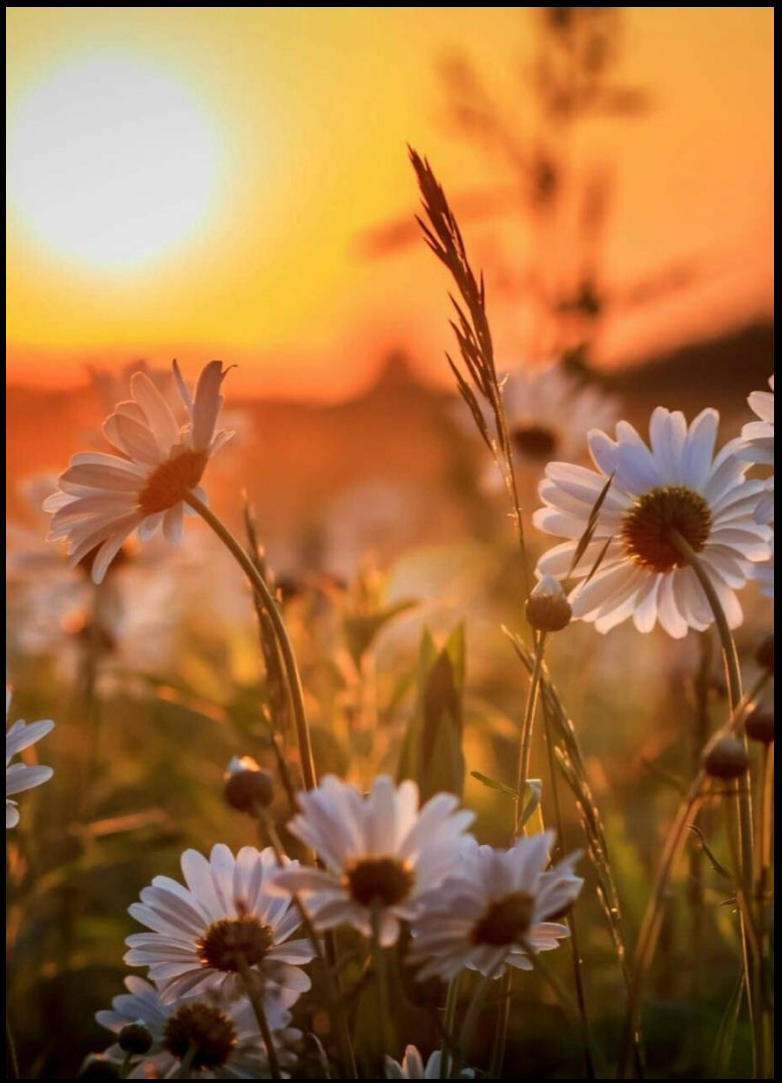


Good
Afternoon!!
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INDIRECT COMPOSITES


INTRODUCTION

- Dental resin composites were introduced initially for use as anterior restorative materials.

- Later, with technological improvements, the prospect of restoring posterior teeth with composite was introduced.
- Though there are numerous causes for failure of direct composites, the major cause was poor wear resistance.

- While the newest direct composite resins offer excellent optical and mechanical properties, their use in larger posterior restorations is still a challenge since polymerization shrinkage remains a concern in cavities with high C-factor.

- Though there have been numerous advances in adhesive systems, the adhesive interface is unable to resist the polymerization stresses in enamel-free cavity margins. This leads to improper sealing, microleakage, postoperative sensitivity, and recurrent caries.

- The achievement of a proper interproximal contact and the complete cure of composite resins in the deepest regions of a cavity are other challenges related to direct composite restorations.

- Various approaches have been developed to improve some of the deficiencies of direct-placement composites. However, no method has completely eliminated the problem of marginal microleakage associated with direct composite.

Failures in Direct Restorations

Modes of failures

- Marginal discoloration
- Marginal fracture
- Recurrent caries
- Post operative sensitivity
- Gross fracture of the restoration
- Lack of maintaining contact
- Accumulation of plaque around the restorations

- ***Reasons of failures***
    - Incomplete excavation of the caries
    - Incomplete etching or failure to remove residual acid from enamel tags
    - Non uniform coating of bonding agent
    - Lack of isolation
    - Touch of composite with fingers
    - Bulk placement of composites
    - Incomplete curing

Indirect Resin Composites

- Were introduced to reduce polymerization shrinkage and improve the properties of material.

TYPES OF IRCS

- Touati and Mörmann introduced the first generation of IRCs for posterior inlays and onlays in the 1980s.Direct resin composites were composed mostly of organic resin matrix, inorganic filler, and coupling agent.
- The first generation IRCs had a composition identical to that of the direct resin .
- Upon light initiation, camphoroquinone decomposes to form free radicals and initiates polymerization, resulting in the formation of a highly crosslinked polymer. It is observed that 25%–50% of the methacrylate group remains unpolymerized.

- For inlay composites, an additional or secondary cure is given extraorally, which improves the degree of conversion and also reduces the side effects of polymerization shrinkage. The only shrinkage that is unavoidable is that of the luting cement.

- It was observed that the first generation IRCs showed improved properties only in lab studies but had failures in clinical studies. With the first-generation composites either a direct–indirect / semi-indirect method or an indirect method was used to fabricate the restoration.

DIRECT-INDIRECT / SEMI-INDIRECT METHOD

The composite material is condensed into the cavity after the separating medium is applied to the cavity.

- This separating medium helps in easy removal of the inlay after the initial intraoral curing. The restoration is then subjected to extraoral light or heat tempering in an oven, used at 110°C for 7 min.
- This technique eliminates the need for an impression of the cavity and the procedure can be completed in a single sitting.

INDIRECT METHOD

- The inlay is fabricated in a die. After the separating medium is applied to the die, composite material is condensed in increments into the cavity and light cured for 40 sec for each surface. The inlay is then removed and heat cured in an oven at 100°C for 15 min. The advantage of this technique is that the proximal contours can be achieved appropriately

DISADVANTAGES OF FIRST GENERATION COMPOSITES

- First-generation composites showed poor In vitro and clinical performance.
- Deficient bonding between organic matrix and inorganic fillers was the main problem leading to
- Unsatisfactory wear resistance,
- High incidence of bulk fracture, marginal gap, microleakage, and adhesive failure in the first attempts to restore posterior teeth.
- Measures to solve these problems included increasing of inorganic filler content, reduction of filler size, and modification of the polymerization system.

SECOND-GENERATION IRC

- The clinical failures endured with first-generation composites.
- The improvements occurred mainly in three areas:
- structure and composition,
- polymerization technique, and
- fiber reinforcement.

Structure and Composition

- The second-generation composites have a ‘microhybrid’ filler with a diameter of 0.04–1 μ, which is in contrast
- to that of the first-generation composites that were microfilled.
- The filler content was also twice that of the organic matrix in the latter composites.
- By increasing the filler load, the mechanical properties and wear resistance is improved, and by reducing the organic resin matrix, the polymerization shrinkage is reduced.
- The new composite resins like Artglass® and belleGlass HP® contain high amounts of filler content, which make them adequate for restoring posterior teeth.

Brand name	Composition	Key points
Artglass Launched in 1995 By HeraeuslKulzer	Filler- 70wt% filler of bariumsilicate glass of 0.7µ. Matrix- 30wt% organic resin. Additional to conventional bifunctional molecules, Artglass contains four to six functional groups which provides the opportunity for more double-bond conversions	used to fabricate inlay, onlays and crowns with/without metal substrate (ranges from nickel-chromium to gold-based metals). Bonding to the metal substrate is achieved by applying an acrylonitrile copolymer (Kevloc), a flexible copolymer, to the metal surface before placing and curing the restorative material

Belle glass HP introduced by Belle de St. Claire in 1996	Filler-Silanated microhybrid fillers of 0.6 µ. Base and surface composites are available which are used on dentin and enamel respectively. The base composite has barium glass fillers (78.7% wt and 65% volume) Surface material has borosilicate fillers which provide enhanced optical characteristics are used (74%wt and 63% volume). Resin matrix of dentin -bis-GMA, whereas, for enamel - a combination of a hydrocarbon saturated methacrylate diurethane of TEGDMA & aliphatic dimethacrylate.	The reduction in size of the filler improves the polishability and smoothness of the material. Newer composite like “Foundation” has been modified to have a filler diameter of 30 µ in the base composite, which will allow for further reduction in polymerization shrinkage.

Sinfony Introduced by 3M ESPE	Fillers - ultra-fine glass or glass-ceramic powders Pyrogenic silica is also used as a microfiller. It is a form of amorphous silicon dioxide with a primary particle diameter of < 0.05 µm, produced in an oxy-hydrogen gas flame. Matrix-polyfunctional methacrylate monomers	Used for full veneering of fixed and removable prostheses on metal frameworks, for inlays / onlays, individual crowns, glass fibre reinforced bridges and for the customization of prefabricated teeth. Pyrogenic silica has large surface area (up to 350 m2/g) and have therefore a thickening effect. They are used to control the rheological properties of the composite. The microfiller particles can insert themselves into the gaps between the macrofillers.

Targis Launched in 1996 by Ivoclar Vivadent	[ceromer] filler- 77wt% , trimodal and has barium glass of particle size of 1µ. Spheroid silica filler - 0.25 µ and colloidal silica – 0.015-0.05 µ. Matrix- conventional monomers.	veneering composite material. The material can be without framework material, to fabricate adhesive inlays/onlays/ veneers and anterior crowns. In addition, Targis is suitable for veneering metal frameworks

PROPERTIES

- Flexural strength to 120 -160 MPa and
- Elastic modulus to 8.5–12 Gpa
- Optical properties :One of the problems associated with composite materials is the unpredictable color stability.
- Heat-treated inlays showed less microleakage than direct restorations.
- The surface roughness ranges from 6–8 µ.

Terminologies

- ***Inlay:***

  A restoration which is designed to restore occlusal and proximal surfaces of posterior teeth and may cap one or more but not all the cusps

- ***Onlay*** :

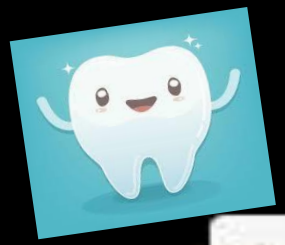
  A restoration which is designed to restore proximal surfaces of posterior tooth and caps all the cusps

Emergence Of Tooth Colored Inlays

Emergence Of Tooth Colored Inlays

Composite inlays vs Direct composite restorations

- ✓ Contacts and contours can be developed outside the mouth
- ✓ Polymeization shrinkage will be less
- ✓ Less microleakage
- ✓ Greater strength and hardness
- ✓ Less post operative sensitivity



Types Of Tooth Colored Inlays

Composite Inlays

Composite Inlay

Definition:

A restoration which is cemented into a dental cavity as a solid mass that has been fabricated from composite resin with a form established either by an indirect or direct procedure outside the oral cavity

Indications

- ✓ Regular dental patients requiring tooth colored restoration of better quality
- ✓ Moderate to large sized lesions, where sufficient tooth tissue appropriate for bonding and free of marked undercuts remain following preparation
- ✓ Where there is no evidence of excessive tooth wear in relation to patient's age

Indications

- ✓ Where the performance of other composite restoration is satisfactory
- ✓ Restoration not overloaded occlusally
- ✓ When better control over contacts and contours is desired

Contraindications

- Patients who do not maintain oral hygiene
- Uncooperative patients
- Teeth which show excessive wear
- Teeth broken down to the extent that inadequate tooth tissues remain to create adequate resistance and retention forms for the purposes of bonding

Contraindications

- Teeth that experience heavy occlusal forces like in bruxism, clenching
- Teeth in which outline form includes marked undercuts
- Teeth in which there are deep gingival margins that have insufficient enamel for bonding

Advantages

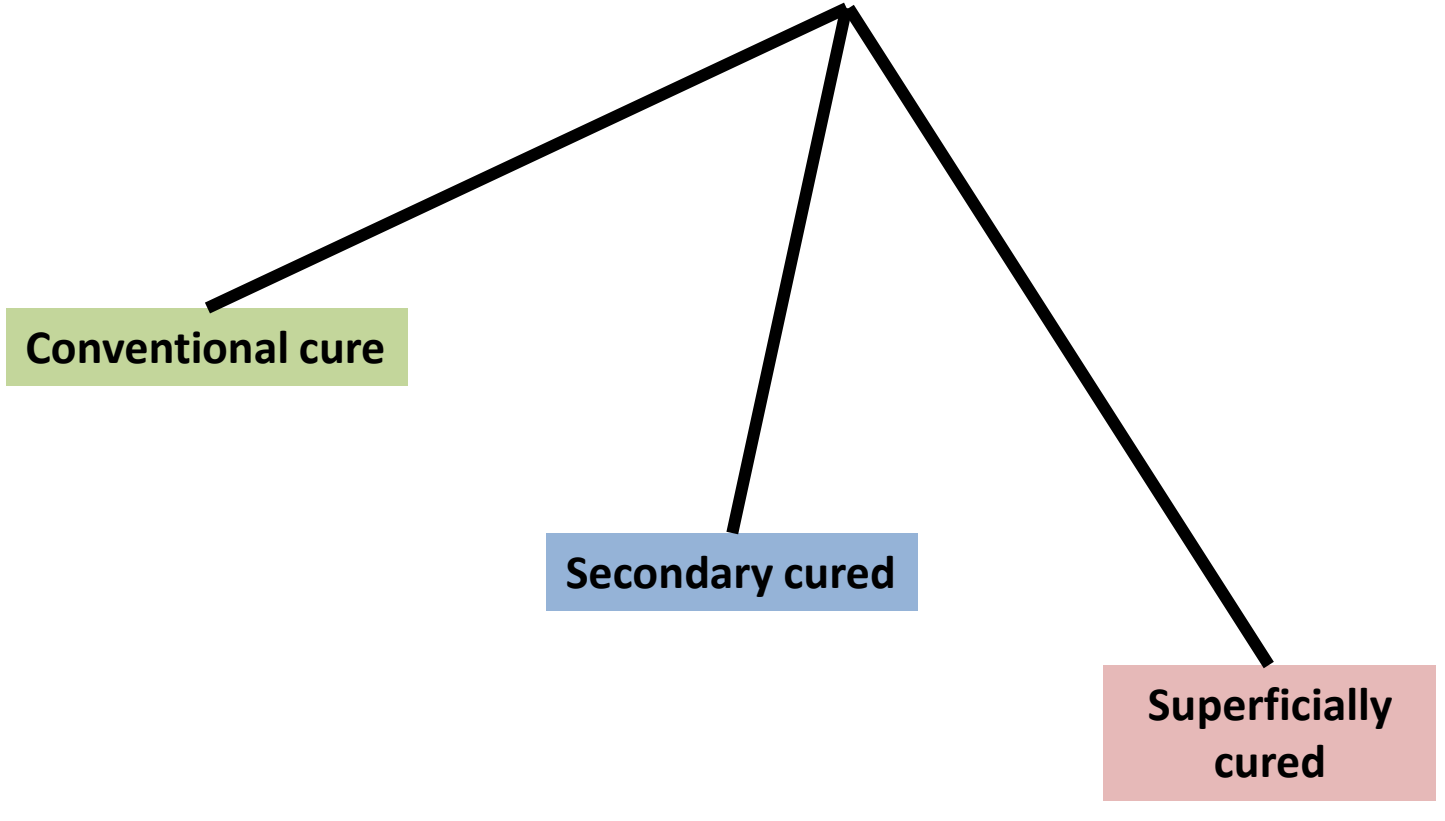
- ✓ Control of polymerization shrinkage
- ✓ Enhanced physical properties
- ✓ Contacts and contours
- ✓ Improved control over marginal adaptation with composite inlays
- ✓ Less technique sensitive than directly placed composites
- ✓ Saves patient’s as well as doctor’s chair time

Disadvantages

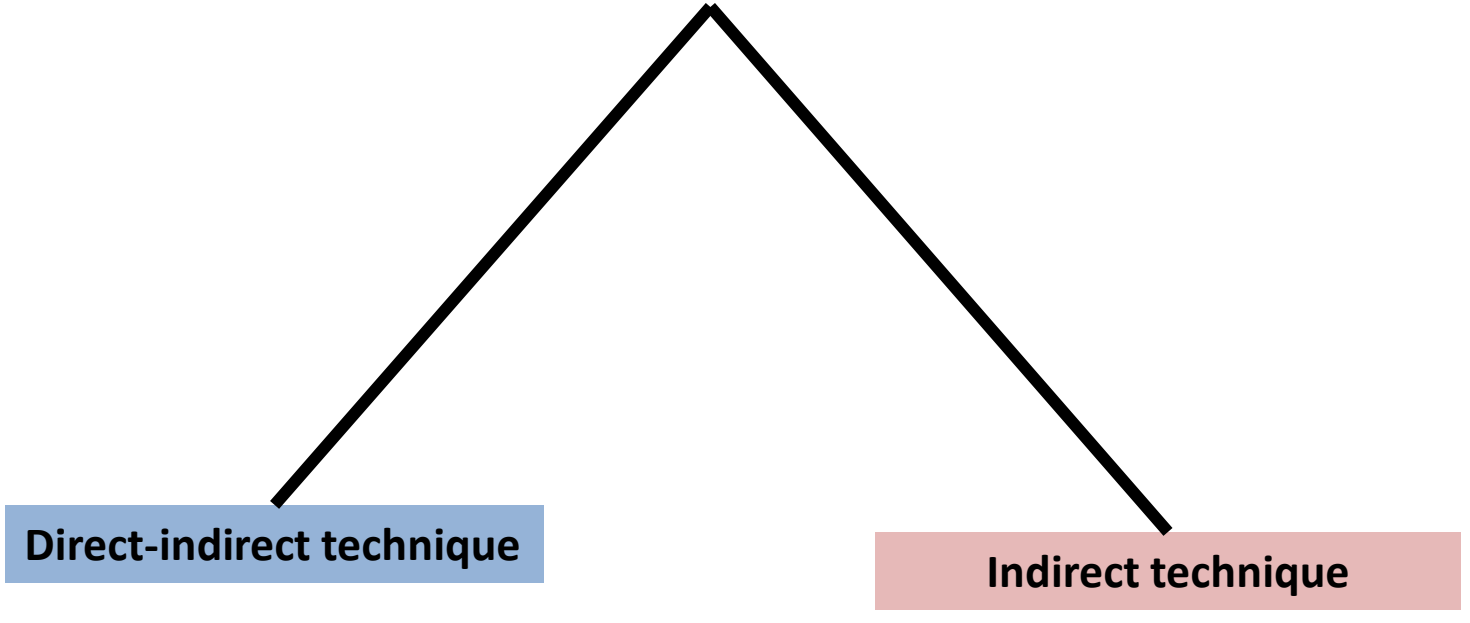
- Increased cost and time
- Technique sensitivity
- Resin-to-resin bonding difficulties
- Short clinical track record:

Classification Of Composite Inlays

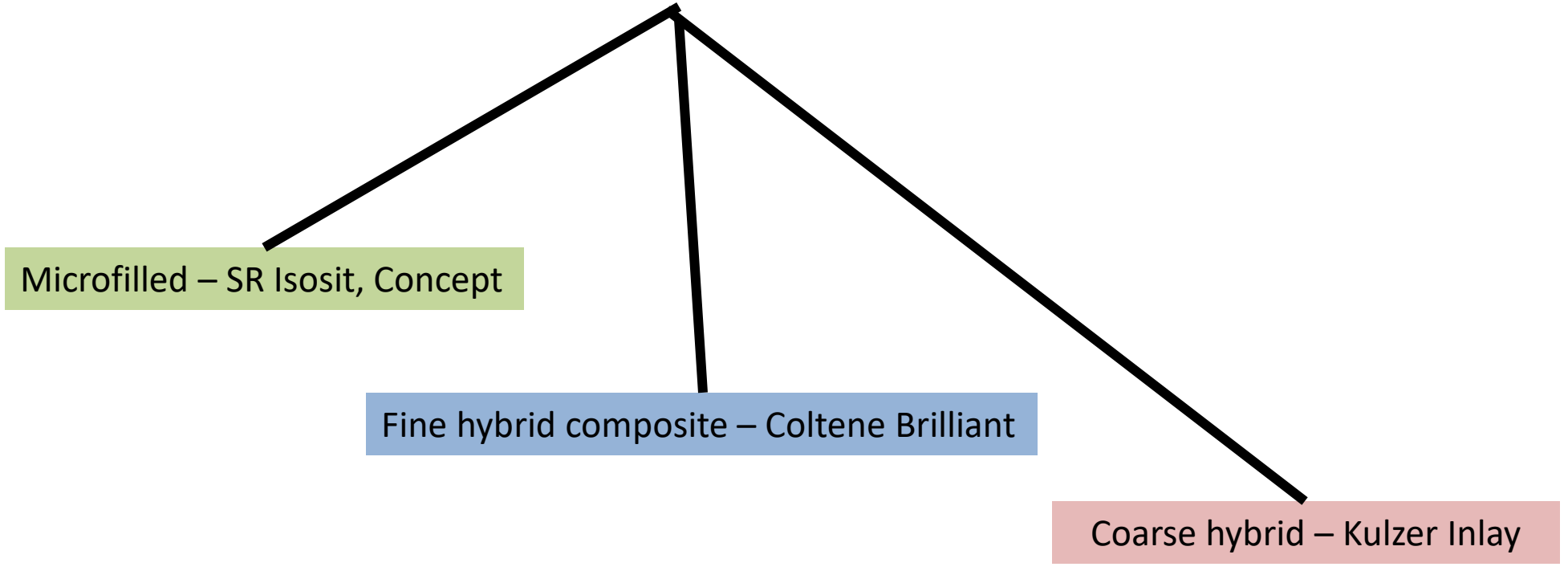
Method of curing



Method of Construction



Type of composite



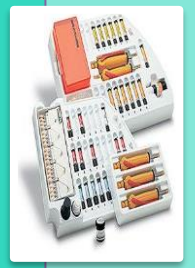
Advances in indirect composite resin systems

Ceromer
Single crystal modified composites
Fiber-reinforced composites

CEROMERS

Ceramic Optimized Polymer was introduced by Ivoclar

Have specially developed & conditioned fine particle ceramic fillers of submicron size, closely packed & embedded in an advanced temperable organic polymer matrix



Contains barium glass, spheroidal mixed oxide, ytterbium trifluoride, and silicon dioxide (57 vol%) in dimethacrylate monomers (Bis-GMA and urethane dimethacrylate)

Setting is by a polymerization of C=C of the methacrylate.

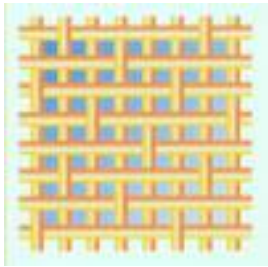
Properties of ceromers are similar to composites & fluoride release lower than conventional glass-ionomers or compomers.

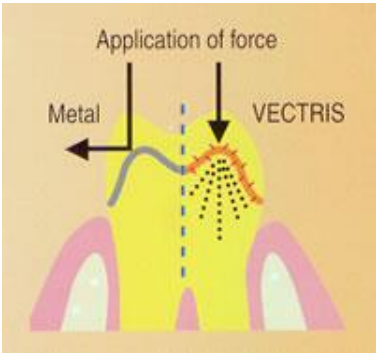
In 1996 a **CEROMER** was developed for indirect composite restoration- **Targis (**Vivadent).

Fiber-Reinforced Substructure

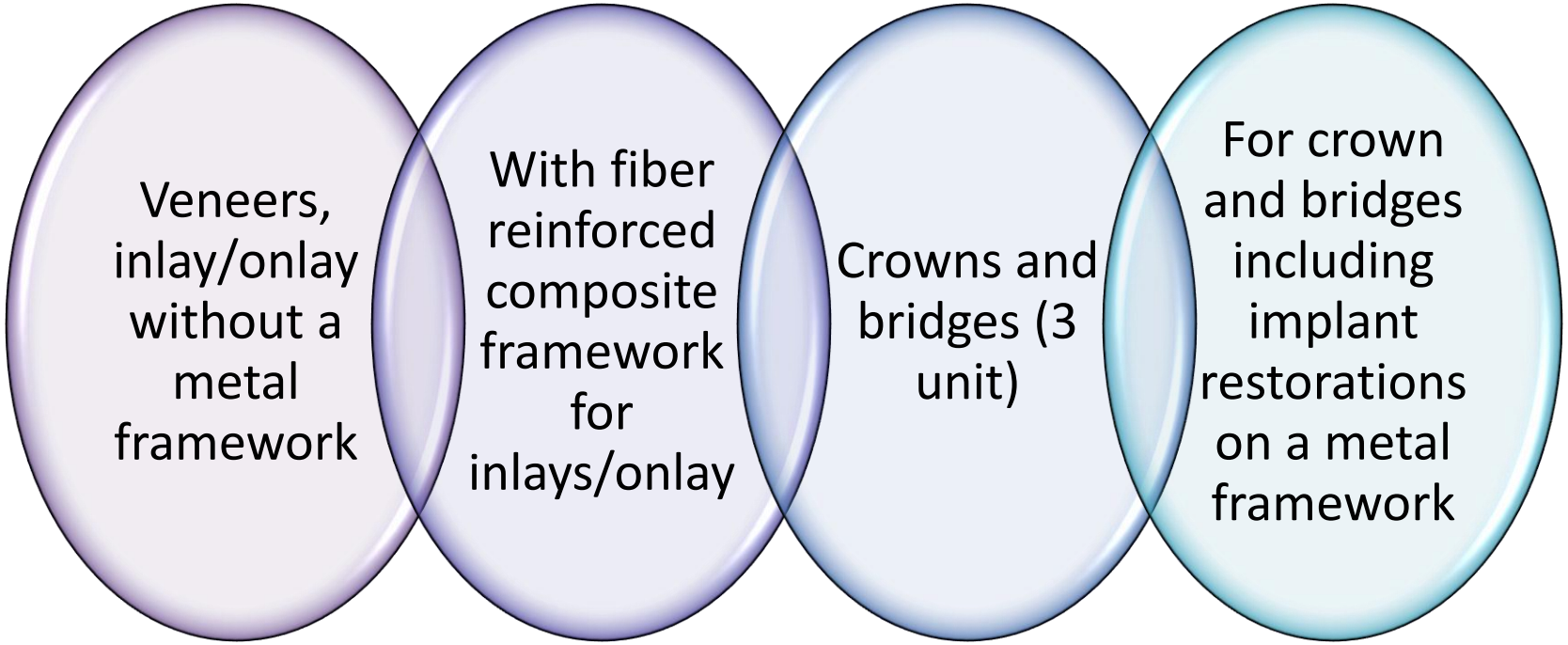
- Fibers of glass or polyethylene & resin matrix are coupled during the manufacture of composite resin → resulting in fibers uniformly impregnated with the matrix.
- These fibers may be pre-impregnated with resin.
- The pre-impregnated fibers are silanized and coated with resin which provides a cohesive bond to the resin matrix.

Have high compressive, tensile and flexural strength.





USES


Veneers, inlay/onlay without a metal framework
With fiber reinforced composite framework for inlays/onlay
Crowns and bridges (3 unit)
For crown and bridges including implant restorations on a metal framework

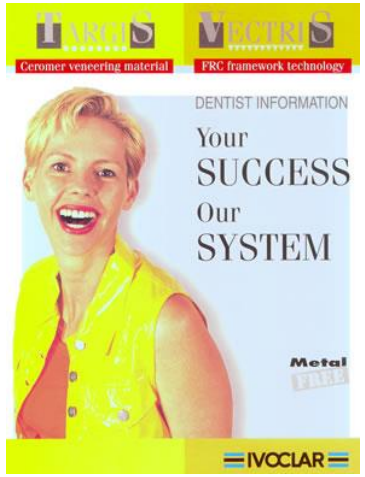
LABORATORY BASED, PREIMPREGNATED FIBER REINFORCED SYSTEMS

TARGIS/VECTRIS

- Highly filled **Targis Ceromer** (ceramic optimized polymer) composition, along with **Vectris**, a fiber reinforcing composite framework

Consist of 2 major components
1. Targis - forms the bulk of the restoration
2. Vectris - fiber framework.

TARGIS (Ivoclar Vivadent)



Composition:

- ✓75-85 weight % of Inorganic filler
- ✓Ceramic particle
- ✓Organic matrix

- Metal-free bridges with Vectris framework
- Metal-free single posterior crowns
- Metal-reinforced crown, bridge, and implant veneers
- Metal-free anterior crowns
- Metal-free inlays,onlays, veneers
- Metal-reinforced combination dentures

SCULPTURE/FIBREKOR (Generic Pentron)

- Involves veneering a composite resin (Sculpture) to a resin preimpregnated glass fiber network (Fibrekor)
- Fibers available in 15 cm lengths of various widths.
- Sculpture is polycarbonate based composite resin.

RIBBOND

- It is a cross-linked leno stitch weave of polyethylene fibers.
- Can be used chair side or in laboratory to fabricate composite resin bridges .

USES

There are many uses for Ribbond. See how this product can enhance your services and how thinner fibers can benefit you.

- Periodontal Splinting
- Endodontic Post and Cores
- Single Visit Bridges
- Provisional Bridges
- Composite Restoration
- Trauma Stabilization

ADVANTAGES

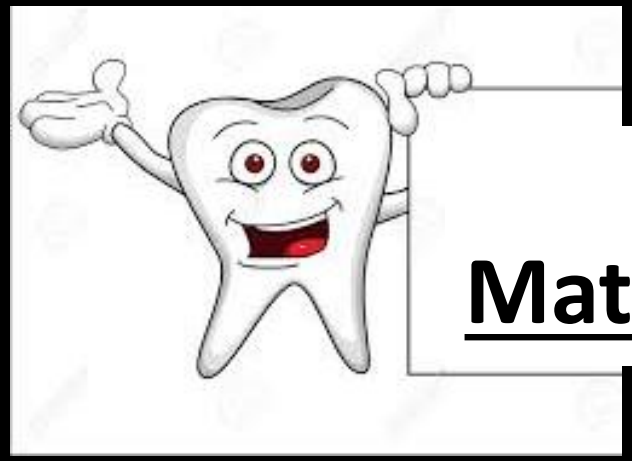
There are many uses for Ribbond. See how this product can enhance your services and how thinner fibers can benefit you.

- Safe and Biocompatible
- Unsurpassed Fracture Toughness
- Superior Ease of Use and Manageability
- Does Not Unravel, Fall Apart or Rebound
- Indefinite Shelf Life

Show All

Single crystal modified composites

- An experimental indirect composite system has been recently developed which uses silicon carbide single crystals as filler component.
- Have symmetric shapes like long plates and behave like fibers.
- These are silanized and incorporated into the resin matrix.
- Used for posterior inlay and onlay restorations



Materials Of Composite Inlays

Indirect Composite Restorations Materials

Name	Composite type	Resin type	Curing method	use
Artglass	Polyglass	Proprietary	Light	Crowns, Inlays, Onlays, laminates, veneers, veneers on metal substructures
Belleglass HP	Plymer- ceramic	Bis-GMA	Light, Heat & Pressure	Crowns, Inlays, Onlays, laminates, veneers, veneers on metal substructures Multi unit metal free fiber reinforced restorations
Clearfil CR Inlay	Hybrid	Bis-GMA	Light & Heat	Inlays & Onlays

Indirect Composite Restorations Materials

Name	Composite type	Resin type	Curing method	use
Coltene	Hybrid	Bis-GMA	Light & Heat	Inlays, Onlays, laminates, veneers,
Cristobal	Bioglass polymer	Bis-GMA, TEGDMA, UDMA	Light	Crowns, Inlays, Onlays, laminates, veneers, veneers on metal substructures Multi unit metal free restorations
Sculpture	Polymer ceramic	PCDMA	Light, Heat & Vaccum	Crowns, Inlays, Onlays, laminates, veneers, veneers on metal substructures Multi unit metal free fiber reinforced restorations

Indirect Composite Restorations Materials

Name	Composite type	Resin type	Curing method	use
Targis	Ceromer	Bis-GMA	Light, Vaccum & Pressure	Crowns, Inlays, Onlays, laminates, veneers, veneers on metal substructures Multi unit metal free fiber reinforced restorations
True Vitality	Hybrid	Modified Bis-GMA	Heat, Light & Self	Crowns, Inlays, Onlays, laminates, veneers, Multi unit metal free restorations
Visio Gem	Microfill	Bis-GMA	Light & Vaccum	Inlays, Onlays, laminates, veneers,

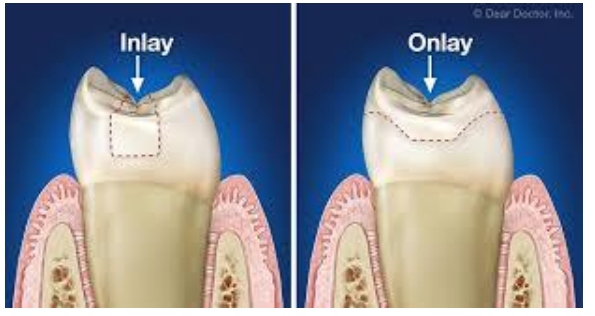
- Indirect composite resin restorations are those in which the composite restorations are fabricated outside the patient's mouth and cemented into place using a suitable luting medium. Most indirect restorations are made on a replica of the prepared tooth in a dental laboratory by a trained technician.

- DIRECT

INDIRECT

- Indirect composite resin restorations include:

- Indirect composite resin inlays



- Indirect composite resin onlays

- Indirect composite veneers

- Fiber reinforced composite bridges

I.D. INDICATIONS

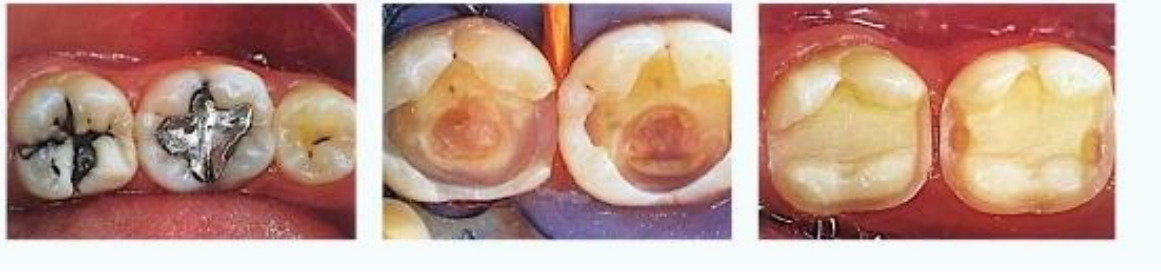
2. LARGE CAVITIES OR PREVIOUS RESTORATION:

- **Indirect tooth-colored restoration should be considered for large Class I or II cavities or previous restorations, especially those that are wide facio-lingually and require cusp coverage**

I.D. INDICATIONS

2. LARGE CAVITIES OR PREVIOUS RESTORATION (CONT.,):

- **Indirect tooth colored restoration will provide the following advantages when restoring such large cavities:**
  - **It is an adhesive restoration that strengthen the remaining tooth structure**
  - **The contours of large restorations are more easily developed when using indirect techniques**
  - **Indirect tooth-colored restorative materials are more durable than direct composites, especially in regard to maintaining occlusal surfaces and occlusal contacts**



I.E. CONTRAINDICATIONS

2. INABILITY TO MAINTAIN DRY OPERATIVE FIELD:

- Current adhesive techniques require near perfect moisture control

3. EXTREMELY DEEP SUB GINGIVAL PREPARATION:

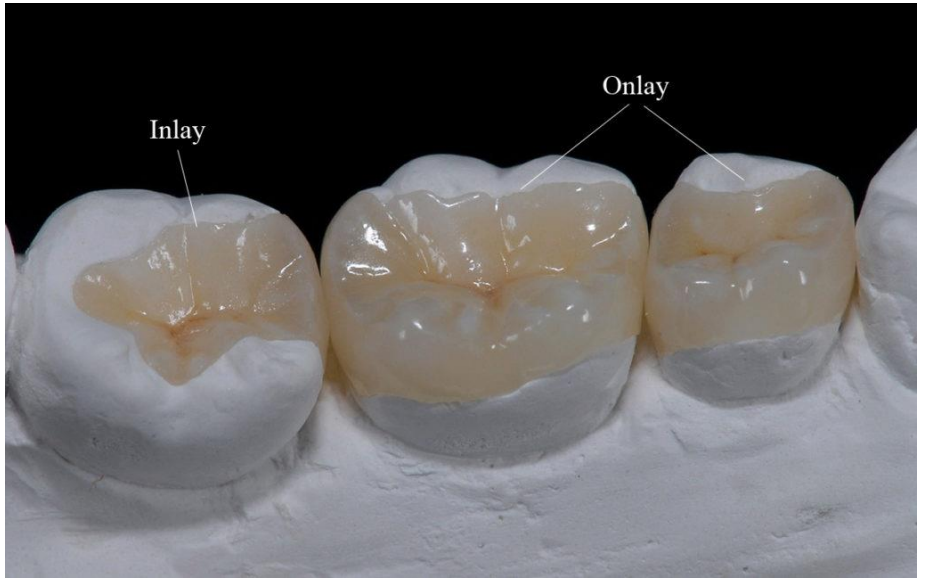
- Bonding to enamel margins is greatly preferred, especially along gingival margins of proximal boxes

- Teeth that show excessive wear/ parafunctional habits

- Teeth broken down to the extent that inadequate tooth tissues remain to create adequate resistance and retention forms for the purpose of bonding

COMPOSITE INLAYS

- A Composite inlay is defined as a restoration which is cemented into a dental cavity as a solid mass that has been fabricated from composite resin with a form established by either an indirect or direct procedure outside the oral cavity.



Indications

1. Esthetics- Indirect composite restorations are indicated for Class I or Class II restorations located in areas of esthetic importance for the patient.

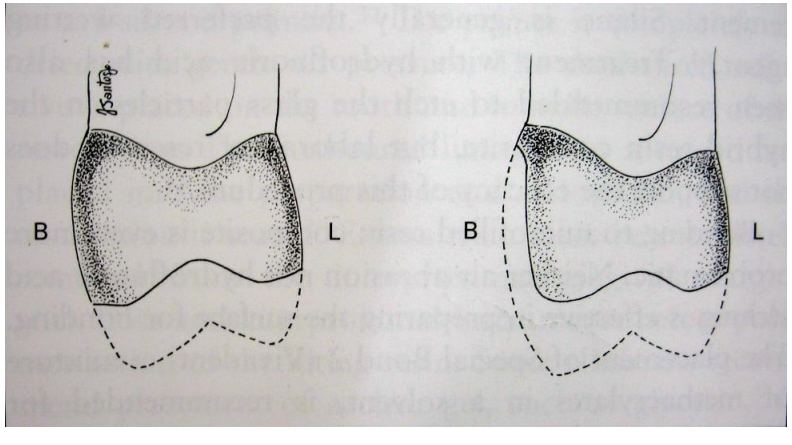
2. Restoration of conservative cavity preparations that have an isthmus of less than one-third the intercuspal distance; serial restorations in the same arch to be treated simultaneously; more distally located stress-bearing teeth.

3. Replacement of posterior composite resin restorations that have been successful for a long time but now need routine replacement because of fracture or recurrent caries.

4. Replacement of existing metallic restorations for esthetic reasons that do not require the complete onlaying of the occlusal surface.

- 5. Esthetic restoration of teeth in patients who have a diagnosis of bruxism or clenching and exhibit mild to moderate wear on the opposing dentition. In such cases the indirect composite restoration would cause less wear of the opposing dentition than a similar ceramic restoration.
-
- 6. Cases where a ceramic restoration is not indicated due to cost factors and achievement of proper contours and contacts would otherwise be difficult.

- Standard onlay preparation (left) and modified preparation (right) that covers facial surface to achieve superior esthetic blend with natural tooth color.

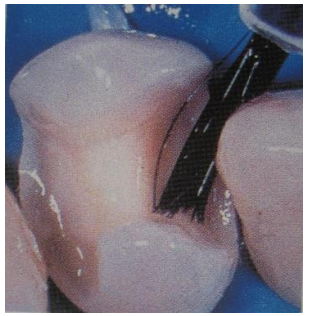


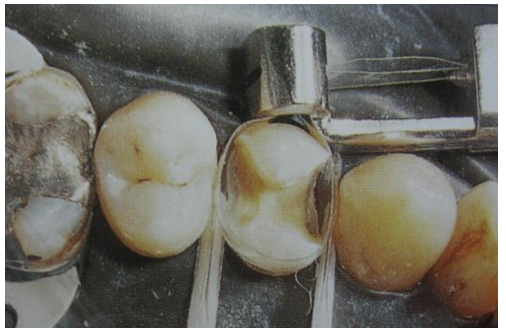
- The fabrication technique for the composite resin inlay depends on the specific system of materials being used. Two different fabrication techniques are available:

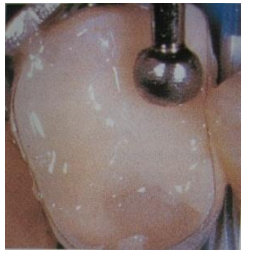
- **Direct resin inlay technique** : For this technique, the composite resin inlay is fabricated directly on the tooth preparation in the mouth and then the inlay is removed and cured in a curing oven.

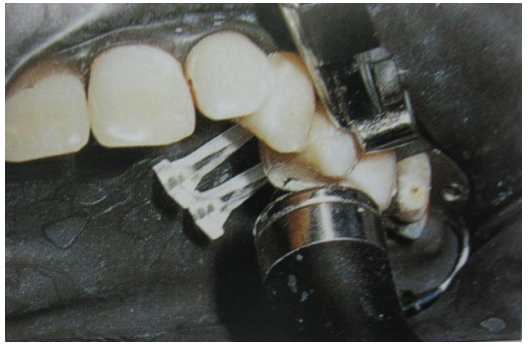
- **Indirect resin inlay technique** : The alternative method of composite resin inlay fabrication is to make an **impression** of the prepared tooth and **fabricate the inlay on a die**.

Direct technique









- video

INDIRECT COMPOSITE VENEERS

- A **veneer** is a layer of tooth-colored material that is applied to the tooth to restore localized or generalized defects and intrinsic discolorations.
- Common indications for veneers include teeth with facial surfaces that are malformed, discolored, abraded, eroded or have faulty restorations

Indications for processed composite indirect veneers

- 1. Recommended for placement in children and adolescents as interim restorations until the teeth have fully erupted and achieved their complete clinical crown length. At that time (i.e.,18 to 20 years of age) a more permanent alternative (porcelain or pressed ceramic veneers) can be pursued.

- 3. Where economic constraints do not make porcelain or pressed ceramic a viable option. However, patient must be told that composite veneers do not exhibit comparable clinical longevity.

Technique

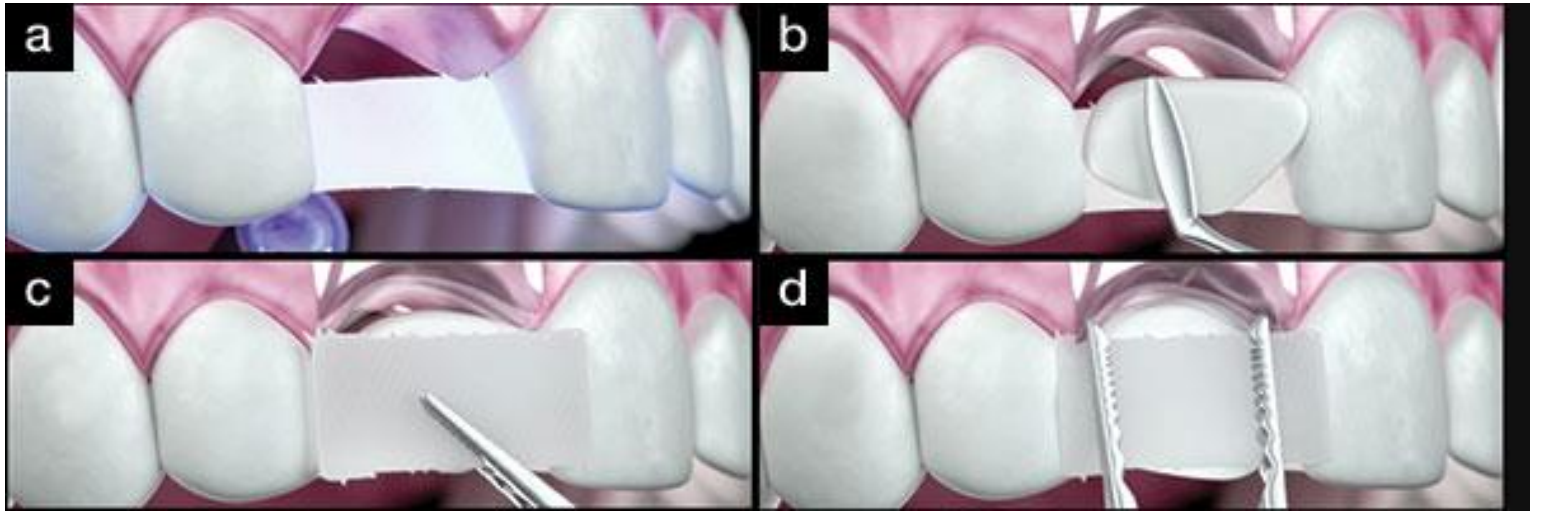
1. Shade selection
2. Tooth preparation
3. Temporization
4. Impression
5. Fabrication of cast
6. Fitting of the veneer
7. Shade selection of the bonding medium
8. Seating of the veneer
9. Finishing
10. Instructions

- video

Fiber reinforced composite bridges

- Fiber-reinforced composites (FRCs) are resin-based materials containing fibers to improve their physical properties.

- glass fibers, carbon fibers, kelvar fibers, vectran and polyethylene fibers


a
b
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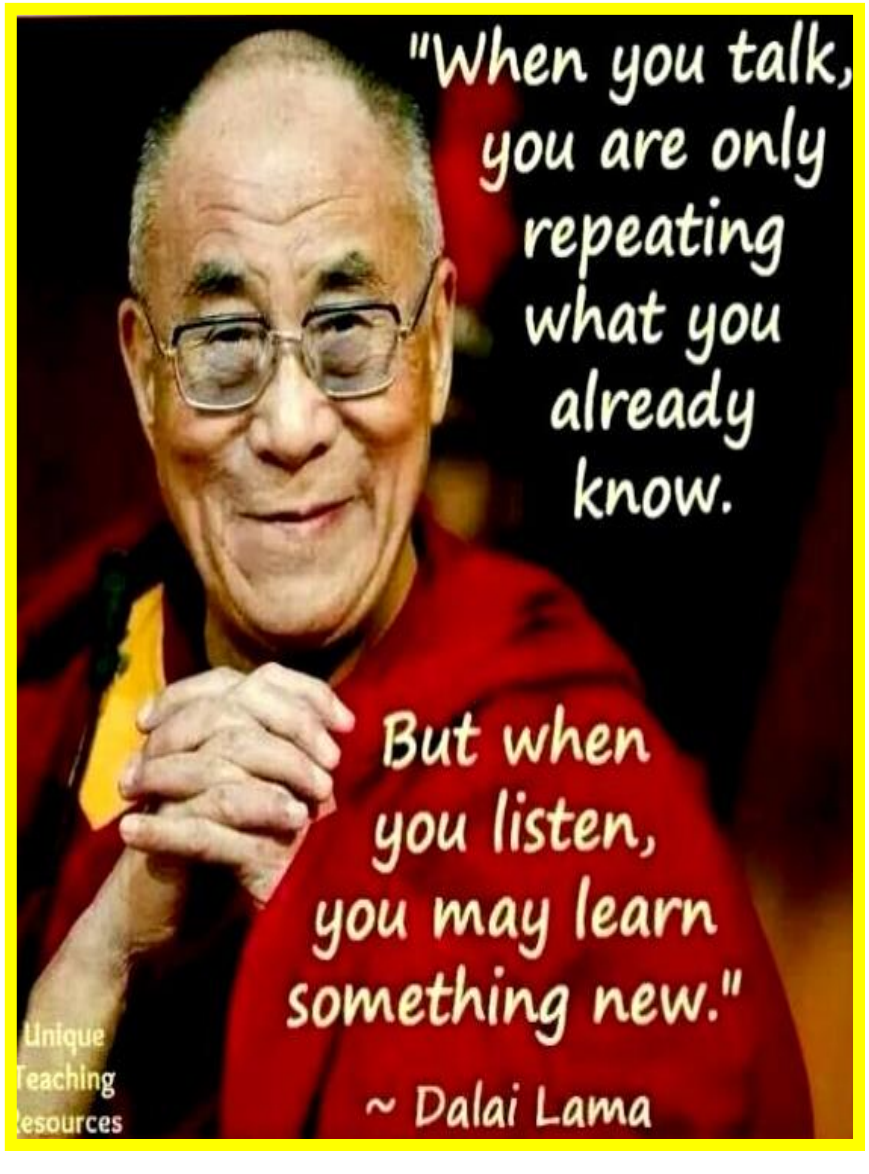
d

- Composition, properties and manipulation of indirect resin composites
- indications., contraindications, advantages and disadvantages of indirect resin composites
- Types of indirect resin composites
- Clinical applications indirect resin composites

conclusion

- A properly fabricated indirect restoration is wear resistant, esthetic, and relatively less prone to postoperative sensitivity.
- significant reduction in polymerization shrinkage Additional clinical benefits include precise marginal integrity, ideal proximal contacts, excellent anatomic morphology, and optimal esthetics.

- The success of the restoration depends on the proper diagnosis, planning and excellent laboratory support. More studies are needed to determine the survival rates of indirect resin composite restorations. The indirect composite restoration could be an excellent choice for the patients when indicated. Since there is no ideal “one-fits- 8 all restorative system” that could be successfully applied to every clinical condition, it is the doctor’s responsibility to select the appropriate restorative materials and techniques for each patient after a thorough examination and diagnosis.



Thank you for your patient listening