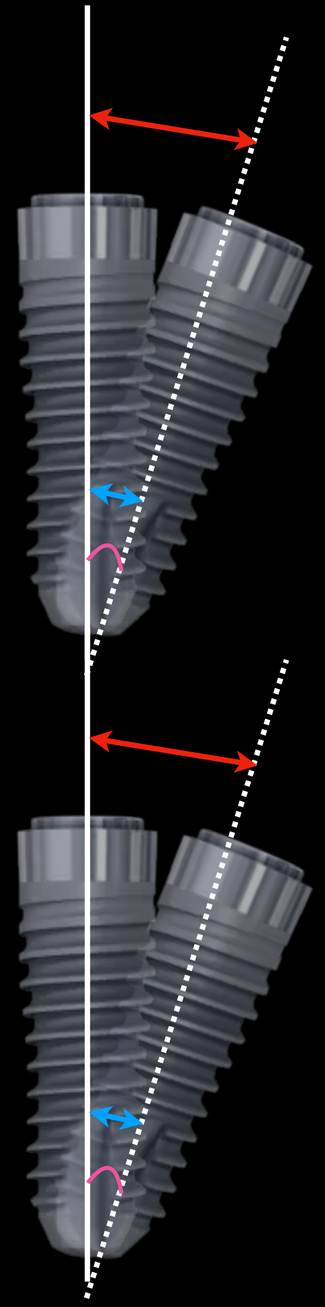
robotic dentistry

robotic guided



static guided





Accuracy:

Robot

0.45 ± 0.28 mm

0.47 ± 0.28 mm

0.95°

statisch geführt

1.45 ± 1.27 mm

1.77 ± 1.14 mm

4.31 °

robotic dentistry

29.04.2024

Innosuisse unterstützt das Robotik-Projekt der Klinik für Rekonstruktive Zahnmedizin mit einer Gesamtförderung von 2 Millionen Schweizer Franken.

Dank eines kompetitiven Forschungsgrants von Innosuisse in Höhe von 2 Millionen Schweizer Franken erh
die Klinik für Rekonstruktive Zahnmedizin eine einzigartige Gelegenheit, ihr innovatives Projekt «Miniature
Intraoral Robot (MIR) Performing Minimal-invasive, Personalized and Precision Dentistry» (101.453 IP-LS) z
realisieren und damit die rekonstruktive Zahnmedizin auf ein neues Niveau zu heben.

robotic dentistry

Workflow

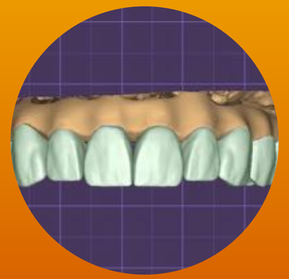
Besuch 1

Befundaufnahme

Scan

Labor 1

digitale Planung



Besuch 2

Präparation

Scan

Labor 2

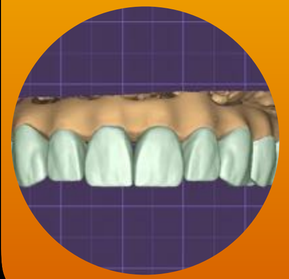
Herstellung Prothetik

Besuch 3

Zementation

Labor 1

digitale Planung



Design Stumpf

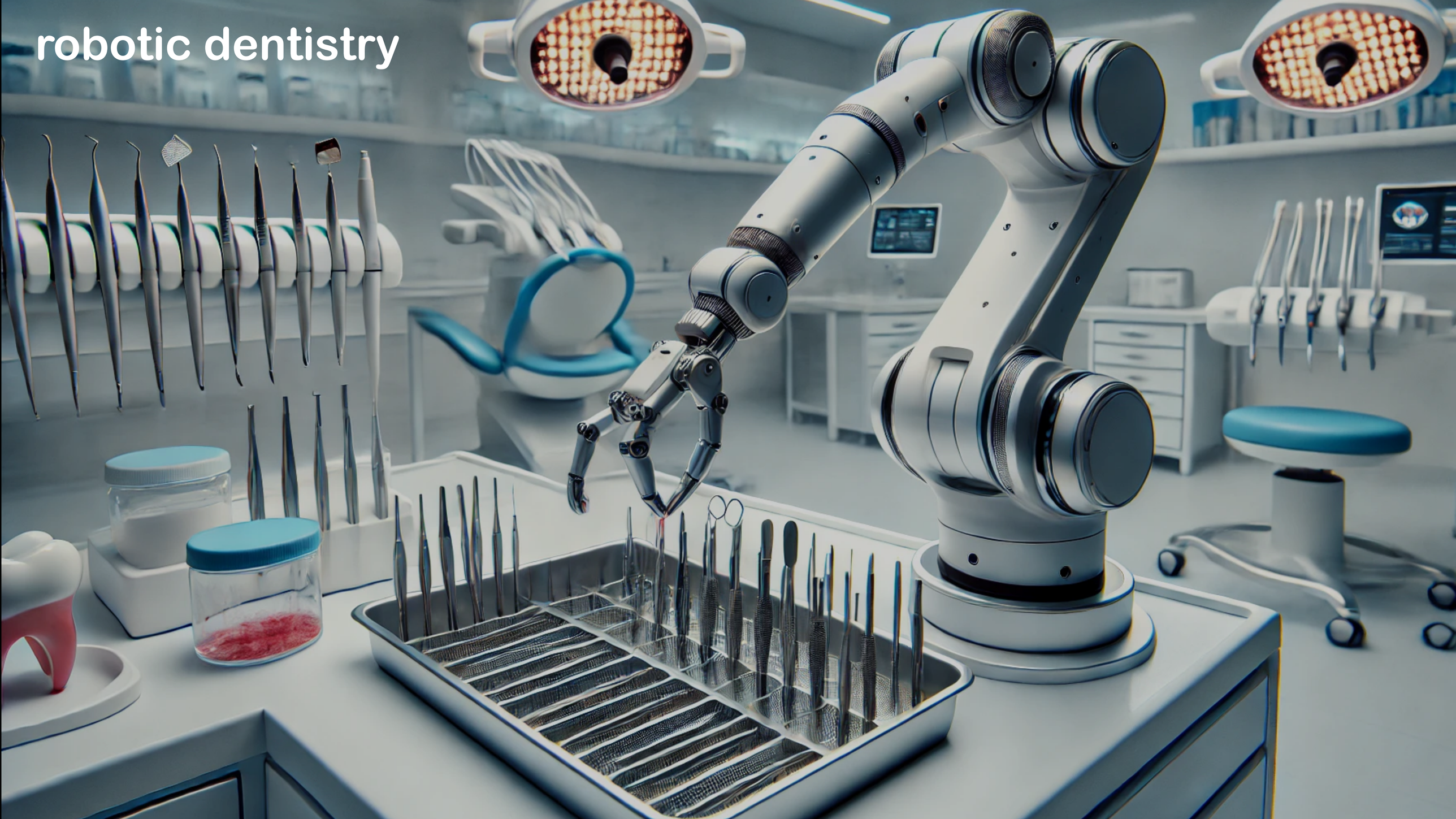
Herstellung Prothetik

Besuch 2

Automatisierte Präparation

Zementation

robotic dentistry

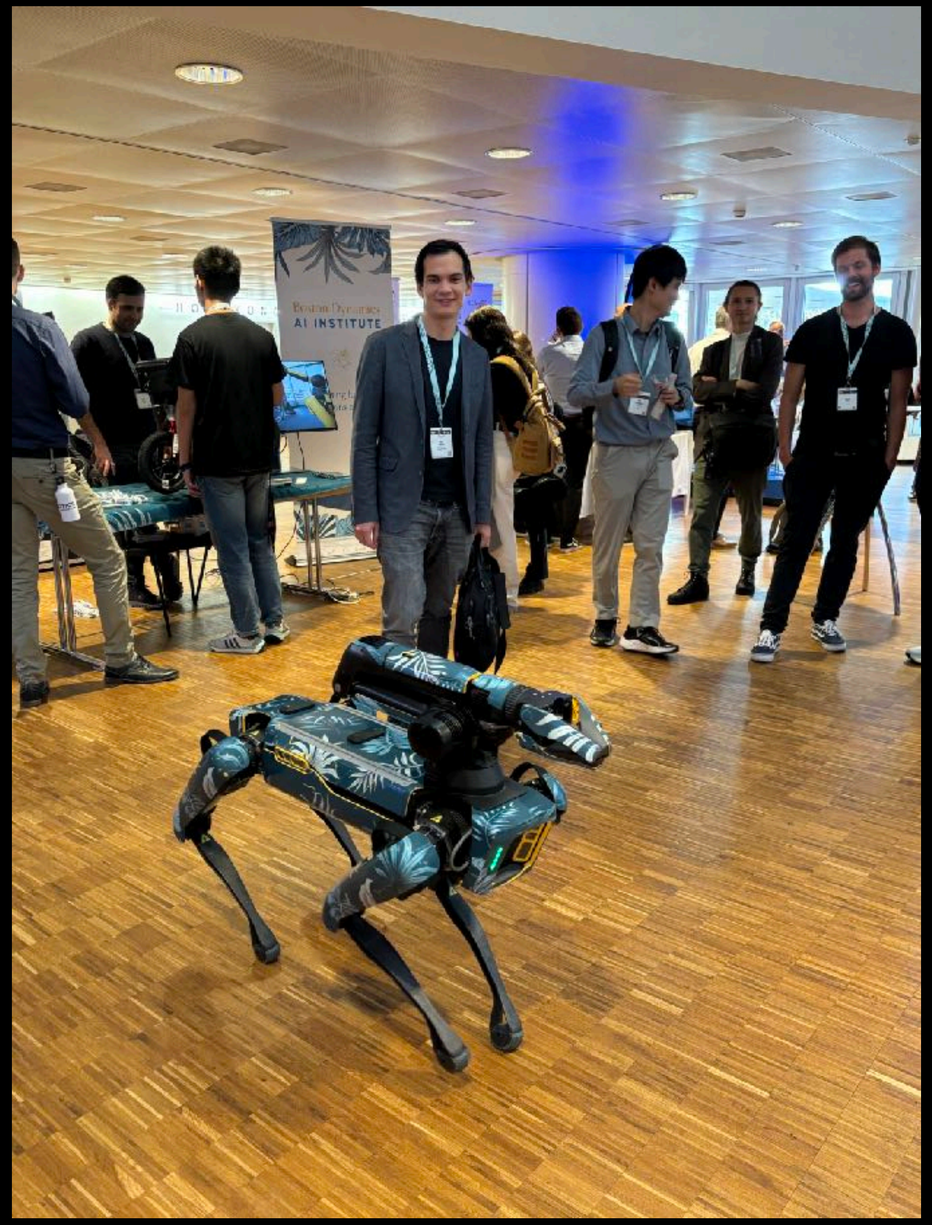


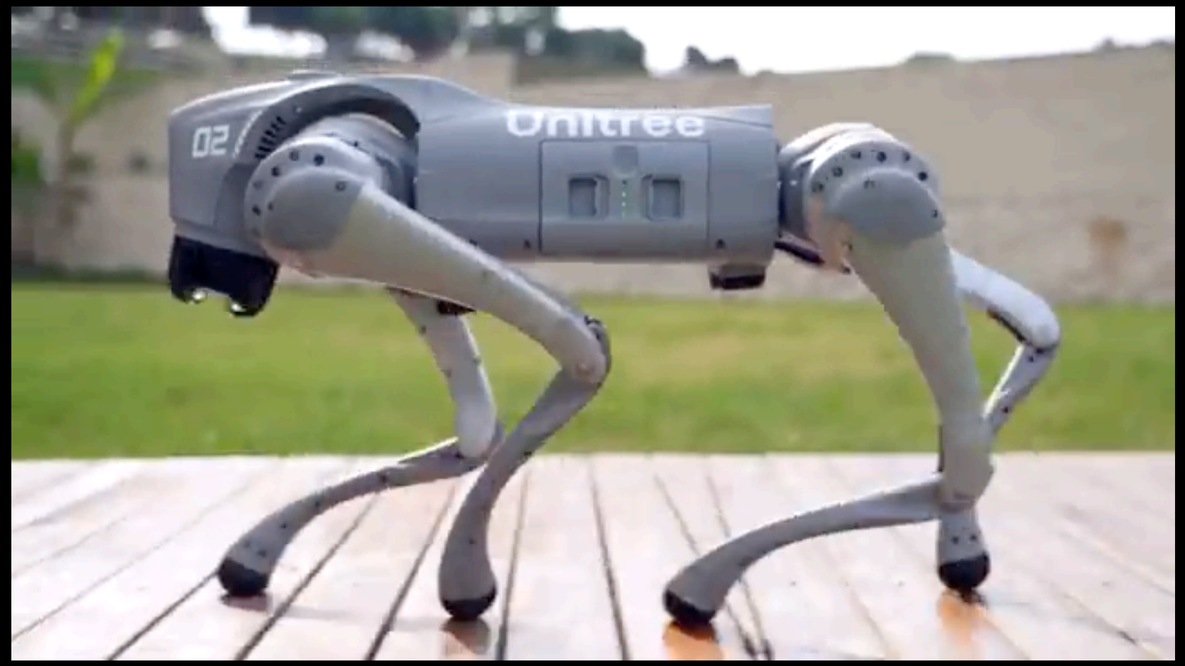
robotic dentistry

Während der Operation…

- Instrument vergessen
- richtiges Implantat aus Lager holen
- Rezept für Medikamente ausstellen
- Bekannte anrufen, dass die Operation bald fertig ist

robotic dentistry





robotic dentistry

Braucht es mich dann noch?

robotic dentistry

Braucht es mich dann noch?

Vielen Dank für Ihre Aufmerksamkeit

marc.balmer@hin.ch

dr.med.dent.marc.balmer