

# Closing spaces with partial ceramic veneers: A clinical report

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This clinical report describes optionally conservative concepts in closing spaces in anterior teeth, consisting of non-preparation partial ceramic veneers and composite resins. A 32-year-old Thai female with the chief complaint of having spaces between her anterior teeth. The intra-oral examination found spaces between 12 and 13, 22 and 23, 42 and 43. Moreover the patient presented unpleasant previous diastema closure with composite resin in terms of a shifted and canted dental midline. The repeated proportion was used to calculate the width of each upper anterior tooth for planning. This clinical report included partial ceramic veneers in the treatment plan as an option to close spaces which would be considered as non-invasive technique. In this clinical report, partial ceramic veneers achieved not only good esthetic results but also showed the strength and predictable longevity of restorations on bonded enamel.

**Keywords:** close space, conservative, diastema closure, enamel bonding, non-preparation veneer, partial ceramic veneer, veneer

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## Introduction

In esthetic dentistry, we cannot deny that a pleasing smile can enhance personal appearance. Moreover, it will lead to greater self-confidence and improve socialization. One of the major esthetic problems is tooth size discrepancy or inappropriate distribution of space in the anterior region of the mouth. Among the suggested options for space closure are orthodontic, restorative, and prosthodontic treatment. However, a number of clinical cases cannot be corrected or maintained by only one approach. Therefore, an interdisciplinary approach that combines

two or more treatment modalities may be required for better outcomes [1].

Currently, more conservative methods have been advocated. Although non-preparation veneers were placed on the unprepared tooth surface, as yet no conclusive location has been determined for non-preparation veneers [2]. This clinical report described the rationale for non-preparation of partial ceramic veneers. Because of their biocompatibility and esthetic results which blend in effectively with the adjacent dental structures, partial ceramic veneers have now become the restoration of choice as shown in this clinical report.

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Moreover, the new technique in this clinical report proposed a conservative concept, consisting of direct composite resin and indirect partial ceramic veneer involving no preparation so that all restorations could be used to correct tooth size discrepancy or inappropriate distribution of space in the anterior teeth with maximum preservation of dental structure. The patient's esthetic expectations were successfully met through this comprehensive approach.

## Clinical case report

A 32-year-old Thai female visited the Esthetic and Implant Clinic, Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand with the chief complaint of having spaces in her anterior teeth (Figure 1, 2-A and 2-B). The medical history of the patient was unremarkable.

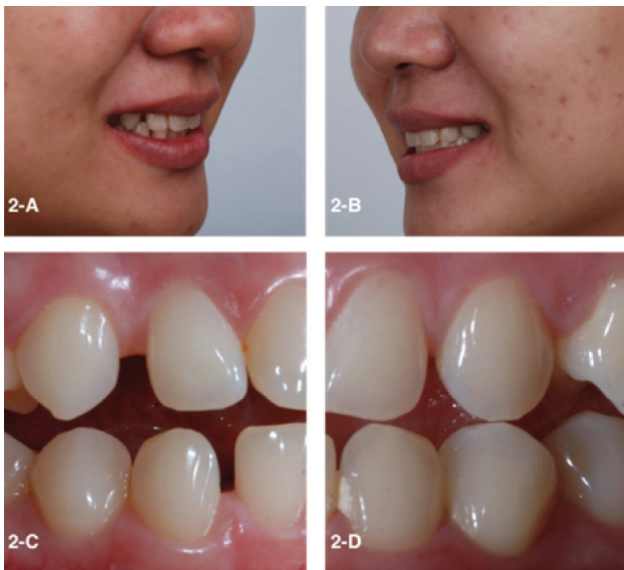
From facial examination, the patient exhibited an interpupillary line and a commissural line parallel to the horizontal line with a medium lip line, convex incisal curvature and presented buccal corridor

(Figure 1). Intra-oral examination showed molar class I relationship and no periodontal disease. Her dental midline was shifted and canted to the right from previous inadequate diastema closure treatment with composite resin when compared to the skeletal midline. Spaces at 12 and 13 (Figure 2-C), 22 and 23 (Figure 2-D), 42 and 43 (Figure 2-C) were observed. Periapical lesions were absent in the radiograph images.

Recently, the non-preparation partial ceramic veneer has been introduced and interested among restorative dentists. Since preparation is no longer necessary unlike the conventional ceramic veneer. This technique preserves tooth structure and can also nicely blend into adjacent teeth. From our previous clinical study (Figure 3), a patient who was treated with the non-preparation partial ceramic veneer showed the most outstanding benefit as mention earlier. Furthermore, partial ceramic veneer can be entirely bonded to enamel.



**Figure 1** A 32-year-old female Thai patient presented with chief complaint of having spaces in her anterior teeth (1-A). The patient exhibited an interpupillary line and a commissural line parallel to the horizontal line with a medium lip line, convex incisal curvature and presented buccal corridor (1-B).



**Figure 2** Pre-operative photographs showed all spaces extra and intra oral (right 2-A, 2-C and left 2-B, 2-D).

However, from an esthetic perspective concerning, an important point should be noted on the use of partial ceramic veneer showed in our pervious clinical study (Figure 3). The labial margin of the partial ceramic veneer was visible from some angles of light-reflecting conditions. The direction of light reflection is perpendicular to the dominant central incisor but not the later incisor and canine. For that reason, the labial margin of the partial ceramic veneers in central incisor is noticeable even to non-professionals. Unlike lateral incisors and canines, the position of the lateral incisor and the canine positions are on the proper angle of smile. This clinical study demonstrated an optional treatment plan to close the spaces with non-preparation partial ceramic veneers.

Prior to all treatments, space analysis and diagnostic wax-up cast were performed. Tooth shape and proportion were analyzed based on the proportion of central incisor to lateral incisor width and lateral incisor to canine width which can be

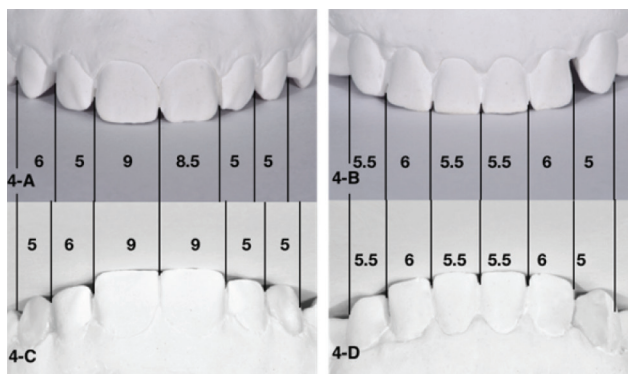


**Figure 3** Our previously clinical study showed margin of partial veneers on both dominant central incisors.

applied to calculate the width of each upper anterior tooth (Figure 4-A and 4-B). The optimal width/height ratio of the upper central incisors was 0.88 [3]. The diagnostic wax-up cast is very important because it is an aid in treatment planning and acts as a communication tool between dentist, patient and dental technician (Figure 4-C and 4-D).

The space between 12 and 13 (Figure 5-A) was 2 mm which is too large for a single indirect restoration. Therefore, it was proper to fill the space between 12 and 13 with 2 restorations. However, the size of the restoration on 12 was too small to fabricate a piece of partial ceramic veneer and it would be too difficult to insert the small ceramic veneer on the distal of 12. So direct composite resin on 12 became the chosen option to create the proper space for partial ceramic veneer on 13.

The space between 22 and 23 (Figure 5-B) and the space between 42 and 43 (Figure 5-C) were suitable for closure with partial ceramic veneers.



**Figure 4** Space analysis: upper teeth (4-A) and wax up model (4-C), lower teeth (4-B) and wax up model (4-D).

The shifted and canted dental midline between 11 and 21 from the previous improper restorations were corrected by replacing the new direct composite resin restorations. In this case, it was decided that closing the median diastema on the central incisors with direct composite resin restorations was more appropriate than using partial ceramic veneers on both dominant teeth. The reason underlying this plan concerned the reflection of light on both dominant central incisors, since composite resin can blend in at the margin of the labial surface better than ceramics.

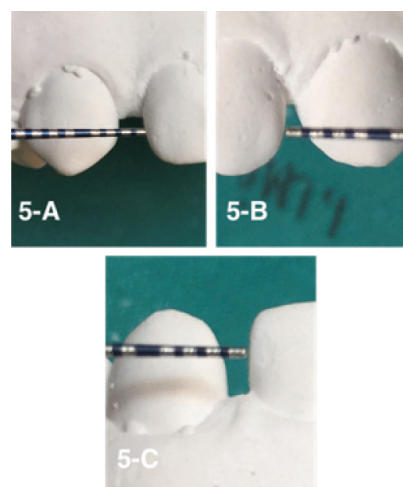
## Treatment procedure

### Disease control phase

Plaque-induced gingivitis was treated and all surfaces were polished with pumice to make all surfaces smooth and clear [4, 5]. The situation was monitored until good oral hygiene status demonstrated no further sign of gingival inflammation.

### Restorative phase

The distal of 12 underwent grinding with an abrasive disc (Kerr, Orange, CA, USA) to remove the aprismatic enamel, [5, 6] and the adjacent



**Figure 5** Space measurement at 13 (5-A), 23 (5-B) and 43 (5-C).

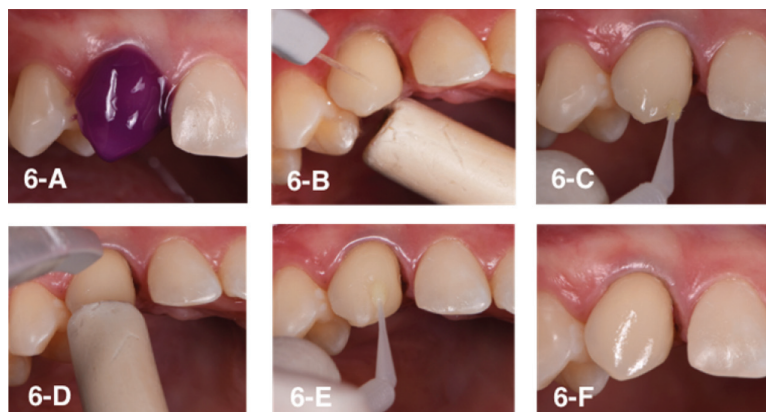
teeth were separated by Teflon tape (Fantastic Triumph, BKK, Thailand). The prepared tooth was etched with 37.5% phosphoric acid (Kerr, Orange, CA, USA), Optibond FL was applied (Kerr, Orange, CA, USA), and the tooth was restored with direct composite resin (Premise, Kerr, Orange, CA, USA) then light cured with an LED light-curing tip (DEMI PLUS, Kerr, WI, USA) for 40 seconds and polished with the HiLuster PLUS polishing system (Kerr, Orange, CA, USA).

All bonded areas in 13, 23, and 43 labial surfaces underwent grinding with an abrasive disc (Kerr, Orange, CA, USA) to remove the aprismatic enamel [5, 6] then the gingival margin was apically retracted with Ultrapak no.000 cord (Ultradent, South Jordan, UT, USA). Subsequently, impressions were taken with polyvinyl siloxane (Silagum®, DMG, Hamburg, Germany) and sent to a dental laboratory to fabricate partial ceramic veneers with lithium-disilicate (IPS e.max press HT, Ivoclar Vivadent, Schaan, Liechtenstein). To evaluate the color in this clinical study, the Vita 3D shade guide and stump shade was used to match the restoration and the tooth color underneath the restoration, and then all photographs were used for the process of color matching and all information was sent to the dental laboratory to calibrate the optimal color for the partial ceramic veneers.

After the partial ceramic veneers were fabricated with lithium-disilicate (IPS e.max press HT, Ivoclar Vivadent, Schaan, Liechtenstein), the inner surface of the ceramic was carefully treated with 5% hydrofluoric acid (IPS Ceramic etching gel, Ivoclar Vivadent, Schaan, Liechtenstein) for 20 seconds, then washed with water spray and dried with oil-free air. A silane coupling agent (Monobond Plus, Ivoclar Vivadent, Schaan, Liechtenstein) was carefully applied in a thin coat to the internal ceramic surfaces with a fine-tipped brush (Vivabrush, Ivoclar Vivadent, NY, USA) for 60 seconds. Any remaining excess was dispersed by gentle air-blowing, eventually curing the silane layer with hot air from a hair dryer (Parlux® 2800, Milano, Italy) for 5-10 minutes before cementation [7].

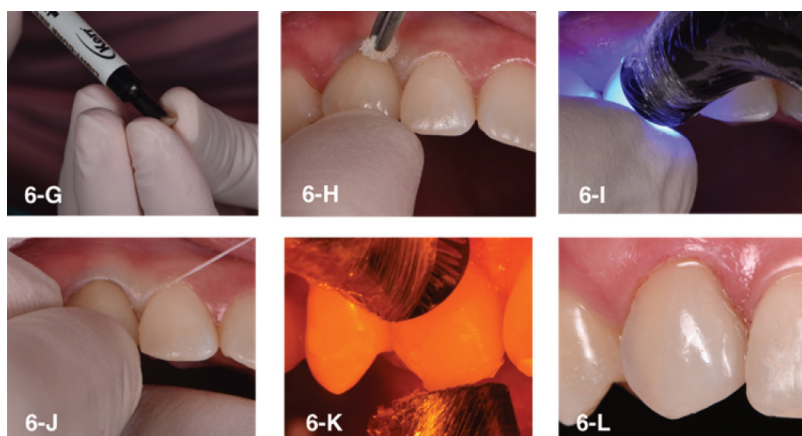
At the cementation visit of the partial ceramic veneers, all teeth surfaces were cleaned. Then all partial ceramic veneers were fitted on the teeth surfaces to find the path to insert and determine their marginal fit. When all partial ceramic veneers were ready for cementation. The prepared tooth was etched with 37.5% phosphoric acid (Kerr, Orange, CA, USA) for 15 seconds then washed with water spray and dried with oil-free air (Figure 6-A and 6-B) and Optibond FL was applied (Kerr, Orange, CA, USA) (Figure 6-C, 6-D, 6-E, and 6-F).

The partial ceramic veneers were loaded with dual cure resin cement (NX3 Nexus, Kerr, Orange, CA, USA) in clear shade and gently inserted on the teeth surfaces (Figure 6-G). Excess cement was initially removed by using a sponge (Figure 6-H) then cured the remaining cement by an LED light-curing tip (DEMI PLUS, Kerr, WI, USA) for 5 seconds on each surface (Figure 6-I). All excess cement was removed with blade No.12 (Swann-Morton, Sheffield, UK) and the remaining cement fully polymerized by an LED light-curing tip (DEMI PLUS, Kerr, WI, USA) for 40 seconds (Figure 6-J and 6-K). Then the occlusion was adjusted and the margin of the partial ceramic veneers was polished with OptraFine (Ivoclar Vivadent, Schaan, Liechtenstein) to blend the restoration margin with the natural tooth surface to achieve an effect similar to that of a contact lens [8] which shows in the veneer restoration (Figure 6-L). The result showed excellent biocompatibility, harmonious characterization, and natural color appearance (Figure 7). The previous inadequate diastema closure was replaced with the new direct composite resin for the reason mentioned earlier (Figure 8-A and 8-B) and all restorations were polished with the HiLuster PLUS polishing system (Kerr, Orange, CA, USA) (Figure 8-C).

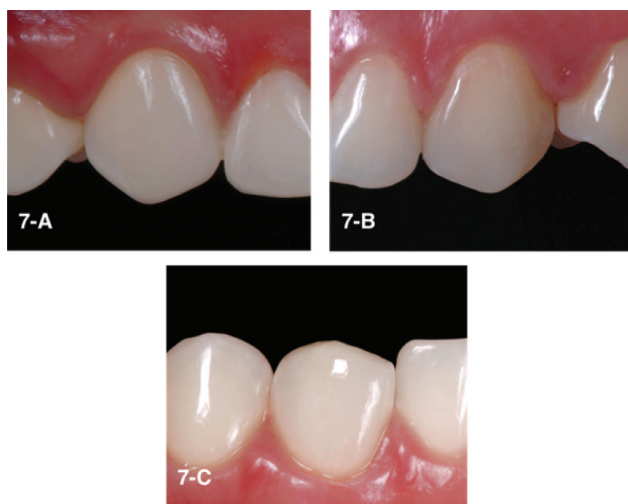


**Figure 6** 6-A: Apply 37% phosphoric acid (Kerr, Orange, CA, USA) on enamel for 15 seconds.  
6-B: Rinse etchant with water spray for 15 seconds.  
6-C: Apply primer (OptiBond FL, Kerr, Orange, CA, USA) on enamel.  
6-D: Air dry with oil free air for evaporating solvent in primer.  
6-E: Apply bonding (OptiBond FL, Kerr, Orange, CA, USA) on enamel.  
6-F: Air dry with oil free air for evaporating solvent in bonding.





**Figure 6** 6-G: Load with photo-polymerized resin cement (NX3 Nexus, Kerr, Orange, CA, USA) using a clear shade.  
6-H: Initial remove excess cement with sponge.  
6-I: Light curing with an LED light-curing tip (DEMI PLUS, Kerr, WI, USA) for 5 seconds.  
6-J: Remove all excess cement.  
6-K: Light curing with an LED light-curing tip (DEMI PLUS, Kerr, WI, USA) for 40 seconds.  
6-L: Immediate after cementation.



**Figure 7** After cementation, adjusted occlusion and polished the margin of partial ceramic veneers 13 (7-A), 23 (7-B) and 43 (7-C).



**Figure 8** Median diastema on 11 and 21: Previously inadequate restorations on median diastema (8-A), then removed old restorations (8-B) and new restorations for median diastema closure 8-C).

### Maintenance phase

All maintenance methods were instructed to patient. There were evaluated at 6 and 12 months (Figure 9-A and 9-B) after cementation. And subject exhibited excellent results. Most importantly,

the patient was very satisfied with her new confident smile without any spaces (Figure 9-C, 9-D, 10) compared to her previous smile (Figure 2). Oral hygiene and periodontal status were also evaluated at every dental follow-up visit.



**Figure 9** Follow up visit after 12 months when all partial ceramic veneers were cementations Intra oral (9-A and 9-B) and extra oral (9-C and 9-D)



**Figure 10** Extraoral photographs after all restorations were finished.

## Discussion

From a conservative point of view, treatment with ceramic veneers is less aggressive than crowns and the biomechanical functions of the original tooth would be maintained. Due to high success rates in the clinical use of ceramic veneer, it has become common practice in a wide variety of clinical situations and indications [9] However,

to deal with this great variety of clinical situations, one of the most important factors is case selection.

In this clinical situation, esthetic issues on the anterior teeth are concerned, spaces occurred from the improper shape of 12, 13, 23, 43 and the previous inadequate diastema closure. Direct bonded composite resin restorations and partial ceramic veneers may be preferable in different clinical situations. However, interdisciplinary

approaches are required in the treatment plan for better outcomes.

The process of closing space and re-anatomization with partial ceramic veneers in this clinical report showed good biocompatibility and satisfactory esthetic results of the anterior teeth. Partial ceramic veneers involving no preparation technique are more conservative compared with conventional ceramic veneers and crowns, which need tooth preparation for bonding restoration. Both exposed dentin and severe tooth discoloration are contraindications for partial ceramic veneer because the moisture on the dentin surface can affect the bonding interface unlike enamel. Micromechanical retention mechanisms for the attachment of hydrophobic resin restorative materials are also more effective on enamel than on dentin [10]. Moreover, dentin bonding systems are technique sensitivity in multiple steps on surface preparation for dentin bonding. For severe tooth discoloration from tetracycline, it is difficult to fabricate the color of restoration mimic the adjacent tooth.

The enamel bonding provides more reliable bonding than dentin. In clinical situation should preserve enamel for reliable bonded interface [6, 11]. When preparation is absolutely necessary for the path of insertion, the maximum preservation of enamel at cervical third becomes a must. It has been scientifically proven that ceramic veneers bonded to enamel tooth preparations have higher survival rates.

Even though the minimal width of finish line for conventional ceramic veneer was required 0.3 mm, the thickness of enamel at cervical third does not permit 0.3 mm or a deep chamfer preparation. The mean thickness of the enamel at the cervical third is 410  $\mu\text{m}$  (0.410 mm) on the maxillary central incisor and 367  $\mu\text{m}$  (0.367 mm) on the maxillary lateral incisor [12]. After the preparation, dentin would already be exposed or remained only enamel island which both are poor in bonding interface of restoration [12]. In other

words, the enamel thickness at the cervical third does not perfectly bond in a deep chamfer preparation or 0.3 mm depth for restorations involving already exposed dentin like ceramics when compared with enamel bonding.

Currently, ceramic restoration thickness can be fabricated from 100  $\mu\text{m}$  (0.1 mm) to 300  $\mu\text{m}$  (0.3 mm). This makes it possible to fabricate a partial piece that involves one or more surfaces like partial ceramic veneers [13]. The main advantage of a partial ceramic veneer is re-anatomization without the need for tooth preparation.

Before starting any procedure, transferring the information (representing the planning of treatment) from the patient's mouth to the diagnostic cast is necessary. The diagnostic wax-up of the diagnostic cast is another tool allowing the dentist and patient to evaluate whether any adjustment is needed to achieve adequate esthetics and function.

Although partial ceramic veneers have several advantages, the limitation is the potential for light reflection at the labial surface margin which can draw the attention of the observer, even among non-professionals, when the clinician places the partial ceramic veneer in an improper position.

To solve the problem, the margin of the partial ceramic veneer on the labial surface should be placed at the proper angle. Light reflection is an issue of concern before filling any space with partial ceramic veneer. The recommended location and position in our study are on the distal part of the lateral incisor and mesial part of the canine, representing the best location and position to avoid direct light reflection and to mimic the natural tooth surface. On the median diastema as mentioned earlier, direct composite resin should be the material of choice to mimic the natural tooth. When partial ceramic veneer is placed on the central incisor it could easily catch the eye as our previous clinical study showed (Figure 4).



In the case of a large single space that cannot be filled with only one partial ceramic veneer, the use of 2 partial ceramic veneers to fill the space is very complicated and not recommended. This is because the clinician has to insert 2 small pieces of partial ceramic veneer with proper proportion on each side of the space. During cementation, it is difficult to stabilize a small piece of partial ceramic veneer. Therefore, placing only one partial ceramic veneer is more appropriate. In this clinical report it is suggested to fill the smaller part of the single space with a direct restoration, and the large part of the space with partial ceramic veneer.

One further reason for placing the partial ceramic veneer on the canine instead of the lateral incisor was the shape of the canine. Especially in this case, the mesial surface of canine is difficult to build up the proper shape with direct composite resin. Thus, it is appropriate to restore canine with indirect restoration.

Over-contoured restorations normally occur due to inadequate preparation or planning and they disrupt the gingival margins and natural emergence profile of the teeth, promoting plaque accumulation, gingival inflammation, and consequently, gingival recession over time. Location of the gingival finish line of veneer is determined by retraction cords during the final impression. In cases with no gingival finish line, the final impression must be taken with retraction cord because retraction cord will apically displace gingival margin. Gingival finish line of veneer should be placed about 0.5 mm below the gingiva.

The combination of color from ceramic, tooth substrate and luting cement affects the final color of veneer [14]. Shade selection is another key to mimic natural-looking restorations. Shade matching must be performed visually and also taking photographs. For the highest precision, tooth color must be compared with shade guide in moist condition for protecting color mismatch from tooth

dehydration. Similar color shade tabs should be calibrated by photographs. The translucency of ceramic restorations adds another level of complexity to the color matching process because ceramics allow light to diffuse and scatter, meaning that the underlying substrate can also have a significant influence on the final color [15]. The luting cement is used to bridge the color between tooth substrate and ceramic color. The use of try-in paste is an important tool in overcoming this challenge. The try-in is designed to verify that the color of the final restorations is acceptable. This final esthetic result is a blending of the color of the ceramic and the underlying tooth structure as light passes through both and is reflected back. The main purpose of esthetic dentistry is to mimic natural hard and soft tissues, so dental ceramic is commonly used as an esthetically pleasing material capable of meeting this objective [16-18]. It has suitable color stability, biocompatibility, mechanical properties and esthetic outcomes [19].

In conclusion, the ultimate success of esthetic treatments can only be achieved when patients understand the importance of maintaining good oral health. The main restorative approaches are designed to achieve the maximum preservation of enamel as demonstrated in this clinical report, and digital treatment planning can be performed to facilitate interdisciplinary measures in a further study. The advantages of non-preparation partial ceramic veneers in this clinical report demonstrated the absence of pain, no need for anesthesia, fast technique, no harm to dental pulp tissue, and the ease of impression and bonding to enamel (long lasting restoration due to enamel bonding).

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