Ceramics

Asbjørn Jokstad
## History

<table>
<thead>
<tr>
<th>Year</th>
<th>Event/Invention</th>
<th>Details</th>
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<tbody>
<tr>
<td>2001</td>
<td>CAD-CAM</td>
<td>Zirkonium-Ceramic</td>
</tr>
<tr>
<td>1998</td>
<td>Nobel biocare, Sweden</td>
<td>CAD-CAM Al-Ceramic (AllCeram)</td>
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<tr>
<td>1996</td>
<td>Micrystalsa, Switzerland</td>
<td>copy grinding (Celay)</td>
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<tr>
<td>1994</td>
<td>Dentsply, UK</td>
<td>pressure cast ceramic (Empress)</td>
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<tr>
<td>1990</td>
<td>Galvano crowns (AGC)</td>
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<tr>
<td>1988</td>
<td>Sadoun, Frankriche</td>
<td>Slip-infiltrated Ceramic (In-Ceram)</td>
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<tr>
<td>1987</td>
<td>Malament, USA</td>
<td>Castable glas Ceramic (Dicor)</td>
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<tr>
<td>1984</td>
<td>Mörmann, Switzerland</td>
<td>CAD-CAM-consept (Cerec)</td>
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<tr>
<td>1980</td>
<td>Lutz, Switzerland</td>
<td>Indirect inlay</td>
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<tr>
<td>1965</td>
<td>McLean, UK</td>
<td>Al-rich porcelain</td>
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<td>1923</td>
<td>Wain, USA</td>
<td>Sintered porcelain in model</td>
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<td>1907</td>
<td>Taggard, USA</td>
<td>Wax investment</td>
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<tr>
<td>1889</td>
<td>Land, USA</td>
<td>Sintered porcelain in foil</td>
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<td>1882</td>
<td>Herbst, Tyskland</td>
<td>Sintered glas in model</td>
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</tbody>
</table>
## All Ceramics - in use 10 Scandinavian schools (1997)

<table>
<thead>
<tr>
<th>Material</th>
<th>Inlay</th>
<th>Crowns</th>
<th>Veneer</th>
<th>Onlays</th>
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<tbody>
<tr>
<td>Empress</td>
<td>8</td>
<td>7</td>
<td>4</td>
<td>7</td>
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<tr>
<td>Vita-Cerec</td>
<td>7</td>
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<td>4</td>
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<tr>
<td>Inceram</td>
<td>4</td>
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<td>Dicor</td>
<td>3</td>
<td>4</td>
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<td>Vita-porcelain</td>
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<td>Mirage</td>
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<td>Ceramco</td>
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<td>Cerinate</td>
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<td>Optec HSP</td>
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<td>Procera</td>
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</tbody>
</table>
Ceramics in dentistry
Production methods

1. Hand condensing and “firing” (sintering)
2. Press-forWith and sintering
3. Casting and sintering
4. Presintered-machined-glas infiltrated
5. Sintered and machined
   - Machining: copy-grind /CADCAM / Electro
6. High pressure sintering on enlarged model
Principles for fabrication - 1

Sintering
Biodent
Cerinate
Ducera Pluss
Hi-Ceram
IPS Corum
Microbond
Mirage II
Optec HSP
Vitadur-N
Principles for fabrication - 2

Pressforming & sintering

IPS Empress
Principles for fabrication- 3

Casting & sintering

CeraPearl
Dicor
Principles for fabrication - 4

**Slip-sintering**

In-Ceram
Principles for fabrication - 5

Pre- Sintered and machined
Vita-Cerec MkI
Vita-Cerec MkII
Dicor MGC
Principles for fabrication- 6

High pressure sintering on enlarged model

Procera
Ceramics in dentistry

- Traditional felspatic ceramics
  - With or without aluminium oxide crystals
- Felspatic glass
  - With leucite crystals
- Tetra-silico-mica glass
- Lithium-disilicate glass
- Pre-Sintered aluminium-oxide glass infiltrated
- High pressure sintered aluminium oxide
- Zirkonium oxide
<table>
<thead>
<tr>
<th>Reinforcement, concepts</th>
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<tbody>
<tr>
<td><strong>Magnesium-Aluminium</strong></td>
<td>Alceram-Cerestore 1983</td>
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<tr>
<td><strong>Mica</strong></td>
<td>Dicor 1984</td>
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<td><strong>Oxyapatite</strong></td>
<td>CeraPearl 1985</td>
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<td><strong>Leucite</strong></td>
<td>Biodent</td>
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<td>Optec HSP 1987</td>
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<td>IPS Empress 1990</td>
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<td><strong>Galvano techniques</strong></td>
<td>1989</td>
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<tr>
<td><strong>Aluminium-oxide</strong></td>
<td>In-Ceram 1990</td>
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<td>Procera Allceram 1994</td>
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</table>
Ceramics

All-Purpose
1a. Ceramco 3
   Dentsply/Ceramco
1b. Omega 900
   Vident
2. Ceramco II
   Dentsply/Ceramco
3a. Creation
   Jensen
3b. IPS d.Sign
   Ivoclar Vivadent

Bonded
1. IPS Empress
   Ivoclar Vivadent
2. IPS Eris
   Ivoclar Vivadent
3. OPC
   Pentron
4. Finesse All-Ceramic
   Dentsply/Ceramco

Miscellaneous
1a. Duceram LFC
    Dentsply/Ceramco
1b. Procera AllCeram
    Nobel Biocare
2. Finesse
    Dentsply/Ceramco
3a. In-Ceram Alumina
    Vident
3b. In-Ceram Spinell
    Vident
Shear strength Mpa (N/mm²)

- Carrara Core
- Optec OPC
- Synspar
- Vitadur Alfa
- VMK95
- Creation LF
- InCeram Spinell
- Empress
- Carrara Dentin
- InCeram Alum
- Empress2
- Vintage
- Duceram LFC
- InCeram Zirconia

Carrara Core
- Optec OPC
- Synspar
- Vitadur Alfa
- VMK95
- Creation LF
- InCeram Spinell
- Empress
- Carrara Dentin
- InCeram Alum
- Empress2
- Vintage
- Duceram LFC
- InCeram Zirconia
Preparation margins

A. Featheredge, B. Chisel, C. Chamfer, D. Bevel, E. Shoulder
F. Sloped Shoulder, G. Beveled shoulder
Clinical aspects

- Surface treatment
- Corrosion
- Cement
- Repairs
- Polishing
Bonding between ceramic:resin cement

1. etching with HF acid

Use with care!

\[
\text{SiO}_2 + 4\text{HF} \rightarrow \text{SiF}_4 + 2\text{H}_2\text{O}
\]
Bonding between Ceramic : resin-cement

1. etching
2. Silanization

- Not etched & not silanized
- Etched & not silanized
- Etched & silanized
Bonding between Ceramic and resin cement

1. etching
2. Silanization immediately before cementation
Ceramics

Quartz glas  Normal glas
Corrosion

LFC = Low Fusing Ceramics
Corrosion

LFC
inner foil
alloy

cast
other

Ceramic
Clinical observations
1. A. Hüls. Georg-August University, Gottingen, Germany, 1996
3. Lehner et al. IADR, Nice, France 1998
5. Odin et al. Thesis at University of Umeå, 1996
8. Vita Zahnfabrich, 1998