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A clean surface is the first prerequisite: an interview on the cementation of partial restorations.

Interview with Prof. Dr. Marcio Vivan Cardoso, Belgium

The shift towards partial restorations, which are less invasive than full crowns, has become possible because of advancements in dental materials. As a result, luting procedures gained importance and the focus on them increased. Prof. Dr. Marcio Vivan Cardoso explains the importance of the luting selection and pretreatment procedures.

1. In which cases can you lute conventionally and which cases require adhesive luting?

Prof. Vivan Cardoso: First, we need to understand the difference between conventional and adhesive cementations.

Conventional cementation is mostly done with a glass ionomer-based luting agent and relies on the mechanical retention of the indirect restoration on the tooth preparation. Main advantages are related to its less sensitive technique and the protection it offers to the tooth substrate against secondary caries. Glass ionomers do not require the use of rubber dam or complicated adhesive procedures while providing an excellent sealing ability and fluoride release against secondary caries.

Adhesive cementation is done with a resin-based luting agent and assures

the bonding of the indirect restoration when its mechanical retention on the tooth preparation is not optimal, as in the case of onlays and veneers, for example. Main advantages are related to the ability to bond to both tooth and restoration and the good aesthetic results it offers.

The choice between a conventional and an adhesive cementation relies completely on the evaluation of the clinical case.

As said before, we opt for a conventional cementation when the design of the tooth preparation is retentive enough so that no extra adhesion is needed. It is also preferred in case isolation with rubber dam is not possible during the luting procedure - glass ionomers are more moisture tolerant - or in case of patients with high caries risk because glass ionomers may prevent secondary caries.

On the other hand, we opt for an adhesive cementation when the design of the tooth preparation is not retentive enough, as in the case of onlays. It should also be preferred when a more translucent restorative material is used to obtain a more aesthetic result. Glass ionomers are more opaque, may shine through the restoration and may spoil the aesthetics in these cases.

2. Regarding onlay and overlays, what are the general recommendations regarding the luting selection?

Prof. Vivan Cardoso: With the trend towards minimally invasive dentistry, we tend to preserve as much tooth structure as possible. After removal of old fillings, carious tissue and unsupported enamel, the remaining tooth structure will determine the preparation design, which can include a combination of the so-called inlays, onlays and overlays. We call this more flexible preparation design 'partial crowns'.

Because preparations for partial crowns do not provide mechanical retention, we need to count on the adhesive ability of the luting agent to bond it to the dental abutment. Therefore, the only choice in this case is to use a resin-based luting agent that will bond both to the tooth structure and the indirect restoration, being it a dual-cure self-adhesive cement, a dual-cure adhesive cement or a light-cure adhesive cement.

3. In dentistry, there is a clear trend towards universal luting agents which can be used in self-adhesive mode or with an additional tooth primer. In your opinion, is there still a use for tooth primers?

Prof. Vivan Cardoso: Self-adhesive cements bond to enamel and dentine without the use a separate adhesive

agent. In some cases, it even bonds directly to certain restorative materials like zirconia without the use of a primer. This makes its use quite attractive as it renders the procedure faster and less technique sensitive. However, the use of a separate adhesive - or tooth primer - still provides extra bond strength and should be used whenever the preparation is not retentive enough. This is the case in most of the preparations for partial crowns.

4. G-CEM ONE is such a universal luting agent which comes with an optional primer for the tooth surface, the G-CEM ONE Adhesive Enhancing Primer. Alternatively, you can also use G-Premio BOND instead of G-CEM ONE Adhesive Enhancing Primer to optimize the bond strength. Which one would you prefer to use and why?

Prof. Vivan Cardoso: Studies are showing that there is no difference in the bond strength provided by G-Premio BOND and G-CEM ONE Adhesive Enhancing Primer in combination with G-CEM ONE. That being said, I would prefer to use the universal option – by that I mean G-Premio BOND - which can be used in virtually any adhesive procedure. This reduces my arsenal of materials besides simplifying the decision-taking process: one single bonding agent for all my adhesive procedures.

It should be taken into account, however, that G-CEM ONE Adhesive Enhancing Primer contains a touch-cure accelerator that initiates its polymerisation when in contact with G-CEM ONE. G-Premio BOND does not contain such accelerator and should therefore be air-thinned with strong air-pressure for 5 seconds and light-cured before cementation. Its film thickness is very low and will therefore not interfere with the seating of the indirect restoration.

5. How should the tooth be prepared and disinfected before cementation?

Prof. Vivan Cardoso: The first principle for an effective adhesion is a clean surface. Therefore, one should ensure that all kinds of contaminants like saliva, blood, plaque or rests of temporary cement are removed prior to the cementation procedure. This can be done with an abrasive paste like pumice and water or, even more recommended, with a chair-side sandblaster which will also remove the smear layer of the tooth surface, allowing for a better interaction of self-adhesive luting or bonding agents with the tooth hard tissues.

Thereafter, dentine and enamel should be etched with phosphoric acid at 37% in case an etch-and-rinse adhesive is used. When using self-adhesive or universal bonding agents, selective enamel etching is recommended.

In case of glass-ionomer cements, a conditioner based on polyacrylic acid like GC Dentine Conditioner should be used. It removes the smear layer and increases the energy of the tooth surface, leaving it more prone to interact with the GI cement for an improved adhesion and sealing.

6. Are there any pitfalls to avoid/ materials that are contra-indicated?

Prof. Vivan Cardoso: Disinfection or cleaning solutions should be avoided as some of them may negatively affect the bond strength of the adhesive to the tooth surface. Hydrogen peroxide, for example, releases oxygen which inhibits the polymerization of resin-based materials and should therefore be avoided.

Alternatively, cleaning solutions containing chlorhexidine could be used prior to adhesive procedures. Besides its disinfecting properties, chlorhexidine seems to inhibit the action of metalloproteinases; host-derived enzymes responsible for the degradation of the bonding interface over time.

Temporary cements containing eugenol are also contra-indicated in case a resin cement is planned as a definitive luting agent. Eugenol is well known for hindering the polymerisation of resin-based materials.

7. Are the luting steps different in case immediate dentine sealing (IDS) was applied in the first appointment?

Prof. Vivian Cardoso: That is a good question, since IDS has been broadly recommended by opinion makers around the world. In this case, all care needed for a good bond to dentine has already been taken in the first appointment, as described above. In the second appointment, when the adhesive luting procedure is carried out, it is recommended to first clean the surface with a chair-side sandblaster with 37 to 50 µm aluminum oxide powder. This will not only remove impurities of the adherent surface, but also create micro-irregularities which will be penetrated by the new bonding agent creating the so-called micro-mechanical retention. Then, the exposed enamel is etched with 37% phosphoric acid and the bonding agent is applied as usual on the whole preparation according to the manufacturer's instructions.

8. What is the most important point when preparing the restoration?

Prof. Vivian Cardoso: Again, the first

	Substrate	Glass ceramics	Zirconia and alumina	Metal	Hybrid ceramics	Composite
1	Micro-mechanical retention	Etching with 5-9% HF for 60s or 20s ¹	Sandblast ²	Sandblast	Sandblast or etching with 5-9% HF for 60s	Sandblast or etching 5-9% HF for 60s
2	Chemical adhesion	Silane	Phosphate monomer (MDP)	Phosphate monomer (MDP/MDPT)	Silane	Silane
3	Luting cement	Resin-based cement				

Fig. 1: Protocol for preparation of the adherent surface of different indirect restorations.

Notes:

- ¹ Glass ceramics should be etched with 5-9% hydrofluoric acid gel for 60 s in case of feldspathic ceramic and for 20 s in case of lithium disilicate (like Initial LiSi Press (GC), Initial LiSi Block (GC), IPS e.Max (Ivoclar Vivadent)).
- ² Correct parameters for sandblasting of zirconia surfaces: Sandblast with <50 µm Al₂O₃ particles with pressure between 1 and 2.5 bar (0.1 and 0.25 MPa) at a distance of 10 mm for 20 s.

principle of adhesion should be considered: the adherent surface should be completely free of impurities before bonding.

Contamination of indirect restorations with oil after chair-side milling of pre-fabricated blocks, for example, could hinder the action of etchants. Therefore, the restoration surface should always be cleaned. Alcohol could be used for this purpose, eventually in ultrasonic bath if available.

Further preparation when using resin-based luting agents depends on the material of which the restoration is made. Each one of them require a specific protocol, although the basic principle is the same for all materials. The first step is to create porosities on the adherent surface for micromechanical retention, which can be achieved by etching or sandblasting. Second step is to apply a primer that will provide chemical adhesion between the restoration and the luting cement.

It is noteworthy that, in the case of adhesive cementation of zirconia and metal restorations, possible

contamination with blood and saliva cannot be simply rinsed away with water, alcohol or etching gels (specially not phosphoric acid gel). Both blood and saliva bond strongly to zirconia and metal oxides, and can only be removed by new sandblasting. Alternatively, cleaning solutions like Ivoclar Vivadent's Ivoclean can be used.

9. How do pre-treatment recommendations differ between materials? (Hybrid Ceramics/ Lithium Disilicate/ Zirconia)?

Prof. Vivian Cardoso: Each one of them requires a different protocol, which must be followed strictly, as explained in Figure 1.

10. And what about restoration primers? In which cases are they needed?

Prof. Vivian Cardoso: Restoration primers are always needed when an adhesive cementation protocol is followed. As said before, it promotes chemical bonding between the restorative material and the resin-based cement. As an exception, the primer can be excluded when bonding zirconia and metal with luting cements

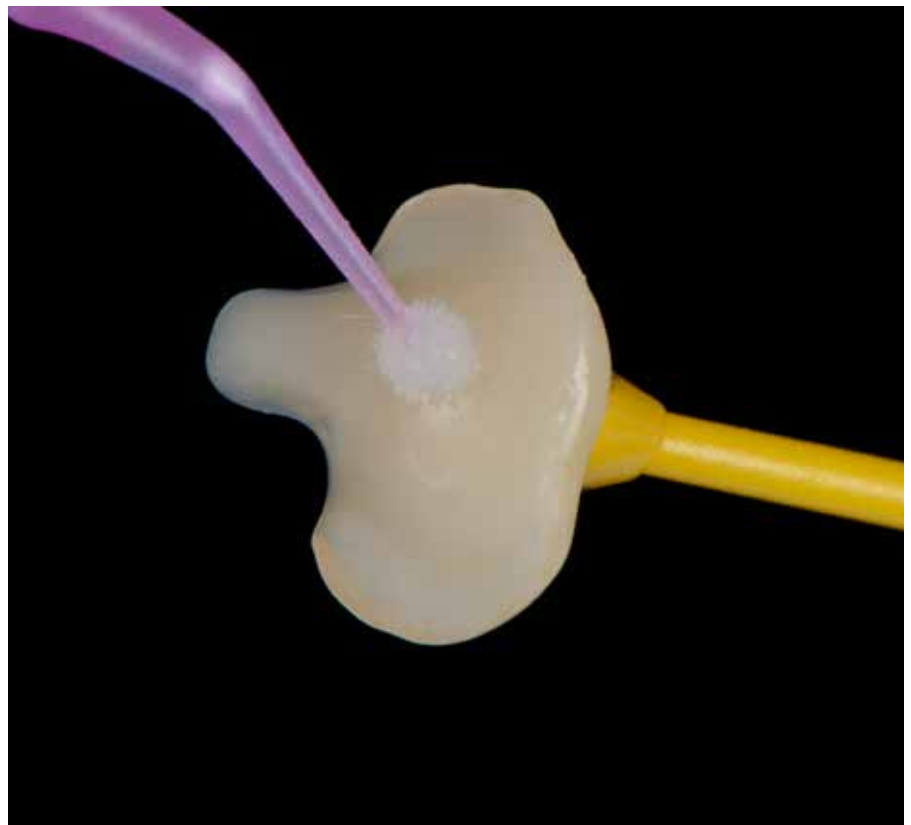
that contain phosphate monomers (MDP) in their composition, such as in the case of G-CEM ONE. In case of doubt, a restoration primer can always be used.

11. In your opinion, what makes G-Multi PRIMER stand out from other restoration primers?

Prof. Vivian Cardoso: G-Multi PRIMER is a universal primer that contains silane, phosphate monomers - MDP and MDTP - and methacrylate monomers. Therefore, it can be used on the preparation of all restorative materials, being it composite, hybrid ceramic, ceramic, zirconia or metal. The literature has been showing that universal primers do perform well in bond strength tests. Therefore, I do not see a need for separate primers nowadays.

12. Many universal bonding agents claim they can be used to bond to the tooth as well as to the restoration. Would you rather use an all-in-one product or do you still prefer a separate restoration primer and why?

Prof. Vivian Cardoso: Universal bonding agents seem to be performing well but it is still recommended to use a separate silane-containing primer, like G-Multi-PRIMER, when preparing the surface of indirect restorations made of ceramics, composites or hybrid-ceramics. The silane coupling agent seems not to be stable enough when incorporated in the composition of universal bonding agents, thus adhesion to ceramic and composite-based materials will become less durable.



Application of the restoration primer