

# Epidemiological survey of different clinical techniques of orthodontic bracket debonding and enamel polishing

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## ABSTRACT

**Objectives:** To conduct an epidemiological survey of the orthodontic debonding techniques in Italy, and describe the most commonly used methods to remove the brackets and adhesive from the tooth surfaces.

**Materials and Methods:** A survey consisting of 6 questions about bracket debonding methods and instruments used was emailed to 1000 orthodontists, who were members of the Italian Orthodontics Society (SIDO). Clinicians were characterized by different sex, age, origin, and professional experience.

**Results:** Overall, 267 surveys were returned, representing a response rate of 26.7% of the participants interviewed. The 0.2% of the orthodontists responded, via email, confirming that they were not interested, while 3% of the questionnaires were sent back not completed. The 70.1% of the clinicians interviewed did not return any response. Overall, 64% of SIDO members (orthodontists) did not detect any enamel damage after debonding. The brackets used most frequently (89.14%) in clinical practice were the metal ones. The most commonly used pliers for bracket removal were cutters (37.08%) and bracket removal pliers (34.83%). For adhesive removal, low speed tungsten carbide burs under irrigation were the most widely utilized method for adhesive removal (40.08%), followed by high speed carbide burs (14.19%), and diamond burs (14.19%). The most frequently used instruments for polishing after debonding were rubber cups (36.70%) and abrasive discs (21.35%). The 31.21% of the orthodontists found esthetic enamel changes before bonding versus after debonding.

**Conclusions:** This survey showed the high variability of different methods for bracket debonding, adhesive removal, and tooth polishing. The collected answers indicate that most orthodontists have developed their own armamentarium of debonding and polishing, basing their method on trials and errors.

**Key words:** Adhesive, bracket, enamel, orthodontic, polishing, survey

## INTRODUCTION

The acid-etch technique and composite bonding of orthodontic brackets to enamel surface had a revolutionary impact on clinical orthodontic treatment. The advantages of direct bonding

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are easy technique, accurate bracket placement, and patient comfort. Although the benefits outweigh the disadvantages, some doubts and concerns remain, principally in returning the enamel surface back to its original condition, after the removal of bonded orthodontic attachments.<sup>[1-3]</sup> In fact, the elimination of the remaining adhesive material following the failure of brackets or debonding procedures is claimed to remove about 50 µm of enamel.<sup>[4]</sup>

The term debonding is commonly used to describe those procedures that include the removal of brackets and adhesive after orthodontic therapy. A correct debonding technique must

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obtain the restoration of the morphology of the enamel surface as before bonding procedures.<sup>[1]</sup> In fact, the detaching forces can lead to enamel fracture and cracking that may occur during bracket debonding particularly with ceramic brackets.<sup>[5]</sup>

Therefore, a correct debonding technique is important to avoid irreversible iatrogenic injuries such as rough surfaces, vertical cracks, pulp necrosis, loss of the external enamel surface, and also the presence of residual adhesive near the adhesion area.<sup>[6]</sup>

The literature describes the various methods of adhesive removal such as high and low speed tungsten carbide burs, adhesive removing pliers, laser application, abrasive discs, fiberglass burs, and ultrasound.<sup>[1,7-9]</sup> For polishing, rubber cups with pumice and water as well as diamond pastes have been reported.<sup>[1,9]</sup> Anyway, no consensus has yet been reached regarding the most efficient and safe technique.<sup>[6]</sup>

For this reason, most clinicians have developed their own armamentarium, basing their methods on trials and errors.

The purpose of this study was to conduct an epidemiological survey of the debonding techniques currently used in Italy and to describe the results in order to assess the most commonly used instruments for the future compilation of clear guidelines.

## MATERIALS AND METHODS

An email was sent to each of the 1000 orthodontists, who were members of the Italian Orthodontics Society (SIDO). The clinicians were characterized by different sex (male or female), age (from young postgraduate to retired), origin (Italian or not Italian), and professional experience (different number of years of orthodontic practice).

Each email was provided with:

- A letter of presentation of the aim of the study
- A survey of 6 questions with the possibility to add personal considerations [Figure 1].

All data were collected and analyzed with the R program (R version 3.1.3, R Development Core Team, R Foundation for Statistical Computing, Wien, Austria). Descriptive statistics was calculated.

## RESULTS

Overall, 267 clinicians (with different sex, age, and professional experience) returned the submitted survey, representing a response rate of 26.7% of the interviewed population. The 0.2% of the orthodontists responded via email that they were not interested, while 3% of the questionnaires were sent back not completed. The 70.1% of the clinicians interviewed did not return any response.

### Percentage of enamel damages

The 64% of the orthodontists did not detect any enamel changes after debonding, whereas the 36% found surface damages, mostly in a percentage lower than 5% of the total amount of the cases treated [Table 1].

### Bracket types used

The brackets used most frequently (89.14%) in the clinical practice were the metal ones [Table 2] followed by ceramic brackets used in combination with metal (5.99%). Among esthetic brackets, ceramic is more common (1.50%) than polycarbonate (0.37%).

### Pliers used

The most commonly used pliers for bracket removal were cutters (37.08%) and bracket removal pliers (34.83%), followed by Weingart (11.24%), and How (7.12%) pliers [Table 3].

Low speed tungsten carbide burs under irrigation are the most widely used method for adhesive removal (40.8%), followed by high speed tungsten carbide (14.20%), and diamond (14.19%) burs [Table 4].

### Figure 1: Survey mailed to 1000 SIDO members of orthodontists. 26.7% of the clinicians returned the submitted survey

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#### Epidemiological survey

1. During your clinical practice have you found any damages in the enamel after debonding? In what percentage?
  - No
  - Yes - Specify approximate percentage: \_\_\_\_\_%
2. What bracket type do you use most frequently in your clinical practice?
  - Metal
  - Ceramics
  - Polycarbonate
3. What kind of plier do you use during bracket removal? \_\_\_\_\_
4. How do you remove residual adhesive from enamel after debonding?
  - Hand instruments (please specify): \_\_\_\_\_
  - Rotating instruments (please specify): \_\_\_\_\_
  - Ultrasound
5. What is your method of polishing the enamel after debonding? (You must specify if single or in combination)
  - Pumice
  - Abrasive discs
  - Rubber cup
  - Prophylaxis paste
  - Other (please specify): \_\_\_\_\_
6. After debonding, have you found any enamel esthetic changes compared with untreated teeth?
  - No
  - Yes

SIDO – Italian Orthodontics Society

**Table 1: Question 1 - Percentage of enamel damages observed**

Percentages of enamel damages detected	Subjects (%)
<5	80 (46.78)
6-10	30 (17.54)
11-20	12 (7.02)
21-30	9 (5.26)
31-40	0 (0)
41-50	0 (0)
51-60	1 (0.58)
61-70	0 (0)
71-80	0 (0)
81-90	0 (0)
91-100	3 (1.75)
Not quantified	36 (21.05)

**Table 2: Question 2 - Percentage of brackets used**

Bracket type used in clinical practice	Subjects (%)
Metal	238 (89.14)
Ceramic	4 (1.50)
Polycarbonate	1 (0.37)
Metal and ceramic	16 (5.99)
Polycarbonate and ceramic	0 (0)
Metal and polycarbonate	4 (1.5)
Metal ceramic and polycarbonate	4 (1.5)

**Table 3: Question 3 - Percentage of pliers used**

Pliers used in clinical practice	Subjects (%)
How	19 (7.12)
Lingual arches pliers	1 (0.37)
Root extraction pliers	1 (0.37)
Mathieu	3 (1.12)
Bracket remover pliers	93 (34.83)
Band remover pliers	10 (3.75)
Cutter	99 (37.08)
Universal pliers	3 (1.12)
Weingart	30 (11.24)
None	8 (3.00)

**Table 4: Question 4 - Instruments for adhesive removal**

Instruments for adhesive removal	Subjects (%)
Arkansas	23 (5.18)
Fiberglass	13 (2.93)
High speed tungsten carbide burs	63 (14.19)
Low speed tungsten carbide burs	181 (40.77)
None	13 (2.93)
Pliers	15 (3.38)
Manual scaler	21 (4.73)
Ultrasound	22 (4.95)
Diamond burs	63 (14.19)
Bistoury	14 (3.15)

### Instruments used for polishing after debonding

As shown in Table 5, the most frequently used instruments for polishing after debonding were rubber cups (36.70%), abrasive discs (21.35%) alone, or in combination of each other (11.60%).

### Percentage of enamel surface changes recorded

After debonding the 31.21% of the orthodontists noticed the esthetic changes of tooth surface if compared with prebonding enamel, whereas 68.79% did not report any esthetic changes (Question 6).

## DISCUSSION

Approximately, one-third (32.17%) of the orthodontists who answered back the survey found the presence of significant (>5%) enamel damage after debonding (white spot lesions were not considered as damages). Campbell<sup>[1]</sup> reported the findings of enamel irregularities after orthodontic treatment also in a previous study among American orthodontic clinicians. The results of the Campbell survey showed that 12% of American orthodontists found damages in the half of the cases. This is in contrast with the present investigation [Table 1] in which 46.78% of the orthodontists reported a damage percentage lower than 5%, and only 0.58% found damages in half of the cases. A possible explanation could be found in the different method of bracket removing devices. In fact, in an American survey, the use of ligature cutters or band splitting pliers is more common than in the questionnaire of Italian orthodontists, and it could represent a possible explanation of the difference between the results. Other authors also reported enamel irregularities such as losses or fractures after debonding.<sup>[2,3,10]</sup>

Moreover, in our study [Table 2], metal brackets have been reported to be the most commonly used appliances in clinical practice (89.14%). Although metal brackets are less esthetic, they can undergo corrosion<sup>[11]</sup> and can release the minimum quantities of chromium<sup>[12]</sup> and nickel,<sup>[13]</sup> these brackets present advantages over ceramic and polycarbonate brackets, such as improved adhesion, easier debonding, and lower friction.<sup>[14,15]</sup>

As shown in Table 3, the most commonly used pliers for bracket debonding were the cutter (37.08%) and bracket removal pliers (34.83%), followed by Weingart (11.24%), and How (7.12%) pliers. The lack of guidelines leaves high variability also in literature. In fact, debonding methods influence enamel damages and various pliers have been suggested to provide proper control during debonding.<sup>[16,17]</sup> Debonding instruments with tensile force, and bracket removing pliers with shear-peel force via squeezing bracket wings can result in bond failure at the bracket adhesive interface with less enamel damages. However, ligature cutter by applying shear force at bracket base, How and Weingart pliers, by applying pressure force at the bracket base, are claimed to lead bond failure at enamel adhesive interface with more enamel damages.<sup>[18]</sup>

Similar variability of the results has also been reported for the method used for adhesive removal from enamel surfaces.<sup>[1,6]</sup> In the present investigation [Table 4], 40.77% of the clinicians use low speed tungsten carbide burs, followed by high speed tungsten carbide burs, (14.90%) and diamond burs (14.90%). A minimal percentage of the orthodontists (2.93%) do not

**Table 5: Question 5 - Percentage of instruments for polishing after debonding**

Instruments used for polishing after debonding	Subjects (%)
Rubber cup	98 (36.70)
Rubber cup and prophylaxis paste	8 (3.00)
Abrasive discs	57 (21.35)
Abrasive discs and rubber cup	31 (11.60)
Abrasive discs, rubber cup, and prophylaxis paste	4 (1.50)
Prophylaxis Paste	4 (1.50)
Pumice	15 (5.62)
Pumice and rubber cup	25 (9.36)
Pumice and abrasive discs	4 (1.50)
Pumice abrasive discs and rubber cup	21 (7.87)

use anything for adhesive removal. In the literature, various methods of adhesive removal have been analyzed under scanning electron microscope, showing the presence of irregularities on the treated enamel. Tungsten carbide burs seem to produce less damage, whereas diamond burs are not recommended.<sup>[19-21]</sup> In fact, when comparing high speed tungsten carbide drill, low speed abrasive disc, adhesive removing plier, ultrasound tip, and low speed fiberglass burs, it has been reported that almost all the adhesive remnant removal methods changed enamel topography and roughness. Abrasive discs have been shown to produce less damage than fibre and carbide low speed burs. Moreover, abrasive discs have been shown to produce fewer scratches also than fiber burs that particular burs are designed to remove cement, stains, and colored coatings from the surface of the enamel. They are claimed to not abrade tooth enamel or ceramic and lightly grind cement, dentin, and filling composites.<sup>[8]</sup>

The highest damages were reported with adhesive removing pliers. Moreover, ultrasound method has been reported to be unsuitable to remove all remnant adhesive,<sup>[6]</sup> thus confirming ultrasonic scalers are the key armamentarium for the gross removal of heavy supragingival calculus in the treatment and prevention of periodontal disease,<sup>[22]</sup> but not useful for postorthodontic residual adhesive removal. Other authors reported that tungsten carbide burs have been reported to be faster and more effective in adhesive removal than abrasive discs, ultrasonic tools, hand instruments, rubbers, or composite burs. Arkansas stones (aluminum oxide stones, specially designed for polishing composite and porcelain), green stones, diamond burs, steel burs, and lasers should not be used for adhesive removal.<sup>[23]</sup>

As shown in Table 5, the most commonly used instruments for polishing after adhesive removal were rubber cups (36.70%), abrasive discs (21.35%) alone, or in combination with rubber cups (11.60%). In the literature, a great variability in polish methods has been recorded.<sup>[6,19]</sup>

Moreover, although most clinicians reported irregularities in the enamel after orthodontic treatment, the present survey showed that only 31.21% of professionals found esthetic differences (enamel cracks or surface scratches) between

the treated and untreated teeth. This is in agreement with Campbell<sup>[1]</sup> who assessed that the enamel irregularities reported can be noticed only under magnification.

One limitation of our investigation was the low response rate. In fact, similar studies presented the same problem. The response rate of the present report was 26.70%, which appears to fall within a range not uncommon for oral hygiene survey researches<sup>[22,24,25]</sup> that have been previously conducted in different geographic areas.

Another limitation of the present study is the choice of bracket debonding, adhesive removal, and tooth polishing procedures that have been included in the survey. In fact, many procedures and instruments are present in the market. Considering that orthodontists largely use the mentioned techniques, scientific knowledge about debonding procedures as well as their biological cost to tooth structure is crucial. As a result, there is a great need for choosing the most correct removal techniques. In fact, literature is still waiting clear guidelines in order to preserve the tooth's original condition after bracket debonding.

## CONCLUSIONS

In the present epidemiological study, the survey showed the high variability of different methods for bracket debonding, adhesive removal, and tooth polishing. The knowledge of the current status could help in future, both researchers and clinicians to draw clear guidelines for debonding procedures.

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## Conflicts of Interest

There are no conflicts of interest.

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