Minimally invasive and micro-invasive dentistry. Digital dentistry.

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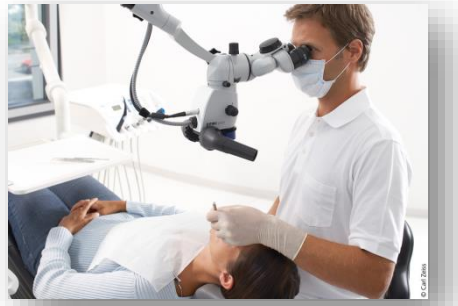
Minimal intervention dentistry (MID)

- A **growing trend** in all fields of dentistry
- This term has been introduced by Davis and Makinson (1992)

- Instead of using the primary surgical and operative methods, this new concept is based on **four modalities**:
  - The early detection of caries and risk factors
  - Reduction of cariogenic microbes
  - Remineralisation of early lesions
  - Reparation and minimally invasive treatment of the evolved lesions



- The **main principle**: to keep all teeth and those functions through the life

Minimal intervention dentistry (MID)

This principle involves **more specialities** in dentistry

- Preventive dentistry
- Conservative dentistry
- Prosthodontics
- Orthodontics and Pedodontics
- Periodontology

Minimal intervention dentistry (MID) – in preventive dentistry

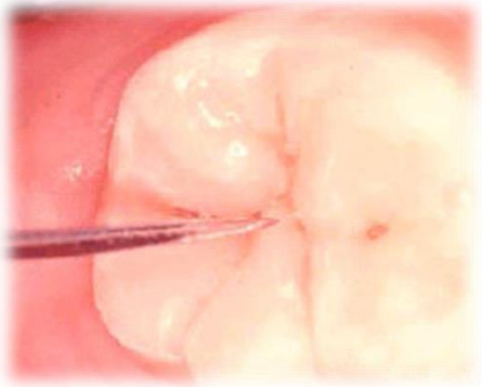
- **Early detection of** caries → Cariological diagnostics
- **Caries risk assesment**

- **Caries prophylaxis** with the propagation of natural remineralisation of enamel

  - Diethetic Control (change of food intake)
  - Plaque Control
  - Salivation Control
  - Instructions and motivation of the patient

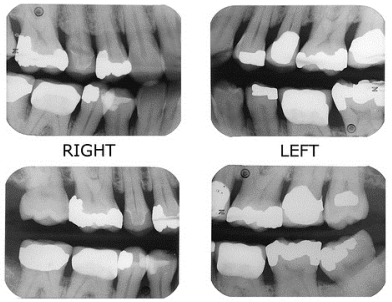
- **Remineralisation** of the beginned lesions
- **Biofilm-modulation**
- Preventive cllosure of the caries predilection areas: **fissure sealing**

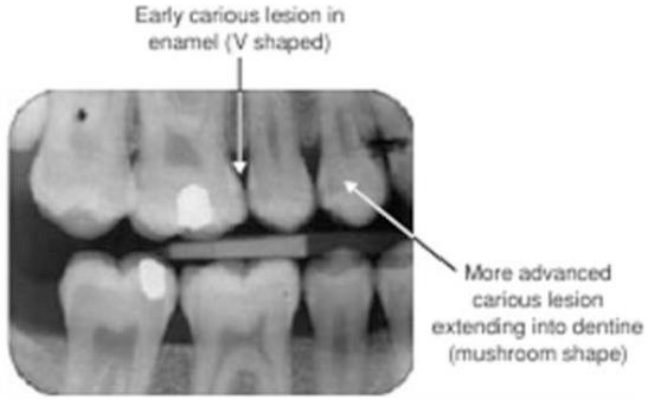
Caries diagnostics



- **Visual and tactile caries diagnostics**
  - Probing – carefully, with blunt-ended probe!
  - Limited diagnostic possibilities in the interproximal areas

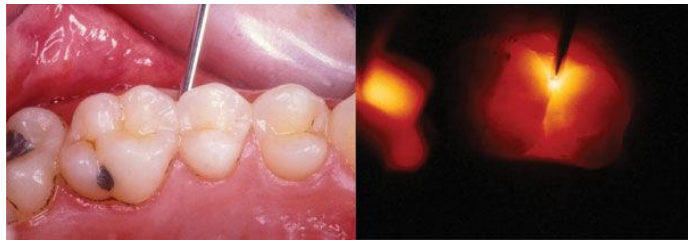
- **X-Ray Diagnostics**
  - Occlusal („Bitewing”) recordings
  - Min. 60% loss of hard tissues!



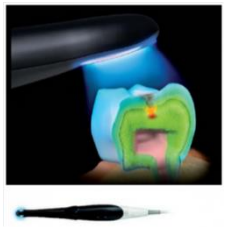


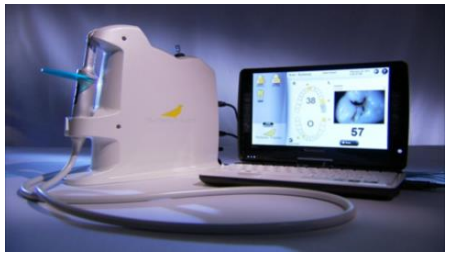
Caries diagnostics

- **Use of special devices:**



- **Transillumination**
  - Fiber-optics: FOTI (Fiber-optic TransIllumination), DIFOTI
  - Infrared: DiagnoCam®
- **Fluorescence based Systems**
  - Infrared Laserfluorescence: DiagnoDent, DiagnoDent Pen ®
  - QLF (Quantitative Light-Induced Fluorescence) – Fluorescence based Intraoral camera: VistaCam, VistaProof, SoproLife ®
- **Electric Impedance-based Systems**
  - Electric Impedance-Spectroscopy: CarieScan Pro ®
- **Phototermal Radiometry**
  - A laser beam directed onto the tooth will be rebounded with heat production and luminescence → this will be perceived
  - Canary System ®





Remineralisation – Local (topical) use of Fluorides

- Fluoride varnishes
- Fluorid Iontoforesis

- Individual oral hygiene: toothpastes, mouthrinses

Biofilm Modulation

- **CPP-ACP Technology**
  - Gc Tooth mousse ®
  - Recaldent ®

Minimal intervention dentistry (MID) – in the conservative dentistry – use of special operative techniques

- Microinvasive Techniques
  - Cariesinfiltration
  - Ozone Therapy

- Minimalinvasive Techniques
  - Enamel microabrasion
  - Air abrasion, Hydroabrasion
  - Oscillation-based Instruments: Ultrasonic abrasive, Sonoabrasive Preparation methods
  - Laser Preparation
  - Rotary Intrsuments → Special cavity designs and Preparation techniques (Micropreparation; box-preparation; Tunnel-Preparation…)

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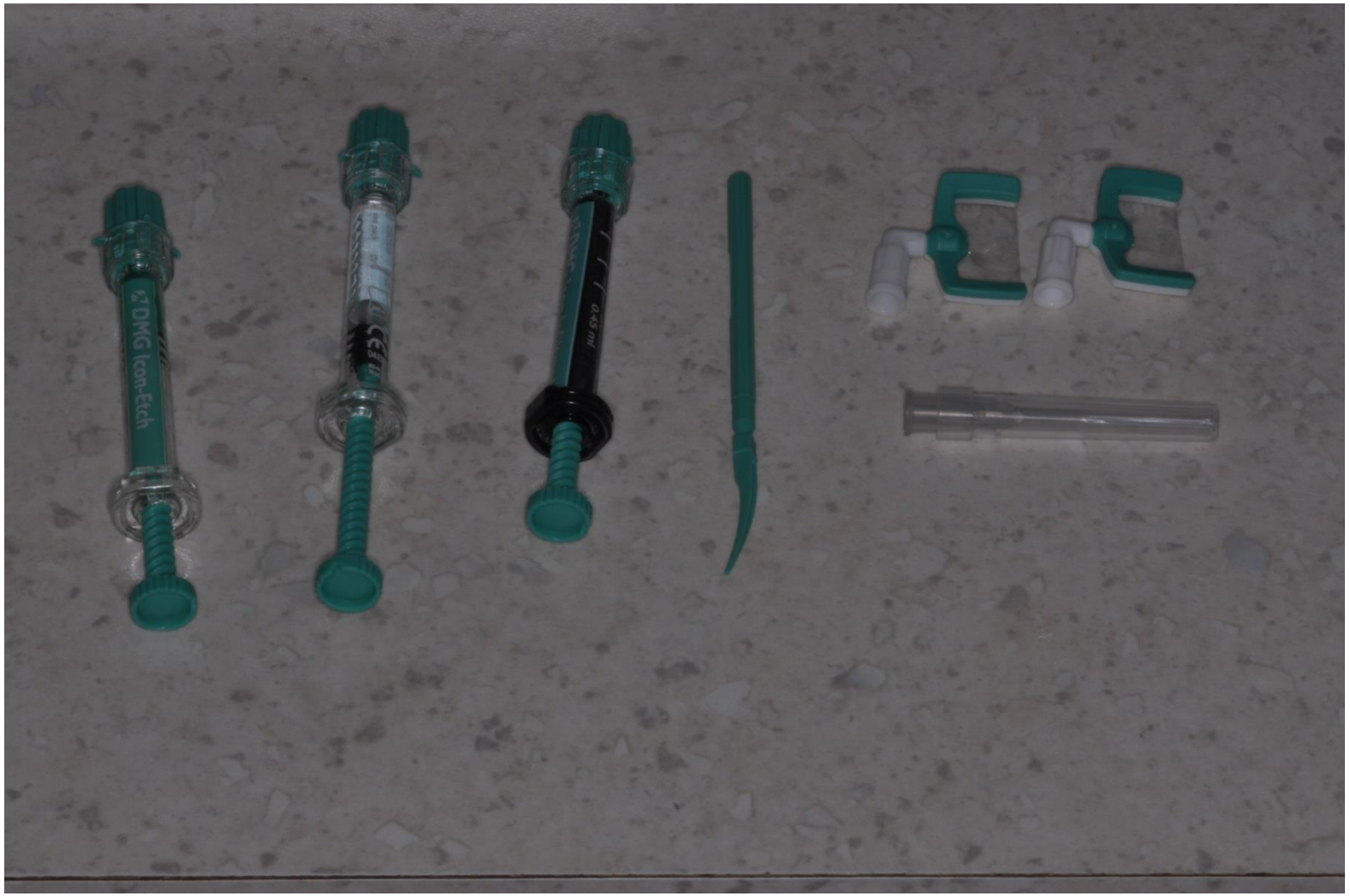
Caries infiltration

- Special microinvasive operative technique, which stops the enamel caries lesions and also the early stages of dentine caries, without irreversible removal of hard tissues
- Principle of Caries infiltration:
  - penetration of a **methacrylat-based, low viscosity material** (infiltrant) into the body of a carious lesion
  - After light-curing, the **infiltrant closes the micropores of the lesion**, and forms a barrier which prevents bacteria and substrates to diffuseinto the lesion
  - the carious process will be **stopped**
- DMG Icon ®
- In our Phantom Head-Practice this therapy method will be explained and introduced


DMG Icon-Etch
0.45 ml

Caries infiltration - Steps

- tooth cleaning with dental floss and polishing paste
- absolute isolation with dental dam
- Inspection of the Lesion: is there a cavitation?
- Separation of the teeth with a special wedge (Icon; DMG, Hamburg)
- use of a special celluloid matrix with the etchant syringe (Icon Etch)
- Application of the 10 % hydrocloric acid (Icon Etch) for 2 minutes
- Rinsing off the acid with air-water syringe, then drying the surface
- Application of Ethanol (Icon Dry)
- thorough drying
- use of a new celluloid matrix with the infiltrant syringe(Icon Infiltrant)
- 1. Infiltration: 3min
- Removal of the surplus material with dental floss and air syringe
- Light polymerisation for 40 s
- 2. Infiltration: 1min.
- Removal of the surplus material with dental floss and air syringe
- Light polymerisation for 40 s
- Removal of the surplus material with scaler and finishing strips
- documentation!

Caries infiltration - Steps

Preparations

- Tooth cleaning with dental floss and polishing paste
- Absolute isolation with dental dam
- Inspection of the Lesion: is there a cavitation?
- Separation of the teeth with a special wedge (Icon; DMG, Hamburg)

Caries infiltration - Steps

Etching the surface

- Use of a special celluloid matrix with the etchant syringe (Icon Etch)
- Application of the 10 % hydrocloric acid (Icon Etch) for 2 minutes
- Rinsing off the acid with air-water syringe, then drying the surface
- Application of Ethanol (Icon Dry)
- Thorough drying

Caries infiltration - Steps

Application of the Infiltrant

- use of a new celluloid matrix with the infiltrant syringe(Icon Infiltrant)
- 1. Infiltration: 3min
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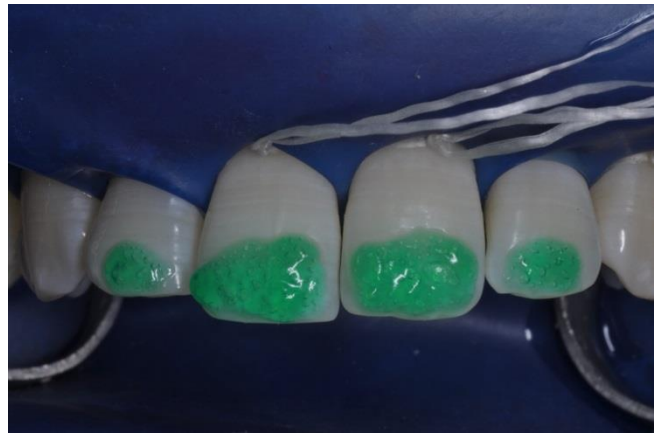
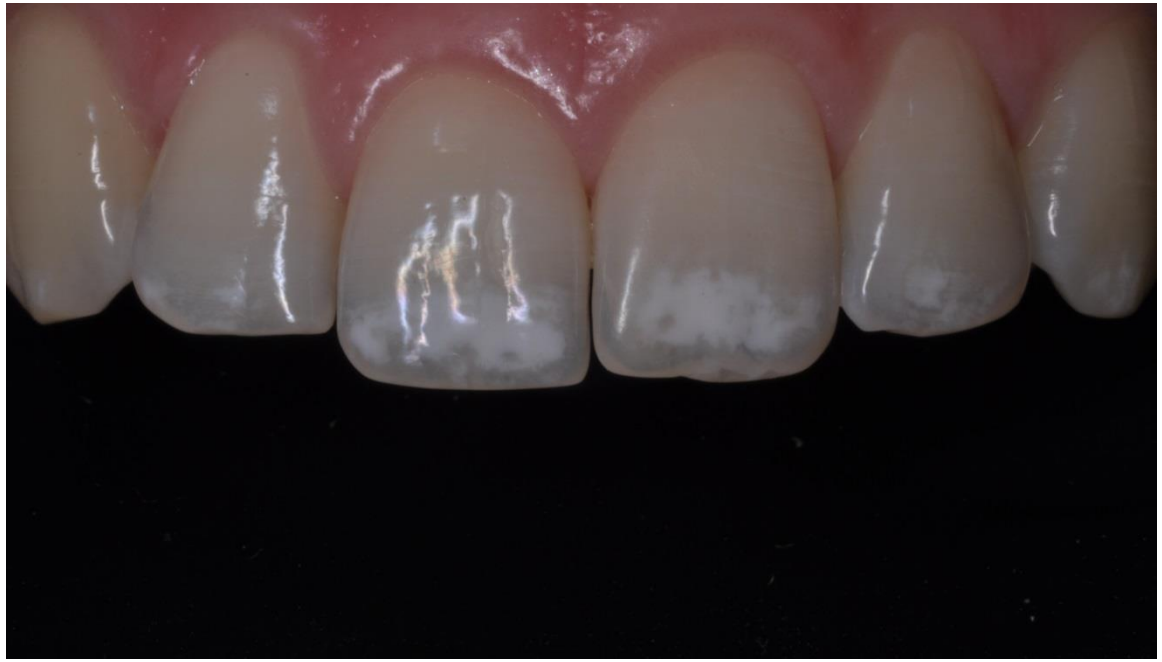
Caries infiltration – in the esthetic region

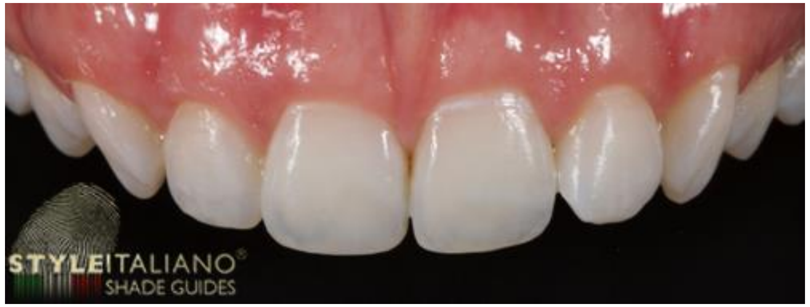





Caries infiltration – in the esthetic region



Caries infiltration –
in the esthetic region



Caries infiltration

Contraindications

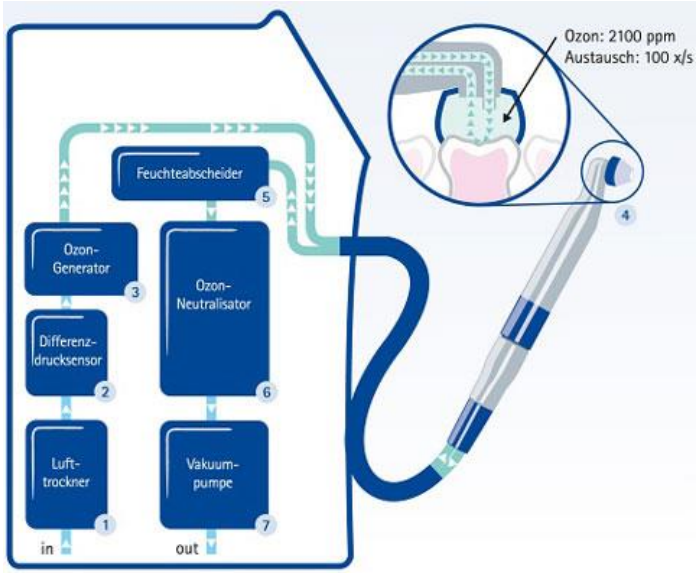
- deep caries (ICDAS 4, 5 und 6 and/or radiological > D1)
- inactive carious Lesions
- Root caries (Dentin)
- Erosions

Restrictions

- carious Lesions in Pits and Fissures
- Molar-Incisor-Hypomineralisation syndrome (MIH), Amelogenesis imperfecta
- Fluorosis
- enamel development defects, traumatic enamel lesions

Ozone therap

- Non- or Microinvasive possibility to treat **early fissure caries**, without drilling and pain
- **Endodontic** use is also possible
- **Mechanism of action**: the tooth is treated with ozone gas for 20-60 secons → bactericid, virucid, fungicid effect; The carious process will be stopped
- After treatment the treated tooth should be **remineralized** (fluoride varnish)
- The device is very **expensive**; therefore this treatment modality gained little popularity



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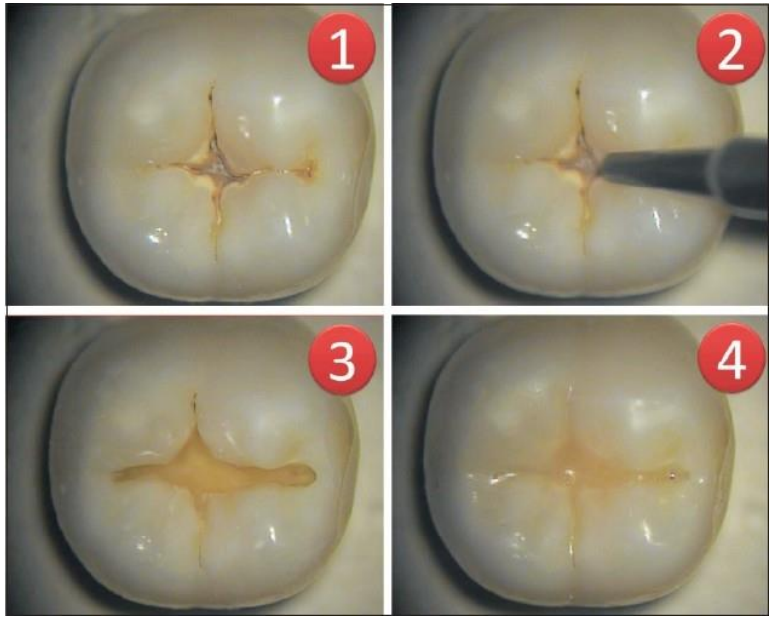
Enamel Microabrasion

- Removal of the surface stains of the enamel layer (until 0,2 mm depth)
- Clinically usable in cases of enamel hypocalcification, hypoplasty, fluorosis or demineralisation
- Principle: decalcification of the enamel (with 6% hydrochloric acid), then removal of a 20-25 micrometer thick layer from the surface (with SiC Abrasive Paste)
- This treatment can also be completed by adhesive filling therapy in the operative field
- Opalustre ®

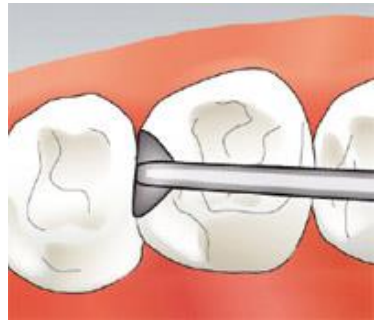
Air abrasion; Hydroabrasion

- Minimalinvasive cavity preparation technique – without drilling
- Mechanism of action: blowing of 27-50 micron Aluminiumoxid-Particles with air pressure onto the tooth surface
- Use: preparation for Fissure sealing; Minimalinvasive treatment of Fissure caries; surface roughening for adhesive procedures
- PrepMaster®, EtchMaster®, Kavo Rondoflex® (Hidro-abrasion)

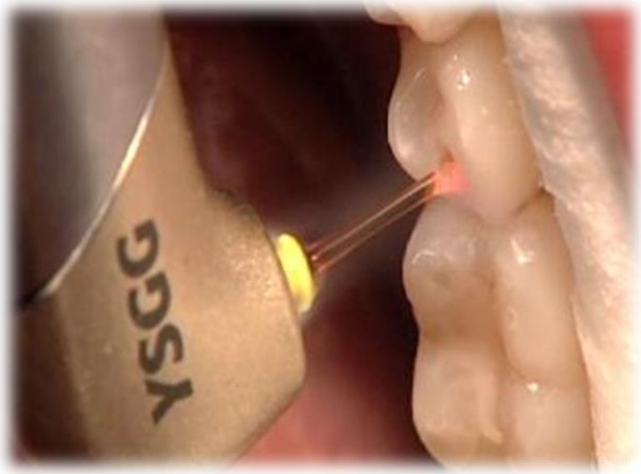


Ultrasonic / Sonoabrasive Preparation

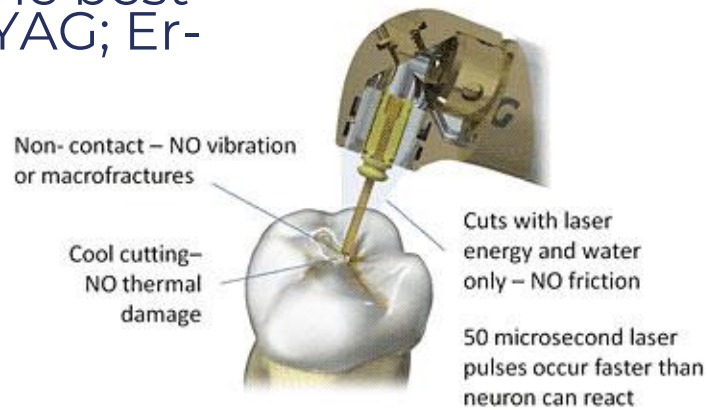
- ultrasonic or sonic (25 kHz/6,5 kHz), pneumatic preparation instruments
- Various working heads for each cavity design
  - endodontics, Inlay-Preparation, Approximal cavities
- Controlled tooth structure removal, with maximum protection of the neighbouring teeth
- Kavo SonicFlex ®



Laser Preparation



- Possibility of selective tooth preeprataion and Caries removal - without Vibration und Sensibility
- After preparation the surface will be rough, with opened dentinal tubules → good for adhesive techniques
- Mechanism of action: The carious tissues with high water content will be removed with ablation
- Erbium Laser (with Infrared Wave length) is the best for cavity preparation and caries removal: Er-YAG; Er-YSGG
- Waterlase ®

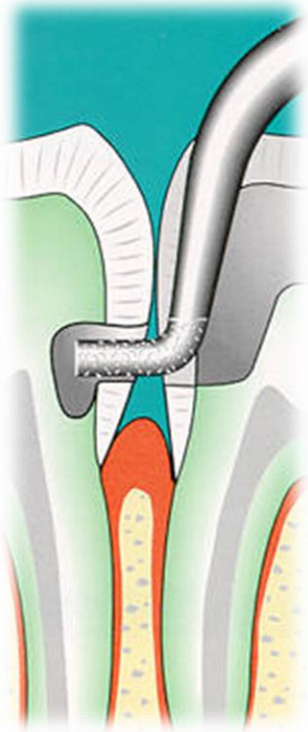


Use of Rotary Instruments new way - "Micro-dentistry"

- The original rotary instruments can also be used with the principles of minimally invasive dentistry
- Use of special burs, which guarantee a controlled and minimally invasive reduction of tooth structure: MicroPrep Kit (KOMET®)
- Use of the Operative microscope and various loupes in the modern dentistry:
  - Cavity preparation
  - Endodontics
  - Minimally invasive Prosthodontics: Preparation and cementing

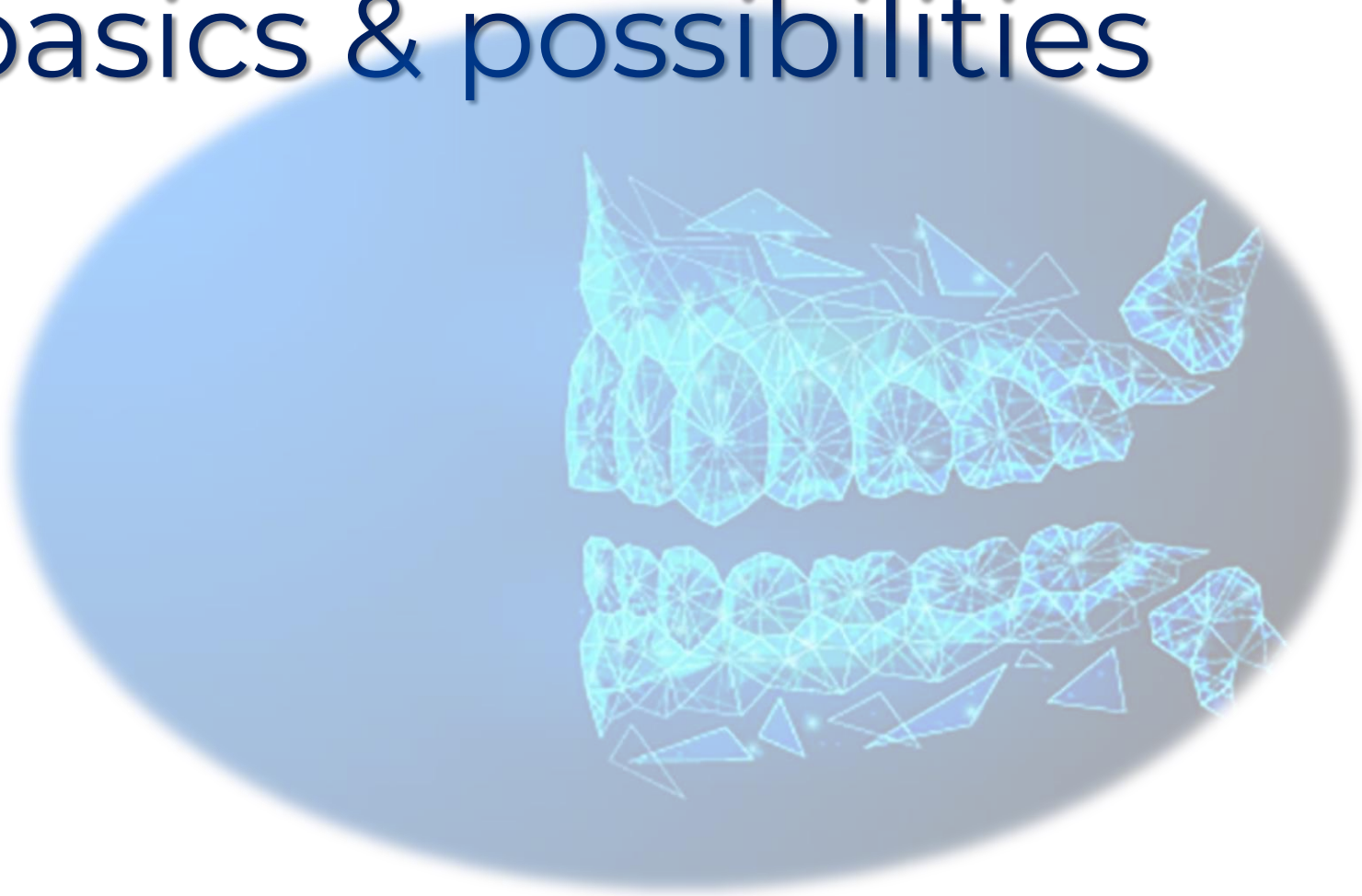
Special cavity designs

- Approximal Box Preparation
- Tunnel Preparation



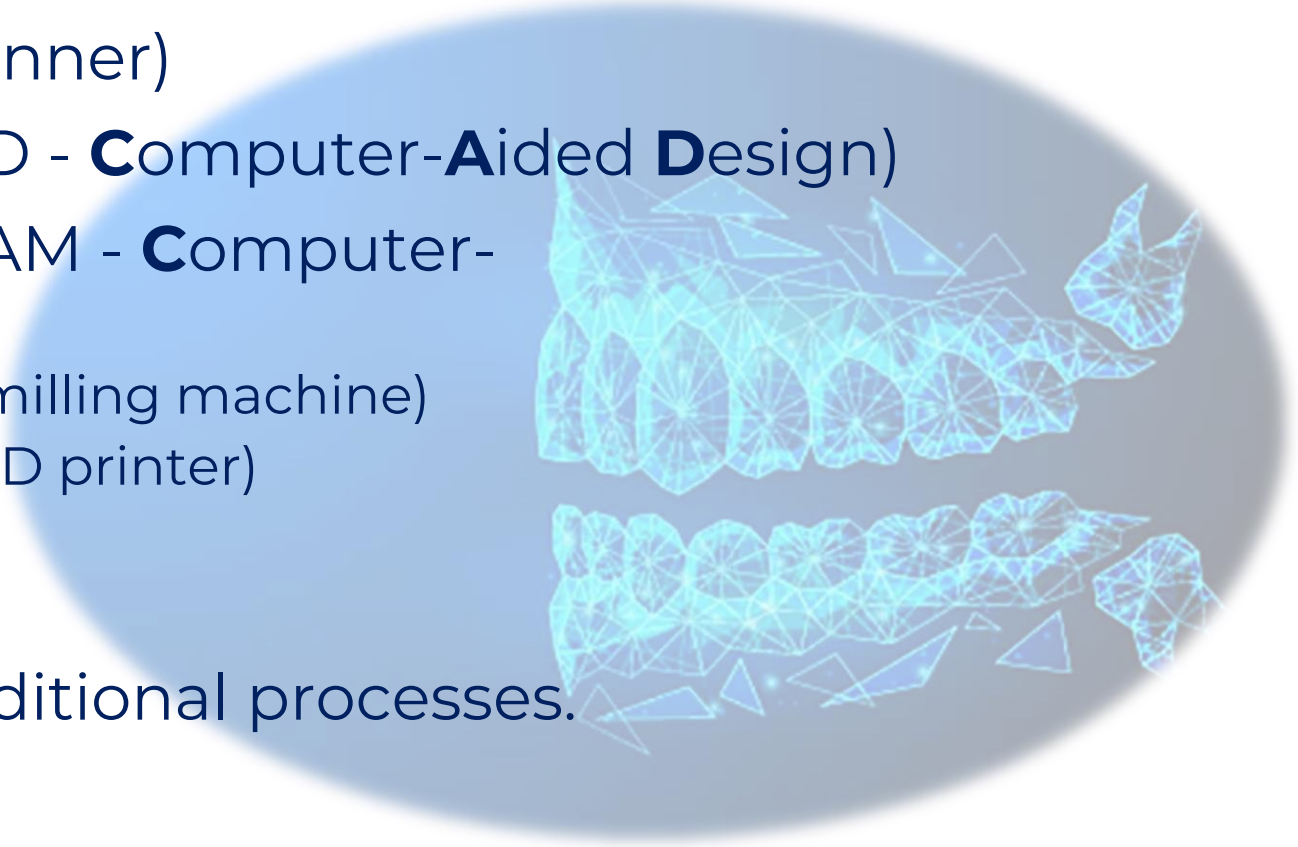
Digital Dentistry

The basics & possibilities



CAD/CAM Systems

- Digitising device (Intraoral scanner)
- Data processing software (CAD - **C**omputer-**A**ided **D**esign)
- Manufacturing technology (CAM - **C**omputer-**A**ided **M**anufacturing)
  - Subtractive techniques (Dental milling machine)
  - Additive (building) techniques (3D printer)



- To complement or replace traditional processes.

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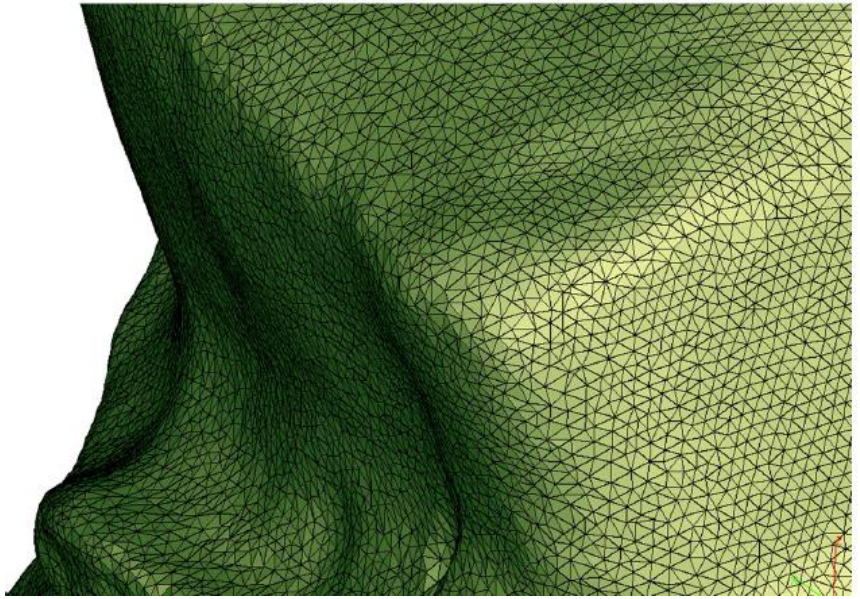
Digitising device

- **Optical scanner**
  - "Triangulation" - compiles three-dimensional data series based on the angle between the light source and the receiver



3D scanned data file in STL format

- **Mechanical scanner**
  - The pattern is traced line by line using a round head part

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Intraoral scanner

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Planning software

- Design of restorations (crown, bridge, primary telescope, etc...)
- STL file
- Continuous improvements, updates available

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Dental milling machine

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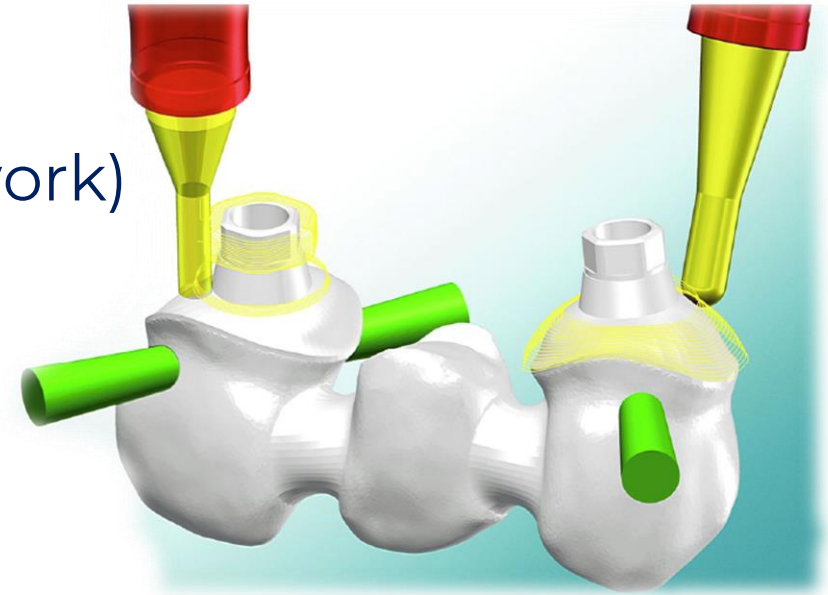
Dental milling machine

- CNC (Computer Numerical Control) milling machine
  - Programmable
  - Contains a computer itself – controls the movement of the milling tool
- CAD designed restoration (e.g. bridge framework)
  - Needs to be complemented with holding pins
- STL – initial data for CAM program
  - Planning the spatial movement of the milling tool
    - Data sent to CNC milling machine control computer



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3D Printing

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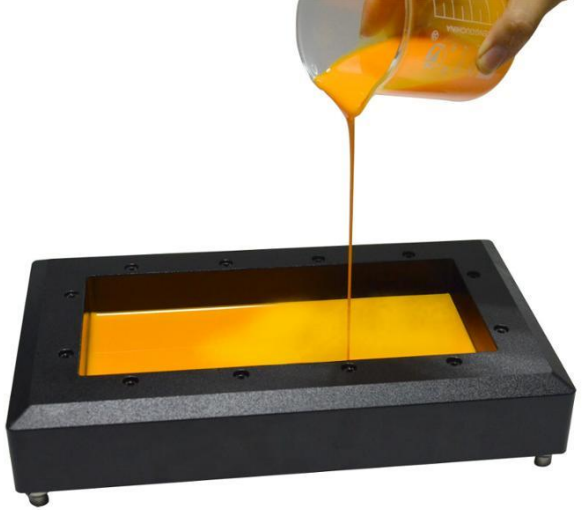
3D Printing



- Additive technology - adding model material layer by layer
- CAD designed model is broken down into slices - layer by layer the 3D object is built

- Problems encountered: Material, strength, stiffness, unsupported parts, size, accuracy...

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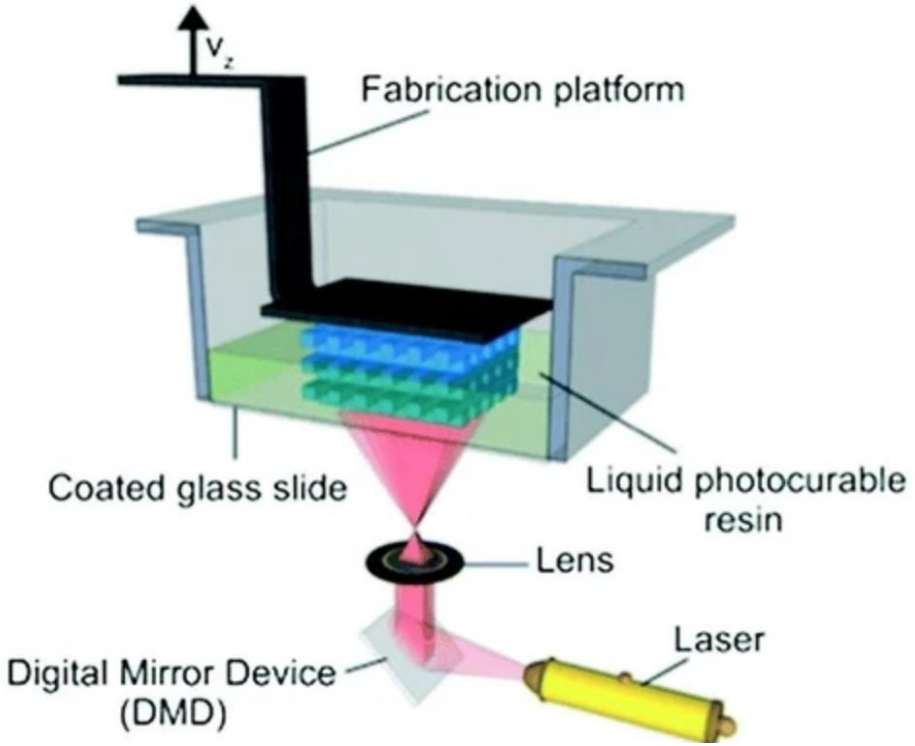
3D Printing



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Making a dental bridge
Traditional vs digital technology

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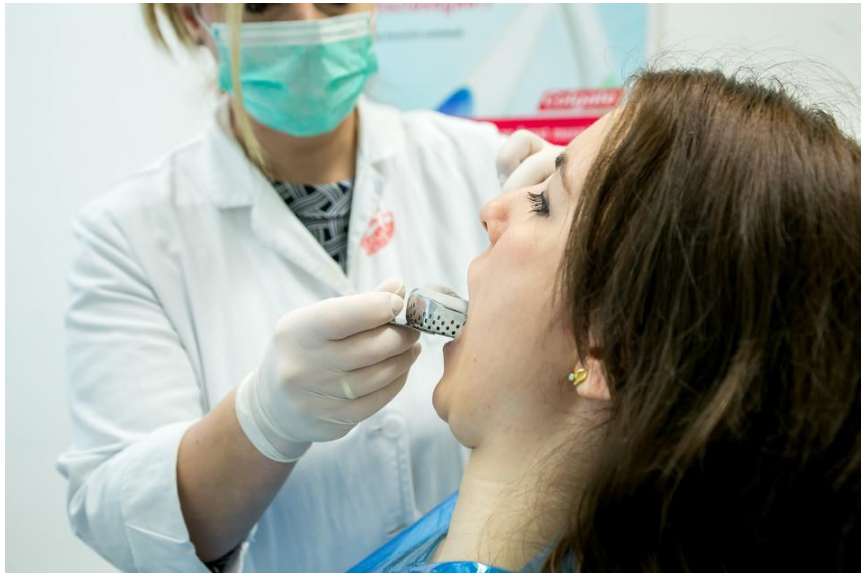
Traditional



Digital

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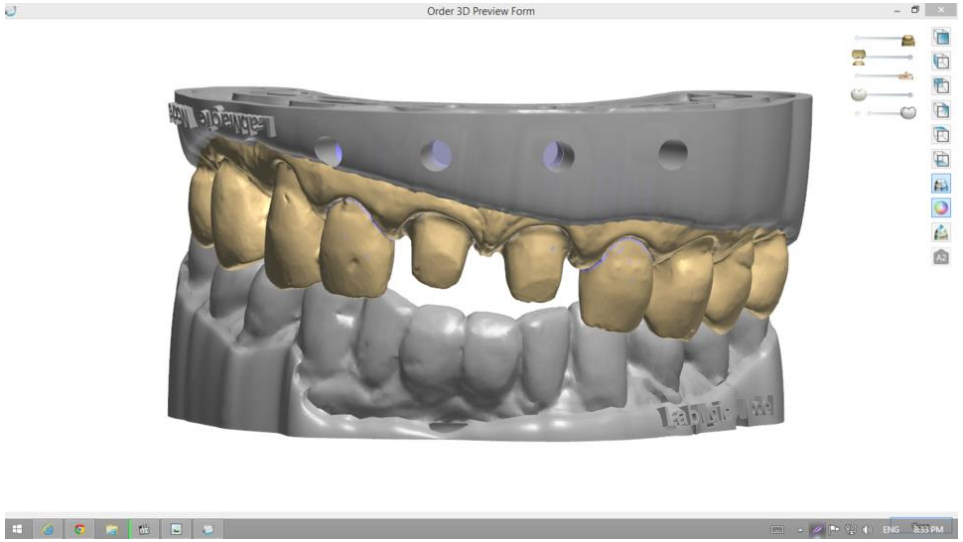
Traditional

Digital



3D printed

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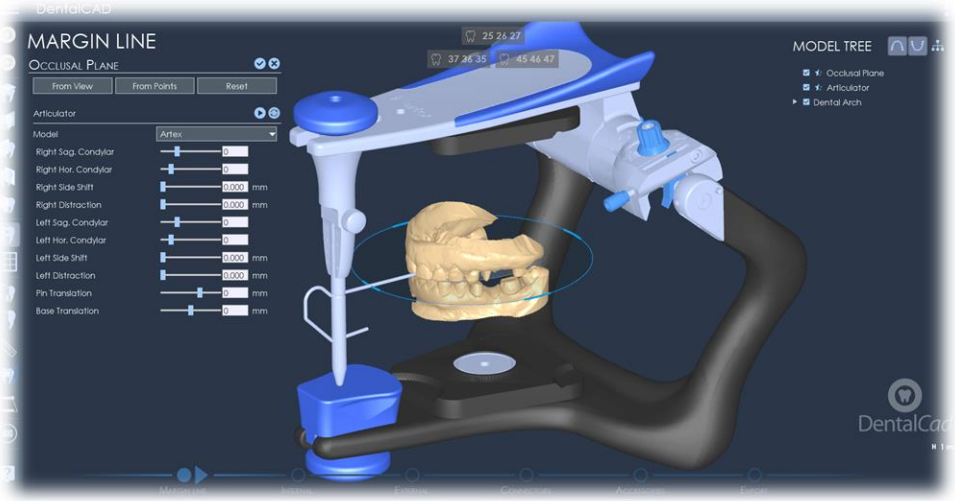
Traditional

Digital



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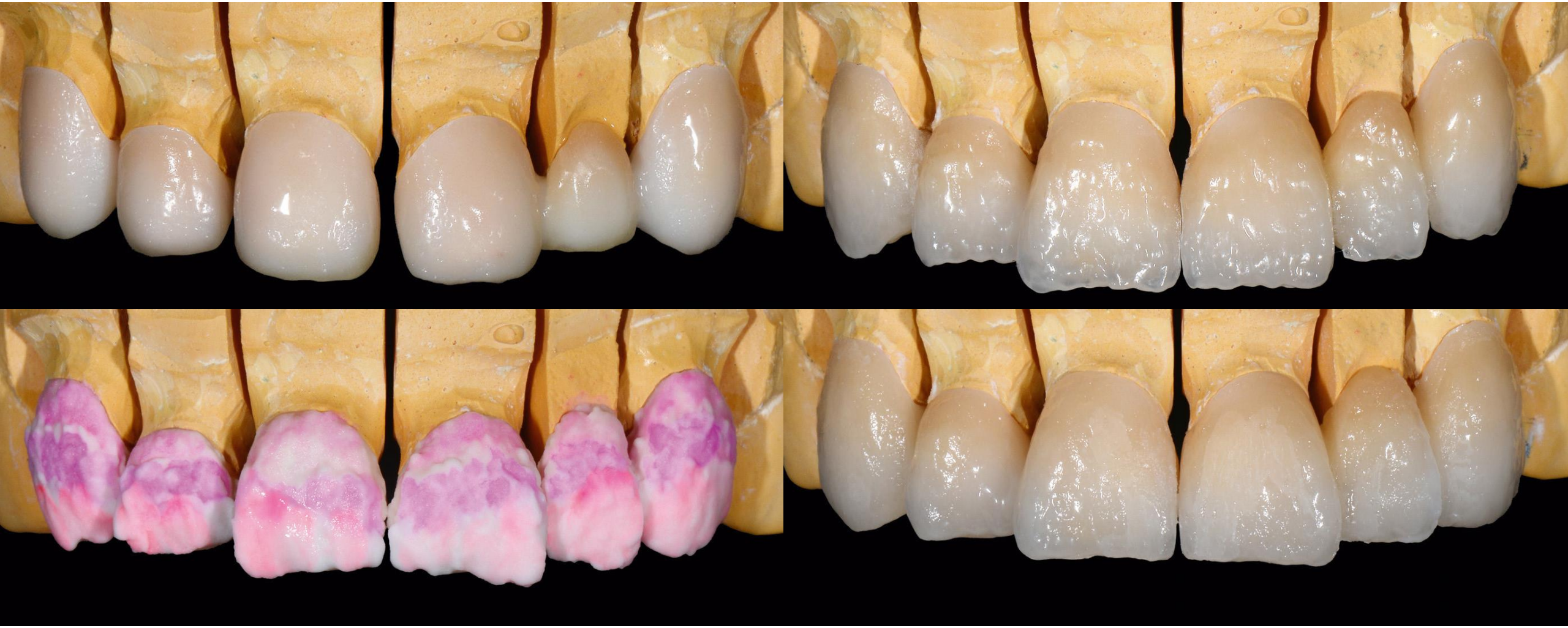
Traditionell



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Digital

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Dental milling machine

3D Printing

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Thank you for your attention

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