Digitalisering af tandplejen, Tandlægeforeningen og Plandent 01.09.2023 - del 2

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Forbehold:
Alle forbehold for noternes korrekte gengivelse af kursusmaterialet tages af forfatteren.

Top 3 Dental Insights

1. 3D print og design i almen tandlægepraksis

Det er fremtiden at scanne alle nye patienter. Her i 2023 er det ca. 40% af de danske tandlæger, der har en intraoral scanner, men stadig meget få tandlæger har en 3D printer.

Man kan printe en stent (digital waxup) til plastfyldning. Ved traumer, kan man bruge gamle scanninger til at bygge tænderne op igen. Tandteknikeren printer en model, og så laver man injection moulding og bygger tænderne op igen med 3D-printet digital stent.

Det er en god idé at besøge sit dentallaboratorium (og evt. teste flere dentallaboratorier) og få et godt samarbejde med dem, så man får det præcist som man vil have det.

Man kan printe sine modeller (i stedet for gipsmodeller), og bruge sin tandtekniker til at designe sine bidskinner og kroner osv. Skal man designe alt selv? Nej tak. Det er tidskrævende at designe selv, og det er dentallaboratoriet super dygtige til. Der kommer flere designlabs, der udelukkende laver digitale designs.

Patienterne er ret ligeglade med hvordan deres molarer ser ud, bare de virker og er symptomfrie. Molaræstestik handler nok mest om tandlægens egen tilfredsstillelse og arbejdsglæde. Det er vigtigt at vide hvad der gør én glad at arbejde med, og så arbejde på den måde.

Your comfort zone is NOT where the magic happens!

2. VR, AR and robotics in dentistry

Mixed reality:
Real environment
Augmented reality (AR)
Augmented virtual reality (AV)
Virtual reality (VR)

AR is really interesting for us in dentistry, as we can enhance/augment our reality and fx see the xray while you're working. Or fx the dental technician can see what you're seeing via VR.

Cancer treatment planning can be done in VR, so the real surgery will be well timed and planned.

VR, AR and AV can create immersive training with haptic feedback in fx dentistry.

Robot-guided laser surgery:
Robotics can perform automated surgeries with laser. The studies are showing early signs that the laser robot is faster and more precise.

First FDA-approved dental robot for dental implants (Yomi by Neocis). Yomi combines the feel of freehand surgery with the advantages of haptic guidance.

Live surgery will in the future be able to be performed remote. Telemedicine can be used for live surgeries on site with a remote located expert. That way the expert can help many people without having to be physically in the room.

3. AI in dentistry

Many patients are first screened by AI, and then a doctor looks at them afterwards. AI can now see things better and faster than doctors can.

Doctor Google is not the biggest problem anymore, but it is Doctor AI. Insurance companies want to run patient information through AI, which can be problematic.

Individual, personalised chairside dentistry and medicine is the future. We are moving away from serial production towards personalized production.

Gerenative AI can think for us, passive AI can't. AI is not a solitary tool, but it integrated in many different technologies.

AI tool to recognize and classify nerves (CBCT/CT). It's possible to label annotate a nerve fast and chairside on a scan or xray, if you see an interesting case.

Using dentist tagging of xray findings, a machine can perform AI-supported dental assessment via xray can deep learn radiological findings. In the future you can get haptic feedback fx if you begin treating the wrong tooth.

Next year there will be a xray program with full automatic assessment of teeth using AI. It uses tooth segmentation and classification, recognition of pathologies and restorations, and automatic diagnosis and written documentation. It's optimizing time and the lack of dental professionals.

Cephalometric analysis using AI can measure the different anatomical reference points. The AI can show you how sure or unsure it is of its findings.

The best technologies are intuitive and integrate themselves in our lives, in such a way that we can't remember how we ever lived without them before. AI, just like the internet did before, is changing the way healthcare is delivered.

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3D print i almen praksis

V/ Martin Heiden, tandlæge

Martin har arbejdet digitalt siden 2014, og har kun brugt silikone til provisorier. Har testet flere forskellige dentallaboratorier og taget ud og besøge dem og få et godt samarbejde med dem, så man får det præcist som man vil have det.

Præpgrænse er okay bagtil, hvis man laver en god pocheudpakning. Men fortil kan pocheudpakning godt påvirke æstetikken. Martin bruger ikke kun farveprøve fra sin Trios scanner, men bruger den til korpusfarve, og tager bagefter en Vita farveprøve med foto på smartphone og app. Anteriore tænder får farveprøver med spejlreflekskameraer.

Martin printer sine modeller (i stedet for gipsmodeller), og bruger sin tandtekniker til at designe sine bidskinner og kroner osv. Det er for tidskrævende for ham at designe selv.

Martin har haft intraoral scanner siden 2014, været beta tester for 3Shape siden 2015 og har haft 3D printer siden 2021. På Martins klinik scanner de altid nye patienter, så indtil videre har de 16.000+ scans. Det er fremtiden.

Martin er KOL for Dentiq, chairside printer. Martin skal hjælpe med sammenføring af Trios scannet og Dentiq printeren. Lige nu er det lidt besværligt og er en stopklods for 3D printet.

Martin driver to FB grupper: “3D print for tandlæger” og “Triosbrugere i Skandinavien”

2023: Det er ca. 40% af de danske tandlæger, der har en intraoral scanner. Kun 25 i FB gruppen har en 3D printer.

Man kan printe en stent (digital waxup) til plastfyldning. Isolere nabotanden med teflontape.

Ved traumer, kan man bruge gamle scanninger til at bygge tænderne op igen. Tandteknikeren printer en model, og så laver man injection moulding og bygger tænderne op igen med 3D digital stent.

3D print proces:
Printer (flydende CE-godkendt resin bygges op i lag)—>
Vask (af overskydende flydende resin med alkohol)—>
Ovn (hærdning af resin) —>
PC med software og LCD-skærm (reservedel)

3D printer bruger AI til hele processen.

Formlabs har en langsomtfordampende wash solvent (TPM) til modeller, der ikke skal i munden.

Ministar pressemaskine fungerer nemt.

Andre ting der kan 3D printes:
Blegeskinner (oftest dét, der bliver 3D printet)
Clear retainere (alignere)
Retainer af en smiletand
Tandbeskyttere

En patient med udtalte erosioner og slid:
Smiledesign er en god motivator til patienten.
Elongerede tænder kan intruderes ortodontisk.

Bidhævning med digital waxup (Munich splint af polykarbonat), så patienten kan prøve 3D modellen først.

Fremtiden:
Fx 3D printede bidskinner til bruksister.

En 3D printer koster i engangsinvestering 60-100.000 kr.

Fordele ved 3D print:
Hurtigere end at lave gipsmodeller.
Man kan printe filer fra tekniker.
Klar til næste niveau, bedre materialer.
Levere til tekniker. Slut med svinere, trimning, støv, gipsfang.

Skal man designe alt selv? Nej tak. Det er dentallaboratoriet super dygtige til at gøre. Der kommer flere designlabs, der udelukkende laver digitale designs.

Patienterne er ret ligeglade med hvordan deres molarer ser ud, bare de virker og er symptomfrie. Molaræstestik handler nok mest om tandlægens egen tilfredsstillelse og arbejdsglæde. Det er vigtigt at vide hvad der gør én glad at arbejde med, og så arbejde på den måde. Your comfort zone is not where the magic happens!

Applications of AI in dentistry and medicine - Tendenser inden for digital tandpleje — I dag og i morgen

V/ Jan Wolff, professor, oromaxillofacial surgery, IOOS

AI is going to change our field, faster than we think.

The young generation is very good at learning machine learning, however there are only few young dentists

Jan's favorite apps:
Google
Medarbejdere AU DK
DeepL Translate
DeepL Write
Google Translate
ChatGPT
GPTZero
Home Feed Research
Brightspace Aarhus

Computer-aided surgery

Industry 4.0:
Autonomous robots
Simulation
System integration
Internet of things
Cybersecurity
Cloud computing
Additive manufacturing (3D printing)
Augmented reality
Big data

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AI precursors:
Additive manufactured medical constructs (AMMCs, 3D printing), material science, bioprinting tissue engineering, VR, AR, robotics.

STL files are used for 3D printing, VR, AR, robotics, AI.

Spectral CT / photon counting will be in the near future.

3D Digital surgery:
Medical image processing —>
3D printing —>
Surgical simulation —>
Digital medical imaging —>
Virtual surgical planning —>
Personalized surgery

3D Workflow:
CT, CBCT, MRI, scan —>
DICOM data and optical scan —>
STL-model and CAD design —>
3D printed skull

Virtual planning and 3D printing:
Plan implant surgery with scan and CBCT —>
CAD in dental lab —>
G-Code for 3D printing—>
Printed drill guide for implant surgery

3D printing reconstruction with materials such as titanium can be used for individual organ implants, fx orbital, jaw or head. Close collaboration between surgeons and engineers/technicians is extremely valuable. They can 3D print a heart!

There's 25 AI tools that work together to 3D print an organ. There's only 5 clicks to order a Tesla car. We have to make AI simpler, for it to become mainstream.

Machine learning need different types of convolutional neural networks in order to train the machine. CBCT: CT slice and many different layers and segmentations.

AI applications in medicine:
Natural language processing (NLP) —>
Clinical decision support —>
Image acquisition and processing —>
Screening / Diagnosis —>
Treatment planning —>
Follow up

Many patients are first screened by AI, and then a doctor looks at them afterwards. AI can now see things better and faster than doctors can.

The use of generative AI for crown designs is being developed by fx 3Shape by “supervised learning”. Karl Hollenbeck is 3Shape Head of AI.

Doctor Google is not the biggest problem anymore, but it is Doctor AI.
Insurance companies want to run patient information through AI, which can be problematic.

AI tool to recognize and classify nerves (CBCT/CT). Label annotation. It’s possible to label annotate a nerve fast and chairside on a scan or xray, if you see an interesting case.

Data labeling supervised learning demands many sets of the same type of patient data sets. You can buy training data sets, and it’s not regulated. You have to annotate where fx the nerves, teeth and implants are using defined boxes and individual numbering, and where there are artifacts on all the data sets, and that way you can train the machine to become smarter. Machine learning has to be trained with both correct and incorrect data sets.

Anyone can do machine learning. Many programs are open source.

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Virtual reality will be 3D in 5-10 years, but the social gatherings will still be in real life!

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Live surgery will in the future be able to be performed remote. (See slide)

Automatic surgery planning.

Dentsply Sirona asked a good question: Why do dentists always want a model before the crown? Why not just get the crown immediately?

Cancer treatment planning can be done in VR, so the real surgery will be well timed and planned.

Conjoined twins who shared a brain have been successfully separated by 20 experts using VR planning.

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Change is difficult. Change management is difficult!

Denmark and Finland are very digitally advanced.