CARIESDIAGNOSTIC METHODS

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CARIES...

- is defined as a localized post eruptive, pathological process of external origin involving softening of the hard tooth tissues and proceeding to the formation of a cavity.
- resultant of demineralisation and remineralisation processes.
- early stage is reversible ➡ Early dg!

Types of Caries

- Primery
- Secondary

Based on Time Course

- Slowly progressing caries
- Quickly (rampant) progressive caries

By Starting Point

- Smooth surface (approximal, oral, buccal)
- Fissure

DIFFERENTIAL DIAGNOSIS

- Caries
- Tooth structure losses by non-caries origin:
- Abrasion: abnormal mechanical origin, diffuse-localized.
- Erosion: chemical effects (but not bacterial), external and internal.
- Demastication: physiologic occlusal tooth wear, masseter chewing.
  Attrition: abnormal occlusal tooth wear.
  Abfraction: overload causes chipping of the toothneck (malocclusion).
- Mixed: most often combination of the above …

Why is Diagnosing Caries Important?

- By recognizing early it can be cured without invasion
- Small lesion, small filling…
- Restoration of function and aesthetics
- Preventing consequences

CARIES DG

- Anamnesis recording

  - Subjective symptoms:
    - cold, warm, sweet sensitivity, pain,
    - food impaction between teeth, gum bleeding,
    - bad taste.

  - Objective symptoms:
    - shape and color change of the tooth.

The optimal dg method is:

- Reliable
- Suitable for all surfaces
- Quick
- Simple
- Safe
- Objective
- Reproducible
- Suitable for monitoring
- Cheap
- Demonstrative to the patient
- Documentable

Sensitivity: the number of lesions declared as caries compared to all suspected carious lesions (x true+/(x true+ + y false-).

Specificity: the number of correctly diagnosed intact tooth surfaces compared to all suspected caries-free cases (x true-/(x true- + y false+).

The higher the %, the safer the method, the more secure the dg!

CONVENTIONAL CLINICAL INVESTIGATION METHODS

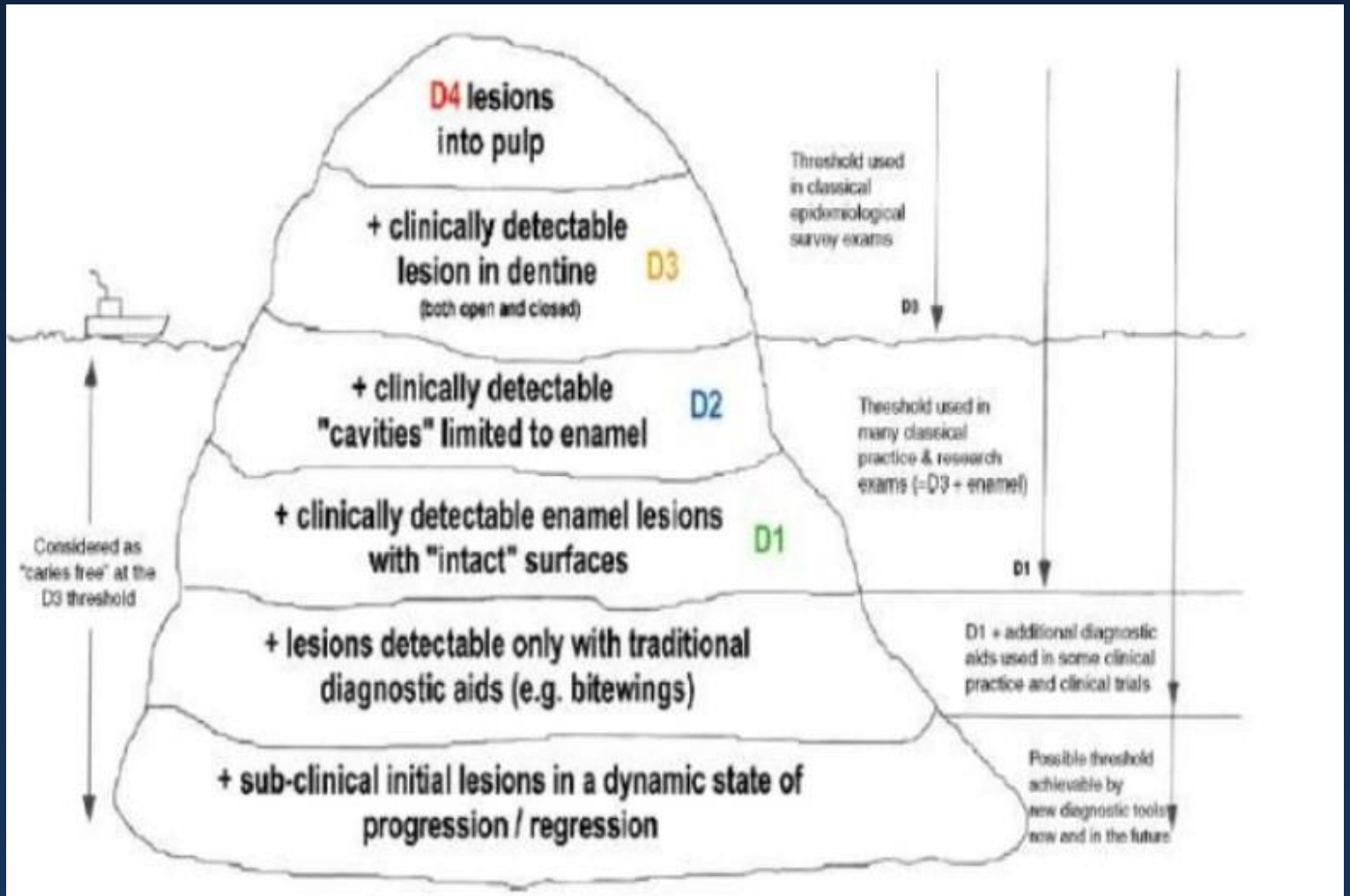
- Inspection (mirror, magnifying glass, illumination, drying)
- Palpation, tactile examination (probing)

- **Low sensitivity: it does not allow early lesions/caries to be recognized. Detection depends to a large extent on the subjective judgment of the dentist**
- **High specificity: because conventional diagnostics do not result in many false-positive diagnoses**

Probing

- It is ease to make mistakes at deep grooves… (false positive)
- Long ago: "if the probe tip get stuck, that is the sign of the decay.„
- Use periodontal probes, otherwise you may damage the weakened enamel surface! Thin cover layer mash and passive caries is converted into active. Iatrogenic cavitation, however, this already requires invasive treatment!!!
- Can cause transinfection!

Sensitivity of various diagnostic devices



The 'iceberg' of caries and the influence of detection system (modified from Pitts, 2001[7]).

Retrospective Cariesdiagnosis

Caries intensity measurement:

CER: caries, extraction, restauration
DMFT, DMFS indexes („M” problem)

ICDAS: International Caries Detection Assessment System

It is excellent for monitoring lesions and to evaluate the success of preventive interventions.

NEWER METHODS OF CARIES DETECTION AND ASSESSMENT

SALIVARY BACTERIA AND FUNCTIONAL TESTS

Strep mut/Lactobacillus CFUs, pH, acid formation from carbohydrate, buffer capacity, enamel solubility

Ivoclar CRT Bacteria

Dentocult® SM Strip Mutans

GC Saliva-Check Mutans

CariScreen (CariFree®)

CARIES-DETECTOR DYES

- Locating soft dentin what is presumably infected
- 1% acid red (fuchsin red carcinogenic) for 10(!) sec, rinse, remove discolored dentin, reevaluate with tactile sensation

- Methyl red indicator dye changes colour in the pH range from 6.3 (yellow) – 4.2 (red). Red colour is developed in the area of plaque accumulation

METHODS BASED ON X-RAY RADIATION

Traditional – bite wing
Digital radiography - coronal recording

- ✓ Radiation exposure is reduced to a fraction.
- ✓ Records can be retrofitted and saved.
- ✓ Detects approx lesions by 95% sensitivity.

Subtraction radiography

- ✓ Suitable for monitoring lesions.
- ○ Reproduction of the appropriate shooting position is difficult.

TRANSILLUMINATION BASED METHODS

FOTI - Fiber Optic Transillumination

- In the carious area the photons of the incoming light are absorbed ➡ dark spot.

DiFOTI
Digital Fiber Optic Transillumination

- **High intensity, given wavelength light + camera + image analysis**

- ✓ It can be used on all tooth surfaces
- ✓ Spectacular and motivating
- ✓ Detects up to early caries laesion
- ✓ Suitable for monitoring - activity measurement
- ✓ Its sensitivity to rtg is higher, and it can be used even in pregnant women

- It is recommended to clean tooth surfaces before its application
- It can not separate fluorosis, dental plaques or discoloration from demineralized lesions
- It is not suitable for defining the depth of the lesion

DIAGNOcam oralcamera

Not suitable for subgingival lesions or for detecting lesions under fillings

FLUORESCENCE BASED METHODS

QLF - Quantitative Light Induced Fluorescence

- It is based on natural autofluorescence of enamel/dentin. In contrast, the fluorescence of demineralized areas is much smaller
- 370 nm (blue) illumination, enamel emits green spectrum while demineralized areas appear black
- Autofluorescence depends on mineral content
- Qualitative: depth, extent, volume determination

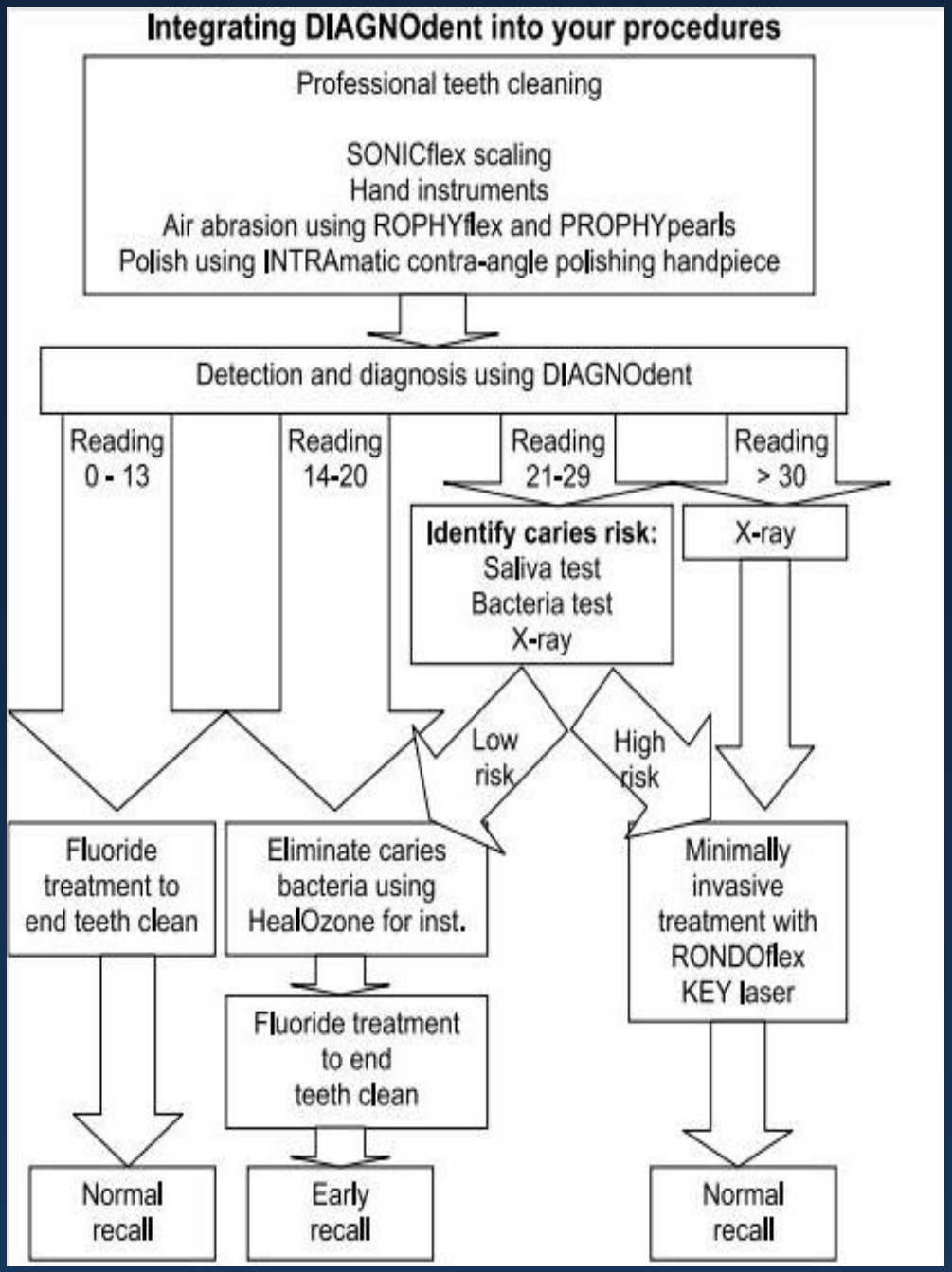
Vistaproof device

Spectra device

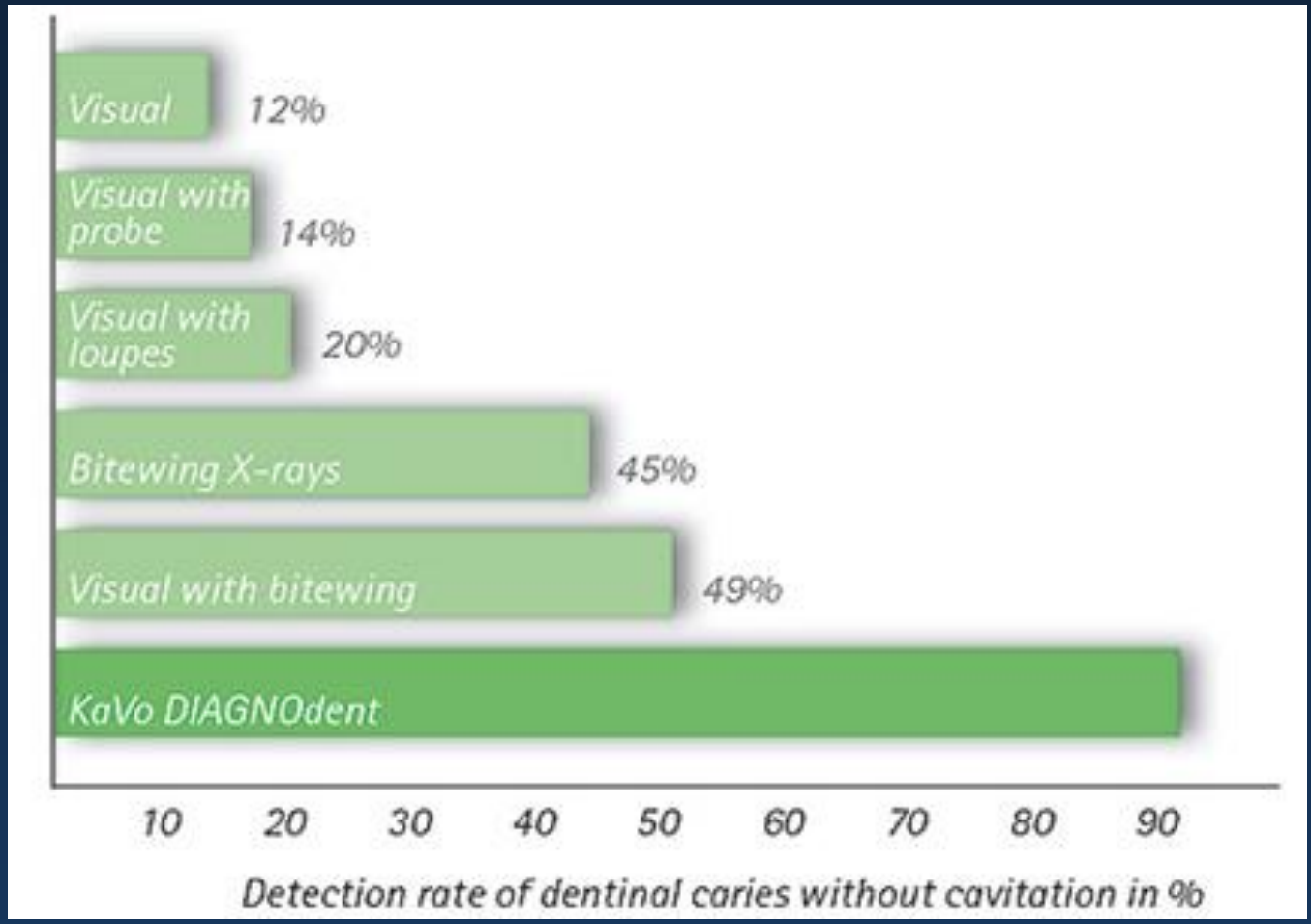
Red fluorescence is caused by bacterial porphyrins, metabolites

DIAGNOdent DIAGNOdent pen

Tartar, plaque, discolorations must be removed, fillings may give false + results


Integrating DIAGNOdent into your procedures
Professional teeth cleaning
SONICflex scaling
Hand instruments
Air abrasion using ROPHYflex and PROPHYpearls
Polish using INTRAmatic contra-angle polishing handpiece
Detection and diagnosis using DIAGNOdent
Reading 0 - 13
Reading 14-20
Reading 21-29
Reading > 30
Identify caries risk:
Saliva test
Bacteria test
X-ray
X-ray
Low risk
High risk
Fluoride treatment to end teeth clean
Eliminate caries bacteria using HealOzone for inst.
Minimally invasive treatment with RONDOflex KEY laser
Fluoride treatment to end teeth clean
Normal recall
Early recall
Normal recall

Percent Success of Conventional and New Diagnostic Methods in Non-cavitated Lesion Detection



Fluoresce HD LED MX Turbine

- ✓ Turbine light emits UV light at 405 nm wavelength, causing red areas of caries and green fluorescence of healthy tissues
- ✓ During cavity preparation at the same time caries dg can be performed and the principle of minimum invasion can also be applied
- ✓ Wear yellow tinted safety goggles

DELF - Dye Enhanced Laser Fluorescence

- ✓ Na-fluorescein, Pyrromethene 556 for stainig carious lesions - Argon laser
- ✓ It is also suitable for testing filling margins and enamel cracks

- It is difficult to apply in pits and fissures
- Toxicological problems
- It fills porous gaps in enamel/dentin due to acid/hypomineralization, stains collagen fibers

Canary System

PTR/LUM - Photothermal Radiometry & Modulated Luminescence

Using 2 Hz pulse laser impulses, the laser light penetrates as deep as 5 mm from the tooth surface. Laser impulses generate phototermal and luminescence responses - complex algorithm - Canary numbers

Advantage: besides composite/amalgam fillings it is also able to detect caries, before its use it is not necessary to clean/dry the teeth as the wet tooth surface or discolouration/plaque does not affect the measurement

Cavity Detection Systems
- Clinical Comparison -

The Canary System

PRODUCT	Canary System	DIAGNOdent	Spectra	SoproLife	CariVu
MANUFACTURER	The Canary System by Quantum Dental Technologies	KaVo	AIR TECHNIQUES equipped for life	ACTEON	DEXIS CariVu
Detects caries and cracks on all tooth surfaces	✓	✗	✗	✗	Interproximal Only
Detects caries under sealants – clear & opaque	✓	✗	✗	✗	✗
Detects sub-surface caries	✓	✗	✗	✗	✗
Detects & measures tooth structure beneath White/Brown spots	✓	✗	✗	✗	✗
Detects caries around margins of restorations (amalgam, composite, crowns & Glass Ionomer)	✓	Not accurate Measures porphyrins	Restorative materials glow preventing view of margin	Restorative materials glow preventing view of margin	Only large interproximal lesion at gingival margin
Detects caries around orthodontic brackets	✓	✗	✗	✗	✗
Quantifies changes in lesion size & volume	✓	Not accurate Measures porphyrins	Not accurate Measures porphyrins Small scale	Image Only no measurements	Subjective Observation of black/white image
Monitors & creates reports on the effectiveness of remineralization agents	✓	✗	✗	✗	✗

*Comparison information is based on published studies

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UCD - ULTRASONIC CARIES DETECTOR

- ✓ Using ultrasound incipient lesions can be detected reliably
- ○ Direct contact with the given area - approx. difficult

ECM, EIS - Electronic Caries Monitor, Electrochemical Impedance Spectroscopy

CarieScan Pro: impedance spectrum

- ✓ **Site specific:** the area is measured in compressed-air drying for 5 seconds cycles módszernél
- ✓ **Surface specific:** liquid containing special electrolyte is added to the surface before the measurement
- ✓ One of he most accurate instrument for detecting non-cavitating lesions on the occlusal surface of molar teeth

- ○ **Do not apply in pacemaker users!**

SUMMARY

- Even modern test methods should be evaluated together with the anamnesis and the clinical examination!
- To avoid false positive and false negative results, everything must be done! Other new techniques…
- **EARLY RECOGNITION, PREVENTION!!!**
- Select the most appropriate therapeutic method for your patient!

Thank you for your attention!

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