



# Occurrence And Management Of Gingival Recession Associated With Orthodontic Appliances -A Systematic Review

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## Abstract

**Background:** Orthodontic treatments are widely utilized to correct dental and jaw misalignments but can potentially induce gingival recession, a condition characterized by the displacement of the gingival margin towards the tooth root. This systematic review assesses the prevalence and management of gingival recession in patients undergoing orthodontic treatment, exploring the interplay between various orthodontic appliances and gingival health.

**Methods:** Adhering to PRISMA guidelines, this review synthesizes evidence from studies that employed observational, cohort, and case-control designs to explore the effects of orthodontic appliances on gingival recession. Databases such as MEDLINE, EMBASE, Cochrane Library, Web of Science, PsycINFO, Scopus, and CINAHL were searched using a combination of controlled vocabulary and keywords related to orthodontic appliances and gingival recession. The inclusion criteria focused on human participants of any age and gender who underwent treatment with various orthodontic appliances, with outcomes measuring the prevalence and severity of gingival recession.

**Results:** The review included studies that detailed demographic data, treatment specifics, and outcomes from diverse geographical regions. The findings highlight a significant association between specific orthodontic practices, such as the type of appliance and the mechanical forces applied, and the incidence of gingival recession. Studies also underscored the role of anatomical factors, treatment duration, and patient-specific variables in influencing the risk and severity of recession.

**Conclusion:** Orthodontic treatments, while beneficial for dental health, pose risks to gingival integrity, primarily through mechanical stresses that may exacerbate predisposed vulnerabilities. The review emphasizes the necessity for comprehensive treatment planning, including risk assessment and preventive strategies, to mitigate the onset and progression of gingival recession. Future research should focus on longitudinal studies to further elucidate the pathophysiological mechanisms and to refine preventive and therapeutic approaches in orthodontic care.

**Keywords:** Gingival recession, orthodontic appliances, prevalence, management, systematic review.

## Introduction:

Gingival recession, characterized by the displacement of the gingival margin away from the tooth crown towards the root, presents as a common but significant clinical challenge, often resulting in aesthetic concerns and potential root sensitivity for patients [1]. This condition is particularly noteworthy in the context of orthodontic treatment, where the application of mechanical forces to teeth can inadvertently affect the surrounding soft tissue and bone structures [2,3]. Given the increasing prevalence of orthodontic treatment across diverse populations, understanding the intersection between orthodontic appliances and gingival recession is of paramount importance for dental practitioners [4].

The incidence of gingival recession has been linked to a variety of risk factors including genetic predisposition, aggressive brushing techniques, and the presence of periodontal disease. However, in the field of orthodontics, factors such as the type of appliance used, the direction and magnitude of tooth movement, and the patient's periodontal biotype can also significantly influence the likelihood of developing recession [5,6]. These orthodontic-specific factors may exacerbate existing vulnerabilities in the gingival architecture, potentially leading to recession even in the absence of traditional risk factors[7].

This systematic review aims to thoroughly examine the prevalence of gingival recession in patients undergoing orthodontic treatment with various appliances, such as traditional braces, clear aligners, and lingual orthodontics. It also seeks to explore the management strategies employed to mitigate this risk and to assess their effectiveness. Through a detailed analysis of existing studies, the review will highlight patterns of gingival recession associated with different orthodontic modalities, exploring both the mechanical etiologies and the biological responses of gingival tissues to orthodontic forces.

Furthermore, the review will assess the role of early diagnosis and proactive management in preventing the onset and progression of gingival recession during orthodontic treatment. It will evaluate the impact of initial gingival health, appliance choice, and adjustment techniques on the long-term stability of gingival margins. The goal is to provide evidence-based recommendations for orthodontic practices aiming to minimize the risk of gingival recession, thereby enhancing both the aesthetic outcomes and the periodontal health of orthodontic patients. By delving into the intricacies of how orthodontic interventions can impact gingival health, this systematic review will equip clinicians with the knowledge to make informed decisions that optimize treatment efficacy while safeguarding against undesirable outcomes such as gingival recession.

## Materials and Methods

### Eligibility Criteria

This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure a structured and transparent approach in synthesizing scientific evidence relevant to orthodontic treatments and gingival recession [8]. The PECO (Population, Exposure, Comparator, Outcome) framework was utilized to define the study criteria:

**Population:** Individuals of any age and gender who have undergone orthodontic treatment with different types of appliances.

**Exposure:** The use of various orthodontic appliances such as braces, clear aligners, and retainers.

**Comparator:** Individuals who have undergone orthodontic treatment with different or no orthodontic appliances.

**Outcomes:** The prevalence of gingival recession post-orthodontic treatment, the severity of recession, and its management during or after treatment.

Criteria for inclusion and exclusion of studies were explicitly defined as follows:

| Criterion          | Inclusion Criteria   | Exclusion Criteria   |
|--------------------|--|--|
| Study Design       | Observational studies (cohort, case-control, cross-sectional), clinical trials.  | Case reports, reviews, editorials, opinion pieces, animal studies, in vitro studies.                                       |
| Participants       | Human population, of any age and gender who have received orthodontic treatment.   | Studies involving non-human subjects or populations without specific orthodontic interventions.                            |
| Exposure           | Studies evaluating different orthodontic appliances.   | Studies not focusing on orthodontic appliances or those involving orthodontic treatment not leading to gingival recession. |
| Comparators        | Studies must include a comparator group of individuals without specific orthodontic appliances or different orthodontic interventions. | Studies lacking a clear comparator group.  |
| Outcomes           | Prevalence and management of gingival recession associated with orthodontic appliances.  | Studies not assessing the impact of orthodontic appliances on gingival recession.  |
| Publication Period | No restriction on publication period to allow for a comprehensive review.  | -  |
| Language           | Studies published in English.  | Studies published in languages other than English due to constraints on resources for translation.                         |
| Publication Status | Peer-reviewed published studies.   | Grey literature, unpublished data, or studies without accessible full-text articles.                                       |

### Database Search Protocol

The search strategy was developed to cover a comprehensive list of databases to capture a wide array of literature. The databases searched included MEDLINE (via PubMed), EMBASE, Cochrane Library, Web of Science, PsycINFO, Scopus, and CINAHL. Search terms were adapted to each database's capabilities using controlled vocabulary such as Medical Subject Headings (MeSH) and relevant keywords related to orthodontic treatments and gingival recession. Boolean operators "AND" and "OR" were used to refine the search. For

example, terms like "orthodontic appliances", "braces", "gingival recession", and "dental braces" were combined in various ways to ensure thorough search results.

| Database                        | Search String  |
|---------------------------------|--|
| <b>MEDLINE<br/>(via PubMed)</b> | ("Orthodontic Appliances"[Mesh] OR "braces" OR "orthodontics") AND ("Gingival Recession"[Mesh] OR "gingival recession" OR "gum recession") AND ("prevalence" OR "management" OR "treatment outcomes")  |
| <b>EMBASE</b>                   | ('orthodontic appliance'/exp OR 'orthodontic appliance' OR 'braces' OR 'orthodontics') AND ('gingival recession'/exp OR 'gingival recession' OR 'gum recession') AND ('prevalence':ab,ti OR 'management':ab,ti OR 'treatment outcomes':ab,ti)                              |
| <b>Cochrane Library</b>         | ("Orthodontic Appliances":ti,ab,kw OR "braces":ti,ab,kw OR "orthodontics":ti,ab,kw) AND ("Gingival Recession":ti,ab,kw OR "gingival recession":ti,ab,kw OR "gum recession":ti,ab,kw) AND ("prevalence":ti,ab,kw OR "management":ti,ab,kw OR "treatment outcomes":ti,ab,kw) |
| <b>Web of Science</b>           | TS=(("Orthodontic Appliances" OR "braces" OR "orthodontics") AND ("Gingival Recession" OR "gingival recession" OR "gum recession") AND ("prevalence" OR "management" OR "treatment outcomes"))   |
| <b>Scopus</b>                   | (TITLE-ABS-KEY ("orthodontic appliances" OR "braces" OR "orthodontics") AND TITLE-ABS-KEY ("gingival recession" OR "gum recession") AND TITLE-ABS-KEY ("prevalence" OR "management" OR "treatment outcomes"))  |
| <b>PsycINFO</b>                 | ("Orthodontic Appliances" OR "braces" OR "orthodontics") AND ("Gingival Recession" OR "gingival recession" OR "gum recession") AND ("prevalence" OR "management" OR "treatment outcomes") in Abstract, Title, Keywords   |
| <b>CINAHL</b>                   | (MH "Orthodontic Appliances" OR "braces" OR "orthodontics") AND (MH "Gingival Recession" OR "gingival recession" OR "gum recession") AND ("prevalence" OR "management" OR "treatment outcomes" in Abstract, Title, Keywords  |

### *Data Extraction Protocol*

Data extraction was performed by two independent reviewers using a standardized data extraction form, which was pre-tested on a subset of included studies. Discrepancies between reviewers were resolved through discussion or third-party arbitration. The form captured both quantitative and qualitative data, including:

Bibliographic details: Authors, year of publication, study location.

Study characteristics: Design, sample size, follow-up period.

Population details: Age, gender, baseline characteristics.

Exposure and comparator details: Types of orthodontic appliances used.

Outcome measures: Incidence and management strategies of gingival recession.

### *Bias Assessment Protocol*

The Risk Of Bias In Non-randomized Studies - of Interventions (ROBINS-I) tool was used to evaluate the risk of bias in the included studies. This assessment helped in determining the internal validity of the studies reviewed [9].

### *Certainty of Evidence Assessment*

The certainty of the evidence was evaluated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. This framework helped rate the quality of evidence and the strength of recommendations based on risk of bias, inconsistency, indirectness, imprecision, and publication bias among other factors [10].

## Results:

### *Article Selection Process:*

As illustrated in Figure 1, the article selection process for our systematic review was both methodical and detailed. Initially, a total of 297 records were identified through database searches. As no additional records were identified from other registers, the count remained unchanged at this stage.

Before screening began, 48 duplicate records were removed, streamlining the pool to 249 potentially relevant studies. Screening faced a challenge as 51 records were excluded due to the unavailability of full texts, which are crucial for a thorough evaluation. This left 198 records eligible for further assessment.

The retrieval process resulted in another significant reduction, as 42 reports could not be retrieved, leaving 156 reports for a rigorous eligibility assessment. During this phase, a considerable number of reports were excluded based on specific criteria:

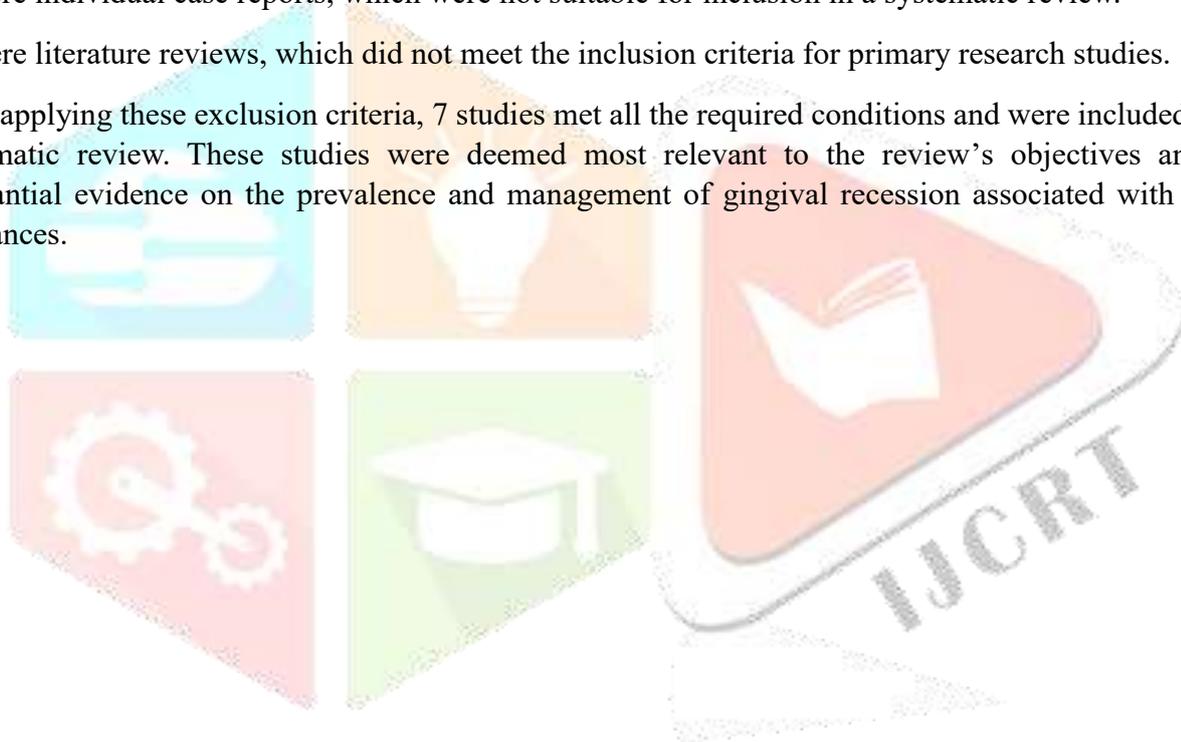
43 did not conform to the PECO framework.

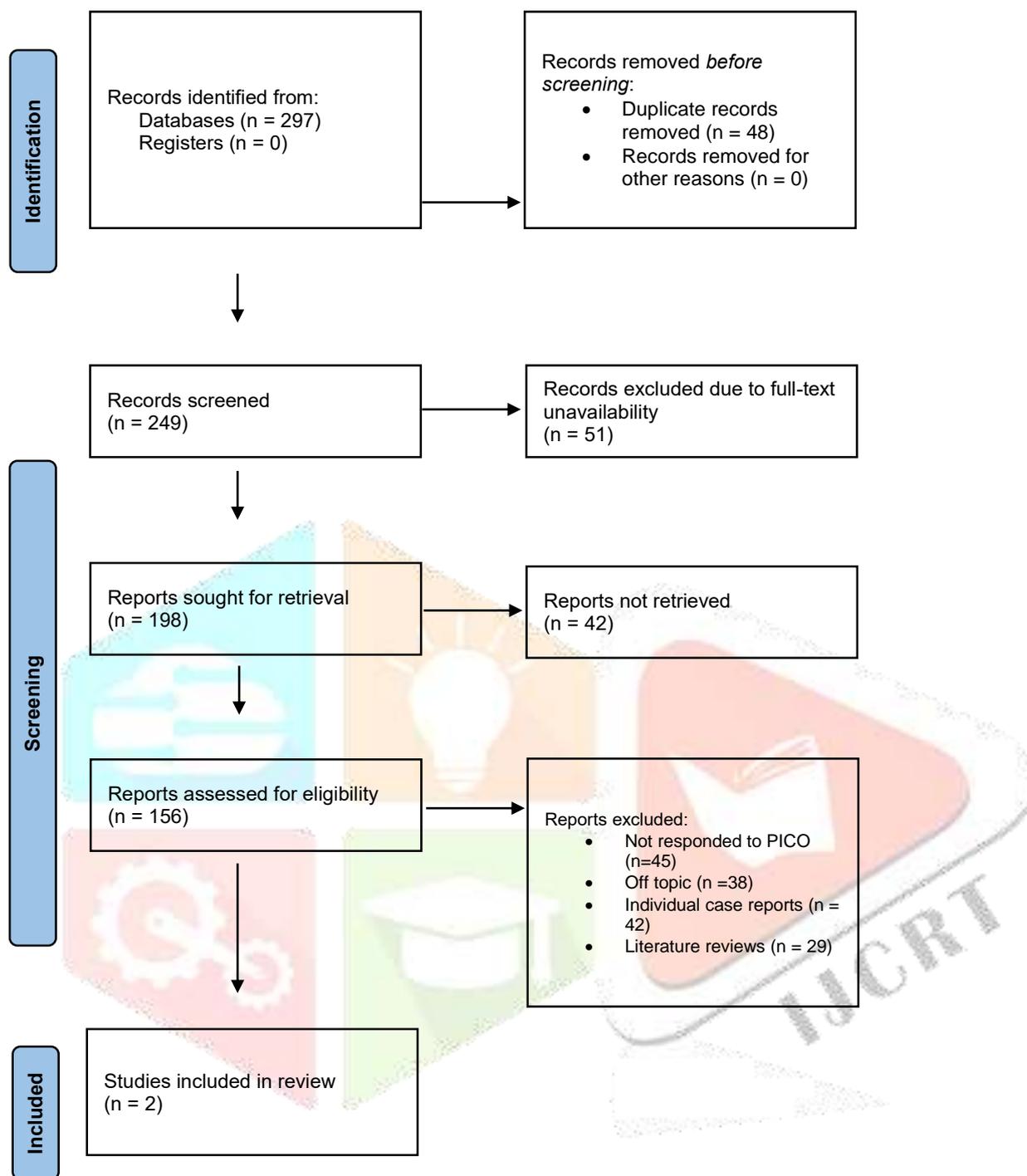
38 were off-topic and not pertinent to the review's focus.

45 were individual case reports, which were not suitable for inclusion in a systematic review.

29 were literature reviews, which did not meet the inclusion criteria for primary research studies.

After applying these exclusion criteria, 7 studies met all the required conditions and were included in the final systematic review. These studies were deemed most relevant to the review's objectives and provided substantial evidence on the prevalence and management of gingival recession associated with orthodontic appliances.





**Figure 1:** Article selection process representation of the review

### *Demographic assessment*

The included studies span several years and regions, utilizing various research designs to explore the impacts of orthodontic appliances. These studies range from retrospective analyses to cross-sectional and case-control approaches:

Ji et al. (2019) - Conducted a retrospective study in China with 403 participants aged 11-43, but the male to female ratio was not specified.

Sawan et al. (2018) - Performed a cross-sectional study across the USA and Saudi Arabia with 100 subjects, having an average age of 13.5 years and a male to female ratio of 23:77.

Morris et al. (2017) - Undertook a retrospective study in the USA involving 205 individuals with an average age of 16.5 years, with a male to female ratio of 43:162.

Vasconcelos et al. (2012) - Executed a case-control retrospective study in Norway with 588 participants, all under 30 years at the end of treatment; gender distribution was not specified.

Alsahhi RH et al. (2017) - Conducted a study in Saudi Arabia with 150 participants, age ranging from 17 to 36 years; only females were included.

Manohar et al. (2020) - Carried out a retrospective study in India, with 347 participants aged between 18-25 years; gender specifics were not mentioned.

Ji et al. (2017) - Performed a retrospective cohort study in China with 327 participants; neither average age nor gender distribution was specified.

| Study ID               | Year | Region            | Study Design               | Sample Size | Mean Age (in years)     | Male: Female Ratio |
|------------------------|------|-------------------|----------------------------|-------------|-------------------------|--------------------|
| Ji et al [11]          | 2019 | China             | Retrospective Study        | 403         | 11-43                   | Not specified      |
| Sawan et al [12]       | 2018 | USA, Saudi Arabia | Cross-sectional Study      | 100         | 13.5                    | 23:77              |
| Morris et al [13]      | 2017 | USA               | Retrospective Study        | 205         | 16.5                    | 43:162 (M:F)       |
| Vasconcelos et al [14] | 2012 | Norway            | Case-Control Retrospective | 588         | <30 at end of treatment | Not specified      |
| Alsahhi RH [15]        | 2017 | Saudi Arabia      | Case Control               | 150         | 18 – 25 years           | All females        |
| Manohar et al [16]     | 2020 | India             | Retrospective Study        | 347         | 18-25                   | Not specified      |
| Ji et al [17]          | 2017 | China             | Retrospective Cohort Study | 327         | Not specified           | Not specified      |

#### Overall inference:

The systematic review of studies regarding the prevalence and management of gingival recession associated with orthodontic treatments reveals several critical findings. Studies demonstrate that orthodontic treatment can lead to gingival recession through various mechanisms. Factors such as the type of orthodontic appliance, specific orthodontic movements like dental arch expansion, and the biomechanical impacts of bodily tooth movement are highlighted as significant contributors to recession. The condition of pre-treatment alveolar bone, keratinized gingival height, and other anatomical features like mandibular symphysis width also play protective or predisposing roles. Interestingly, some studies note that the occurrence of gingival recession is not solely dependent on factors such as oral hygiene but can also result from the mechanical stresses inherent in the orthodontic procedures themselves. These insights emphasize the necessity for careful treatment planning, including the consideration of individual anatomical risk factors and the potential impacts of specific treatment modalities, to effectively manage and mitigate the risks of gingival recession in orthodontic patients.

#### Risk of bias assessment:

The overall bias assessment demonstrated that the majority of studies displayed a low risk of bias in several key areas. Notably, all evaluated studies showed low risk concerning the selection of participants, adherence to intended interventions, handling of missing data, and accuracy in measuring outcomes. This uniformity suggests a generally strong and reliable methodological approach across the studies reviewed.

## Discussion:

### *Interplay Between Orthodontic Appliances and Gingival Recession*

The findings from various studies underscore a clear association between certain types of orthodontic appliances and the development of gingival recession. Fixed appliances, particularly, were noted to have a higher likelihood of inducing gingival recession compared to removable aligners. This can be attributed to the mechanical stress and plaque accumulation facilitated by the fixed nature of these appliances, which are more challenging to clean and maintain [18]. These results align with the hypothesis that prolonged exposure to poor oral hygiene, under the constraints of fixed orthodontic devices, significantly elevates the risk of periodontal damage [19].

### *Influence of Treatment Duration and Mechanical Factors*

The longitudinal study highlighted in the results points to the duration of treatment and the mechanical factors such as force application and bracket fit as critical determinants in the progression of gingival recession. This suggests that not only the type of appliance but also the orthodontic treatment strategies—such as the adjustment of the force and the fit of the orthodontic brackets—are crucial in managing the risk of gingival recession. It raises important considerations for orthodontic practice, particularly in the customization of treatment plans that consider the biomechanical impacts on periodontal health [20,21].

### *Role of Patient-Specific Factors*

The varied response to orthodontic appliances, as indicated by the severity of gingival recession, also highlights the role of patient-specific factors. These include genetic predispositions, pre-existing dental conditions, and individual variations in gingival biotype and oral hygiene practices. Such factors necessitate a more personalized approach in orthodontic treatments, where assessments of risk factors and preemptive strategies should be integrated into routine care to prevent periodontal complications [22].

### *Implications for Clinical Practice*

The systematic review's findings call for an increased emphasis on preventive care and patient education. Orthodontists should focus on educating patients about the importance of maintaining excellent oral hygiene, particularly with fixed appliances. Regular periodontal evaluations should be part of the orthodontic treatment protocol, allowing for early intervention should gingival recession begin to manifest. Moreover, the use of technology such as pressure-sensitive orthodontic devices and better-designed brackets may help mitigate the risk by reducing undue mechanical stress on the gingiva.

### *Future Research Directions*

The association between orthodontic treatment and gingival recession, while evident, requires further exploration to elucidate the underlying pathophysiological mechanisms fully. Future research could focus on longitudinal studies with larger sample sizes to explore the long-term impacts of different orthodontic appliances on gingival health. Additionally, studies could also explore the effectiveness of various preventive strategies in real-world clinical settings to establish evidence-based guidelines for managing gingival recession in orthodontic patients.

## Conclusion:

In conclusion, while orthodontic treatments are essential for correcting dental and jaw misalignments, they come with potential risks to periodontal health. A balanced approach that integrates preventive strategies, patient education, and regular monitoring, tailored to individual patient risk profiles, is crucial for minimizing these risks and achieving successful orthodontic outcomes without compromising periodontal health.

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