Received: 22 April 2020 | Revised: 31 May 2020 | Accepted: 15 June 2020

DOI: 10.1111/jerd.12618

CLINICAL ARTICLE

WILEY

Fluorescence-aided composite removal during lingual bracket debonding

Paolo Albertini DDS[1] | Enrico Albertini DDS[1] | Giuseppe Siciliani DDS[1] | Luca Lombardo DDS[2]

[1]Department of Orthodontics, University of Ferrara, Ferrara, Italy

[2]Postgraduate School of Orthodontics, University of Ferrara, Ferrara, Italy

Correspondence
Albertini Paolo, Department of Orthodontics, University of Ferrara, Via Livatino, 9 Reggio Emilia, Ferrara 42124, Italy.
Email: dr.paoloalbertini@gmail.com

Abstract

Objective: This report describes the fluorescence-aided composite removal during lingual bracket debonding with an ultraviolet light emitting diode flashlight. The purpose of this technique is to help clinicians in composite removal without enamel surface damage.

Clinical considerations: The bracket debonding requires clinical attention in order to remove all composites and resins without enamel surface damage. Different protocols can be used in order to minimize the enamel damages and the excess bonding remnants. The fluorescence-aided composite removal permits to have an immediate visualization of the composites and adhesives, especially for the uneven lingual surfaces, of which the interindividual morphological variability is greater than the buccal surfaces.

Conclusions: The fluorescence-aided composite removal during lingual brackets debonding minimizes the risks described in literature and it is an easier, more accurate, reliable, noninvasive, inexpensive, and time-saving method.

Clinical significance: The application of this technique allows, with inexpensive flashlights, to remove all the composite on the lingual surfaces during debonding, without damaging the tooth and saving time.

KEYWORDS

dental bonding, enamel, fluorescence, orthodontic brackets

1 | INTRODUCTION

The bracket debonding requires clinical attention in order to remove all composites and resins without enamel surface damage. The correct choice of bond removers under magnification, such as tungsten carbide burs, polishers, and discs, reduces but does not eliminate tooth damage.[1] Excess bonding remnants are often overlooked because the orthodontic adhesives have a similar color to the enamel, favoring dental plaque accumulation, decalcification, and carious lesions.[2] Lingual orthodontics is becoming increasingly popular in dental practice in recent years due to patients' esthetic needs. Patients report discomfort and difficulties in cleaning gums and teeth after lingual brackets placement[3,4]; therefore, the removal of excessive composite remnants helps to improve the patients' first experience. However, no significant differences are reported between buccal and lingual brackets in terms of clinical periodontal parameters and microbiological values.[5] Concerning bonding materials, many developments have occurred in the last decades, including many new adhesives and composites, faster or more efficient curing methods, self-etching primers, fluoride-releasing agents, and sealants.[6]

Since several modern composites and adhesives have different fluorescence properties than enamel, the fluorescence-aided composite removal represents a more accurate, reliable, noninvasive, and time-saving method.[2,7] Although this technique is useful for

composite and resin removal in visible areas such as the buccal surfaces, it becomes even more effective in the less accessible lingual areas. The lingual bracket debonding under natural or dental operating light can cause a significant increase of the enamel roughness.[8] The lingual surfaces have a greater interindividual morphological variability than the buccal surfaces; therefore, distinguishing enamel and resins of similar color is even more complex. This report describes the fluorescence-aided composite removal during lingual bracket debonding with an ultraviolet (UV; 395 nm wavelength) light emitting diode (LED) Veetop (Indialantic, Florida) flashlight.

2 | CASE REPORT

1. A 25-year-old male presented with the request to align his teeth by means of an esthetic appliance. His previous orthodontic treatment, performed by a colleague with a fixed labial technique and completed 10 years previously, had relapsed (Figure 1).
2. After retainer removal, STb brackets were bonded indirectly in both arches with a manual setup and single jigs, using the Komori Kommon Base system and Lingual Straight Wire Technique (Figures 2 and 3).[9,10]
3. After 18 months of treatment, the fixed appliances were removed. The lower arch after lingual bracket removal shows some excess bonding remnants under dental operating light (Figure 4).
4. The lower arch illumination with an UV LED flashlight is simple and sufficient to allow a much more immediate visualization of excess bonding remnants (Figure 5).
5. The debonding procedure is simplified with the possibility to visualize composites remnants during their removal; the damage risks for lingual bracket debonding described in literature are minimized (Figure 6).[8]

FIGURE 1 Relapsed lower arch after previous orthodontic treatment

FIGURE 3 Lower arch after lingual bracket bonding

FIGURE 2 Lower arch setup

FIGURE 4 Lower arch during lingual bracket debonding under dental operating light

FIGURE 5 Lower arch during lingual bracket debonding with fluorescence-aided composite removal

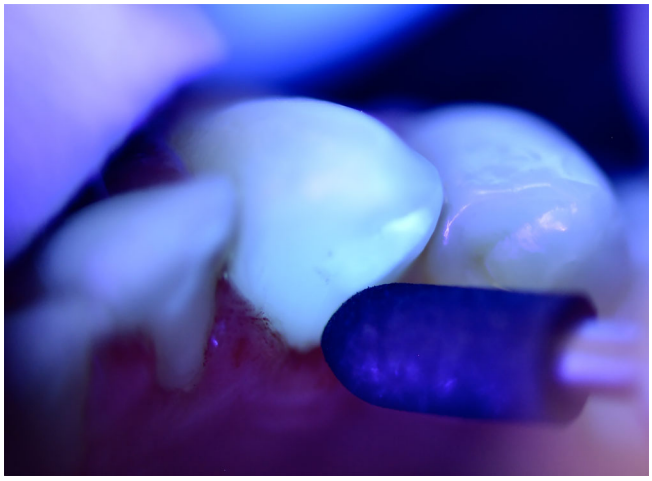

FIGURE 6 Detail of fluorescence-aided composite removal during procedure

3 | DISCUSSION

This report describes the fluorescence-aided composite removal during lingual bracket debonding with an UV (395 nm wavelength) LED flashlight. The purpose of this technique is to help clinicians in composites removal without enamel surface damage. In literature, this technique was applied with other LEDs devices on buccal surfaces, showing a more accurate, reliable, noninvasive, and time-saving method.[11,12] However, the adhesive remnant index (ARI) after debonding lingual brackets seems to be higher than the ARI after debonding buccal brackets.[13] Lingual treatments have become increasingly popular in recent years due to patients' esthetic needs; nevertheless, the resolution of the orthodontic problems would be anti-ethical and anti-professional, if conservative problems arise when removing the appliance. Patients, especially which have maxillary or mandibular retrusion, report discomfort and difficulties of oral hygiene after lingual brackets placement, due to tongue-space restriction[3,4]; therefore, the removal of excessive composite remnants helps to improve the patients' first experience. However, no significant differences are reported between buccal and lingual brackets in terms of clinical periodontal parameters and microbiological values.[5] The maintenance of several home and professional prevention measures during active orthodontic treatment plays a fundamental role. Orthodontists should always instruct their patient on how to maintain good oral hygiene in order to prevent caries and periodontal disease during orthodontic treatment. The treatment end must represent the ideal orthodontic result, but the complete orthodontic bonding removal must allow for an ideal conservative maintenance.[14] The high amount of composite left on enamel after debonding means that polishing procedures are longer. On the other hand, a low amount of composite on enamel after debonding is related to lower bond strength values and is often related to contaminants over enamel that can reduce bond strength. Usually, an orthodontic biomaterial presents a mixed amount of composite after bracket removal.[15] Concerning adhesive removal, rotary instruments used to remove adhesive remnant cause enamel abrasion in an amount dependent on the size and composition of the abrasive particles, the rotational speed, and the pressure against enamel surface.[16] Due to the latter factor, this procedure is operator-dependent. The use of correct instruments is necessary to minimize possible enamel damages.

TABLE 1 Types of composite removal burs

Features	Burs type
Irreversible damage on enamel	Arkansas stones Green stones Diamond burs Steel burs Lasers
Fast and effective composite removal but risk of enamel remotion and roughening	Tungsten carbide burs
Most reliable method of polishing	Sof-Lex discs Pumice slurry
Low effectiveness in composite removal but minimal risk for enamel	Ultrasonic tools Hand instruments Rubbers Composite burs

The most popular tools are tungsten carbide burs that are effective and fast. They remove a substantial layer of enamel and roughen its surface, but are less destructive than Arkansas stones, green stones, diamond burs, steel burs, and lasers. Multi-step Sof-Lex discs and pumice slurry are the most predictable enamel polishing tools. Arkansas stones, green stones, diamond burs, steel burs, and lasers should not be used for adhesive removal (Table 1).[17] For this reason, fluorescence-aided composite removal is useful for composite and resin removal in visible areas such as the buccal surfaces, and it becomes even more effective in the less accessible lingual areas. During the procedures, the visualization of composites and adhesives remnants on lingual surfaces is unpredictable under natural light or dental operating light (Figure 1); while an immediate visualization is permitted with LEDs flashlights (Figures 2 and 3). Furthermore, these devices

with a wavelength of 395 nm are inexpensive and readily available. The limit of the present report is represented by the article type; however, this preliminary study could lead in future to some Randomized Controlled Trials (RCTs) on the topic.

4 | CONCLUSIONS

The fluorescence-aided composite removal during lingual brackets debonding minimizes the risks described in literature and it is an easier, more accurate, reliable, noninvasive, inexpensive, and time saving method.

DISCLOSURE STATEMENT

The authors do not have any financial interest in the companies whose materials are included in this article.

ORCID

Paolo Albertini https://orcid.org/0000-0002-4020-5065

REFERENCES

1. Ryf S, Flury S, Palaniappan S, Lussi A, van Meerbeek B, Zimmerli B. Enamel loss and adhesive remnants following bracket removal and various clean-up procedures in vitro. *Eur J Orthod*. 2012;34(1):25-32.
2. Ribeiro AA, Almeida LF, Martins LP, Martins RP. Assessing adhesive remnant removal and enamel damage with ultraviolet light: an in-vitro study. *Am J Orthod*. 2017;151:292-296.
3. Wiechmann D, Gerss J, Stamm T, Hohoff A. Prediction of oral discomfort and dysfunction in lingual orthodontics: a preliminary report. *Am J Orthod Dentofacial Orthop*. 2008;133(3):359-476.e1.
4. Hohoff A, Stamm T, Kühne N, et al. Effects of a mechanical interdental cleaning device on oral hygiene in patients with lingual brackets. *Angle Orthod*. 2003;73(5):579-587.
5. Sfondrini MF, Debiaggi M, Zara F, et al. Influence of lingual bracket position on microbial and periodontal parameters in vivo. *J Appl Oral Sci*. 2012;20(3):357-361.
6. Gange P. The evolution of bonding in orthodontics. *Am J Orthod Dentofacial Orthop*. 2015;147(4 Suppl):S56-S63.
7. Meller C, Connert T, Löst C, ElAyouti A. Reliability of a fluorescence-aided identification technique (FIT) for detecting tooth-colored restorations: an ex vivo comparative study. *Clin Oral Investig*. 2017;21:347-355.
8. Eichenberger M, Iliadi A, Koletsi D, Eliades G, Verna C, Eliades T. Enamel surface roughness after lingual bracket debonding: an in vitro study. *Materials (Basel)*. 2019;12(24):4196.
9. Scuzzo G, Takemoto K, Takemoto Y, Takemoto A, Lombardo L. A new lingual straight-wire technique. *J Clin Orthod*. 2010;44(2):114-123.
10. Komori A, Takemoto K, Shimoda T, Miyashita W, Scuzzo G. Precise direct lingual bonding with the Kommon Base. *J Clin Orthod*. 2013;47(1):42-64.
11. Schott TC, Meller C. A new fluorescence-aided identification technique (FIT) for optimal removal of resin-based bracket bonding remnants after orthodontic debracketing. *Quintessence Int*. 2018;49(10):809-813.
12. Salomão FM, Rocha RS, Franco LM, Sundfeld RH, Bresciani E, Fagundes TC. Auxiliary UV light devices for removal of fluorescent resin residues after bracket debonding. *J Esthet Restor Dent*. 2018;31(1):58-63.
13. Sfondrini MF, Gandini P, Gioiella A, Zhou FX, Scribante A. Orthodontic metallic lingual brackets: the dark side of the moon of bond failures? *J Funct Biomater*. 2017;8:27.
14. Berlin-Broner Y, Levin L, Ashkenazi M. Awareness of orthodontists regarding oral hygiene performance during active orthodontic treatment. *Eur J Paediatr Dent*. 2012;13(3):187-191.
15. Scribante A, Contreras-Bulnes R, Montasser MA, Vallittu PK. Orthodontics: bracket materials, adhesives systems, and their bond strength. *Biomed Res Int*. 2016;2016:1329814.
16. Alessandri Bonetti G, Zanarini M, Incerti Parenti S, Lattuca M, Marchionni S, Gatto MR. Evaluation of enamel surfaces after bracket debonding: an in-vivo study with scanning electron microscopy. *Am J Orthod Dentofacial Orthop*. 2011;140(5):696-702.
17. Janiszewska-Olszowska J, Szatkiewicz T, Tomkowski R, Tandecka K, Grocholewicz K. Effect of orthodontic debonding and adhesive removal on the enamel - current knowledge and future perspectives – a systematic review. *Med Sci Monit*. 2014;20:1991-2001.

How to cite this article: Albertini P, Albertini E, Siciliani G, Lombardo L. Fluorescence-aided composite removal during lingual bracket debonding. *J Esthet Restor Dent*. 2020;1–4. https://doi.org/10.1111/jerd.12618