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A Simple Method for Modifying the Emergence Profile by Direct Restorations: The Biologically Active Intrasulcular Restoration Technique

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Clinical Relevance

It is possible to modify the natural emergence profile of the tooth using simple intrasulcular direct restorations. The shape of the intrasulcular part of the restoration will determine the design of the gingival contour.

SUMMARY

Some clinical situations, such as the closure of pronounced diastemas and the transformation of malformed, small, or peg-shaped teeth, require a rebalancing of dental proportions accompanied by a modification of the gingival contour. A traditional treatment plan might require surgical, prosthetic, and/or orthodontic treatment, but in some cases, these therapeutic options could be considered too invasive and not always the best solution. Moreover, not all patients are ready to undergo irreversible, long, and expensive procedures. To overcome these limitations and to solve all of these clinical problems in a rapid and noninvasive way, we propose a new technique that allows us to modify the natural emergence profile of the tooth using simple intrasulcular direct restorations. Using the Biologically Active Intrasulcular Restoration technique, it is possible to rebalance tooth shape and dimensions, gingival level and contour with low biological and economic costs. This method, which does not require any preparation of the dental tissues, is reversible and minimally invasive. It is applicable to patients of all ages, and results are obtained in a single appointment.

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INTRODUCTION

Generally, when it comes to applying adhesive techniques, both direct and indirect, one of the requirements is that the margin of the restoration is in an extrasulcular position. This leads to a number of advantages such as improved moisture

control (easier application of the rubber dam) and respect for periodontal health.

However, there are some clinical situations in which, to achieve satisfying esthetic results, it would be necessary to put the restoration margin apically with respect to the gingival line. This condition occurs in several clinical situations, such as the closure of pronounced diastemas or the transformation of malformed, small, or peg-shaped teeth, clinical situations in which a rebalance of dental proportions is required, very often accompanied by a modification of the gingival contour.

A traditional treatment plan might require surgical, prosthetic, and/or orthodontic treatment, but in some cases, these therapeutic options could be considered too invasive and not always the best solution. Moreover, not all patients are in a position to undergo irreversible, long, and expensive procedures.

To overcome these limitations and to solve these clinical problems in a rapid and noninvasive way, we propose a new technique that allows us to modify the natural emergence profile of the tooth using simple intrasulcular direct restorations: The Biologically Active Intrasulcular Restoration (BAIR) technique. The BAIR technique allows us to perform restorations that can actively interact with the surrounding soft tissues and facilitate the adaptation of the gingival margins. By modifying the emergence profile we are able to change the position of the gingival margin since the restoration holds the surrounding soft tissues. The shape of the intrasulcular part of the restoration will determine the design of the gingival contour.

This procedure enables us to apically displace the soft tissues, thus resulting in a lengthening of the clinical crown and an immediate reshaping of the gingival contour, helping to restore more appropriate dental proportions.

Purpose

The aim of this article is to describe the BAIR technique and to show its clinical applications, together with its advantages.

Description of Technique

The proposed method makes use of a circular metal matrix to isolate the operative site and, at the same time, to move the soft tissues and provide clear access to the intrasulcular portion of the tooth.[1] By doing so, a proper isolation is obtained, allowing the application of adhesives and composites.

CASE 1

A young girl showed poor alignment of the two central incisors. The left central incisor seemed to be extruded with respect to the adjacent teeth. The most appropriate therapy could be orthodontic treatment, which the patient had no intention of undertaking. Anamnesis told us that this tooth had a fracture and a subsequent reattachment of the fragment. At the time, there was evident discoloration, with more opaque and high chromatic dentin (Figure 1A). The tooth had been shortened, and space had been created to achieve more translucency. The metal matrix was applied, and the gingiva was pushed apically. The matrix was positioned around the tooth, tilted, pushed in the cervical direction keeping it adjacent to the tooth, and slid up to fit into the gingival sulcus. The matrix adaptation was facilitated with the use of an excavator or tweezers (Figure 1B).

Once in the sulcus, the metal matrix was gently pushed again to move the soft tissues. In this way, it was possible to obtain an isolation of the operative site and dislocation of the soft tissues in the apical, mesial, and distal directions. This process provided clear access to the intrasulcular portion of the tooth (Figure 1C) and allowed easy application of adhesive and composite. These applications facilitated the rebuilding of a new artificial cementoenamel junction (CEJ), which changed the emergence angle between the root and crown (Figure 1D). To avoid overhangs, the first layer had to be applied while the edge of the matrix was in close contact with the tooth.

The junction between the root and composite was moved beyond the natural CEJ. A new hybrid CEJ was re-created more apically, so that the gingiva could be supported and adapt itself to the design that had been created with the composites (Figure 1E). Just after removing the matrix, it was noted that the incisal and gingival levels were reestablished. The finishing of the extragingival part of the restoration was performed, whereas the intrasulcular part did not need finishing or polishing as it was already smooth and well cured because the composite polymerized in contact with the metal matrix and in the absence of oxygen (Figure 1F). After 2 years, the patient's gingival health was stable. Unfortunately, the discoloration was not properly improved. In hindsight, a greater amount of dentin should have been removed to reduce the opacity of the tooth (Figure 1G).

CASE 2

A young patient who was at the end of orthodontic treatment needed and wished for an enlargement of

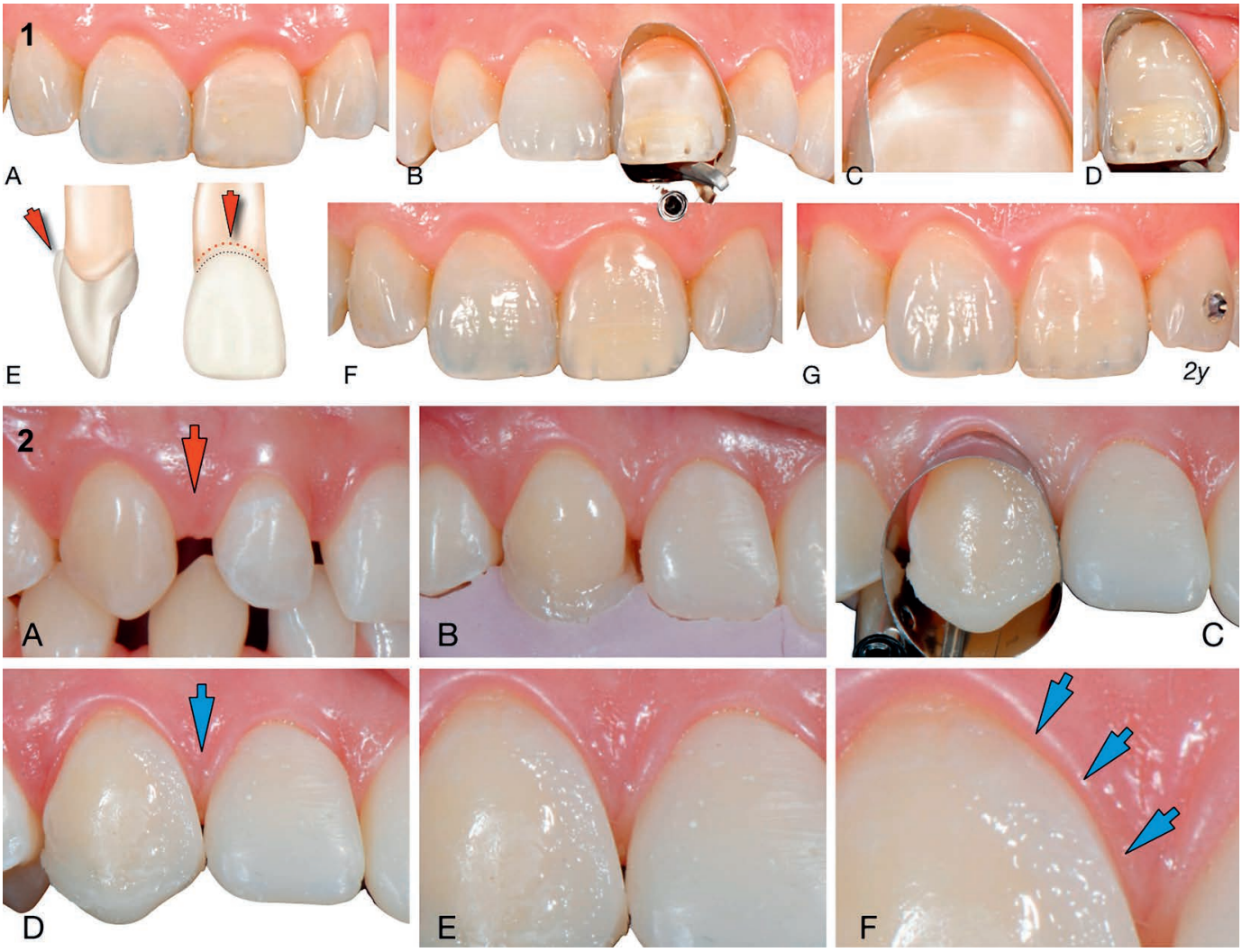

Figure 1. *(A): Poor alignment of the two central incisors. The left central incisor seems to be extruded with respect to the adjacent teeth. (B): The tooth has been shortened, and space has been created to obtain more translucency. The metal matrix is applied, and the gingiva is pushed apically. (C): The cervical area is isolated. (D): The composite is applied and pressed against the matrix and the tooth to change the emergence profile between the root and the crown. (E): In the diagram, it is highlighted that the border between the root and composite has been moved apically (red arrows). A new "hybrid cementoenamel junction" is created more apically, so that the gingiva can be supported and can adapt itself to the design that has been created with composites (red dotted line). (F): Just after removing the matrix, it can be noted that the incisal and gingival levels were reestablished. (G): After 2 years, the patient has stable gingival health.*

Figure 2. (A): A very evident diastema between the canine and lateral incisor (red arrow). (B): Using a template, prepared through a wax-up, we can rebuild the incisal edge with the new mesiodistal dimension. (C): The restoration was completed by connecting the incisal part with the cervical one, with the help of the metal matrix. (D): In this way, the proximal walls emerge from within the gingival sulcus. The diastema is closed (blue arrow). (E, F): It can be noted how the composite supports the gingival tissue (blue arrows) and how in this way we can instantly obtain a papilla.

her tiny teeth (Figure 2A). A wax-up was carried out, and from this, a template was prepared. This helped us to realize the incisal edge with the new mesiodistal dimension (Figure 2B). The restoration was completed by connecting the incisal part to the cervical one, with the help of a metal matrix (Figure 2C). In this way, the proximal walls could emerge from within the gingival sulcus (Figure 2D). It can be noted that the composite supported the gingival tissue, and in this way, the papilla was instantly obtained (Figure 2E,F).

CASE 3

The same procedure is applicable when the restoration of gingival papilla is desired because of the absence of an interproximal contact point. An elderly patient, wearing a removable prosthesis, showed an unpleasant smile because of small and worn incisors

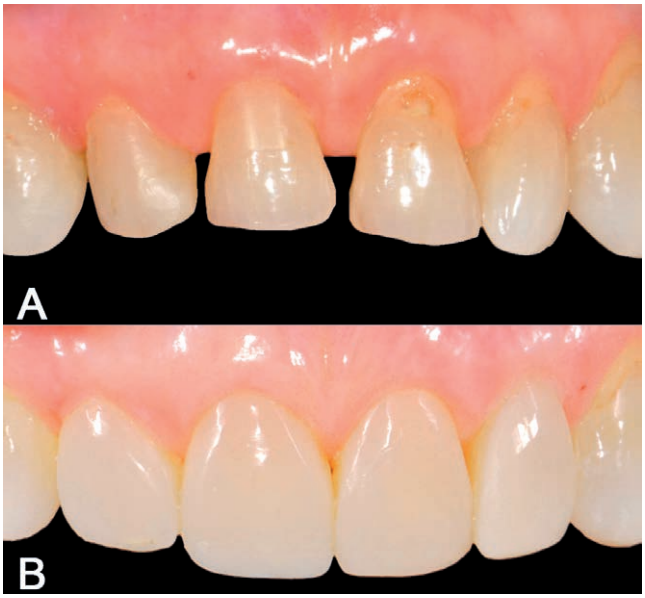

Figure 3. *(A): Unpleasant smile due to small and worn incisors and absence of papillae. (B): In a single appointment, using the Biologically Active Intrasulcular Restoration technique, the shape of the teeth was changed, thus creating new contacts more apically with consequent better adaptation of the soft tissues.*

and the absence of papillae. Her poor economic resources did not allow her to pay for a complex treatment plan (Figure 3A). Using the BAIR technique, the shape of her teeth was changed, thus creating new contacts more apically with consequent better adaptation of the soft tissues (Figure 3B). Her esthetic problems were solved in a single appointment.

CASE 4

A young patient with a peg-shaped upper left lateral incisor was treated using the BAIR technique (Figure 4A). The metal matrix allowed us to obtain insulation of the operative site and, at the same time, dislocation of the soft tissues in the apical, mesial, and distal directions (Figure 4B,C). Excess composite was applied because of the position and shape of the matrix (Figure 4D). The cervical part of the restoration drew the gingival contour and kept the surrounding soft tissues in a more apical position (Figure 4E). The right volumes and shape were restored afterward using a subtractive modeling technique, without milling the intrasulcular part of the restoration (Figure 4F). Changing the emergence angle of the tooth, together with its shape and contact points, allowed us to obtain a rapid adaptation of the soft tissue, with the restoration itself drawing the new gingival contour (Figure 4G). Follow-up after 2 years showed stable gingival health (Figure 4H-J).

MATERIALS USED

We used the Automatrix Medium Regular Band (Dentsply/Caulk, Milford, DE, USA). The adhesive system was chosen depending on the substrate. If only enamel needed to be conditioned, bonding resin (Heliobond, Ivoclar Vivadent, Schaan, Liechtenstein) was applied after conditioning with orthophosphoric acid (Gel Etchant, Kerr, Orange, CA, USA) for 30 seconds. If the restoration margin was located beyond the CEJ on a dentin substrate, a selective etching on enamel was performed, and a self-etch adhesive containing 10-MDP was applied (Clearfil SE, Kuraray, Hattersheim am Main, Germany). A medium-opacity universal composite was used (Supreme XTE, 3M ESPE, St Paul, MN, USA). Once the matrix was removed, a subtractive modeling was performed with a fine diamond bur (Composhape 4236 40 μm, Intensiv SA, Lugano, Switzerland). Finishing was performed with abrasive disks (Sof-Lex Pop-On XT 2381 M Ø 9.5mm, 3M ESPE) and abrasive strips (Proxostrip 40-15, Intensiv SA, Lugano, Switzerland). The restoration was then polished with a polishing paste (Optra-Fine HP, Ivoclar Vivadent) using a round brush (Enamel Plus Shiny S, Micerium, Avegno, Genova, Italy).

POTENTIAL PROBLEMS

The use of a traditional dental dam is not indicated because it is likely to hinder the vision of the gingival parabolas of the teeth, while it is essential to be able to continuously check the soft tissues to achieve a correct balancing of the gingival levels. However, the localized isolation offered by the metal matrix is more than sufficient,[1] and in the BAIR technique, the restoration originates in an area that would not be isolated by the dam anyway.

Generally, the metal matrix was stabilized with wooden wedges or by simply taking advantage of the contact points of the adjacent teeth. However, sometimes there were no adjacent teeth or we needed to significantly modify the position of the soft tissues. In such cases, it was necessary for the operator to exert a constant pressure on the matrix, using a finger to keep it in the desired position until the first composite layer was light cured. Therefore, constant assistance needed to be available.

If it was necessary to complete the restoration of the palatal side of the interproximal walls, we used

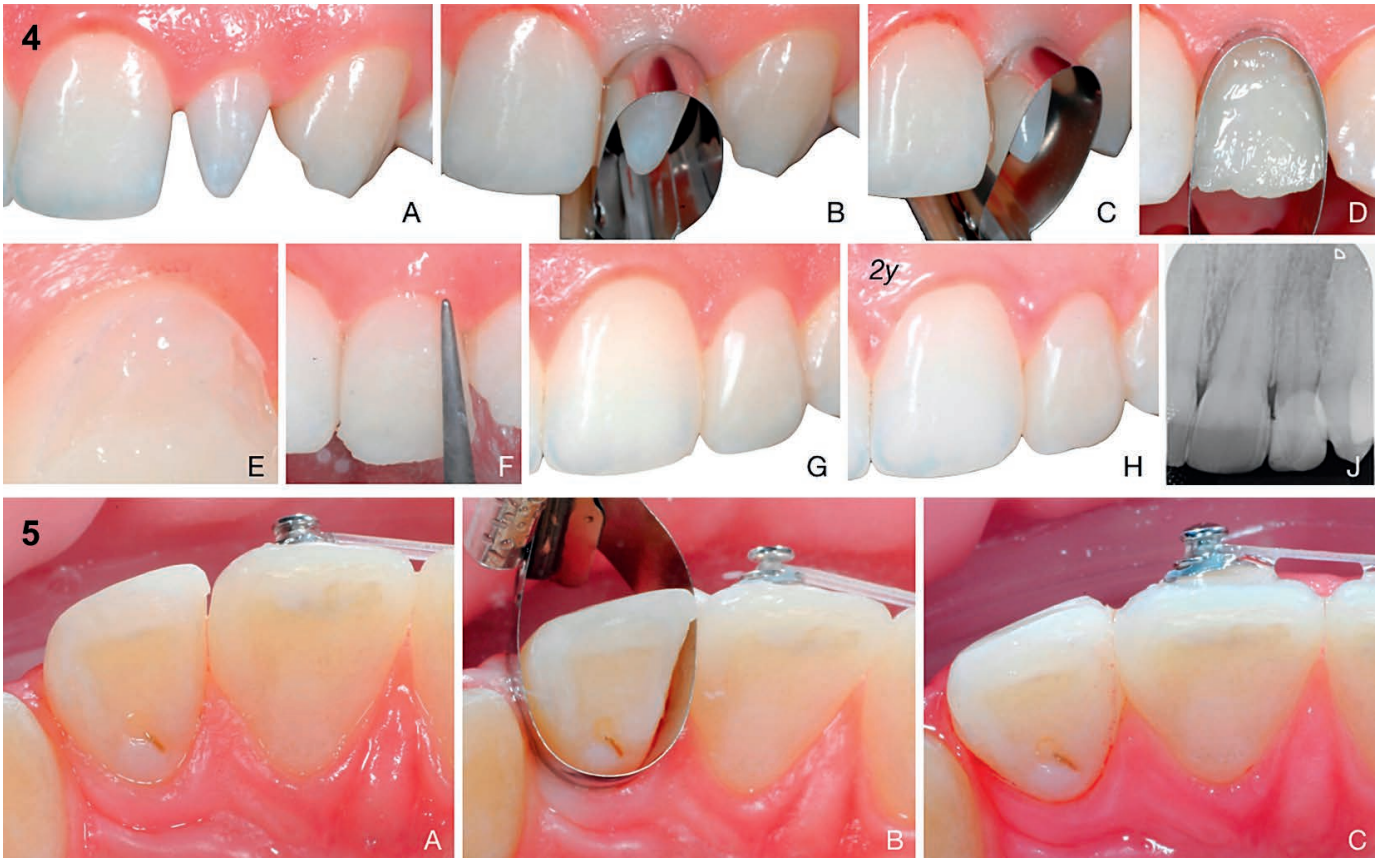

Figure 4. *(A): A peg-shaped upper left lateral incisor. (B, C): The metal matrix allows us to obtain an insulation of the operative site and, at the same time, the dislocation of the soft tissues in the apical, mesial, and distal directions. Gingival ischemia can be noted in the compression zone, which occasionally remains for a short period after the removal of the matrix. Within a few hours, the gingiva regains a healthy and natural appearance. (D): Excess composite is applied because of the position and shape of the matrix. (E): The matrix has just been removed. At high magnification, it is evident how the restoration supports the surrounding soft tissues. (F): The right volumes and shape are restored using a subtractive modeling technique, without milling the intrasulcular part of the restoration. (G): The final result. The restoration draws the new gingival contour. (H): After 2 years, stable gingival health is maintained. (J): X-ray at 2 years.*

Figure 5. (A): After completing the closure of a diastema on the vestibular side, a defect remains on the mesiopalatal side. (B): The matrix was inclined toward the sulcus from the lingual side to isolate the defect and allow the application of the composite. (C): The defect was repaired.

the matrix inclined toward the sulcus from the lingual side (Figure 5A-C).

Another issue could be the periodontal tissue adaptation to the intrasulcular restorations. Scientific evidence suggests that if such a restoration is carried out through careful control of local humidity; superficial polymerization, polishing and finishing; and local hygiene, then it can perfectly integrate with the surrounding periodontium, without being itself a cause of inflammation.[2-9] In the BAIR technique, the circular metal matrix, together with other isolation disposables, provides local moisture control and allows an adequate curing of the restorative materials. Moreover, the contact between the matrix and the composite ensures the realization of a perfectly smooth area in the most apical part of the restoration, which does not require any finishing and polishing. In our clinical experience, none of the treated patients revealed periodontal problems in the site of the restorations.

SUMMARY OF ADVANTAGES AND DISADVANTAGES

Advantages

The use of a metal matrix provides valid local isolation, displaces the gingiva in an atraumatic way, and allows clear access to the intrasulcular portion of the tooth.

The subgingival portion of the restoration is perfectly smooth because it is polymerized in contact with the metal matrix, in the absence of oxygen. For this reason, the intrasulcular part of the restoration does not need finishing or polishing, avoiding

superficial roughness that may interfere with the adaptation of periodontal tissues to the restoration.[10-15]

No surgery is required, and more often than not, anesthesia is not needed.

Since there is no reduction of the dental tissues, this technique is minimally invasive and, if desired, allows us to restore the initial situation.

It is possible to easily modify the restorations later, if necessary, using the same protocol as for the first intervention.

Disadvantages

When there is a need to modify heavily the position of the soft tissues, it is necessary for the operator to exert a constant pressure on the matrix by a finger to keep the matrix in the desired position. This means having constant assistance available.

This technique is indicated for single-rooted teeth only, and it cannot be applied to teeth that are part of a splinting.

CONCLUSION

With simple direct restorations, we can achieve results that would otherwise (ie, with traditional treatment plans) require surgery or orthodontics and much longer treatments often associated with annoying postoperative problems.

Using the BAIR technique, we can rebalance tooth shape and dimensions as well as gingival level and contour with low biological and economic costs. The method does not require any preparation of the dental tissues. It is reversible and minimally invasive. It is applicable to patients of all ages, and results are obtained in a single appointment.

Conflict of Interest

The author of this article certifies that he has no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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