TOOTH SEPARATION AND MATRICING: PAST, PRESENT AND FUTURE

Abstract

Tooth separation and matricing are essential techniques in modern dentistry, aimed at achieving optimal outcomes in various restorative and cosmetic procedures. Tooth separation involves carefully widening the spaces between teeth to enable the proper placement of matrices during restorative treatments. These matrices act as precise guides, helping dentists create accurate tooth contours and facilitating the precise application of dental materials. Through the combined use of tooth separation and matricing, dental professionals can achieve superior results in restorations, leading to improved aesthetics and functional benefits for patients.

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I. INTRODUCTION

Maintaining the health and functionality of the stomatognathic system necessitates proper tooth contacts and proximal restorations. Food impaction, tooth movement, and periodontal problems can result from the failure to restore proximate areas.

Tooth separation during restorative procedures is necessary to prevent damage. Matrix systems are used to create accurate tooth contour and proper proximal contacts.

While objective evaluation methods exist, dentistry relies on a tripartite approach to restoration, focusing on tooth shape enhancement, minimal interference with dental tissue, and use of tooth-colored materials. Meeting these criteria ensures proper function and protection of the oral complex.

II. TOOTH SEPARATION

Tooth separation refers to separating the adjacent teeth during different clinical situations using one device or the other. The devices used are known as tooth separators.

1. **Indications For Tooth Separation:** The situations where tooth separation is required are as follows:

   - For examination of the proximal surfaces of teeth if caries is questionable, especially in cases where contact areas are very tight and it is not possible to examine otherwise.
   - For removal of the foreign bodies (e.g., fruit seeds) that get stuck in between the teeth and are difficult to remove otherwise.
   - For insertion of the matrix band, in cases where the contacts are very tight.
   - For cavity preparation on the proximal surface of a tooth so that the bur does not accidentally injure the proximal surface of the adjacent healthy tooth.

2. **The Techniques Employed in Tooth Separation:** There are two distinct methods for establishing tooth separation referred to as slow and quick methods.
   Slow Separation or Delayed Separation

   This refers to the slow movement of the teeth to achieve the required separation by placing certain materials in between two adjacent teeth, such as gutta-percha sticks and orthodontic wires.

3. **Rapid Separation or Immediate Separation :** This refers to the rapid movement of the teeth to achieve the required separation by placing certain devices in between two adjacent teeth by following either the ‘wedge principle’ or the ‘traction principle’.

   Rapid separation by the wedge principle: A pointed wedge-shaped device is inserted between the teeth to create separation at that point or closure on the opposite proximal side of the involved teeth in order to separate them. The greater the separation, the more facially or lingually the wedge moves. These examples illustrate these types of separators:

Elliot separator: It is indicated for separations of brief duration that do not require stabilisation. It is useful for evaluating proximate surfaces and polishing restored contacts as a final step.

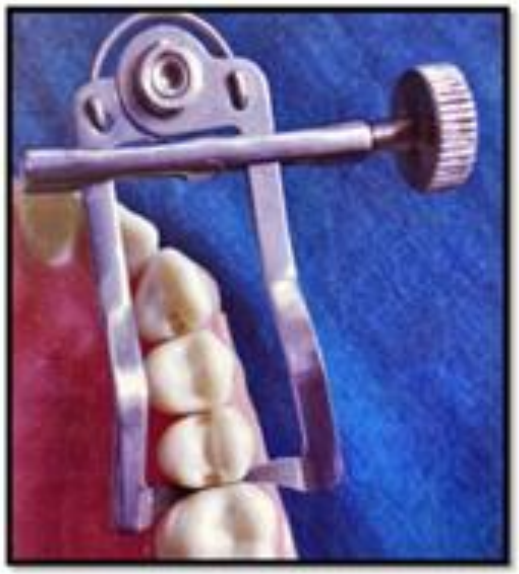

Figure 1: Elliot's Separator

Wood or plastic wedges: These are wedges with a triangular shape, typically made of treated wood or synthetic resin. The base of the triangle will be in contact with the interdental papillae, gingival to the gingival margin of the proximal cavity, in cross section.

Figure 2 : Wooden Wedges

Figure 3: Plastic Wedges

Transparent plastic wedges with a core that reflects light make up **light-transmitting wedges**. They are utilised in conjunction with transparent matrices when Class II composite restorations are being placed.

With the invention of newer sectional matrices, ‘flexible wedges’ are now available, which can adapt flexibly according to the space available in the interdental region.

III. THERE ARE DIFFERENT WEDGING TECHNIQUES

1. **Single Wedging:** The pointed end of a wedge is placed from buccal or lingual embrasure whichever is bigger. The band of the retainer is thus tightly wedged against the tooth.

Figure 4: Single Wedging Technique

2. **Piggyback Wedging:** When there is gingival recession and the proximal box is gingivally shallow, a single wedge may be placed very close to the gingival margin. In such instances, a second, typically smaller wedge is "piggy-backed" on top of the initial wedge. This will assure the matrix band's correct contour.

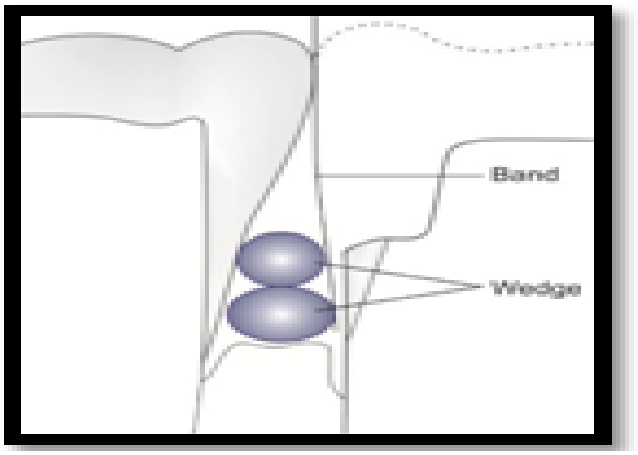

Figure 5: Piggyback Wedging

3. **Double Wedging:** This refers to the technique of incorporating two wedges, one from the buccal aspect and one from the lingual aspect, in order to provide close adaptation of the matrix band at the cervical aspect of the tooth

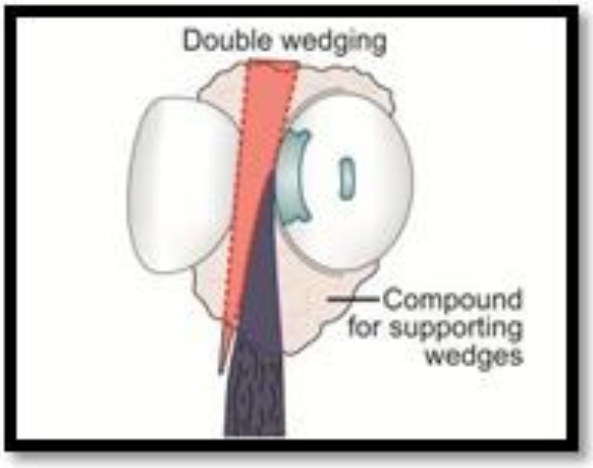

Figure 6: Double Wedging Technique

4. **Wedge-Wedging:** This procedure is predominantly deployed on the mesial aspect of the maxillary first premolars. Due to the fluted areas (concave areas) in the root near the gingival margin of these teeth, placement of a single wedge may still leave an exposed gingival margin. Consequently, a second wedge can be inserted between the first wedge and the band to eradicate this opening and ensure that the matrix band is well adapted to the gingival margin of the prepared cavity.

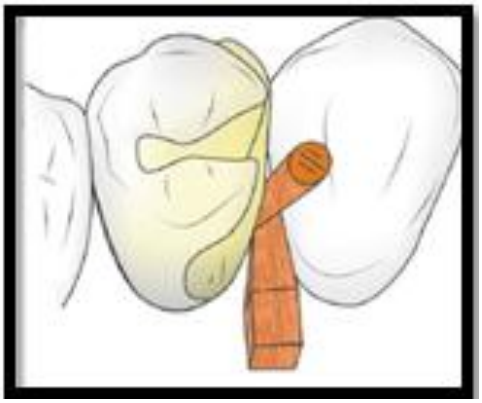

Figure 7: Wedge-Wedging Technique

Rapid separation by the Traction Principle: In this procedure, a specially designed instrument is used to separate two teeth. This device engages the proximal surfaces of two teeth and then separates them. Examples of separators that operate using the traction principle include:

- Non-interfering true separator
- Ferrier double bow separator
- Ivory adjustable separator

IV. MATRICING

A matrix is a device that is applied to a prepared tooth prior to the placement of the restorative material in order to aid in the formation of the proper axial tooth contours and confine the superfluous restorative material.

1. Ideal Requirements of A Matrix:

- Rigidity
- Establishment of proper anatomic contour
- Restoration of correct proximal contact relation
- Prevention of gingival excess
- Easy application
- Simple removal

2. Matrix System

- **Band:** It is a piece of metal or plastic intended to provide support and shape to the restoration during insertion and settling.
- **Retainer:** It maintains the intended position and contour of the band. The retainer may be a mechanical device, a wire, dental floss, or impression material.

V. CLASSIFICATION OF MATRICES

1. Based On Mode of Retention

- With retainer e.g., Tofflemire matrix
- Without retainer e.g., Automatrix

2. Based On Type of Band

- Metallic nontransparent matrix
- Nonmetallic transparent matrix

3. Based On Type of Cavity For Which It Used

- **Matrix for Class I Cavity Preparation**
  - Double banded Tofflemire (Barton matrix)
- **Matrix for Class II Cavity Preparation**
  - Single banded Tofflemire matrix
  - Rigid material supported sectional matrix
  - Ivory matrix no.1
  - Ivory matrix no.8
  - Copper band matrix
  - Anatomical matrix
  - Automatrix

- **Matrix for Class III Cavity Preparation**
  - Mylar strip matrix
  - S-shaped matrix

- **Matrix for Class IV Cavity Preparation**
  - Custom lingual matrix
  - Mylar strip matrix
  - Transparent crown form matrix
  - Modified S-shaped band matrix

- **Matrix for Class V Cavity Preparation**
  - Window matrix
  - Cervical matrix

VI. DESCRIPTION OF VARIOUS MATRICES

Tofflemire Universal Matrix Band Retainer: During preparations, a Tofflemire matrix system is created in which a temporary wall is built on the opposite side of the axial partitions to form the tooth structure around the missing portions. It is a circumferential metal matrix that serves as an effective barrier in class II restorations.

Figure 8: Tofflemire Universal Matrix System

1. **Auto Matrix:** The auto matrix technology enables matrix positioning and maintenance without the use of cumbersome retainers, resulting in simpler placement, enhanced access, a clearer view of the operative field, and increased patient satisfaction.

Figure 9: Auto Matrix System

2. **Ivory Matrix No.1:** For unilateral Class II cavity preparations, the Ivory Matrix No. 1 retainer is most frequently used. It has a claw on one end and two flat, semi-circular arms with a point at the end. On the opposite side of the retainer is a screw that, when rotated clockwise draws the extremities of the two claws closer together.

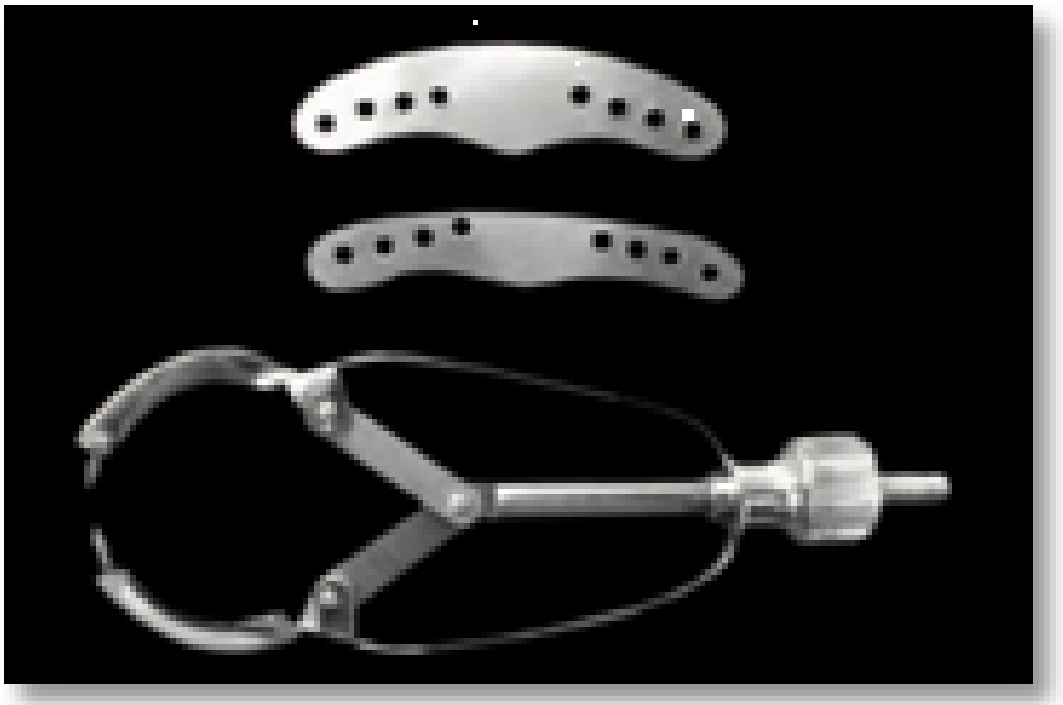

Figure 10: Ivory No.1 Matrix Retainer And Band

3. **Ivory Matrix No.8:** Ivory matrix retainer retains the matrix band that surrounds the tooth to provide lacking proximal walls. The matrix band is composed of a thin metal sheet so that it can pass through the tooth's unprepared proximal contact area. The matrix band retainer contains screw that can be used to modify the circumference of the band.

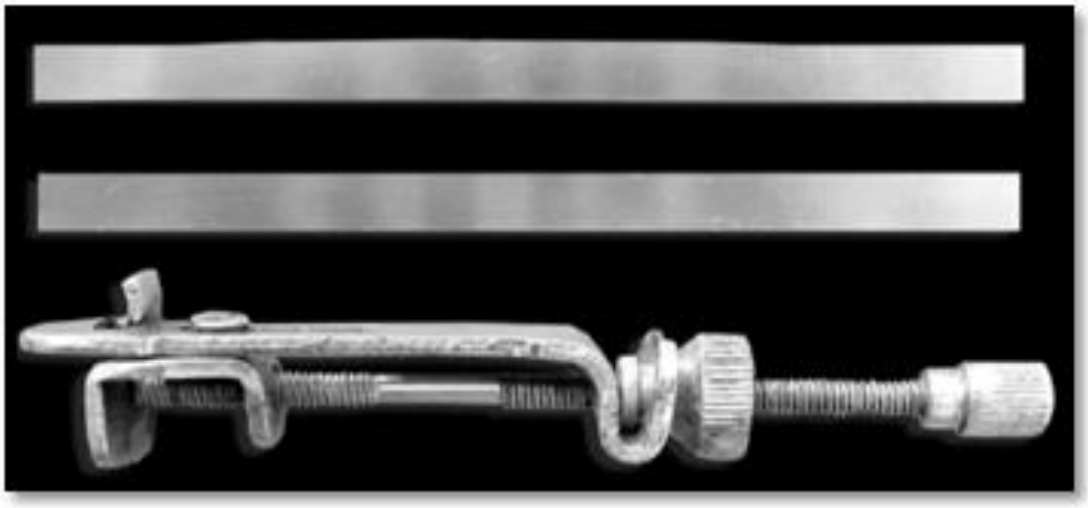

Figure 11: Ivory No.8 Matrix Retainer and Band

4. **Copper Bands:** For MOD restorations, it is recommended to use a continuous band. It may be kept until the restorations are finished.

Figure 12: Copper Band Matrices

VII. RECENT ADVANCEMENTS OF MATRICES

Over the years, the field of dentistry has witnessed significant advancements in matrix system technology, leading to improved techniques for tooth separation and matricing during restorative procedures. The aforementioned developments have enabled dental professionals to achieve improved proximal contact surfaces and anatomically accurate shapes, which are essential for achieving optimal form and function of the teeth and ensuring the preservation of the periodontal complex.

Several innovative sectional matrix systems have emerged, each designed to meet specific clinical needs. Some of these include the ConveXi-T S2 and Palodent Sectional Matrix System, Bioclear Matrix System.

Advancements have not been limited to posterior restorations, as there have also been significant developments in anterior matrix systems for composite restorations. Some of the notable innovations in this area are the Unica Anterior, Unica Minideep, Fusion Anterior Matrix System, and the Blue View VariStrip.

These advancements in matrix technology have led to precise interproximal restorations, ensuring proper marginal adaptation and reducing the risk of poor contours, overhangs, or weak restorative material condensation. The improved contact tightness and better anatomical shaping have resulted in enhanced patient comfort and restoration aesthetics.

VIII. CONCLUSION

Tooth separation and matricing have been crucial techniques in restorative dentistry, allowing for proper contours and contacts in composite resin restorations. The introduction of sectional matrix systems in the 1980s revolutionized the process, and modern advancements have further improved efficiency and effectiveness. Future developments, such as personalized 3D-printed matrices and new materials, hold promise for even better outcomes. Overall, tooth separation and matricing continue to play a vital role in dental restorations, ensuring optimal results for patients.

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