

Incidence Of Accidental Bracket Debonding During Fixed Orthodontic Treatment: A Systematic Review

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ABSTRACT

Aim: To assess the most commonly encountered accidental debonding of brackets in maxillary and mandibular arches in fixed orthodontic treatment.

Materials and methods: We conducted a thorough search, both electronically and manually and we were able to gather a total of 252 articles pertaining to our topic. To ensure the accuracy and relevance of our analysis, we meticulously removed any duplicates and reviewed each article based on specific inclusion and exclusion criteria. From this extensive process, we were able to analyze a final selection of 40 articles for this analysis.

Result: After analyzing 40 studies, it has been conclusively determined that the second premolar had significantly higher debonding incidences. The bracket debonding was disproportionately common in both genders and more in mandibular arch rather than maxillary arch. Debonding was more common in younger individuals than adults.

Conclusion: Orthodontic brackets play a major role in fixed orthodontic treatment. Accidental debonding of brackets were more significant in second premolar, more common among the mandibular arch and younger age patients.

Keywords: Bracket failure, Accidental bracket failure, Frequency bracket failure, Bracket detachment, Debonded brackets.

MAIN TEXT SYSTEMATIC REVIEW

Introduction

A beautiful smile at the end of orthodontic treatment is a main goal for each patient, but patients are also

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concerned about their appearances while receiving treatment. Good aesthetics and optimal technical performance are characteristics of an ideal orthodontic appliance. Reports of enamel fracture and cracking during debonding have raised concerns regarding the safety of the different processes employed to remove these attachments, despite the fact that the tensile strength of ceramic is greater than stainless steel, but less energy is utilized to create ceramic bracket fracture as compared to standard stainless steel brackets [1].

Bond failure is one of the unavoidable issues with fixed orthodontics. One of the primary causes of recurrent emergencies is bracket debonding. Bonding failure increases chairside time and treatment time and reduces effectiveness and causes the risk of enamel damage [2]. Each bracket that needs to be rebonded after failing, can lengthen the course of treatment by roughly 0.6 months, according to the findings of the Stasinopoulos et al [3].

Brackets are bonded to the teeth and arch wires and other auxiliaries are used to apply forces in fixed appliance orthodontics. In 1928, The edgewise brackets were introduced by Edward Angle. Prior to Buonocore's introduction of acid etching in 1955 these brackets were conventionally welded to orthodontic bands which were subsequently cemented to the teeth. This allowed for the direct attachment of brackets to the teeth. Later, brackets bonded with composite resin on treated enamel surfaces were first proposed by Newman et al [4].

Studies conducted on restorative dentistry have revealed that using self-etching primers (SEPs) results in a less precise enamel etching pattern than using the traditional acid-etching method [5]. The results obtained from conventional enamel acid-etching were similar to the bond strength established for SEPS [6] and no clear correlation was found between a particular bond strength and etching pattern [7]. Although Arnold and Combe [8] observed no statistically significant difference in shear bond strength between traditional acid-etching and SEPs, they did find that SEPs had a higher shear bond strength than conventional etching [9].

A number of factors pertaining to patients and operators impact how frequently bonds fail. Factors pertaining to the patient include age, treatment compliance, oral hygiene, mandible or maxilla, jaw, anterior or posterior teeth, overbite, overjet, and any pre-existing dentine or enamel deficiencies [10]. Bracket failure rate can be influenced by operator-related factors such as etching pattern, concentration of etchant, primer type, bracket material, type of resin, kind of curing lamps, curing duration, and bleaching technique used before orthodontic treatment [10].

Studies have been done to assess which tooth has maximum amount of bracket debonding in patients undergoing fixed orthodontic treatment in various malocclusions. This systematic review signifies the accidental bracket debonding prevalent in maxillary or mandibular arches during fixed orthodontic treatment. This study evaluates and quantify accidental bracket debonding happening during fixed orthodontic therapy.

Methodology:

SOURCES AND SEARCH ENGINES:

In order to ensure a comprehensive search, we employed a combination of manual and electronic methods. Our search engines are comprised of reputable platforms such as Google scholar, PUBMED, Science direct, and Wiley. We did not impose any limitations on the demographic characteristics of the subjects. To optimize our search, we utilized a range of relevant keywords, including bracket failure, accidental bracket failure, frequency bracket failure, bracket detachment, debonded Brackets.

CRITERIA OF SELECTION OF ARTICLES

INCLUSION CRITERIA

All the following requirements were satisfied by the included articles:

1. Studies published in english between 1978 to 2023.
2. Studies evaluating the incidence of accidental bracket debonding during fixed orthodontic treatment.
3. Studies including extraction and non extraction cases
4. Studies including only fixed orthodontic treatment
5. Studies evaluating MBT bracket system.
6. Studies investigated accidental debonding due to occlusion.

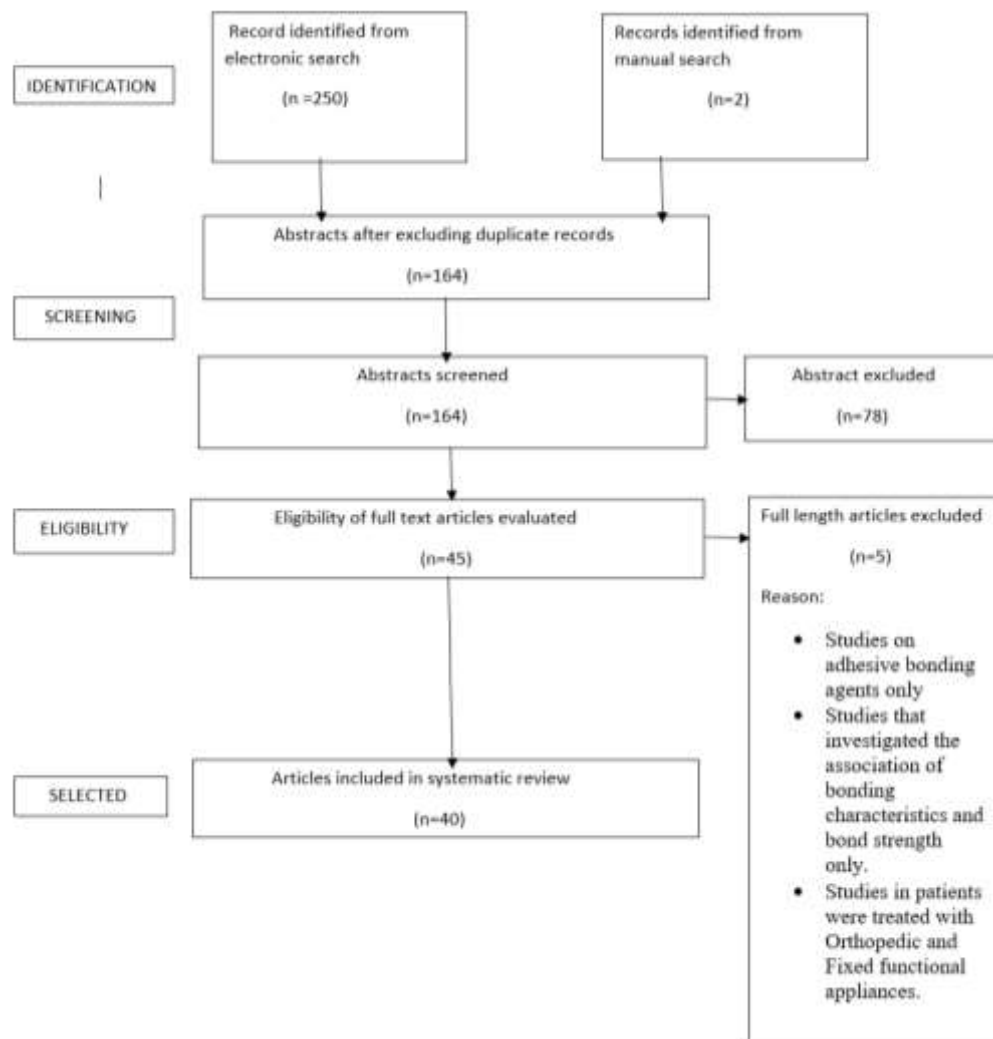
EXCLUSION CRITERIA

1. Studies with a low level of evidence, but not limited to the study: review articles studies with questionnaires.
2. Studies that investigated the association of bonding characteristics and bond strength only.
3. Studies on adhesive bonding agents only.

4. Studies investigating any bracket systems except MBT bracket prescription
5. Studies in patients were treated with orthopedic and fixed functional appliances.

Results:

We identified a total of 250 studies using electronic search methods and an additional 2 studies were manually identified. The flow chart 1 below gives a clear view of the selection and exclusion procedure for analysis. Out of the grand total, a mere 40 studies fulfilled the inclusion criteria in the systematic review. Based on thorough analysis of data from 40 carefully chosen studies, it has been determined that second premolar teeth had significantly higher debonding incidences. The bracket debonding was disproportionately common in both genders and more common in mandibular arch rather than maxillary arch.



FLOWCHAT 1- Prisma flow diagram

Discussion:

When beginning orthodontic treatment for a patient who primarily has issues with mastication or facial esthetics, bracket placement is crucial. It is a critical concern because it can lead to treatment delays and additional costs. Debonding is a frequently seen phenomena that happens when the brackets separate from the tooth surface within the patient's mouth for a number of reasons, such as biting on sticky foods, chewing hard objects, developing parafunctional habits, and leading an incorrect lifestyle [10]. A study conducted by M. J. A. AL- Duliamey et al in 2018 concluded that adolescent patients (those under the age of 18) accounted for about 58.3% of the bracket failure when age was taken into account. An increased rate of failure among younger people may be caused by a number of factors, including trauma, habits, and thick gingival biotype [10].

The posterior teeth, particularly the lower second premolars, were the site of the majority of bracket failures

(61%). These findings are consistent with other research where S. N. Papageorgiou et al found that lower second premolars and posterior teeth have higher bracket failure rates [11-13]. Compared to the anterior brackets (incisors and canines), the posterior bracket (premolars) had a failure rate that was twice as high. Mavropoulos et al.'s comparative clinical research [14] found that failure of the posterior bracket was three times more frequent than that of the anterior bracket.

Some findings were in line with previous research in relation to the upper and lower jaws' failure rate where Khan H, Mheissen S et al [15] concluded that compared to the maxillary dental arch, the mandibular dental arch had a greater incidence of bracket failure rate. This may be because of the impact of the cusps on the upper teeth, the greater influence of masticatory forces in the lower arch, and poor bonding as a result of insufficient moisture control [15]. According to earlier studies the skeleton relationship had no discernible impact on bond failure rates. Zivko-Babic et al. reported similar results, showing that the second premolar region was the most often afflicted area where the debonding occurred [16]. The difference was statistically significant in the number of bracket failures reported in deep biting cases compared to average or open bite instances. In their epidemiologic survey, Atashi and Shahamfar [17] reported similar findings biting blocks can reduce the likelihood of bond failure in deep biting situations, as the majority of bracket failures were observed on lower premolars.

Whittacker DK. et al [18] suggested that etiology behind debonding of second premolar region is due to a number of factors, including insufficient moisture control, problems accessing the buccal surface of teeth, the existence of aprismatic enamel and premature occlusal interactions. Using a 60-second etch time, Zachrisson's [19] and Newman's [20] discovered that posterior teeth experienced a higher bond failure than anterior teeth, as well as lower teeth compared to upper teeth. The latter phenomena were explained by their finding that occlusal forces were more pronounced in the lower jaw.

It's also possible that there was inadequate moisture control during the mandibular arch bonding process, which would have compromised the durability of those connections. Rognvald A. Linklater et al study in 2003, reported that morphological difference between maxillary and mandibular teeth can also be a possibility [21]. The inability to maintain a dry field (gingival fluid and saliva) posteriorly the varied morphology of buccal grooves that weaken bond strength due to different rates of polymerization shrinkage or thermal expansion and inadequate bracket adaptation to the tooth surface due to attrition by malocclusion are additional factors that contribute to bracket bond failure on posterior teeth [22].

Conclusion:

According to the systematic study, second premolar teeth showed noticeably greater occurrences of unintentional bracket debonding. This debonding was more commonly seen in patients in lower age groups. Debonding was more common in the mandibular arch. Orthodontists can be little more careful and take precautions in treating young patients and while bonding mandibular arch. Debonding cannot entirely be eliminated, but it can be minimized in future treatments.

Conflict of interest:

This article does not include any conflicts of interest.

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