Caries infiltration – better than fluoridation and drilling?

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Content

• Where do we come from in Cariology?
• Where should we go?
• Caries infiltration technique
  • Development
  • Efficacy
  • Clinical application for various surfaces
  • Future developments
Where do we come from in cariology?

G.V. Black 1895
„Extension for prevention“
Less invasive (adhesive restoration)
"the death spiral"

It’s all about **time**:

- Delay of first invasive intervention
- Delay time in-between treatments

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Where should we go?
The Paradigm Shift in Cariology

Specific Plaque Hypothesis

“Caries is an infectious and transmittable disease.”

Therapeutic consequences:
• Avoid transmission of bacteria
• Target causing factor: bacteria
• Excavate infected tissues

Ecological Plaque Hypothesis

“Caries is caused by an ecological shift in the dental biofilm.”

Therapeutic consequences:
• Avoid ‘transmission’ of unhealthy behaviour
• Target disturbing factor: diet
• Heal (but possibly leave) infected tissues

A Contemporary Caries Model...

Indirect Factors
- Age
- Genetic Factors
- Socioeconomic status

Direct Factors
- Fermentable carbohydrates
- Biofilm with physiological flora
- Biofilm with pathogenic flora
- Host defense
- Oral hygiene
- Remineralisation
- Saliva
- Fluoride, Ca^{2+}

Demineralisation
- Signs and symptoms

Contemporary Caries Model...

A Contemporary Caries Model...

fermentable carbohydrates

biofilm with physiological flora

biofilm with pathogenic flora

demineralisation

remineralisation

signs and symptoms

host defense

oral hygiene

saliva

fluoride, Ca\(^{2+}\)
... and Therapeutic Interventions

Modification of diet
- Dietary counselling
- Sugar substitutes

Modification of biofilm
- Oral hygiene instructions
- Antimicrobial agents

Modification of mineralization
- Fluorides
- CPP-ACP

Diffusion barriers
- Fissure sealing

Symptomatic therapy
- Caries excavation
- Restoration

and proximally....?

modifications of biofilm and mineralization

non-invasive

micro-invasive?

symptomatic therapy (excavation, restoration) (minimal-)invasive

Caries infiltration development
Sealing - Infiltration

Sealing

Infiltration


# Resin Penetration in vitro

(adesives and sealants)

<table>
<thead>
<tr>
<th>artificial lesions</th>
<th>natural lesions</th>
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<tbody>
<tr>
<td>Davila et al. 1975</td>
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<td>Robinson et al. 1976</td>
<td>Robinson et al. 1976 (case-report)</td>
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<td>Rodda 1983</td>
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<td>Goepferd and Olberding 1989</td>
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<td>Donly and Ruiz 1992</td>
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<td>Garcia-Godoy et al. 1997</td>
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<td>Robinson et al. 2001</td>
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<td>Gray and Shellis 2002</td>
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<td>Schmidlin et al. 2004</td>
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Adhesive Penetration (Natural Lesions)

- Etching with phosphoric acid for 2 min.
- Application of an adhesive for 5 min.

sl = surface layer, ad. = adhesive

Etching of Natural Lesions

15% hydrochloric acid gel 120 s

37% phosphoric acid gel 120 s


Infiltrant

Washburn equation

\[ d^2 = \left( \frac{\gamma \cdot \cos \theta}{2\eta} \right) r \cdot t \]

penetration coefficient

\[ PC = \frac{\gamma \cdot \cos \theta}{2\eta} \]

- \(d\) penetration depth
- \(\gamma\) surface tension
- \(\theta\) contact angle
- \(\eta\) dynamic viscosity
- \(r\) capillary radius
- \(t\) penetration time

Caries Infiltration

**Prerequisites:**

- **Erosion** of the surface layer (etching with HCl-Gel 2 min)
- **Demineralization** of the lesion
- Use of special infiltrants

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Reduction solubility

Proximal Application
Proximal probing

Proximal Application

Caries infiltration efficacy
Efficacy of Proximal Infiltration

relative risk reduction (95% CI)

recall interval

100%  80%  60%  40%  20%  0  -20%  -40%

1 – 1.5 years

Ekstrand et al. 2010
Paris et al. 2010
Martignon et al. 2010
Peters et al. 2012 (Abstract)

3 years

Meyer-Lueckel et al. 2012
Martignon et al. 2012

favors infiltration

favors control (non-invasive treatment)
Stratification: Radiographic Lesion Depth

relative risk reduction (95% CI)

radiographic lesion extension

favors infiltration

favors control (non-invasive treatment)

Meyer-Lueckel et al. 2011
Martignon et al. 2012
Martignon et al. 2012

Therapeutic Options Proximal

- **E0**: Non-invasive
  - Modification of diet, biofilm and mineralization

- **E1**: Micro-invasive
  - Diffusion barrier (infiltration, sealing)

- **E2**: (Minimal)-invasive
  - Symptomatic therapy (excavation, restoration)

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Minimum intervention

- Incomplete caries removal
- Repair of restoration
- Sealing
- Caries infiltration
Caries infiltration
aesthetically relevant surfaces
Buccal White Spot Lesions

refractive index

- Enamel: 1.62
- Air / Water: 1.0 / 1.33
- Infiltrant: 1.52

Masking of Buccal Lesions
Success Rate of Buccal Infiltration

- completely masked: 11
- partially masked: 6
- no change: 1

Therapeutic Options Buccal

- Enhancing Remineralization
- Bleaching
- Caries Infiltration
- Enamel-Microabrasion
- Composit Restorations
- Veneers
- (Crowns)

Preservation of dental hard tissues
Caries infiltration
future developments
Standardized Radiographic Monitoring

Infiltration of Cavitated Lesions


Infiltration of Occlusal Caries

Enamel Hypomineralization

- Fluorosis
- post-traumatic hypomineralization
- Molar-Incisor-Hypomineralization (MIH)
Infiltration of mild fluorosis

Infiltration of MIH

MIH before infiltration

MIH after infiltration
Infiltration MIH / PTH?

3-5 x etching!
Success Rate of MIH-Infiltration

Conclusion

Caries infiltration – better than fluoridation and drilling?

Not better, but supplementing current therapies!
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26 authors from 15 countries
Thanks for your attention!