

CLINICAL STUDY OF SEVERAL METHODS FOR DIRECT ADHERENT RESTORATIONS IN THE OCCLUSAL AREAS

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Abstract: The features of the marginal sealing of an occlusal restoration depend on several factors, the application technique of the viscous adherent materials playing an essential part in getting a correct and long lasting sealing between the restoration material and the dental tissues. The aim of this study is the assessment of three methods of direct adherent restoration of the occlusal areas: the anatomical layering technique, the "stamp" technique and the "direct shaping in occlusion" (DSO) technique. The results show that the anatomical layering technique provided the best clinical scores even if it did not have the fastest working protocol.

INTRODUCTION

The tooth-coloured restorations of the occlusal areas may be done using various methods, the proper choice depending, mainly, on the features of the clinical case.

The clinical situations of the primary cavitary caries on the occlusal surfaces may have different aspects: caries with small opening and caries with medium/large opening with different depths, their treatment being accomplished accordingly. The excavation of the infected dentin and of the demineralised enamel leads to conservative class I cavities modified for adherent materials, with different sizes and configurations.(1,2,3)

The methods for direct restoration with adherent materials imply the use of classic or modern instruments for application and modelling and several techniques of application. The choice of the technique varies according to the size of the class I cavity, to the adherent materials used for restoration, to the location of the tooth etc.(1,4,5)

An appropriate tooth preparation is mainly dictated by the anatomical features of the occlusal surface, the orientation of the enamel rods at the edge of the preparation and the proximity of the pulp chamber.(3,6,7)

The internal surface of the cavities has rounded angles, its configuration being dictated by the removal of the unwanted tissues.(8,9) The external walls should be rough, with 90 degrees or, most frequently, greater cavo-surface margins. The enamel margins must always have full-length rods or shortened rods supported by sound dentin.(1,2,10) The marginal ridges should be preserved with 1,5-2 mm. The preparations also include the adjacent deep pits and fissures or faults.(1,11,12,13,14)

The preparations are then disinfected and pulp protected according to their depth. The adhesion system is applied according to the manufacturer's indications.(15-22)

There are several techniques of applying the viscous composites:

- **Bulk technique** consists in applying a single layer of restorative material and it is used especially for small

preparations. There are several materials available today that producers consider they can restore bigger sized cavities using this technique.

- **Layering technique** consists in applying several layers of restorative material and it is used for moderate to large restorations. The anatomical layering technique implies the application of the composite in small increments. The surface layer restores the cusps in the decreasing order of their size, the material being applied and shaped according to the cusps inclines.
- **The "occlusal index" ("stamp") technique** consists in applying individual occlusal matrices over the surface layer before polymerization. The individual matrices are useful for direct restoration of caries with small aperture. They are made of different materials that stamped the occlusal surface before preparation.(4)

Without any connection to this technique in particular, there are also standard occlusal matrices that may be used for very large occlusal preparations that should be restored by inlays instead of direct restorations.

- **The DSO ("direct shaping in occlusion") technique.** The patient bites after applying the surface layer and before polymerization.(5)

PURPOSE

The aim of this study is to evaluate the quality of the marginal sealing and of the morphology of the occlusal areas of several restorations obtained with three restoring techniques: the anatomical layering technique, the stamp technique and the DSO (direct shaping in occlusion) technique. The evaluation was made at the end of the treatment, after three months and after six months).

MATERIALS AND METHODS

The one year and a half study included one hundred and twenty clinical cases, every third of them being restored using the "stamp" technique, either the anatomical layering technique, or the DSO technique. The "stamp" method was used

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to restore the occlusal caries with small opening while the other two were involved in the treatment of the occlusal caries with medium/large opening. The maxillary and mandibular caries belonged to fifty-six patients (thirty-two males and twenty-four females) from the urban area. In all cases, the first class preparations had medium to large openings and had various depths.

The study involved several treatment meetings and four practitioners. One of them performed the restorations and the other three assessed the quality of the marginal sealing and morphological aspect of the occlusal aspect three times.

The working protocol had several common steps for all methods of occlusal restoration and some specific stages for each one of them. In all cases, the restorations were made with the same nano-hybrid composite and the same modelling resin. The moisture control method used the same principles in all the situations.

In all cases, after the teeth cleaning and the clinical examination (with paraclinical exams when needed), the practitioner made:

1. The selection and analysis of the clinical features of the occlusal carious lesion to be treated;
2. A short presentation to the patient regarding the steps to be followed;
3. The tooth colour evaluation;

The clinical cases restored using the stamp technique had the following specific steps:

4. Occlusal impression using Memosil 2 (Kulzer);
5. The occlusal contacts determination;
6. Moisture control (MiniDam-DMG);
7. First class modified resin cavity preparation;
8. Disinfection and protection of the preparation;
9. Application of reduced quantities of nano-hybrid composite using a layering technique in the inner corners of the preparation and polymerization of each of the layers. The manual instrument used for application was a metallic carver. A resin for modelling was also used.
10. Application of the occlusal individual conformation system;
11. Polymerization through the individual occlusal matrix kept under slight pressure on the surface of the tooth.

The clinical cases restored using the anatomical layering technique followed the next particular steps:

5. The occlusal contacts determination;
6. Moisture control (MiniDam-DMG);
7. First class modified resin cavity preparation;
8. Disinfection and protection of the preparation;
9. Application of small portions of the nano-hybrid composite at the dentinal base of the cusps in the decreasing order of their size and polymerization of each of them. The superficial layer was applied in small increments with successive polymerization according to the cusps' inclines, from the biggest to the smallest cusp. The manual instruments used for application were OptraSculpt NG (Ivoclar Vivadent) and brushes with squirrel hair. A resin for modeling was also used.

The DSO technique involved the next specific stages:

5. The occlusal contacts determination;
6. Moisture control (MiniDam-DMG);
7. First class modified resin cavity preparation;
8. Disinfection and protection of the preparation;
9. Application of small increments of the nano-hybrid composite at the base of the cusps and their successive polymerization. The superficial layer of uncured composite was covered with Vaseline and the patient was asked to bite without

force. The composite was first cured from the buccal side and, then, after opening the mouth, from the occlusal and lingual sides.

In all cases, the protocol ended with three standard steps:

- Checking of the occlusion stops.
- Finishing and polishing (if necessary).
- Clinical evaluation and photo of the newly occlusal restored area.

The instructions for use of all the products involved in this study were carefully followed.

The clinical evaluations of the restorations considered the next criteria:

- the visual aspect of the marginal sealing;
- the tactile features of the marginal sealing;
- the presence of correct occlusion stops;
- functional and morphological occlusal surface.

The statistical analysis consisted in several charts whose final purpose was to establish the clinical efficiency of every method.

The three observers had various clinical experience and they assessed the restorations at the end of the treatment, after three months and after six months using a table of scores. The scores were as follows: 0-correct restoration, 1-incorrect restoration (it needs correction) and 2-incorrect restoration (it needs replacement).

The observers assigned 1 to the restorations which presented one of the following deficiencies:

- marginal white zone (detected after the treatment);
- marginal gap (under 0.5 mm wide) (detected after the treatment);
- minimal marginal discoloration (detected after three or six months) diagnosed with exploratory methods.

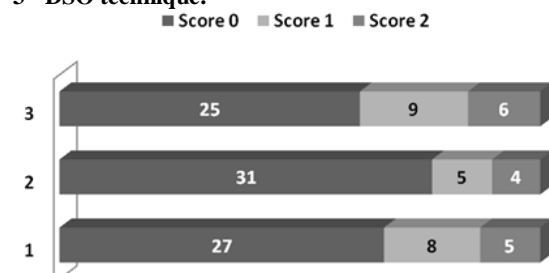
Score 2 was assigned to the restorations having the following clinical defects:

- extensive marginal discoloration (detected after three or six months) diagnosed with exploratory methods;
- marginal gap (over 0,5 mm wide detected after three or six months);
- secondary caries;
- marginal/occlusal wear.

RESULTS

The clinical scores assigned by all the observers at the end of the treatment show that the anatomical layering technique had the highest rate of correct restorations, while the DSO technique and the "stamp" technique provided inferior results, both of them having close rates of incorrect restorations (figure no. 1).

Figure no. 1. Clinical scores for the three methods:
1 - "Stamp" technique; 2 - Anatomical layering technique;
3 - DSO technique.



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The clinical evaluations of the restorations after three months showed similar results, 82% of clinical cases restored with the anatomical layering technique being correct. The “stamp” technique provided 72% of correct restorations, while the DSO technique had 20% and 15% of scored 1 and scored 2 incorrect restorations respectively (figure no. 2).

After six months, 73% of all restorations were correct, 15% and 12% respectively being in need of correction or replacement. The anatomical layering technique kept proving to be the most efficient method of occlusal restoration with 87% of correct restorations. The restorations made using the DSO technique had the highest percentage of defects which led to most of the corrections and replacements. The “stamp” technique had 75% of correct restorations, this technique providing more scored 1 restorations than the anatomical layering technique, both methods having very close rates of scored 2 restorations (figure no. 3).

Figure no. 2. Clinical scores for the three methods:
1 - “Stamp” technique; 2 - Anatomical layering technique;
3 - DSO technique

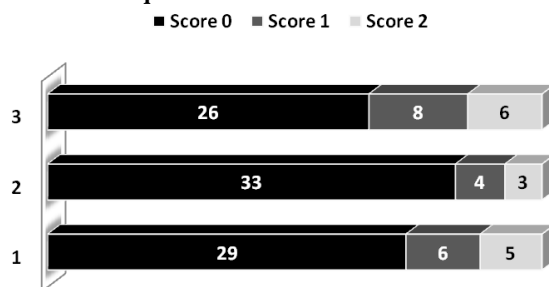
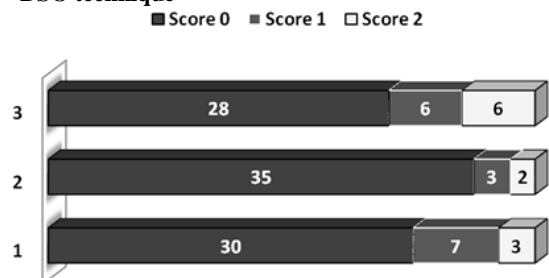
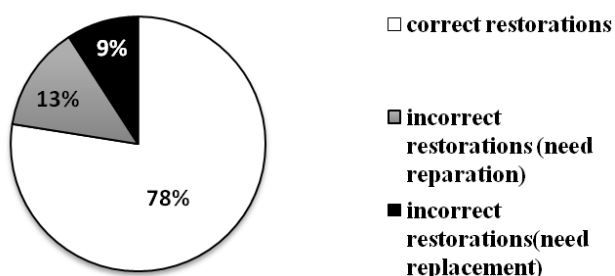


Figure no. 3. Clinical scores for the three methods:
1 - “Stamp” technique; 2 - Anatomical layering technique;
3 - DSO technique



Even if the clinical scores varied among the three methods, the overall efficiency after six months was satisfactory (figure no. 4).

Figure no. 4. The quality of the restorations after six months



DISCUSSIONS

The marginal sealing plays one of the most important roles in the longevity and quality of an adherent restoration. Its

quality depends on several factors.

The C-factor is the ratio between the bonded and unbounded surfaces and its value is directly proportional with the stress from the polymerization shrinkage. The C-factor of an occlusal cavity is five (the highest possible value), the risk for marginal degradation being, in this way, very important. The polymerization shrinkage also depends on the type of the composite (filling and flow), the features of the first class modified resin cavity, the characteristics of the curing process, etc. So, the technique of applying the composite is essential. The material should be applied and cured in small increments, in high contact with itself and less possible contact with the dental tissue.

Another important part is played by the dental tissue which is bonded to the adhesive system. It is well known that bonding to enamel has better quality than bonding to dentin or cementum because of the high mineral content and low level of organic tissue and water.

The base used for pulp protection should be resilient, thick enough and proper for adhesion to the dentin surfaces.

The “stamp” technique and the DSO technique were born out of the practitioners’ desire for a fast protocol in order to get a functional occlusal surface with less working stages and less need for finishing.

Although the rush for “fast and functional” drove to all kinds of ideas, the results of our study show that the anatomical layering technique was the only one to provide a good and long lasting marginal sealing. The other two methods offered the possibility of getting a fast and functional occlusal surface but the marginal area needed in all cases finishing and adapting because the amount of composite in the superficial layer can never be equal to the lost dental tissues. The polymerization shrinkage was also high in all these clinical situations because of the elements discussed above.

CONCLUSIONS

The anatomical layering technique was the most clinically efficient method for occlusal restoration, the DSO (direct shaping in occlusion) technique providing the highest percentage of incorrect restorations. The “stamp” technique was less efficient than the anatomical layering technique but it was better than the DSO technique.

There are several issues that should be accomplished in order to get adherent restorations with long-standing and correct marginal sealing. The proper choice of the technique of application still plays one of the most important parts in the working protocol according to both current theory and practical point of view.

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REFERENCES

- Heymann H, Swift EJ, Ritter AV, Sturdevant CM. Sturdevant’s Art and Science of Operative Dentistry; 6th ed. St. Louis, MO: Elsevier/Mosby; 2013.
- Summitt JB, Robbins JW, Schwartz RS, dos Santos J. Fundamentals of operative dentistry: A contemporary approach; 3rd ed. University of Michigan: Quintessence Pub; 2006.
- Marcov EC. Manual de odontoterapie restauratoare, vol.II. Instrumentarul utilizat în odontoterapia restauratoare Editura Ars Docendi, București; 2012.
- Geena M, Ambily J. Microbrush stamp technique to achieve occlusal topography for composite resin restorations – A technical report. Journal of Scientific

- Dentistry. 2016;6(2):76-81.
5. Opdam NJM, Skupien JA, Kreulen CM, Roeters J, Loomans B, Huysmans MC. Case report: A predictable technique to establish occlusal contact in extensive direct composite resin restorations: The DSO - Technique. Operative Dentistry; 2016. p. 41-3.
6. Burlibaşa M, Şteţiu AA, et al. Finite element method analysis of the stress induced upon the dental implant by the mastication process. Romanian Biotechnological Letters. 2017;22(4):12706-12714.
7. Marcov EC, Marcov N. Electron microscopy validation of ICDAS codes 5 and 6 for proximal caries. Romanian Journal of Oral Rehabilitation. 2013;5(3):92-96.
8. Şteţiu AA, Burlibaşa M, et al. FEM analysis of masticatory induced stresses over surrounding tissues of dental implant Romanian Biotechnological Letters, Received for publication, January, 6, 2018. Accepted, May, 12 2018.
9. Sfarghiu LG, Oancea L, Liţescu R, Burlibaşa M, et. al. The influence of disinfectants incorporation on the stone linear expansion. Romanian Biotechnological Letters. 2016;21(3):11585-11590.
10. Marcov N, Marcov EC, Burlibaşa M, et al. Evaluation of ICDAS II implementation in dental student's educational process. A 6-year study. Acta Medica Transilvanica. 2016;21(3):92-95.
11. Marcov EC. Protocol de restaurare aderentă directă a leziunilor carioase simple proximale din zona laterală. In: Pădure L., Marcov E.C, Burcea C.C, Lupuşoru M., editors. Actualităţi în asistenţa medicală, Editura Ars Docendi,, Bucureşti. 2013;4:19-54.
12. Marcov EC, Marcov N, Burlibaşa M, et al. Comparison of several proximal conformation systems'clinical efficiency in restorative dentistry. Acta Medica Transilvanica. 2016;21(3):84-87.
13. Burlibaşa L, Zarnescu O. In vivo effects of Trichostatin A—A histone deacetylase inhibitor—On chromatin remodeling during Triturus cristatus spermatogenesis. Animal reproduction science. 2013;142(1-2):89-99.
14. Gavrilă L, Mircea L. Chromatin and chromosomal fine structure in spermatogenesis of some species of amphibians Zygote. 2001;9(3):183-192.
16. Şteţiu AA, Oleksik M, Oleksik V, Şteţiu M, Burlibaşa M. Mechanical behavior of composite materials for dental obturations. Romanian Biotechnological Letters. 2013;18(4):8528-8538.
17. Bodnar DC, Pantea M, Bodnar T, Burlibaşa M, Dumitru SG, Cristache CM. Patologia mucoasei orale la pacienţii vârstnici-studiu clinic-statistic. Acta Medica Transilvanica. 2012;2(2):56-60.
18. Cristache CM, Burlibaşa M, Cristache G, Drafta S, Popovici IA, Iliescu AA, Zisi S, Burlibaşa L. Zirconia and its biomedical applications. Metalurgia International. 2011;16(7):18-23.
19. Bodnar DC, Dimova C, Bodnar T, Cristache CM, Burlibaşa M, et al. Dental management of patient with psychiatric disorders. Modern Medicine. 2010;17(10):538-543.
20. Lazăr V, Chifiriuc C, Bucur M, Burlibaşa M, Sfeatu R, Stanciu G, Savu B, Trăistaru T, Cernat R, Suciu I. Investigation of dental-plaque formers biofilms by optic and confocal laser scanning microscopy and microbiological tool. Revista Medico-Chirurgicala a Societăţii de Medici si Naturalisti din Iasi. 2008;112(3):812-820.
21. Burlibaşa M, Muntianu LAS, Tănase G, Bucur MB, Comes CA, Ionescu CA. Study on microbial contamination of biomaterials in medical practice. Metalurgia International. 2010;15:163-166.
22. Burlibaşa M, Cuculescu M, Tănase G, Mihai A, Temelcea A, Popa E. Dental alloys of prothetic use - A retrospective of their use in Romania. Metalurgia International. 2009;14:51-53.
23. Burlibaşa L, Gavrilă L. Developmental epigenetics: roles in embryonic development, in Nutrition in Epigenetics (eds. Niculescu MD, Haggarty P); 2011, Ch. 6, p. 105-126, Willey-Blackwell Publishing.