Republic of Iraq Ministry of
Higher Education and Scientific
ResearchUniversity of Mosul
College of Dentistry

Dental Diastema

A Project Submitted to

The College of Dentistry, University of Mosul, Department of coservative in Dentistry partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry

By
Teba Ahmed Mohamed

Supervised by:

Assistant Professor

Fanar Turki Aljadwaa

January 2025

Certification of the Supervisor

I certify that this project entitled Dental Diastema was prepared by the fifth-year student Teba Ahmed mohamed under my supervision at the College of Dentistry/University of Mosul in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry

Supervisor’s name: Fanar Turki Aljadwaa

Date: January 2025

Acknowledgment

First, I must express my faithful gratitude and thanks to Allah, the Most Merciful and Compassionatc, for providing me strength, willingness. and patience to complete my study; and peace and pray upon our Prophet Mohammad.

I wish to express my sincere appreciation to the Ministry of Higher Education and Scientific Research, Mosul University and College of Dentistry, for giving me this opportunity to continue my study.

I would like to extend my deepest gratitude and appreciation to the Dean of the College of Dentistry, Mosul University, Asst. Prof. Dr. Rayan s.Hamed, his previous and current assistants, Asst. Prof. Dr. Ali M. Al-Naimi, and Prof. Dr. Emad F. Al-Khalidi, for their generous support. kindness, and cooperation. My deep thanks and indebtedness go to my supervisor, Asst. Prof. Dr. Fanar Turki Aljadwaa, for her valuable remarks, guidance, wise suggestions, and encouragement.It is my pleasure to extend my sincere thanks to Asst. Prof. Dr. Alaa Edrees, the head of the Department of Conservative Dentistry, and to all staff members for their unfailing support.

Finally, I am deeply grateful and express great thanks to all my family members, "my dear parents, my sisters for their unlimited concern, support, encouragement, and help throughout my study.

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Introduction

Tooth diastemas are gaps or spaces between two adjacent teeth in the same tooth arch and it is of common occurrence in general population. They manifest spaces of more than 0.5 mm between the proximal surfaces of adjacent teeth and they show multifactorial acthiology. The presence of an anterior diastema or multiple diastemas in adults can cause an aesthetic damage to the smile and facial harmony. Usually, these diastemas can be managed effectively with an orthodontic treatment. Often considered the treatment of choice, this solution may however be not sufficient to resolve the cosmetic defect, especially in cases where the diastema is associated with a dental malformation, which requires the use of additional procedures. In these cases, a restorative procedure is needed. To obtain positive outcomes, there is currently a trend within the restorative dentistry to develop faster and less invasive procedures. Direct Composite resin restoration can provide excellent results based on the biological, functional, and esthetic aspects of the closure of the interdental spaces. These results are mainly due to the development of the adhesive techniques and compositions of these systems, well the improvement of composite resin materials. Due to the development of the adhesive techniques and compositions of composite resin, practitioners can treat these situations and obtain a satisfactory aesthetic result with a restoration that mimics the natural tooth structure. Indeed, recent aesthetic composite resin materials have similar physical and mechanical properties to that of the natural tooth and possess an appearance like the natural dentin and enamel .They offer an expanded range of shades and varying opacities designed specifically for layering technique whereas early brands of composite resins offered only "body" shades and appeared dull and dense.Currently, the use of materials employing nanotechnology in their development has been an option for aesthetic restorations. Composite resin is an ideal material when restoring diastema closure. It is considered non- invasive, rapid and less expensive therapeutic

alternative for the patient. It is highly polishable, long lasting and mimics natural tooth structure .It is indicated when the malposition and the forward inclination of the anterior teeth are sufficiently moderate not to compromise the obtention of satisfactory result, viewable to an analogous or digital aesthetic project. Depending on the clinical and aesthetic situation, the diastemas will be closed either. on one side (unilateral technique) or on both sides (bilateral technique). The choice of techniques depends mainly on the aesthetic requirements of the given situation. Central diastemas generally need to be closed starting from two collateral teeth for reasons of symmetry, lateral diastemas can often be treated with satisfaction using a unilateral technique.

diastema is negatively affecting the patients' smile, psychology, and daily business life by creating disharmony on the patients' face and unattractive smile. Therefore, a comprehensive treatment planning including determination of etiologic factors, soft tissue morphology, occlusion, patient needs, demands, and esthetic considerations should be evaluated carefully for satisfactory outcomes. To accomplish a successful treatment plan and final outcome, multidisciplinary collaboration between orthodontics, restorative dentistry, and periodontology has become necessary in the recent years (Oquendo A, Brea ,2001).

The presence of a gap or space between the adjacent anterior teeth with black areas is called diastema. This unpleasant problem of the teeth commonly occuring in adult dentition negatively affets the patients smile and can be a major esthetic concern for both patients and observers. However, in some situation, especially in small midline diastemas, these spaces do not adversely affect the patient's image and, hence, may not require a treatment. Therefore, before the treatment planning, the etiology of the diastema, patient needs, and demands, esthetic considerations, as well as the soft tissue morphology should be evaluated carefully for the satisfactory outcomes (Kokich VO,2006).

Aims of The Study

To investigate the causes, treatment options, and psychological impacts of dental diastema, with the goal of providing a comprehensive understanding of its prevalence, management strategies, and the effect it has on patients' self-esteem and quality of life. This aim allows for a thorough exploration of the multifaceted nature of diastema, addressing both clinical and psychosocial aspects, and providing insights into effective treatment and care.

Chapter One
Literatures Review

Chapter One
Literatures Review

1.1. Definition

Diastema, defined as the space between teeth, may result from size mismatch between teeth and arch, impacted teeth, tooth loss, congenital tooth deficiency or abnormal frenulum connections. The term polydiastema can also be used to describe a large number of diastemas on the jaw arch. 12 Studies have shown that the most common diastema is the one occurring between the maxillary central teeth. If the diastema seen between the maxillary central teeth is more than 2 mm, it is called midline diastema. It has also been reported that the most common cause of midline diastema is labial frenulum. Midline diastema is not a pathological condition. however, patients demand treatment of diastema because it is not aesthetically pleasing. Today, with the prominence of aesthetics, the demand for treatment of patients is increasing, especially because of the interconnectedness of dental and facial aesthetics. Depending on the conditions such as the location and extent of the diastema, the aesthetic expectations and socio-ecenomic level of the patients, the treatment option changes, as well As shown in the (Fig1) (Tüter, E. Korkut,2019).

Fig1 : median diastema

1.2 Aetiology of Diastema

1.2.1 Physiological Development of the Dentition

Spacing in anterior teeth is a normal feature of the primary and mixed dentition. The spacing of the primary dentition is the sign of the available spaces allowing for accommodation and proper alignment of the permanent teeth which are larger in size than their preceding. The average primary interdental spacing is 4 mm in the maxilla and 3 mm in the mandible. This physiological diastema normally decreases or closes by the eruption of the lateral incisors and/or canines in most of the cases .If there is no blocking pathologic or physiologic condition, spontaneous closure can be expected (Furuse AY,2008).

Maxillary midline diastema may persist until the end of the mixed dentition .In this stage of development, also referred as "ugly duckling stage," devel- oping canines mesially push the roots of the central and lateral incisors causing distal movement of the crowns, leading to maxillary midline diastema .If the midline spacing is 2 mm or less, it will be spontaneously corrected by the eruption of the permanent canines resulting in mesial movement of the incisor's crowns, whereas a greater diastema is unlikely to close without intervention As shown in the (Fig2) (Belser UC,1997) .

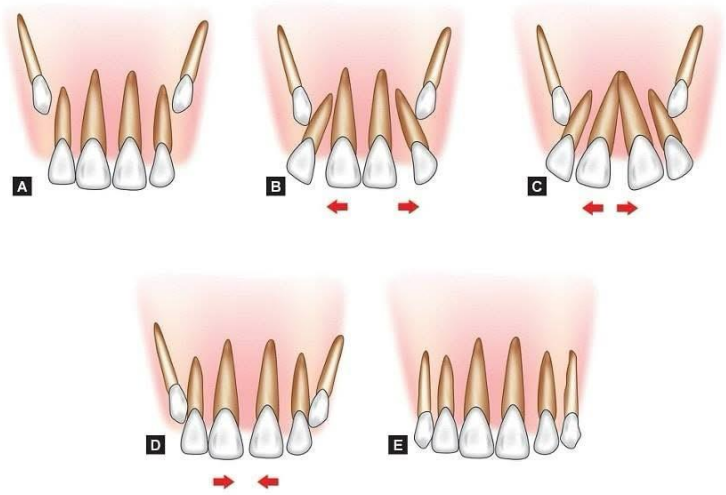

Fig2: ugly duckling stage

1.2.2 Ethnicity and Heredity

It has been established that diastema runs in families, suggesting a genetic predisposition. Studies exposing the genetic base of hypodontia and microdontia corroborate the idea that their hereditary nature is attributable to the genetic regulation of teeth size is the most prevalent etiological determinants of dental distancing.

Revealed a discrepancy in heritability between ethnic groups and indicated a possible for maxillary midline diastema, autosomal dominant inheritance is the norm. Environmental variables may have a larger impact on maxillary midline diastema in the black population, which might explain why it has a lower heritability than the white population (Van Der Linden,2004).

1.2.3 Variations in Dentoalveolar Discrepancies

Conditions associated with the tooth size and arch length discrepancies which result in an imbalance between the width of the teeth and arch length are the most common causes of the diastema in adults. This can be due to microdontia, hypodontia, or increased arch dimensions. In other words, diastema occurs when the mesiodistal width of the anterior teeth is normal but the dental arch is larger or the anterior teeth, particularly maxillary lateral incisors, are smaller than the normal size (peg-shaped) and the arch length is normal (Furuse AY,2007).

This may result in localized spacing in the lateral incisor region or sometimes may lead to maxillary midline diastema due to distal migration of the central incisors into the space that have been formed at the mesial of the lateral incisors. Similarly, when there is congenital or acquired absence of the lateral incisors, migration of the adjacent teeth creates generalized diastema. Furthermore, the central incisors of the subjects with congenitally missing lateral

incisors are likely to be smaller than the normal, leading to increased spacing. An association (Brook AH,2012).

1.2.4 Expansion of the Labial Frenum

The maxillary midline frenum has been linked to an enlarged labial frenum on the maxilla. The aberrant frenum was blamed for the maxillary midline diastema at the turn of the century. Shashua and Artun's research has connected the development of diastema to an expanded labial frenum. After the maxillary lateral incisors and canines have erupted, it is possible for a physiological gap to form between the maxillary central incisors; this space may subsequently close on its own, and the labial frenum may atrophy. On rare occasions, however, the maxillary central incisors might explode in significantly disparate positions. When the labial frenum attaches to the indentation in the alveolar bone, it can cause a diastema by creating a densely fibrous tissue mass flanked by the central incisors As shown in the (Fig3) (Gkantidis N, Kolokitha,2008).

Fig3: Midline diastema due to high frenal attachment

1.2.5 Muscular Imbalance Caused by Poor Habits

In both resting and active states, the teeth are subjected to navies generated by tooth contacts, soft tissue pressures (from the lips, cheeks, and tongue muscles), and intrinsic pressures (from the periodontal ligament and gingival fibers). The teeth remain in their relaxed state due to a balance of forces. Teeth movement is expected to happen if this equilibrium is disturbed by conditions such as macroglossia, oral syndrome, flaccid lip muscle, and tongue push Without intervention to correct or alleviate these imbalances, tooth movement will occur, resulting in diastema (Moyers R. 2002).

Possible equilibrium impacts include the patient's chronic and persistent oral behaviors (such as digit sucking). The unnatural pressure from persistent bad practices might cause the incisors to recede (Moyers R. 2002).

The appearance of a supernumerary tooth in the mouth creates a diastema between the two central incisors. Some researchers have suggested that the tongue's size, placement, and functions affect how space appears between teeth. However, the link between the tongue and malocclusion is debatable. It has been speculated that tongue thrusting contributes to the expansion of a diastema As shown in the (Fig4) (Moyers R. 2002).

Fig4: Diastema due to tongue thrusting

1.3 Patient Assessment and Diagnosis

1.3.1 Smile Design

Smile design is a methodical approach to modifying a patient's soft and hard tissues within the constraints of their anatomy to produce biomimetic restorations that are both functional and aesthetically pleasing. face harmony achieved by maintaining the teeth, gums, and lips in good structural condition (Mitchell, L. 2007).

1.3.2 Lip and Face Analysis

Facial analysis at a macro level, dentofacial analysis (the tooth's arch and midline in relation to the face), dentilabial analysis (how the teeth interact with the lips), gingival analysis (how the teeth interact with the gums), and dental analysis all play a role are all necessary for a thorough evaluation of a patient's smile. Correctly transferring all of this information to help fabricate final restorations depends on the clinician's familiarity with the shape, features, and color of the teeth and their links to the surrounding anatomy (Oquendo A, Brea L, David S. Diastema ,2011).

1.3.3 Dental Examining Methods

The impact on the smile and aesthetics profoundly affects the aesthetic idea and the smile. Patients with diastemas in the anterior region of their mouth (median or poly-diastemas) may be self-conscious about their appearance because of the differences in tooth size, proportion, and even morphology that result from the condition. Therefore, in addition to the aforementioned clinical evaluations, the clinician must assess the tooth size, shape, intra- and inner-tooth proportions, and occlusion to provide a natural and aesthetically pleasing result (Van Der Linden,2004).

1.3.4. Diastema Management and Soft Tissue Considerations

1.3.4.1 The Papilla

Contact between the lateral walls of adjacent teeth or restorative structures and healthy periodontal tissues must be at the base for the interdental papilla to form and look normal. With a gap of 4 mm or less between the interdental contact point and the alveolar crest, papillae were identified in all instances.

As the space between the contact and the alveolar crest widened by 1 mm, papillae disappeared in 2% of the instances. When the space between the alveolar crest and the bone is less than 5 mm, papillae are present in nearly all instances. However, when this distance is 6 mm, only 27% of instances are seen to have a papilla, and 42% of those cases do not have a papilla when the distance is 7 mm. (Bishara SE,2009).

1.3.4.2 The Marginal Gingiva

The most apical point of the buccal marginal gingiva is the gingival zenith. The cementoenamel junction of the tooth, the shape of the root surface, and the alveolar bone along the gum line all affect where the zenith is in healthy gingival tissues. The placement and arrangement of the teeth can also affect the zenith. The zenith of the central incisors is typically 1 mm distal to the midline of the anatomical crown (Bishara SE,2009).

Even though tooth shape and contour determine the gingival margin's undulations. Although the argument over where the zenith lies in the other anterior teeth continues, it is always simpler to make clinical choices when a sister tooth exists in the cross arch. While the zenith point of the lateral incisors is often reported to be at the midline, reports of the zenith point of the canine vary between the midline and distal to it (Bishara SE,2009).

1.4 Treatment of Diastema

1.4.1 Treatment of diastema in the mixed dentition

Most central inter-incisive diastemas during the mixed dentition stage are merely a transitory physiological quirk of the "ugly duckling phase" that will close over time as the permanent lateral incisors and the permanent canines erupt. However, there are circumstances where orthodontic intervention is warranted (Erdemir, U., & Yildiz, E. (Eds.). 2016).

1.4.2. Diastema therapy for adults with full sets of teeth

1.4.2.1 Orthodontic

The orthodontic procedure can be carried out for several reasons, the most common of which are to either close the diastema or redistribute the gaps in preparation for a posterior re-anatomization of the anterior teeth. Additionally, can be treated with orthodontic care (Goldstein,2009).

A diastema of 2 millimetres or less may not require medical attention. Small but unsightly (less than 2 millimetres), which may be remedied by bringing the central incisors closer together, and larger (more than 2 millimetres), which can be remedied by removing superfluous teeth, correcting a tongue push, or using a tongue crib, crowns, or composite fillings As shown in the (Fig5) (Goldstein,2009).

Fig5: Treatment of diastema with orthodontic appliance

1.4.2.2 Frenectomies and Orthognathic Surgery Frenectomies

When the labial frenulum is enlarged and situated close to the gingival margin, this is abnormal. Some authors recommend performing frenectomy after orthodontic closure of the gap because diastema closure and interdental papilla compression may act as a stimulant to cause atrophy of the fibrous tissue interposed between the incisors As shown in the (Fig 6) (Angle Orthod. 2005).

Fig6: Frenectomies

1.4.2.3 Conservative and Prosthetic Replacement

The direct-bonding repair method is the gold standard in aesthetic care. It helps restore function and aesthetics in as few clinical visits as possible while preserving as much of the natural tooth as possible. In addition, the method is cost-effective, allowing advanced indirect restoration to be put off if necessary. Restorations done with direct bonding need high levels of clinical expertise (Heymann HO,2013).

1.4.2.3.1 Materials and methods for direct composite restoration.

Diastema closure with "no preparation" or "minimal preparation" of the tooth is possible with direct restorations using next-generation composite resins or indirect restorations using composite resins or PLVs. The distance between the two central incisors is initially measured. The breadth of the diastema and the individual teeth are measured using a Boley gauge or any appropriate calliper after cleaning and shade selection (Alam , M. K. 2010).

The cervical aspect of the composite restoration must be flawlessly smooth and incessant with the tooth structure to promote healthy gingiva. (Alam , M. K. 2010).

No overhangs are allowed. Gingival retraction cord removal allows for easier gingival examination and smoothing. Gingival embrasures between two central incisors can be cleaned of extra composite with unwaxed floss (Alam , M. K. 2010).

Fig7: direct composite restoration

1.4.2.3.2 Restoration of Indirect Composite Materials

A porcelain veneer is a tiny porcelain shell bonded to the front of a tooth to improve its appearance. They cover up flaws, both big and small, and any inherent discolouration. Clinically, diastema closure might be difficult to treat aesthetically. Thin ceramic shells, called porcelain laminate veneers (PLV), are among the most popular treatments for these issues (Wise RJ, Nevins,2004).

1.4.2.3.3 Full Coverage Crowns

Before the development of laminates, the only restorative alternatives for closing a diastema were direct composite resin bonding and full coverage crowns. Crowns are recommended when the condition of the damaged teeth warrants the use of a highly durable extra-coronal repair (Rouse JS,2010).

Full-coverage restoration designs can effectively fix teeth that lack sufficient enamel for bonding operations (Rouse JS,2010).

1.5 The prevalence of diastema

The prevalence of midline diastema was 23.2%. located in the maxilla (97%), in mandible (1.3%) and in both was (1.7%). The prevalence of midline diastema differs significantly between the age groups ($p< 0.001$). The highest prevalence (55.8%) was among patients aged ≥ 30 years, and it was also high (37.7%) among those aged < 15 years. The prevalence among females (26.4%) was significantly higher than the prevalence (20.3%) among males ($P= 0.020$). The main causes of midline diastema in females was thumb sucking and missing lateral incisors (14.1% and 12.5% respectively) and in males was high labial frenum and super numerally teeth (39.4% and 30.3% respectively) as shown in (Table 1 & Table 2) (Proffit, 2009).

Table 1. Etiological factors of diastema among the gender.

	Male		Female		Total		
	No.	(%)	No.	(%)	No.	(%)	*p*
High labial frenum	43	(39.4)	38	(29.7)	81	(34.2)	
Super numerally teeth (MD)*	33	(30.3)	23	(18.0)	56	(23.6)	
Thumb sucking	7	(6.4)	18	(14.1)	25	(10.5)	
Missing lateral incisors	8	(7.3)	16	(12.5)	24	(10.1)	
Peg shape lateral incisors	2	(1.8)	13	(10.2)	15	(6.3)	
Dento-alveolar Disproportion	5	(4.6)	6	(4.7)	11	(4.6)	0.056*
lip biting	2	(1.8)	4	(3.1)	6	(2.5)	
Mouth breathing	2	(1.8)	2	(1.6)	4	(1.7)	
Family history	2	(1.8)	2	(1.6)	4	(1.7)	
Tongue thrust	1	(0.9)	2	(1.6)	3	(1.3)	
Micro-dontia	1	(0.9)	2	(1.6)	3	(1.3)	
Macro-glossia	2	(1.8)	1	(0.8)	3	(1.3)	
Ectopic migration of canine	1	(0.9)	1	(0.8)	2	(0.8)	
Total	109	(100.0)	128	(100.0)	237	(100.0)	

By Fisher's exact test. * Mesiodens.

Table 2. Location of the midline diastema.

Location	No.	(%)
Maxilla	230	(97.0)
Mandible	3	(1.3)
Both	4	(1.7)
Total	237	(100.0)

Chapter Two
Discussion

Chapter Two

Discussion

2. Discussion

the occurrence of midline diastema was 28% (maxillary 22.5%, mandibular 2.3%, and both arches 3.2%). It occurred more frequently in males (40%) than females (16%), and also better appreciated in females (50.6%) than in males (4.1%). A female is more likely to have a maxillary midline diastema (81.2% females: 65% males), while a male is more likely to have a mandibular midline diastema (22.5% males: 12.5% females). The majority of females (87.5%) found with median diastema were dissatisfied with their esthetic and seeked treatment. Social and cultural and influence was one of the reasons why some people considered diastema as a disfiguring dental feature requiring treatment, while some others saw it as an advantage to their personality, an enhancement of beauty giving them an admirable look and smile.Midline diastema is often complicated by the insertion of the labial frenum into the notch in the alveolar bone so that a band of thick heavy fibrous tissue lies between the central incisors. Tooth material arch length discrepancy with a condition such as missing teeth, microdontia, macrognathia, peg-shaped laterals, causes midline diastema. Habits such as thumb sucking or tongue thrusting can cause proclination of teeth, which causes midline spacing along with generalized spacing. Midline pathology soft tissue and hard tissue pathologies such as cysts, tumors, and odontomes may cause midline diastema. Forces on the anterior teeth are more pronounced if the posterior teeth are missing, which causes flaring to occur. Periodontal and occlusal factor also causes them. Diastemas can be closed orthodontically or restoratively. Restoration includes porcelain laminate veneers, composites, metal free ceramic crowns, and by metal ceramic crowns. Porcelain laminates have their own limitations too. They should not be used when remaining enamel is inadequate to provide adequate retention. Large Class IV defects should probably

not be restored with veneers because of the large amount of unsupported porcelain and the lack of tooth-colored backing. The amount of unsupported porcelain should be carefully evaluated in cases with a large diastema. Darkly stained teeth were not optimally restored with veneers. The prognosis for porcelain veneers in bruxing is doubtful. Certainly, such patients should be instructed to use a night guard after final restoration. Even, if the pocelain laminates fail, in the long run, composite bonding between teeth fills spaces and improves the appearance of diastemas. Long-term studies indicating the success of composites is lacking till date. In this study, the results indicate a higher rate of 91% for the restorations made during the study period of sixty months with 9% had mild chipped restorations rather than complete loss of any restorations done. Contouring the restorations to achieve satisfactory results need good clinical expertise but it is less demanding than placing veneers or an orthodontic procedure. Nearly, half of the group of about 49% exhibited very good satisfactory results and with acceptable contour and need to improve on contour of the restoration for 42% of the sample and 9% with unsatisfactory contour of the study group which indicates the need for preoperative planning with wax up and silicone putty index which helps in better contouring of these restorations. Gingival health also showed a satisfactory level of acceptance to composite restorations. In this study, mild and moderate gingivitis which occurred due to overhanging margins created plaque accumulation, which caused changes in the marginal area of the gingiva. The margins showed signs of improvement after removal of the overhanging margins and oral prophylaxis.

Chapter Three
Conclusions& Suggestions

Chapter Three

Conclusions& Suggestions

3.1 Conclusions

1. composite resin restorations done for midline diastemas between maxillary or mandibular incisors exhibited good clinical acceptance and retention when all the protocols be followed for the proper clinical technique used for the clinical condition and the esthetic outcome depends on the clinical expertise of the operator and the material used for the same.
2. For small to medium gaps with no underlying dental issues, dental bonding or veneers are often the best choice due to their effectiveness and relatively simple process.
3. For larger gaps or misaligned teeth, orthodontic treatment may be necessary to achieve the best long-term outcome, even if additional restorations are needed later.
4. If the gap is caused by other factors, like gum disease or abnormal frenulum, addressing the root cause is essential, and a combination of treatments (possibly including surgery) may be needed.

3.2 Suggestions

1. Small to Moderate Gaps: Composite resin is most effective for small to moderate-sized diastemas. It works well for patients who have a relatively healthy set of teeth with no major misalignment.
2. Cosmetic Treatment: If the diastema is primarily a cosmetic concern and does not significantly affect bite or function, composite resin is a good option.
3. Minimal Tooth Structure Change: This treatment is ideal when the goal is to preserve as much natural tooth structure as possible, as composite resin is bonded directly to the tooth without needing to remove significant enamel

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