A national survey of the debonding protocols used by orthodontists in New Zealand

TianYou Wu, Mauro Farella, Simon Guan, Richard D. Cannon and Li Mei
Department of Oral Sciences, Faculty of Dentistry, University of Otago, Dunedin, New Zealand

Objectives: To investigate the debonding protocols used by orthodontists in New Zealand.
Materials and methods: A pilot-tested electronic questionnaire was distributed to all full members of the New Zealand Association of Orthodontists (NZAO). The survey consisted of 12 questions which collected demographic information and details of the debonding protocols practiced by the orthodontists.
Results: The response rate to the survey was 56.6% (*n*=60 respondents). Most NZ orthodontists (80.0%, *n*=48) preferred the use of debonding pliers to remove orthodontic brackets. A total of 23 different methods were identified for the subsequent removal of residual adhesive of which a low-speed tungsten carbide bur was the most popular tool (83.3%, *n*=50). The majority of the NZ orthodontists (96.7%, *n*=58) performed polishing after the removal of residual adhesive. About 80% (*n*=47) of the NZ orthodontists reported iatrogenic damage to the enamel following debonding. Almost all NZ orthodontists (98.3%, *n*=59) were satisfied with their debonding protocol.
Conclusion: Orthodontists in New Zealand use different debonding protocols, of which the most common was the use of debonding pliers combined with a low-speed tungsten carbide bur without irrigation, followed by additional polishing using pumice and a rubber cup. The commonly-used debonding protocol may not necessarily be the most appropriate approach based on current best evidence. Orthodontists should maintain a critical stance and consistently re-assess the literature to evaluate the appropriateness of their debonding protocol.
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TianYou Wu: wuti4402@student.otago.ac.nz; Mauro Farella: mauro.farella@otago.ac.nz; Simon Guan: simon.guan@otago.ac.nz; Richard D. Cannon: richard.cannon@otago.ac.nz; Li Mei: li.mei@otago.ac.nz

Introduction

The introduction of bracket bonding to orthodontics marked one of the profession's most pivotal developments. Fixed orthodontic appliances are usually attached to teeth using resin adhesives and those materials bonded at the outset of therapy must be removed upon the completion of treatment. The debonding process, involving the removal of the brackets and residual adhesive has a primary objective of restoring the enamel surface to its pre-treatment status without causing iatrogenic damage.

Research into debonding methods began in the 1970s[1–4] and resulted in the development of numerous clinical protocols. However, conflicting opinions persist regarding the most suitable method. Consequently, the selection of a debonding technique often heavily relies on an clinician's empirical evidence, which can vary significantly between orthodontists.

There have been few surveys that have investigated debonding practices. An early survey, conducted in Texas, USA, found that approximately 55% of orthodontists preferred using ligature cutters to remove attached brackets, and the majority utilised fluted burs or hand instruments to remove residual adhesive, followed by various methods of polishing.[5] More recently, two national surveys were carried out in Italy[6] and the USA[7] to identify common debonding protocols. The results of the surveys determined significant differences between the

respondent orthodontists. For instance, the Italian survey found ligature cutters were the preferred tool for removing brackets, while debonding pliers were more popular according to the USA survey. Furthermore, the USA survey revealed that 85% of orthodontists used high-speed tungsten carbide burs without irrigation to remove residual adhesive, whereas the Italian survey determined that most orthodontists preferred low-speed tungsten carbide burs with irrigation. A similar survey conducted in Brazil showed that the most commonly-used method was high-speed tungsten carbide burs with irrigation which was justified by the shorter chairside time required.[8] The findings suggest a significant variation in debonding practices, not only between countries, but also between orthodontists within the same country.

To date, the debonding practices of orthodontists in New Zealand (NZ) remain unknown. The aim of the present study was to conduct a cross-sectional national survey to investigate the debonding protocols used by NZ orthodontists, and to evaluate their appropriateness based on the available evidence from the current literature.

Methods

Ethical approval for the project was granted by the University of Otago Human Ethics Committee (D23/149). An online questionnaire was developed using the Quatrics^{XM} (Seattle, USA) online platform, and pre-piloting was carried out by the orthodontists at the Faculty of Dentistry, University of Otago to ensure that the questions were well-designed to elicit meaningful responses. The questionnaire consisted of 12 questions, the first three of which were related to the demographics of the respondents. The remaining questions concerned the debonding protocols employed by the respondents.

The New Zealand Association of Orthodontists (NZAO) administrator sent an email containing a link to the online questionnaire to all full Association members (N = 108) in July 2023. The NZAO is a professional orthodontic organisation which represents the orthodontists in New Zealand. Only orthodontists registered as a specialist by the New Zealand Dental Council are eligible for full membership with the NZAO. The initial communication was followed by a reminder email that was sent in August 2023. The survey closed in September 2023.

Table I. Demographics of the participants

	Number (percentage)
Sex	
Male	35 (58.3%)
Female	25 (41.7%)
Country of specialist qualification	
New Zealand	44 (73.4%)
Australia	5 (8.3%)
Other	11 (18.3%)
Years of experiences as specialist	
> 20 years	23 (38.3%)
16 - 20 years	10 (16.7%)
11 - 15 years	7 (11.7%)
6 - 10 years	7 (11.7%)
0 - 5 years	13 (21.6%)

Statistical analysis

The received data were exported from the Quatrics^{XM} online platform to a Microsoft Excel (Microsoft, Redmond, WA, USA) spreadsheet for data processing. Data analyses were conducted using GraphPad Prism (version 10.2.3, GraphPad Software Inc, La Jolla, CA, USA).

Results

A total of 60 participants responded to the survey, resulting in an overall response rate of 56%. Table I provides an overview of the participants' demographic details regarding their gender, country of specialist qualification, and years of experience as a specialist orthodontist. One participant did not answer one of the questions.

Methods used to debond brackets

Most participants (80%) preferred to use debonding pliers to remove attached brackets, followed by ligature cutters (13%), or a combination of using ligature cutters and debonding pliers (7%) (Figure 1).

Methods used to remove adhesives

For the subsequent removal of residual orthodontic adhesive (Figure 2), the majority of respondents (83%) preferred using a low-speed tungsten carbide bur. This was followed by aluminum oxide-based polishers (30%), high-speed tungsten carbide burs (25%), and adhesive removal pliers (14%). Other tools that were mentioned are shown in Figure 2. The preferred method for removing residual adhesive by the clinicians varied greatly, as twenty-three different methods and combinations were identified (Figure 3). The three most utilised methods were a low-speed tungsten carbide bur alone (30%), followed by the combined use of a low-speed tungsten carbide bur and aluminium oxide-based polishers (13%), and the combined use of adhesive removal pliers and low-speed tungsten carbide burs (10%).

Polishing after removal of adhesives

After the removal of residual adhesive, almost all (97%) respondents carried out additional polishing (Figure 4). Rubber cups and pumice (50%) was the most used method, closely followed by aluminium oxide-based polishers (44%). Most participants (77%) did not use water irrigation nor dental loupes during debonding, and the majority (69%) usually allocated 30 to 60 minutes for the debonding process (Table II).

Methods for checking the debonding

Most respondents used a combination of visual and tactile (with either an explorer or periodontal probe) inspections after drying the tooth surface to assess the removal of the residual adhesive (78%) (Figure 5). There was an unexpected response from one orthodontist who, on purpose, left a thin layer of orthodontic adhesive on the tooth surface to avoid any iatrogenic damage.

About 80% of the respondents noted iatrogenic damage to the enamel surface following debonding. However, almost all participants (98%) were satisfied with their current debonding protocol (Table III).

Discussion

Orthodontists may use different debonding protocols to remove brackets and adhesives after orthodontic treatment. To date, the debonding practices of orthodontists in New Zealand have remained unknown. This is the first national survey to identify the debonding practices of orthodontists in New

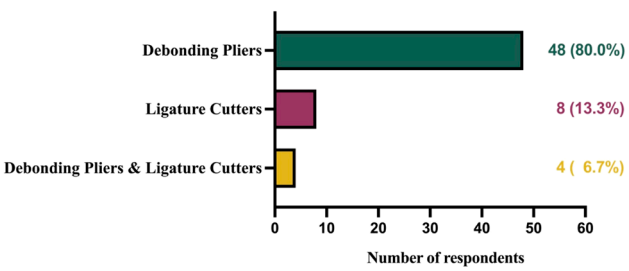

Figure 1. Methods used to debond brackets [Data presents as number (%)].

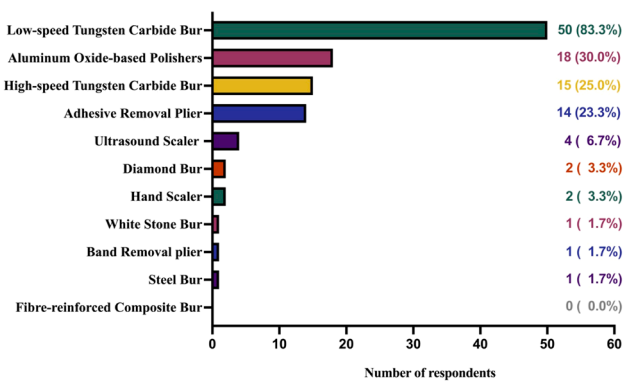

Figure 2. Methods used to remove residual adhesives [Data presents as number (%)].

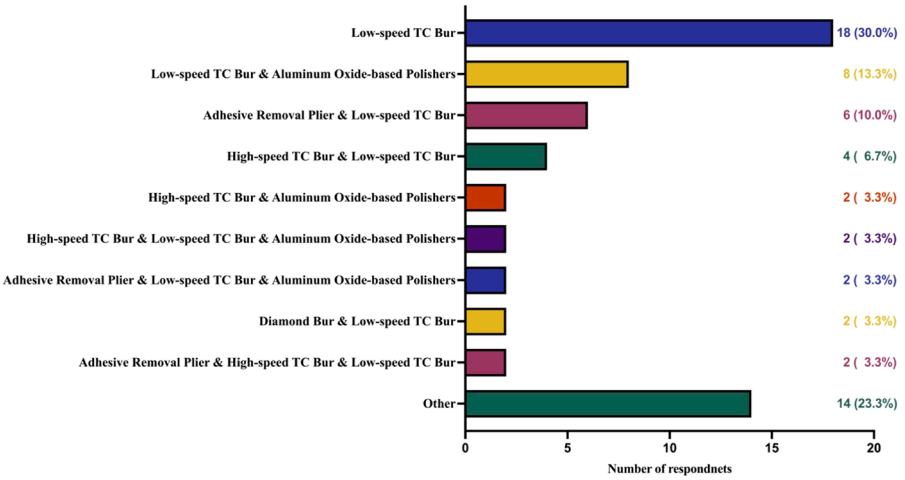

Figure 3. Different combinations of adhesive removal tools used by orthodontists [Data presents as number (%)].

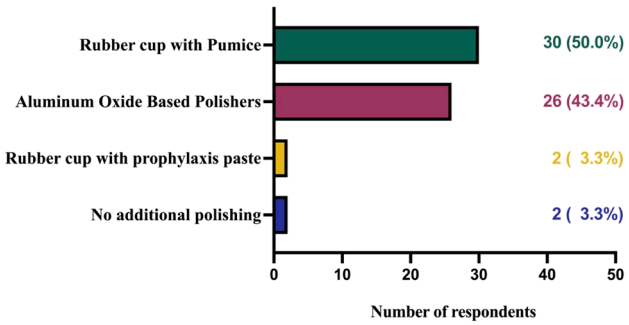

Figure 4. Polishing after removal of adhesives [Data presents as number (%)].

Zealand and the study achieved an acceptable response rate of 56%, which is higher than that of previous national debonding surveys conducted in other countries, which reported response rates of 11.6%,[7] and 26.7%.[6] The results of the present survey revealed considerable variation in debonding protocols following the completion of conventional fixed appliance treatment.

Table II. Additional debonding information from the orthodontists

	Number (percentage)
Water irrigation during debonding	
Yes	14 (23.3%)
No	46 (76.7%)
Utilization of dental loupes	
Yes	10 (16.7%)
No	50 (83.3%)
Time allocated for debonding	
0 to 30 minutes	11 (18.3%)
30 to 60 minutes	41 (68.3%)
More than 60 minutes	8 (13.4%)

The popularity of using debonding pliers to remove orthodontic brackets is similar to the findings of a national debonding survey conducted in the USA.[7] In contrast, a national debonding survey carried out in Italy found that the ligature cutter was preferred for debracketing.[6] Both debonding pliers and ligature cutters are effective for debonding attachments. An advantage of using a ligature cutter is that it avoids the need for additional investment in specialised debonding pliers. However, the use of ligature cutters may increase maintenance demands, as their edges are likely to become blunt more frequently. In addition, the use of ligature cutters has been found to cause more patient discomfort than debonding pliers, whilst the lift-off debonding instrument (LODI) has been associated with the lowest pain scores.[9,10] The present survey found that no orthodontists in New Zealand used the LODI for bracket debonding. Recently, studies have investigated the

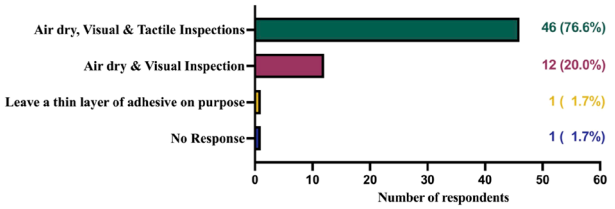

Figure 5. Methods used to check and ensure complete removal of adhesives [Data presents as number (%)].

use of electrothermal and chemical debracketing methods,[11,12] which may be appropriate adjuncts to reduce a patient's discomfort during debonding. However, it has been found that debonding pliers result in less enamel damage than that caused by LODIs and ligature cutters.[13] Overall, the use of debonding pliers by orthodontists in New Zealand appears to be appropriate as their utilisation is associated with a minimal risk of enamel damage and is reasonably comfortable for patients.

The present survey found that the 60 respondents collectively used twenty-three different combinations of tools to remove residual adhesive. The variety of debonding methods highlights the empirical nature of debonding practices. The most-commonly used technique was a low-speed tungsten carbide bur alone, possibly due to the simplicity and efficiency of this method. However, it is noteworthy that the most frequently used approach may not necessarily be the most appropriate. Several previous studies have found that the use of a tungsten carbide bur was associated with increased enamel loss and a greater enamel surface roughness compared to the use of aluminium oxide-based polishing discs, and the use of a fibre-reinforced composite bur.[14–17] Although the clinical significance of these differences is subject to debate, the aim of minimising enamel damage during debonding is always desirable with respect to patient-centred care.

It is notable that one orthodontist chose to leave a thin layer of adhesive on the enamel surface to mitigate potential iatrogenic enamel damage that could result from complete removal. The idea of preserving a smooth, cleanable layer of residual adhesive on the enamel surface might present a viable alternative to the conventional belief mandating complete adhesive removal. However, this approach raises concerns related to compromised dental aesthetics due to adhesive margin staining and colour disparities between the enamel and adhesive. Further evidence is needed to substantiate the validity of this approach.

Table III. Orthodontist's experience and satisfaction with current debonding protocol

	Number (percentage)
Post-debonding enamel damage	
Yes	47 (78.3%)
No	13 (21.7%)
Satisfaction with current protocol	
Yes	59 (98.3%)
No	1 (1.7%)

Almost all orthodontists in the present study carried out additional polishing following debonding, which reflected a shared goal of finishing with very smooth tooth surfaces. The use of pumice and a rubber cup was the most common polishing method, well documented by previous studies.[5,18] However, a recent *in vitro* study found that the use of pumice is associated with greater enamel loss than the use of aluminium-oxide based polishing discs, or fibreglass reinforced composite burs.[16] Therefore, practitioners should be aware of the emerging evidence and innovations that could improve the quality of tooth polishing after debonding.

Almost 80% of the orthodontists preferred to remove residual adhesive without water irrigation. This may be due to the difficulty of visually differentiating adhesive from the enamel under wet conditions. The absence of water irrigation during debonding, however, can raise the temperature of the pulp tissue, potentially causing irreversible pulpal irritation if the increase exceeds the critical threshold of 5.5°C.[19] For instance, the use of tungsten carbide burs without irrigation has been found to increase the risk of thermal irritation to the pulpal tissues, especially when a high-speed handpiece is used.[20] In contrast, the risk of thermal irritation is negligible when water irrigation is used.[21] Therefore, the use of water irrigation is strongly recommended during adhesive removal to minimise the risk of thermal effects on the pulp, especially for adolescent patients due to of the relatively large size of the pulp chamber compared to adult patients.

After debonding, 76% of the surveyed orthodontists ensured the complete removal of residual adhesive through a combination of visual inspection and tactile

examination using either an explorer or a periodontal probe after air drying the teeth. However, reports have suggested that the use of a fluorescent light is a more reliable method for detecting residual adhesive compared to using a visual or tactile examination alone.[22,23] Furthermore, employing a fluorescent light as an adjunct during debonding may also enable clinicians to readily identify residual adhesive, even when water irrigation is used. The fluorescence-aided identification technique has several limitations, including its ineffectiveness on orthodontic adhesives without fluorescent agents, and the additional cost of purchasing and maintaining the fluorescent light-emitting device.

The majority of orthodontists did not use dental loupes during debonding. There are conflicting opinions regarding the benefits of visual aids. Overall, the use of dental loupes did not have a clinically significant impact on the debonding outcome related to enamel damage and roughness.[24,25]

The present study had limitations which included the omission of the orthodontist's protocol when debonding from restorative surfaces and clear aligner attachments.

To date, there remains a lack of consensus regarding the most appropriate debonding protocol. This is reflected by the heterogeneity of debonding protocols practiced by NZ orthodontists. Despite the significant variations between practitioners, almost all expressed satisfaction with their current debonding protocol. However, based on the current literature, there may be scope for updating practices to achieve better debonding outcomes. Additionally, further research evaluating new debonding innovations and techniques would be beneficial.

Conclusion

Orthodontists in New Zealand employ different debonding protocols, the most common being the use of debonding pliers combined with a low-speed tungsten carbide bur without irrigation, followed by additional polishing using pumice and a rubber cup. Whether the commonly-used protocol is the most appropriate approach still requires further study. Until definitive evidence emerges, orthodontists should maintain a critical stance and consistently reassess the literature to evaluate the appropriateness of their debonding protocol.

Conflict of interest

The authors declare that there is no conflict of interest.

Author's contribution

T.Y.W.: contributed to the study design, data collection, and drafting the manuscript; M.F.: contributed to the study design, data analysis and revising the manuscript; S.G.: contributed to the data collection and analysis, and revising the manuscript; R.D.C.: contributed to the study design, data interpretation, and revising the manuscript; L.M.: contributed to the study design, data collection and analysis, and revising the manuscript.

Data availability

Questionnaire is available on request.

Corresponding author

Li Mei, Associate Professor of Orthodontics, Discipline of Orthodontics, Department of Oral Sciences, Faculty of Dentistry, University of Otago. 310 Great King Street, Dunedin, 9016, New Zealand
Tel: +64 3 479 7480; Email: li.mei@otago.ac.nz

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