

INDIRECT RESTORATIONS

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Learning Outcomes

- To improve understanding of the indications for indirect restorations
- Provide an enhanced knowledge of preparation techniques for Composite onlays and overlays
- To improve knowledge of adhesive luting cements
- To improve understanding of intraoral scanners

Overview

Fundamentals of restorations

Indications for onlays / coronal coverage

Onlay materials

Preparation

Preps (CTL)

Cements

Digital Dentistry

Indirect Restorations

↓ Indications for traditional indirect restorations.

Multiple reasons

Removal of natural tooth

How long do they last?



Indirect Restorations - complications

- Secondary Caries
- Devitalisation
- Aesthetics
- Gingival Recession
- Periodontal issues
- Toothwear





Indirect Restorations - considerations

- Oral health
- General Health
- Patient motivation and wishes
- Oral Hygiene
- Condition of dentition
- Periodontal health
- Endodontic health
- Cost
- Operator skill
- Irreversible
- Prognosis

Adhesive Indirect Onlays / Overlays - Indications

- Medium to large cavities with one or more missing cusps
- Morphological modifications e.g. raising OVD in rehabilitation cases
- Cracked tooth syndrome
- Multiple medium to large cavities in a quadrant
- Endodontically treated teeth



Restoring root canal treated teeth

- Type of restoration depends amount of tooth structure remaining and amount/direction of loading
- Difficult to absolutely clarify how to restore endodontically treated teeth
- Evidence is vague and tooth and patient factors need to be taken into account.
- Loss of marginal ridges and occlusal isthmus leads to weakening of teeth



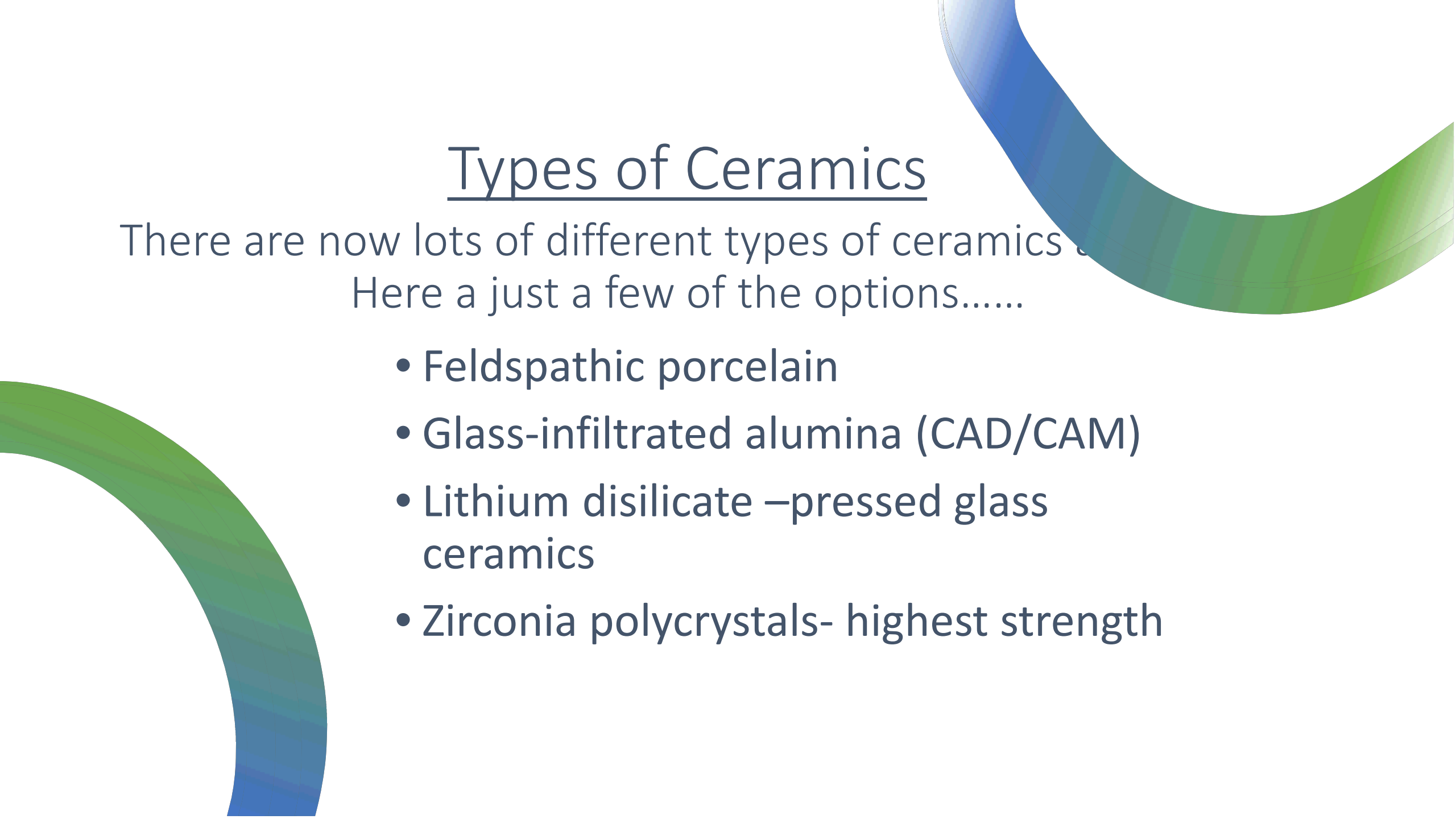
Root canal treated teeth

- Inferior survival with one or less residual walls
- Highest survival with 2 proximal contacts, lowest with no proximal contacts, terminal teeth have increased risk of failure.
- Overwhelming majority of studies show increased survival with indirect cuspal coverage when compared to direct restorations alone.
- A delay of 4 months to placement of direct restoration appears to be associated with a lower survival rate.
- Cracked teeth having undergone RCT have good survival rates when restored indirectly.
- Available evidence indicates onlays perform similarly to MCCs





Composite Vs Ceramic Onlays



Types of Ceramics

There are now lots of different types of ceramics
Here a just a few of the options.....

- Feldspathic porcelain
- Glass-infiltrated alumina (CAD/CAM)
- Lithium disilicate –pressed glass ceramics
- Zirconia polycrystals- highest strength

Indirect Ceramic Onlays

Advantages	Disadvantages
Better physical properties, and higher flexural strength	High lab bill costs
Ideal for larger sized/deep preparations	More destructive prep required
Overall longer survival rates	Need for smooth angles and correct prep
	Difficult to adjust, both fitting surfaces and occlusal adjustment
	Can be difficult to create access if RCT required
	Increased wear to opposing teeth

Indirect Composite Onlays

Advantages	Disadvantages
Good Aesthetics and margins	Low wear resistance compared to Ceramics
Low wear to opposing teeth	Overall lower survival rates
Very conservative prep required	
Easier to adjust	
Can be repaired easily with composite in the long term	
Lower lab bill cost	
Able to access easily through if RCT required	



Advantages of Indirect Composite Onlays to Direct Composite Onlays.

- Better contact point, especially when mesial and distal contact points involved
- Improved occlusal morphology and aesthetics
- No polymerization shrinkage

BUT

Lab bill to pay and a 2-appointment procedure with need for temporary

Composite Onlay
Preparation for LR6 Root
filled tooth

Occlusal Depth grooves of 2 mm created with the rounded shoulder bur



Occlusal depth grooves joined together





Inclined Bevel created on Buccal wall
(between 1-1.5mm in length)



Rounded shoulder margin created on Lingual surface
(1mm thickness)

Lingual and Buccal surfaces joined together mesially and distally. All sharp angles/edges smoothed.



Height reduction shown



Composite Onlay
Preparation for heavily
broken-down Molar



Pre-op photo of LL6.
The Decay has been
removed. MB and DL
cusps are missing.



Firstly, build up lost tooth tissue with SDR/Conventional composite to remove undercuts and preserve tooth tissue.



Occlusal Depth grooves of 2 mm created with the rounded shoulder bur



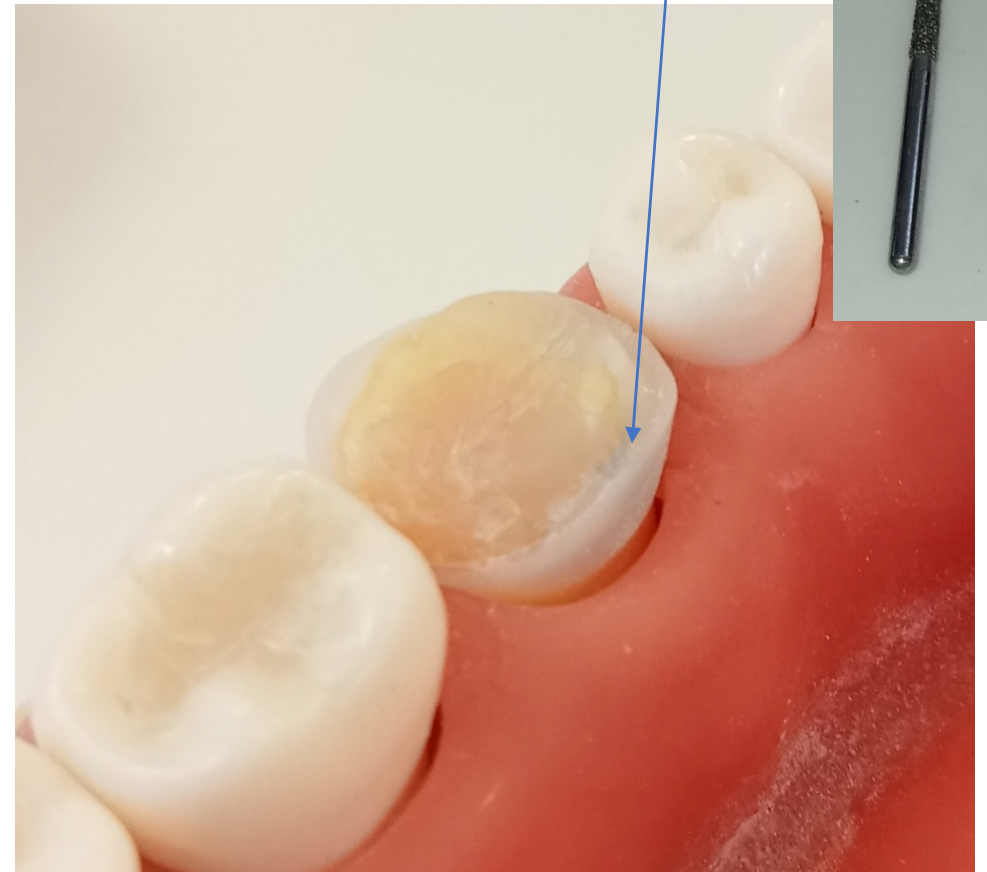
Occlusal depth groves joined together





Inclined Bevel created on Buccal wall
(between 1-1.5mm in length)

Rounded shoulder margin
created on Lingual surface



To finish, remove all sharp edges with a polishing bur.

Height reduction shown.



Bur Selection





Luting Cements

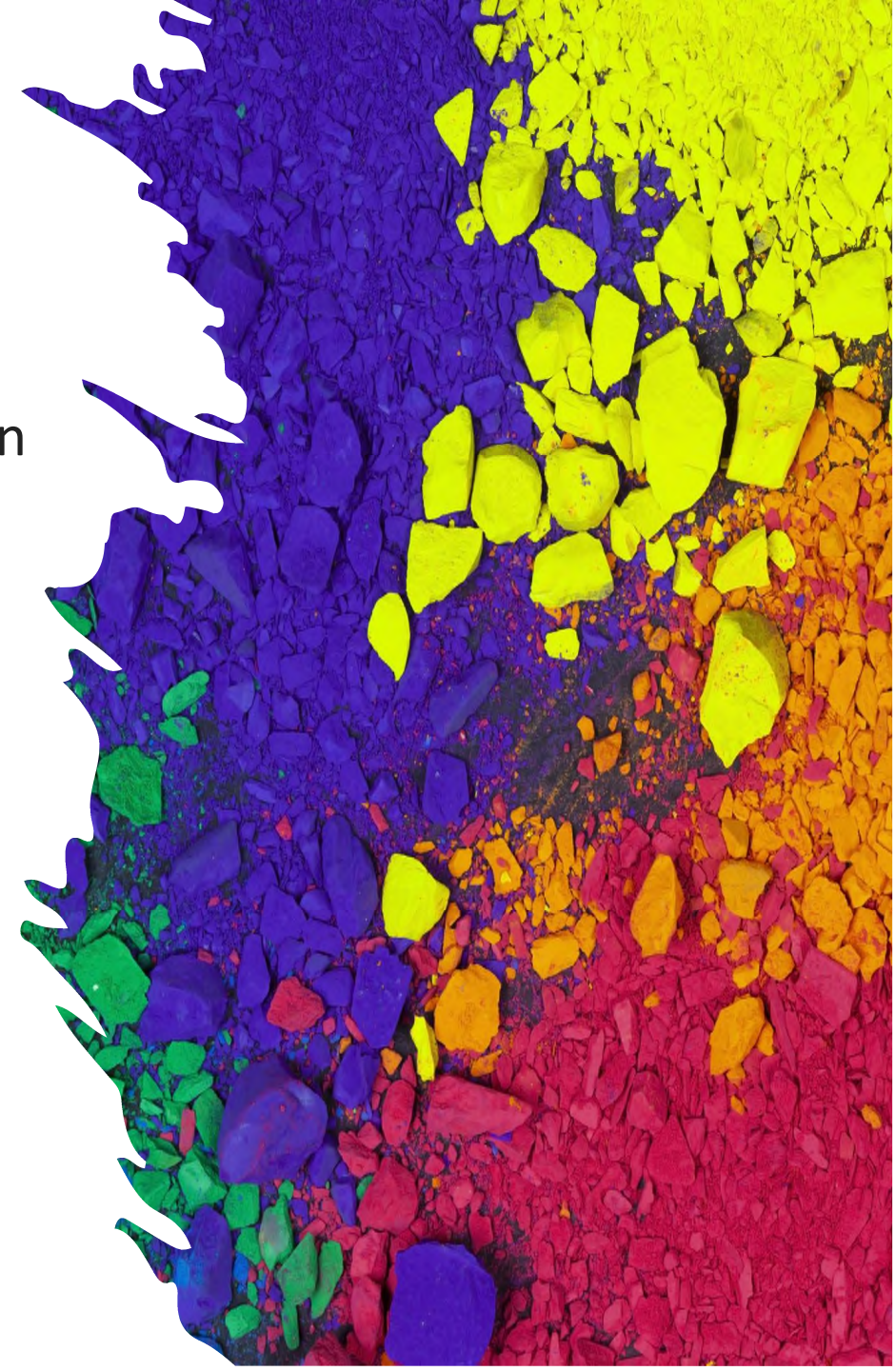
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There is no luting material that can be universally used.

Therefore, it is important to distinguish the physical, mechanical, and biological properties of luting materials in order to identify the best options for each case.

There are 3 main types of Luting cements.....

- Zinc Phosphate
- RMGI Luting Cements
- Resin Luting Cements



Zinc Phosphate

Consists of zinc oxide powder and phosphoric acid liquid.

Type of Cement	Advantages	Disadvantages
Zinc Phosphate 	Easy to use and clean-up (important to keep ratio of powder/liquid to correct quantities) Adequate compression strength Reasonable working time Easy to remove if re-treatment is required	Highly soluble in acidic oral Fluids Low PH – possible pulpal irritation No adhesion to tooth/restoration Requires mechanical retention Low tensile strength

RMGI Luting Cements

	Advantages	Disadvantages
For example: GC Fuji CEM, Fuji Plus  3M Ketac Cem GI Luting cement 	Good Biocompatibility Fl Release Good Adhesion to tooth Adequate compressive and tensile strengths Low solubility in oral fluids Easy Clean-up	Minimal adhesion to restorations

RMGI Luting Cements

- Create a strong bond with Enamel and Dentine
- Can be used to cement *Metal Ceramic crowns, Zirconia crowns & metal crowns/onlays/post & cores*
- Good resistance to marginal permeability
- BUT they are *contraindicated in the cementation for the more fragile all-ceramic restorations*, as they expand due to water absorption, which can lead to fracture of the restoration

Resin Luting Cements

- Been available since 1952 & many types now available on the market
- They provide 'adhesive' luting of crowns and onlays
- A polymer matrix forms to fill and seal the tooth-restoration space
- Can be used to cement metal crowns, ceramic crowns, zirconia crowns, **composite inlays/onlays**, metal–ceramic crowns, fiber posts and ceramic veneers



Resin Luting Cements

	Advantages	Disadvantages
For example: RelyX Unicem/Ultimate Variolink Esthetic LC Panavia 21 G-CEM ONE NX3 Nexus Universal AdheSive Cement	Excellent physical properties Low solubility in oral fluids Adhesion to tooth via Dentine-bonding agent Tooth coloured- can modify shade of restoration Can bond to restorations Enhanced marginal seal Improvement of flexural characteristics of ceramic inlays.	Technique sensitive if separate dentine-bonding procedure required Moisture control is critical **Rubber Dam** Clean-up time is limited Need to finish restoration margins (to prevent an oxygen-inhibition layer forming) Difficulty in removing Restoration if Re-treatment is required Increased Price



Types of Resin Cements

Adhesive – Total Etch
or Self Etch
Self-Adhesive

Self-curing
Light-curing
Dual curing

Adhesive/Self-Adhesive Resin Cements

Adhesive cements e.g., Variolink Esthetic

- require acid etching with phosphoric acid followed by the system's bond.

Self-Adhesive cements e.g., RelyX UNICEM

- no pre-treatment required as they contain a self-etch primer.
- With less steps involved these materials are less technique sensitive.
- These create a superficial interaction with tooth tissues which results in lower bond strengths to enamel and dentine compared to conventional resin cements, especially in the long term.(4)



Research

Eltoukhy RI, Elkaffas AA, Ali AI, Mahmoud SH. Indirect Resin Composite Inlays Cemented with a Self-adhesive, Self-etch or a Conventional Resin Cement Luting Agent: A 5 Years Prospective Clinical Evaluation. *J Dent*. 2021 Sep;112:103740. doi: 10.1016/j.jdent.2021.103740. Epub 2021 Jul 4. PMID: 34233204.

A randomized clinical trial, 40 patients with three large cavities indicated for indirect MOD Class II restorations

120 indirect resin composite inlay restorations (SR Nexco) were placed and luted with three different resin cement strategies (n=40); an etch-and-rinse (Variolink N), self-etch (Panavia F2.0) and self-adhesive (RelyX Unicem).

These restorations were evaluated at 1 week (baseline), 1, 3 and 5 years using modified USPHS criteria.

Results: The outcome showed that there was neither loss of restorations nor recurrent caries after 5 years for all luting cements groups.

etch-and-rinse resin cement group showed better clinical performance regarding marginal discoloration and marginal adaptation at 5-years recall period.

Therefore etch-and-rinse resin cement still has the best prognosis for adhesive luting of indirect resin composite inlays.

Self-Cure/Light-Cure/Dual Cure Resin Cements

- 1) **Self-Curing Resin Cements** - Used to cement restorations that block light, such as zirconium oxide, all-ceramic and composite inlays and onlays **>2.5 mm** thick. They have lower colour stability; therefore, are not indicated to bond with translucent or thin ceramic restorations (3)
- 2) **Light-Curing cements** are cured due to the activation of photoinitiators & provide good colour stability. They are indicated to cement ceramic or indirect composite restorations that are less than **2.0 mm thick** and provide sufficient light penetration
- 3) **Dual-Cure cements**- chemical and light reaction (photoinitiators) They are recommended for ceramic and composite restorations with a thickness of **2.0–3.0mm**, but possible issues with full setting.

****Key points when using Resin Cements****

- Moisture control essential so Rubber dam must be placed
- Ideally Enamel present on peripheral rim for increased bond strengths
- Consider type of material and if suitable for less technique sensitive RMGI Cements
- Consider thickness and translucency of indirect restoration before selecting type of Resin cement
- **ALWAYS READ THE MANUFACTURERS INSTRUCTIONS and use corresponding bonds etc.**



School Of Dentistry

The resin cements we will now be using here at the SOD:

- **Variolink Esthetic DC (Dual Cure)** – Suitable for bonding composite/ceramic & zirconia crowns, onlay/inlays, fibre posts and veneers



- **Panavia 21 OP (Opaque)** - Preferred for bonding metal and Resin bonded bridges



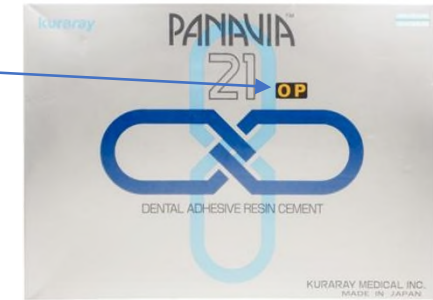
Panavia 21 (OP)

- Adhesive Resin Cement
- Cures under anaerobic conditions
- Radio-opaque composite cement (prevents metal shine through)
- Contains the monomer 10-methacryloyloxydecyl dihydrogen phosphate (MDP) that ionically adheres to the **metal oxides of non-precious alloys** and polycrystalline ceramics (Zirconium)
- Contains the ED Primer which is a mild conditioner for the En/Dentine and accelerates polymerisation
- Panavia etching gel for uncut Enamel only
- Oxyguard used to seal margins for 3 mins for setting before rinsing
- Is available in 3 shades: EX (white), TC (tooth Colour) and OP(Opaque)
- *Excellent long-term research*



Panavia 21 OP(Opaque)

Shade:OP (Opaque)
An opaque paste
used for masking
metal.



Panavia cement (2
pastes) – 1 full
rotation of end cap
will dispense enough
cement for 2 RBB
wings.

OXYGUARD II



Panavia Etching
Agent V –for uncut
Enamel areas

ED PRIMER Liquid A &
Liquid B

Mixing dish and
brushes

Components of Panavia 21 OP

PANAVIA ETCHING AGENT V - for use on uncut enamel only

All uncut enamel should be etched twice for 30secs, washed and dried



ED PRIMER - A mild conditioner for enamel and dentine. Enhances bond strength of PANAVIA 21 and accelerates polymerization.

Consists of Liquid A and liquid B.

ED PRIMER dissolves the smear layer and penetrates the dentine.



Add one drop of each to the mixing dish and mix for 3-5 secs and apply to the tooth surface. Leave for 60 secs and then give gentle air blow.

Components of Panavia 21 OP (cont)

PANAVIA 21 Paste - A radio-opaque composite, consisting of a catalyst and universal paste. It contains the adhesive monomer MDP, which provides long term bond strength

To mix rotate end dispenser one full turn and mix for 20-30secs until a smooth paste is obtained.



Apply to metal fitting surface only, position and hold for 1 min.
(remember Panavia 21 sets in Anaerobic conditions)

OXYGUARD II- For application to the margin. Easy to rinse off. Contains a polymerization accelerator to promote setting. Apply and leave for 3 mins before washing off



Variolink Esthetic DC (Dual Cure)

Monobond Plus
(silane coupling)



Dual Cure

3 syringes Variolink Esthetic DC (light, neutral, warm)



Etch

Adhese Universal
Bond

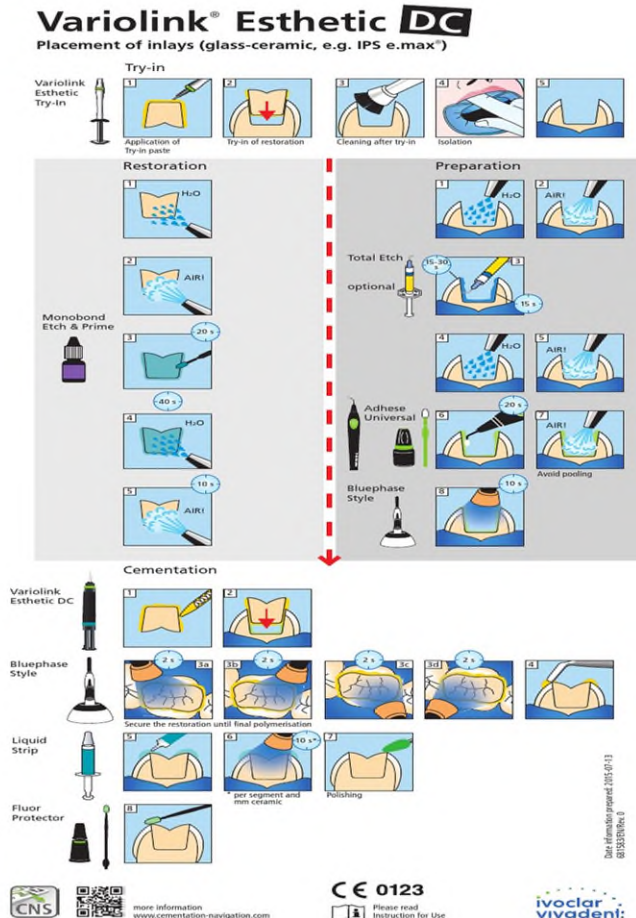


3 syringes Try-In Paste
(light, neutral, warm)

Liquid Strip- Glycerine gel for final curing to
prevent Oxygen Inhibition Layer



Always read and follow the manufactures Instructions



The Instructions for Variolink Esthetic are clear and easy to follow

These should always be in the box.

In Clinical situations where a resin cement is not required....

For Example, cementing Metal Ceramic Crowns/bridges and Zirconium crowns/bridges the cement of choice is Fuji Cem 2.



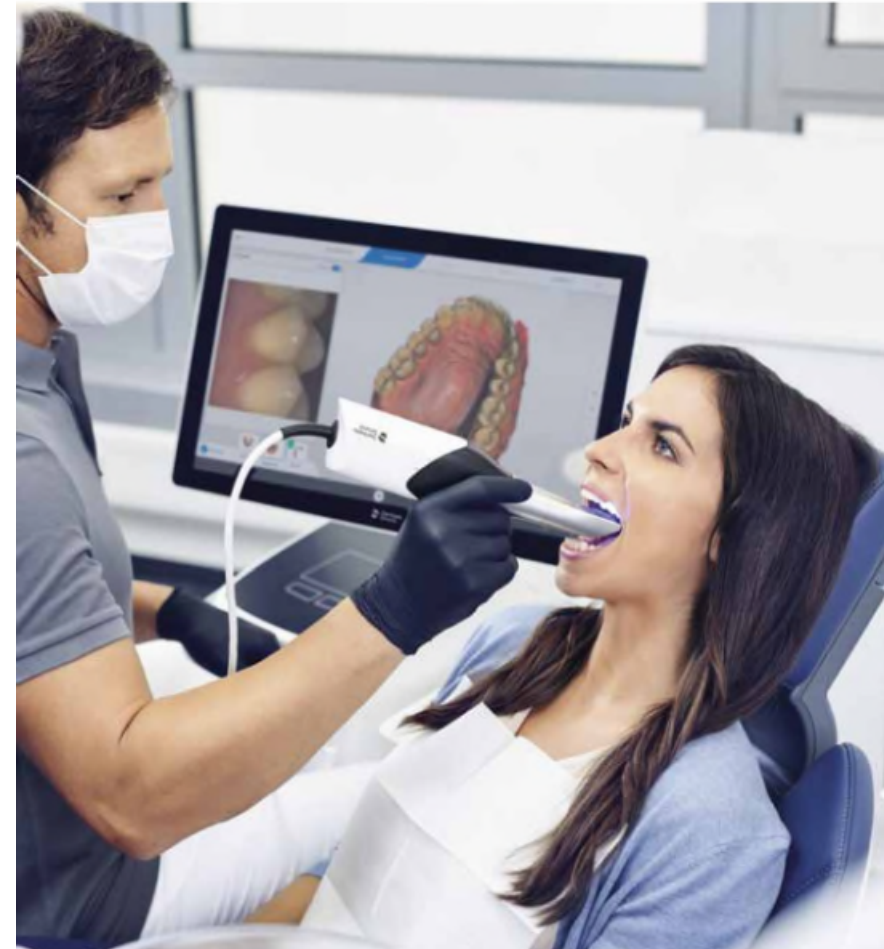
Fuji Cem 2 is a Paste-paste resin-modified glass ionomer luting cement



With this cement you do not need to etch and bond, but use of a tissue conditioner is optional and can increase the bond strength.

Intraoral Scanners (IOS)

- Restorative
- Orthodontics
- Implants
- Patient monitoring
- Milling / CAD/CAM

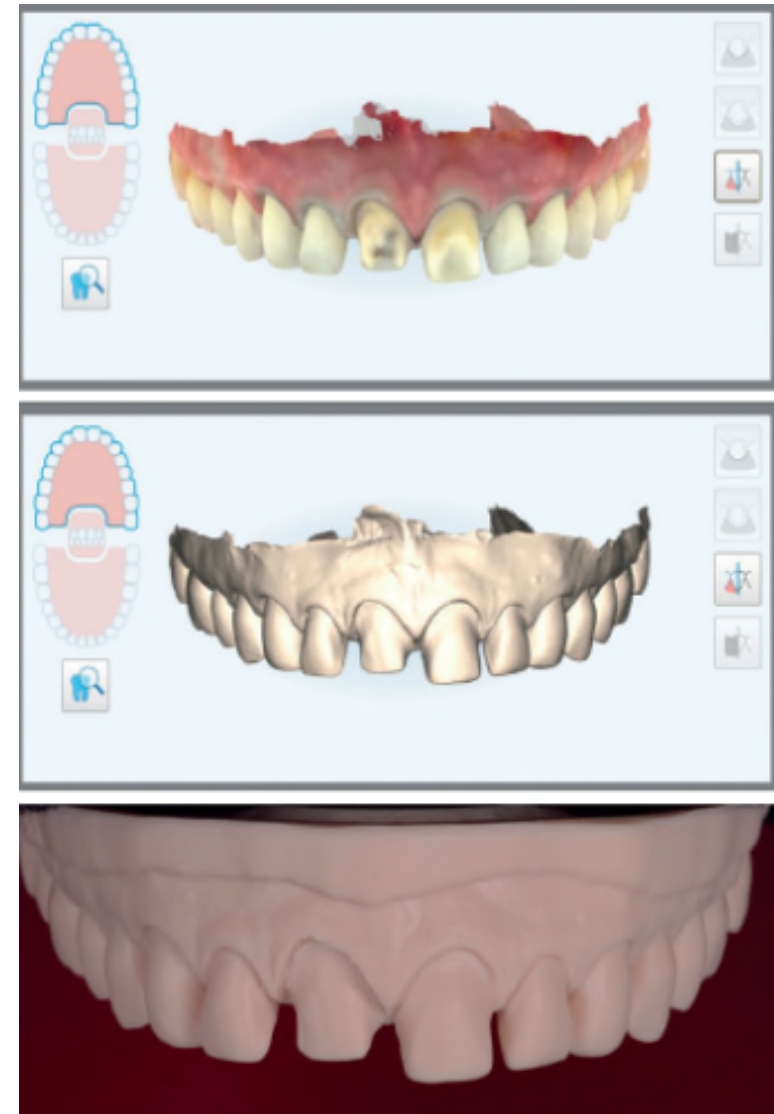


Intraoral Scanners (IOS)

- Similar or enhanced outcomes eg marginal and internal fit
- Patient preference (minimizes discomfort)
- More suitable for patients with a strong gag reflex
- Time saving, shorter/efficient appointment
- Versatile, simplified workflow (especially for complex cases, eg multiple implant-retained restorations)
- Easier laboratory communication
- Eliminates need for impression materials, equipment and transport (eco-friendly)
- Easy to repeat
- Easy to digitally modify preparations eg blocking out undercuts
- Immediate remakes possible
- In-practice milling compatibility (fewer patient appointments)
- Reduction in technical errors eg model fracture, air bubbles, dimensional instability
- Casts stored digitally
- Eliminates need for specialized gypsum disposal

Disadvantages

- Challenges with sub-gingival margin detection
- Financial implications eg high set-up costs and hardware and software upgrades
- Steep learning curve
- Laboratory familiarity is imperative



References

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- (5) Burke FJT. Resin Luting Materials. *Dent Update* 2019;46:371-378