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Case Series

Dentistry Section

Simulating the Nature: Case-Specific Clinical Techniques to Create Biomimetic Direct Posterior Composite Restorations- A Case Series

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ABSTRACT

This article describes various clinical techniques of direct posterior composite restoration to compensate for the polymerisation shrinkage stress and at the same time to create biomimetic (Life-like) restorations. Selection of the technique depends upon the amount of intact tooth structure, extent and depth of the caries. If caries was limited to pit and fissures only then horizontal or oblique layering technique can be used and if occlusal anatomy was intact the tooth can be restored by using occlusal stamp technique. Use of appropriate techniques of restoration govern the success of direct composite restoration and can improve the durability of the restoration.

Keywords: Biomimetic restorations, Horizontal layering, Oblique layering, Occlusal stamp technique

INTRODUCTION

Composite resins among restorative materials, offer excellent aesthetic results and acceptable longevity, also composite restorations are not as expensive as ceramic restorations [1,2]. In spite of the reality that composites have been utilised in posterior teeth since long time, there are still numerous issues related with polymerisation shrinkage due to which the success of direct posterior restorations was often doubted [3].

Layering of composite restoration started with the development of light curing technology and the launch of optically structured composite systems, offering various materials opacities, translucencies and shades [3]. Different techniques used to produce biomimetic restorations include horizontal layering, oblique layering, occlusal stamp technique, etc. These methods are used to upgrade the efficiency and speed of direct composite placement. Posteriorly composite should be placed in small increments to minimise polymerisation shrinkage stress and to achieve aesthetically pleasing results. The layering concepts should be standardised, lucid and reproducible [4].

So, this case series was presented to explain and demonstrate the case based approach to decide which technique is appropriate in which kind of clinical situation.

CASE SERIES

Case I: Horizontal Layering Technique

A 27-year-old male patient reported to the Department of Conservative Dentistry and Endodontics complaining of decayed tooth in lower left posterior region of jaw since two months. According to patient's chief complaint, he had sensitivity to cold beverages which used to last only for a few seconds. An intra-oral examination revealed moderate size Class I caries (1.2 according to GJ mount's classification) [5] with respect to 37 [Table/Fig-1a]. The patient expressed the desire to restore tooth number (no.) 37 with a tooth coloured restoration rather than metallic restorations (silver amalgam). Patient accepted the treatment plan and informed consent was secured from the patient. No pre-operative radiograph was taken since there was no history of pain associated and the size of the lesion was moderate (1.2) and the treatment planned suggested was caries excavation and evaluation.

Single tooth rubber dam (nic tone) isolation was done with respect to tooth no. 37. Caries removal was done with a no. 245 bur and rounding the internal sharp line and point angles with a no. 2 and no. 4 tapered fissure bur was done. After gross caries removal [Table/Fig-1b], remaining caries was excavated using a spoon excavator (Hu -Friedy).

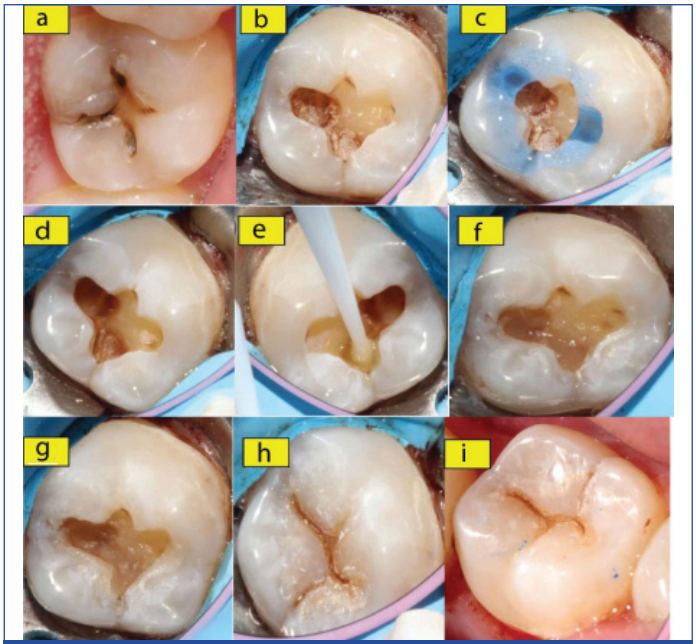
Since cavity depth was approximately 2.5 mm and all four cusps were sound and intact, hence, this case was indicated for a "Layering technique" and "Horizontal layering technique" was selected. To begin with, the selective etching technique was carried out by using a 37% phosphoric acid (D-Tech) for 20 seconds [Table/Fig-1c]. Etchant was removed by water spray and the cavity was air dried with three-way syringe. Frosty white appearance was seen [Table/Fig-1d] then bonding agent (Palfique Universal Bond) was applied. It was light cured for 20 seconds [Table/Fig-1e]. Shade selection was done and dentin shade (A3) and enamel shade (A2) were selected (Palfique LX-5). In dentin layer, the first horizontal increment of composite was placed with thickness less than 2 mm [Table/Fig-1f] and cured for 20 seconds, which was followed by another horizontal increment. Subsequently final horizontal increment following the anatomy of the tooth [Table/Fig-1g] each increment was cured by 20 seconds. Tint (Kolar+Plus: Kerr, Corp) (brown colour) was applied on the grooves and fissure area with the microbrush [Table/Fig-1h] and cured for 20 seconds. After removal of rubber dam, high points were checked and finishing and polishing was done by Shofu Super snap mini kit [Table/Fig-1i]. Six months follow-up has been done and restoration was still intact.

Case II: Oblique Layering Technique

A 30-year-old male patient reported to the Department of Conservative Dentistry and Endodontics complaining of decayed tooth in lower right posterior region of jaw since one month. An intraoral examination revealed moderate size Class I caries (1.2 according to GJ mount's classification) on no. 46 with the marginal ridges intact [Table/Fig-2a]. When given the choices, patient expressed the desire to restore the teeth with tooth coloured restoration. Patient accepted the treatment plan and informed consent was secured from the patient.

Single tooth rubber dam (nic tone) isolation was done with respect to tooth no. 46. Caries removal was done with a small round carbide bur no. 2 and remaining caries was excavated using a spoon excavator (Hu -Friedy) [Table/Fig-2b].

In this case, also, all the cusps were intact and cavity depth was approximately 2 mm so this case was also indicated for "Layering technique" and this time "Oblique layering technique" was selected.



[Table/Fig-1]: Horizontal layering technique: a) Pre-operative view; b) After caries removal; c) Application of etchant; d) Frosty white appearance; e) Application of bonding agent; f) Application of first horizontal layer; g) Application of second horizontalm layer; h) Application of tint and complete composite build up; i) After finishing and polishing.

After that the selective etching was done by using a 37% phosphoric acid (D-Tech) for 20 seconds [Table/Fig-2c]. Etchant was removed by water splash and the cavity was air dried with three-way syringe [Table/Fig-2d] followed by application of bonding agent (Palfique Universal Bond) which was light cured for 20 seconds [Table/Fig-2e]. Shade selection was done. Dentin shade (A3) and enamel shade (A2) was selected (Palfique LX-5). Composite was placed in oblique manner. In dentin layer, the first wedge shaped increment of composite was placed on disto-buccal cusp [Table/Fig-2f] followed by subsequent layering. Each increment was cured for 20 seconds from both side first cavity walls, followed by the occlusal surface, to reduce the polymerisation shrinkage and following the anatomy of the tooth [Table/Fig-2g]. Tint (Kolar+Plus: Kerr, Corp) (brown colour) was applied on the grooves and fissure area with the microbrush [Table/Fig-2h]. Subsequently, final oblique increment was applied following the anatomy of the tooth. The rubber dam was removed,

[Table/Fig-2]: Oblique layering technique: a) Pre-operative view; b) After caries removal; c) Application of etchant; d) Frosty white appearance; e) Application of bonding agent; f) Application of first oblique layer; g) Successive oblique layer build up; h) Application of tint; i) After finishing and polishing.

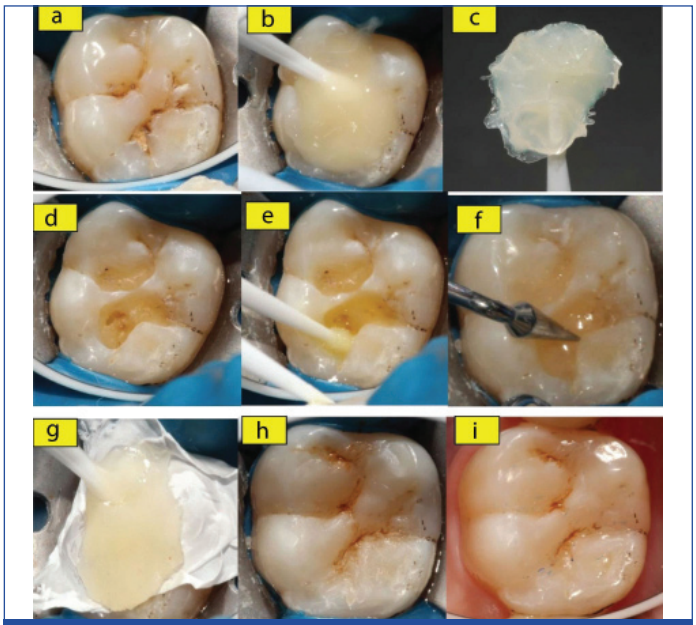
high points were checked and finishing and polishing was done by Shofu Super snap mini kit [Table/Fig-2i]. Six months follow-up was done and restoration was still intact.

Case III: Occlusal Stamp Technique

A 25-year-old female patient reported to the Department of Conservative Dentistry and Endodontics complaining of mild sensitivity to cold in lower left back tooth region since one month. An intraoral examination revealed moderate size Class I caries on teeth 36 (1.2 according to GJ mount's classification) with an unusual anatomy. Mandibular molar had occlusal anatomy which was similar to a maxillary molar that is presence of oblique ridge on the occlusal surface. Electronic pulp testing was carried out which revealed score 3, that means tooth was vital, therefore preoperative intraoral periapical radiograph was not taken. Caries was present only on occlusal pits and fissures [Table/Fig-3a]. A finalised treatment plan was accepted, and informed consent was secured from the patient.

Single tooth rubber dam (nic tone) isolation was done with respect to tooth no. 36. Since, Occlusal anatomy was intact involving only pits and fissures, therefore customised occlusal stamp technique was selected. Flowable composite (Ivoclar Tetric N-Flow) was applied on occlusal surface of tooth and a tip of microbrush was cut which served as a handle and placed over flowable composite and light cured for 20 seconds [Table/Fig-3b]. Entire occlusal anatomy was replicated in the occlusal stamp [Table/Fig-3c]. Caries removal was done with a small carbide round bur no. 2 and rounding the internal sharp line and point angles were done with a no. 2 and no. 4 tapered fissure bur [Table/Fig-3d].

After that, the selective etching technique was carried out by using a 37% phosphoric acid (D-Tech) for 20 seconds. Etchant was removed by water splash and the cavity was air-dried. After that bonding agent (Palfique Universal Bond) was applied and light cured for 20 seconds [Table/Fig-3e]. Shade selection was done and A2 shade was selected. Incremental restoration (horizontal increment) of composite (Palfique LX-5) was done in the cavity upto 1 mm lower the occlusal surface and light curing for 20 seconds [Table/Fig-3f]. Tint (Kolar+Plus: Kerr, Corp) (brown colour) was applied on the grooves and fissure area with the microbrush. A piece of teflon tape was placed on the occlusal surface on the final layer of composite and occlusal stamp was placed over the tape and sealed [Table/Fig-3g] and later it was removed. The excess material was removed and polymerisation of composite was done [Table/Fig-3h]. Minimal finishing and polishing were done using Shofu Super snap mini kit [Table/Fig-3i]. Patient is still on follow-up.



[Table/Fig-3]: Occlusion stamp technique: a) Pre-operative view; b) Fabrication of occlusal stamp; c) Occlusal stamp; d) After caries removal; e) Application of bonding agent; f) Application of composite; g) Placement of Teflon tape and occlusal stamp; h) After removal of stamp and application of tint; i) After finishing and polishing.

DISCUSSION

In case of anterior teeth restorations, the composites have always been a popular choice and have been considered as one of the best treatment modalities as a direct restorative material, but the increasing demand for esthetic restorations and advancements in restorative materials and techniques have led to the shift in the trend in terms of direct posterior composite restorations [6]. Now, the newer materials have better strength (e.g., fibre reinforced composite), better bonding mechanism and better handling properties making them an equally viable alternative to be a suitable posterior restorative material [7].

Since composite, being one of the most consistent tooth coloured direct restorative materials, has its own problems associated with it in clinical scenario such as proper isolation, accurate shade matching, correct and precise sculpting/carving before light curing and polymerisation shrinkage, etc., [8,9]. Now, present article discussed about how to simulate/recreate the anatomy which has been lost during caries excavation and cavity preparation at the same time managing the polymerisation shrinkage while performing the direct posterior composite restorations. This article recommends few techniques which are 'case specific' as they are advised depending upon the following factors:

i) The size of the caries and its involvement on the tooth surface, involving enamel or both enamel and dentin before caries excavation.

ii) The amount of 'Intact' occlusal anatomy before caries excavation.

Up to what extent the occlusal anatomy has been lost/sacrificed, as in removal of grooves and fissures and/or undermining of any of the cusps, in the process of caries excavation and cavity preparation. The size and depth prepared cavity [10].

Present case series describes three different techniques of composite placement to minimise polymerisation shrinkage with the direct posterior composite. Study done by Nadig RR and Bugalia A showed that microleakage was minimal with incremental technique as compared to bulk fill technique and among all the techniques, least microleakage was seen in oblique layering followed by horizontal layering technique [11]. In cases where moderate size cavity was present with an approximate depth of 1.5 to 2 mm and caries was limited to enamel and some part of dentin, horizontal or oblique layering technique can be used [12].

Coming to the occlusal stamp technique, this technique can be used when the occlusal anatomy (tooth structure) is completely intact and the caries (Class I) beneath can be seen through the enamel (Grayish blue discolouration) giving an idea of the extent of the caries and subsequent outline of the cavity preparation. That is why taking an occlusal stamp before caries excavation helps to recreate the exact occlusal anatomy. The main benefit of this technique was very simple once mastered, requires reduced overall time because there was no need of carving and instant desired cusp fossa relation can be attained [13]. This technique is slightly costly since it requires a microbrush and flowable composite adding to the extra expenses. Hence, to overcome these cons, expired flowable composite can be used [14]. A very important prerequisite for this technique which has to be kept in mind that placement of the occlusal stamp should be exact and correct to get an accurate cusp fossa relationship [15].

The clinician should choose a restorative technique to reduce polymerisation shrinkage, to recreate life-like (Biomimetic) anatomy and to establish an ideal occlusion. This will decrease the chances of post-operative sensitivity, premature marginal breakdown, enamel fractures and pulpal injury and hence it will increase the durability of the restoration.

CONCLUSION(S)

The clinicians must have thorough knowledge and skills to restore the tooth in such a way that the final restoration not only looks like a natural tooth but also functions like the same and that is what the objective of the biomimetic dentistry is. Every case requires a different approach in terms of selection of the restorative material and the technique of placement for the same when it comes to direct posterior restorations. This article might be helpful for the clinicians to decide an appropriate technique for their clinical cases.

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