UMY UNIVERSITAS MUHAMMADIYAH YOGYAKARTA | FAKULTAS KEDOKTERAN DAN ILMU KESEHATAN

BAHAN RESTORASI SEWARNA GIGI

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Material

- Resin komposit
- Glass ionomer cement
- Amalgam
- Bases and liner (calcium hydroxide)

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RESIN KOMPOSIT

***Indikasi anterior komposit* :**

- **Pada kasus diastema**
- **Memperbaiki anatomi gigi**
- **Labial veneer----- utk kasus ada pewarnaan instrinsik dan structural defect**

***Indikasi posterior komposit* :**

- **Pengganti amalgam**
- **Core built-up**
- **Inlay dan onlay**
- **Restorasi proksimal**

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RESIN KOMPOSIT

- **Resin komposit ------ bahan restorasi estetik yang digunakan utk gigi anterior dan posterior**
- **Resin komposit pertama kali diperkenalkan thn 1960-an**
- **Anterior teeth :**

  aesthetics, high surface polish, excellent colour matching, and colour stability
- **Posterior teeth :**

  Biting forces may be up to 600 N, high compressive, tensile strength, excellent

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Composition of resin composites

- *Matrix resin*
- *Glass filler*
- *Coupling agents*
- Intiators.
- Accelerators

polymerisation

- Inorganic oxide (shades)

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Resin matrix

- Bis GMA (bisephenol A-glycidyl methacrylate)------*Mayority (High Viscosity)*

- UDMA (Urethane dimethacrylate)---*Mayority*

- TEGDMA (Tryethylene glycol dimetacrylate)-----*Low Viscosity*

- Bisphenol-A-polyethylene glycol diether dimethacrylate

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Glass Filler Particles

- Silicon dioxide, aluminium oxide, barium, zirconium oxide, borosilicate dan barium alumunium silicate glasses
- Banyaknya partikel filler------ *better physical and mechanical properties*
- **Filler Particles**,
  increased----- wear resistance, hardness, translucency
  decreased-----polymerisation contraction, coefficient of thermal expansion
- Resin composite bisa dikategorikan berdasarkan *ukuran* dan *distribusi* dr filler particles

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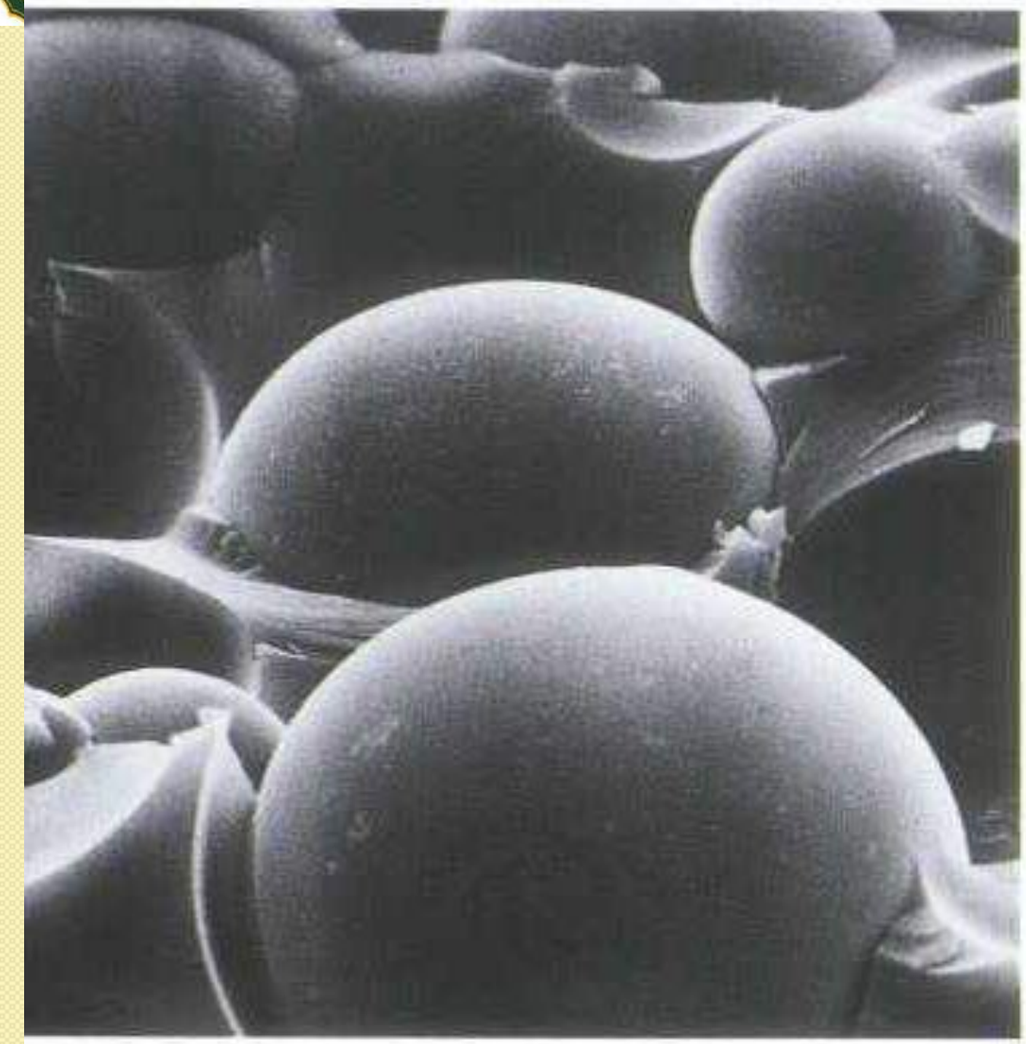
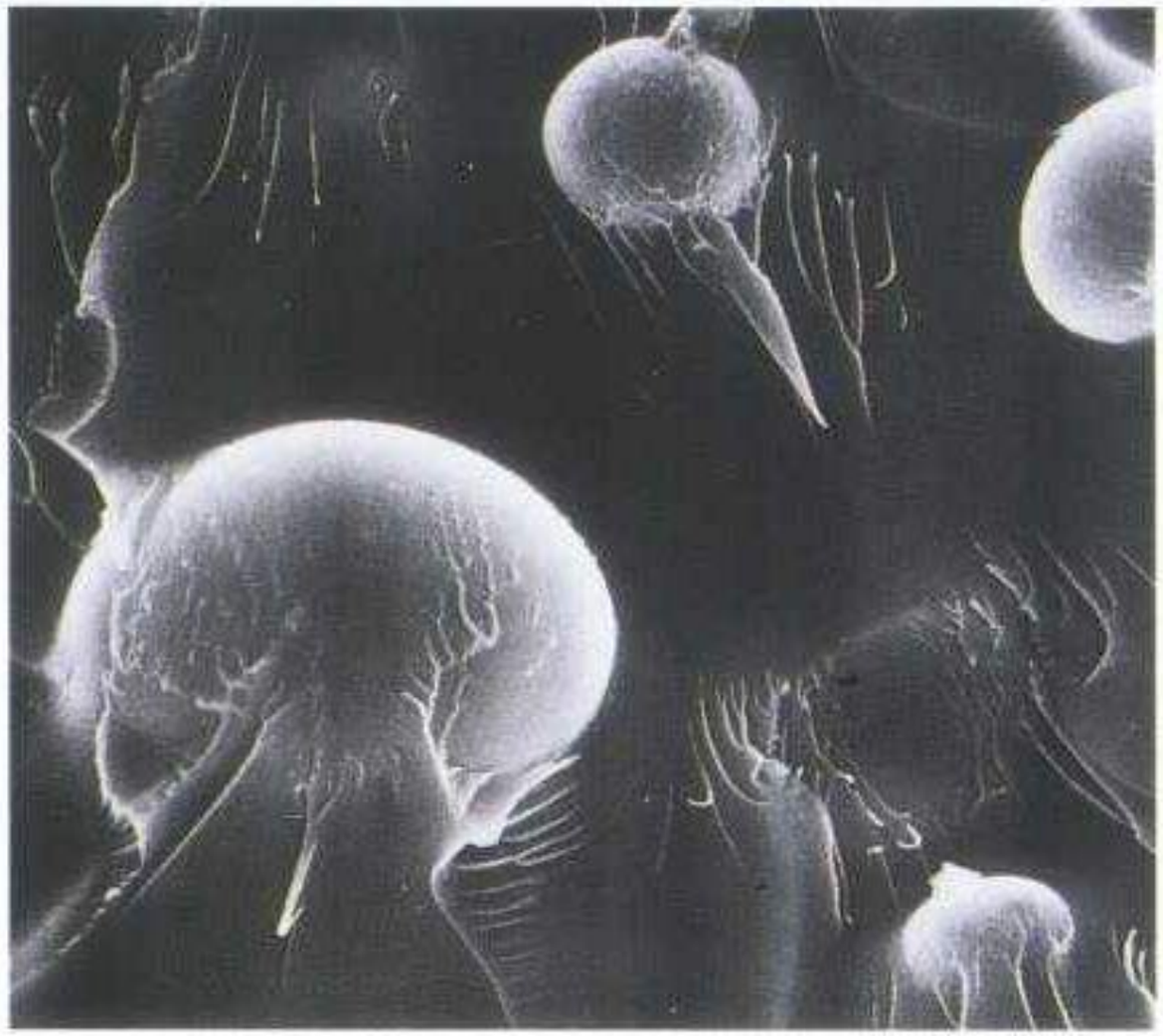
Coupling Agents

- Silanes--------coupling agents
- MPS (3-Methacryloxypropyl trimethoxysilane)
- Untuk ikatan antara matrik resin dengan glass filler
- Ikatan akan menurun, jika terekspos air/saliva dalam mulut



Composite with nonsil
anated spherical filler particles.
The resin is not bonded to the
filler surface. Therefore, when the
composite is stretched the resin
bears all the stress.



Composite with silanated
spherical filler particles. The resin
i s bonded to the filler surface.
Stress transfer occurs between
resin and filler when the composi
te is stretched.

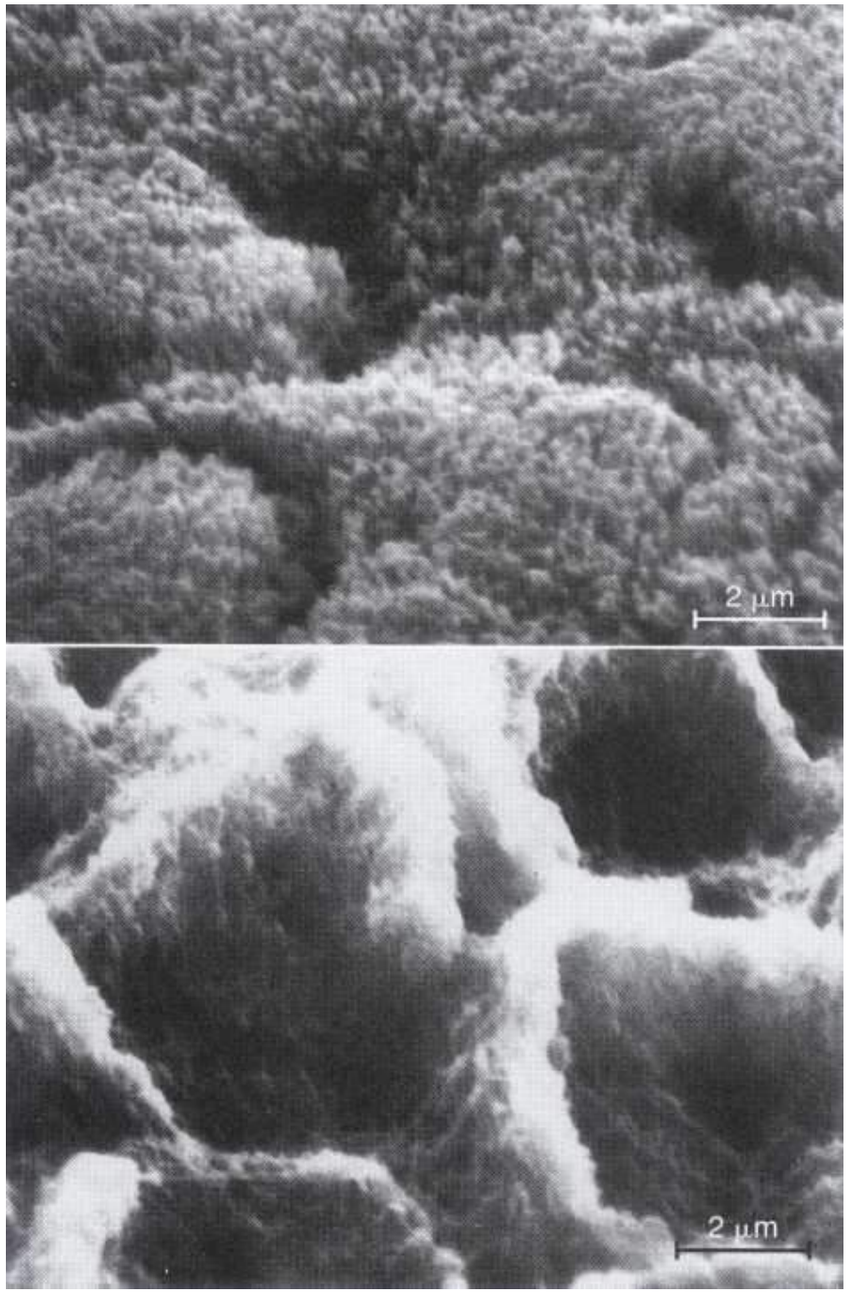
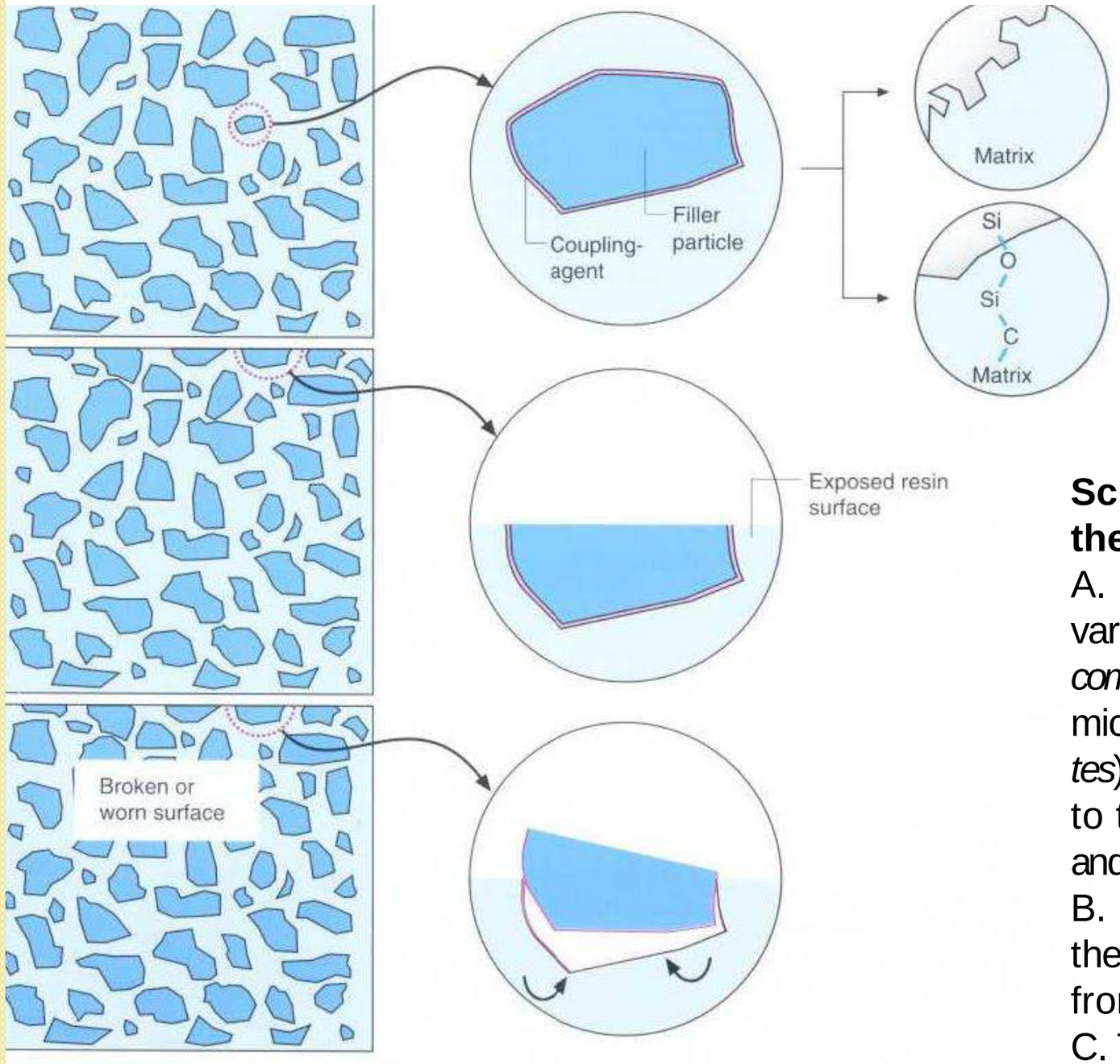


FIG . 4-54 **Micromechanical retention of bonding systems to dental enamel**.

A. SEM view of etched enamel showing relief between enamel rods and within their ends.

B. SEM view of enamel bonding agent, from which etched enamel has been removed, with cup-shaped macrotags and thousands of fine microtags on each one.

(**Courtesy *Stephen C. Bayne, School of Dentistry, University of North Carolina, Chapel Hill, NC.)***



Schematic overview of the resin system

A. The diameter of a filler particle varies from 20-40 nm (*microfilled composites)* up to a few microns (*macrofilled composi tes*). The filler particles adhere to the matrix through chemical and/or mechanical bonding.

B. During finishing and polishing the silane layer is removed from the exposed filler surface.

C. The filler particles can become dislodged from the surface of the composite during chewing

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Initiators and Accelerators

- Kebanyakan resin komposit polimerisasi dg *light-cured*
- Polimerisasi dimulai ketika bahan terekspose blue light, pj gelombang 470 nm----- cahaya terabsorbsi olh photoactivator (*champhorquinone*)
- Polimerisasi resin dapat dual cure, tri cure

DEGREE OF POLYMERISATION

- Length of time of exposure
- Distance from the curing light
- Shade of Composite
- Type of resin
- Filler composition

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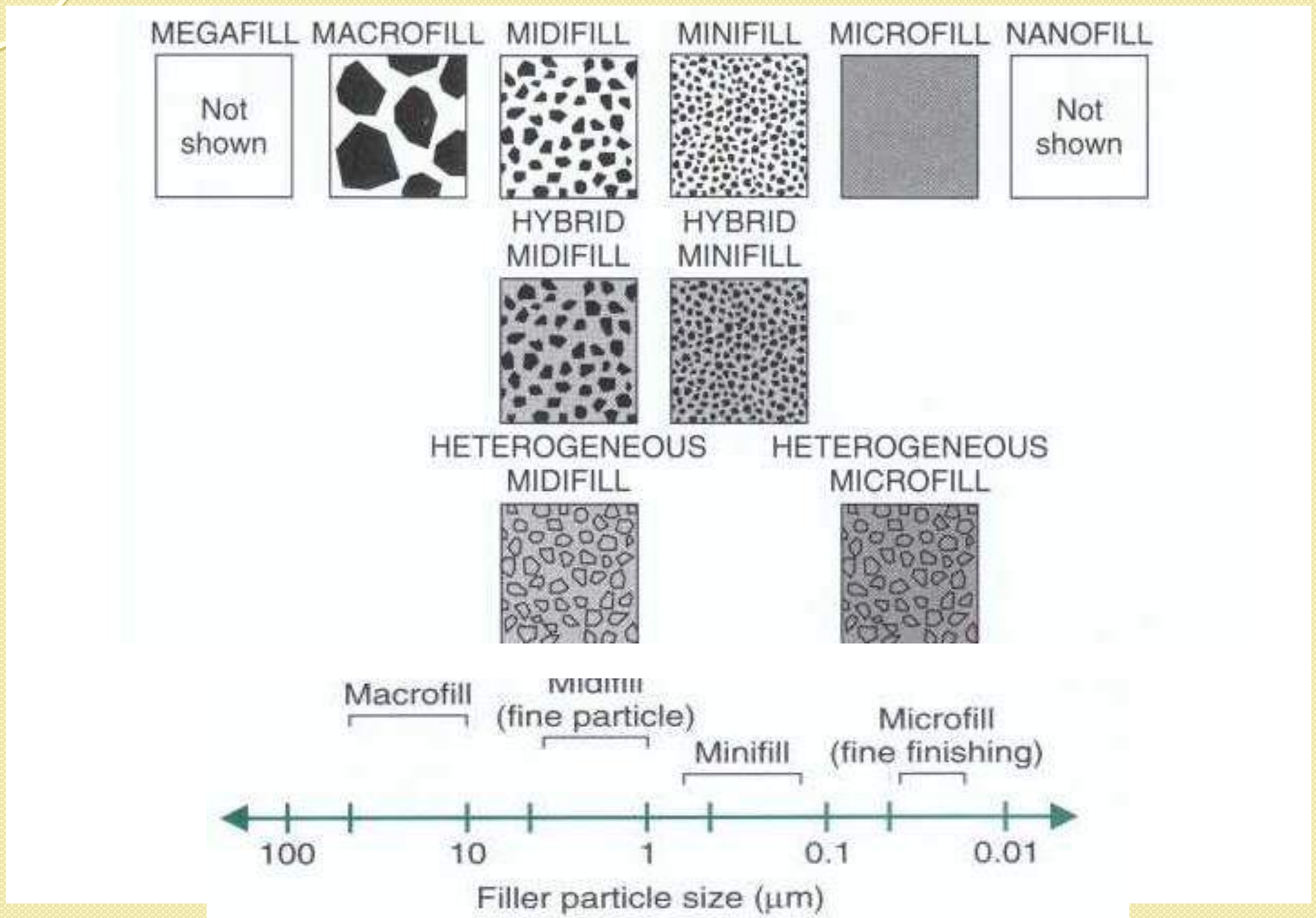
Tipe resin komposit

- Microfill composite
- Hybrid composite
- Nano composite
- Flowable composite
- Packable composite

CLASSIFICATION OF RESIN COMPOSITE

Classification	Range of Particle	Filler (% by Volume)
Hybrid	0.04 – 3.0	60 - 70
Microfill	0.04 – 0.2	32 - 50
Condensable (packable)	0.04, 0.2 - 20	59 - 80
Flowable	0.04, 0.2 – 3.0	42 - 62
Nanohybrid (nanocomposite)	0.002 - 0.075	68 – 78.5

Ukuran partikel pengisi



FILLER SIZE

The convention is as follows:

- macrofill (particle size > 10 µm)
- midifill (particle size < 10µm > 0.1 µm)
- microfill (particle size < 0.1µm > 0.01 µm)
- hybrid (combinations of macro, midi and/or microfill filler particles)
- nanofill (particle size < 0.01 > 0.0.001 µm).

FILLER PARTICLE SIZE

Differences in filler particle size and loading percentage will influence

- the strength
- shrinkage
- polishability
- optical properties of RBCs

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RESIN COMPOSITE

Advantages	*Disadvantages*
Tooth-coloured, have excellent aesthetics	Shrinkage on polymerization (0.6 – 6 %)
Good Colour Stability	The dentine-composite bond may degrade with time
Mercuri-free	The coefficient of thermal expansion 2-6 times higher than that of tooth subtance
Conversative of tooth substance as mechanical and resistance features are not required	Working time is less
Can be bonded to enamel and dentine	Absorption of Water by resin composite
Low thermal conductivity	Hihher rate of secondary caries compared with amalgam or glass-ionomer restoration
No galvanic potential	Increased incidence of post operative sensitivity

Glass ionomer Cement

- Semen ionomer kaca modifikasi resin/ RMGI
- Semen ionomer kaca konvensional/ Traditional

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Glass Ionomers (1976)

- ASPA (*AluminoSilicate glass and Polyacrylic Acid)*
- Slow setting
- Sulit d*alam manipulasi*
- Estetik kurang
- Indikasi :

a. kavitas dengan beban oklusi rendah
b. Restorasi pada gigi decidui
c. Restorasi sementara pada gigi permanen dws
d. Core built- up
e. Liner and base
f. Luting
g. Fissure sealant

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GLASS IONOMER CEMENTS

Conventional Glass Ionomer		Resin-Modified Glass Ionomer Compomer		Composite
High fluoride release	◄			Low fluoride release
Low strength			►	High strength
Poor esthetics			►	Excellent esthetics
Low wear resistance			►	High wear resistance

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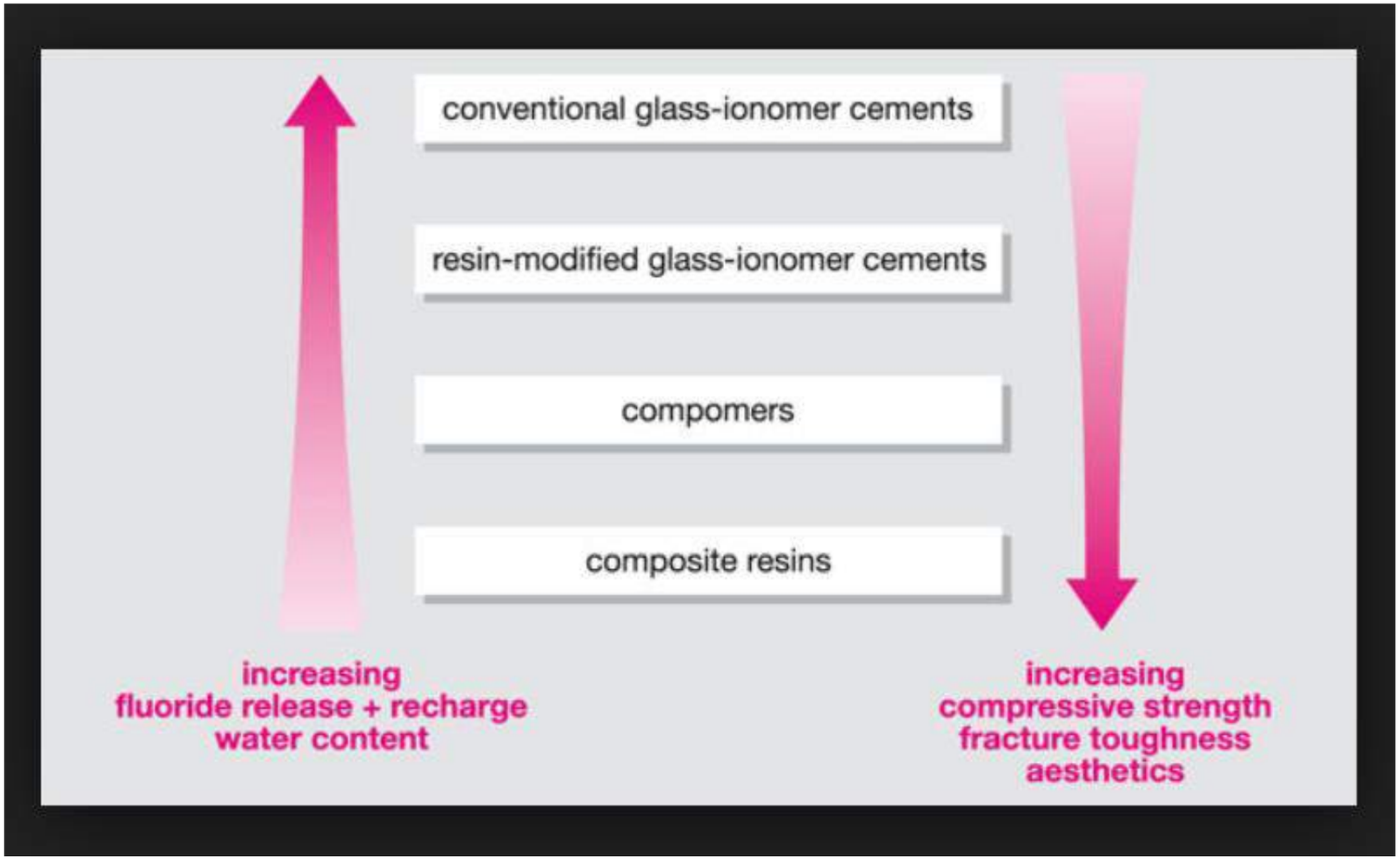
GLASS IONOMER CEMENTS



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Physical properties

	Conventional GIC	RMGI	Compomer	Resin composite
Compressive strength	100-240	180-240	220-340	220-340
Flexural strength	10-20	40-70	120-160	120-200
Fluoride release	++	++	+	-
translucency	buruk	baik	baik	baik
Radiopacity	+	+	+	+
Bond strength	3-6	4-10	Tidak ada	Tidak ada

COMPOSITION OF GLASS FILLER PARTICLES

Table 9.1 Approximate composition of a calcium fluoroaluminosilicate glass.

Component	Weight %
SiO_2 (quartz)	29.0
Al_2O_3 (alumina)	16.6
CaF_2 (fluorite)	34.2
Na_3AlF_6 (cryolite)	5.0
AlF_3	5.3
$AlPO_4$	9.9

Adapted from Prosser *et.al.*

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advantages

- Tooth coloured
- Bond chemically to tooth, without additional adhesive
- Release fluoride
- Coeff thermal expansion is equivalent to that of tooth structure
- Biocompatibility

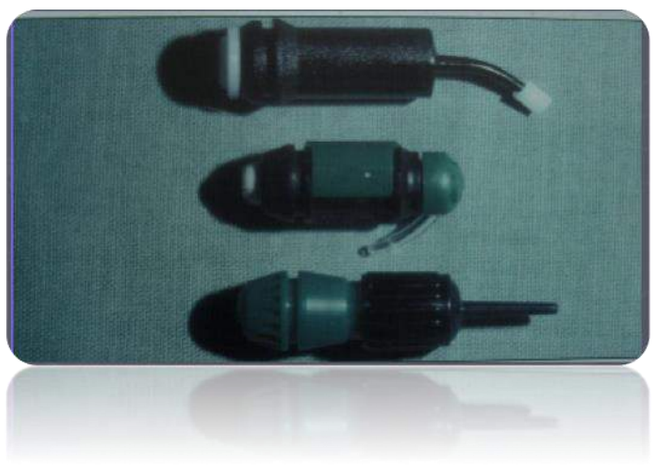
disadvantages

- Low fracture toughness
- Erosion
- Low flexural strength
- Low wear resistance

GLASS IONOMER CEMENT

SEDIAAN GIC

- Bentuk **Powder** dan **Liquid**
- Bentuk **kapsul** (pencampurannya menggunakan mixing machine)
- Bentuk **Pasta** (Terdapat 2 pasta yang kemudian dicampurkan secara hand mix. Memiliki ukuran partikel yang halus dan setting time 3 menit)



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Sediaan GIC (*mixer and capsule*)

TYPE OF GIC

1. **Type *I-Luting***

- Use : ***cementation of crowns, bridges, inlays, orthodontic*** Appliances
- Setting rate : fast set
- **Powder:liquid rasio 1,5:1**
- Radiopaque : generally
- Film thickness : 20µ or less
- Post-insertion sensitivity mineralising solution/dentine bonding agent
- Low Viscosity

Mount J.G and Hume W.R (2005)

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TYPE I LUTING

Keuntungan GIC sebagai Luting Cement :

- Ketebalan lapisan/film yang baik
- Biokompatibilitas baik
- Pelepasan fluoride
- Kemudahan manipulasi

Contoh : Fuji I (GC), Fuji I capsule, Ketac-cem applicap, Vitremer dll

Type I (luting) Reason for use

- Film thickness---**good flow properties**
- **Low solubility** in the oral environment
- Tensile strength and abrasion resistance equivalent to zinc phosphate
- Presence of continuing **fluoride release**
- High tissue tolerance of both pulp and gingival tissue

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TYPE II-RESTORATIVE

Type II.1 *Restorative Aesthetic (type II.1/A)*

- ❑ Use : ***aesthetic*** restoration
- ❑ Setting rate : autocure-slow resistance to water uptake & loss
  resin-modified-fast set, resistance to water uptake
- ❑ Powder:liquid **ratio-3:1 or greater**
- ❑ Radioopaque : most materials
- ❑ ***Contoh : Fuji II konvesional, Fuji II LC, Chemfill*** dll

Type II.1 Restorative Aesthetic

Reason for use

- *Adequate aesthetics* and translucency (autocure or RMGI)
- Physical properties are sufficient as long as the restoration is fully *supported by surrounding tooth structure* and no occlusal load
- Adhesion can be achieved with underlying tooth structure through the *ion exchange mechanism* thus completely eliminating mikroleakeage
- The materials acts as *a fluoride reservoir* (remineralization)
- Bioactive materials----continuing exchange of fluoride

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TYPE II-RESTORATIVE

Type II.2 Restorative Reinforced (type II.2/II.A)

- ✓ Use : **physical properties**-aesthetic not important
- ✓ Setting rate : fast set
- ✓ Powder:liquid ratio – 3:1 or greater
- ✓ Radioopaque : always
- ✓ Contoh :

Konvensional : Fuji IX, Fuji IX GP, Fuji IX GP capsule, Ketac Molar

Modifikasi metal : Miracle mix, cermet

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Type II.2 Restorative Reinforced

Reason for use

- Fast setting
- *Increased* physical properties
- *Colour match* of the restoration with the tooth are *not important*
- Core built-up

TYPE III-LINING

1. **Lining**

- Use : thin section as ***thermal barries*** under metal restoration
- Setting rate : autocure-rapid resistance to water uptake dualcure- autocure plus light assisted cure
- Powder:liquid ratio – **1,5:1**
- Radioopaque : always
- *Contoh* : Fuji lining LC, Fuji lining capsule, Ketac bond, Vitrebond, Base line

TYPE III BASE

Base - dentine substitute

- Use : combination with composite resin in *lamination technique*
- Setting rate : fast set
- Powder : liquid ratio – ***3:1 or greater***
- Radioopaque : always

Type III- Lining and Base

Reason for use

- **Low powder content** (ratio 1.5 : 1) should be used primarily **as a lining** under another restoration **to prevent thermal change irritating the pulp**
- **High powder content** (ratio 3.5 : 1 or greater) should be used **as a base or dentine substitute**

ADDITIONAL TYPE

- Fissure protection (Fuji III, Fuji III LC)
- Bonding Agent (Fuji Bond LC)
- Root canal sealing (Ketac endo)
- Orthodontic braket bonding (Fuji ortho, Fuji ortho LC dan Fuji Ortho Capsule)

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Types of glass Ionomer Cement

- Conventional glass ionomer cement
- Reinforced glass ionomer cements
- Resin modified glass ionomer cement

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Conventional Glass Ionomer cements

- Glass powder :
  - aluminosilicate glass with fluoride
- Acidic poly (alkenoic)
- Tartaric acid
- Water

- Glass ionomer cements with silver
- Ex : ketac mix, miracle mix
- Metallic appearance
- Low fracture toughness
- Compressive st

Conventional reinforced Glass Ionomer Cement

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Resin Modified Glass Ionomers

- HEMA ---- 5-7 %
- Acid-base reaction
- Polymerisation reaction with light cure

SETTING REACTION OF RMGI

- In the first stages of the setting chemistry, the acid/base reaction between the glass and the polyalkenoic acid
- the moment light activation is undertaken. the resin component will polymerize and the risk of water contamination will be eliminated

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RMGI

Advantages

- Compressive strength
- Flexural strength
- Fracture toughness
- Clinical handling
- Core bulit up (bulk)

Disadvantages

- Allergic reaction (HEMA)
- HEMA---hydrophilic and absorbs water
- Trimming and polishing with water coolant
- Cement discolour----poor oral hygiene

POLYACID-MODIFIED COMPOSITE RESIN: 'COMPOMERS'

- Group of materials that contain either or both of the essential ***components of a glass-ionomer cement*** but at levels insufficient to promote the acid/base setting reacton in the dark
- These materials **will not set without** light activation (*photoiniators*)
- There is a **small fluoride release** that can be detected some time after placement.
- Glass filler particles : *fluoroaluminosilicate, strontium fluorosilicate or barium fluorosilicate or barium fluorosilicate glass.*
- *Stabilizers*

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COMPOMERS/ PMRC

INDICATIONS	CONTRAINDICATIONS
All types of cavities in deciduous teeth	Direct and Indirect pulp capping is required
Cervical cavities in adults	A core bulid-up for an all ceramic crown
Anterior proximal restorations in adults	Dry field cannot be achieved
Small load-bearing restorations in adults	The patient has an allergy to dimetathacrylate resins
As a temporary or transitional restorative	The restoration will be contact with a eugenol-containing
As a core build-up material if at least 50% of coronal dentine is still available	

GIOMERS

- A recent addition to the range of materials has been classified as a ‘giomer’.
- This contains pre-polymerized glass-ionomer particles (PRG) , in a range of sizes, supported by a light-activated resin vehicle.
- As the matrix is resin, the ion exchange potential will not be available to the surrounding tooth structure and
- the material clearly falls into the same group as the resin-based composites (UDMA and HEMA)
- Giomers released significantly more fluoride than compomer and a composite resin

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GIOMERS

INDICATION

1. All type of cavities in deciduous teeth
2. All type of cavities in adult teeth
3. Core Built-ups
4. The repair of composite and porcelain restorations

PROTECTION OF PULP

TABLE 4-11 Summary of Pupal Protection Procedures (Medicament/Liner/Sealer)

	SHALLOW EXCAVATION (RDT >2mm)	MODERATE EXCAVATION (RDT 0.5-2mm)	DEEP EXCAVATION (RDT <0.5mm)
Amalgam	No/No/Sealer	No/Base/Sealer	CH/Base/Sealer
Composite	No/No/DBS	No/No/DBS	CH/No/DBS
Gold inlays and onlays	No/No/ Cement	No/Base/ Cement	CH/Base/ Cement
Ceramic, PR, FRP	No/No/DBS, CC	No/No/DBS, CC	CH/No/DBS, CC

Note: Pulpal protection includes pulpal medication, dentin sealing, thermal insulation, electrical insulation, and mechanical protection.
Sealer = Gluma or Hurriseal; base = Vitremer or Durelon cement; cement = Luting cement (e.g., resin-modified glass ionomer).
CC, Composite cement (e.g., Rely X Luting Cement); CH, Dycal liner; *DBS, Dentin bonding system; FRP, fiber-reinforced prosthesis; PR, processed*

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LINERS

TABLE 4-9 Composition, Structure, and Properties of Typical Liners*

	CALCIUM HYDROXIDE (VLC DYCAL)	TRADITIONAL GLASS LINOMER (FUJI LINING LC)	REINFORCED ZOE IONOMER (IRM)
COMPONENTS			
Components 1 and 2	Paste (with $Ca(OH)_2$; LC resin, and polyphenolics)	Powder (Al-silicate glass); liquid (polyalkenoate acid, LC resin)	Paste (with ZnO); paste (with Eugenol)
P/L or paste/paste ratio	(1 component)	1.4/1.0 by weight	6.0/1.0 by weight
Setting reaction	Acid-base reaction	Acid-base reaction	Acid-base reaction
STRUCTURE			
Arrangement	Amorphous matrix Crystalline fillers	Amorphous matrix Crystalline fillers	Crystalline matrix Crystalline fillers
Bonding	Covalent; ionic	Covalent; ionic	Covalent; ionic
Composition (phases)	Multiphase	Multiphase	Multiphase
Defects	Pores; cracks	Pores; cracks	Pores; cracks
PHYSICAL PROPERTIES			
LCTE (ppm/°C)	[Low]	[Low]	[Low]
Thermal conductivity	[Insulator]	[Insulator]	[Insulator]
Electrical conductivity	[Insulator]	[Insulator]	[Insulator]
Radiopacity (mm Al)	—	4	—
CHEMICAL PROPERTIES			
Solubility (% in water)	0.3-0.5 [high])	0.08 [low]	[Modest]
Shrinkage on setting (μm/mm)	—	24 [low]	—
MECHANICAL PROPERTIES			
Elastic modulus (MPa)	588	1820	—
Hardness (KHN_{100})	—	—	—
Elongation (%)	—	—	—
Compressive strength, > 24 hr (MPa)	138	128	71
Diametral tensile strength (MPa)	—	24	—
Flexural strength (MPa)	—	46	—
Shear bond strength to dentin (MPa)	—	5.8	—
BIOLOGIC PROPERTIES			
Biocompatibility	[Acceptable]	[Acceptable]	[Acceptable]

TABLE 4-10 Composition, Structure, and Properties of Typical Bases*

	ZINC PHOSPHATE CEMENT (MODERN TENACIN)	POLYCARBOXYLATE CEMENT (DURELON)	GLASS IONOMER CEMENT (KETAC-CEM)
COMPONENTS			
Component 1	ZnO powder	ZnO powder H_2O	F-Al-Si glass powder
Component 2	H_3PO_4/H_2O	Polyacrylic acid/H_2O	Polyacrylic acid/H_2O
P/L ratio	[High]	[High]	[High]
Setting reaction	Acid-base reaction	Acid-base reaction	Acid-base reaction
STRUCTURE			
Arrangement	Crystalline matrix Crystalline fillers	Amorphous matrix Crystalline fillers	Amorphous matrix Crystalline fillers
Bonding	Ionic	Covalent; ionic	Covalent; ionic
Composition (phases)	Multiphase	Multiphase	Multiphase
Defects	Pores and cracks	Pores and cracks	Pores and cracks
PHYSICAL PROPERTIES			
Thermal	[Insulator]	[Insulator]	[Insulator]
Electrical	[Insulator]	[Insulator]	[Insulator]
LCTE (ppm/°C)	[Low]	[Low]	10 [Low]
CHEMICAL PROPERTIES			
Solubility (% in water)	0.10 [Low]	[Low]	0.10 [Low]
MECHANICAL PROPERTIES			
Modulus (MPa)	—	—	—
Hardness (KHN_{100})	—	—	—
Percent elongation (%)	—	—	—
Compressive strength (MPa)	77	[100]	120
Diametral tensile strength (MPa)	—	[17]	—
BIOLOGIC PROPERTIES			
Safety	[Acceptable]	[Acceptable]	[Acceptable]

*Relative or estimated properties are shown in brackets.
LCTE, Linear coefficient of thermal expansion.

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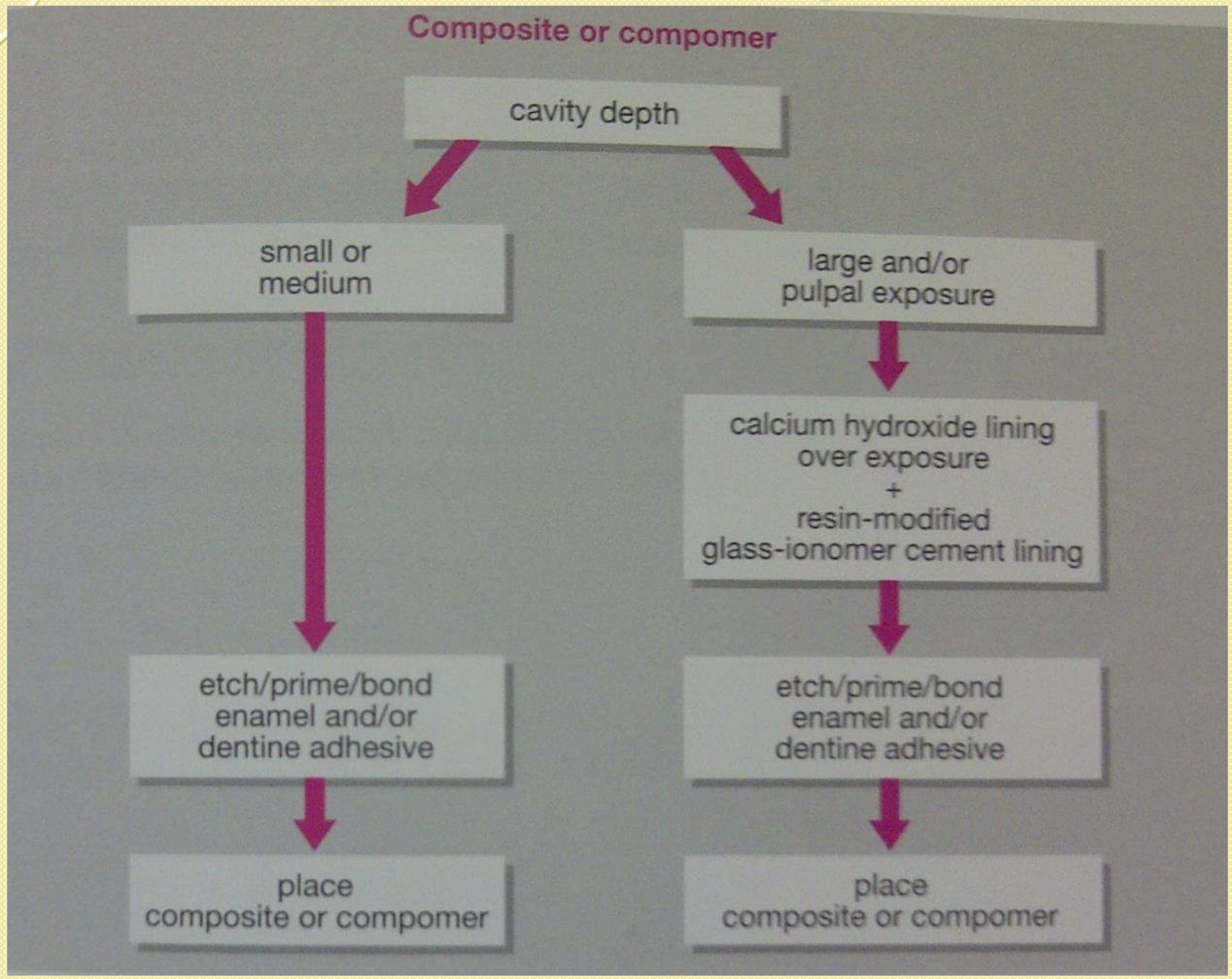
Diagram cavity depth



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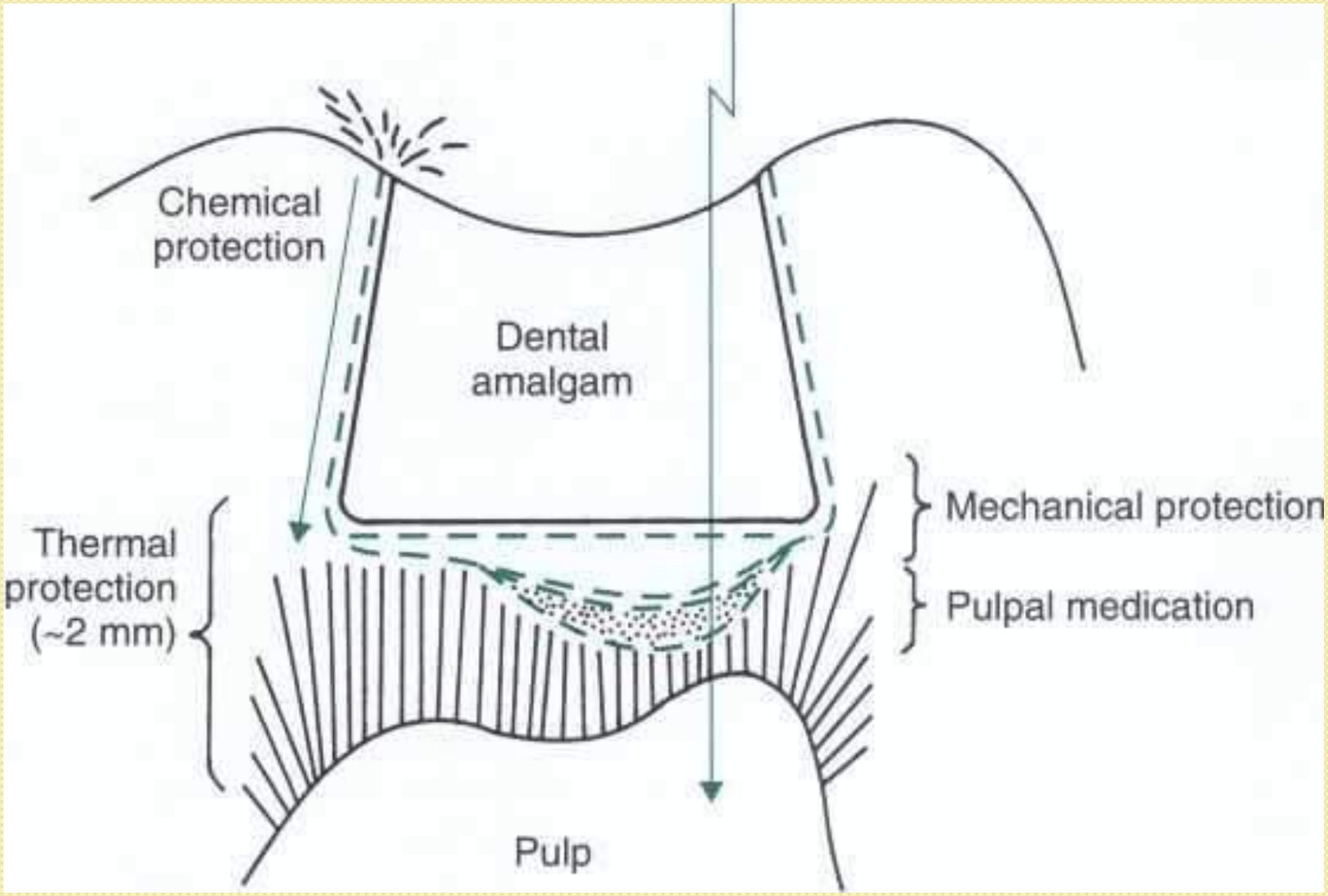
LINERS AND BASES



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LINERS AND BASES

- Bacteriostatic agents
- Biologically active and stimulating odontoblasts lining the pulp chamber---tertiary dentin
- Protecting the pulp
- Reducing leakage between the restoration and dentine
- Limiting fluid movement through dentine
- Blocking out undercut (indirect restoration)

Is lining necessary?

- Sealer : Varnish, resin based dentine
- Liner : a resin or cement coating (hard setting calcium hydroxide or RMGI low viscosity)---- 0,5 mm thick
- Base : > 0,5 mm thick (indirect restoration

Material---- protects the pulp and maintains its vitality is dentine

Calcium Hydroxide

Berdasarkan sediaannya:

- Hard-setting /fast-setting calcium hydroxide
- Low setting calcium hydroxide
- Suspension

LOW SETTING

- Serbuk/bubuk Ca(OH)2+ (bahan pengikut misalnya Barium sulfat+excipient)+ Pelarut
- Sifat :

  - Daya larut tinggi

  - Daya serap air tinggi

  - Low strength

  - Efek antimikroba lebih panjang daripada hard setting
- Contoh produk : metapaste

SUSPENSI

- Serbuk/bubuk Ca(OH)2 murni + Pelarut
- Sifat :

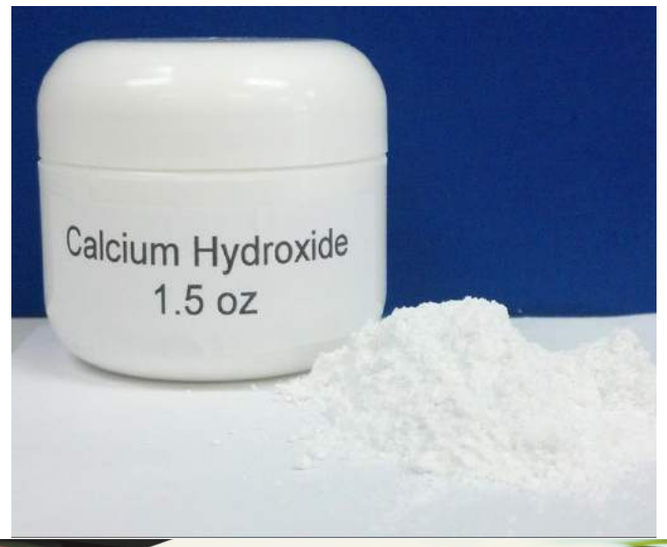
  - Daya larut tinggi

  - Daya serap air tinggi

  - Efek antimikroba lebih panjang daripada low setting

  -Low strength

- Contoh produk : *Calcipulp* (Septodont)



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Cavity depth

Small/medium

- Etch/prime/bond enamel and/or dentin adhesive
- Place composite or compomer

Large/exposure

- Calcium hydroxide dan lining
  Dan RMGI
- Etch/prime/bond enamel and/or dentin adhesive
- Place composite or compomer

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Calcium Hydroxide

advantages	***disandvantages***
1. Biologically active (stimulating new dentine formation) 2. Bacteriostatics against bacteria present in carious dentine 3. Able to protect the pulp	1. Poor physical properties 2. Soluble 3. Poor thermal insulation 4. They do not bond to dentine 5. They need to be protected by an overlying base/liner bonds to dentine—provide protection 6. They cannot be used to block out undercuts

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HARD SETTING/FAST SETTING

- Pasta yang terdiri dari base dan catalist
- Sifat :
  - Daya larut rendah
  - Daya serap air rendah
  - High strength
  - Efek antimikroba lebih pendek (not longterm antimicroba)
- Contoh produk : dycal, pulpadent, hydrex, life

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REFERENCES

- Mount G.J and Hume W.R (**2005**) ***Preservation and Restoration of Tooth Stucture***, 2nd edition

- Brenna, F (**2009**), ***Restorative Dentistry*** : *Treatment Procedures and Future Prospects*, Elsevier, Mosby, pp 490-510

- Heymann H.O.,Swift E.J and Ritter A.V (**2016**), ***Sturdevant's Art and Science of Operative Dentistry***, seventh edition, Elsevier