The Split Centripetal Build-Up Technique for Large Class II Composite Restorations

Gaetano Paolone, DDS
Salvatore Scolavino, DDS
Nitzan Bichacho, DMD

Abstract

This article describes a modification of the centripetal build-up technique as an alternative treatment to optimize certain Class II restorations, based on cavity size. Key points of the proposed technique are the reduction of shrinkage stress issues via a vertical splitting of the composite increments, and the transfer of anatomical information toward the occlusal portion through the construction of thicker interproximal increments. This procedure can minimize shrinkage stress for easier subsequent occlusal modeling obtained by anticipation of the anatomy through thicker interproximal increments.

Key Words: composite, Class II, direct restoration, contact area, centripetal build-up

Introduction

Direct resin-based composite restorations in posterior teeth demonstrate a good survival rate (annual failure rate of 2.4% over 10 years, strictly related to caries risk and the number of restored surfaces).[1] Class I restorations require anatomical knowledge and the ability to select the best occlusal modeling technique (additive[2] or subtractive[3]) for a specific cavity configuration and are considered simpler to perform than Class II restorations.

There are several layering approaches for Class II restorations. The most commonly used are horizontal layering (HL) and the centripetal build-up technique (CBT).[4] The latter is a proven method that, in order to simplify restorative and modeling procedures, converts a Class II cavity design to a Class I through the application of a thin composite interproximal wall. The CBT defines the perimeter of the restoration and, once it is completed, the clinician has the advantage of a Class I cavity design.

This article presents a modified version (split CBT) for medium-to-large Class II cavities in which multiple thicker, separated interproximal increments are used to reduce the number of adhesive surfaces, minimize the shrinkage issues of resin-based restorative materials, and provide proper anatomical information for occlusal modeling.

“In medium-to-large Class II restorations, the thicker, separated centripetal increments of the split CBT can minimize shrinkage and facilitate easier, controllable anatomical buildup for more predictable occlusal modeling.”

Technique

The first composite increment is placed on one side of the interproximal cavity (buccal or lingual) **(Fig 1)** between the axial wall and the matrix. Although the interproximal area is not restored in one step as it is in the original CBT, thicker increments can be applied.

Using a spatula with an orientation of approximately 45 degrees, it is possible to project, extend, and interpolate the residual anatomy **(Fig 2)** defining the occlusal embrasures and reproduce the apicocoronal and the buccopalatal curvatures.

Two or three separated increments generally are sufficient to complete the anatomical buildup of the interproximal area **(Fig 3)** when curing each increment independently. Molars and premolars may or may not have one or more secondary grooves on the marginal ridges. When required, they are obtained by moving a sharp instrument gently and slowly across the uncured composite ridge, almost parallel to the occlusal surface **(Fig 4)**. The information contained on a thicker marginal ridge **(Fig 5)** can be projected toward the occlusal surface, thus facilitating occlusal modeling. The differences in increment thickness and anatomical buildup of the interproximal walls between the conventional CBT and the split CBT are shown in **Figures 6 through 8**.

Figure 1: The first increment is placed either buccally or lingually/palatally.

Figure 2: The increment is adapted and modeled to define the occlusal embrasure and the apicocoronal and buccopalatal curvatures.

Figure 3: More increments are added to complete the interproximal area.

Figure 4: Secondary grooves are obtained and occlusal anticipation is performed before curing the increment.

Figure 5: A split CBT with anatomical buildup.

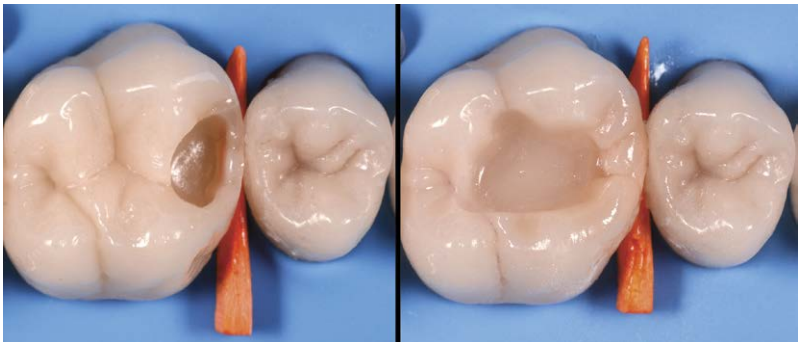

Figure 6: A conventional (left) and split CBT (right) on a model.

Figure 7: A conventional (left) and split CBT (right).

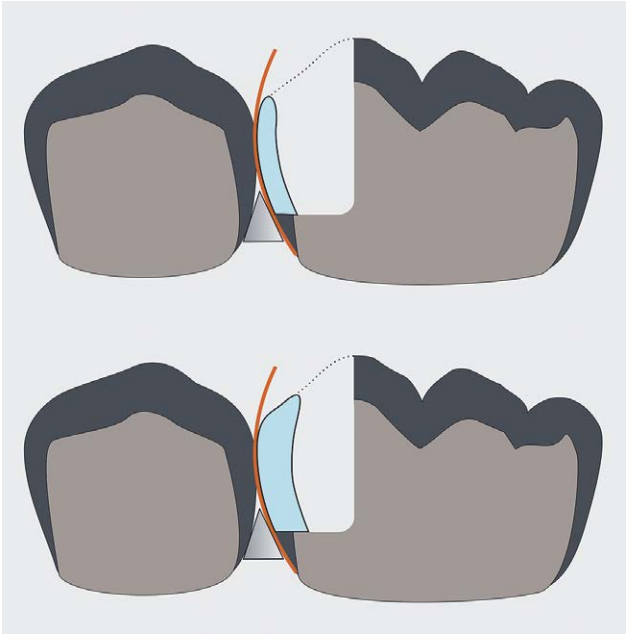

Figure 8: A conventional (top) and split CBT (bottom).

Clinical Case Reports

Case 1

A 37-year-old male presented for treatment. Secondary caries around a previous restoration was detected on tooth #3. **Figures 9 through 16** show the steps in the split CBT and the two-year follow-up. In this particular case, there were three vertical increments: buccal, palatal, and central. Once the marginal ridge was completed, the sectional matrix system was removed and the occlusal modeling was completed.

Case I

Figure 9: Initial clinical situation.

Tips for Clinicians

Beginner

- Choosing a sectional matrix rather than a circumferential one will help to obtain a contact point in the proper position.
- Transforming the Class II into a Class I can be challenging at first, but the benefits are enormous.

Intermediate

- The conventional CBT is always a good starting point and may be easier at first. As soon as you gain confidence, try the split CBT.
- To determine the height of a marginal ridge, don't look only at the adjacent tooth—also follow and interpolate the residual anatomy (buccal and lingual).

Expert

- Adaptation can be achieved with one or more wedges, but they often move or dent the matrix. Using polytetrafluoroethylene (PTFE) tape instead can prevent damage to the matrix.
- To model the split increments, micro brushes or round-headed pluggers are the best options. Before curing, a spatula at a 45-degree angle can easily create the occlusal embrasures.

"The anatomical buildup of the marginal ridge creates a great advantage for the occlusal modeling."

Figure 10: A sectional matrix, wedge, and separating ring are applied. Although the cavity was wider buccally, some PTFE tape was inserted between the ring and the matrix to prevent damage to the matrix.

Figure 11: A split CBT was performed by applying first the buccal and then the palatal increments.

Figure 12: The anatomical buildup of the split CBT was completed with a central increment.

Figure 13: Occlusal modeling.

Figure 14: Completed and polished restoration.

Figure 15: Palatal view, two years postoperative.

Case 2

Another clinical case employing the same technique is shown in **Figures 17 through 22**. The anatomical buildup of the marginal ridge provides a great advantage for the occlusal modeling.

Class II Restorative Technique Selection

Choosing the most appropriate restorative approach for a Class II cavity design should enable effective and reliable outcomes. The CBT is suitable **(Fig 23)**, but it is not always easy to apply. In fact, when the mesiodistal diameter of the cavity is not wide enough (< 2 mm), there is limited room to build the interproximal wall and thus HL is more appropriate **(Fig 24)**. On the other hand, when the mesiodistal diameter is large enough, the box may be too wide to restore with the conventional (single increment) CBT because of material volume and consequent shrinkage issues. In these clinical situations (interproximal boxes wider

Figure 16: Bitewing radiograph, two years postoperative.

Case II

Figure 17: Initial clinical situation.

Figure 18: Cavities treated and ready to be restored.

Figure 19: Split CBT and anatomical buildup of the marginal ridge.

Figure 20: Completed restorations.

Figure 21: After finishing and polishing.

Figure 22: Three months postoperative.

than 50% of the buccolingual distance), the split CBT can be a valid treatment option to reduce shrinkage issues and take advantage of thicker increments for an anatomical buildup. Technique selection is therefore dependent on cavity size, as shown in **Figure 25**.

Discussion

Direct posterior restorations involve addressing the shrinkage of the composite resin. The resulting dimensional change can cause margin debonding,[5] cuspal deflection,[6] enamel cracking, postoperative pain,[7] secondary caries,[8] and premature failure of the restoration.[9] This shrinkage and internal strain continues for 15 hours after the initial curing.[10] All these issues are strictly related to the quantity of material and to the configuration factor of the cavity. Employing an appropriate layering technique may significantly decrease the incidence of these problems.[11-13]

CBT is aimed at reducing cervical gaps in combination with a simple-to-apply centripetal build-up reconstruction.[4] The contact area, cervical profile, and marginal ridge are restored with a very thin proximal layer connecting the buccal and lingual walls interproximally.[4]

The proposed split CBT is based on using thicker, separated increments to reduce the number of adhesive surfaces toward which the composite can shrink.[14] This approach is also advantageous in defining the occlusal embrasures and the apicocoronal and buccolingual curvatures to preserve periodontal tissue and transfer occlusal load among teeth. It is advisable to use a preformed sectional matrix (characterized by multiple convexities), wedges, and separating rings[15-17] rather than circumferential matrices, as circumferential matrices move the contact area toward the occlusal area (where the occlusal embrasure space[18] generally should exist), resulting in a flat and inappropriate interproximal contour.[19]

The split CBT can be performed either with conventional composites or with bulk-fill composites. The latter are classified as either high viscosity or low viscosity.[20] High-viscosity bulk-fill composites can be

Figure 23: A conventional CBT.

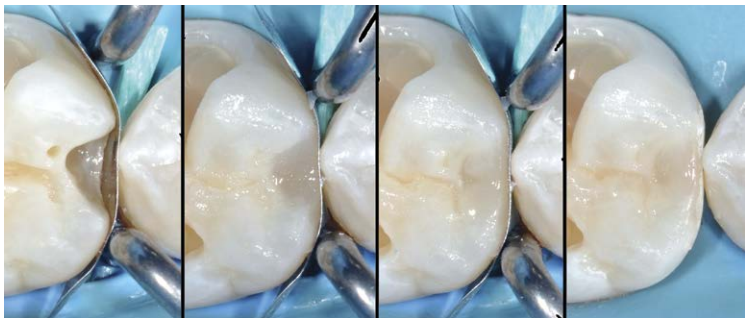

Figure 24: When there is no space for a CBT, HL is advisable.

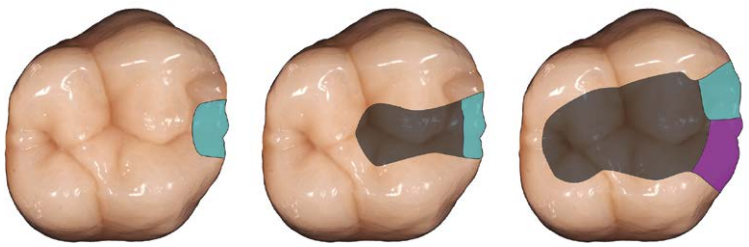

Figure 25: Small cavity mesiodistal size (left) is < 2 mm; HL is recommended. Medium cavity mesiodistal size (center) is > 2 mm but the box is < 50% of the buccolingual distance; conventional CBT is recommended. Large cavity mesiodistal size (right) is > 2 mm and the box is > 50% of the buccolingual distance; split CBT is recommended.

applied on the external surface of a restoration, whereas low-viscosity bulk-fill composites must be "capped" by conventional or high-viscosity bulk-fill composites. In the split CBT, the interproximal split wall can be restored with high-viscosity bulk-fill composites while low-viscosity bulk-fill composites can be used to fill the internal part of the restoration after the split CBT is performed.

Summary

Predictable Class II restorations can be achieved by selecting the restorative technique based on the cavity size and configuration. In medium-to-large Class II restorations, the thicker, separated centripetal increments of the split CBT can minimize shrinkage and facilitate easier, controllable anatomical buildup for more predictable occlusal modeling.

References

1. Opdam NJ, van de Sande FH, Brokhorst E, Cenci MS, Bottenberg P, Pallesen U, Gaengler P, Lindberg A, Huysmans MC, van Dijken JW. Longevity of posterior composite restorations: a systematic review and meta-analysis. J Dent Res. 2014 Oct;93(10):943-9.
2. Liebenberg WH. Successive cusp build-up: an improved placement technique for posterior direct resin restorations. J Can Dent Assoc. 1996 Jun;62(6):501-7.
3. Dietschi D, Spreafico R. Adhesive metal free restorations: current concepts in the aesthetic treatment of posterior teeth. Hanover Park (IL): Quintessence Pub.; 1997.
4. Bichacho N. The centripetal build-up for composite resin posterior restorations. Pract Periodontics Aesthet Dent. 1994 Apr;6(3):17-23.
5. Moorthy A, Hogg CH, Dowling AH, Grufferty E, Benetti AR, Fleming GJ. Cuspal deflection and microleakage in premolar teeth restored with bulk-fill flowable resin-based composite base materials. J Dent. 2012 Jun;40(6):500-5.
6. Politi I, McHugh LEJ, Al-Fodeh RS, Fleming GJP. Modification of the restoration protocol for resin-based composite (RBC) restoratives (conventional and bulk fill) on cuspal movement and microleakage score in molar teeth. Dent Mater. 2018 Sep;34(9):1271-7.
7. Oliveira LRS, Braga SSL, Bicalho AA, Ribeiro MTH, Price RB, Soares CJ. Molar cusp deformation evaluated by micro-CT and enamel crack formation to compare incremental and bulk-filling techniques. J Dent. 2018 Jul;74:71-8.
8. Alvanforoush N, Palamara J, Wong RH, Burrow MF. Comparison between published clinical success of direct resin composite restorations in vital posterior teeth in 1995-2005 and 2006-2016 periods. Aust Dent J. 2017 Jun;62(2):132-45.
9. van Dijken JWV, Pallesen U. Bulk-filled posterior resin restorations based on stress-decreasing resin technology: a randomized, controlled 6-year evaluation. Eur J Oral Sci. 2017 Aug;125(4):303-9.
10. Germscheid W, de Gorre LG, Sullivan B, O'Neill C, Price RB, Labrie D. Post-curing in dental resin-based composites. Dent Mater. 2018 Sep;34(9):1367-77.
11. Jafari T, Alaghehmad H, Moodi E. Evaluation of cavity size, kind, and filling technique of composite shrinkage by finite element. Dent Res J (Isfahan). 2018 Jan-Feb;15(1):33-9.
12. Nikolaenko SA, Lohbauer U, Roggendorf M, Petschelt A, Dasch W, Frankenberger R. Influence of c-factor and layering technique on microtensile bond strength to dentin. Dent Mater. 2004 Jul;20(6):579-85.
13. Fok ASL, Aregawi WA. The two sides of the C-factor. Dent Mater. 2018 Apr;34(4):649-56.
14. Raghu R, Srinivasan R. Optimizing tooth form with direct posterior composite restorations. J Conserv Dent. 2011 Oct-Dec;14(4):330-6.
15. Cho SD, Browning WD, Walton KS. Clinical use of a sectional matrix and ring. Oper Dent. 2010 Sep-Oct;35(5):587-91.
16. Chuang SF, Su KC, Wang CH, Chang CH. Morphological analysis of proximal contacts in class II direct restorations with 3D image reconstruction. J Dent. 2011 Jun;39(6):448-56.
17. Santos MJ. A restorative approach for class II resin composite restorations: a two-year follow-up. Oper Dent. 2015 Jan-Feb;40(1):19-24.
18. Keogh TP, Bertolotti RL. Creating tight, anatomically correct interproximal contacts. Dent Clin North Am. 2001 Jan;45(1):83-102.
19. Scolavino S, Paolone G. Posterior direct restorations. Batavia (IL): Quintessence Pub. Forthcoming 2020.
20. Price R. Consensus statements on bulk fill resin composites. Int Dent. African Edition 2017;7(6):64-8. **jCD**

Dr. Paolone is an adjunct professor of restorative dentistry at Vita-Salute San Raffaele University, in Milan, Italy. He owns a private practice in Rome, Italy.

Dr. Scolavino is an adjunct professor of restorative dentistry at the University of Milan, in Milan, Italy. He owns a private practice in Nola, Italy.

Prof. Bichacho is an Expert Professor of Prosthodontics for the Oral Rehabilitation Department Faculty of Dental Medicine at Hebrew University and Hadassah Medical Center in Jerusalem, Israel, and for the Prosthodontics Department at the Tel Aviv University School of Dental Medicine, Tel Aviv, Israel. He owns a private practice in Tel Aviv.

Disclosures: The authors did not report any disclosures.