

8-31-2022

Uncut Enamel for Optimizing Bonded Composite Restoration on Multiple Diastema Closure Cases

Citra Kusumasari

Department of Conservative Dentistry, Faculty of Dentistry Universitas Indonesia, Jakarta, Indonesia,
citra.kusuma02@ui.ac.id

Meiken Hayashi

Department of Cariology and Operative Dentistry, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, Tokyo, Japan, meiken.hayashi@gmail.com

Yasushi Shimada

Department of Cariology and Operative Dentistry, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, Tokyo, Japan, shimada.ope@tmd.ac.jp

Follow this and additional works at: <https://scholarhub.ui.ac.id/jdi>



Part of the [Dental Materials Commons](#), and the [Other Dentistry Commons](#)

Recommended Citation

Kusumasari, C., Hayashi, M., & Shimada, Y. Uncut Enamel for Optimizing Bonded Composite Restoration on Multiple Diastema Closure Cases. *J Dent Indones.* 2022;29(2): 140-146

This Case Report is brought to you for free and open access by the Faculty of Dentistry at UI Scholars Hub. It has been accepted for inclusion in Journal of Dentistry Indonesia by an authorized editor of UI Scholars Hub.

CASE REPORT

Uncut Enamel for Optimizing Bonded Composite Restoration on Multiple Diastema Closure Cases

Citra Kusumasari^{*1}, Meiken Hayashi², Yasushi Shimada²

¹*Department of Conservative Dentistry, Faculty of Dentistry Universitas Indonesia, Jakarta, Indonesia*

²*Department of Cariology and Operative Dentistry, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, Tokyo, Japan*

**Correspondence e-mail to: citra.kusuma02@ui.ac.id*

ABSTRACT

The main advantage of using a minimal invasive strategy concept by uncut enamel technique while doing direct composite restoration is to create a color and translucency close to the natural teeth with long-term bonding durability. **Objective:** This case report presents an uncut enamel technique for multiple diastema closure cases using direct composite restoration. **Case Reports:** an 18-year-old male and a 50-year-old female patient complained of diastema in their upper front teeth and requested aesthetic correction. Digital mock-up was made prior to the uncut enamel technique for showing the expected results to the patient and as a guidance for the clinician. Uncut enamel preparation was continued by free-hand restoration technique with a two-step self-etch adhesive system and composite resin application to correct the diastema. The teeth in the first and second cases were followed up after three months and four years, respectively. **Conclusion:** The uncut enamel preparation, free-hand restoration technique with two-step self-etch adhesive, and digital mock-up are viable options in the multiple diastema closure to re-create natural teeth and optimize bonding durability

Key words: diastema closure, digital mock-up, minimal invasive, multiple diastema, uncut enamel

How to cite this article: Kusumasari C, Hayashi M, Shimada Y. Uncut enamel for optimizing bonded composite restoration on multiple diastema closure cases. *J Dent Indones.* 2022;29(2):140-146

INTRODUCTION

Smile esthetics plays a primary role in the community as it affects how people are perceived and how they perceive themselves. Diastema is a space between adjacent teeth that considered as malocclusion and an esthetic problem. The etiology of diastema, especially midline diastema can be multifactorial such as physiological, dentoalveolar due to a missing tooth, peg shaped lateral, midline supernumerary teeth, proclination of the upper labial segment, prominent frenum and a self-inflicted pathology by tongue piercing.¹ According to the investigation among Japanese junior high school students, subjects with incisal spacing was 24%. Seventy-one percent of them had diastema of 1 mm or more.² Meanwhile, in Japanese high school students aged 15 to 18 years, the percentage of subjects with diastema was 7% and two thirds of them had diastema of 1 mm or more.³ To date, there is no data about Japanese adult patient diastema prevalence, as its prevalence reduces with growth. Additionally, the investigation among British showed

they had the midline diastema present in approximately 98% of 6-year-old and 7% of 12- to 18-year-old.⁴

Treatment option for a patient with multiple diastema include ceramic veneers or crowns which present good durability and orthodontic treatment. However, the latter requires high-cost and is time consuming. Direct composite restoration has favorable results for some extensive restorative cases, including multiple diastema closure. Latest development of adhesive systems using self-etch with 10-methacryloyloxydecyl dihydrogen phosphate monomer and resin composite materials allow clinician to create bonded composite direct restoration with minimally invasive technique.⁵

Minimally invasive techniques in tooth restoration optimize tooth structure preservation of both the affected and normal dentin, reduce insults to the dentin-pulp complex, and minimize the risk of iatrogenic damage to adjacent hard and soft tissues.⁶ Furthermore,

the uncut enamel showed greater resistance to erosive challenges than cut enamel.⁷ By using optimal adhesive restorative materials to strengthen the residual tooth structure, the long-term bonded composite direct restoration could be achieved.⁸

In order to restore multiple diastema without creating tooth emergence profile distort and black triangle, the use of a free-hand technique with flowable composite and a transparent matrix with no wedge is required.⁵ In this report, the uncut enamel preparation technique was used, continued by free-hand restoration technique with composite resin on multiple diastema teeth.

CASE REPORT

Case 1

An 18-year old male patient came to the university dental hospital seeking for restorative treatment for the teeth spacing which interfere his appearance (Figure 1). Clinical and radiological examination showed sound anterior teeth with no symptom of periodontitis. Figure 2 showed the comparison between patients' anterior teeth width and the normal average anterior teeth. Clinical measurement revealed the midline diastema was 3.37 mm, the lateral right diastema was 1.08 mm, and the lateral left diastema was 1.18 mm. The patient had proclination upper labial segment.

A minimal invasive treatment was chosen on this case through the uncut enamel technique. Digital mock-up was made using keynote program (iOS version 11.1, Apple Inc.) by creating the diastema teeth into the normal width teeth size and it was used for showing the expected results to the patient (Figure 3A). Then, pre-operative teeth color shade is taken using polarized filter with "button-try" technique after light curing of three composite colors (NE: Natural Enamel & OcE: Occlusal Enamel; Estelite asteria, Tokuyama dental, Japan and CE: high translucency; Estelite universal flow, Tokuyama Dental, Japan) on the incisal edge of enamel (Figure 3B).

No enamel preparation was done on the diastema teeth; however, a plaque check solution (Merssage PC Pellet, Shofu Inc., Japan) was applied on the diastema teeth. Purple colored stain was removed by brushing with prophylaxes paste (Pressage, Shofu Inc., Japan) until no stain left (Figure 4A-4C).

Afterwards, enamel etching was done by 38% phosphoric acid (Kuraray, Japan) on the half part of mesial proximal diastema teeth (Figure 5 and 6).

In order to achieve proportional width of the diastema teeth, central and mesial labial ridges were shifted around 1 mm to the midline to create new mesio-labial



Figure 1. Pre-operative retracted view



Figure 2. Teeth size ratio on the patient to normal average width size (in mm)

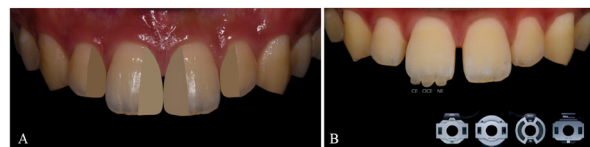


Figure 3. (A) Digital mock-up was made using keynote program, (B) Pre-operative color shade with polarization filter using camera and the "button try technique" for enamel.

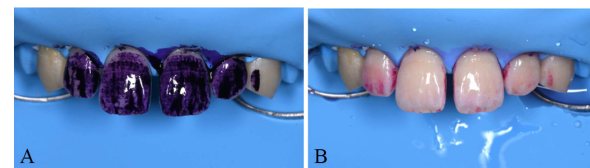


Figure 4. (A) Caries dye application, (B) It was removed by brushing with prophylaxes paste, and (C) Final condition after no stain left.



Figure 5. Enamel etching using 38% phosphoric acid on mesial diastema teeth.



Figure 6. After enamel etching using 38% phosphoric acid on mesial diastema teeth.



Figure 7. Margin line shifting on labial valley (between central and mesial labial ridge).



Figure 8. Papilla preservation.



Figure 9. Metal matrix placement.

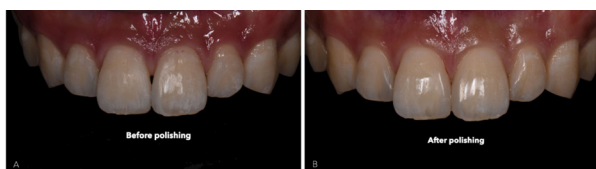


Figure 10. A and B. Before and after teeth restoration polishing.



Figure 11. A and B. Baseline and 3 months teeth restoration evaluation

sulcus position (Figure 7). Another thing to considerate is papilla preservation; if the distance between the contact point to the bone is less than 5 mm then papilla can be preserved (Figure 8). Therefore, the papilla was preserved in this case because the distance was 3 mm.

After etching was completed, the bonding procedure was done by two-step self-etch adhesives (SE Bond 2, Kuraray, Japan). The next step is metal matrix placement into the sulcus area between mesial tooth surface and rubber dam (Figure 9). Prior to matrix

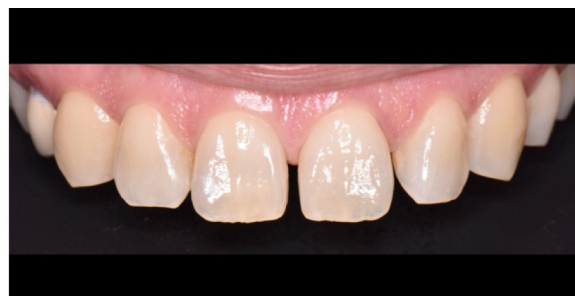


Figure 12. Case 2 pre-operative retracted view

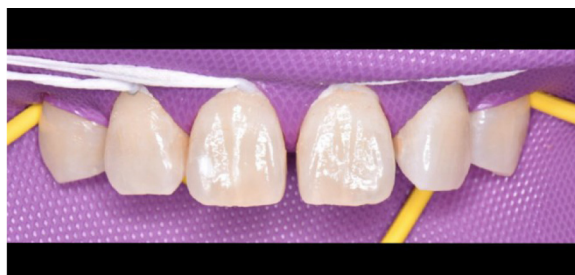


Figure 13. Isolation using rubber dam

placement, a small quantity of the Estelite universal flow resin composite (Medium, High translucency CE, Tokuyama, Japan) was applied into the sulcus between the tooth profile and the rubber dam to shift the position of the matrix placement. The fluidity of the material allows it to be applied without pressure.

Make adaptation of the matrix with the fingers to make the proper emergence profile to the flowable resin composite. Then polymerized using light curing unit (1000 mW/cm², VALO, Ultradent, Utah, USA). It was continued by applying the flowable resin composite until a new mesial wall was created. There after put oxyguard 2 (Kuraray Noritake Dental Inc., Japan) and re-polymerized. Polishing and finishing was done by OptiDisc (KerrHawe, CA, USA). (Figure 10A and 10B).

The baseline and 3 months evaluation results of diastema closure was shown on below pictures (Figure 11A and 11B).

Case 2

A 50-year-old female patient came to the dental hospital due to esthetic problem, therefore she demanded for multiple diastema closure (Figure 12). Clinical and radiographic examination showed healthy anterior teeth with no symptom of apical periodontitis. No oral bad habit was found. Clinical measurement revealed the midline diastema was 2 mm, the lateral right diastema was 1 mm, and the lateral left diastema was 1 mm. The patient had proclination upper labial segment.

As same as the first case, an uncut enamel technique, digital mock-up (keynote program, iOS version 11.1, Apple Inc.), and “button-try” technique was chosen on

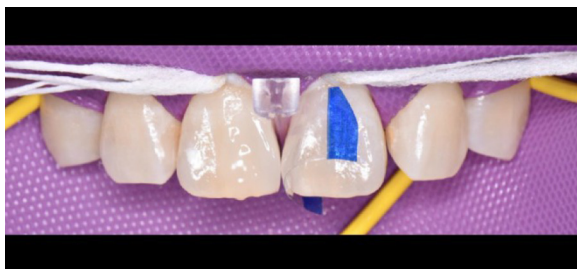


Figure 14. A clear matrix and wedge were adapted on the mesial diastema tooth.



Figure 15. Baseline, one month, 1 year, and 4 years follow-up of restoration.

this case. The first step prior the diastema restoration was rubber dam placement, which was inserted into the sulcus area by using a floss tie (Figure 13). A simple way to make a floss tie is to make a loop around tooth, then tie an overhand knot, and pull from each end to tighten the knot. Finally, use an instrument to keep it in below gingulum.

Prior to acid etching using 38% phosphoric acid (Kuraray Noritake Dental Inc., Japan), cleaning procedure was done using brush. Then, a two-step self-etch adhesive (SE Bond 2, Kuraray Noritake Dental Inc., Japan) was used for bonding procedure. A clear matrix and wedge were adapted on the mesial diastema tooth (Figure 14). Moreover, the flowable resin composite (Estelite universal, Medium, High translucency CE, Tokuyama, Japan) applied into the mesial side. The rest of procedures are same and mentioned on the first case. The final restoration results, one month, 1 year, and 4 years follow-up were shown on the picture (Figure 15). The materials used in these cases were mentioned in table 1.

F.D.C: Food, Drug & Cosmetics color; RDA: Relative Dentin Abrasivity; 10-MDP: 10-methacryloyloxydecyl dihydrogen phosphate; HEMA: 2-hydroxyethyl methacrylate; CQ: camphorquinone; BIS-GMA: 2,2-bis[4-(2-hydroxy-3-methacryloyloxypropoxy) phenyl]propane; Bis-MPEPP: 2,2-bis[(4-methacryloxy polyethoxy)phenyl]propane; TEGDMA: triethylene glycol dimethacrylate; PI: photo initiator; UDMA: 1,6-bis(methacryloxyethylcarbonylamino)trimethyl hexane.

DISCUSSION

Closing diastemas with direct composite has become popular in restorative dentistry, especially in treating non-carious teeth where a minimum intervention approach is preferable. The survival rate of direct composite diastema closure is 84.6% after five years and showed clinically acceptable quality parameters at follow-up, such as: aesthetic parameters (surface luster, surface staining, color stability, translucency, and anatomic form), functional parameters (fracture and retention, marginal adaptation, wear, proximal contact, and patient's view), biological parameters (post-operative hypersensitivity, recurrence of caries, erosion, abfraction, tooth integrity, periodontal response, adjacent mucosa, oral and general health).⁹

The uncut enamel is a minimally invasive method to increase bonding to enamel using self-etch adhesive systems. The concept was to enhance the outer surface of intact enamel that has indistinct and abnormal prism structures or no prism structures to be prismatic enamel surface using phosphoric acid prior to self-etch adhesives. Thus, the bond strength was significantly improved on etched-uncut enamel using the mild and ultra-mild self-etch adhesive by the increased of acid-base resistant zone thickness of the enamel.¹⁰ The application of phosphoric acid on uncut enamel increases the porosity of enamel surface, resulting in an initially superior marginal seal as well reduces microleakage at the enamel bonding interface.¹¹

A free-hand restoration technique is a cost and time effective in applying resin composite, as further laboratory stages are not required. Moreover, the success of free-hand technique depends on the concepts of dental anatomy understanding, aesthetics, and occlusion, as well the skills to apply resin composite in order to achieve a desirable and predictable outcome.¹²

The selective etch on enamel with 30-40% phosphoric acid followed by two-step self-etch adhesive, improves the bond strength for self-etch adhesive systems.¹³ The two-step self-etch adhesive Clearfil SE Bond used in these cases deserves to be recognized as a gold standard for self-etch adhesive systems, based on two meta-analytic proofs of laboratory and clinical effectiveness along with one independent randomized clinical trial.¹⁴⁻¹⁶

Even though no enamel preparation is needed, a clean enamel surface should be achieved by applying the plaque check solution (Mersage PC Pellet, Shofu Inc., Japan) on the working field, then the stain was removed by brushing with prophylaxes paste (Pressage, Shofu Inc., Japan) until no stain left. This step is expected to optimize enamel bonding.

Table 1. Materials compositions and application methods that used in the cases.

Materials	Composition	Application methods
Merssage PC Pellet (Shofu Inc., Japan)	F.D.C red	Rubbing the tooth surfaces with cotton pellet.
Pressage (Shofu Inc., Japan)	RDA 170-180, without fluoride	Apply a small quantity of paste to tooth surfaces using low speed (less than 2,00 min ⁻¹ without water spray; allow patient to rinse completely after cleaning is completed.
K-Etchant Syringe (Kuraray Noritake Dental Inc., Tokyo, Japan)	35% phosphoric acid, water, colloidal silica, pigment	Selective etch: apply the etch on enamel only and leave for 15 s, rinse with water, dry with mild air.
Clearfil SE Bond 2 (Kuraray Noritake Dental Inc., Tokyo, Japan)	<u>Primer</u> : 10-MDP, 2-HEMA, hydrophilic aliphatic dimethacrylate, dl-CQ, water pH= 2.5	Apply primer to entire cavity and leave for 20 s; dry with mild air.
	<u>Bond</u> : 10-MDP, 2-HEMA, Bis-GMA, hydrophobic aliphatic dimethacrylate, dl-CQ, initiators, accelerators, silanated colloidal silica	Apply bond to entire cavity, create a uniform bond film using a gentle air stream; light-cure for 10 s.
Estelite universal flow resin composite (Medium, High translucency CE, Tokuyama Dental, Japan)	Bis-GMA, Bis MPEPP, TEGDMA, UDMA, Supra-Nano Spherical filler (200 nm spherical SiO ₂ /ZrO ₂)	Put the composite into the cavity and then light-cured.
Oxyguard 2 (Kuraray Noritake Dental Inc., Tokyo, Japan)	Polyethylene glycol, catalysts, accelerators, dyes	Put the gel to the margins after removing the excess resin composite and light curing, then wait for 3 minutes.

The digital mock-up was preferred (keynote program, iOS version 11.1, Apple Inc. USA) instead of using physical mock-up due to its simplicity to handle and can be done and undone anytime to get the optimum aesthetic and functional needs of the patient. Also, currently, the smile designing of the complete digital drawing on digital smile design software on computer was developed and had promising results.¹⁷ Digital imaging and designing help patients and clinicians to communicate and visualize the expected final result prior to the treatment.

In order to create matching tooth color with the patient's natural tooth color, the "button-try" technique was used. It was introduced by Dr. Lee in 2010 by placing small amounts of different shades of the resin composite on the vestibular surface to be restored and then light-curing.¹⁸ Three composite colors (NE & OCE; Estelite asteria, Tokuyama dental, Japan and CE; Estelite universal flow, Tokuyama Dental, Japan) were placed on the incisal of enamel to decide which one is the most suitable for the patient.



Figure 16. The application of flowable composite

The flowable composite resin showed excellent clinical efficacy on small occlusal restoration after 36 months.¹⁹ The other clinical study represented extremely promising results after seven years in the multiple diastemas case.²⁰ Therefore, flowable composite resin paired with a matrix was used for multiple diastema closures in this report. It can easily penetrates the

narrow space between the cervical margin and the gingival tissue isolated by the rubber dam almost without pressure.⁵ The flowable composite was filled in back and front, then light-cured to confirm it flowed adequately without voids²¹ (Figure 16).

There was no need to use a wedge in the first case. This technique allowed the clinician to create the natural restoration without creating a dark triangle.²² However, in the second case, a clear matrix and wedge were used to allow for the injection of composite into the embrasure without creating an overhanging margin and may not create a dark triangle.

Glycerin gel - Oxyguard 2 (Kuraray, Japan) was applied to the tooth surface after complete closure of the diastemas using composite to minimize the oxygen inhibition layer. Glycerin gels contain catalysts and curing accelerators that may influence the superficial layer of composite restoration by preventing direct contact between oxygen and the composite during its setting period.²³ Polishing and finishing were done by optidisc (3M ESPE) that contains aluminum oxide produced the lowest surface roughness value (0.114 mm) compared to the combination of aluminum oxide and diamond particle or silicon carbide (0.23 mm). The surface roughness over 0.2 mm will affect the bacterial plaque retention area.²⁴

At three-month recalls, the general outlook of the teeth in the first case was considered natural and aesthetical. Clinically, all the restorations have no fractures and no dark triangles, and also the restoration margins demonstrated no discolorations. The second case performed clinically aesthetic and functional at one-month, one-year, and four-year follow-ups. Unfortunately, a dark triangle is seen in the four-year follow-up of the second case.

CONCLUSION

The minimal invasive strategy concept by uncut enamel technique, continued by free-hand restoration technique successfully created optimal bonding to the tooth structure, preserve the natural tooth, as well as predictable esthetics results on multiple diastema teeth.

CONFLICT OF INTEREST

The authors declare that there were no conflicts of interest related to this case report.

REFERENCES

1. Rafter M. Apexification: A review. *Dent Traumatol.* 2005; 21(1):1-8.
1. Hussain U, Ayub A, Farhan M. Etiology and treatment of midline diastema: A review of literature. *Pak Orthod J.* 2013; 5(1):27-33.
2. Takahashi F, Abe A, Isobe Y, Aizawa Y, Hanada N. Assessment of malocclusion of Japanese junior high school pupils aged 12-13 years in Iwate prefecture according to the Dental Aesthetic Index (DAI). *Asia Pac J Public Health.* 1995; 8(2):81-4.
3. Ansai T, Miyazaki H, Katoh Y, Yamashita Y, Takehara T, Jenny J, Cons NC. Prevalence of malocclusion in high school students in Japan according to the Dental Aesthetic Index. *Community Dent Oral Epidemiol.* 1993; 21(5):303-5.
4. Campbell A, Kindelan J. Maxillary midline diastema: A case report involving a combined orthodontic/maxillofacial approach. *J Orthod.* 2006; 33(1):22-7.
5. Saratti CM, Krejci I, Rocca GT. Multiple diastema closure in periodontally compromised teeth: How to achieve an enamel-like emergence profile. *J Prosthet Dent.* 2016; 116(5):642-6.
6. Mackenzie L, Banerjee A. Minimally invasive direct restorations: A practical guide. *Br Dent J.* 2017; 223(3):163-71.
7. Lin WT, Kitasako Y, Nakashima S, Tagami J. A comparative study of the susceptibility of cut and uncut enamel to erosive demineralization. *Dent Mater J.* 2017; 36(1):48-53.
8. Kusumasari C, Hatayama T, Shimada Y. Replacement of two failed indirect restorations with direct bonded restorations using minimally invasive strategy. *J Dent Indones.* 2021; 28(3):198-204.
9. Frese C, Schiller P, Staehle HJ, Wolff D. Recontouring teeth and closing diastemas with direct composite buildups: A 5-year follow-up. *J Dent.* 2013; 41(11):979-85.
10. Sato T, Takagaki T, Hatayama T, Nikaido T, Tagami J. Update on enamel bonding strategies. *Front Dent Med.* 2021;2(June):1-10.
11. Khosravi K, Ataei E, Mousavi M, Khodaeian N. Effect of phosphoric acid etching of enamel margins on the microleakage of a simplified all-in-one and a self-etch adhesive system. *Oper Dent.* 2009; 34(5):531-6.
12. Dietschi D. Free-hand composite resin restorations: A key to anterior aesthetics. *Pract Periodontics Aesthet Dent.* 1995; 7(7):15-25.

13. Van Meerbeek B, Yoshihara K, Van Landuyt K, Yoshida Y, Peumans M. From Buonocore's pioneering acid-etch technique to self-adhering restoratives. A status perspective of rapidly advancing dental adhesive technology. *J Adhes Dent.* 2020; 22(1):7-34.
14. De Munck J, Mine A, Poitevin A, Van Ende A, Cardoso MV, Van Landuyt KL, Peumans M, Van Meerbeek B. Meta-analytical review of parameters involved in dentin bonding. *J Dent Res.* 2012; 91(4):351-7.
15. Peumans M, De Munck J, Mine A, Van Meerbeek B. Clinical effectiveness of contemporary adhesives for the restoration of non-cariou cervical lesions. A systematic review. *Dent Mater.* 2014; 30(10):1089-103.
16. Peumans M, De Munck J, Van Landuyt K, Van Meerbeek B. Thirteen-year randomized controlled clinical trial of a two-step self-etch adhesive in non-cariou cervical lesions. *Dent Mater.* 2015; 31(3):308-14.
17. Jafri Z, Ahmad N, Sawai M, Sultan N, Bhardwaj A. Digital Smile Design-An innovative tool in aesthetic dentistry. *J Oral Biol Craniofac Res.* 2020; 10(2):194-8.
18. Lee YK, Yu B, Lee SH, Cho MS, Lee CY, Lim HN. Shade compatibility of esthetic restorative materials--A review. *Dent Mater.* 2010; 26(12):1119-26.
19. Dukić W, Majić M, Prica N, Oreški I. Clinical evaluation of flowable composite materials in permanent molars small class I restorations: 3-year double blind clinical study. *Materials (Basel).* 2021; 14(15):4283.
20. Terry D, Powers J. Using injectable resin composite: Part one. *Int Dent Afr.* 2012;5(1):52-62.
21. Mohamed N, Al-Kadhim AH, Wan Hussin WHI. Closing the diastema and teeth spacing using direct composite resin build-up. *Malaysian J Sci Health Tech.* 2021; 7:22-25.
22. Korkut B, Yanikoglu F, Tagtekin D. Direct midline diastema closure with composite layering technique: A one-year follow-up. *Case Rep Dent.* 2016; 2016:6810984.
23. Rechenberg DK, Göhring TN, Attin T. Influence of different curing approaches on marginal adaptation of ceramic inlays. *J Adhes Dent.* 2010; 12(3):189-96.
24. Aydın N, Topçu FT, Karaoğlanoğlu S, Oktay EA, Erdemir U. Effect of finishing and polishing systems on the surface roughness and color change of composite resins. *J Clin Exp Dent.* 2021; 13(5):e446-54.

(Received February 15, 2022; Accepted August 2, 2022)