DENTAL AMALGAM ALTERNATIVE RESTORATIVE DENTAL MATERIALS I- DENTAL RESIN COMPOSITES

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In use for restorations in the past 60 years.

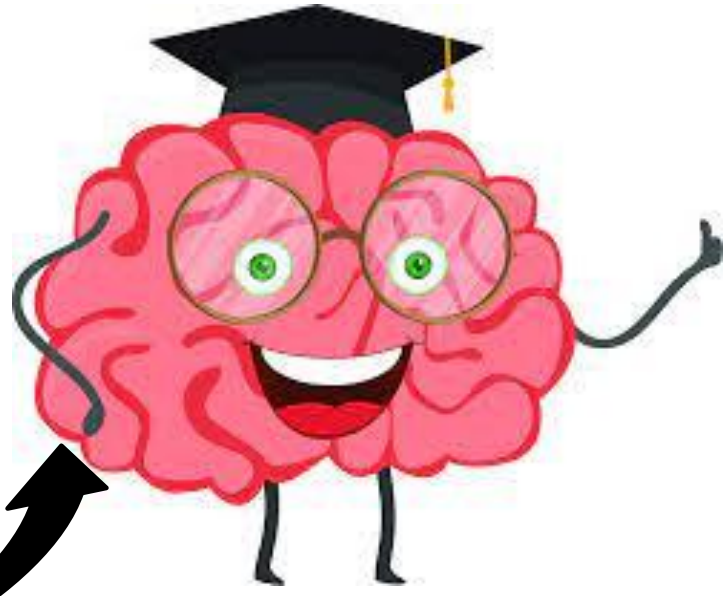
Module II
Lecture I

DENTAL RESIN COMPOSITES (DRCS)

INTRODUCTION

Corporeal literacy

Developed



1. Refresh
2. Additional knowledge and skills

ABBREVIATIONS

- Dental amalgam phase down - DAPD
- Dental amalgam alternative restoratives - DAARs
- Dental resin composites - DRCs
- Glass ionomer cements - GICs

LEARNING OBJECTIVES

- Introduce the range of the available DAAR dental materials
- Discuss clinical performance limitations of DAARs
- Demonstrate novel manipulative techniques for selected DAARs
- Discuss considerations in selection of suitable DAARs for various clinical applications.

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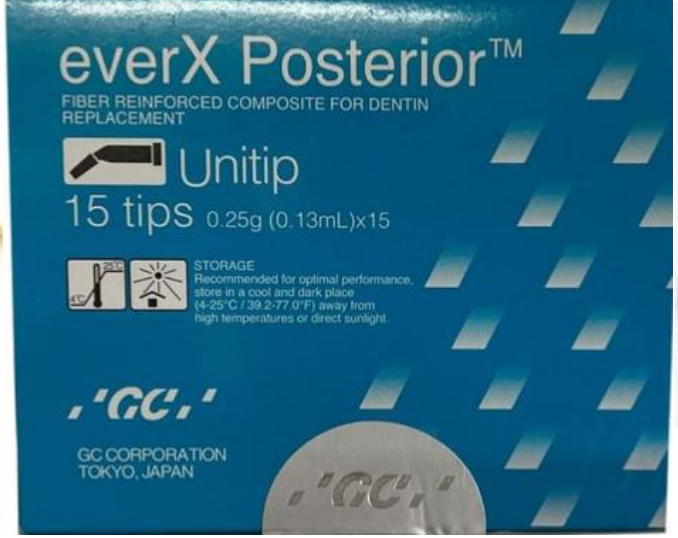


If well executed 2nd to none (Small, 2000)

INTRO' TO DAARs

INTRODUCTION - DAAR DENTAL MATERIALS

For application in molars and premolars in the 2^{o} dentition.

Resin composites

Bulk fill

Gold alloys

Dental ceramics

Glass Hybrid

Alkasites

INTRODUCTION - DAARS

DAARs for use in in the 1^{0} dentition, anterior restorations minimally invasive and preventive restorations

The GIC's

↓

LECTURE II:
Module II

Resin composites
Compomers
Giomers, Alkasites,

Conventional glass ionomer cements
Advanced GIC's
Resin modified GIC's
Glass Hybrid
Nano ionomers , Glass Carbomers and Zirconomers

Biodentine
Fissure sealants
Unfilled resins

Stainless steel crowns

CONTRAINDICATIONS OF DIRECT DAARs

DA applied for over 180 years

Poor compliance to treatment/OH

Patients with high caries risk

Large restorations

e.g ??

Cavities extending sub-gingivally

Moisture ☹

Access ☹

Capacity deficiencies

✓ ✓

INDIRECT DRCS

Gold alloys

Ceramics

Lynch C D, 2008,Opdam NJ et al 2014, Demarco FF et al 2017

- Currently the most commonly used DAAR is DRC

(Frankenberger R et al 2021, Varughese RE et al 2016. Ilie N and Hickel R 2011.

- Annual failure 2.4% after 10 years of service. Opdam N.J et al 2014

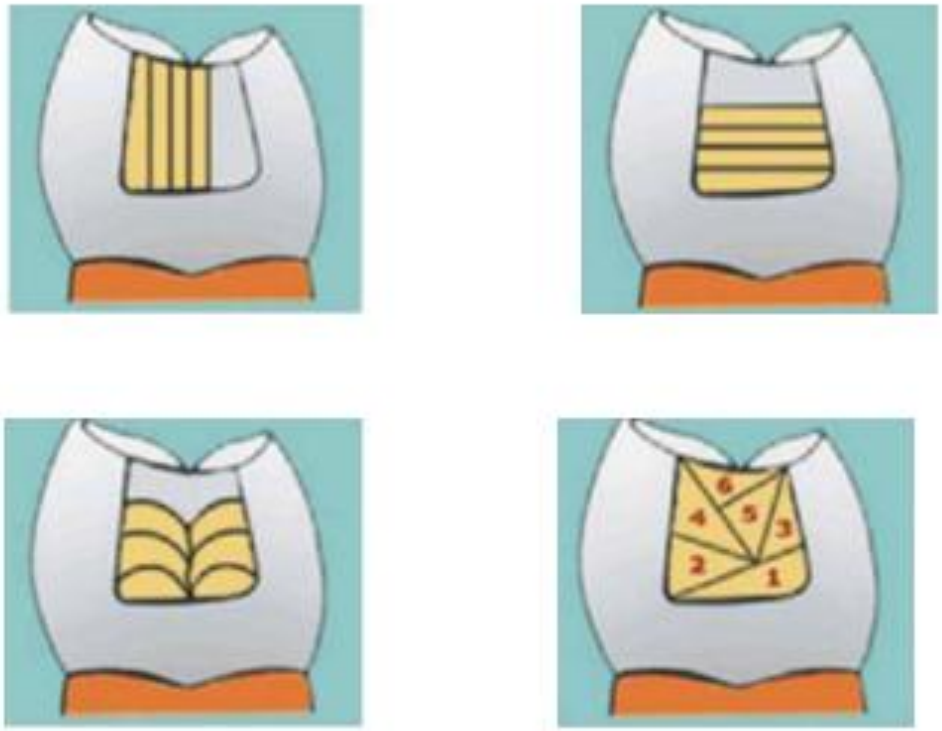
However, to date there are no direct DAARs able to substitute DA in all clinical situations.

SELECTION AND PERFORMANCE OF DRC'S

- Select universal DRC's with filler ≥ 60 vol% / 74% by weight
- User friendly manipulation mode types ↑ DOC
- Apply in small to moderately sized cavities – Correct indication proper manipulation
- Large restorations occlusal portion > 2/3 of the inter-cus-pal indirect restorative materials. Oyagüe et al 2012

UNIVERSAL RESIN COMPOSITES – DRAWBACK

Incremental layering technique



Narene AV et al 2014

Assorted DRC's used at UoN Dental School

To reduce polymerisation shrinkage stress

Post-op sensitivity

MANIPULATION

The time-consuming incremental layering techniques

Addressed by bulk fill resin composites

Bulk fill refers to single step lege artis

ADDITIONAL TIPS IN HANDLING DRCs

- Pick resin composite with least instrument surface area contact
- Very deep cavities spot calcium hydroxide/ cover with GIC Colak H et al 2017
- Unnecessary Liner/base >>increased failure ? Due to fatigue related to weaker cement. Pallesen et al 2013

LIGHT INCIDENCE AT 90^0
MAXIMUM 3MM
600MW/CM2

Cure buccally and lingually

Overlapping irradiance to cure large restorations

Malhotra N et al 2010

WHAT IS NEW IN DENTAL RESIN COMPOSITES?

1. Ormocers
2. Packable resin composite
3. Low shrinking resin composites
4. Compomers
5. Giomers

1. Flowable resin composites
2. Bulk fill resin composites
3. Fibre reinforced resin composite
4. Smart resin composites; Alkasites and ACP resin composites

BULK FILL FLOWABLE RESIN COMPOSITES

- A new development in FRCs, ⇨ lower PS and higher depth of cure.
- However, their flexural strength and elastic modulus is inferior
- Their use is therefore relegated to liner/base applications, non- stress NOT CLASS II's AND I's IN THE 2^0 DENTITION. Nitta et al 2017

Tetric N Flow Flowable Restorative

3 M Filtek Supreme Flowable Restorative

AVAILABLE IN KENYA

BULK FILL RESIN COMPOSITES (BFRCS) - 2010

Larger increments 4 -6 mm attained in most BFRC's, Flowable

The first BFRC was *Surefil SDR®flow* (Dentsply Caulk).

BFRC's - widespread usage in posterior restorations

Nascimentos As et al 2019. Ilie N and Hickel R 2010, Czasch P Ilie N 2013

CLASSIFICATION OF BULK FILL RESIN COMPOSITES

Filler load and consistency

- **High-viscosity (sculptable/full-body)**
- **Low-viscosity (flowable/base),**
- **Sonic activated BFRC (sonic activator that generates sonic vibration,**

Polymerisation mode

- Light cured
- Dual Cured

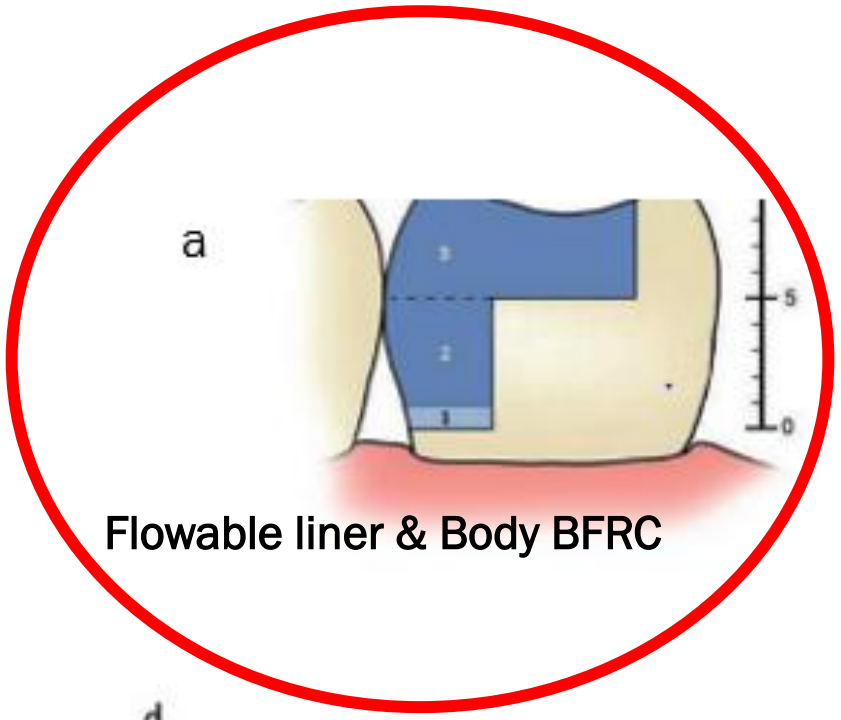
Adjustable DRC flow via a dial

Kelic K et al 2016, Kerr SonicFill 2 2016.

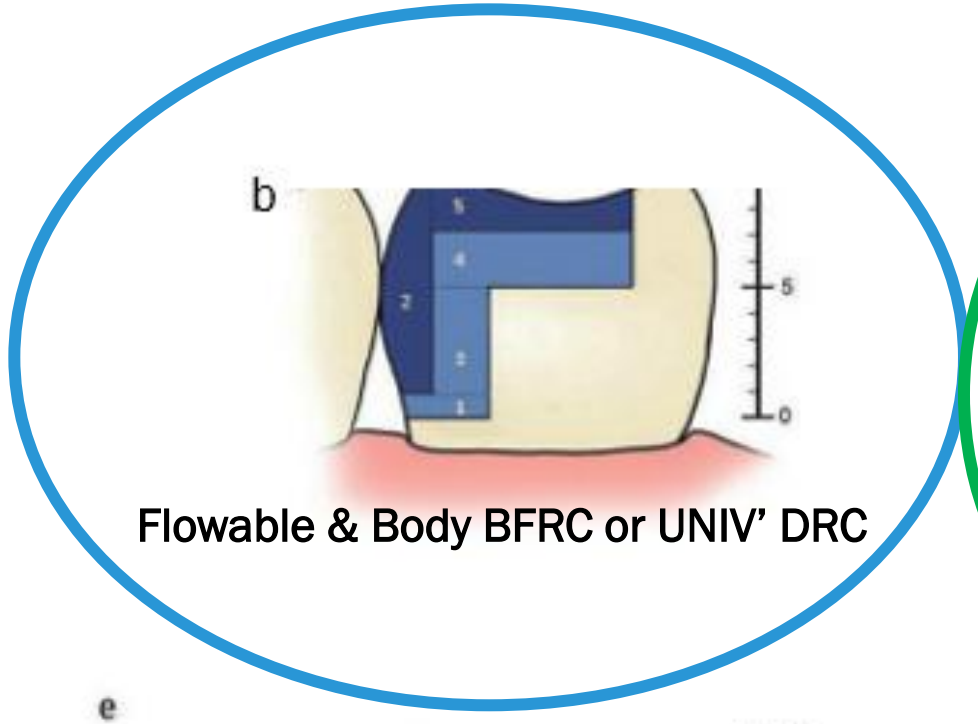
CLASSIFICATION, BRANDS AND MATERIALS HANDLING

	Bulk fill resin composites	
a.	Full-body + optional flowable liner 1-step	3M ESPE - Filtek Bulk-Fill Posterior Restorative; Ivoclar Vivadent- Tetric EvoCeram Bulk-Fill; Voco - xtra fil
b.	Base + capping with conv' DRC	Dentsply - SDR; 3M ESPE - Filtek Bulk-Fill Flowable; Heraeus Kulzer - Venus Bulk-Fill; Ivoclar Vivadent - Tetric EvoFlow BulkFill; Voco - xtra base.
c.	Sonic activated	Kerr - SonicFill
d.	Dual cured BF	Coltene - Fill Up; Parkell – HyperFil.(some have inferior aesthetics and need conventional DRC capping
e.	Conventional DRC	DITTO

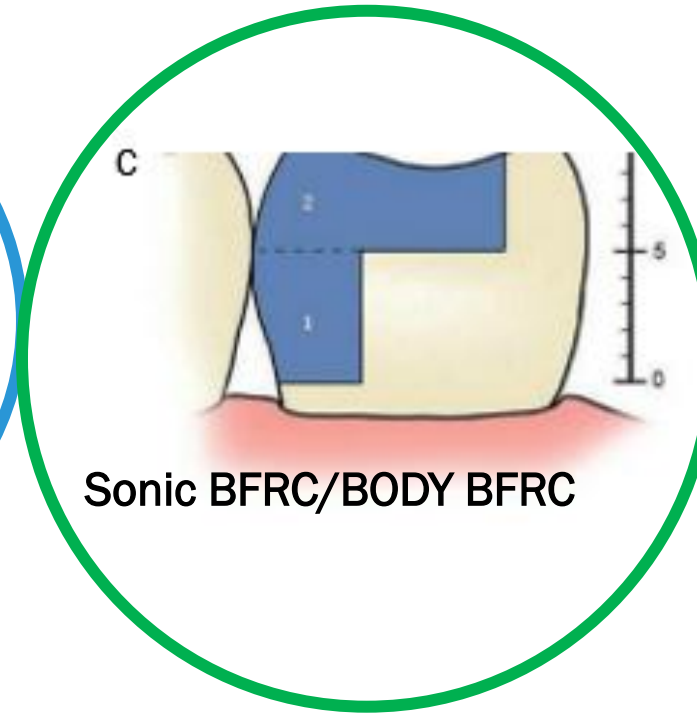
MANIPULATION OF BULK FILL AND CONVENTIONAL DRC'S



Flowable liner & Body BFRC



Flowable & Body BFRC or UNIV' DRC



Sonic BFRC/BODY BFRC

Dual BFRC

UNIversal DRC

NÚÑEZ C.C et al 2015

TIPS RELEVANT TO DRCs

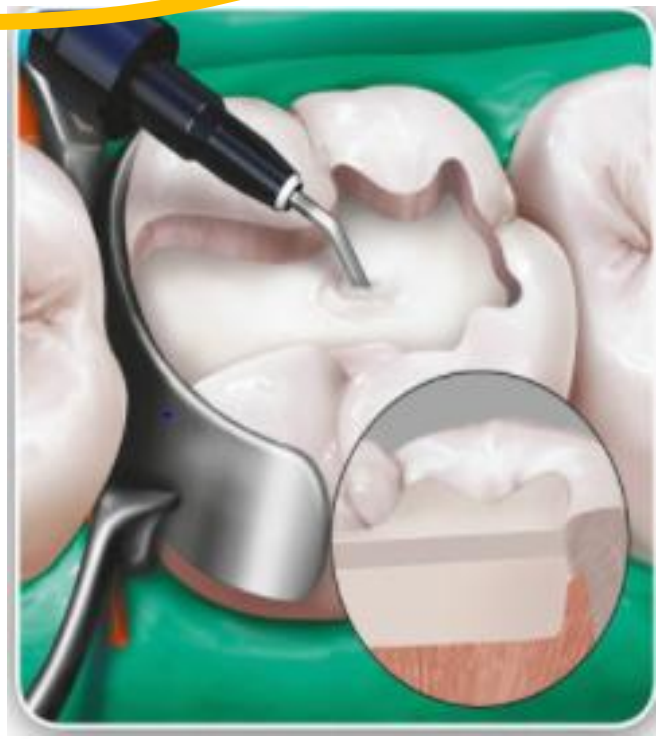
- Use of rubber dam is indicated for all DRCs
- Restorations under cotton rolls and aspiration did not significantly differ from those placed using rubber dam isolation in a ten year study.
- For BFRCs some manufacturers only increase filler load and reduce pigments, selection is key!!!.

Raskin et al 2000, Cajazeira M R et al 2014, Olegário IC et at 2022

HANDLING - <038MM MATRIX BANDS

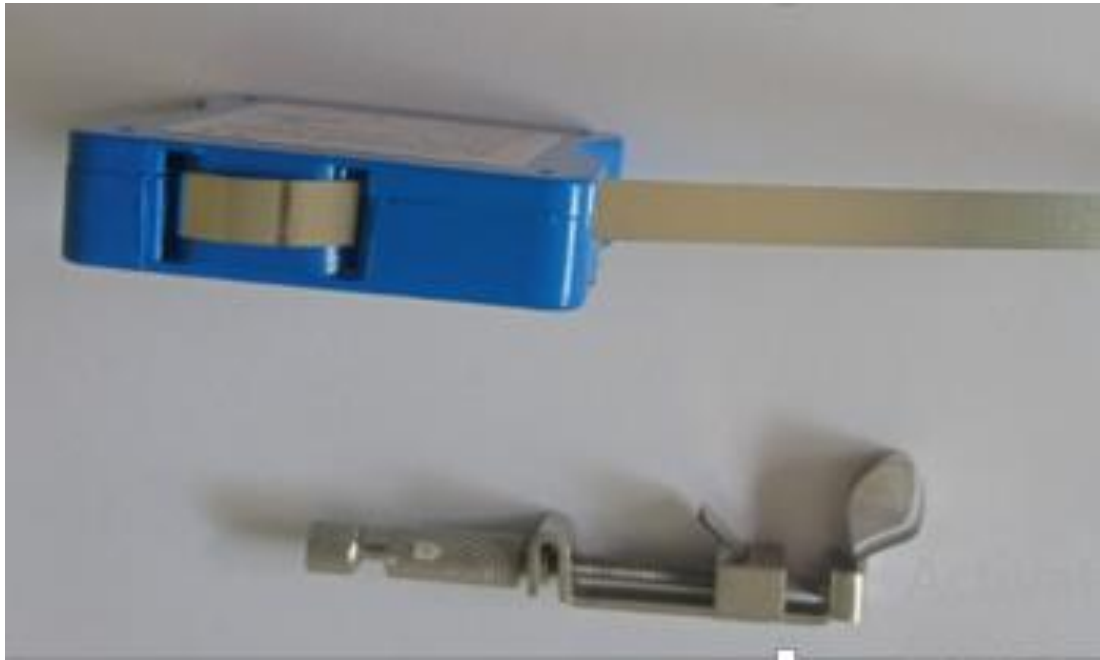
Sectional Matrix bands

Matrix band

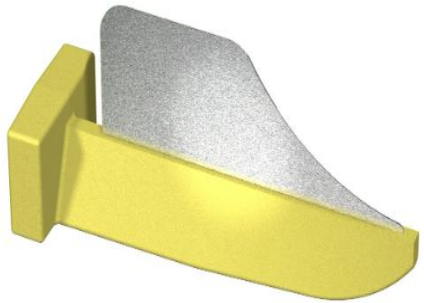


DEAD SOFT MATRIX BANDS – GO BULK MATRICES

0.025mm thick



MANIPULATION: PRE-WEDGING



Fender wedge

PROPERTIES OF BULK FILL RESIN COMPOSITES VS UNIVERSAL DRCS

Clinical performance of conventional resins and bulk fill resins for carious lesion restorations is similar except in microhardness for some products .

Heber Isac Arbilo-Vega et 2020, Haugen HJ et al 2020, Rizzante FAP et al 2019)

BULK FILL PROPERTIES ARE MATERIAL SPECIFIC, AND DIFFER ACROSS PRODUCTS

BF	Filler %wt	Filler % vol	Depth of cure (mm)	Microhardness Knoop Hardness Number (80% of initial MH)
Filtek 350 (conventional)	82		2.63	89.37
Sonicfill 2 (Kerr)	83.5		6.6	101.58**(at 4mm)
Tetric Ceram Bulk Fill	79-81	60	4.88	50.89
Surefill SDR (Dentsply)	68	45	-	34.38 (4mm) VHN
Fill-up (Dual) Ivoclar)	65	49	-	34.5** (4mm) VHN
Filtek Bulk Fill Posterior (3M ESPE)	76.5	53.4	5.0	49.6
Extra fil (Voco)	86		5.38	74.34
Filtek Bulk fill Flowable	64.5	42.5	5.63	16.21
SDR	68	45	6.94	22.05

Rizzante FAP et al 2019 , Penha KS et al 2020, Aggarwal N et al 2019

SOME BRANDS AVAILABLE IN KENYA

OTHER BFRC PRODUCTS

SMART RESIN COMPOSITE – BULK FILL ALKASITES

BRANDS

IN KENYA

Few products available

Aiston PHc

Cention N 30g powder 8ml liquid

SMART RESIN COMPOSITES

Bulk fill Alkasites – Cention N

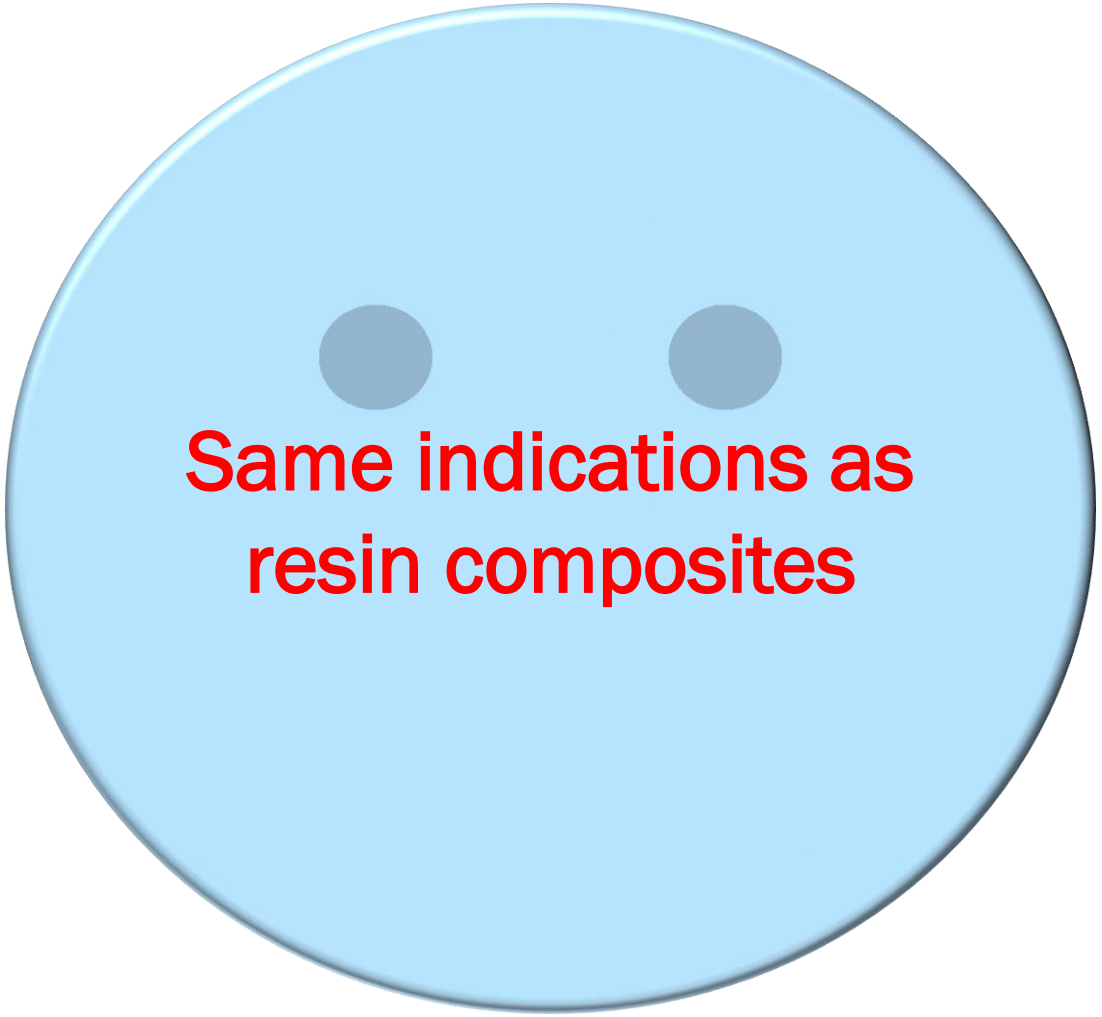
- Alkaline glass filler
- Releases Ca^{2+}, F^- and OH^- when intraoral pH values drop below the critical pH of 5.5 - 5.7, acid neutralising. Favouring remineralization.

Dual cure

Bond application is optional

Xu HH et al 2007

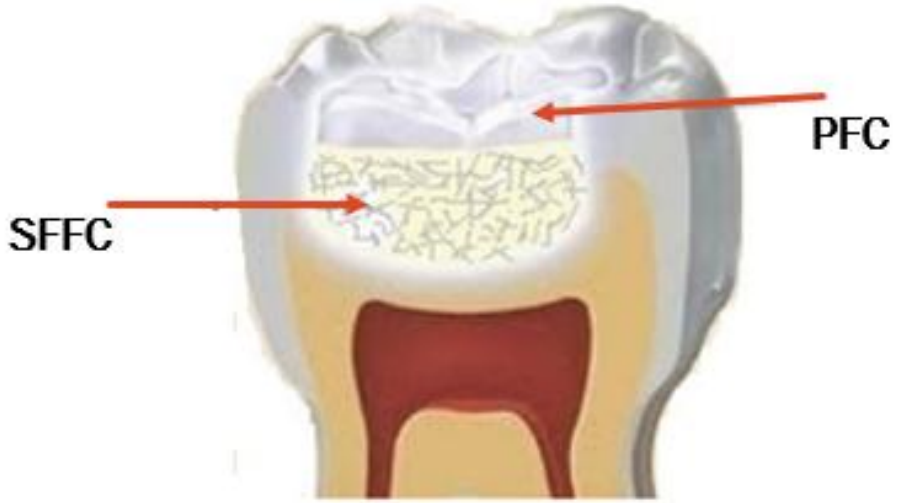
APPLICATION OF BFRCs



Gupta Nupur 2019.

SHORT FIBRE RESIN COMPOSITES (SFRC)

- Resin matrix
- Randomly-orientated E-glass fibers, and
- Inorganic particulate fillers



minimally invasive and biomimetic

Garoushi S. et al 2018

Technically biomimetic; 1-2mm thickness of conventional RC over a bulk base of SFRC

Large cavities

Survival rate of 97.2% and success rate 88.9% reported by Tanner J et al 2018

Garaoushi G et al 2012, Tanner J et al 2018

SHORT FIBRE RESIN COMPOSITE PRODUCTS

Xenious, StickTeck Ltd, Turku, Finland

Nulite System International, Hornsby, Australia

Nanova, Ann Arbor, Michigan 48103

RESIN COMPOSITES FOR CAD CAM

Over ceramics

1. Easier to machine
2. Repairable intraorally
3. Cost friendly

Ruse ND and Sadoun MJ 2014 , Johnson AC et al 2014

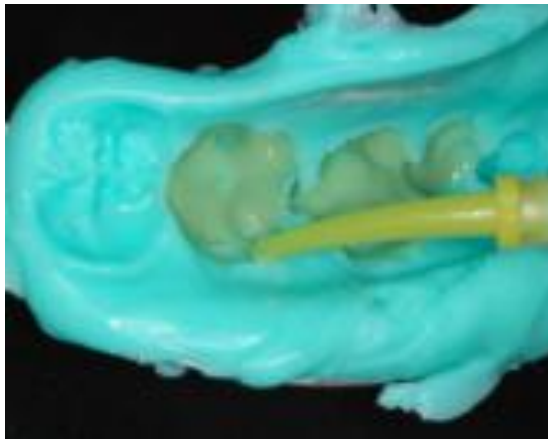
INDIRECT RESIN COMPOSITES (IRC'S)- HIGHLY FILLED

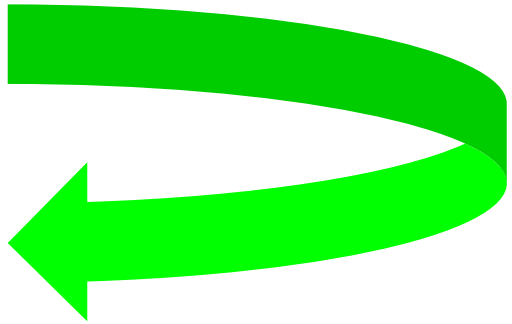
SINFONY (3M ESPE)

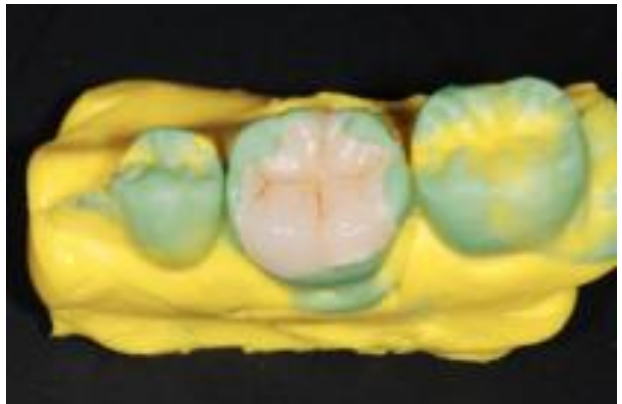
Scientifically based dental amalgam alternative in socioeconomic considerations

Gresnigt MMM et al 2019, Azeem R A 2018

SEMI-DIRECT MANIPULATION OF INDIRECT RESIN COMPOSITE







Alharbi et al 2013

Module II
Lecture II

NEW GLASS IONOMER CEMENTS

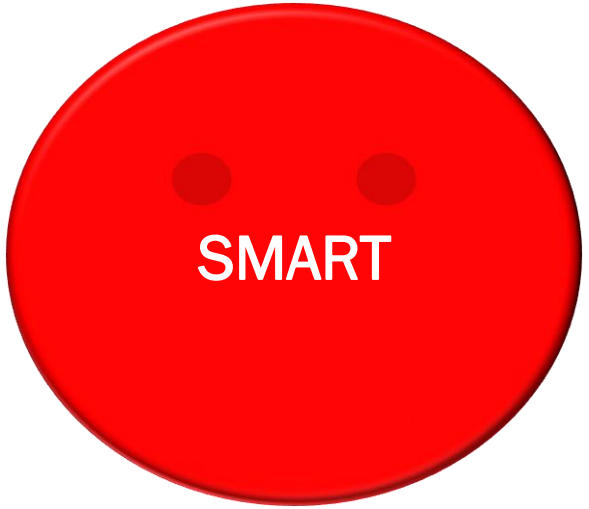
DITTO

LEARNING OBJECTIVES

- Outline the new Glass ionomer cements
- Illustrate the modes of presentation
- Demonstrate the manipulation of GIC's
- Discuss the salient properties of the GIC types
- Outline indications and performance of GIC's

MODIFICATIONS OF GLASS IONOMER CEMENTS (GICS)

- Conventional GIC's
- Advanced GIC's &
- Glass Hybrid
- Resin modified GIC's &
- Nano ionomers
- Glass Carbomers
- Zirconomers



MODE OF PRESENTATION - 5 MODES

Capsulated

Paste-paste

High strength GIC's

ART restoration and fissure sealant

GLASS HYBRID - RESIN-COATED GIC ANOTHER DAAR DA AND DRC

Glass Hybrid essentially an high viscosity GIC with a resin-based coating agent

With Nano-sized fillers

The GIC material sets by acid base reaction, resin coat is light cured

SOME COMMERCIALLY AVAILABLE RESIN COATS

Resin coat laminates and toughens the material

CLINICAL PERFORMANCE

GH >> Short-term clinical trials
BUT a promising DA alternative restorative

- Successful similar performance with DRC in restoration of large class II in a 24 month study. Miletić I et al 2020, Rożniatowski P et al 2021
- Good clinical performance in 6 years Gurgan S et al 2016

NANO IONOMERS

Modification of conventional and RMGC's with fillers to 1-100nm .

+

Addition of nano-sized bioceramic glass under research, nHA, nFHA

- Supplied with a primer for dentine pre-treatment
- Can even etch with 37% Phosphoric acid!
- Strength lower than conventional GIC's.

Priyadarshini et al 2017, Najeeb S et al 2016, Padmaja S et al 2020

ZINC REINFORCED GLASS IONOMER CEMENT

Higher strength than conventional GICs , ↑ Longevity

Lower microhardness, surface roughness

Patil K et al 2020, Zoergiebel J, Ilie N 2013

ZIRCONIA REINFORCED GLASS IONOMER CEMENT - WHITE AMALGAM

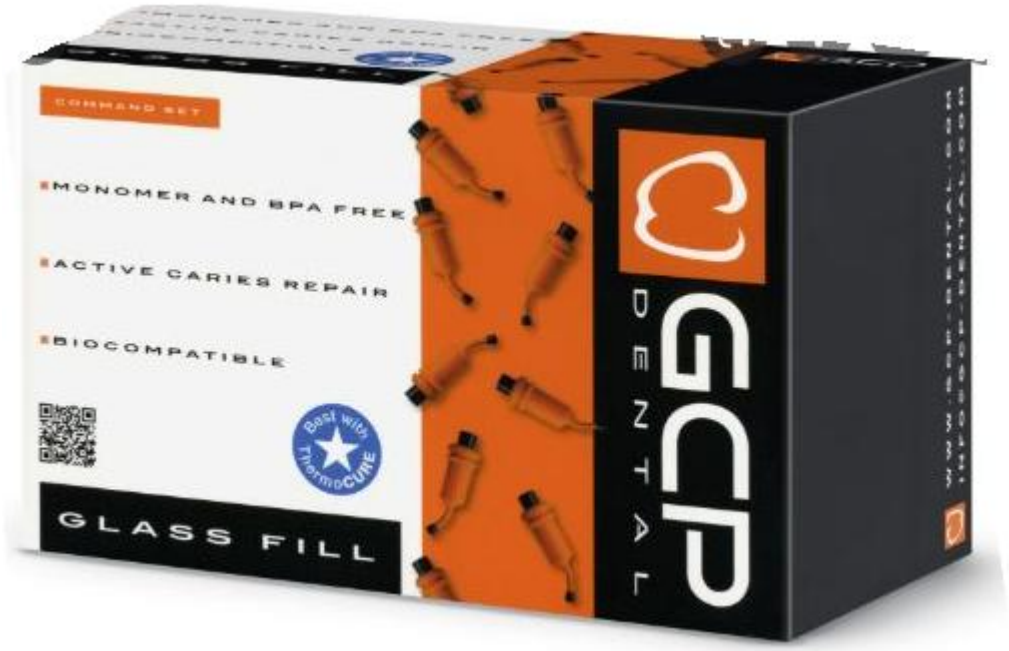
Higher strength than GICs comparable to DA, ↑ Fluoride

Ref. Chalissery VP et al 2016, Tiwari S et al 2016

GLASS CARBOMER CEMENT

- Nano hydroxyapatite

hydroxyapatite crystals fillers

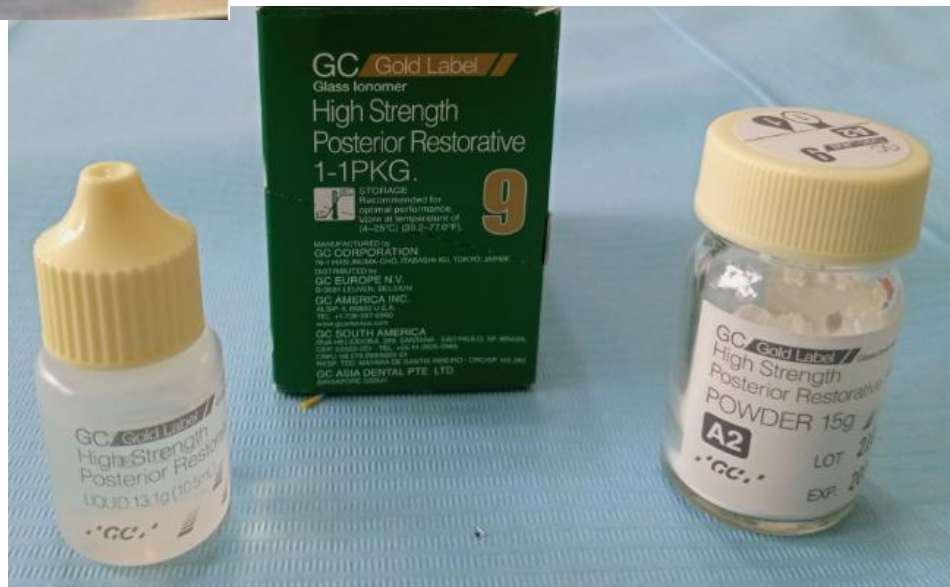


Glass carbomer cement
GCP Dental, Vianen, Netherlands

Flexural strength≤ Fuji IX (GIC)

Sidhu et al 2016, Buldur M et al 2019

PRODUCTS IN KENYA AS @ 2022 ARE MANY



SELECTION OF DAAR DENTAL MATERIALS

- Cavities in deciduous dentition – spoiled for choice all DAARs except indirect composites and gold alloys.
- Permanent dentintion Upto moderately sized cavities; DRCs, BFRCs, Alkasites, Glass hybrid.
- >2/3 intercuspal width. Indirect resin composites, SFRCs, CAD/CAM DRCs, Ceramic Inlays and Gold alloys
- Prevention, remineralisation and caries arrest
- **GO PREVENTIVE ARREST CARIES PERSONALISE CARE**

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MODULE III

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VIDEO DEMONSTRATION

THANK YOU VERY MUCH COLLEAGUES FOR YOUR PARTICIPATION