Incidence of Orthodontic Brackets Detachment During Orthodontic Treatment

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KEYWORDS

Fixed appliance, MBT, bond failure, debonded brackets, metal braces.

ABSTRACT

Introduction: For orthodontic treatment with fixed appliances, it is important that the brackets and tubes be accurately positioned and that the bonding failure rate during treatment be minimised. The bracket bonding procedure plays a major role in achieving an optimal outcome during orthodontic corrective procedures, as the required tooth movement relies upon it. Bracket detachment during corrective procedures may also lead to increased treatment duration, damage to tooth enamel, and increased chair-side time due to re-bonding procedure. Consequently, it could also raise the costs of the overall treatment.

Aim: To evaluate the incidence of Orthodontic brackets detachment during Orthodontic treatment.

Materials And Method: Using electronic database 60 patients were evaluated and 1440 MBT metal brackets were included. Duration of the study took place for 6 months at Saveetha dental college and hospitals, Chennai. Bond failure of incisor,canine, premolar and molar tubes were recorded.

Results: The mean age of patients in this study was 18.5. Highest bond failure is observed with molar tubes with a bonding failure in molar of 19.5% followed by premolar brackets with a bonding failure of 7.9%.

Conclusion: From this study it is concluded that highest bonding failure is seen in the posteriors rather than the anteriors. Molar tubes have a higher bonding failure compared to premolar brackets.

1. Introduction

For orthodontic treatment with fixed appliances, it is important that the brackets and tubes be accurately positioned and that the bonding failure rate during treatment be minimised. The bracket bonding procedure plays a major role in achieving an optimal outcome during orthodontic corrective procedures, as the required tooth movement relies upon it. Bracket detachment during corrective procedures may also lead to increased treatment duration, damage to tooth enamel, and increased chair-side time due to re-bonding procedure. (1) Consequently, it could also raise the costs of the overall treatment. Bracket detachment is a major concern during orthodontic treatment with fixed appliances, as it can be tedious and, in some instances, critical in the overall success of the treatment. (2)

Recent advancements in dental materials and bonding techniques have helped to make orthodontic brackets bonding easier, efficient, predictable, and effective. Orthodontic bonding technique has changed significantly since it was first used in 1950s (3). At present, there are direct and indirect bonding techniques used in orthodontic treatment with fixed appliances. (4)

However, both the techniques have advantages and disadvantages in relation to bond failure rates. Although indirect bonding technique has more advantages in terms of shorter initial bonding appointment, higher degree of precision, and more focused results, yet the majority of the orthodontists prefer the direct bonding technique to avoid laboratory involvement. (5)

Many operator and individual factors exist for orthodontic bracket debonding. Operator factors include the type of adhesive, isolation or moisture contamination, curing time and intensity, etching, and the experience of the operator (6). Individual factors include enamel quality, caries and or restorations, oral hygiene and dietary practices, etc. Studies in the past have evaluated the orthodontic bracket debonding concerning various techniques in bonding, patient compliance, age, sex, location of the bracket, treatment place, overbite, bite plane and skeletal class. (7) However, studies on the incidence of the orthodontic bracket debonding and its associated factors were scant. Individual factors such as patient motivation, commitment to the treatment, and type of personality might have a potential role in the treatment outcomes as they are linked with adherence to the treatment instructions (8). Studies have reported that patient motivation, adherence to treatment, and commitment to treatment may present with higher orthodontic bracket debonding and longer treatment times.

Failure to comply may lead to poor treatment outcomes due to Orthodontic bracket debonding. (9) The aim of the study was to evaluate the incidence of bracket debonding in metal preadjusted edgewise brackets in a 6 months follow up period during the course of treatment.

2. Materials and Method

Using electronic database 60 patients were evaluated and 1440 MBT metal brackets were included. Duration of the study took place for 6 months at a college setup. Bond failure of incisor, canine, premolar and molar tubes were recorded.

Inclusion criteria- non- extraction case, spacing of less than 6mm or crowding less than 6mm. Exclusion criteria- Fluorosis, white spot lesion, buccal filling, prosthetic crown. Methodology- 0.022 metal MBT brackets and molar tubes were bonded with Orthofix adhesive. Bond failure was recorded. Days of bond failure was identified as the date of detachment was observed by the operator. Statistical analysis- chi square test was used to compare the bracket failure rate in different tooth.

3. Results

Table 1: Descriptive Statistics

Factor	Mean and SD
Age	18.5 +/-6
Male	34
Female	26

Table 2: Number and Percentage of Failed Brackets

Tooth	Bonded	Failed	Failed %
Incisor	480	35	7.2
Canine	240	6	2.5
Premolar	480	38	7.9
Molar	240	47	19.5
Total	1440	126	8.7

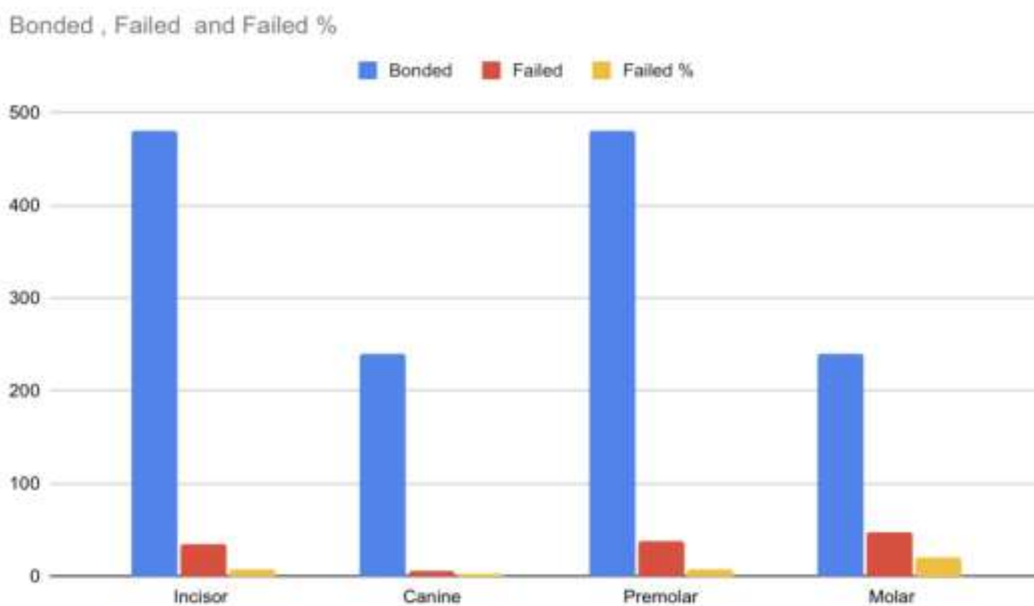

Figure 1: Number and Percentage of Failed Brackets

From this study it seen that highest bond failure is observed with molar tubes with a bonding failure of 19.5% followed by premolar brackets with a bonding failure of 7.9%

4. Discussion

Our study showed that highest bond failure is observed with molar tubes with a bonding failure of 19.5% followed by premolar brackets with a bonding failure of 7.9%. A previous study done in 2017 reported bonding failure between 10.6% and 13.8% for molar tubes. A minimum observation period of 6 months for bracket failure was chosen as it was reported that 82% of bracket failures occur during that period. (10)

Another study showed that regarding the total number of bracket failures per patient, 81 patients had no bracket failure during treatment, while 45 had one, 34 had two, 11 had three, 13 had four, and 13 had five or more bracket failures. The average failure rate per patient was 4.8%, and per bracket (when looking at the totality of brackets) was 4.4%, i.e., approximately 1 in 23 brackets failed. (11)

The finding that bonded tubes failed more often than brackets on premolars, canines, and incisors is in concordance with a previous study, it was reported that there was no significant difference in bond failure between the first and second molar. (12)

These authors concluded that the mean survival time for brackets in incisors was statistically higher than the failure rates of canines and premolar brackets. The higher bond failure rate for first and second molar tubes can be related to the difficulty of avoiding contamination, manipulation of the tube during bonding, and higher forces of mastication in the molar region. (13)

Several studies have investigated the incidence of bracket bond failure in orthodontic treatment. One study showed that, regarding the total number of bracket failures per patient, 81 patients had no bracket failure during treatment, while 45 had one, 34 had two, 11 had three, 13 had four, and 13 had five or more bracket failures. The average failure rate per patient was 4.8%, and the overall bracket failure rate was approximately 4.4%, meaning roughly 1 in 23 brackets failed (12). Compared to our findings, where molar tubes exhibited a significantly higher failure rate, the difference could be attributed to the type of adhesive used and the technique employed during bonding.

The finding that bonded tubes failed more frequently than brackets on premolars, canines, and incisors is consistent with a previous study, which reported no significant difference in bond failure between the first and second molars (13). These authors concluded that the mean survival time for brackets on incisors was statistically higher than that for canines and premolars. The higher bond failure rate for first and second molar tubes can be related to the difficulty in avoiding contamination, manipulation of the tube during bonding, and higher masticatory forces in the molar region (14).

Bond failure can be influenced by various operator-dependent and patient-related factors. Operator-dependent factors include the type of adhesive, isolation or moisture contamination, curing time and intensity, etching, and the experience of the clinician (15). Moisture contamination remains a significant challenge in molar regions due to the proximity to the parotid glands and increased salivary flow, making proper isolation critical to prevent bond failure (16). Additionally, the quality of adhesive application and the technique used during bracket placement can impact bond longevity (17).

Patient-related factors such as oral hygiene, dietary habits, enamel quality, and occlusal forces also contribute to bond failure. Patients with poor oral hygiene and a high-carbohydrate diet may experience higher rates of adhesive breakdown and bond failure (18). Bruxism and heavy occlusal forces exert additional stress on bonded brackets and molar tubes, increasing the risk of failure (19).

The clinical implications of bond failure are significant, as they can prolong treatment duration, increase chair-side time, and raise overall treatment costs. Multiple re-bonding procedures can lead to enamel damage due to repeated etching and adhesive removal (20). Additionally, frequent bracket failures may impact patient compliance and satisfaction with treatment. Studies have shown that patients who experience multiple bracket debonding events often exhibit frustration and decreased motivation to adhere to treatment guidelines (21).

Recent advancements in bonding techniques and materials have aimed to reduce bond failure rates. The introduction of self-etching primers, resin-modified glass ionomer cements, and light-cured adhesives has improved bond strength and reduced technique sensitivity (22). Laser-etched bracket bases have been shown to enhance mechanical retention and improve bonding efficacy compared to traditional mesh bases (23). Additionally, nanotechnology-based adhesives with enhanced mechanical properties and antibacterial effects are currently being explored to further improve bond durability (24).

To minimize bond failures, clinicians should adopt several preventive strategies, including meticulous isolation techniques, proper enamel conditioning, and optimal adhesive selection. Using rubber dam isolation or cheek retractors can help minimize moisture contamination in the posterior region (25). Additionally, increasing curing time and intensity for adhesive polymerization in molar regions can improve bond strength (26). Patients should be educated on dietary modifications and oral hygiene practices to reduce adhesive breakdown and enhance overall bracket retention (27).

The present study has some limitations. The sample size was relatively small, and the study was conducted in a single institutional setting, only MBT prescription metal brackets were taken into consideration which may limit the generalizability of the findings. Additionally, the study did not account for variations in bonding technique among different operators, which could influence bond failure rates. Future studies should investigate the impact of different adhesive systems, operator experience, and patient-specific factors on bond longevity. Additionally, a longer follow-up period may provide more comprehensive data on long-term bracket survival rates.

5. Conclusion

Our study confirms that the highest bond failure occurs in the posterior region, particularly with molar tubes, which exhibit a significantly higher failure rate than premolar brackets. Operator-dependent and patient-related factors contribute to bond failure, highlighting the need for improved bonding techniques, adhesive materials, and patient compliance strategies to minimize treatment interruptions and ensure successful orthodontic outcomes. From this study it is concluded that highest bonding failure is seen in the posteriors rather than the anterior. Molar tubes have a higher bonding failure compared to premolar brackets.

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Conflict of Interest:

The authors would like to declare no conflict of interest in the present study.

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