

NON-INVASIVE ESTHETIC REHABILITATION OF ANTERIOR DIASTEMA WITH DIRECT COMPOSITE RESTORATION

(REHABILITASI ESTETIKA NON-INVASIVE DIASTEMA ANTERIOR DENGAN RESTORASI KOMPOSIT DIREK)

Asih Rahaju^{1*}, Itoh Rositoh¹

¹Departement of Conservative Dentistry, Faculty of Dentistry, Universitas Jenderal Achmad Yani, Cimahi

*Corresponding author

asih.rahaju@lecture.ac.unjani.ac.id

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ABSTRACT

Diastema is a gap between adjacent teeth that occur physiologically from the teeth eruption. However, diastema between the maxillary central incisors in an adult can be an aesthetic problem and sometimes impair speech. Diastema treatment with low or enlarged superior labial frenulum includes frenectomy, orthodontic treatment, veneers, crown, and bridge or resin-based composite direct restorations. This case report will discuss the rehabilitation of diastema in an aesthetic zone of maxillary central incisors due to low frenulum attachment. It was done by a minimally invasive approach using direct composite restoration, completed within several hours after the study model was analyzed, and much less expensive than other forms of treatment. The protocol involved model analysis, smile design, mock-up, silicon index creation, and composite selection. Patient cooperation and understanding of the limitations are critical to long-term treatment success. The direct composite resin is a fast, simple method yet durable to achieve good

improvement of small diastema in the aesthetic zone. And stable after three years.

Keywords: diastema; resin composite; direct restoration

ABSTRAK

Diastema adalah celah diantara gigi yang berdekatan, yang terjadi secara fisiologis sejak gigi erupsi. Namun, diastema antara gigi seri tengah rahang atas pada orang dewasa dapat menjadi masalah estetika dan terkadang mengganggu bicara. Pilihan perawatan diastema dengan frenulum labial superior yang rendah atau membesar meliputi frenektomi, perawatan ortodontik, veneer, mahkota dan jembatan atau restorasi komposit langsung berbasis resin. Laporan kasus ini akan membahas tentang rehabilitasi diastema pada zona estetik gigi insisivus sentralis rahang atas akibat perlekatan frenulum yang rendah. Pendekatan dilakukan dengan minimal invasif menggunakan restorasi komposit langsung, diselesaikan dalam beberapa jam setelah menganalisis model kerja dan jauh lebih murah dibandingkan dengan bentuk perawatan lainnya. Protokol yang terlibat, analisis model, desain senyum, pembuatan mock up dan indeks silikon, juga memilih komposit. Kerjasama dan pemahaman pasien tentang keterbatasan sangat penting untuk keberhasilan perawatan jangka panjang. Restorasi resin komposit direk adalah metode yang cepat, sederhana namun tahan lama untuk mencapai perbaikan yang baik dari diastema kecil di zona estetika dan stabil setelah tiga tahun.

Kata kunci: diastema; komposit resin; restorasi direk

INTRODUCTION

The gap between adjacent teeth is known as a diastema. Diastema locations mostly occur between the upper central incisors. The incidence varies according to age development, mostly 98% at the 6-year-

old, 49% at 11, and about 7% at 12-18 years old.¹ The teeth with diastema are a normal condition at the development, caused by the position of maxillary canine eruption with maxillary lateral incisor.^{1,2}

Missing teeth is a physiological cause of diastema.² Several conditions such hyperactive tongue, hypotonic perioral muscles, discrepancy between tooth size, dental arch length, abnormal frenulum, and ectopic tooth eruption lead to esthetic problems in adults. They sometimes slightly effect of speech.^{1,3}

At the eruption stage, the proximal labial that extends proximally will obliterate the eruption of the central incisors. The ideal treatment to eliminate the etiology of the lower superior labial frenulum is frenectomy. It follows orthodontic treatment. Other alternatives include veneers, crowns, bridges, or resin-based direct composite restorations^{2,4-8}. Treatment for diastema cases depends on etiology and the distance between the teeth.

Resin-based direct composite restoration is a minimal and conservative treatment that can be performed to close the diastema in terms of aesthetics with economical costs and fewer visits to other treatment options.⁶⁻⁸ Patient success and satisfaction in diastema closure rehabilitation with resin-based composite resin restorations depends on several factors, including communication with the patient and analysis of the study model.

CASE REPORTS

A 21-year-old woman came to

RSGM Unjani complaining of a gap between her upper front teeth due to low frenulum. No caries or complaints of pain. The patient demands esthetic treatment. Based on the patient's medical and dental history, clinical examination; Low labial frenulum at maxilla, 11 and 21; caries (-), vitality (+), percussion (-), palpation (-), mobility (-), bite test (-), discoloration (-). Periodontal tissue within normal limits, with no recession or bleeding on probing. Diagnosis: diastema 11 || 21. The treatment plan was to reach the aesthetic and economic demands. Closing the gap with composite resin increases the incisors' mesiodistal dimension proportionally. And without damaging tooth structure.

Smile analysis.

At the first visit, extra-oral and intra-oral photos were taken before treatment as a reference and comparison of treatment results (Figure 1,2). Upon the analysis, a gap between teeth 11-21 with the upper buccal frenulum separating the two teeth.

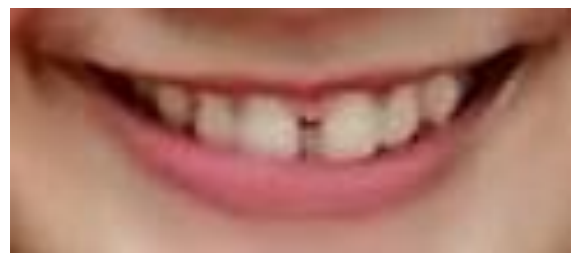


Figure 1: Extraoral clinical photo of teeth.



Figure 2: Intra-oral photo.



Figure 3: Maxilla and mandible study model.

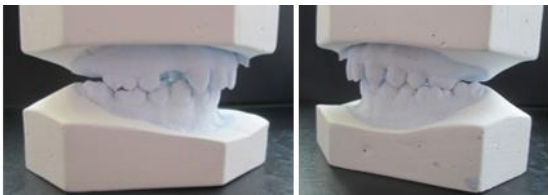


Figure 4: Tooth relationship.

Maxillary and mandibular study models were made to analyze the intra-oral condition. The contact relationship of the upper and lower anterior teeth showed a large overbite and overjet (Fig. 3-4).

The upper central incisors teeth were found to have a small mesiodistal width concerning cervicoincisal dimension. As proximal contact in final restorations

reference points, we used the ideal distance between the incisal edge and the gingival papilla and required 4mm or less from the interdental crest bone.⁹



Figure 5: Cervicoincisal height (blue line); gingival papilla level (pink line).⁹

Measurements of the diastema gap and mesiodistal size of teeth 11 and 21 with the caliper in the study model were recorded. The size of the diastema between teeth 11-21 is 2 mm, while the mesiodistal distance of teeth 11 is 9 mm, and the mesiodistal distance of teeth 21 is 9.5 mm. Mesiodistal wide 12 and 22 were the same, 6.5 mm (Figure 6).

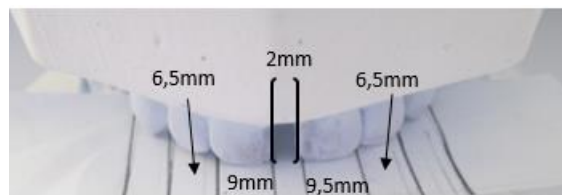


Figure 6: Diastema and mesiodistal measurements of 11 and 21.

From the preop model evaluation, treatment design was made to increase the

mesiodistal size of 11 and 21 to fill the gap. Calculating the additional width of the teeth in each side was made as follows: half the distance between the teeth is added to the right and left middle incisors, respectively, and the proportional size is calculated with the result that the left and right teeth are of equal size. The size of tooth 21 should be based on model analysis = $(9+2+9.5)/2 = 10.25$ mm so that the mesiodistal addition of tooth 11 is = $10.25-9.5$, which is 0.75 mm. Based on the analysis of the calculation of the proportional size of the teeth, it is necessary to increase the mesiodistal width of tooth 21 by 1.25 mm. The horizontal size of the teeth is calculated to fulfill a symmetrical shape.

The mock-up was made with wax according to the proportions of 11 and 21 by closing the gap between the two teeth using dental wax (Figure 6).

At the second visit, the treatment plan on the working model was presented to the patient as an overview of the expected treatment results.

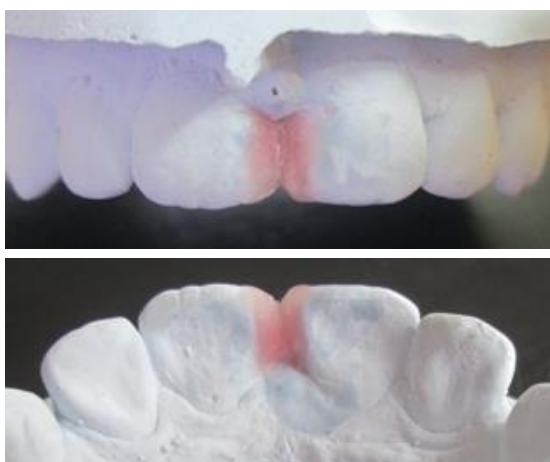


Figure 7. Mock-up on the working model.



Figure 8. Silicone index.

The silicone index was made from polyvinylsiloxane impression material on the working model mock-up by cutting the labial part to the incisal border of teeth 11-12 using blade number 12 (Figure 8).

Intra-oral management begins with placing a rubber dam to isolate the working area. Rubber dam isolation with ligatures is recommended. The rubber dam keeps the operation field dry and free of contaminants. The cord facilitates the rubber to be pushed apically to allow access to the proximal gingival areas for ideal contouring and polishing restorations.

A retraction cord was placed (Ultrapak, number #000) on the cervical teeth of 11 and 21. The process retracts the gingiva and isolates the working area from the sulcus fluid (Fig. 9). Isolation roughed

the proximal enamel with a superfine bur and the tooth surface. The process removes saliva and residual debris with 0.2% chlorhexidine.



Figure 9. Rubber dam and cord retraction.

Color selection was made while the teeth were moist. The shade guide made the color selection with teeth 11 and 21, and the color A2 was chosen. In this procedure, the patient is involved in reaching an agreement to get the most suitable color. The nanofiller composite (Filtex Z350 XT, 3M ESPE) was selected for good polishing results) according to the specified tooth color (A2).

The next step was to check the silicon index on teeth 11 and 21. Etching by 35% phosphoric acid gel was applied on the roughened surface for 10-15 seconds, followed by rinsing with water. The bonding agent system (Single Bond Universal Adhesive, 3M ESPE) was applied for 10 seconds. Then sprayed with gentle air and light-cure polymerized for 10-20 seconds, composite (Filtex Z350 XT, 3M ESPE) according to the specified tooth

color (A2) was applied. Flowable composite resin was applied to the silicon index in the proximal area 11 to keep it from crossing the midline, then polymerized with a light cure unit for 20 seconds (Figure 10). The same treatment was carried out on tooth 21. After the palatal composite layer was formed, Z350 composite resin was applied layering to form the anatomy per the treatment plan. The final step was removing excess resin, polishing with an interdental polishing strip, rubber cup (Enhance, Dentsply), and composite polishing paste (Prisma Gloss, Dentsply). The final results are shown in Figures 11 and 12.



Figure 10. Composite application



Figure 11 Final result after polishing.

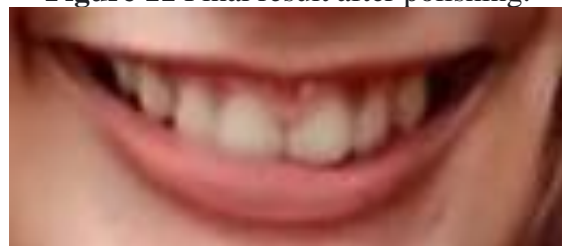


Figure 12 Extra oral photo.

The patient was rescheduled for a follow-up at one week and three months to evaluate her satisfaction, gingival healing, and marginal adaptation. It was a tangible result when the black triangle was not visible at all.



Figure 13. three months after treatment

The treatment outcome improved shape, symmetry, and general aesthetic appearance. The patient was satisfied with the final result because all her aesthetic complaints had been handled.

DISCUSSION

The most common treatment options for diastema are restoration, veneer, orthodontic, and dental crowns. It requires a correct etiology diagnosis and early intervention relevant to the specific etiology.^{8,10} Classification of diastema size and type of frenulum were divided into small diastema of 1 mm. The mucosal frenulum attachment; moderate diastema > 1- 2 mm, mucosal frenulum attachment; moderate diastema > 1-2 mm, attachment of

the gingival frenulum; large diastema > 2 mm, the papilla penetrates the attachment of the frenulum.⁸

Based on the classification of diastema, there are treatment options for small diastemas. They do not need to be prepared, composite application on the proximal to facial and palatal parts, 2-3 mm diastema facial veneering with or without preparation. At the same time, full-coverage veneers are made for large diastema.

Rubber dam isolation and cord retraction are essential to achieve the correct anatomical location of the proximal contact. The proper location of the contact area concerns the level of the alveolar crest. It might determine that the interdental papilla will fill the gingival embrasure and prevent the unesthetic black triangle. This process can occur if the proximal contact is located too far incisally. Achieving anatomically correct contact and contour is essential for the esthetics and longevity of any restorative technique. Thus, rubber dam isolation offers an advantage in adhesive restorative techniques, where a dry and clean surgical field provides the foundation for a long-lasting esthetic restoration.

One of the difficulties encountered is closing diastema without creating "blacktriangles," especially difficult with wide gingival embrasure and thick gingival

biotype. Especially when handling composite freehand requires skillful practice, it may be considered a disadvantage to some operators. According to studies, the interdental papilla is present when the distance between the contact point and the bone crest is 5.0 mm or less.

In this case, there were only minimal black triangles seen. The use of a silicone index is useful to minimize it. Black triangles appear when gingival tissue, tooth structure, or restorative material does not fill the interproximal. It is an embrasure space below the contact point. These spaces appear black because of the darkness of the posterior oral cavity. Preventing the formation of a black triangle between the teeth when closing diastema requires careful considerations in the gingival architecture based on the concepts of cervical contouring and the location of the contact point. The factors that influence the presence of papilla to fill the interdental space are the distance from the contact point (C.P.) to the alveolar bone crest (B.C.).

Dental bonding is a popular option for diastema closure, which is applying a bonding material to existing teeth to fill in the space between each tooth. The material used in dental bonding is tooth-colored and indistinguishable from natural enamel. Dental bonding is a non-invasive procedure that can be completed within several hours

and on the same day as the initial visit in many instances. It is often a much less expensive diastema treatment option when compared to other forms of treatment, although it may not last quite as long as dental veneers.

Dental veneers are another popular form of treatment for diastema. Dental veneers are thin, tooth-colored shells applied to the surface of a tooth to fill in gaps. Dental veneers are durable and can last for decades without needing to be replaced. Since they are tooth-colored, they provide patients with a natural look and a full smile of beautiful teeth. Dental veneers are much more of a permanent solution than dental bonding, which means they last longer but are not intended to be removed after placement.

Braces and aligners are capable of treating a specific type of diastema. In some cases, a diastema is caused by a misalignment of teeth or a missing tooth that may not be necessary for a full smile. Braces and aligners work to pull teeth into a straighter position, closing the gap between teeth and giving patients a full smile without additional space between each tooth. However, braces and aligners do not solve all instances of diastema. It is important to consult with an orthodontist before choosing braces or aligners as a treatment option for diastema. In this case, there is a

deep overbite anterior relationship between the maxilla and mandible teeth. It is better corrected previously. So, it is possible to close space with retraction of anterior teeth. Orthodontic treatment might be too expensive for a patient to close diastemas, in which case composite bonding is more desirable. Another factor to consider is time. Orthodontics takes months or years to complete. Patients who want instant procedures will not accept treatment with such a long duration until a final result. However, payments for orthodontic treatment can be planned over a longer period.

When labial frenulum is abnormal, with enlarged or attached to the gingival, a frenectomy is recommended after orthodontic closure of the gap. Now that diastema closure and compression of interdental papilla act as a stimulus to encourage fibrous atrophy between incisors.¹⁰

In rare instances of diastema, dental crowns may work to fill in the gaps between a tooth, especially if damaged or eroded teeth cause the diastema. Dental crowns work to restore the size and shape of natural teeth, which means they can widen the surface of each tooth, providing a smile that does not contain gaps between teeth. However, dental crowns may not work well for natural cases of diastema in which the

gaps occur between every tooth, and the teeth are healthy. Porcelain restoration requires two or more appointments and a transition time with provisional restorations.

The correction was carried out by a multi-disciplinary approach to prevent diastema relapse in multiple cases. The approaches are orthodontics, prosthodontics, oral surgery, and periodontics.¹¹

Meanwhile, in small and medium diastemas, the gap between the teeth can be filled using a direct composite restoration. When there are spaces between teeth appropriate to tooth size discrepancy, or small teeth, orthodontic treatment is contraindicated. It will be advisable to take restoration or prosthetic crown therapy. For a better esthetic result, orthodontic treatment before the restorative procedure may reduce the gap between the teeth.¹²

Another rehabilitation option for diastema closure is subapical and interdental osteotomy procedures. It's because the main factor for diastema relapse is not only the frenulum and soft tissue:

The main goal of minimally invasive dentistry is to stop the disease or disorder using non-operative management techniques. Management of resin-based direct composite restorations without

preparation and surgery is a minimal treatment to close the diastema.

Diastema spacing, color selection, Isolation, preparation, material selection, material placement, finishing, and polishing should be considered in diastema closure treatment. So oral physiological functions are obtained with the same emphasis or ideal teeth through color, shape, and structure restorations. And function to achieve good aesthetics and optimal durability.

Resin-based direct composite is a treatment that can be performed in *diastema closure* treatment with good aesthetics, economical cost, and fewer visits to other treatment options.⁶⁻⁸ Composite direct restoration can only be performed if the diastema distance is less than 2.5 mm. When it exceeds 2.5 mm, the treatment is carried out with direct *veneers* and orthodontic treatment. Personal time limitations are important to some patients. Composite bonding is completed in one appointment, and patients like instant results.

Filtex Z350 XT, 3M ESPE was used in this case because this nanofiller composite has strength and durability properties and excellent polishing results.¹² This composite type has a composition of BIS-GMA, BIS-EMA, UDMA and a small amount TEGDMA, 20 nm nano silica filler.

The composite is not clustered and easily bonded zirconia/silica nanoclusters to form groups, where the group consists of zirconia/silica particles with a size of 5-20 nm. The combination of nanoparticles with nanoclusters will reduce the amount of interstitial space between filler particles so as to improve physical properties and better polishing results.

Color is a property of light, an object reflects only certain wavelengths, and the rest of the entire wavelength is absorbed by the object.¹¹ In dentistry, color greatly determines the success of treatment, especially in terms of aesthetics. Color aspects that need to be considered are chroma, value, intensity, and translucency.¹³⁻¹⁴ The color selection, in this case, was carried out with the patient, single shade A2. After applying the composite on the second visit, the patient was satisfied with the final result because the diastema tooth had closed. Overall, the suitability of the composite color with the teeth and the anatomical shape of the teeth was satisfactory. Still, the gingival embrasure was slightly exposed at the median cervical line. The translucent line on the distal part of the restoration seemed to be shadowed when viewed closely, which was then informed to the patient. Composites with several shade options should be used to get maximum color

results.

Recontouring in the form of smoothing and rounding the incisor angle can improve aesthetics, prevent tooth structure, and prevent gingival irritation. In this case, the email roughing does not remove the email layer. The gap in the embrasure may be due to the application of a retracted cord. This condition disappears when the control is carried out. Composite changes color with time, and leakage around the margins can occur. Touch-ups to composite are usually required every 7 to 10 years.

The wax-up illustrated how the individual restorations would appear dimensionally and whether an occlusal/functional scheme could be worked out that would provide proper force management for the longevity of the restorations. The wax-up would serve as the prototype design for the direct fabrication of the provisional restorations so that laboratory approximations could be adjusted and verified in vivo.¹⁵

Before starting the composite application with the PVC matrix on the palate, an enamel cleaning procedure was performed to improve etching adhesion and bonding. The teeth were restored one by one by layering technique that can also be used in the silicon matrix technique

In addition, several things must be

considered in creating a smile (smile design) for each individual. This process includes midline, the incisal distance of teeth, zenith point, healthy gingiva, and interdental embrasure, the axial position of central incisors, interdental contacts, dimensions, and character. Teeth.¹⁶⁻¹⁸ The vertical size of the upper central incisors is 1,618 times longer than the horizontal size^{18,19} The dimension starts with the central incisor being the largest and then each subsequent tooth posterior to it looking one sixteenth smaller.

Case analysis of the study model can estimate the outcome of direct restoration.¹⁴ This technique includes a dental diagnostic procedure planned restoration waxed on a working model to determine the procedures required to achieve the desired clinical outcome. It will accommodate for the calculation of space available and how to manipulate it, and also help to evaluate the results and can be used as a communication tool between dentist and patient. The *mock-up* made on the working model is a pattern for making PVC matrix which will serve as a guide during the restoration process.²⁰

CONCLUSION

A minimally invasive approach managed a 2 mm diastema between the maxillary central incisors; direct composite

restoration was satisfactory with direct composite restorations with good esthetics, economical cost, and fewer visits compared to other treatment options.

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