Direct Modern
POSTERIOR RESTORATIONS

Managing Simple and Complex Restorations Predictably

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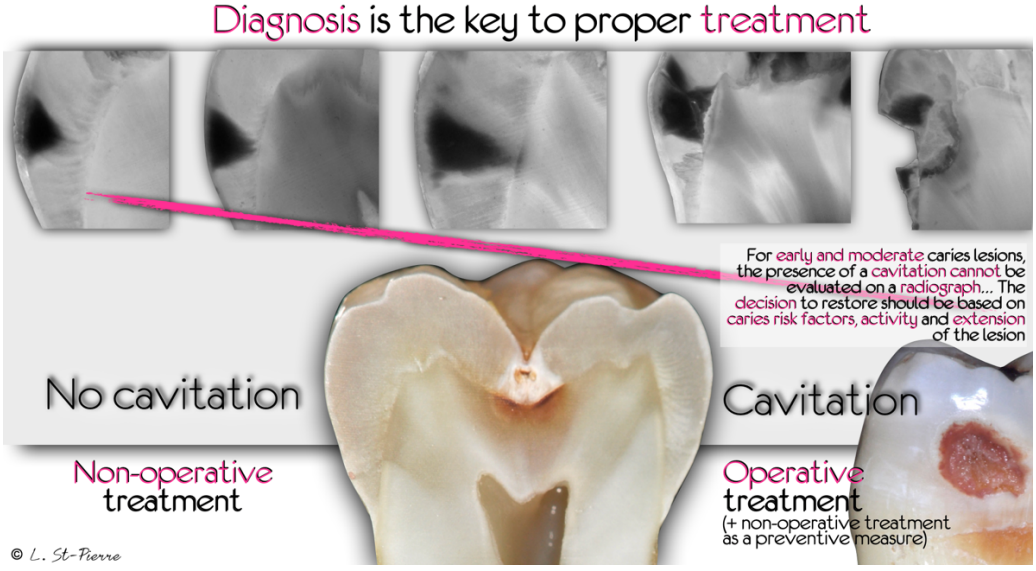
Since no restoration is really permanent, the primary goal should be the conservation of sound tooth structure and the possibility of future interventions. This allows to slow down the restoration cycle while preserving pulp vitality whenever possible. It begins with remineralization or arrest of early caries lesions to reduce the need for a restoration. It continues with adhesive dentistry offering conservative options preserving a maximum of healthy tooth structure.

Black's principles and retentive preparations are necessary for dental materials without adhesive properties. Adhesive dentistry has revolutionized everyday dentistry. It allows for non-retentive preparations with remarkable clinical performance. Technique and rigor are essential to clinical success and therapeutic choices should be based on scientific evidence.

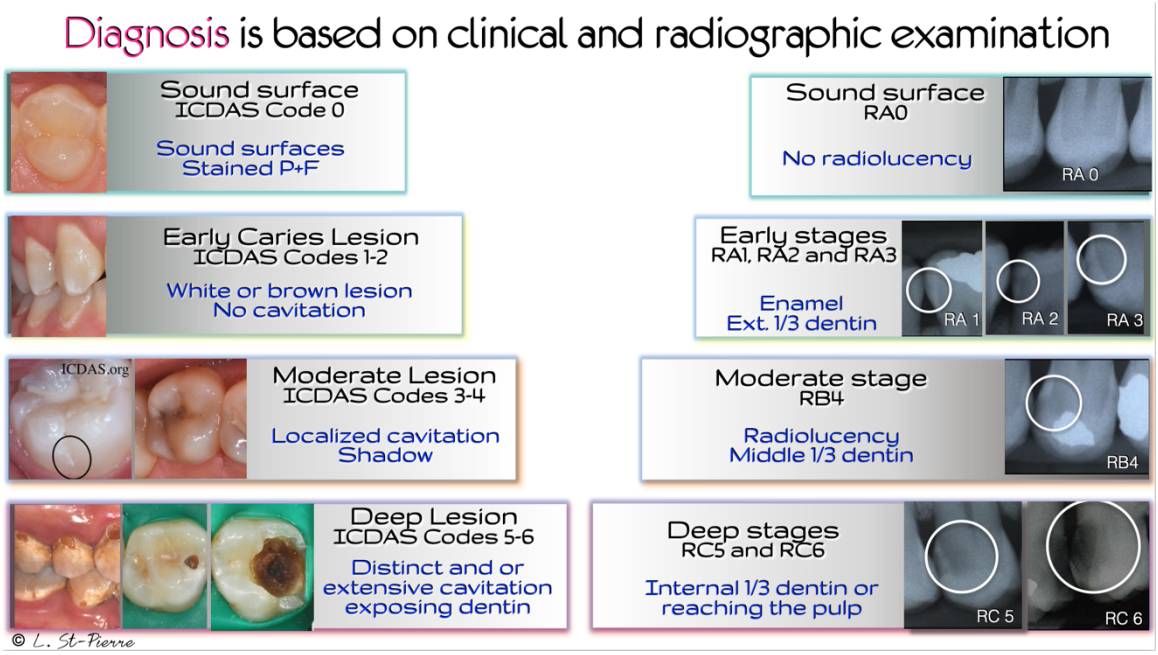
Direct Restorations
Back to Basics :

Diagnosis and Appropriate Management:

The diagnosis is a synthesis of clinical findings and radiological interpretation. Caries risk assessment is an integral part of the treatment planning and is crucial for prevention.



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Treatment

Active Lesions :

- Early active lesion : Non operative approach by remineralization (High fluoride toothpaste twice a day + fluoride varnish 5% NaF (or Clinpro Clear) q 3-6 mo) or lesion arrest (resin infiltration, sealants);
- Moderate active lesion : Conservative restoration (or non operative treatment such as SDF);
- Deep active lesion : Pulpal and periapical diagnosis are necessary including vitality tests and periapical radiograph. In case of normal pulp or reversible pulpitis with no apical pathosis: Selective caries removal + conservative restoration may be planned. Sound margins are mandatory (enamel, DEJ and periphery for an optimal seal) and ideal isolation should be achieved with a rubber dam.

For early lesions (especially those slightly exceeding the DEJ – RA3), the decision to restore should be based on caries risk factors and the probability of progression, not only on the simple presence of a lesion.

Inactive lesions:

Inactive lesions do not require a treatment, but they do require monitoring.

Caries Risk Assessment:

Caries risk assessment and management of risk factors are essential to clinical judgment and to patient care (remineralization/prevention). Caries risk must be evaluated and controlled to prevent new caries lesions and the progression of existing lesions.

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Posterior Composites - Indications :

Direct posterior composites may be preferred in several situations (conservation and cost), even in cases of extensive restorations. The failure rate of posterior composites is estimated to be 1.8% after 5 years and 2.4% after 10 years, influenced primarily by caries risk. Therefore, controlling caries risk must be an integral part of patients' management.

Direct vs indirect : Indications of Indirect Restorations

- Weakened tooth;
- Extensive restorations (large, deep, thin cusps, fractured cusps, worn/eroded dentition);
- Cuspal coverage required (vital or endodontically treated teeth);
- Cracked teeth (symptomatic to bite/cold or not) ref: Iowa staging index – Crack Teeth and Vertical Root Fractures : A New Look at a Growing Problem – 2022 Edition - AAE.)
- High occlusal stresses.

If the patient's caries risk is high, indirect restorations should be postponed until the disease is under control.

Direct Restoration

Frequent Problem and challenges – often related to the technique

- Postoperative sensitivity;
- Interproximal contacts and contours;
- Overhang;
- Voids and porosities;
- Deep margins;
- Marginal discoloration;
- Composite color change;
- Morphology;
- Efficiency;
- Contamination;
- Missing cusps;
- White lines;
- Multiple adjacent Class II restorations.

Technique – Step by Step :

1. Check occlusion first;
2. Proceed with proper isolation. Rubber dam placement promotes optimal adhesive strength and seal;
3. Prepare conservatively without retention (GV Black principles apply to amalgam preparations);
4. Limit preparation to the defect (selective caries removal in cases of deep active carious lesions);

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a. Divergent walls/bevels. Exposes the head of enamel rod, increasing adhesive strength and seal (reduces white lines);
b. Rounded internal angles;
c. Enamel preservation. Improves long-term adhesion and sealing;
d. Adjacent restorations recontouring as needed.



5. Use air abrasion using 50-µm aluminum oxide particles, while protecting the adjacent teeth:
    a. Cleans the preparation and removes biofilm at the margins;
    b. Improves visibility (residual composite, cracks, etc.);
    c. Does not create a difference in adhesion (however, it reduces the thickness of the smear layer and has been shown to improve adhesion with two-step self-etch adhesives, e.g., Clearfil SE).
6. Place the matrix;
   The profil/contour is very important and has an impact on gingival and parodontal health (food impaction, inflammation, etc.) and patients' satisfaction. Using sectional matrices and rings help to obtain ideal contours and strong contact points.
    a. Wedges are used to seal the matrix. It is the ring that provides tooth separation.
    b. Wedges should be tried first, before placing the matrix. In this regard, "pre-wedging" is very useful. Insert the wedge into the most opened embrasure. It should completely fill the embrasure from the buccal to the lingual (or the opposite) and gingivo-occlusally. If this is not possible, place one wedge buccally and another wedge lingually. Adjust the wedge(s) as needed if it encroaches on the contact area.
    c. Matrix selection: measure the height from the gingival level to the marginal ridge of the adjacent tooth. The matrix should ideally extend about 0.5 mm above the marginal ridge of the adjacent tooth and seal the gingival margin.
        - A matrix that is too tall compromises ideal contours and placement of the marginal ridge at the same level as the adjacent tooth;
        - The matrix should extend sufficiently below the gingival wall to reduce the risk of the matrix slipping into the preparation, which would result in an under-contoured restoration;
        - In cases of deep margins, consider margin elevation (technique described below);
        - When sectional matrices cannot be used (too many missing walls), pre-contoured matrices (e.g., Palodent 360 [Dentsply], Convexi-T [Clinician's Choice], Dixieland [Waterpik], etc.) help to achieve a more ideal contour. Avoid using Tofflemire bands for posterior composite restorations, as they tend to produce flat contours and weak, occlusally positioned contact points.
    d. Teflon tape may be used to improve gingival matrix sealing, while ensuring that the final shape and contour are not altered.

ADHESION :

Success depends on adhesion, on rigorous technique, and on proper isolation.

- Dentin Vs Enamel;
- Enamel bond strength : Head > side of enamel rods;
- Dentin bond strength : Superficial > deep dentin.

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Immediate Dentin Sealig (IDS) + Flowable Composite (Resin coating/Biobase)

Description

For indirect restorations, the technique involves performing adhesion to dentin immediately following preparation (before taking the impression). The addition of a thin layer of flowable composite then creates a "biobase" which allows for optimal polymerization. Several adhesives, particularly those with no or low filler content (e.g. universal adhesives), have a very thin adhesive film which may be even thinner than the oxygen inhibited layer (<40 um). The addition of a flowable composite would significantly increase the tensile strength of unfilled or lightly filled adhesives, particularly universal adhesives. For direct restorations, the technique is the same but includes enamel. Applying a thin layer of flowable composite also helps to achieve proper gingival seal obtained with the matrix.

Technique :

1. If using an etch-and-rinse adhesive, etch enamel (20s) first followed by dentin (5-15 s) with orthophosphoric acid. If a self-etching system is used, etching dentin with orthophosphoric acid should be avoided, while etching enamel is recommended.
2. Apply primer/adhesive with vigorous scrubbing for 30 seconds and gently evaporate solvents until no movement of the solvent is noticeable. Repeat if the surface is not shiny;
    a. Use a dedicated air syringe or check on a mirror surface that no water is coming out of the air nozzle before evaporating the solvents to prevent any contamination;
    b. In general, this step can take several seconds depending on the quantity of adhesive placed... 3-5 seconds are insufficient;
    c. Avoid dispensing the primer/adhesive in advance as this may cause premature solvent evaporation.
3. When using a total-etch 3-step or self-etch 2-step adhesive (e.g.: Optibond FL or Clearfil SE or Clearfil SE Protect), apply a thin layer of hydrophobic resin. Avoid eliminating excess using an air stream since it may create a layer of variable thickness (pooling in the internal angles and thin on the surface). Instead, remove excess in a clean, dry gauze and repeat the operation;
4. Light-cure;
5. Apply a thin layer of highly filled flowable composite (~0.5mm) on dentin and on the gingival margin to increase the seal obtained with the matrix;
6. Light-cure;
7. Place the composite.
   Centripetal + snowplow technique (a minimal amount of uncured flowable composite followed by conventional composite) - Transform a Class II into a Class I. This approach allows optimal insertion, reduces voids and porosities, increases efficiently and promotes ideal morphology while minimizing stress and the need for finishing.
   1- Restore the missing cusps first;
   2- Continue with the marginal ridges;
   3- Complete with the occlusal surface (a 1-mm horizontal layer first, followed by oblique layers for the cusp inclines).

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Bulk-fill composite may be used to increase efficiency, ideally with the centripetal technique to optimize proper anatomy. Although bulk-fill composites improve efficiency, they must be used with strict attention to technique.

- Quality of the curing light unit;
- Adequate curing from the occlusal, buccal, and lingual surfaces to ensure optimal conversion rate;
- Avoid porosities or voids in critical areas;
- Usage according to manufacturer's instructions: measuring the depth of the preparation before proceeding.

8. Finishing and polishing including occlusal adjustments.

Deep Margin Elevation:

Deep margins may require crown lengthening with some risk of compromising the attachment level and exposing the furcation. An alternative is to relocate the gingival margin supragingivally to facilitate isolation, adhesion, contours and interproximal contact.

Steps :

1- Matrix selection

Seal is essential as well as emergence profile. Typically, placing a wedge subgingivally is difficult/impossible. However, the margin must be sealed (no rubber dam or tissue between matrix and tooth);

2- Reprepare/clean gingival margin before adhesion to promote optimal seal (air abrasion or Katana Cleaner or diamond tip on an ultrasonic handpiece)

3- IDS: proceed with the adhesive technique as described above followed by a thin layer of flowable composite;

4- Apply composite resin:

Conventional preheated composite or highly filled flowable composite or bulk fil flowable. If the thickness of required material is >1.5mm, preheated conventional composite is preferred. For patients with a high caries risk, a restorative RMGI may be used followed by the adhesive procedure and composite placement (open sandwich technique).

5- Remove excess

Check with dental floss that can shred to indicate the presence of an excess.

Deep margin elevation is compatible with periodontal health if restorations are well adapted and polished. Although promising, more clinical studies are necessary.

Back-to-Back Restorations

Challenge

Anatomy/ideal contours;
Proportions and width of each teeth reproduced;
Strong interproximal contact;

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Technique :

Restoring one preparation at a time often creates a proportion issues in which one tooth becomes wider than the other;
An ideal and more efficient alternative for proper contours is to place both matrices at the same time and restore one adjacent marginal ridge at a time, removing one matrix before proceeding with the adjacent restoration. This approach can be applied to multiple adjacent teeth for greater efficiency.

Contamination

Importance of rubber dam and meticulous isolation.

There is no doubt about the importance of a rigorous technique. But what should be done if, despite all efforts, contamination occurs? Based on the evidence, my philosophy/preference is the following:

- Contamination during etching: rinse and continue;
- Contamination after etching and before adhesive polymerization: rinse, dry and repeat the procedure;
- Contamination after adhesive polymerization: rinse, re-etch (optional, but it is my preference), dry and re-apply the adhesive.

Repair

For a localized and limited defect, repair may be an option.

Steps to repair composite and amalgam restorations:

1. Preparation;
2. Air abrasion;
3. Often recommended: application of silane (composite) or MDP (amalgam)
   A universal adhesive containing MDP and silane may replace this step and the next one;
4. Adhesive procedure;
5. Composite.

Light-curing

The quality of the photopolymerization is important as it influences the degree of conversion (amount of residual monomers), shade stability, bond strength, material properties (wear and fracture resistance) and bacterial adhesion to the restoration.

• Technique: The tip must:

a. be parallel to the surface;
b. be as close as possible to the surface;
c. cover the entire surface. If not possible, superimpose multiple cycles.

- Equipment
  a. Use high quality light-curing units;
  b. Test Regularly test the light curing units with certified radiometers.

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Longevity

Success depends on several factors including the prognosis of the tooth, the patient (caries risk, hygiene, parafunctions, dynamics of the oral environment, etc.) and also the operator! In adhesive dentistry, rigorous technique is essential. Quality cannot be achieved without optimal isolation and meticulous use of proper materials.

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