NEW MATERIALS AND TECHNIQUES IN PROSTHODONTICS

Asbjørn Jokstad, Professor, Dr.Odont.
Department of Prosthodontics and Oral Function
Institute of Clinical Dentistry
University of Oslo, Norway

1. New materials & methods
   - Dental implants
   - Articulators
   - Precision attachments
   - Repairs (Ceram fracture, crown removal, post retrieval, etc.)
   - Denture fabrication: production, materials, lining & repairs
   - Laboratory: process & new materials
1. Rotating instrument
2. Root Post
3. Gingival retraction
4. Impression
5. Bite & jaw registration
6. Color shade
7. Temporary construction
8. Restorative materials
9. Production techniques
10. Cementation

Preparation & finishing kits

- Acrylic Adjustment Kit
- R.A.P.T.O.R. Resin Sculpting Set
- R.A.P.T.O.R.
- Brasseler
- Acrylic Temporization Kit
- Anterior Bur Box
- Esthetic Inlay/Onlay
- Nixon Inlay/Onlay II
- Nixon Porcelain Veneer II Laminate Veneer System
- Ultra Denture Adjustment & Polishing Kit

Cosmedent
- Top Finisher System

Dentsply/Caulk
- Enhance Composite Finishing and Polishing System

Nobel Biocare
- Procera Preparation Kit

New materials & methods–Fixed prostheses

1. Cast
2. Prefabricated
   - Metal
   - Non-metal
1. Cast posts
   Indirect technique
   • Impression
   Direct technique: Post & resin
   • Wax
   • Resin
     - Accuset
     - ExactaCast
     - Luminex
     - GC Pattern Resin

2. Prefabricated posts
   1. Cast Posts
      - Indirect
      - Direct: Post & resin
   2. Prefabricated Posts

   Additional core
   Metal No Yes
   Non-metal - Yes
   > 30 products

“Core”-materials

Bis-core Bisco Dual co.
Bisfil core Bisco Light co.
Build II Bisoc Chem Co
Blue core Teledyne Chem Co
Build-II FR Jeneric Dual co.
Coracap Brasseler ceramic
Clearfil Core Kuraray Chem Co
*PhotoCore Kuraray Light co.
Coradent Vivadent Chem Co
Core Paste Den-Mat Chem Co
* Syringe Den-Mat Dual co.
CoreFlo Bisoc Chem Co
CoreRestore sds/Kerr Dual co.
* HDCC sds/Kerr Dual co.
CoreShade Shofu GIC

CurRay-support Sci-Pharm Dual co.
Encore Centrix Chem Co
FluorCore Dentaspray Dual co.
Fuji-Ⅱ LC GC GlC-modif.
HardCore Pulpdent Dual co.
Infracore Temrex Dual co.
Ketac silver 3M ESPE Ag-GIC
Light-Core Bisco Light co.
LuxaCore Auto DMG Dual co.
Magnacore Bosworth Dual co.
Micronest Core GC Chem Co
Parapost Paracore Collene Dual co.
Rothids VOCO Chem Co
Tri-Core EDS Chem Co
Vitремer 3M Espe GlC-modif.
2. Prefabricated posts, metal

- Steel
- Titanium-alloy
- Titanium

- "Active" – "Inactive"
- Conical
- Parallel Steps
- Threaded
- Smooth
- Structured
- Flat
- Conical
- Ovoid
- Slots & grooves

2. Prefabricated post, non-metal

Five main groups

1. Ceramic, prefabricated
2. Ceramic, made in the dental laboratory

Posts made in ceramics

Prefabricated
- Biopost (Incemed), ZrOx, D, ~ 1990
- Cerapost (Brasseler), 1995
- Cosmopost (Ivoclair), 1998

Laboratory
- + “Cosmopuck” (Ivoclair), 1998
- In-Ceram (VITA), 1994
2. Prefabricated post, non-metal
Five main groups:
1. Ceramic, prefabricated
2. Ceramic, made in laboratory
3. “Black post”, Carbonfibres dispersed in resin
4. “White post”, Quartsfibres dispersed in resin
5. “Translucent post”

Non-metal, non-ceramic posts - many variants
Quarts
Quarts+Zirkonium (Carbon)
Quarts & Carbon composite “resin”
(epoxi polyester)

New materials & methods - Fixed prostheses
Rotating instrument Root Post
1. Cord
   • Impregnated
   • Non-impregnated
2. Gel/paste
3. Cotton
4. Electrosurgery
5. (Cobber-tube)
### Retraction cords, impregnated

<table>
<thead>
<tr>
<th>Product</th>
<th>Producer</th>
<th>Active substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allrec</td>
<td>VOCO</td>
<td>AlCl₃</td>
</tr>
<tr>
<td>Biopak</td>
<td>SDI</td>
<td>Fe₂(SO₄)₃</td>
</tr>
<tr>
<td>Crown-Pak</td>
<td>Gingi-Pak</td>
<td>dl-Adrenalin (4-ply)</td>
</tr>
<tr>
<td>Ging-Aid</td>
<td>Gingi-Pak</td>
<td>dl-Adrenalin (gip- Soft-twist)</td>
</tr>
<tr>
<td>Ginga-Pak</td>
<td>Ging-Pak</td>
<td>dl-Adrenalin (dl-Adrenalin)</td>
</tr>
<tr>
<td>Ginga-Tract</td>
<td>Del-Matt</td>
<td>Al₂SO₄, 3.5 mg/l</td>
</tr>
<tr>
<td>Gingtrabraid</td>
<td>VanR</td>
<td>AHSO₄ adrenalin + Aluminium</td>
</tr>
<tr>
<td>Hematin</td>
<td>VODO</td>
<td>Adrenalin</td>
</tr>
<tr>
<td>Hemodent</td>
<td>WAWE Premier</td>
<td>AlCl₃ 21%</td>
</tr>
<tr>
<td>Pacord</td>
<td>Pascal</td>
<td>ADO</td>
</tr>
<tr>
<td>Racetrabraid</td>
<td>Septodot</td>
<td>AlCl₃ + lignocain</td>
</tr>
<tr>
<td>Record</td>
<td>Pascal</td>
<td>di Adren HCl +Zifenosulfonat 0.3%</td>
</tr>
<tr>
<td>Retractol</td>
<td>Roeko</td>
<td>AlSO₄, 0.5 mg/l</td>
</tr>
<tr>
<td>St-Trax</td>
<td>Pascal</td>
<td>AlSO₄, di-ad HCl + ad + Zifenosulfonat braided</td>
</tr>
<tr>
<td>Stretavid</td>
<td>Henry Schein</td>
<td>AlSO₄/adrenalin twin/braid</td>
</tr>
<tr>
<td>Tiyapak</td>
<td>Sultan</td>
<td>AlK + Fibrocin-HCl 4%</td>
</tr>
<tr>
<td>Traco</td>
<td>VODO</td>
<td>AlCI, 6%</td>
</tr>
<tr>
<td>Ultra</td>
<td>Sultan</td>
<td>AlK + Fibrocin-HCl 4%</td>
</tr>
<tr>
<td>Unibraid</td>
<td>VanR</td>
<td>Adrenalin-alum braided</td>
</tr>
<tr>
<td>Z-Twist</td>
<td>Ging-Pak</td>
<td>di Adrenalin + AlCl</td>
</tr>
</tbody>
</table>

### Retraction cord, non-impregnated

- Astringedent (Ultradent)
- First Stop (Stevenson)
- Gingi-Aid (Gingi-Pak)
- Gingiva liquid (Roeko)
- Hemodent (WAWE Premier)
- Hemo-gin-L (Van R Dent Prod.)
- Hemo-stat (Henry Schein)
- Ocu Clear (Health Care Prod.)
- Orostat (Gingi-Pak)
- Rastringent (Pascal Comp)
- Racemistat (Pascal Comp)
- Stasis (Gingi-Pak)
- Styptin (Van R Dent Prod.)
- Ultradent Alum Chlor. (Ultradent)
- ViscoStat (Ultradent)
- Visine (Pfizer Inc)
- Wet Pack (Van R Dent Prod.)

### Expasyl (Kerr /Pierre Roland)

- 15% Al-Chlorid + Caolin
New materials & methods—Fixed prostheses

- Rotating instrument
- Root Post
- Gingival retraction
- Impression

A perfect impression

1. Influence of the impression material?
Most commonly used materials in USA

<table>
<thead>
<tr>
<th>Crown/bridges</th>
<th>Inlays/onlays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vinyl siloxane</td>
<td>81%</td>
</tr>
<tr>
<td>Alginate</td>
<td>38%</td>
</tr>
<tr>
<td>Polyeter</td>
<td>28%</td>
</tr>
</tbody>
</table>


A perfect impression

2. Influence of the impression technique?

Method 1 - Dual-arch
SYN: Dual-arch impression, Double-arch impression, Triple tray technique, Closed-bite impression, Double arch single mix impression, Double arch double mix impression

Dual-arch
- Patient comfort
- Maximum intercuspid
- Easy for laboratory
- Time
- Occlusion?
Method 2 -
One polymerisation phase - one viscosity

SYN: One phase technique, Single phase impression, Medium viscosity technique, Single mix technique, Single mix single impression, Monophase technique

Materials - ex.
Aquasil Monophase Dentsply
Examix Monophase GC
Imprint II 3M Espe
Impregum F 3M Espe
Provil Novo Monophase Kulzer
President System 75 Coltene

Method 3 -
One polymerisation phase - two viscosities

SYN: Double mix technique, Double mix single impression, Express technique, One step putty wash technique, Sandwich impression, Simultaneous one-step technique, Two phase technique/impression, Wet/Wet impression

Materials - ex.
Aquasil Putty + Reprosil HF Light Dentsply
Examix Putty + Examix Regular eller Inject GC
Express Putty + Express Medium 3M Espe
Impregum F + Permadyne 3M Espe
Optosil Comfort P Plus + Xantopren Kulzer
President Heavy + President (Jet) Light Coltene

Method 4 -
Two polymerisation phases - two viscosities

SYN: Correction impression, Double Impression, Double mix double impression, Overlay impression, Putty-wash technique / impression, Two-step putty-wash technique, Wash technique, Wet/Dry impression

Materials - ex.
Coltoflax + Coltex Xtrafine Coltene
Panasil Heavy + Panasil Regular Kettenbach
President Putty Soft + President (Jet) Light Coltene
Examix Putty + Examix Regular GC
Express Putty + Express Medium 3M Espe
Aquasil Putty + Reprosil HF Light Dentsply
<table>
<thead>
<tr>
<th>Dual-arch</th>
<th>Single-phase</th>
<th>Two-phase</th>
<th>Two-phase - two stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Patient comfort</td>
<td>• Maximum intercuspid</td>
<td>• Easy for laboratory</td>
<td>• Time</td>
</tr>
<tr>
<td>• Occlusion?</td>
<td>• Putty : wash hardness compatibility?</td>
<td>• Technique sensitive</td>
<td>• Replacement</td>
</tr>
</tbody>
</table>

Alternative method 5 - “Hydraulic principle”

For upper anterior abutments with fragile gingiva

Alternative method 6 - “Laminar” principle

(Ref: G Schoenrock (1989))

For lower posterior abutments with dry work field problems
Alternative method 7 - Tube-section

The safest technique when abutments are periodontally unstable

A perfect impression

1. Dual-arch
   1. Metall
   2. Plastic
2. Other
   1. Metall
   2. Plastic
   3. Individual

3. Influence of the impression tray?

Trays - Dual-arch

- Bite Relator (Temrex)
- Bite Tray (Kerr)
- Exacta
- First Bite
- Quad-Tray
- Tri-Bite (Tri-Bite)
- Triple Tray (Premier)
Trays - metal

- Platinated brass
- Steel
- Titanium
- Aluminium

- Perforated
- Uperforated

Trays - metal, for implant prosthodontics

Kohler Medizintechnik
Trays - plastic

Most used in USA
Percent used for impressions

<table>
<thead>
<tr>
<th>Material</th>
<th>Crowns /bridges</th>
<th>Inlays /onlays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vinyl siloxane</td>
<td>81%</td>
<td>71%</td>
</tr>
<tr>
<td>Alginate</td>
<td>38%</td>
<td>20%</td>
</tr>
<tr>
<td>Polyether</td>
<td>28%</td>
<td>22%</td>
</tr>
</tbody>
</table>

Do you ever use individual tray?
- Yes 73%
- No 24%


Tray - individual

<table>
<thead>
<tr>
<th>Tray Type</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candulor C-plast</td>
<td>Cavex</td>
</tr>
<tr>
<td>Citotracy</td>
<td>Bayer AG</td>
</tr>
<tr>
<td>Contryx</td>
<td>Schütz Dental</td>
</tr>
<tr>
<td>Easy Tray</td>
<td>Kerr</td>
</tr>
<tr>
<td>Erkoden</td>
<td>Erkodent</td>
</tr>
<tr>
<td>Exodent</td>
<td>Pro-Dent</td>
</tr>
<tr>
<td>Fastray</td>
<td>Beathworth</td>
</tr>
<tr>
<td>Formatray</td>
<td>Kerr</td>
</tr>
<tr>
<td>Hypon</td>
<td>Premier</td>
</tr>
<tr>
<td>Individa/Lux</td>
<td>VOCO</td>
</tr>
<tr>
<td>Othin 100</td>
<td>G-C Dental</td>
</tr>
<tr>
<td>Palstray/LC</td>
<td>Heraeus Kulzer</td>
</tr>
<tr>
<td>Pekstray</td>
<td>Bayer</td>
</tr>
<tr>
<td>Spectra-Tray</td>
<td>Ivoclar</td>
</tr>
<tr>
<td>SR-Ivoclar</td>
<td>Ivoclar</td>
</tr>
<tr>
<td>T-LUX</td>
<td>Scheu Dental</td>
</tr>
<tr>
<td>TrayAcryl</td>
<td>Schütz Dental</td>
</tr>
<tr>
<td>Traid</td>
<td>Dentsply</td>
</tr>
</tbody>
</table>
Digital Shade Systems
- Dental Color Analyser (clearlight.com/~aei)
- Metalor-ikam system (metalor-ikam.com)
- Pocketspec (Pocketspec.com)
- ShadeVision /ShadeRite (X-Rite.com)
- Shadescan (Cynovad.com)
- Spectroshade (mhtint.com)
- ShadeEye NCC (Shofu.com)

New materials & methods - Fixed prostheses
- Rotating instrument
- Root Post
- Gingival retraction
- Impression
- Bite & jaw registration
- Color shade
- Temporary construction
Alternatives

- Bis-Acrylic composite
- Polymethyl metacrylate
- Polyethyl methylacrylate
- Microfill light cured
- UDMA composite

Bis-acryl most popular

<table>
<thead>
<tr>
<th>Material</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bis-acryl resin</td>
<td>43%</td>
</tr>
<tr>
<td>齿聚合物粘合剂</td>
<td>40%</td>
</tr>
<tr>
<td>PMMA</td>
<td>24%</td>
</tr>
<tr>
<td>PMMA</td>
<td>21%</td>
</tr>
<tr>
<td>UDMA</td>
<td>16%</td>
</tr>
<tr>
<td>Ethanol methacrylate</td>
<td>8%</td>
</tr>
<tr>
<td>Light cured composite</td>
<td>8%</td>
</tr>
<tr>
<td>Epoxy diether carbonate</td>
<td>5%</td>
</tr>
<tr>
<td>Resin discs</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>10%</td>
</tr>
</tbody>
</table>

*These figures are approximate.

Scientific Association 2005 FAME
Telemark: Restoration Service
Chemical cured

- Cool Temp
- Integrity
- Luxatemp Automix
- Protemp 3 Garant
- Structur 2
- Tempofit
- Trim II H

- Coltene
- Dentsply
- DMG
- 3M ESPE
- VOCO GmbH
- Detax
- Bosworth

Temporary cements

- Eugenol-containing
  - E.g. Temp-Bond and IRM
- Non-eugenol-containing
  - E.g. Nogenol and Dycal
- Light & chemical cured
  - E.g. Provilink

New materials & methods – Fixed prostheses

- Rotating instrument
- Root Post
- Gingival retraction
- Impression
- Bite & jaw registration
- Color shade
- Temporary construction
- Restorative materials
Most used in USA – full ceramics
1. Pressed 63%
   (e.g., Empress, OPC)
2. Aluminium-oxide 46%
   (e.g., Procera)
3. Lithium disilicate 36%
   (e.g., Empress 2)


Fibre-reinforced Composite

Laboratory
- FibreKor & Sculpture
- Vectris & Targis
- Connect & BelleGlass
- Fiber-splint
- FibreSpan NSI & Nulite
- GlassSpan
- Ribbond & Revolution
- Ribbond Triaxial & Revolution
- Splint-it! & Flow-it! & Protect-It!
- Stick / Sticknet / Everstick

Pre-impregnated
- Glass
- Kevlar
- Polyethylene

Mesh
- Parallel
- Twinned

Pre-impregnated
- Glass
- Kevlar
- Polyethylene
1. Development of materials, e.g. Ceramics

(Tensile strength, MPa)

<table>
<thead>
<tr>
<th>Material</th>
<th>0</th>
<th>200</th>
<th>400</th>
<th>600</th>
<th>800</th>
<th>1000</th>
<th>1200</th>
<th>1400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrera Core</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optec QPC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wonder Atis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YMK95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creation LF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InCeram Spinell</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leax 3M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empress</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empress2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrera Dentin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitang</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InCeram LPC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>InCeram Zirconia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schivide</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Development of software

Time - precision

CEREC 1  CEREC 2

3. Development of production units
New materials & methods–Fixed prostheses

- Rotating instrument
- Root Post
- Gingival retraction
- Impression
- Bite & jaw registration
- Color shade
- Temporary construction
- Restorative materials
- Production techniques
- Cementation

Water-based - conventional

- Zinc-phosphate

Water-based: Glassionomer
### Resinmodified GIC & polyacrylate modified resin

Resinmodified GIC & polyacrylate modified resin

**REALITY’S CHOICES 2003**

#### Resin Cements

<table>
<thead>
<tr>
<th>Type</th>
<th>Product</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Light-Cured/Dual-Cure</strong></td>
<td>Insure/Insure Lite</td>
<td>Cosmedent</td>
</tr>
<tr>
<td></td>
<td>Versalink II</td>
<td>Ivoclar Vivadent</td>
</tr>
<tr>
<td></td>
<td>Nexus2</td>
<td>Kerr</td>
</tr>
<tr>
<td></td>
<td>RelyX Veneer Cement</td>
<td>Ivoclar Vivadent</td>
</tr>
<tr>
<td></td>
<td>Choice</td>
<td>Bisco</td>
</tr>
<tr>
<td></td>
<td>Illusion</td>
<td>Bisco</td>
</tr>
<tr>
<td></td>
<td>Calibra</td>
<td>Dentsply/Caulk</td>
</tr>
<tr>
<td><strong>Dual-Cure-Only</strong></td>
<td>Panavia F</td>
<td>Kuraray</td>
</tr>
<tr>
<td></td>
<td>RelyX ABC</td>
<td>3M ESPE</td>
</tr>
<tr>
<td></td>
<td>Biolite II DC</td>
<td>Tokuyama Soda/J. Morita USA</td>
</tr>
<tr>
<td></td>
<td>Duo-Link</td>
<td>Bisco</td>
</tr>
<tr>
<td></td>
<td>Cement-Zr</td>
<td>Universal C &amp; B Pentron</td>
</tr>
<tr>
<td></td>
<td>PermaFlow DC Indirect</td>
<td>Luting/Restorative Resin Ultradent</td>
</tr>
<tr>
<td><strong>Self-Cure</strong></td>
<td>Panavia 21</td>
<td>Kuraray</td>
</tr>
<tr>
<td></td>
<td>Post Cement HZ-X</td>
<td>Bisco</td>
</tr>
<tr>
<td></td>
<td>C &amp; B Metabond</td>
<td>Parkell</td>
</tr>
<tr>
<td></td>
<td>M-Bond</td>
<td>Tokuyama Soda/J. Morita USA</td>
</tr>
<tr>
<td></td>
<td>C&amp;B Cement</td>
<td>Luting Composite</td>
</tr>
</tbody>
</table>

---

[Diagram showing various resin cements and their properties]
1. Clean surface with H$_2$O$_2$, wash, dry
2. Mix powder and liquid
3. Apply cement in crown
4. Place crown on prepared tooth
5. Wait
6. Remove surplus with probe
7. Inspect crown margin

Zinkphosphate cement

Thank you for your kind attention