

Dental restoration with composite materials in the posterior zone

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Abstract

The purpose of the present study is to highlight the aesthetic success and the short time needed for shaping the occlusal surface of the composite restoration by using a silicon putty matrix as well as the reduction of the marginal leakage and the increase in the quality of marginal adaptation in restorations performed using this method.

Material and method. The in vivo experiment consisted in rebuilding the functional and aesthetic autonomy of the occlusal surface of posterior teeth (which initially presented carious lesions) by using a silicon putty matrix. For this purpose, a spatula was used, carrying retentions and impression adhesive. The composite was applied in layers of maximum 2 mm in order to reduce the contraction composite shrinkage during curing. As soon as the last composite layer is applied the silicon putty matrix is set upon the surface in the right position. A low viscosity sealer is applied that penetrates the surface (Fortify, Itasca), in order to minimize microleakage and percolation. Minimum occlusal adjustments are necessary, yet they occur in very few cases.

The in vitro study was performed upon 25 extracted molars and bicuspid teeth which supported restorations with resin composite materials on the occlusal surface performed using the silicone putty impression technique. These were placed in physiologic solution at 37 °C for 24 h and afterwards minimally invasive cavities and classical cavities were performed using the Black rules. The teeth were separated into 2 groups: 15 for the minimally invasive method and 10 for the classical method.

Results and discussions. The operation time is reduced using this method, by eliminating the delicate shaping and finishing maneuvers (into solid material). Moreover, excessive finishing may increase the chances of damaging the composite. Due to the fact that most of the disadvantages presented by the posterior composites are frequently met in cases of large cavities, the silicon putty matrix is recommended for small restorations that present sufficient enamel for the bonding procedure and with a low risk of damage or fracture.

Once the experiment is over, the extracted teeth treated through the classical method (the Black rules) present a higher impregnation degree, proving that the marginal adaptation of the filling material to the cavity edges was not perfect.

The teeth treated through the silicon putty matrix, the impregnation is hardly visible, proving that from this point of view also this method is clearly more efficient.

Conclusion. The technique described ensures excellent aesthetic results and minimum occlusal adjustments are necessary. The teeth treated through the occlusal matrix method, the impregnation is hardly visible, proving that from this point of view also this method is clearly more efficient.

Key-words: silicon putty matrix, resin composite materials, percolation.

Introduction

Adhesive techniques and use of bonding led to an increase in the use of preventive restoration with resin composite materials in posterior restorations. The use of light curing composite materials meant a new step forward towards the direct restorations on the posterior teeth.

The bonding of the light curing composite

material is conditioned upon the thickness of the composite layer (maximum 2 mm) in order to allow the light to penetrate. Moreover, the light curing composite materials makes the contraction of the direct light source and the superficial area of restoration is most hard [1, 2].

During the classical restorations, because of the occlusal finishing and polishing, a significant

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portion of best material (superficial surface) is removed through the shaping procedure, thus reducing the quality of the restoration procedure.

Starting from these issues, we considered the possibility of creating an silicone putty matrix that would be used for better modeling the surface of the restoration, reducing the need for extra shaping and thus eliminating the above mentioned disadvantages.

Material and method

"In vivo" study

Following a thorough clinical and radiological exam, the portion that needs restoration is isolated in order to prevent saliva infiltration and consequent bonding problems. In case the occlusal surface presents deep pits and grooves, bonding agent (resin) is applied (without acid upon the enamel) – in order to create a more favorable occlusal anatomy (*fig.1*).

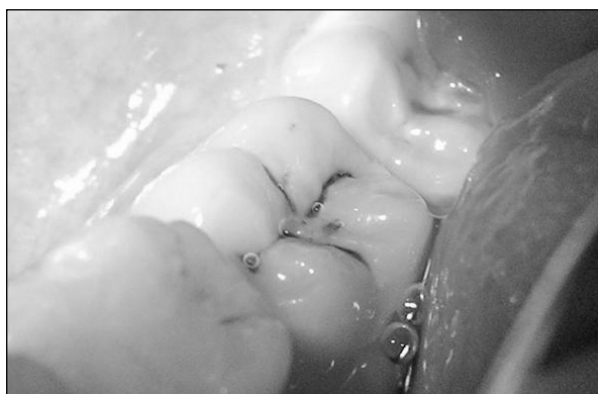


Fig 1. Cavity diagnosis

Retentions and impression adhesives are applied on a spatula (*fig 2*).

Then, an impression polyvinylsiloxane material is injected (Extrude™, Kerr, Romulus, MI, SUA).

Express impression material produced by 3M was used to perform this study.



Fig 2. Spatula carrying retentions.

The spatula is placed gently upon the occlusal surface, in the area that needs restoration, until the material bonds. All remaining from the impression are removed. The matrix is placed again to make sure it resents the necessary degree of stability.

The preparation technique described by Simonsens or Swift for preventive resin restorations is performed next [3]. Cavity lesions are removed sacrificing a minimum dental structure, using high-speed small rounded bur such as a 329 or 2 or diamond bur. No extension of the treatment in the pits or fissure in the non-cavity areas will be done and without sharp internal angles [4,5].

Within the deep cavities, where dentin is less than 0,5 mm thick, a thin layer of CaOH is recommended [5,6]

On the remaining dentin, a glass-ionomer cured cement layer (Vitrebond, Irvine) is placed, in order to release fluoride and to reduce percolation [1,2].

Phosphoric acid 37% gel (Scotchbond Etchant, 3M-ESPE) is placed on enamel for 30 seconds, rinse for 20 seconds, and dry with uncontaminated air with oil drops. A bonding agent can be now placed on the remained dentin.

Otherwise, a bonding agent (ProBond, L.D. Caulk) is applied and will be cured for 20 seconds. ProBond bonding agent strengthens remaining tooth structure while eliminating postoperative sensitivity.

The choice of composite in the posterior area is made upon the clinical performances.

For this study an cured nano-filled composite (Filtek Supreme, 3M-ESPE) was used because it has high wear resistance, it is radioopaque and filters the fluoride [7, 8]

The composite is applied in layers - no more than 2 mm - in order to reduce the bonding contraction and the consequent marginal gaps.

Each layer is cured for 40 seconds. For polymerization, a conventional quartz tungsten halogen light-curing unit (XL 2500, 3M ESPE, USA) calibrated at 500 m W/ cm² was used from a distance of 0.5 mm from its outer surface.

The matrix is lubricated (*fig.3*) with bonding adhesive in order to prevent sticking between the composite and the impression material.

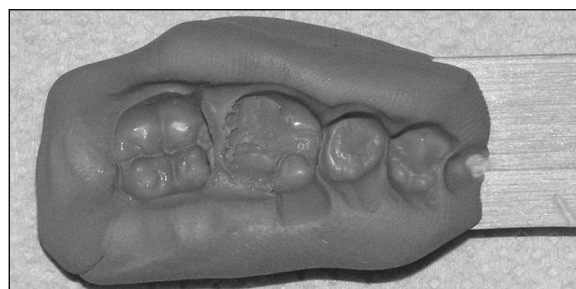


Fig 3. The impression lubricated with a thin bonding layer in order to prevent sticking between the composite and the impression material

Once the last layer of composite is applied, the silicon putty matrix is placed on top of the surface in the right position and the excess of composite are removed.

This procedure is reiterated until all excess is removed and composite is cured for 20 seconds. Restoration image is shown in *fig. 4, 5*.



Fig 4. The light cured of the composite restoration using the silicon putty matrix



Fig. 5. Final image

A face-penetrating sealant (Fortify, Bisco) is used, in order to reduce marginal leakage and percolation.

Minimum occlusal adjustments are still necessary, yet they are needed in very few cases.

In order to ensure the better results of the marginal adaptation since of percolation we performed study in vitro on the extracted teeth.

The study “in vitro” was performed upon 25 extracted molars and premolars supported restorations with composite materials on the occlusal surface performed using silicone putty matrix. These were placed in physiologic solution at 37°C for 24 h and afterwards standardized saucer shaped cavities were prepared in each teeth (2.0 mm depth and 1.5 mm diameter) using minimally invasive and

classical techniques (the Black rules). The teeth were separated into 2 groups: 15 for the minimally invasive method and 10 for the classical method.

Five types of restorative materials were used, each material being used on a certain number of teeth, as displayed by the table below (table 1):

Table 1. Materials and techniques used

Material	Occlusal modeling method	Classical method (Black rules)
Amelogen® Plus Ultradent Inc. Adhesive sistem (Single Bond)	5	2
Point 4 - Kerr Adhesive sistem (Single Bond)	5	2
Aelite™ LS Posterior (Bisco) Adhesive sistem (Single Bond)	5	2
Amalgam	-	2
Ketac™ Molar Easymix (3M ESPE)	-	2
Fortify sealing (BISCO)	2	

For modeling the teeth, we took the teeth impression before preparing the cavity. We used Express material, produced by 3M, and the technique used is the one previously described.

Once the teeth were prepared, according with the procedures described above, they were isolated in order to avoid lateral impregnation and immersed into methyl blue 1% for one hour (*fig. 6*).



Fig. 6. Immersing teeth into methyl blue 1%

Five teeth were treated with using the Amelogen® Plus occlusal modulation technique with the matrix and 2 teeth were treated using the classic method.

Restorations made with Point 4 – Kerr that used the occlusal modulation technique were finished by applying Fortify sealing (BISCO) an unfilled resin, specially formulated to seal composite surfaces, agent which reduces marginal leakage and percolation.

Teeth treated with Aelite™ LS Posterior (Bisco) (Light-Cured Low Shrinkage Hybrid Composite) using the occlusal modulation technique with occlusal matrix 3 were also treated with Fortify sealing agent, but 2 were not. The teeth treated using the classical method and restored with Aelite™ LS Posterior Bisco were not sealed (*fig. 7, 8, 9, 10*).

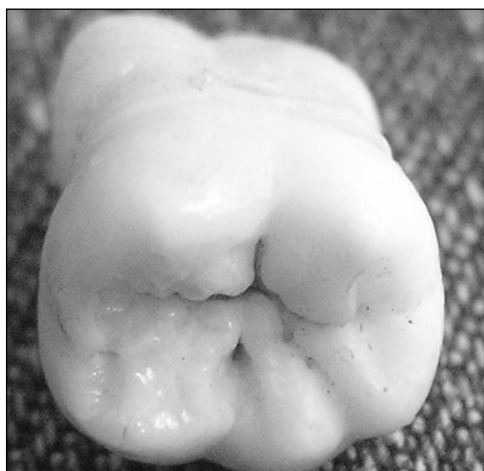


Fig.7. Initial aspect of dental caries

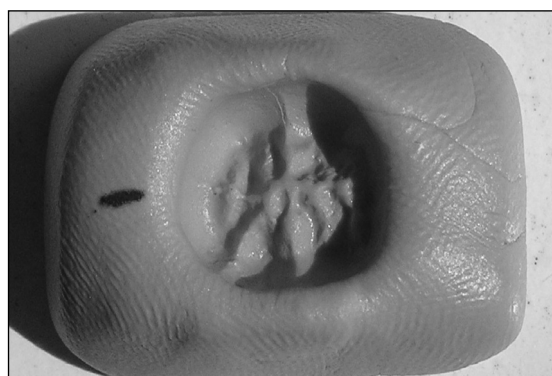


Fig 8. Occlusal matrix for the tooth treated with Aelite™ LS Posterior Bisco



Fig 9. Cavity surface

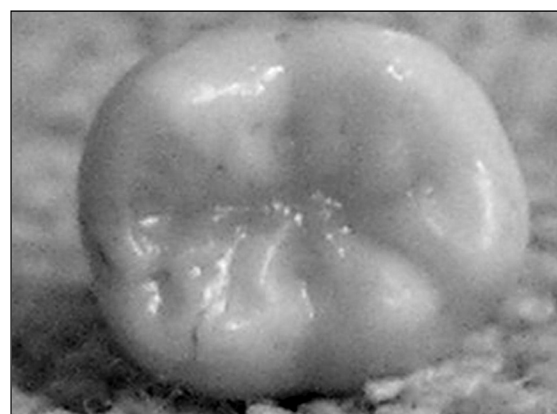


Fig.10. Final restoration

Classical treatment of the cavities included amalgam (*fig.11, 12*) and Ketac™ Molar Easymix (3M ESPE) restorations.



Fig 11. Cavity for the tooth treated with amalgam



Fig 12. Amalgam obturation before polishing

After teeth were treated, they were sectioned using a diamond disc in order to observe the impregnation degree of each method.

The following images present some of the most representatives sections (*fig.13, 14, 15*).

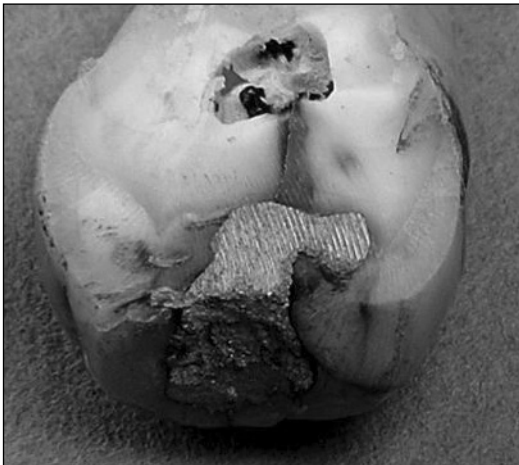


Fig 13. Section within the tooth treated with amalgam using the classical method.

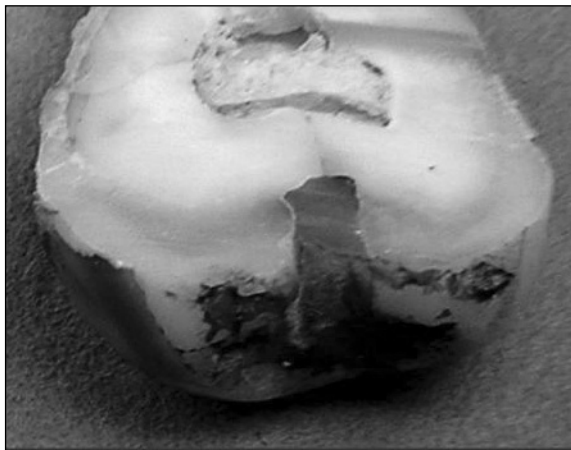


Fig 14. Section within the tooth treated with Aelite™ LS Posterior (Bisco) using the occlusal matrix technique and the Fortify sealing agent that reduces marginal leakage and percolation.

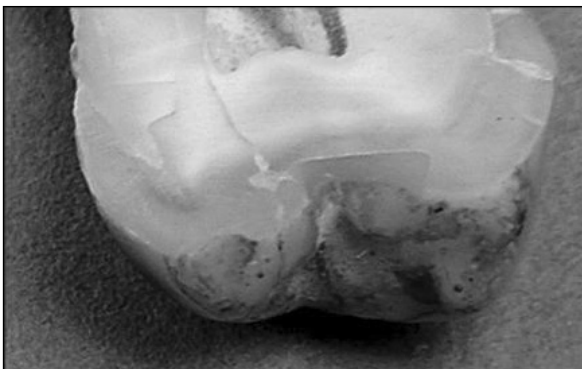


Fig 15. Section within the tooth treated with Aelite™ LS Posterior (Bisco) using the classical method. Fortify sealing agent was not used.

Discussions

The occlusal matrix method is very useful for accurately modeling the restoration surface thus reducing the need for shaping the surface and eliminating the subsequent disadvantages.

There are many advantages deriving from using the occlusal matrix technique in order to rebuild the functional and aesthetic autonomy of the posterior teeth (that presented initially carious lesions).

The operation time is reduced using this method, by eliminating the delicate shaping and finishing maneuvers (into solid material). Moreover, excessive polishing may increase the risk of damaging the composite.

Use of composite resins allows conserving the dental structure by means of narrow and superficial preparations and it is not dependent upon the thickness of the material (for resiliency purposes) - as it is in the case of amalgam.

Conserving the dental structure increases the life of the restoration.

A larger cavities preparation has proven to significantly weaken the resiliency of the dental crown and the bonding composites reinforce the structural integrity of the cusps [8].

Still, the use of composite resins has its disadvantages. The bonding contraction may lead to postoperative sensitivity and to marginal percolation [9]

Clinical studies show that damage and secondary cavities are the causes for these failures.

In order to ensure the success, a selection of cases must be performed.

The following rules should be followed [8,9,10]

- 1 Avoiding bonding in the central areas;
- 2 The width must not exceed 1/3 of the distance between cusps;
- 3 There should not be any signs of occlusal damage caused by teeth grinding
- 4 It should be possible that the teeth be isolated with a rubber dam.

Due to the fact that most of the disadvantages presented by the posterior composites are frequently met in cases of large restoration, the occlusal matrix is recommended for small restorations, placed between crowns that present sufficient enamel for the bonding procedure and with a low risk of damage or fracture.

At the end of the in vivo study, we noticed the quickness, the easiness and the maximum of effectiveness obtained using the occlusal modeling technique.

However, this technique can only be applied in teeth with undamaged cusps zone.

Once the experiment is over, the extracted teeth treated through the classical method (Black)

present a higher impregnation degree, proving that the marginal adaptation was not perfect.

The teeth treated through the occlusal matrix method, the impregnation is hardly visible, proving that from this point of view also this method is clearly more efficient.

In composite restoration Fortify sealing agent, far better results were obtained through both the classical and the silicone matrix method. The use of composite resins allows preservation of the dental structure, through narrow and superficial preparations and is not dependent upon the thickness of the material for resiliency as it is in the case of the amalgam.

Preserving the dental structure insures higher life.

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A larger occlusal cavities has proven to weaken the crown resiliency and the bonding composites reinforce the structural integrity of the adjacent cusps.

Conclusions

Higher patient demands concerning aesthetics led to a more frequent use of composites on posterior teeth. The technique described ensures excellent aesthetic results. The use of the silicone putty matrix facilitates the polishing and finishing procedures.

Even though these restorations are more difficult from the procedural viewpoint, they allow a more conservative approach and a lower damage to the dental crown.

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