Clinical and Experimental Health Sciences

Diastema Closure Following Detection and Removal of Residual Resins After Orthodontic Treatment: Case Report with 1-year follow-up

Bengü Doğu Kaya[1], Pınar Yılmaz Atalı[2], Deniz Meltem Sever[3], Dilek Tağtekin[2]

[1] Çanakkale Onsekiz Mart University Faculty of Dentistry, Restorative Dentistry Department, Çanakkale, Türkiye.
[2] Marmara University Faculty of Dentistry, Restorative Dentistry Department, Istanbul, Türkiye.
[3] Private Dentist, Istanbul, Türkiye.

Correspondence Author: Bengü Doğu Kaya
E-mail: bengu.dogukaya@comu.edu.tr
Received: June 17, 2025 **Accepted:** July 24, 2025

ABSTRACT

This case report aimed to determine and remove the residual resins after debonding, to restore the upper lateral teeth with a single shade composite to evaluate with follow-ups. An 18-year-old female patient applied to our clinic with the complaint of the presence of diastemas. Following the sond marking technique, MDP (Smile Lite, Smile Line) and mobile phone (iPhone 11, Apple); DSLR camera (Nikon), macro lens and D-Light caries detection mode (GC) before and after the application of plaque disclosing gel (Tri Plaque ID, GC) to detect resin residues on tooth surfaces after bracket removal. The residual resins were removed with finishing and polishing discs (last 3 stages) (OptiDisc, Kerr). One week later, the selective-etch technique, universal adhesive (Gluma Bond Universal, Kulzer), and single shade composite (Charisma Diamond One, Kulzer) were used for diastema closure. The patient was called for follow-up at 3, 6, and 12-months and evaluated FDI criteria. Residual resins were best determined by using a combination of plaque disclosing agent and MDP since the composite used was not a fluorescent light-emitting material. For restorations, FDI 1 and 2 scores were observed in the esthetic, functional, and biological evaluations.

Keywords: Bracket, cross polarizing filter, diastema closure, residual resin, plaque disclosing gel.

1. INTRODUCTION

Many clinical conditions in anterior teeth, such as diastema, peg-shaped teeth, alterations in shape and color, or asymmetry of the smile, may potentially require esthetic treatment. Patients undergoing orthodontic treatment to resolve malposition are a population in which anterior restorations are indicated to complete the esthetic aspect of the therapy (1). There are multiple alternative treatments for anterior esthetic restorations, including direct and indirect methods. A contemporary and more conservative approach to direct restorations without preparing sound tissues demonstrates promising clinical outcomes. If minimally invasive or noninvasive procedures are required on healthy teeth, it may be recommended that the tooth shape be corrected, and the diastema be closed following orthodontic treatment with micro or nano-filled resin composites. Moreover, the recent introduction of single shade universal resin composites has simplified the restorative procedure, allowing for the achievement of esthetic requirements with ease of shade selection (2). Before the restorations, removing residual resin after orthodontic treatment is critical for restoring the enamel surface to its original state before treatment (3). The de-bracketing and removal of residual orthodontic adhesive resin is often a complex task that may involve the mechanical removal of enamel, which poses a risk to the dental structure and may result in irreversible enamel damage. There are studies evaluating different resin removal methods. Among these studies, some studies found no difference in surface properties between removal systems (4) or recommended using a 4-stage finishing and polishing disc system (Sof-Lex, 3M, USA) (5).

Clinical photography has become a standard procedure in daily practice. A variety of photography methods are utilized in dentistry to examine and imitate tooth shade and structure, as well as to follow patients and treatments. DSLR (digital single lens reflex) body, macro lens, and external sources of light remain the golden standard in terms of photographic equipment used in dentistry (6). On the other hand,

How to cite this article: Doğu Kaya B, Yılmaz Atalı P, Sever DM, Tağtekin D. Diastema Closure Following Detection and Removal of Residual Resins After Orthodontic Treatment: Case Report with 1-year follow-up. Clin Exp Health Sci 2025; 15: 713-717. https://doi.org/10.33808/clinexphealthsci.1721525

smartphones are constantly being developed in combination with the portable device Mobile Dental Photography (Smile Lite, Smile Line, Switzerland) represents a photographic instrument for the documentation and communication of dental practice. This system is less expensive than other instruments and high-quality images can be taken using this simple and easy smartphone-based system (7). In addition to dental photography, there are various systems, devices, or agents for examining defects, caries, restorations, or dental plaque. Although traditional plaque-disclosing gels are available, 3-tone plaque-disclosing gels (Tri Plaque ID Gel, GC, Japan) have been developed to confirm the presence of caries, plaque, and cariogenic microorganisms, as well as oral hygiene (8). Furthermore, a variety of devices and light sources are utilized to assess dental caries, initial enamel defects, surface texture, and restorations. One such device is the D-light Pro GC (GC, Japan), which uses an LED at near-ultraviolet wavelengths in detect mode to visualize bacteria in plaque, fissures, infected dentin, and the presence of microleakage. It has been reported that this device is not invasive, safe to use, and convenient (9).

In the absence of a detailed examination of residual resins following orthodontic treatment, there is a risk that they might be left on the tooth surface without either the clinician or the patient noticing. Similarly, the removal of residual resins from the tooth surface without a detailed examination might result in damage to the dental hard tissues. In both instances, the long-term consequences of these conditions include increased susceptibility to complications such as discoloration, plaque accumulation, and caries. Furthermore, these factors influence the procedures for planning restorative treatments following orthodontic treatment and the potential lifespan of restorations. Considering this information, this case report examined the diagnosis of residual resins following orthodontic treatment using various methods and technologies. The 4-stage disc system was used to remove residual resins while causing minimal damage to the tooth structure. To meet the patient's esthetic expectations, the diastemas were closed with single shade nanohybrid resin composite, and the patient was followed up.

2. CASE PRESENTATION

2.1. Detection and Removal of Residual Resin

An 18-year-old female patient applied to the Restorative Dentistry Department with a complaint of the presence of diastemas following orthodontic treatment. After clinical and radiological examinations, residual resins were identified in the buccal surface of the lower and upper teeth.

This case report employed a range of imaging techniques to optimally detect residual resins in the patient's teeth. First, residual resins were determined by the sond marking technique. The residual resins were also evaluated with 6 different systems as follows:

I. DSLR Camera (D500, Nikon, USA), Macro Lens (100 mm, Nikon, USA), Twin Flash (MK-MT24IIC, Meike, China).

II. DSLR Camera, Macro Lens, Twin Flash, and plaque-disclosing gel (Tri Plaque ID Gel).

III. DSLR Camera, Macro Lens, and LED light-curing unit (D-light Pro GC).

IV. DSLR Camera, Macro Lens, LED light-curing unit, and plaque-disclosing gel.

V. Cross-polarized mobile dental photography (Smile Lite MDP, Smile Line; iPhone 11, Apple).

VI. Cross-polarized mobile dental photography and plaque-disclosing gel.

The residual resin photographs obtained from the designed systems are presented in Figure 1. Among the imaging systems used, the boundary of residual resins was most clearly discernible in images obtained with "cross-polarized mobile dental photography and plaque-disclosing gel". Despite the DSLR camera's superior resolution, the plaque-disclosing gel is purple, and the mobile dental photography system exhibits a cross-polarized image. In contrast, the resin residues were not clearly discernible in the photographs obtained with the cross-polarized mobile dental photography system alone. The second most effective imaging system for detecting the boundaries of residual resins was the system that combined a "DSLR camera with plaque-disclosing gel". In this instance, the use of plaque-disclosing gel might be considered an appropriate method for the detection of residual resin. In this case report, the caries detection mode of the light-curing unit did not accurately determine the boundaries of the residual resins due to the absence of a fluorescence-emitting material during the orthodontic treatment. The combination of a "light-curing unit and plaque-disclosing gel" resulted in superior visualization of the boundaries of residual resins.

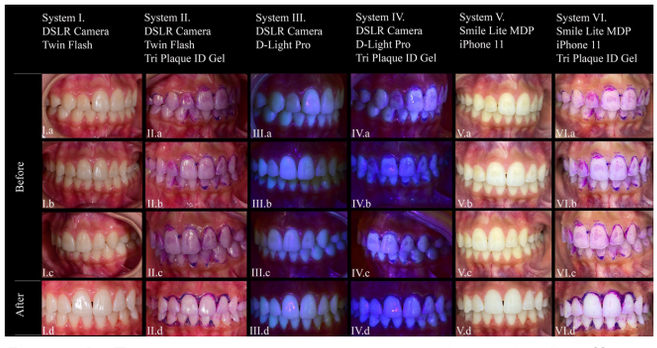

Figure 1. *The residual resins were evaluated with 6 different systems. I. a-d: Nikon DSLR Camera and Twin Flash, II. a-d: DSLR Camera, Twin Flash, and Tri Plaque ID Gel, III. a-d: DSLR Camera and D-Light Pro, IV. a-d: DSLR Camera, D-Light Pro, and Tri Plaque ID Gel, V. a-d: Smile Lite MDP and iPhone 11, VI. a-c: Smile Lite MDP, iPhone 11, and Tri Plaque ID Gel. Images before the removal of the residual resins were presented in I, II, III, IV, V, and VI. a-c. Images after the removal of the residual resins were as follows: I, II, III, IV, V, and VI-d.*

After the determination, the residual resins were removed with the last 3 stages (40, 20, and 10 µm) of finishing and

polishing discs (OptiDisc, Kerr, USA) at 10,000 rpm, following the manufacturer's instructions. The sond marking technique was also used during the removal process (Fig. 2). The coarse disc was not used to facilitate greater control over the removal of resin residues. As the final step in the process, the surface was polished with Opti1step diamond rubber point (Kerr, USA) for 10 seconds. Following the removal of residual resin, the teeth' buccal surfaces were again examined using the mentioned different systems (Fig. 1 and Fig. 3). The patient was scheduled for an appointment 1 week after the resin removal session.

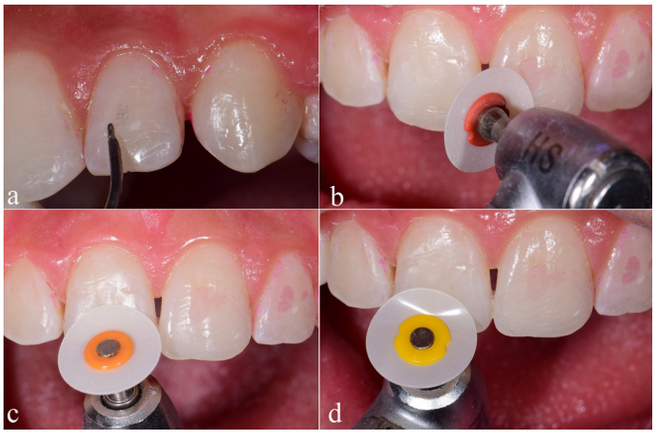

Figure 2. *a. Residual resins were also detected with the sond marking technique. b-d. The last 3-stages of multi-step discs were used to remove the residual resin.*

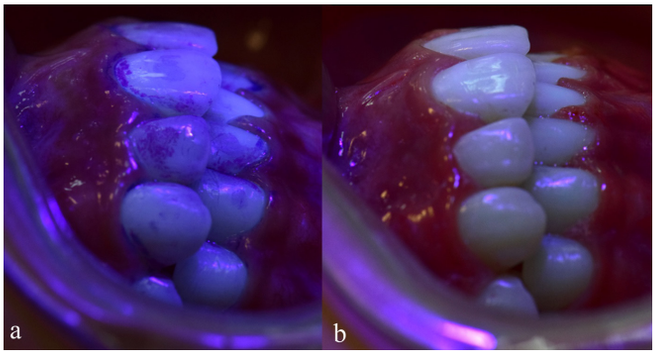

Figure 3. *a. Before the removal of residual resins. b. After the removal of residual resins.*

2.2. Diastema Closure with Single shade Composite and Recalls

One week later, the mesial of the right upper lateral tooth and the distal of the left upper lateral tooth were etched with 37% orthophosphoric acid (Etching Gel, President, Germany) under rubber-dam isolation. One week later, the mesial of the right upper lateral tooth and the distal of the left upper lateral tooth were etched with 37% orthophosphoric acid (Etching Gel, President, Germany) under rubber-dam isolation (Fig. 4). Universal adhesive agent (Gluma Bond Universal, Kulzer, Germany) was applied according to the manufacturer's recommendations. Layering technique (2 mm increments) and single shade composite (Charisma Diamond One, Kulzer, Germany) were preferred. A polywave LED light curing device (Valo Cordless, Ultradent, USA) was used for polymerization with 1000 mW/cm^2 for 20 seconds. Finishing and polishing were completed with discs (OptiDisc) and 2-step diamond spiral rubbers (Diacomp Twist Plus, Eve, Germany). In the 6th month follow-up, a chipping and fracture of the restoration in the right upper lateral tooth was detected in the incisal corner due to eating hazelnuts. A repair procedure was applied with tungsten carbide burs (1.5 mm preparation) and the same materials and protocols as in the first restoration session. The patient was called for follow-up at 3-, 6-, and 12-months and evaluated according to revised FDI criteria (Fig. 5, 6) (10). Restorations received a "clinically very good (score 1)" in all esthetic and biological aspects subcategories at the 3-, 6-, and 12-month follow-ups. At six months, the upper right lateral was fractured due to the patient's consumption of nuts. This resulted in a "clinically unsatisfactory restoration (score 4)" in the fracture of the material and retention criteria.

Figure 4. *a. Rubber dam isolation on the restoration session. b. 37% orthophosphoric acid etching procedure.*

Figure 5. *Six-month follow-up of restorations. Chipping of the restoration in the right upper lateral tooth in the incisal corner (blue arrow).*

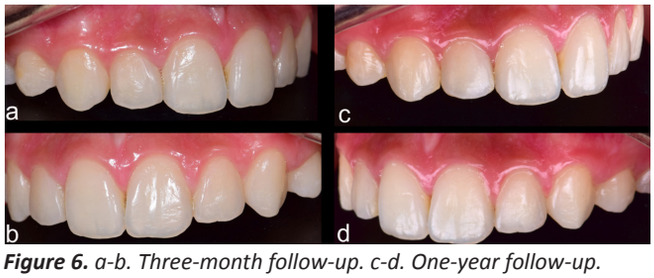

Figure 6. *a-b. Three-month follow-up. c-d. One-year follow-up.*

In addition, restoration in the right upper lateral tooth received a "clinically good restoration (score 2)" in the proximal contact point and form and contour criteria at the 12-month follow-up (Table 1).

Table 1. *The scoring of restorations according to the revised FDI criteria.*

Categories	Subcategories	Upper right lateral			Upper left latral		
		3-months	6-months	12-months	3-months	6-months	12-months
Esthetic Aspects	Surface luster & surface texture	1	2	1	1	1	1
	Marginal staining	1	1	1	1	1	1
	Color match	1	1	1	1	1	1
Functional Aspects	Fracture of material & retention	1	4	1	1	1	1
	Marginal adaptation	1	1	1	1	1	1
	Proximal contact point	1	1	2	1	1	1
	Form & contour	1	1	2	1	1	1
	Occlusion & wear	1	1	1	1	1	1
Biological Aspects	Caries at restoration margins	1	1	1	1	1	1
	Dental hard tissue defects at restoration margin	1	1	1	1	1	1
	Postoperative hypersensitivity & pulp status	1	1	1	1	1	1

1: Clinically very good restoration (sufficient), 2: Clinically good restoration (sufficient), 3: Clinically satisfactory restoration (sufficient), 4: Clinically unsatisfactory restoration (insufficient), 5: Clinically poor restoration (insufficient).

3. DISCUSSION

In the field of dentistry, the role of photography is becoming increasingly significant. The capabilities of smartphones offer advantages that make them valuable tools for digital photography. Some of these include their small size and lightweight design, favorable ISO settings, high resolution, and superior sensor quality. Additionally, they possess the capacity for manual alteration of certain camera values. The light source in smartphones can be provided by the SmileLite MDP device, which also enables the use of a cross-polarizing filter for photographic purposes (7). Prasad et al. conducted a questionnaire study on the evaluation and comparison of images taken with DSLR and smartphone by orthodontists and as a result, no significant difference was found between the two devices (6). In this case report, the use of a cross polarized mobile dental photography device in combination with a plaque staining agent was found to be superior to others, as the aim was the detectability of the residual resin rather than the quality of the photograph.

Leaving residual resin after orthodontic treatment means that rough areas remain on the tooth surface. The increase in the roughness of the surface is one of the most important factors determining the increase in the amount of dental plaque (11). Since the amount of plaque is expected to be high around the residual resin, the use of a plaque staining agent has shown an effect to increase its detectability. On the other hand, it would have been useful to use a composite disclosing agent which can help dentists distinguish resin boundaries from the tooth structure and facilitate its complete removal while avoiding damage to the surrounding sound tooth structures (12). In their study on the removal of adhesive residues under UV light following lingual bracket removal, Albertini et al. found that this method minimized damage to the enamel tissue and was an easier, more accurate, reliable, non-invasive, inexpensive, and time-saving alternative (13). Although a D-light Pro device that reflects UV light was utilized in this case, the UV light imaging method was not superior to others in the detection of residual resin due to the preference for resin material without fluorescent dye for bracket cementation. It has been reported by studies that orthodontic adhesives cannot be completely removed from the enamel surface regardless of the debonding techniques used and enamel damage occurs (14).

Direct resin composite restorations are a common treatment option in dentistry, utilized for restoring both posterior and anterior teeth. In particular, the anterior teeth may require restorative treatment following orthodontic treatment. Surface quality is an important parameter affecting the clinical behavior of dental restorations. Optimal finishing and polishing of resin composites are essential to maintain esthetics and ensure the longevity of resin-containing restorations. Smooth and polished restorations are less prone to plaque accumulation and staining. It can also affect the physical and mechanical properties, and wear resistance of restorations. Ali et al. concluded that the surface smoothness obtained with Optidisc (Kerr) is superior (15). Optidisc was preferred for resin composite restoration sessions due to its superior finishing and polishing properties. In their five-year follow-up study, Comba et al. found that direct composite restorations following orthodontic treatment exhibited satisfactory esthetic outcomes and good or very good clinical performance when combined with conservative procedures. Additionally, the study revealed that many failures were occured, which were easily repaired to achieve the correct shape, function, and esthetic. Furthermore, the study demonstrated a minimal incidence of repairs that were completed with minimal disruption to form, function, and esthetic quality (1). The functional, esthetic, and biological outcomes of diastema closure restorations following orthodontic treatment remained satisfactory during the one-year follow-up period in this case report. The upper right lateral tooth exhibited the only fracture resulting from hazelnut consumption at six months. However, this was easily repairable. It would be beneficial to conduct further studies and case reports on both the removal of residual resin with fluorescent material and the follow-up of single shade resin composite restorations longer than 1 year.

4. CONCLUSION

The residual resins were most accurately identified using a combination of plaque disclosing agent and MDP, as the resin composite was not a fluorescent light-emitting material. For single shade composite restorations, FDI 1 and 2 scores were observed in the esthetic, functional, and biological evaluations. Single shade resin composite restorations may be preferred for the treatment of anterior teeth. It was noted that the incisal fracture detected at the six-month follow-up was cohesive and that the adhesive bond of the cervical part of the composite remained intact.

Funding: *The authors received no financial support for the research.*
Conflicts of interest: *The authors declare that they have no conflict of interest.*
Ethics Committee Approval: *Not applicable.*
Author Contributions:
Research idea: D.T.
Design of the study: B.D.K., P.Y.A., D.M.S., D.T.
Acquisition of data for the study: B.D.K. and D.M.S.
Analysis of data for the study: B.D.K. and P.Y.A.
Interpretation of data for the study: B.D.K. and P.Y.A.
Drafting the manuscript: B.D.K. and D.M.S.
Revising it critically for important intellectual content: P.Y.A. and D.T.
Final approval of the version to be published: : B.D.K., P.Y.A., D.M.S., D.T.

REFERENCES

[1] Comba A, Vergano E, Baldi A, Alovisi M, Pasqualini D, Castroflorio T, Stura I, Migliaretti G, Berutti E, Scotti N. 5-year retrospective evaluation of direct composite restorations in orthodontically treated patients. J Dent. 2021;104:103510. https://doi.org/10.1016/j.jdent.2020.103510

[2] Sidhu SK, Ikeda T, Omata Y, Fujita M, Sano H. Change of color and translucency by light curing in resin composites. Oper Dent. 2006;31(5):598-603. https://doi.org/10.2341/05-109

[3] Karan S, Kircelli BH, Tasdelen B. Enamel surface roughness after debonding: comparison of two different burs. Angle Orthod. 2010;80(6):1081-1088. https://doi.org/10.2319/012610-55.1

[4] Almudhi A, Aldeeri A, Aloraini AAA, Alomar AIM, Alqudairi MSM, Alzahrani OAA, Eldwakhly E, AlMugairin S. Comparison of enamel surface integrity after de-bracketing as affected by seven different orthodontic residual cement removal systems. Diagnostics. 2023;13(20):3284. https://doi.org/10.3390/diagnostics13203284

[5] Cesur E, Arslan C, Orhan AI, Bilecenoğlu B, Orhan K. Effect of different resin removal methods on enamel after metal and ceramic bracket debonding: An in vitro micro-computed tomography study. J Orofac Orthop. 2022;83(3):157-171. https://doi.org/10.1007/s00056.021.00306-1

[6] Prasad AS, Sivakumar A. Smartphone vs DSLR dental photography among orthodontists. Indian J Public Health Res Dev. 2020;11(6):118-122. https://scholar.google.com/scholar?cluster=142.889.04449 53.063.7776&hl=tr&as_sdt=0,5

[7] Hardan L. Mobile dental photography (MDP): A new era in dental documentation. Int Arab J Dent. (IAJD). 2017;8(3):115-118. https://scholar.google.com/scholar?hl=tr&as_sdt=0%2C5&q =Hardan+L.+Mobile+dental+photography+%28MDP%29%3A+A+new+era+in+dental+documentation.+International+Arab+Journal+of+Dentistry+%28IAJD%29.+2017%3B8%283%29%3A115-8.&btnG=

[8] Lee J, Park H, Lee J, Seo H, Lee S. Study of bacteria associated with dental caries using a 3 tone disclosing agent. J Korean Acad Pediatr Dent. 2018;45(1):32-40. https://doi.org/10.5933/JKAPD.2018.45.1.32

[9] Blumer S, Kharouba J, Kats L, Schachter D, Azem H. Visual examination, fluorescence-aided caries excavation (face) technology, bitewing x-ray radiography in the detection of occlusal caries in first permanent molars in children. J Clin Pediatr Dent. 2021;45(3):152-157. https://doi.org/10.17796/1053-4625-45.3.2.

[10] Hickel R, Mesinger S, Opdam N, Loomans B, Frankenberger R, Cadenaro M, Burgess J, Peschke A, Heintze SD, Kühnisch J. Revised FDI criteria for evaluating direct and indirect dental restorations—recommendations for its clinical use, interpretation, and reporting. Clin Oral Investig. 2023;27(6):2573-2592. https://doi.org/10.1007/s00784.022.04814-1

[11] Meshni AA, Fageeh HN, Arishi MH, Preethanath RS. Physical characteristics and bacterial adhesion of computer-aided design/computer-aided manufacturing and conventional provisional restorative materials. J Biomater Tissue Eng. 2018;8(2):228-233. https://doi.org/10.1166/jbt.2018.1735

[12] Oweis Y, El-Hadad A, Mezour M, Abdallah M-N, Retrouvey J, El-Khoury R, Cerruti M, Tamimi F. Disclosing agent for resin composite based on adsorption surface treatment. ACS Appl Bio Mater. 2021;4(9):7222-7233. https://doi.org/10.1021/acsabm.1c00734

[13] Albertini P, Albertini E, Siciliani G, Lombardo L. Fluorescence-aided composite removal during lingual bracket debonding. J Esthet Restor Dent. 2020;32(7):634-637. https://doi.org/10.1111/jerd.12618

[14] Thawaba AA, Albelasy NF, Elsherbini AM, Hafez AM. Comparison of enamel surface roughness after bracket debonding and adhesive resin removal using different burs with and without the aid of a magnifying loupe. J Contemp Dent Pract. 2022;23:1091-1099. https://doi.org/10.5005/jp-journals-10024-3432

[15] Ali AMM, Al-Assadi HZ, Nema TG, Al-Bazi SMA, Mohammed ZH. Surface roughness of nano-hybrid universal composite restorative materials after different finishing and polishing protocols. Nanotechnol Percept. 2024; 20(S3):148-158. https://www.researchgate.net/publication/381917439_Surface_Roughness_of_Nano-Hybrid_Universal_Composite_Restorative_Materials_After_Different_Finishing_and_Polishing_Protocols