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Original Article

Orthodontic Debonding Procedures: A Survey of Thai Orthodontists

Buranee Anurukkulkij* Supassara Sirabanchongkran**

Abstract

Background: Orthodontic debonding procedures impact enamel integrity. Despite various proposed techniques, no standardized protocol exists. Understanding commonly used methods among Thai orthodontists may aid in developing practical, evidence-based guidelines. **Objective:** To investigate current practices of Thai orthodontists regarding bracket removal, adhesive removal, and enamel polishing during debonding, aiming to identify prevailing clinical trends and support standardized protocol development. **Materials and methods:** A structured four-part questionnaire was distributed to 726 active members of the Thai Association of Orthodontists via electronic message and postal mail. It covered: 1) respondents' general background; 2) bracket type, surface preparation, and adhesive system frequently used; 3) debonding instruments and procedures for metal and ceramic bracket debonding; and 4) adhesive removal, enamel polishing, and time spent. Descriptive statistical analyses were performed. **Results:** 389 orthodontists (53.58 %) responded; and 388 responses were analyzed. Bracket debonding pliers were most frequently used, typically applying squeezing force occlusogingivally. For adhesive removal, up to four instruments were used sequentially, with high-speed white stone bur favored in both one- and multi-step methods. Rubber cup with slurry pumice was common for enamel polishing. Water was the primary coolant used in both adhesive removal and enamel polishing. Most entire procedures took under 15 minutes per arch. **Conclusion:** Variability in orthodontic debonding practices among Thai orthodontists was observed, the findings suggest that instrument selection is influenced by the need to balance clinical effectiveness with procedural efficiency, aiming to achieve optimal outcomes within a reasonable chair time.

Keywords: Adhesive removal, Bracket debonding, Enamel polishing, Orthodontic debonding, Survey

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Introduction

With the success and popularity of direct bonding in orthodontics, conventional fixed orthodontic treatment necessitates enamel surface preparation using an acidic etchant, typically a viscous gel of phosphoric acid pioneered by Buonocore.[1] This step roughens and develops microporosity on the enamel surface, allowing brackets to be adhered. The increased surface energy enables the hydrophobic monomer of the resin adhesive to spread across the surface, penetrate the microporosities and form a mechanical interlock between the adhesive and enamel.[2]

The orthodontic debonding procedure, including bracket removal and adhesive residue elimination, also impacts the enamel surface.[3] Post-debonding, the enamel surface should be restored to as close to its original pretreatment condition as possible, for both aesthetic and hygienic reasons. Adhesive remnants can affect the appearance and color of the enamel surface.[4] These procedures inevitably alter the enamel surface.[5] Therefore, minimizing enamel surface damage is crucial. Awareness of enamel surface modifications caused by both orthodontic bonding and debonding procedures should be emphasized.

Various orthodontic debonding methods have been studied and advocated.[3] A range of instruments have been employed for bracket removal, such as a sharp ligature cutter, bracket debonding pliers, How pliers and anterior band slitting pliers.[6-11] Different bracket removal techniques result in varying amounts of adhesive on the enamel surface.[9] The direction and magnitude of debonding forces can influence the risk of enamel fractures or cracks, making the site of bonding breakage between the bracket base and enamel surface significant. Cohesion failures within the adhesive or adhesion failures between adhesive and bracket are more favorable.[12] Multiple of mechanical methods for adhesive removal and enamel polishing have been studied in order to minimize iatrogenic damage to the enamel surface and achieve acceptable aesthetic outcomes. Suggested methods include a green rubber wheel, a tungsten carbide bur, multistep Sof-Lex discs, a fiber-reinforced composite bur, and a fiber glass bur.[5,6,8,11,13-16] However, no universal protocol has been established. Improper instrument selection and inconsistencies in each step of the debonding process can lead to significant enamel damage and compromise the treatment outcomes.

Due to the variability in clinical practice surrounding these delicate procedures, the purposes of this study were: 1) to survey the orthodontic debonding procedures employed by the orthodontists in Thailand; and 2) to identify the most commonly used methods for bracket removal and adhesive cleanup after fixed orthodontic treatment by Thai orthodontists. This information aims to reflect current clinical trends and support the development of practical guidelines for safer and more consistent orthodontic debonding procedures.

Materials and methods

The population of this study comprised 726 active ordinary members of the Thai Association of Orthodontists. Other categories of membership, as well as deceased ordinary members, were excluded from the study.

A preliminary questionnaire was developed based on a comprehensive literature review. Validity and reliability assessments were conducted to ensure the quality of the instrument. For validity testing, the preliminary questionnaire was revised and refined in accordance with feedback and recommendations provided by advisory committee. Subsequently, content validity was evaluated using the Index of Item-Objective Congruence (IOC), followed by pilot testing. Reliability was assessed using Cronbach's alpha coefficient to confirm the internal consistency and dependability of the questionnaire responses. The finalized questionnaire was distributed in two formats - online and postal mail - both containing

identical content. An electronic message containing a link to the online questionnaire was sent to all 726 active ordinary members of the Thai Association of Orthodontists via the association's official social media platform. One month later, a hard-copy version of the questionnaire, along with a pre-stamped return envelope and a link to the online form, was mailed to each member. A reminder message was sent electronically one month after the postal distribution. Respondents who completed the online form were instructed not to submit the paper version. Only one submission per respondent was accepted. The questionnaire comprised four parts: 1) background information of the respondent; 2) frequently used type of bracket, enamel surface preparation, and adhesive material; 3) preferred bracket debonding instruments and procedures used separately for metal and ceramic bracket removal; and 4) details on adhesive removal, enamel polishing (e.g., bur types or coolant used), and the time spent on the entire debonding procedure per arch. The results were analyzed using descriptive statistical analyses.

Results

At the end of the survey period, 389 orthodontists responded, yielding a response rate of 53.58 %. 76.09 % (296 responses) were submitted online, while 23.91 % (93 responses) were received by post. One postal respondent was excluded from analysis due to no longer using fixed appliances, resulting in a final sample of 388 responses. In part 1 of the survey, respondents ranged in age from 29-94 years old with an average of 44.29 ± 9.70 years. Orthodontic practice experience ranged from 0 to 51 years, with an average of 13.20 ± 9.64 years. A total of 306 respondents (78.76 %) obtained their orthodontic degrees from certified universities in Thailand, while 82 (21.24 %) graduated from institutions abroad, including those in Australia, England, Germany, Hong Kong, Japan, Norway, the Philippines, Scotland, Taiwan, and the United States. The distribution of responses by institution is presented in Figure 1.

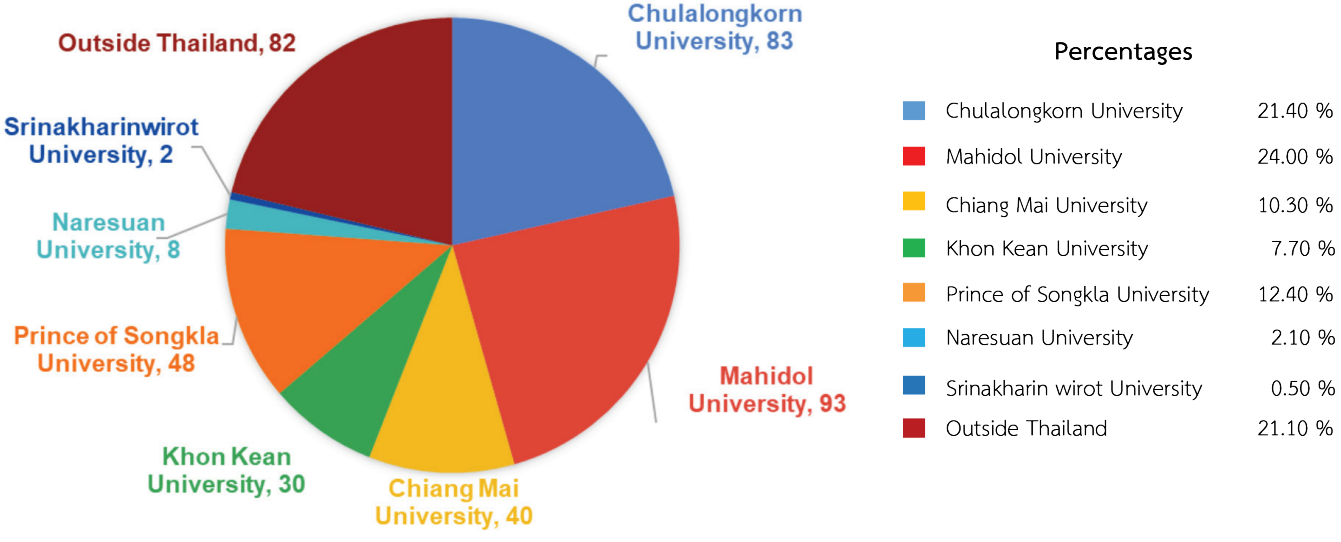

Figure 1 The numbers and percentages of responses in each institute.

In part 2 as seen in table 1, most respondents mainly used stainless steel bracket (99.20 %) with a total etch system for enamel surface preparation (97.20 %) and light cure (85.30%) composite resin adhesive (99.50 %).

In part 3 of the survey on bracket debonding, 96.60 % of respondents debonded brackets while the main archwire was still engaged. Bracket debonding pliers were the most commonly used instrument for both stainless steel (88.10 %) and ceramic (34.80 %)

Table 1 Orthodontic appliances frequently used.

Orthodontic appliances frequently used	Respondents (%)
Type of bracket	
Stainless steel	385 (99.20)
Ceramic	3 (0.80)
Surface preparation method	
Total-etched	377 (97.20)
Self-etched	11 (2.80)
Adhesive material	
Composite resin	386 (99.50)
Resin-modified glass ionomer	2 (0.50)
Adhesive system	
Light cure	331 (85.30)
Dual cure	1 (0.30)
Self-cure	56 (14.40)

Table 2 Instruments commonly used in stainless steel and ceramic bracket debonding.

Instrument used	Respondents (%)	
	Stainless steel bracket removal	Ceramic bracket removal
Bracket debonding pliers	342 (88.10)	135 (34.80)
Ligature cutter	30 (7.70)	12 (3.10)
Weingart pliers	5 (1.30)	5 (1.30)
Band remover	4 (1.00)	-
How pliers	2 (0.50)	1 (0.30)
Hard wire cutter	2 (0.50)	-
Band slitter	2 (0.50)	-
LODI pliers	1 (0.30)	-
Ceramic bracket debonding pliers*	-	28 (7.20)
Grinding with aerotor	-	2 (0.50)
Jarabak pliers	-	1 (0.30)

*Ceramic bracket debonding pliers provided by manufacturer

Table 3 Method used and direction of instrument placement in bracket removal.

Bracket removal	Respondents (%)	
	Stainless steel bracket removal	Ceramic bracket removal
Method used		
Squeezing	216 (55.70)	101 (26.00)
Peeling, Shearing	163 (42.00)	69 (17.80)
Tensile	9 (2.30)	6 (1.50)
Direction of instrument placement		
Occlusogingival	355 (91.50)	121 (31.20)
Mesiodistal	33 (8.50)	57 (14.70)

Table 4 Position of instrument placement in bracket removal.

Position	Respondents (%)	
	Stainless steel bracket removal	Ceramic bracket removal
Bracket base-enamel junction (Point A)	84 (21.60)	87 (22.40)
Bracket base (Point B)	57 (14.70)	49 (12.60)
Bracket wings (Point C)	247 (63.70)	42 (10.80)

brackets; ligature cutter (7.70 %) and Weingart pliers (1.30 %) followed in metal bracket removal; while the specific ceramic bracket remover (7.20% %) and ligature cutter (3.10 %) were next most frequently used in ceramic bracket removal (Table 2).

For both metal and ceramic brackets, the most common method was to squeeze the pliers occlusogingivally (Table 3). However, the placement position of the pliers for metal brackets was on the bracket wings (Point C in Figure 2, Table 4), whereas the position for ceramic brackets was on the bracket base-enamel junction (Point A in Figure 2, Table 4).

In part 4 of the survey, numerous different individual protocols were utilized for adhesive removal and enamel polishing.

For adhesive removal, multiple instruments were used consecutively, ranged from one to four instruments used in total. One-step (145 responses or 37.40 %) and two-step (157 responses or 40.50 %) protocols were most common (Figure 3). Among one-step users, the most popular instrument was a high-speed (HS)

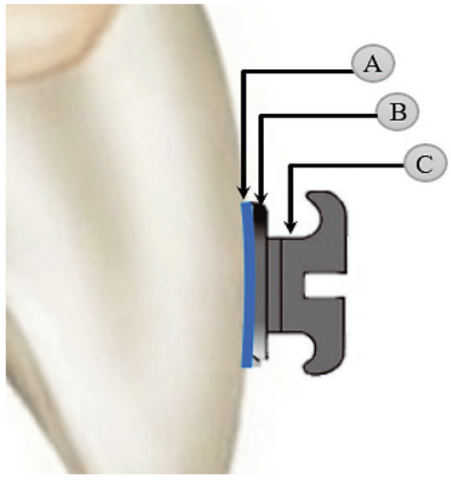

Figure 2 Position of instrument placement in bracket debonding. (A) Bracket base-enamel junction, (B) Bracket base, and (C) Bracket wing

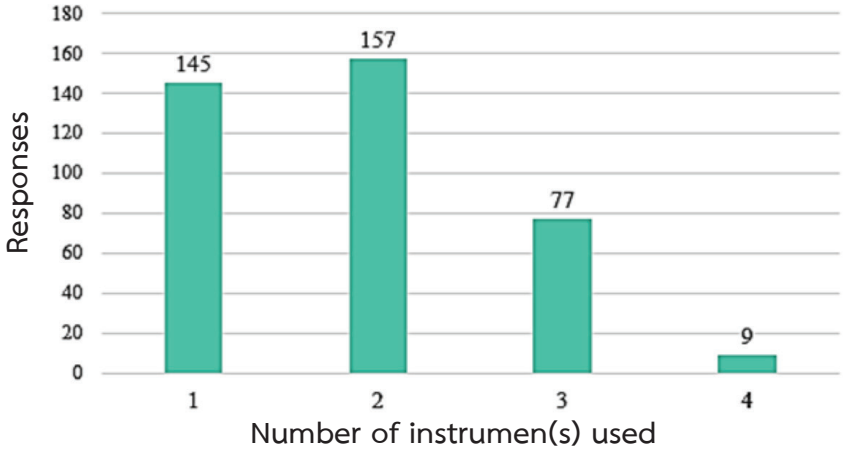

Figure 3 Number of steps used consecutively in adhesive removal

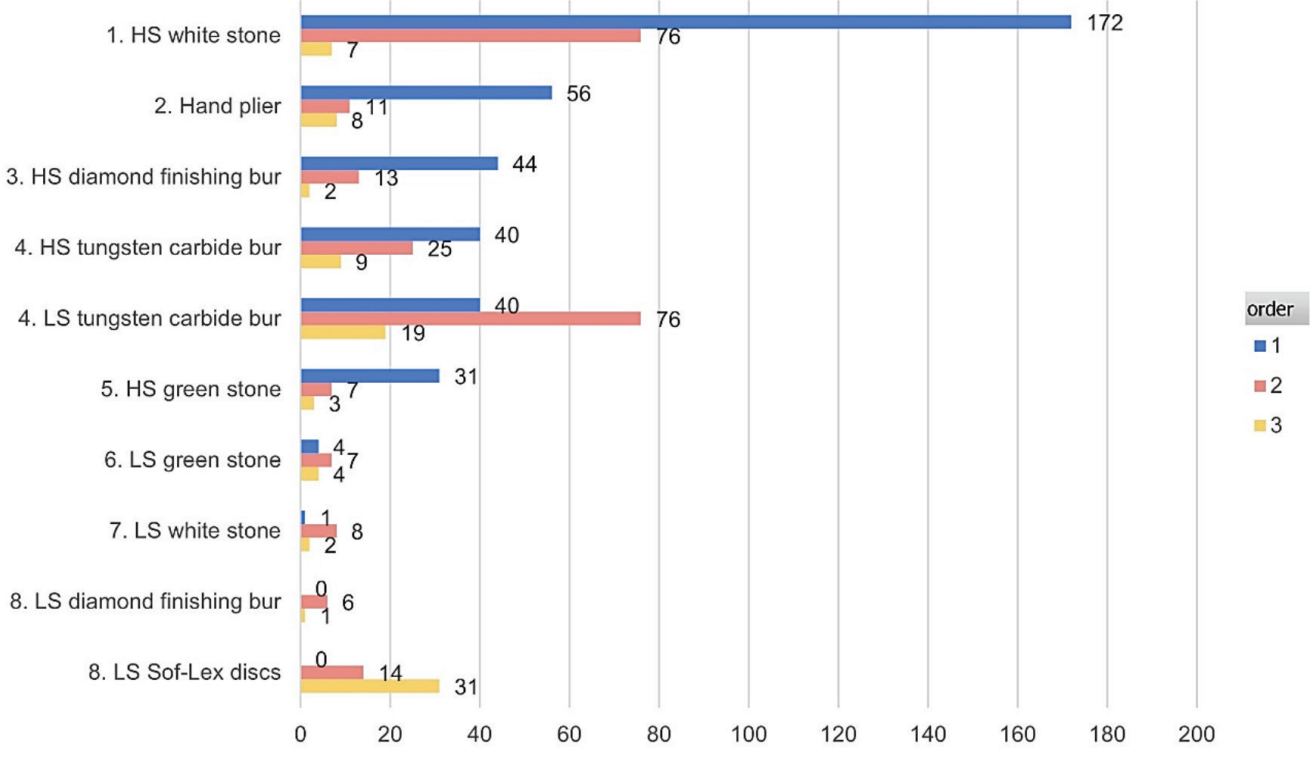

Figure 4 Overall instruments used in adhesive removal

Table 5 Instruments used in one-step adhesive removal.

Instrument used	Respondents (%)
HS white stone bur	90 (62.10)
LS tungsten carbide bur	25 (17.20)
HS tungsten carbide bur	10 (6.90)
HS diamond finishing bur	10 (6.90)
Hand pliers	6 (4.10)

white stone bur (62.10 %), and the second-most popular was a low-speed (LS) tungsten carbide bur (17.20 %) (Table 5). For multiple-step users, the most commonly used instruments in first step were a HS white stone bur (44.30 %), hand pliers (14.40 %), and HS diamond finishing bur (11.30 %) (Figure 4). The instruments most frequently used in second step were a HS white stone bur and LS tungsten carbide bur (31.30 % each). The most common coolants for removing remnant adhesive were water (87.40 %), none (10.60 %), and air (2.10 %).

Enamel polishing was also performed in various ways. With respect to frequency of enamel polishing steps, 55.40 % of respondents always polished enamel after adhesive removal (Table 6). Up to three instruments were used, but 85 % of respondents utilized only one instrument. The most frequently used instruments were a rubber cup with slurry pumice, Sof-Lex abrasive discs, and Enhance points (Figures 5 and 6). The most common coolants used were water (49.10 %), none (45.70 %), and air (5.20 %).

Table 6 Frequency of enamel polishing.

Frequency of enamel polishing	Respondents (%)
Always (100 %)	215 (55.40)
Usually (75 %)	40 (10.30)
Sometimes (50 %)	39 (10.10)
Rarely (25 %)	34 (8.80)
Never	60 (15.50)

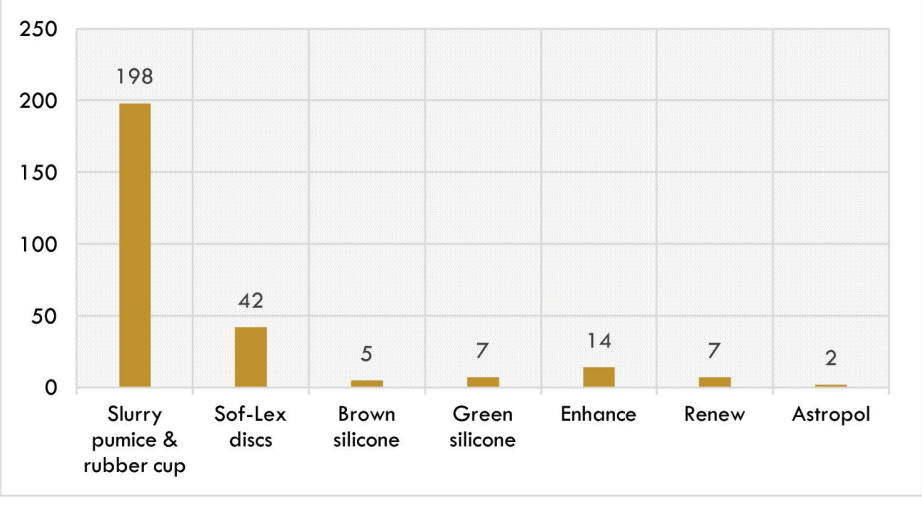

Figure 5 Instruments used in one-step enamel polishing

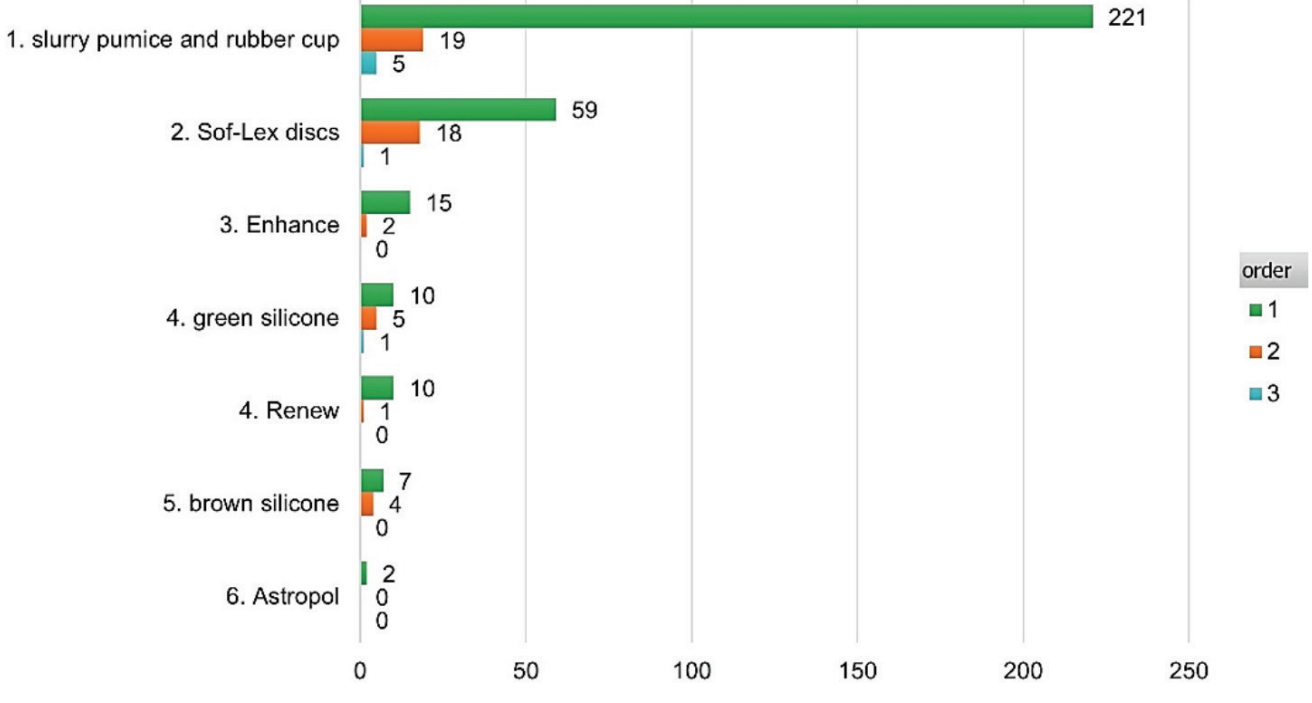

Figure 6 Overall instruments used in enamel polishing

Time spent on the entire orthodontic debonding procedure per arch was mostly less than 15 minutes (64.70 %).

Discussion

Based on the survey among the active ordinary members of Thai Association of Orthodontists, stainless steel bracket was the most commonly used fixed appliance in clinical practice (99.20 %), as in the study by Sfondrini et al.[17] Although the esthetic of metal brackets is inferior to that of the ceramic ones, the metal appliance remains more popular. A total of 97.20 % of respondents etched the enamel surface before bracket bonding using total-etched system as in the survey by Webb et al.[18] Even though the use of self-etched primer shows a statistically significant time saving compared to the use of total-etched,[19] the total-etched system was still mostly used among the respondents. Light cure composite resin was the most favored bonding agent used in bracket bonding, followed by self-cure composite resin - which is similar to the survey results of Webb et al.[18] The shear bond strength obtained from using both light cure and self-cure adhesive materials reached the minimal requirement for orthodontic bonding, but the light cure composite resin produced higher shear bond strength.[20] Furthermore, before the light-curing polymerization, orthodontists have a period of time to place the bracket at the correct position before light activation to initiate polymerization. On the other hand, self-cure adhesive has an advantage over light cure adhesive in areas that the light from the tip of the light curing unit cannot fully reach. In those areas, declination of the bond strength of the light cure adhesive occurs.[20]

As shown in Table 2, bracket debonding pliers were the most common instrument used (88.10 %), followed by ligature cutter (7.70 %). This is in line with the survey results of Webb et al.,[18] but contrasts with the survey findings of Campbell[5] and Sfondrini[17] where a ligature cutter was mostly used. For ceramic bracket debonding, there has not yet been a survey study specifically about the instrument used. Bracket debonding pliers were the most typical instrument used (34.80 %), followed by the specific ceramic bracket debonding pliers provided by the bracket manufacturer (7.20 %), and a ligature cutter (3.10 %). Bracket debonding pliers are easy to apply and can be used in both metal and ceramic bracket removal which might be due to the existence of instruments and experience that orthodontists already have from metal bracket debonding. Placement position of debonding appliances affects area of bonding breakage and adhesive remnant on enamel surface. Adhesion failure between adhesive and enamel surface leaves the least adhesive remnant, however, orthodontist has to place the debonding appliance nearest to enamel surface (Point A in Figure 2) to obtain this type of breakage which usually causes enamel gouges and damage due to the scraping of the remover.[7,9] To minimize the enamel damage, the adhesion failure between adhesive and bracket or the cohesion failure within the adhesive layer itself is more favorable. From this reason and according to previous studies[7,9,13,21], the suggestion in metal bracket removal was to squeeze the bracket debonding pliers on the bracket wing (Point C in Figure 2) mesiodistally to reduce the stress transmitted to the tooth and to avoid enamel scarring. Nevertheless, removal of the increased residual adhesive certainly takes more time in the subsequent procedure. Most respondents utilized the advised instrument and method, but the instrument placement direction was different. According to the survey, 96.60 % of respondents debonded the brackets while the main archwire was still engaged, whereas in a laboratory situation in previous studies this was not the case.[7,9,13,21] As a result, due to blockage from the main archwire to access mesiodistally, respondents had to place the debonding instrument occlusogingivally instead. However, the effect of these two different directions in the same squeezing method has not been investigated. Further study is suggested to clarify this aspect.

In ceramic bracket removal, most respondents squeezed the pliers at the bracket base-enamel junction, which is congruent with Bishara's studies.[22-25] The bracket base of the ceramic bracket was the strongest and bulkiest part, which can decrease the chance of bracket fracture during debonding as the ceramic bracket had far less deformation resistance than the metal bracket.[26] Furthermore, the squeezing force transmitted less force to the enamel compared to shear force.[25]

Concerning the instruments used in orthodontic adhesive removal, the survey showed that there were several combinations used by orthodontists to remove adhesive and polish the enamel surface. The data collected in this survey differed from other surveys due to differences in questionnaire design. The similarity in trends of instruments used among respondents who graduated from different institutes with accredited orthodontic program were interestingly found. As shown in Table 5 and Figure 4, a HS white stone bur was apparently the most popular instrument used in single-step adhesive removal, and also the most first-used if multiple instruments were applied. In contrast, a fluted tungsten carbide bur was the most typical instrument used in all other surveyed studies.[5,17,18] With respect to the second-used item of multiple instruments used, a HS white stone was still the most popular and usually used after coarser instruments such as hand pliers, HS green stone, or diamond finishing bur. The white stone bur was found to produce a smoother enamel surface than tungsten carbide bur with clinically acceptable result.[16] Its widespread use among respondents in this survey may be attributed to its versatile properties. The white stone bur is commonly used for finishing and polishing composite restorations. It is inexpensive, durable, and suitable for use in all areas of the oral cavity, while still providing an acceptable level of enamel surface smoothness. However, it has been reported to cause enamel loss, surface scratches, and the formation of facets.[6,21] In contrast, the use of coarse instruments alone, such as hand pliers, green stone burs, or diamond finishing burs, produces grooves and notches on the enamel surface, which may persist even after subsequent polishing.[5,13] Considering the coolant in adhesive removal, water was mostly used (87.40 %), in line with the study by Sfondrini et al.[17] This was congruent with the use of all HS instruments for adhesive removal indicated in the survey. HS instruments produce a large amount of heat and can lead to pulpal damage or patient discomfort. Water diminishes the vision performance of adhesive and enamel isolation.[27] For the enamel polishing procedure, there was also variability of survey results. The most used instrument was a slurry pumice and rubber cup, which was also reported as the most common polishing material in the survey by Campbell[5] and Webb et al.[18] Sandpaper abrasive discs were the next-most common instrument used, as in the survey by Campbell[5] and Sfondrini et al.[17] The coolant used in enamel polishing was not evaluated in other studies.[5,17,18] Nonetheless, the enamel polishing step is necessary because this process can remove fine enamel scratches and polish the enamel surface back to its pretreatment glossy condition.[6] Slurry pumice with rubber cup was recommended.[5,6,8,13]

Most of the respondents reported spending less than 15 minutes per arch for the entire debonding procedure. Our finding differs from the approach used in the survey by Webb et al.,[18] in which participants were asked to report the amount of time allocated for a full-mouth debonding appointment. In their findings, the majority of orthodontists scheduled approximately 15 minutes for the entire debonding process. This is different from the time spent metric in our study which was mostly less than 15 minutes "per arch." This emphasizes the need to consider the relationship between instrument selection and procedure duration as a potentially influential factor in clinical efficiency and outcomes.

Previous studies have recommended a multistep approach to adhesive removal with; 1) initial bulk

removal using a HS tungsten carbide finishing bur with adequate air cooling; 2) subsequent polishing with composite polishers such as Sof-Lex discs or Enhance points and cups, using light pressure and adequate air cooling; [5,11,15,16] and 3) final enamel polishing with a rubber cup and water slurry of pumice.[8] Although the sequence of steps reported by respondents in our study was generally consistent with these recommendations, the instruments used differed. The most commonly used tool for adhesive removal was the white stone bur with water coolant, often followed by the use of composite polishers. Final enamel polishing with a rubber cup and pumice slurry was also commonly performed. These findings may reflect practical adaptations in clinical protocols and highlight the variations in routine orthodontic debonding procedures among practitioners.

A limitation of this study might be the questionnaire design for the adhesive removal and enamel polishing parts, where respondents were allowed to sort their usage order and instruments used individually. Each orthodontist has their preferred personal protocol with different institutional background and practice conditions; therefore, a variety of different protocols was submitted. With the increasing popularity of clear aligner treatment, there are situations where multiple composite attachments must be applied. The protocol for removing these attachments is a very interesting area to be investigated.

Conclusion

This survey demonstrates considerable variation among Thai orthodontists in the instruments, techniques, and time allocation used for orthodontic debonding procedures. Bracket debonding pliers were most commonly employed for both metal and ceramic bracket removal, while HS white stone burs and rubber cups with pumice were the preferred choices for adhesive removal and enamel polishing, respectively. A common approach involved either a one-step adhesive removal with HS white stone bur or a two-step technique using HS white stone bur with water cooling for bulk reduction, followed by a finer bur and final polishing with a rubber cup and pumice. These findings reflect current clinical practices rather than establish the standards, and no single ideal debonding protocol was identified. Orthodontists are encouraged to adopt evidence-based techniques that minimize enamel damage, shorten chair time, and enhance patient comfort while maintaining satisfactory clinical outcomes.

Author contributions

BA: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing-Original Draft, Writing-Review & Editing, Visualization, Project administration; SS: Conceptualization, Methodology, Formal analysis, Investigation, Resources, Writing-Review & Editing, Visualization, Supervision, Project administration, Funding acquisition.

Ethical statement

The research protocol was approved by the Ethics Committee of the Faculty of Dentistry, Chiang Mai University (No. 48/2019).

Disclosure statement

The authors have no conflicts of interest.

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References

1. Buonocore MG. A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces. J Dent Res 1955;34(6):849-53.
2. Nicholson JW. Adhesive dental materials—a review. Int J Adhes Adhes 1998;18(4):229-36.
3. 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.
4. Joo HJ, Lee YK, Lee DY, Kim YJ, Lim YK. Influence of orthodontic adhesives and clean-up procedures on the stain susceptibility of enamel after debonding. Angle Orthod 2011;81(2):334-40.
5. Campbell PM. Enamel surfaces after orthodontic bracket debonding. Angle Orthod 1995;65(2):103-10.
6. Gwinnett AJ, Gorelick L. Microscopic evaluation of enamel after debonding: clinical application. Am J Orthod 1977;71(6):651-65.
7. Bennett CG, Shen C, Waldron JM. The effects of debonding on the enamel surface. J Clin Orthod 1984;18(5):330.
8. Zachrisson BU, Årthun J. Enamel surface appearance after various debonding techniques. Am J Orthod 1979;75(2):121-37.
9. Oliver RG. The effect of different methods of bracket removal onthe amount of residual adhesive. Am J Orthod Dentofacial Orthop 1988;93(3):196-200.
10. Su MZ, Lai EHH, Chang JZC, Chen HJ, Chang FHF, Chiang YC, et al. Effect of simulated debracketing on enamel damage. J Formosa Med Ass 2012;111(10):560-6.
11. Zarrinnia K, Eid NM, Kehoe MJ. The effect of different debonding techniques on the enamel surface: an in vitro qualitative study. Am J Orthod Dentofacial Orthop 1995;108(3):284-93.
12. Bishara SE, VonWald L, Laffoon JF, Warren JJ. Effect of a self-etch primer/adhesive on the shear bond strength of orthodontic brackets. Am J Orthod Dentofacial Orthop 2001;119(6):621-4.
13. Retief DH, Denys FR. Finishing of enamel surfaces after debonding of orthodontic attachments. Angle Orthod 1979;49(1):1-10.
14. Karan S, Kircelli BH, Tasdelen B. Enamel surface roughness after debonding: comparison of two different burs. Angle Orthod 2010;80(6):1081-8.
15. Özer T, Başaran G, Kama JD. Surface roughness of the restored enamel after orthodontic treatment. Am J Orthod Dentofacial Orthop 2010;137(3):368-74.
16. Mohebi S, Shafiee H-A, Ameli N. Evaluation of enamel surface roughness after orthodontic bracket debonding with atomic force microscopy. Am J Orthod Dentofacial Orthop 2017;151(3):521-7.
17. Sfondrini MF, Scribante A, Fraticelli D, Roncallo S, Gandini P. Epidemiological survey of different clinical techniques of orthodontic bracket debonding and enamel polishing. J Orthod Sci 2015;4(4):123.
18. Webb BJ, Koch J, Hagan JL, Ballard RW, Armbruster PC. Enamel surface roughness of preferred debonding and polishing protocols. J Orthod 2016;43(1):39-46.
19. Fleming PS, Johal A, Pandis N. Self-etch primers and conventional acid-etch technique for orthodontic bonding: a systematic review and meta-analysis. Am J Orthod Dentofacial Orthop 2012;142(1):83-94.
20. Shukla C, Singh G, Jain U, Swamy K. Comparison of mean shear bond strength of light cure, self-cure composite resins, self-etching and moisture-insensitive primers: An in vitro study. J Indian Orthod Soc 2012;46(4 suppl 1):254-7.
21. Hong YH, Lew KKK. Quantitative and qualitative assessment of enamel surface following five composite removal methods after bracket debonding. Eur J Orthod 1995;17(2):121-8.
22. Bishara SE, Trulove TS. Comparisons of different debonding techniques for ceramic brackets: an in vitro study: part I. Background and methods. Am J Orthod Dentofacial Orthop 1990;98(2):145-53.
23. Bishara SE, Trulove TS. Comparisons of different debonding techniques for ceramic brackets: an in vitro study: part II. Findings and clinical implications. Am J Orthod Dentofacial Orthop 1990;98(3):263-73.
24. Bishara SE, Fonseca JM, Boyer DB. The use of debonding pliers in the removal of ceramic brackets: force levels and enamel cracks. Am J Orthod Dentofacial Orthop 1995;108(3):242-8.
25. Bishara SE, Fonseca JM, Fehr DE, Boyer DB. Debonding forces applied to ceramic brackets simulating clinical conditions. Angle Orthod 1994;64(4):277-82.
26. Scott Jr GE. Fracture toughness and surface cracks—the key to understanding ceramic brackets. Angle Orthod 1988;58(1):5-8.
27. Uysal T, Eldeniz AU, Usumez S, Usumez A. Thermal changes in the pulp chamber during different adhesive clean-up procedures. Angle Orthod 2005;75(2):220-5.