Minimally and micro invasive dentistry

Mikó Sándor
Minimally invasive dentistry adopts a philosophy that integrates **prevention, remineralisation** and **minimal intervention** for the placement and replacement of restorations.

- Minimally invasive dentistry (MID) is based on advanced science. Emerging technologies will facilitate evolution to primary prevention of caries, though technical, cultural and economic obstacles to full implementation in clinical practice now exist.

- During the past few decades, scientific developments in cariology, dental materials and diagnostic systems have changed dentistry’s approach to diagnosis and management of dental caries.

- This conservative approach minimizes the restoration/re-restoration cycle, thus benefiting the patient over a lifetime.
Black’s cavity preparation is modified

- Extension for prevention (education, good oral hygiene)
- Box form (adhesive technic)
- Tunnel preparation
Dental surgery and endodontia

Ultrasonic preparation (tissue saving)
• Early diagnosis (caries detection)
• Remineralization of early lesions and reduction of cariogenic bacteria
• Minimal tooth preparations and repairing old prosthetics (adequate materials)
• Diseases control
• (The issue of reimbursement)
Early diagnosis

Detection of the carious lesion:
Clinical information and radiographs are usually used to make. Other diagnostic tools are emerging: some methods are better for detecting occlusal caries, while others are better for detecting proximal or smooth surface lesions (quantitative laser fluorescence, laser fluorescence, optical coherence tomography, electrical conductance methods and tuned-aperture computed tomography).
Most generally used tools: DIAGNODent (KaVo)

- The technology enables us to detect the earliest signs of dental decay. The better and earlier the diagnosis, the better suitable therapy can be planned. This enables us to provide minimally invasive and tooth preserving treatment.
- The DIAGNODent operates at a wavelength of 655 nm LASER light. At this specific wavelength, clean healthy tooth structure exhibits little or no fluorescence, resulting in very low scale readings on the display. However, carious tooth structure will exhibit fluorescence, proportionate to the degree of caries, resulting in elevated scale readings on the display of the DIAGNODent) indicated both visibly and audibly).
## Values

<table>
<thead>
<tr>
<th>Display value:</th>
<th>Therapy:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 14</td>
<td>No special measures.</td>
</tr>
<tr>
<td>15 - 20</td>
<td>Usual prophylactic measures.</td>
</tr>
<tr>
<td>21 - 30</td>
<td>More intensive prophylaxis or restoration: indication is dependent on * caries activity. * caries risk. * recall interval, etc.</td>
</tr>
<tr>
<td>from 30</td>
<td>Restoration and more intensive prophylaxis.</td>
</tr>
</tbody>
</table>
Most generally used tools: VistaProof (Dürr Dental)

- The technology enables us to detect the earliest signs of dental decay. The better and earlier the diagnosis, the better suitable therapy can be planned. This enables us to provide minimally invasive and tooth preserving treatment.
- The fluorescence camera VistaProof emits blue light, at 405 nm wavelength, to capture and digitalize images from the teeth while they are emitting fluorescence. The software that belongs to the product is supposed to analyze the digital images, correlate the green and red amount of pixels observed on the screen, and translate this ratio into numerical values. These values would be related, then, to the lesion severity. It seems that the device is better in detecting dentin than enamel caries.
Most generally used tools: MIDWEST Caries ID (Dentsply)

- The Midwest Caries ID uses LED and fiber optic technologies to detect occlusal and interproximal caries. An audible tone signals the presence of either type lesion, while a visual signal on the tooth provides additional feedback. Detects 92% of occlusal and 80% of interproximal caries.
Most generally used tools: Spectra (Air Techniques)

- Fluorescence technology indicates extent of decay with colour and numerical readings (405 nm)
Most generally used tools: SoproLife (Acteon)

- The blue LEDs emit light at 450nm.
Most generally used tools: CarieScan Pro (CARIOESCAN LTD.)

- Cariescan PRO™ utilises AlternateCurrentImpedance Spectroscopy Technology (ACIST) for the earliest caries detection. (Electrical Impedance)
DIFOTI (digital imaging fiber-optic trans-illumination) system

- It is the only instrument of its kind to be approved by the FDA for the detection of incipient, frank, and recurrent caries. A single fiber-optic cable in the patented mouthpiece delivers visible light to a tooth's smooth surfaces. As the light travels through layers of enamel and dentin, it scatters in all directions toward the nonilluminated surfaces. The light is then directed through the mouthpiece to a CCD camera in the handpiece. The camera digitally images the light emerging from the various surfaces of the teeth.
Disposable Mouth Place

Single Use Anti-Fog Window
Fiber Optic Light Transilluminates coronal tissue

Handpiece
Image Relay Mirror Send transmitted light to the CCD imaging camera in the handpiece
Control the view of the tooth and assure reproducible alignment

DIFOTI™ transilluminate from both sides of tooth and images the occlusal surface.

DIFOTI™ transilluminate #20 on the facial (labial) side of the pre-molar and images the lingual side.

Light Source

DIFOTI™ Digital Image

X-Rays
Incipient Caries (Undetected)

Film or Digital Image

Incipient Caries (Detected)
Remineralization of early lesions and reduction of cariogenic bacteria

- Decreasing the frequency of intake of refined carbohydrates
- Ensuring optimum plaque control (chlorhexidine)
- Ensuring optimum salivary flow
- Conducting patient education
- Local fluorid intake (iontophoresis, varnishes, toothpastes, mouthwashes)
- Caries infiltration (Icon)
The liquidation of bacteria. HealOzone

- In 40 seconds the progress of teeth caries is stopped and the cured surfaces undergo remineralisation. A process of biological self-healing is started.
- Ozone kills 99.9% of all decay producing bacteria in 20 seconds! It is used in dentistry to stop and even reverse small caries.
Fluoride iontophoresis, varnishes
Caries infiltration (Icon)

Icon was specifically developed to gently counteract early proximal caries. This innovative product, a caries infiltration therapy, uses micro-invasive technology that reinforces and stabilises demineralised enamel without the need for drilling or sacrificing healthy tooth structure. The product aims to bridge the gap between prevention (fluoride therapy) and caries restoration, as its micro-invasive infiltration technology can be used to treat smooth surface and proximal carious lesions up to the first third of dentine. The patented proximal tip provides quick and easy access to the affected areas.
Caries infiltration (Icon)

- The beginning caries’ surface layer is removed with HCL gel
- The pore system is dried with alcohol
- The infiltrant soaks into the caries, seals the pores and is light cured
- Hydrochloric acid, pyrogenic silicic acid
Minimum surgical intervention of cavitated lesions

- MID utilizes techniques and materials to access caries that cannot be remineralized and to restore the tooth with minimal loss of healthy structure (extension for prevention is over)
- New classification (Mount and Hume)

<table>
<thead>
<tr>
<th>Location</th>
<th>Classification</th>
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<tbody>
<tr>
<td></td>
<td>1: Minimal</td>
</tr>
<tr>
<td>Site 1: Pits and Fissures</td>
<td>1,1</td>
</tr>
<tr>
<td>Site 2: Proximal Surfaces</td>
<td>2,1</td>
</tr>
<tr>
<td>Site 3: Cervical Surfaces</td>
<td>3,1</td>
</tr>
</tbody>
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- New preparation techniques (air abrasion, hydro-abrasion, laser, ultrasonic)
Air abrasion

- **Air abrasion** is a decay removal and tooth preparation tool that is often used in place of the traditional dental drill. This innovative system allows to conserve more natural tooth structure and reduce the risk of enamel micro-fracturing. Because the equipment does not produce vibration or heat, patients require little or no anesthetic.
- They all work essentially by blowing aluminium oxide, silica powder using compressed air through tips.
Most generally used tools:
Hydro-abrasion

- **Hydro-abrasion** unit sprays a conical jet of warm water around the abrasive stream to capture virtually all dust. The warm water, which further improves patient comfort, starts and stops instantly with air/abrasive flow. (Rondoflex, KaVo; Aquacut Quattro, Velopex; PrepStart H2o, Danville)

![Hydro-abrasion devices](image-url)
Laser

- Erbium family lasers (Er, Cr: Chromium yttrium scandium gallium garnet, YSGG and Er: Yttrium aluminum garnet, YAG) are less invasive in patient treatment than are high speed handpiece. It prevents surface and pulpal temperature rise, tissue cracking and unnecessary removal of healthy surrounding tissue during cavity preparation unlike the regular turbine drills.
Most generally used Er,Cr:YSGG lasers: Waterlase (Biolase)
Most generally used Er:YAG lasers: KEY 3 (KaVo)
Ultrasonic Cavity Preparation

• Gentle treatment of individual teeth, preserves the tooth substance and protects adjacent teeth.
Materials

• Adhesive dental materials make possible to conserve tooth structure using minimally invasive cavity preparations, because adhesive materials do not require the incorporation of mechanical retention features.

• There are several materials that can be used: glass ionomer cements (GICs); resin based composite/ dentin bonding agents; and a layered combination of resin based composites and GICs applied with a technique called lamination.
Glass Ionomer Cements

- Adhesion to tooth
- Release fluoride, calcium, aluminium, stroncium ions into the tooth and saliva
- Fluoride uptake/ release „Rechargeable”
- Technique sensitivity (Resin-modified GICs)
- Cervical restorations, fissure sealants, proximal lesions in anterior teeth, primary teeth, base material, lamination/ sandwich technique
Resin-based composite/ dentin bonding agents

- No needs of macromechanical retention
- Esthetic
- Polimerization shrinkage
Minimal invasive prosthetics (Maryland bridges)
Conclusion

- Development of new dental restorative materials, instruments.
- Better understanding of the caries process, remineralization, caries progression.
- „Extension for prevention“ to „minimally invasive“
- The goal is preservation of natural tooth structure.
Thank You!