CONTEMPORARY APPROACH FOR REESTABLISHMENT OF PROXIMAL CONTACTS IN DIRECT CLASS II RESIN COMPOSITE RESTORATIONS

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ABSTRACT

The topic of the present paper represents a still problematic aspect of the direct esthetic adhesive restoration of Class II (proximo-occlusal) cavities, which is adequate contouring the interdental proximal area and accurate re-establishing of the proximal contact. The appropriate approach of this matter is quite difficult due to several problems, such as the convex emergence profile (both occluso-gingival and bucco-lingual) of the proximal coronal wall, the need for a perfectly adapted matrix system in order to contour the missing proximal coronal part, rather complicated access and visibility in the operating area, and the need of separating the adjacent teeth for creating the necessary space to compensate the thickness of the matrix band. The authors try to present the theoretical issues related to the clinical techniques, which are currently available nowadays, as therapeutic options to be taken into consideration for solving some of the mentioned problems.

Key Words: direct composite restorations, Class II cavities, proximal contact, clinical techniques.

INTRODUCTION

The esthetic dental materials in the range of direct composite resins and the adhesive techniques represent currently an indisputable clinical solution for the posterior restorations. These materials and techniques allow crown reconstructions using much more conservative preparations, with respect to the sound dental tissues, and the final restorations present excellent qualities, from the viewpoint both of practitioners and of patients. Therefore, these therapeutic methods are replacing more and more frequently the classic solutions of directly restoring posterior teeth using dental amalgams.

The present paper proposes to approach the numerous problems this topic still raises, when restoring proximal contacts in Class II esthetic direct restorations.

The importance of this area is indisputable.¹ Correct proximal contacts provide a multitude of benefits:²
- Proper proximal coronal outline restoration;
- Protection of the papilla against food impaction, which represents a conducive factor for periodontal disease;
- Prevention of horizontal migration due to lack of proximal contact, which leads to premature contacts and interferences (implicit reason for occlusal trauma);
- Physiological stimulation and gingival protection provided by correct food deflection on crown surfaces;
- Favors accurate hygiene in proximal areas.

There are some reasons for the difficulty of correct contouring the proximal contacts: the convex outline in both cervical-occlusal and buccal-lingual direction of the proximal surface, the requirement of a perfectly adapted matrix for contouring the missing dental surface, more difficult visibility and access, the necessity of teeth separation in order to obtain the space required by the thickness of the matrix.²

Obtaining an adequate proximal contact involves a correct cavity, a well-adapted matrix, a proper positioned wedge and an appropriate insertion and modeling of the direct restoration material.³⁴

Every clinical case implies dealing in a specific manner with all these - otherwise well known - issues.⁵

The different methods of restoring proximal contacts in class II cavities are strongly related to the type of matrix and wedge used.⁵⁻⁶ Interdental wedges are used to adapt and maintain the matrix in contact with the tooth in the gingival wall area. The wedges are made of different materials, such as wood or synthetic resins, have standard lengths, triangular cross-section and display thickness, taper and profile designed to best adapt to the anatomical tooth outline. The wedges may be rigid or flexible.

Some rules have to be respected when using wedges ("wedging"):⁷
- The wedge must not prevent the matrix to be properly contoured; an oversized wedge generates a far too large embrasure.
- All wedges have to be adapted to the tooth outline, because a universal wedge fitting all clinical cases does not exist.
- The wedges are generally introduced in a lingual-buccal direction because the proximal contact – that has to be contoured by the thinnest part of the wedge – is buccally oriented. The wedge has to be placed slightly gingivally with respect to the gingival margin of the preparation, in tight contact with the tooth. If the wedge is placed coronal to the gingival wall of the cavity, the matrix will be pushed into the cavity and an abnormal concavity will occur at this level of the restoration. On the other hand, placing the wedge too apically will prevent the tightening of the matrix to the cavity margins, with subsequent material excess in the gingival area, due to the slight matrix displacement during placement and condensation of the restorative material.

Occasionally - when the cavity has a large width - two wedges may be applied, one from the gingival and the other from the buccal ("double wedging"). This allows the correct condensation of the material in the proximal angles and prevents overflow at the gingival margin.

Placing the wedge should sufficiently displace the two teeth, in order to compensate the thickness of the matrix, and therefore facilitate a proper proximal contact, once the matrix will be removed. This aspect can also be verified during the previous stage of cavity preparation, during which the dental separation proves to be favorable ("pre-wedging").

The tensions induced in the rubber dam when placing the wedge frequently tend to separate the wedge from the tooth. In order to prevent this, the rubber dam in the proximal area should be pulled in opposite direction when placing the wedge. Lubricating the wedge may also help it glide and prevents catching on the rubber dam.

As a conclusion - in order to be efficient, the wedge has to be placed apically and as close as possible of the gingival margin of the cavity. The pressure induced by the wedge has to fit tightly the matrix on the surface of the tooth, sufficiently enough to adapt it to the tooth outline, thus preventing the overfill of the cavity, particularly in the gingival wall area. The same pressure also slightly displaces away the two teeth, enabling a correct proximal contact, once the matrix is removed.⁸⁻⁹

Some of the most frequently used matrix band systems are still the classic ones: Ivory and Tofflemire matrix bands and matrix retainer (the latter in Senior, Junior and Contra Angle variants). The Automatrix and Palodent systems are also being used.

The Ivory system consists of segmental matrix ribbons - reconstructing only one of the tooth’s walls – and the matrix retainers.

The matrix ribbon is straight, with a corrugated gingival margin adapted to the gingival contour and can reach subgingivally when the gingival wall is situated far more apically.

Due to the facility of placement, this kind of matrix band is frequently used in everyday practice, but - as for the Tofflemire system – requires careful shaping in order to correctly remodel the proximal outline of the tooth.

The Tofflemire universal matrix bands system is indicated for restoring teeth with mesio-occluso-distal cavities, because the matrix surrounds the tooth more tightly at the gingival margin than at the occlusal level. This system is also used for single proximal surface class II cavities. Tofflemire has become the most popular system because of its adaptability and ease of use.
One of the advantages of this system consists in the possibility of the angled type to be positioned both buccally and lingually. Once inserted in place, the matrix ribbon and the matrix retainer have a good stability, the matrix is easy introduced and removed from the retainer. There are different ribbon profiles, but all of them need to be adapted to the tooth outline. The matrix is also available in small size for the temporary dentition.

Though remarkably versatile, the Tofflemire system is not ideal. The specific disadvantages of this system are:
- The matrix ribbon is flat and has to be contoured to remodel the anatomical outline of the tooth and the correct proximal contact;
- The resulting surface requires many adapting maneuvers;
- If rebuilding cusps becomes necessary, the matrix does not offer the rigidity and adaptability that Automatrix system presents.

To overcome these drawbacks of the classic Tofflemire system, anatomical ribbon matrix for Tofflemire matrix retainer have been developed. These ribbons do not require adaptations before being introduced in the matrix retainer, but are, naturally, more expensive.

If a flat matrix ribbon is used, it has to be accurately adapted to the tooth outline. This can be achieved by using an amalgam burnishing egg-shaped instrument. The matrix ribbon is placed on a sheet of paper and burnished in such a manner to obtain the double convex profile specific to the proximal surface of the tooth. The matrix thus formed is introduced in the retainer with the handle preferably buccally directed, and the retainer grooves always facing gingivally, in order to allow an easy removal.

The matrix will be put in place once introduced in the retainer, and fastened by mean of the screw. Inspection of the gingival area verifies if the matrix encompasses the limits of the cavity. If the flat matrix does not fully encompass the gingival margin, it has to be replaced with a corrugated one, with an extension applied apically to the gingival limit of the preparation. The ribbon's height is verified and reduced if it goes 2-3 mm beyond the occlusal surface, in order to facilitate the placement and the shaping of the restorative material.

Using the screw, the matrix is tightened without deformation around the tooth and the wedge is applied. The gingival area is examined to find out if the rubber dam or the gingival tissue have been caught between the tooth and the matrix. Cavity cleansing follows. The wedge and the matrix are being kept in the same position, so that the interdental separation is maintained and the restorative material can now set. After the restorative material has set, the retainer is first removed, then the wedge and eventually the matrix, which is moved in a lateral direction in order to avoid the displacement of the restorative material.

The Automatrix system includes four types of ribbons, which can be adapted to any tooth, regardless the perimeter, and do not need a matrix retainer. The ribbons are in four sizes, with height between 4.7 mm and 7.9 mm and thickness between 0.038 mm and 0.05 mm.

This system is recommended in extensive class II cavities, especially when one or more cusps have to be restored. The Automatrix system naturally has its own advantages and disadvantages. One of the advantages is the possibility of positioning the matrix retainer both on the buccal and on the lingual side. The major disadvantage for these bands is that they are not preformed, and contouring them to reestablish the anatomical profile of the proximal surface turns out to be difficult sometimes.

Figure 1. Tofflemire and Ivory matrix bands.
The most suitable matrix is selected and applied. The clamp is positioned in the preferred position: buccal or lingual. The matrix is then tightened around the tooth, using the special designed device from the kit and the wedge is applied. After the restorative material is placed, adapted and set, the clamp is cut off and the matrix is removed towards an oblique direction.

The Palodent matrix systems used for class II occluso-proximal cavities in posterior teeth includes a range of sectional matrix ribbons and elastic metallic rings which fasten the matrix to the tooth. (Fig. 2)

The original Palodent system (Darway Inc. – now manufactured by Dentsply/Caulk) includes a kit of sectional matrix with double convexity (both buccal-lingually and lingual-buccally oriented), which are fastened in the adequate position by mean of the BiTine rings. These rings are available in both round and oval shapes, suitable to be used single or in pair (for mesio-occluso-distal cavities).

Some of the advantages of this system are:
- The anatomical contour helps obtaining proper proximal contact and embrasures;
- The facility of use;
- The good visibility of the operating field;
- Smaller tension on the tooth and thus greater comfort for the patient.

Some authors consider the curvature of the Palodent matrix to be too strong and in some situations to pressed in a too tight proximal contact against the next tooth.

Properly placing the precontoured matrix requires enough space in order to avoid forcing and distorting the band. This separation can be obtained either interdentally placing the BiTine ring before and during preparation, or introducing a wedge during preparation.

A special forceps (similar to the one used for rubber dam clamps) is used to place the ring into position; the arms of the forceps are placed diametrically opposed on the ring, which is opened to spread and positioned with the ends of the ring’s arms placed interdentally.

Standard Palodent matrix are usual; the Mini type is applied in cases of partially erupted teeth and the Plus type in the situation of extensive subgingival cavities: the ribbons are longer and have a gingival extension. (Fig. 3)

After cavity preparation and wedge or ring removal, the matrix is rolled for adapting it at the circumference of the tooth, and is placed in the interdental space. The wedge is then introduced in order to perfectly adapt the matrix to the gingival area and the ring is positioned, the wedge is placed between the matrix and the ring. The ring must not lean against the wedge. (Fig. 3)

The matrix may be slightly burnished from inside the cavity (taking care not to warp it), to reach an intimate contact with the next tooth. After the restorative material is inserted and polymerized, first the ring, then the wedge and eventually the matrix are removed and the finishing of the restoration can take place.
Class II occluso-proximal restorations represent one of the most important steps in achieving an aesthetic composite restoration; the main issue is the choice and proper placement of the matrix. Unlike amalgam, which can be laterally condensed to obtain an optimal proximal contact, aesthetic materials entirely depend on the contour and position of the matrix. This makes the restoration of the proximal contact with aesthetic materials difficult and requires much care in adapting the matrix and wedge.

As mentioned, it is recommended to place a wedge in the interdental space corresponding to the proximal surface that is to be prepared ("pre-wedging"), one of the reasons is to obtain an enough teeth separation to compensate the thickness of the matrix. In situations where the clinical situation imposes this two ("double wedging") or even more wedges ("multiple wedging") can be used in the same interdental space. The matrix will be positioned in tight contact with the next tooth.

A thin metallic matrix is recommended because it occupies a smaller space and is easier to contour and maintain in place than a celluloid matrix. At the same time the metallic matrix has a greater resistance when condensing the restorative material, particularly when a harder one is used.

No problems usually occur with the polymerization of the restorative material when using metallic matrix, as far as limited quantities of the material are successively placed in the cavity and polymerized before adding new increments.

If a Tofflemire-type matrix is used when restoring a cavity extended on two surfaces, its (double) thickness has to be compensated by placing an adequate thick wedge. It is preferably to use an ultra-thin matrix (001) in order to obtain a correct proximal contact. The ribbon has to be burnished before the insertion - in the same manner as for amalgam restorations - for the future restoration to be properly contoured.

Similar systems of matrix ribbons have been developed for Tofflemire-type matrix retainers, using preformed ultra-thin ribbons. The usual thickness of a standard Tofflemire ribbon of 0.0015 inch (30 µm) is replaced by 0.0010 inch (20 µm) and 0.0006 inch (12 µm). Such systems are:

- HO Bands (Young Dental); (Fig. 4)
- Microbands (Dental Innovations).

A good matrix used for restorations in class II cavities with two surfaces is the pre-formed semi-matrix, fastened to the tooth by mean of thermoplastic points and special designed devices (rings). The wedge for “pre-wedging” is removed before placing the matrix, the matrix is introduced and maintained using a metallic instrument in tight contact with the adjacent tooth. Two thermoplastic points are softened and used to secure the matrix both buccally and lingually, and the ring is adapted with a special forceps. (Fig. 5) The interdental wedge is placed cervically, and if further matrix adjustments are still necessary, they can be performed by mean of a heated Black hand-excavator.

In cases of mesioocclusodistal cavities, an ultra-thin, burnishable Tofflemire-type matrix is recommended to be used in order to properly reestablish the proximal contact. The matrix is contoured, placed, fixed with wedges and then adapted to obtain a correct proximal profile in both proximal contact and embrasure areas. Ring matrix, already
pre-formed and suitable to be used with Tofflemire retainer, are also very comfortable.

**Figure 6.** Pre-contoured contact-forming instruments OptraContact.

**Figure 7.** Aspect of restoration material after using the OptraContact instrument.

The use of polyester ribbons has to be limited to very small proximal cavities. The matrix has to be very careful contoured to the convex profile of the proximal surface. This profile can be obtained by applying and pulling the band on a round metallic instrument.

Polyester pre-formed ribbons are commercially available, both for Tofflemire retainer and as special systems (Translite Auto Matrix System). The polyester transparent ribbons are usually thicker than the metallic matrix, which implies using thicker wedges to obtain enough interdental separation. It is to be stressed that polyester bands are not to be used in restoring large cavities, as they can not be adequately adapted and do not have the necessary strength for condensing dense materials.

Contemporary concerns related to the reestablishment of the proximal contact for composite resin restorations lead to pre-contoured instruments specially designed to obtain the proximal contact (“precontoured contact-forming instruments”). Such specially designed class II occlusoproximal systems are:

- ContactPro (C.E.J. Dental);
- TriMax (AdDent);
- OptraContact (Ivoclar Vivadent). (Fig. 6, 7)

The matrix and the wedge are removed after polymerization and the restoration is examined for gaps or deficiencies of the proximal contact. If some corrections are necessary, they have to be performed before the field isolation is removed, in order to increase the chances for the newly added restorative material to adhere to the already polymerized one.

The proper proximal contact reestablishment in class II occluso-proximal cavities aesthetically restored with composite materials essentially depends on the contour and position of the matrix. The correct choice, adaptation and placement of the matrix and wedge decisively depend on this aspect. This can be illustrated by mean of some comparative clinical observations.

**Clinical case No. 1**

**Figure 8.** Tooth 3.6.- Cavity aspect after preparation.

**Figure 9.** Tooth 3.6.- Placement of Tofflemire matrix and retainer.
CONCLUSIONS

Some instructions have to be followed in order to obtain a correct proximal contact when using aesthetic restorative materials of composite type in class II cavities:

1. Ultra-thin matrices have to be used, because, unlike amalgams, aesthetic materials can not be efficiently laterally condensed; the matrix needs to be pre-contoured or adapted by the dentist to the profile of the proximal surface.

2. Placement of the interdental wedges before the cavity preparation ("pre-wedging"), thus obtaining:
   - The interdental separation necessary to compensate for the thickness of the matrix;
- Protection for the adjacent tooth and the rubber dam;
- Adequate proximal contact, after the removal of the wedge and return of the tooth to its normal position.

3. Placement of elastic positioning clamps for the sectional matrix before cavity preparation, in order to obtain the same effect of teeth separation for compensating the thickness of the band – for the Palodent system and the Compositight, Sectional Matrix Retainer and Hawe Adapt Sectional Matrix systems.

4. Push the matrix toward the proximal surface of the adjacent tooth, taking care not to wrap the pre-contoured profile.

5. Use the small diameter cones to guide the light during the light curing.

6. Use rigid pre-polymerized or prefabricated inserts in order to facilitate the proper proximal contact and to increase the strength of the restoration.

The failure to obtain correct proximal interdental contacts with aesthetic material restorations has usually the following reasons:

1. The matrix does not have an adequate profile for the proximal outline of the tooth;
2. The matrix is too thick, with the impossibility to be compensated by the return movement of the tooth;
3. The matrix is incorrectly adapted;
4. The change of matrix position during placement and shaping of the restorative material;
5. The use of a circular matrix when restoring a single proximal contact without an additional teeth separation;
6. The incorrect use of the wedge which either does not firmly press the matrix on the tooth in the gingival area, or wraps the matrix profile;
7. The lack of interdental separation with wedges or rings prior to and during cavity preparation;
8. The insufficient polymerization of the composite material with distortion at matrix removal;
9. The inadequate finishing of the proximal surface.

REFERENCES