INTRODUCTION

In recent years, the progress made in operational techniques and the continuous improvement of the physical, chemical and mechanical characteristics of reconstruction materials have made it possible for dentists to focus their attention on the constant pursuit of the best aesthetic restoration results. Patients asking for aesthetic restorations want them to integrate with their natural teeth. Dentists, therefore, should not only rely on scientifically validated techniques to restore dental biology but also be guided by their sense for aesthetics in order to reproduce the polychromatic and anatomical characteristics of teeth, so that restorations are ultimately unnoticeable.

In philosophical terms, the word ‘aesthetics’ indicates the “science of beauty, liberal arts and gnoseology, closely related to logics”, i.e. the beauty and outward appearance of something. In dentistry, a restoration is aesthetic when it best matches the color, shape and function of what it replaces.

The physiological behavior of teeth, in fact, is the result of a close interaction between mechanical, biological, functional and aesthetic properties. This is where composite inlays come into play.
The current composite resin formulations have improved the characteristics of materials through the size, shape, concentration and type of filler used.

Shrinkage caused by curing has been reduced while tensile and flexural strength as well as resistance to abrasion and long term color stability have increased.

Add to all this the benefits of high power curing lights, in combination with heat and pressure, that improve the quality of the polymerization reaction.

In recent years, two factors, at least, have contributed to the development of aesthetic inlays and onlays:

- continuous innovation in enamel and dentin adhesives, which provide a high bond strength of the composite to dentin and enamel
- increased and constant request for aesthetic restorations on the part of patients.

MATERIALS AND METHODS

Composite offers several advantages: it does not require large thicknesses, it provides a good marginal precision and the possibility to correct shape and color, it is easy to repair, and lab
procedures are not complex. Indeed, it (almost) matches several of the most significant qualities of ceramic materials (resistance to wear, long-term aesthetics, high stability) while offering remarkable advantages in terms of lower investment and less complex laboratory procedures, the possibility to perform intraoral corrections and repair, a more conservative cavity preparation, effective polishing, and a lower frailty and tendency to fracture. In particular, the modulus of elasticity (a body’s rigidity or flexure), resilience (the ability to absorb stress up to the breaking/failing point) and fatigue strength (rupture after dynamic stress is applied) are the mechanical properties that, unlike with ceramic systems, make it possible to work with lower thicknesses of composite material, which is also less subject to breakage.

Indirect composite restorations such as inlays, onlays and overlays can be made with both dental office and laboratory composites, without distinction.

Composite has three phases: matrix, filler and bonding agent. The most commonly used organic phase in composite materials mainly consists of Bis-GMA and/or UDMA together with other resins with a lower molecular weight. Fillers are those substances that are added to increase the strength...
of the resin:
- macro particles (8-25 microns)
- fine particles (1-8 microns)
- micro particles (0.04-0.2 microns)

The composite used for this clinical case was Estelite Sigma Quick by Tokuyama Dental.

Estelite Sigma Quick is a light-curable and radiopaque, submicron-filled composite resin, containing 82% by weight (71% by volume) of composite filler and zirconia/silicate filler. Thanks to these filler particles, shrinkage caused by curing is reduced. Each inorganic particle in the composite is submicronic (average size of the particles is 0.2 µ, in a range from 0.1 to 0.3 µm) and this preserves brightness and resistance to wear to a very high degree. The monomeric matrix contains Bis-GMA and triethylene glycol dimethacrylate.

CAVITY PREPARATION

Knowledge of the fundamental principles of adhesive dentistry is a prerequisite when working with composite in order to obtain good levels of aesthetic-functional integration of the restoration and long-term duration.

Adhesive cavities do not foresee retentions, internal sharp edges
shall be avoided and a rounded cavity has to be prepared to facilitate the flowing of composite cement. When preparing the cavity for indirect adhesive restorations, the principle of maximum tissue preservation shall be observed and the shape of the cavity depends on the extension of the caries or the presence of pre-existing restorations to be replaced.

The clinical procedure includes two sessions: the first one to prepare and take the impression, and the second one to cement the composite restoration.

Ideally, cavity preparation entails that the lateral walls converge towards the bottom of the cavity by approx. 15-18 degrees, that minimum thickness is approx. 1.5-2 mm, that there is an approx. 2 mm wide isthmus, that the cavosurface angle is not beveled and that enamel prisms are regular. When the general design of the cavity is predetermined, as when replacing old restorations, the cavity preparation has to be adapted to adhesive techniques.

Adhesive restorations require a conical shape with clear-cut margins and the filling of any undercuts with composite material, in order to avoid excessively invasive preparations. After finishing the preparation, the dentinal substrate is properly treated to protect tooth vitality, if
any. Then, after removing the rubber dam, an impression is taken of both the arch to be rehabilitated and of the opposite arch, and the intermaxillary relationship is recorded with wax and face bow, which is what the dental technician needs to subsequently mount the casts on the articulator.

Preparations can now be provisionalised with light-curable Eugenol-free provisional cement.

CEMENTATION

At the cementation stage, the artifacts delivered by the laboratory have already been subjected to a post-polymerization cycle which, thanks to the combination of light, heat and pressure, provides the inlay with physical and mechanical characteristics which are absolutely superior to those of direct restorations.

The already sandblasted and silanized inlays are then cleansed and conditioned with an enamel-dentin adhesive. After removing provisional cement and placing the rubber dam, cavities are cleaned and cleansed so as to remove all residues of dental and cavity surfaces; congruity of artifacts is then checked and cementation procedure is started.
Cavities are sandblasted with particles having a size of 30 microns, at 2 bar pressure, for approximately 10 seconds; etching is performed with 36.5-37.5% orthophosphoric acid for approx. 40 seconds; cleansing with 0.2% chlorhexidine is carried out to inhibit metalloproteinase and after applying the primer/bonding agent (EnaBond, Micerium). A uniform layer of pre-heated composite (37-39 degrees C) is then placed into the cavity, after which the inlay/onlay is seated and kept in situ by exerting constant pressure. Excess cement is removed before its polymerization, and dental floss is used to remove it also from interproximal areas. Curing with UV radiation is performed on all sides for at least 2 minutes per side, while exerting constant occlusocervical pressure on the prosthetic artifact. Once curing is complete, coarse composite residues on the margins are removed and 40 micron diamond burrs and silicone trimmers are used for finishing. After checking marginal congruity, occlusion is also checked, followed by finishing and polishing. In another session, final polishing and glossing can be performed under a rubber dam.
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