



Direct Bonding in Diastema Closure High Drama, Immediate Resolution

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Abstract

Diastema is described as space more than 0.5 mm between the teeth. It is the most usual forms of incomplete occlusion present usually between the maxillary incisors than the mandibular incisors. It's a dark space between adjacent teeth that are separated from each other, with no presence of a contact area. Causes for this defect may be an extremely wide dental arch, congenital tooth absence, anomalous tooth size, and labial frenum hypertrophy. This article describes a new modification in matrixing system to achieve biological, functional, and esthetic result in the anterior region.

Keywords: Midline Diastema Closure; Direct Composite Resin; Layering Technique; Esthetic; Bonding

Abbreviations

IPC: Interproximal Carver; DSD: Digital Smile Design.

Introduction

Diastema in Greek means interval, gap or space between two or more adjacent teeth. Spacing of upper or lower central incisors is commonly known as midline diastema. It has been defined as a natural spacing between the central incisors occurring more frequently on the upper teeth [1]. Improve facial aesthetics is one of the main reasons why patients are addressing the orthodontist, facial symmetry having a determining importance in facial aesthetics. Face symmetry and midline coordination are essential criteria for achieving harmony and facial balance [2].

Diastema (MMD) is defined as a space or a gap which is greater than 0.5 mm between the adjacent teeth [1]. It is

called as "midline diastema" when seen between maxillary central incisors "polydiastema" when seen between a group of teeth in the dental arch [2,3]. Generally these spaces create an unpleasant appearance for individuals. Sometimes they may lead to phonetic problems, particularly in cases with wide spaces [2,4]. The prevalence of midline diastemas occurs primarily in children. Still, the number drastically decreases between the ages of 9 to 11 and continues a gradual decrease up to 15 years of age. Gender and racial differences may also play a vital role in developing diastemas. According to some reports, maxillary median diastema prevalence was observed greater in Africans when compared with Caucasians or British population and Mongoloids (Chinese who are from Malaya & Hong Kong). Black children, who are around the age of 10 to 12 years old, may also have a higher prevalence of nearly 19% of midline diastema compared with white children with a prevalence rate of 8%. As an ethnic norm, most blacks and Mediterranean whites exhibit midline diastema [5,6].

Numerous studies have investigated the frequency/prevalence of diastema. Consequently, there was a wide range of findings from 1.6% to 25.4% in adults and an even greater range in groups of young people. Differences in epidemiological study findings may be attributed to

the increased number of factors contributing to midline diastema, to the definitions used to explain its presence and to gender and race differences in the distribution of the hereditary feature in question [1,2,3,5,6].



Figure 1: Preoperative intraoral image.

Disparities in the anterior aesthetic zones might manifest as a high frenal attachment, resulting in midline diastema, mesiodens, fractures, microdontia, and Talon's cusp. Among all these aesthetic issues, public opinion has come to value the management of midline diastema. A diastema is a gap or distance between two or more neighbouring teeth. A midline diastema is the space between the initial incisors of the jaw or maxilla. It has been suggested that there are several different contributing factors to midline diastema, such as lip, tongue,

or thumb sucking. Dental anomalies such as proclination in the maxillary incisor, a misaligned jaw, and a crooked fusion of the teeth [1,3,4]. There are several clinical therapies involving multidisciplinary approaches that help resolve an MMD. These include the management of this alteration via orthodontic resolutions combined with surgical techniques that involve the resection of the labial frenum or restorative dentistry through rehabilitation using such materials as composite-based resins or ceramics [1-7].

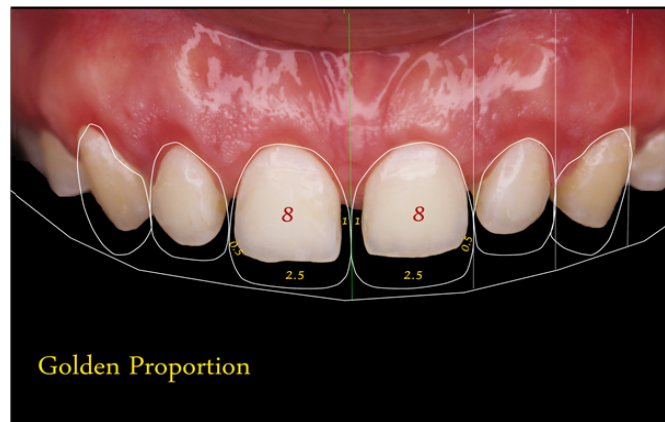


Figure 2: Digital Smile Design very important in these cases used as guide in all steps.

The Golden Proportion (proportion of 1.618:1.0:0.618) used to determine adequate distribution of the spaces between teeth. The dental morphology usually determines the shape and the volume of the interdental space, which must be filled by a dense connective tissue covered by oral epithelium to achieve pleasant esthetics. When resin

composite restorations are placed to solve esthetic problems, the restorative procedure must be designed to allow the formation of healthy interdental papilla [1,8,9].

This article describes a new modification in matrixing system to achieve biological, functional, and esthetic result in the anterior region.

Case Report

A 25-year-old female concerned with the space between her front teeth presented to our practice (Figure 1). The patient also stated that a friend had their diastema closed, but that a black space was left between the buildups and the gingiva (i.e., black triangles). It was explained that a black triangle results from the architecture of the bone and the distance between the contact points and the crest of the bone.¹ The option of closing the diastema with resin composites was presented to the patient, who agreed to the proposed treatment plan (Figure 2).



Figure 3: To better control the gingival margin, a split dam technique was used.

Tooth shade should be obtained by comparing the center middle-third of the tooth against the middle of the shade tab (Figure 2). An enamel-like opacity material is usually selected when closing diastemas up to 2 mm. Larger diastemas may require layering of a dentin-like opacity material to prevent show-through, followed by an enamel-like opacity material.



Figure 4: No preparation of the tooth surface is needed other than passing a coarse disc over the enamel to only remove the aprismatic layer, and provide a clean substrate for the adhesive procedures.



Figure 5: The enamel surface was treated with 37% orthophosphoric acid for 20 seconds, followed by rinsing thoroughly with water.

Tooth preparation is not required when closing a diastema. In situations where the teeth are slightly misaligned (Figure 3), a slight recontouring may be necessary when the teeth are positioned facially. On the other hand, no preparation is necessary when the teeth are lingually positioned. Roughening of the enamel is recommended only when self-etch adhesives are to be used. Following tooth preparation, the enamel surface of both teeth is etched for at least 30 seconds (Figures 5 & 6), after which the adhesive bonding agent is placed and cured.

Composite resin materials for this technique must demonstrate handling characteristics that enable placement without slumping or sticking to placement instruments. Few commercially available resin composites demonstrate the handling characteristics for this particular diastema closure technique.

Step 1. A small increment of the appropriately shaded composite resin that corresponds to the facial half of each diastema is placed over the mesiofacial aspect of each tooth. These increments are placed simultaneously and contoured to ensure optimal contour and identical width for both central incisors (Figure 7). Attention should be given to blending the increments over the facial surface..

Step 2. Using a thin-bladed interproximal carver (IPC) instrument, contour the increments to match each other's profile and ensure adequate gingival embrasure and emergence profile (Figure 8),

Step 3. A metal matrix is sometimes utilized to produce a small separation between the two increments. A small brush is used to smooth the composite resin surface and approximate the increments (Figures 9-12). Light-cure the increments.



Figure 6: A universal bonding agent was applied all over the etched enamel.

Step 4. Place a matrix against one of the central incisors and layer the lingual half of the diastema between the tooth and the matrix. Push this increment facially, close the matrix against the tooth, and pull it through toward the facial to ensure proper lingual contour. If excess composite remains in the gingival embrasure, remove it prior to light-curing.



Figure 7: Multiple coats of universal bonding agent were applied with air thinning then curing for 20 seconds.

Step 5. Light-cure the direct resin buildup and repeat Step 4 for the other central incisor.

Proximal polishing was achieved by sequentially using polishing strips. Polishing cups (were used to create the restoration's final luster and surface anatomy-my (Figures 13-17). In this case, the patient was scheduled a week later to evaluate her satisfaction, gingival healing, and marginal adaptation.



Figure 8: The thin palatal shell was built with the Enamel shade (0.5-1mm), freehand using transparent strips.

Discussion

The composite material was smoothly adapted to the tooth hard tissues and after the final polishing and rehydration period the effect was very good. The obtained clinical results were highly assessed by dentists and patients. The patients were satisfied with their appearance after closing diastema. As shown on pictures, it was possible to obtain optimal aesthetic results with composite restorations only. Chosen clinical situations of performed restorations are pre-sented on.



Figure 9: The palatal shell is carefully created to close the diastema gap, following specific measurements from the Digital Smile Design (DSD) approach. It is designed to harmonize with the palatal surface of the teeth, adhere to the golden proportion, and maintain facial symmetry, Ultimately enhancing both dental aesthetics and function.

According to Tarnow [10], when the distance between the contact points is 5 mm or less, there is 100% presence of interdental papilla, and that ensures a good re-lation between teeth and gums. In our case, the use of direct reconstruction, such as recontouring of tooth shape and

closing diastema provided the symmetrical and harmonious arrangement of the teeth. Even in some cases when it was not totally closed, the patient was satisfied with the result. However, in difficult cases for better aesthetic results, where the correction or management cannot be done by the composite restorative technique only, an interdisciplinary approach is often required.

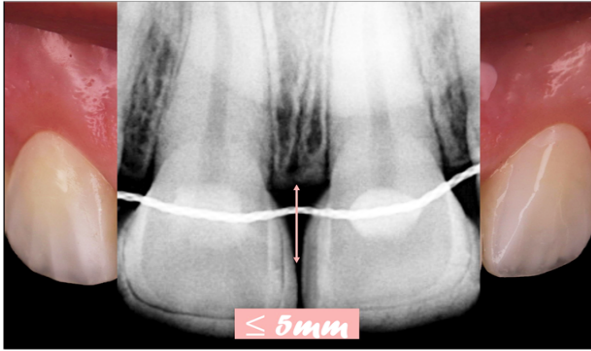


Figure 10: According to the results of various studies, it was observed that when the distance from the contact point to the crest of the bone was 5 mm or less, the papilla was present almost 100% of the time. When the distance extended to 6 mm, the papilla was present 56% of the time, and at a distance of 7 mm or more, the papilla was present 27% of the time or less.

The utilization of direct composite restorations for bridging gaps in cases of midline diastemas is known to all. Direct composites undoubtedly are the material of choice for anterior restorative procedure buildup.

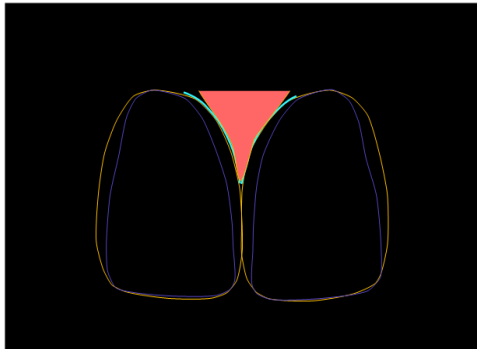


Figure 11: This diagram illustrates the post-composite restoration tooth and papilla shapes, as well as the dimensions of the incisal and cervical embrasures, with an absence of any cervical black triangles. Procedure for fabrication [12]. However, these restorations have some significant drawbacks, making case selection crucial. When compared to ceramics, composite restorations have inferior colour stability.

These resin-based composite restorations require a single visit appointment, avoid the laboratory fabrication time, and reduce the expenses involved in fabrication. They also have the advantage of not requiring wax-ups or preliminary model preparation, are soft on opposing dentition, and are simple to repair in fractures. This, however, seems impossible in cases of porcelain restorations that require an elaborate.

Smile design is a systematic process that enables to make some changes on the soft as well as hard tissues within the limitation of the anatomical features to create functional, esthetically pleasant, biomimetic restorations for a patient [13]. Creating an esthetically pleasant smile often requires multidisciplinary approaches for the structural integrity and harmony between teeth, gingiva, and lips for facial conformity. Therefore, clinician should be competent on the objective analysis protocols that include dimensions, lines, and mathematical ratios of the facial, dentofacial, dentogingival, and dental components to achieve an esthetic psychological aspect that includes personality, expectations, and demands for creating natural and pleasant smile [14,15].



Figure 12: Immediately after building the proximal wall by modifying the sectional matrix and achieving the correct position for the contact point.



Figure 13: Immediately after building the proximal wall by modifying the sectional matrix and achieving the correct position for the contact point.

In general, smile design principles are divided into two main parts: micro- and macroesthetics [16]. Microesthetics means form, fine characterization of teeth such as reflection of light, color, and/or transparency that mimic natural teeth as well as relationship between teeth, gingiva, and lips [17,18]. These anatomic features are unique characteristics and may vary from tooth to tooth, age to age, and person to person. The primary factor of the esthetic and attractive smile is the teeth, and hence, thoroughly understanding of the tooth characteristics, anatomy, and optic features are the key factor for the optimization of the restoration [14,19,20]. Macroesthetics addresses the proportions and relationship of the teeth with each other and in harmony with the surrounding structures such as gingiva, lips, and facial characteristics of the patients [21].



Figure 14: Transparent enamel placed between mamelons and incisal edge.



Figure 15: The final enamel shade was carefully applied using solo instrument and smoothed using a dental brush.

Presence of a diastema results with missing interdental

tissue; hence, restorative procedures to augment the diastema should also require soft tissue management.

Since the interdental papilla is a small rounded protuberance in between two teeth, two implants, or a tooth and an implant or a pontic and a tooth or implant, management of any diastema consequently requires soft tissue management [22,23]. Furthermore, management of the diastema may also change the mesiodistal dimensions of the clinical crown resulting in a discrepancy at the location of the zenith points [24]. The closure of diastema in the restorative treatment procedures is often successfully accomplished with resin composite materials and porcelain laminate veneers [16,25].

Emerging technologies, improvements in the resin composite formulations, and adhesive materials have made it possible to restore teeth same as natural, biomimetic, and functional by creating a strong bond between tooth structures with minimal invasive or no tooth preparation by preserving the healthy tooth [27]. When closing diastema or any anterior restoration, the clinician should mimic the dentin and enamel structures for creating esthetically pleasant and natural-looking restorations. Stratification technique with a suitable composite having good handling, sculpting and viscosity characteristics are perfect for the manipulation and creation of a natural-looking final restoration. In addition to this, enhanced polishing capacity and optical properties are also essential [28].

Resin composite materials have dramatically evolved since its inception [14], and recent technologies have made major improvements especially in the filler technology of these materials [1,12,13,29]. As improvement in filler size and morphology, resin matrix of the composite materials decreased, and this allowed proper polymerization, manipulation, and reduced volumetric shrinkage to a degree of 0.9–1.5 % for creation esthetically pleasant restorations [30].



Figure 16: Immediately following the comprehensive finishing and polishing procedure



Figure 17: Intraoral postoperative view after one month.

In esthetic dentistry, one of the biggest challenges practitioners face is closing anterior diastemas without the presence of “black triangles” around the teeth. Although the success of a restorative treatment in anterior teeth depends on the esthetic integration between soft and hard tissues, direct restorative techniques can be applied to treat this condition [31]. Following the step-by-step protocol described here will enable the dentist to successfully close the diastema, while taking into consideration those criteria necessary to create an ideal emergence profile for gingival health and properly managing “black triangles” [32].

As for the layering technique used in this case, bilaminar layering with natural layering shading was used to utilise the CLOUD shade effect of the resin composite used which has enhanced chameleon blending ability. In this technique, natural tooth layers are used as model and emulated by the resin composite used with single body shade used for both dentine and enamel layering [33]. Resin composite that emulates this concept use combination of universal shading of dentine with single opacity with ranges of chrome and different tint and translucency for the enamel shade. With much simplified shading and layering, this technique reduces the armamentarium and material needed for the procedure and making it less demanding compared to much more complicated layering technique such as trilaminar and polychromatic approach [34,35].

Conclusion

The emergence profile should be identified and respected when restorations are placed to obtain diastema closure because healthy periodontal tissues and acceptable esthetics depend on it. In order to close the diastema, restorative treatment modality was considered as the first plan. But a satisfactory dental appearance and a pleasant smile would not have been achieved because of the uneven distribution of the spacing between maxillary incisors.

A second treatment option was planned to solve both the skeletal and dental malocclusion and the spacing. This interdisciplinary treatment plan, including orthodontic treatment, orthognathic surgery, and restorative treatment, was rejected by the patient because it was an invasive approach. The third alternative was an interdisciplinary approach including orthodontics to address the malocclusion and redistribute the spacing, followed by a restorative treatment. A frenectomy was also planned. The patient preferred the third option because it was more conservative.

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