Cementation is a crucial step in the process of ensuring the retention, marginal seal and durability of indirect restorations. Cementing procedures are either adhesive or non-adhesive. Adhesive cementation involves the use of an agent to promote bonding of the restorative material to the substrate; it is a combination of adhesive chemical bonding and micromechanical interlocking. Non-adhesive cementation involves the use of a luting agent to fill the space between the restoration and the natural tooth and relies solely on micromechanical retention. The clinician must have a good understanding of metal alloys or ceramic type to determine whether a restoration should be cemented adhesively or non-adhesively. Choosing and applying the appropriate surface treatment and cementation procedure will contribute to long-lasting restorations.

A Blog by Giuseppe Marchetti and Giovanna Orsini

BONDING PROCEDURES IN INDIRECT POSTERIORS

CEMENTATION OF METAL RESTORATIONS

The cementation of metal or metal-ceramic restorations can be performed with conventional cements (zinc phosphate, glass ionomers, resin-modified glass ionomer) or with a chemical polymerization resin cement. In using chemical polymerization composite cements, base-metal alloys can increase adhesive bond to metal and metal-ceramic restorations due to the formation of a oxides layer capable of reacting with cement acid groups (1-2). Silanization of surfaces of silicate metal (Rocatec, 3M ESPE, St. Paul, Minnesota, USA; and Silicoater, Heraeus Kulzer, Hanau, Germany) can further improve the micromechanics interconnection and chemical covalent bonds (3). The adhesion that is reached is a micro-mechanical type and some surface treatment is generally required to increase the adhesive bond. However, the noble alloys offer a lower adhesion capacity compared to other materials, such as vile alloys.

CEMENTATION OF GLASS CERAMICS RESTORATION

This ceramic is highly esthetic, biocompatible and resistant to abrasion and compressive forces. It must be
cemented to the prepared tooth adhesively to increase the restoration’s resistance to fracture (4). Non-adhesive cementation is not indicated for feldspathic ceramic (5). The clinician must condition the glass feldspathic ceramics before performing adhesive cementation. The clinician etches the ceramics’ internal surface with a solution of hydrofluoric acid (HF) 5% for approximately two minutes (6), to increase surface area, micromechanical retention and to clean surface for adhesive cementation. Then the surface must be silanized (5-6). Adhesive cementation to enamel or dentine requires the use of an adhesive system, followed by application of a resin cement (7). Adhesive systems can be either self-etching or total etching (8). Resin cements can be cured via light, chemicals or a dual process combining the two. Light-polymerized resins are recommended when the ceramic is thin and fairily translucent (9). Dual-polymerized resin cements are indicated when the ceramic is too thick or too opaque to allow the light transmission (5).

CEMENTATION OF ALUMINUM OXIDE CERAMICS

Adhesives protocols applied with success to the silica-based ceramics cannot be used for the aluminum oxide ceramics, because the etching with HF acid does not appear to increase the retention of resin cements (10). These ceramics can be cemented conventionally rather than adhesively. Long-term adhesion studies recommend blasting (with particles of Al2O3 from 30-50 µm at 2.8-3 atm) to roughen the surface for micromechanics adhesion (11-12). Coating the ceramic with tribochemical silica and air abrading of internal surface, followed by application of 10-methacryloyloxydecyl dihydrogen phosphate before using resin cement (chemical or dual cured resin cement), improve the bond to this type of ceramic (13-14).

CEMENTATION OF ZIRCONIA CERAMICS

Zirconium oxide ceramics are characterized by the absence of glass in their composition. These ceramics possess high toughness and strength. Polycrystalline ceramics most often are cemented conventionally but can benefit from adhesive cementation. The use of low-pressure air abrasion with aluminum oxide particles or tribochemical silica application followed by application of an adhesion-promoting agent increase the bond-strength of resin cements (chemical or dual cured resin cement) (15).

It is imperative that the clinician achieve affective isolation to keep the field free of saliva and other contaminants when using adhesive cements (16). Field isolation in not required in the case of zinc-phosphate and glass-ionomer cementation, but it is necessary the fluid and saliva control.

CEMENTATION OF COMPOSITES

The bond between composite restoration and resin cements is very high and allows to have good levels of adhesion. So we can reach a very good adhesion even with indirect restorations. To have it one of the most effective protocols is that one that provides sandblasting the inner surface of the restoration with aluminum oxide for about 10 seconds, silanization (possibly activation with hot air or in special ovens of the silane), drying, then the application of a layer of bonding resin and at the end the luting procedures with a resin material that could be a dual composite cement or composite photo-polymerizable (generally pre-heated in a special oven) (17-18).

Case 1:
New rubber dam isolation.
The build up of the endo treated tooth is performed with a fiber post and composite.
Details of the build up of 4.5
Final curing with glycerin gel to inhibit the presence of oxygen.
I.D.S. and build up of 4.6 4.7 are performed and preperationss are done for indirect restorations under rubber dam.
The three restorations on the plaster model.
Details of the composites restorations
Note the presence of the stitches, no troubles in placing the preps 3 mm far from the bone crest.
Details of the new isolation.
Try in of the composite restorations.
The contact areas fit well.
Bonding procedures: Total etching for 15 seconds, rinse for 15 seconds, gently dry.
Apply the primer for 10 seconds (if needed with the exposure of the dentin) and apply the bonding for 20 seconds with a brush, gently dry it and cure for 20 seconds.
With a preheated composite the restorations are bonded.
Details after the bonding procedures.
Details after rubber dam removal.
One week later, shape and morphology look good and the restorations are well integrated too.

Case 2:
In a different clinical case the same procedures, I.D.S. and build up.
An ultrasonic tip is used to refine the cavity shape.

A retraction chord is placed to take the impression.
The composite restoration is done indirectly by the laboratory technician.
And it's bonded under the dam.
Details of the bonding procedures.
One week after, we have a proper integration.

Case 3:
Sometimes we can perform posteriors in semi direct ways.
After the preps an impression is taken.
A silicon model is done with two different types of silicon.
Details of the two different types of silicone.
A lego base is used.
The blue one is for bite registration, we use it for the base of the model.
The brown one is more flowable and it fits the need of accuracy.
We run the separation of the teeth.
A wax up is done.
A diaphanous silicon index is build over the wax.
Then the composite is pressed into it.
Details before finishing and polishing.
The final restorations before bonding procedures.
The isolated field before bonding, showing all the sound margins, accessible to the probe for excess removal.

The partial restorations cemented, control after 1 month.

Case 4:
Full indirect restorations can be done by the Lab too. Wax has been used as a spacer.
A dentin to start the layering.
All is done free hand in this technique.
The dentin mass defines the shapes.
With an enamel the Overlay is ended.
Some stains to increase the depth.
The final result before bonding procedures.

Case 5:
Old fillings that needed to be removed.
Isolation and removal of the fillings and secondary decay.
Build up and I.D.S.
Layered Lithium Disilicate Onlays.
The bonding procedures are performed with a dual curing composite cement to be sure of a full conversion of the material. Due to the opacity of the inner ingot a preheated composite is less recommended in this case.
PTFE (teflon) to avoid the contamination of the adjacent surfaces and silicon tip to fit the restoration and make it seat till the finishing line.
Final aspect after finishing and polishing procedures.

Case 6:
With indirects, in some cases we can use new flowable composites which are filled at 69-70% in weight, for bonding procedures, this can be useful to avoid the usage of special ovens to heat the composite (which is still the gold standard in bonding composite indirect restorations).
Try in.
This flowable materials (due to their fillers dimension and percentage) are easy to clean and don’t drain. They are close to normal composites in terms of fillers (69-70% against 80% in weight).
Details after the removal of the excess.
We are testing the cementation of indirect composite restorations with bulk flowable composites.

The results are encouraging because of the low stress specifications of these materials.
A quick finishing and polishing.
No macro differences if compared with preheated (or not) composite in bonding procedures.

Case 7:
Composite overlays are always bonded under rubber dam. We can use transparent matrices instead of PTFE to control the excess.
An etch and rinse 3 steps adhesive is used.
Details of the bonding appliance.
The overlay is bonded with preheated composite in a oven for 20 minutes at 55° and the excess is removed with the Fissura Instrument (LM Style Italiano kit).
We cure each surface at least for 180 secs.
Details after the bonding procedures.
Immediately post op.
After one week, we can see a good integration.

Case 8:
Eventually there are situations in which bone resection (osteotomy and osteoplasty) is necessary in order to achieve a proper marginal seal, bringing the cervical margins at the right distance from the alveolar bone crest (3mm, minimum 2mm). We have to replace old crowns with new ones.
In this case in the same session of osteosurgery resection, the build up are performed with a glass fiber post.
The stitches are in place for 15 days then after their removal the preliminary preps of the two overlays with supragingival margins are done under rubber dam, leaving the cervical margin at 3 mm from the bone crest in order not to invade the biological width neither now nor when there will be tissue rebound.
Details of the preps.
After 15 days we have a good healing, tissues are not perfect and will grow in next 6 months. The acrylic provisionals are done by the lab.
Details of the provisionals.
It's essential to maintain supragingival margins if we want to work on the tissue before six months. Conversely, in those cases where it is required to place subgingival margins after osteosurgery resection, we will need to wait for six months in the posterior and up to a year in anteriors to be able to work safely and take the final impression.
After the creation of provisional acrylic (preferred in extensive preparations) and their cementation we refer the finishing of the preps that will remain supragingival and polyether impressions at a distance of 3-4 weeks to get a good initial tissue healing.
Details of the tissue healing.
If we can isolate it with rubber dam and see it all in preparation we succeed in bonding most of the time.
Details of the new isolation.
Monolithic lithium disilicate (not layered) overlays are first tested and then cemented with adhesive technique using a dual resin cement that makes us feel more confident because the opacity of the ingots is an obstacle to the light transmission.
Details of the fitting.
Details of the fitting.
So we believe that there should also be a component with self-curing cement with ceramics instead of traditional composites which are perfect to bond composites restorations.

After sandblasting with aluminum oxide the inner surface of the restoration and etching it with 5% or 9.6 hydrofluoric acid for 20 seconds, the acid is rinsed and the overlays are put in alcool at 96% for 5 minutes to remove the precipitates. Then the silane is applied and the bonding too into the inner surface of the restorations. We bond the restorations and remove the excess.
After rubber dam removal, tissues are a bit damaged by the dam.
Details of the restorations just bonded.
Details after two weeks.
The control after 2 weeks showed good tissue healing and integration of the restorations.
Preoperative view: old fillings need to be replaced.
Proper isolation with rubber dam.
After the removal of the decays and one endo treatment.
A crown lengthening was performed in order to have the right distance between the cervical margin and the bone crest (biological width).

CONCLUSIONS:

We have to use dual cements when the restoration is not easily penetrable by the polymerization light. Among the dual cements those who do not self-polymerize in less than 6 minutes are preferred: this in order to reduce any problems caused by composite shrinkage.

We can use light-cured composites when the indirect restoration is easily crossable by the polymerization light and it is of adequate thickness (over 7-800 micron).

Finally we can use flowable composites when the restoration is easily crossable by the polymerization light but is very thin (less than 7-800 micron) (19-20-21).

REFERENCES


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