

"Everything About Matrix and Matrix Systems - A Review Article"

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Abstract

To realign the tooth with its arch, it is necessary to provide the correct anatomical form and proximal connections. It stops additional issues with the tooth's position shifting, which lessens food impaction, interproximal caries, and periodontal issues. For the clinician, making the right contacts can be a very difficult procedure. The best contacts can be created using a variety of methods and supplies, such as retracting the gingiva to provide adequate access and visibility throughout the cavity and to provide the right shapes.

Using matrices, wedges, Teflon tapes, etc., perfect connections are constructed. The current narrative review explains how to establish contact with the many matrices and wedges that are available.

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I. Introduction

Appropriate tooth form and anatomy restoration is required for the lifetime of posterior and anterior restorations. During the repair of class II cavities, most physicians have significant obstacles in restoring adequate anatomical proximal contour and tight interproximal contact. The proximal contour of a class II restoration must mirror the sound tooth to create proper proximal geometry. Maintaining the typical mesiodistal connection between teeth stabilizes the dental arch, reduces food impaction, safeguards the interdental gingival papilla, and preserves a healthy periodontium when optimal contact and contour are restored. Malaligned teeth are linked to improper proximal contact or contour, which can result in food lodgement, halitosis, and the start of dental caries and periodontal illnesses.¹

Regaining the appropriate proximal contact tightness in class II resin composite restorations is one of the primary problems. The application of rubber dam, the flexibility and thickness of the matrix band, the incondensability of resin composites, and the volumetric shrinkage that happens during polymerization are some of the elements that are blamed for this challenge.

A restoration can be contoured using a matrix to mimic the structure of the tooth it is replacing. The Latin word "Mater," which means "Mother," is the source of the English term matrix. It was first presented by Dr. Louis Jack in 1871.

According to the definition given with the reconstruction, a dental matrix band is "a properly shaped piece of metal, or other material, inserted to support and to give form to the restoration during placement and hardening of the restorative material."²

Dental matrix systems are divided into groups based on the kind of matrix band and the application method. Matrix systems specifically made for posterior direct resin composite restorations are widely available on the market. The two most popular ones are the sectional and circumferential matrix systems. The circumferential matrix band was initially described by Dr. Louis Jack in 1871. Various schemes were introduced after the Jack matrix. The Tofflemire band and retainer were created in 1946 by Dr. Joseph Tofflemire and are still in use today. Although circular matrix systems are simple to operate and save time, they typically only replicate one point of contact rather than an area and are unable to replicate the correct position and tightness of the contact.³

II. Functions Of Dental Matrices

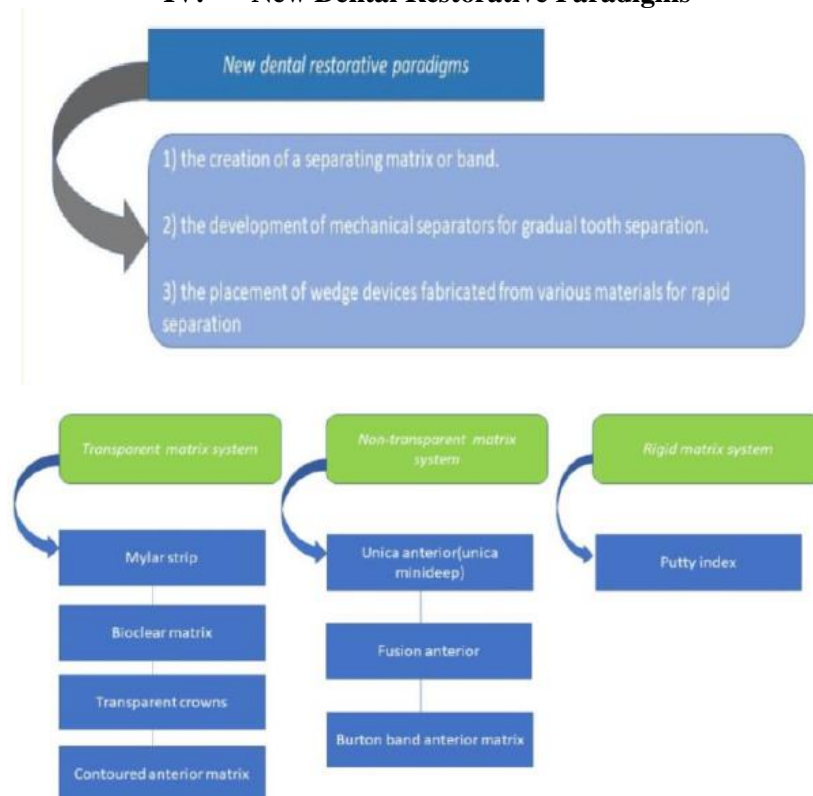
- Keep the restorative material contained and avoid letting it overflow.
 - Restore the tooth's anatomy to aid in reconstructing its lost contour and contact relationship.
 - Preserve the tooth's biological function and shield the surrounding tissues to prevent damage.
 - Contribute to the surface polish to make the surface less prone to collecting food particles or plaque.
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- Diminish the likelihood of developing secondary caries.
- Extend the composite repairs' useful life.
- Preserve the adjacent tooth while undergoing a cavitary preparation process.

III. Ideal Requirements

- **It ought to be simple to use:** Tools that are simple to use can significantly improve the efficiency and accuracy of dental procedures. Tools should be ergonomically designed, intuitive, and require minimal adjustments. Simplicity in use reduces the risk of errors, shortens procedure time, and enhances the overall experience for both the dentist and the patient.
- **Removal ease:** Dental materials should be easy to remove when necessary, without causing damage to the surrounding tissues or structures.
- **Ensure appropriate contouring and proximal contact:** Proper contouring and proximal contact are essential for the functionality and aesthetics of dental restorations. Proximal contact ensures that the restored tooth maintains appropriate contact with adjacent teeth. This helps in preventing food impaction, maintaining periodontal health, and ensuring proper tooth alignment.
- **The rehabilitation should be contained and cost-effective:** Dental restorations and treatments should be contained within the intended area and should not cause unnecessary damage or affect surrounding tissues. This containment ensures that the rehabilitation addresses the specific issue without creating additional problems. Moreover, cost-effectiveness is a key consideration. Materials and methods used should provide high-quality results while being affordable for patients.
- It should operate as a temporary wall of resistance during the introduction and setting of the restorative material;
- it should exhibit resistance to condensation pressure; it should not adhere to or react with the matrix; and it should help isolate the teeth with a rubber dam during the introduction of the restorative material without injuring the gingiva.
- It should assist in creating an adequate seal and keeping the operating field dry to avoid contamination.⁴

IV. New Dental Restorative Paradigms



V. Mylar Strip

- **Mylar Strip and Pull-Through Technique:** Effective for restorations with flat contact regions but challenging when multiple surfaces need restoration.

- **Multiple Restorations:** Time-consuming and complex, requiring precision and skill to simultaneously manage various lesions and surfaces.
- **Class V Cervical Defects:** Traditional matrices like Mylar strips are ineffective; specialized techniques and materials are needed to handle the unique challenges posed by these defects.⁵

VI. Teflon Tape

- **Translucency:** Both cellulose acetate strips and clear Teflon allow light to pass through, ensuring thorough photoactivation of composite resins. This results in well-cured, strong restorations.
- **Non-Stick Properties:** PTFE tapes and clear Teflon strips prevent the composite material from adhering to the matrix, making the removal process straightforward and preserving the integrity of the restoration.
- **Thin and Flexible:** PTFE tapes, when stretched, become very thin and flexible, making them ideal for creating precise interdental barriers and achieving realistic contact areas in restorations.
- **Versatility:** These matrices can be used in various restorations, including anterior and posterior teeth, and are particularly useful in situations where multiple surfaces or complex contact points need to be managed.⁶

VII. Modified Putty Index Using Mylar Strip⁷

A putty index of the incisor teeth is created when the tooth defect that needs to be fixed is developed using direct or indirect techniques. Silicone putty ingredients, either addition or condensation, are used to make the index. After applying a bonding agent and acid-etching the tooth surface that has to be fixed, the putty index is placed on the palatal surface in preparation for composite insertion. Using a clear silicone index is an additional choice. Since silicone is sticky, it may be difficult to build, making it difficult to correctly implant many direct composite resin restorations.

Advantages

- It produces the proper incisal edge shape and length when the palatal surface is restored using a hard matrix, which is then utilised to direct and support the labial surface composite buildup.
- It aids in controlling the moisture on the palatal surface.
- It can be applied to badly flawed restorations, crowded teeth, and multiple tooth restorations.
- Flexible matrix Mylar strips aid in achieving the best possible labial surface finish and optimal attractive anatomic contour when employed in the labial surface buildup.

Disadvantages

- Flexibility can lead to inaccurate contour and contact establishment in severe defect restorations, making it difficult to obtain precise contour in the palatal aspect of restorations.

VIII. Transparent Crown

They are typically utilised for first full coronal restorations when tooth tissue has been lost from numerous surfaces, usually due to trauma or cavities. Additionally, they are commonly used in the growth of microdont incisors. The 0.05 mm thin anatomical strip is tapered, offering the perfect curvature and band height for almost any anterior restoration from one end to the other. To ensure that the tooth heights are precisely aligned, slide the strip interproximally. Pre-contouring makes it simple to rebuild the occlusal-gingival anatomy and prevents flat embrasures. Class IV and diastema closure use it.

IX. Bioclear Matrix System

They have less curvature than diastema closure matrices and are utilised in aesthetic and restorative dental operations where small regions need to be filled. Narrow sections can be closed with a big contact by using the matrix wedge-free. Once the matrix is placed in the sulcus, the papilla stabilises it and closes it to some extent. The composite can be injected or positioned into the embrasure without running the danger of an overhanging margin thanks to the anatomically shaped Bioclear matrices. It offers better cervical adaptation compared to flat Mylar strips. It preserves the gingival papilla and allows for easy matrix selection.

X. Burtonbands Anterior Matrix System

The anterior matrix system of the Burtonbands aids in the development of the proximal wall. It makes the restoration completely accessible, which enhances the creation of the face embrasures and makes it possible to properly shape and position the incisal embrasure. Sealing the gingival margin to avoid isolation issues, excess flash, and overhang margin while permitting access to subgingival cavities that are challenging to reach.

XI. Fusion Anterior Matrix System

It offers a strong seal at the cervical margin, preserving the perfect tooth anatomy, and its special "T" shape rests deep in the interproximal area, lessening the dreaded "black triangle." When deep restorations are used, the cervical interface offers superior adaptability. Strong metal matrix bands are much thinner than regular plastic strips and can be inserted into the sulcus and through existing contacts for deeper repairs. Because the ideal face and lingual anatomy and gingival/incisal anatomy are pre-built, sculpting in the vital anterior region is made simpler. They sit interproximally by sliding easily along the interdental papilla, enabling maximal tooth separation and assisting in the prevention of black triangles.

Indication:

Suitable for Anterior Restorations Such as Class III and IV Crowns and Composite Veneers

1. **Class III Restorations:** These involve cavities located on the interproximal surfaces of anterior teeth (incisors and canines) that do not include the incisal edge. The use of appropriate matrices ensures proper contouring and contact, which is crucial for both function and aesthetics.
2. **Class IV Restorations:** These involve the interproximal surfaces of anterior teeth that include the incisal edge. Matrices help in reconstructing the lost tooth structure, ensuring the restored tooth maintains its natural shape and strength.
3. **Composite Veneers:** For improving the appearance of anterior teeth by covering imperfections such as discoloration, chips, or minor misalignments. Using matrices in these procedures helps achieve a smooth, even surface and ensures that the veneers blend seamlessly with the natural teeth.

Produces the Correct Anatomical Curvature in Both Gingivo-Incisal and Facial-Lingual Orientations When Properly Inserted

XII. Unica Anterior

The Unica Anterior Matrix System is specifically designed for anterior dental restorations, offering a range of benefits that enhance the predictability and quality of restorations. Here are its applications and advantages in detail:

Applications:

Direct Composite Veneers

- **Direct Composite Veneers:** This system is highly suitable for the application of direct composite veneers, where composite resin is applied directly to the tooth surface to improve its aesthetics and function. The Unica Anterior Matrix helps in achieving a smooth and even veneer surface, ensuring that the composite material is correctly shaped and contoured to match the natural tooth anatomy.

Class III Anterior Restorations

- **Class III Restorations:** Involve cavities located on the interproximal surfaces of anterior teeth that do not include the incisal edge. The Unica Anterior Matrix system facilitates the restoration of these cavities by providing a stable and well-adapted matrix that helps in achieving proper contour and contact points, critical for both function and aesthetics.

Class IV Anterior Restorations

- **Class IV Restorations:** Involve the interproximal surfaces of anterior teeth including the incisal edge. The system aids in reconstructing the lost tooth structure, ensuring that the restored tooth maintains its natural shape and strength. It is particularly effective in restoring the tooth's incisal edge and proximal contacts.

Class V Anterior Restorations

- **Class V Restorations:** These are lesions located at the cervical third of the tooth, often involving both the enamel and dentin near the gum line. The Unica Anterior Matrix system's design allows it to adapt well to the cervical area, providing excellent control and predictability for restorations in this challenging area.

Advantages:

Simultaneous Restoration of Proximal and Cervical Margins

- **Efficiency:** The Unica Anterior Matrix system allows for the simultaneous restoration of both proximal and cervical margins. This improves efficiency by reducing the number of steps and simplifying the procedure, leading to shorter chair times and increased patient comfort.
- **Accuracy:** Achieving a proper contour in both proximal and cervical areas simultaneously ensures a more accurate and natural restoration. This is crucial for maintaining the tooth's function and appearance.

Effortless Handling of the Cervical Area

- **Predictability:** The system's design allows for precise handling of the cervical area, leading to predictable outcomes. This is particularly important for ensuring a tight seal and proper adaptation of the restorative material to the tooth surface, preventing microleakage and secondary caries.
- **Gingival Retraction:** The matrix system helps in retracting the gingiva (gums), providing better visibility and access to the cervical margin. This ensures that the restoration extends properly to the gingival margin, enhancing both the function and aesthetics of the restoration.

Restoration of Proximal Borders to Their Contoured Profile

- **Natural Contours:** The Unica Anterior Matrix system helps in restoring the proximal borders of the tooth to their natural, contoured profile. This is essential for achieving proper interproximal contacts, preventing food impaction, and maintaining periodontal health.
- **Stability:** The system ensures that the composite material is held in place during the curing process, resulting in a stable and durable restoration that closely mimics the natural anatomy of the tooth.¹²

XIII. Newer Matrix system

First Generation Rings: Reel Matrix

Developed by Garrison, the Reel Matrix system features a reel that securely fits into a handle. By pressing the reel into the handle, the grippers retract to lock it in place. These matrices are pre-contoured in three dimensions and have a retainer-less design. An additional ring can be added to prevent material flash. The bands are available in both clear and metal options.

Palodent 360

The Palodent 360 is a new circumferential matrix system designed to establish tight contacts with anatomically natural curves without needing a retainer or applicator. Its integrated tightener/retainer eliminates the need for bulky retainers or additional placement and tightening tools. This design improves efficiency, simplifies placement, provides better access and a clear view of the operative field, and enhances patient comfort.¹⁴

Pro-Matrix Curve¹⁸

The Pro-Matrix Curve utilizes a straight band that extends from the side casing. To create the necessary conical shape, a "band deflector" component is used, which can be adjusted up and down, allowing the device to be employed in all four quadrants of the mouth.

Features:

- Freely Rotating While Tightening:** The device turns freely during tightening and has a slim body and toggle that do not extend.
- Versatile Use:** The circumferential band can be used for both proximal and cuspal restorations.
- No Assembly Required:** The Pro-Matrix Curve requires no assembly or additional tools for application.
- High-Tension Mechanism:** Its high-tension mechanism enhances compacting of the restorative material.
- Customizable Fit:** Easily adjustable to match the shape of the tooth.
- Improved Visibility and Comfort:** The narrow front section of the matrix enhances visibility and patient comfort.
- Quadrant Versatility:** Suitable for restoring cavities in all quadrants with any restorative material.
- Ease of Use:** Wedges and rubber dams can be easily placed.¹⁹

SuperMat²⁰

The SuperMat is a Universal Matrix Tensioning System designed for large areas and is compatible with both transparent and steel posterior matrices. It offers a quick, simple, and uniform application process. According to statistical data, its thin and distinctive Adapt Super Cap ring matrices are specifically engineered for better adaptation to the tooth structure. The Super Cap is available in steel or transparent plastic, with two band heights and a single shape suitable for both molars and premolars. Additionally, the Super Cap spool can be used to adapt and utilize Kerr's matrices with the SuperMat system.¹⁶

Second Generation Rings:

V3 Rings (Triodent)

Invented by Dr. Simon McDonald in 2008, the V3 rings come in two varieties for bicuspid and molar teeth. These rings use pre-contoured matrix bands and a unique wedge called the "wave wedge" to aid in gingival adaptation. Made from nickel-titanium, the rings are more flexible and durable than those made from stainless

steel. The plastic tines accommodate the wedge and are wider, allowing the ring to contact more tooth structure buccally and lingually, resulting in a precise contour for the restoration. The system offers various types of matrices.

V3 Super Curve Kits:²¹

- **Features:** Micro-thin, color-coded matrices with a gingival apron that provides coverage for deeper preparations.

Clear Metal Matrix:

- **Features:** Resin-laminated micro-window that allows light to pass through, enhancing the curing process.
- **Design:** Greater curvature hugs the tooth for increased stability during placement.

Available Wedges:

- **Wave Wedge with Wedge Guard**
- **V-Wedge**
- **Adaptive Wedges:** Transparent options for improved visibility and adaptation

Third Generation Rings:

Composi-Tight Matrix²²

The Composi-Tight Matrix system features two independent rings specifically designed for premolar and molar teeth. These rings have converging tines with retentive balls at the ends for better grip on the teeth and are omnidirectional. However, the connections are not as tight (0.27 kg/mm), and the large diameter of the rings can cause them to collapse when used in large cavities. The ring thickness is 0.03 inches. The height options are: Periodontic - 4 mm, Small - 4.5 mm, Regular - 6 mm, and Large - 8.5 mm. The manufacturers are Garrison Dental Solutions and Danville Materials.

Composi-Tight 3D Soft Face Ring XR or DXR:²³

- **Design:** Two types of rings provide necessary tooth separation and aid in band adaptation for a tighter, more natural contact.

Features:

- Silicone-coated tines offer strong support and shape for the band in wide proximal preparations.
- The soft face replicates the interproximal area between teeth, allowing the band to conform accurately to the tooth contour and eliminate flash.
- The slotted bottom is designed to fit directly over the wedge, ensuring secure placement.

Disadvantages:

- Stacking rings, such as placing one ring over another for MOD restorations, poses a challenge.
- Since the contact rings are made of stainless steel, repeated use and sterilization cause them to lose their springiness over time.
- The system is expensive.
- Rings may collapse or become displaced in the case of wide proximal boxes

Composi-Tight 3D-Fusion²⁴

The Composi-Tight 3D-Fusion system features variations in tine curvature and wide ring separators, complemented by ultra-adaptive wedges.

Contents:

- 1 Short ring (blue)
- 1 Tall ring (orange)
- 1 Wide prep ring (green)
- 70 Assorted matrix bands
- 80 Assorted ultra-adaptive wedges
- 12 Assorted fender wedges
- 1 Ring placement forceps

Composi-Tight 3D Clear Matrix (Third Generation System)²⁵

This system utilizes transparent and translucent materials to facilitate trans-enamel polymerization.

Advantages:

- Allows curing light application from both buccal and lingual surfaces without obstruction from metal matrix bands and opaque separator rings.
- Ensures proper curing of deeper proximal boxes and bulk-filling Class II restorations.

Kit Contents:

- Composi-Tight 3D XR ring (3DXR)
- Composi-Tight 3D clear ring (3D600)
- Clear bicuspid bands
- Clear molar bands
- Clear tall molar bands
- Assorted clear wedge wands
- Assorted fender wedges
- Ring placement forceps

Indications:

- Suitable for small to moderate Class II cavities involving one or both proximal surfaces in posterior teeth.
- Applicable for both amalgam and composite restorations.

Advantages:

- Easy to use with good visibility.
- Anatomic contour of bands ensures optimal contact areas and embrasures.
- Exerts minimal tension on teeth, providing greater patient comfort.
- Pre-wedging is not required.
- Adequate contact dimensions in the correct anatomic location.
- Promotes good gingival adaptation of the restoration.

Special Features:

- Rings have hugging silicone tips for flash removal.
- Matrix bands are tinted blue to enhance visualization.
- Cure-through WedgeWands allow curing light to penetrate directly to the critical gingival floor

Dual-Force Sectional Matrix System²⁶

The Dual-Force Sectional Matrix System is designed to provide optimal proximal contacts and reduce overall finishing time. The system features dual NiTi rings that generate up to 37% more separating force while significantly reducing hand strain during ring expansion. The even distribution of forces enhances fracture resistance, and the prongs engage deeply into the embrasure, preventing the ring from dislodging. Its 20° placement angle to the occlusal plane facilitates easy rubber dam placement. The system includes active wedges in various sizes and matrix bands available in 4.5 mm, 5.5 mm, and 6.5 mm.

Advantages:

- Delivers predictable, tight, and broad proximal contacts.
- Minimizes flash and eliminates composite overhang.
- Accommodates wide Class II restorations, including cases with full cusp loss.
- Maintains consistent separating force, eliminating the need for additional tension.

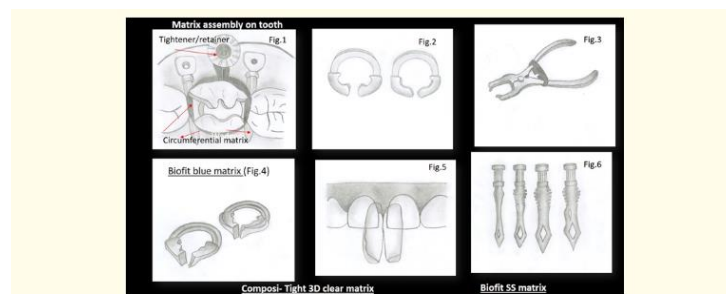


Figure 1-6: Matrix assembly and Parts of matrix system.

Figure 1: Palodent 360 circumferential matrix system, Figure 2: V3 rings (TRIODENT), Figure 3: Ring placement forceps, Figure 4: Compositight3D XR ring (3DXR), Figure 5: Biofit blue matrix, Figure 6: Diamond wedges.

Clinical Steps for Placing Sectional Matrices to Achieve Optimal Contacts in Challenging Situations:²⁷

Preparation of the Operatory Field:

This is the most critical step. Proper isolation is necessary to ensure good access and visibility for the operator. A rubber dam should be used with a large metallic frame. For molars, the clamp should be placed as far back as possible, while for premolars, it should be placed at least two teeth distally from the tooth being restored. This positioning prevents interference with the proper placement of the wedge, matrix, or ring. For additional isolation, a gingival or liquid dam can also be utilized. According to a Cochrane study by Wang Y. et al., isolating the tooth with a rubber dam may be essential for restoring the tooth with resin composite. While there was no strong evidence to suggest that using a rubber dam improves the survival rate of restorations, it remains an important practice during restorative treatments. Clinicians should continue to practice rubber dam placement, as never using a rubber dam is not an acceptable approach.

Pre- wedging

Before removing decayed tissue, using protective wedges or wedge guards with a metal fin is essential to prevent damage to the adjacent tooth wall. Achieving separation greater than the matrix thickness is crucial for proper placement, which is why using wide A+ Wedges inserted with a curved mosquito hemostat is recommended to ensure firm pressure and control gingival bleeding.

Due to their thin nature, sectional matrices can easily deform. Inserting the wedge can create a gap between the rubber dam and the tooth contour at that level. Another method to achieve separation is by placing an orthodontic separator a few days prior to the procedure. Anatomically hard wooden wedges are preferred as they produce the most pronounced separation effect. These wedges absorb water, causing them to expand (swell), whereas soft wooden wedges become weaker and more flexible, reducing the separation effect.

Space Evaluation

Volumetric harmony of the interproximal area is crucial for a functional Class II composite restoration. Before placing the matrix band, the available interproximal space must be assessed. If the proximal surface of the adjacent tooth is over-contoured, it should be corrected to prevent inverted anatomy and the formation of a deficient contact area. If necessary, the proximal contour of the adjacent tooth can be adjusted using abrasive disks in the middle and occlusal thirds. In the cervical third, a reciprocating handpiece with diamond-coated files and/or abrasive strips can be used.²⁸

XIV. Summary

Dentists strive to design restorations that maintain the tooth's functionality, integrity, and durability. Advances in materials, accessories, techniques, and the training of dental graduates have rapidly evolved the science of posterior, direct placement restorative technology. Proper restoration of anatomical landmarks is essential to maintain occlusal harmony and extend the longevity of restorations.

A critical step in placing restorations is the selection and use of the appropriate matrix. Matrices should be chosen based on their design to ensure ease of use and the creation of optimal contacts and contours. Dentists must select the best approach for each case, considering its specific requirements. Currently, pre-contoured sectional matrices and contact rings for composite restorations meet most criteria for achieving ideal contacts and shapes. For amalgam restorations, the universal matrix system is preferred.

Clinicians must have a comprehensive understanding of the anatomical and functional characteristics of contacts and contours to accurately recreate them with the best restorative materials. This knowledge helps maintain the health of the oral cavity.

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