Title: Prevalence of gingival recession in university students: a systematic review

Article type: Systematic review

Running Title: Gingival recession among university students

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Abstract

Purpose: This systematic review aims to comprehensively assess the prevalence, extent, severity, and distribution of gingival recession (GR) among university students. Recognizing that GR represents a significant periodontal concern with aesthetic and functional consequences, this review focuses on a young demographic that is underrepresented in epidemiological surveys.

Materials and Methods: Following the PRISMA guidelines and a pre-registered protocol, a structured search strategy was designed and executed across PubMed, Web of Science, Cochrane, and EBSCO databases, targeting studies published over the last 20 years. Eligibility was defined using the PICO framework: Population: university students; Intervention/Exposure: presence of GR; Comparison: absence of GR; Outcome: prevalence rates. The Joanna Briggs Institute (JBI) critical appraisal checklists were used to assess methodological quality and risk of bias across various study designs, including cross-sectional, cohort, case-control, and randomized controlled trials.

Results: Out of 299 initially identified articles, nine met the inclusion criteria, encompassing a total of 1,619 participants. The design of the included studies revealed considerable heterogeneity in sampling, measurement methods, and reported prevalence, which ranged widely from 29.4% to 82.6%. Risk factors linked to GR included age, gender, oral hygiene practices, brushing technique and force, occlusal interferences, and anatomical factors.

Conclusion: This systematic review demonstrates a high prevalence of gingival recession among university students, underscoring the importance of targeted preventive strategies and educational interventions in this population. Future well-designed longitudinal studies are needed to clarify causality and inform tailored prevention programs.

Keywords: *gingival recession, systematic review, prevalence, university students, PRISMA design*

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Türkçe öz: *Üniversite Öğrencilerinde Dişeti Çekilmesi Prevalansı. Amaç: Bu sistematik derleme, üniversite öğrencileri arasında dişeti çekilmesi (DÇ) prevalansını, yaygınlığını, şiddetini ve dağılımını kapsamlı bir şekilde değerlendirmeyi amaçlamaktadır. DÇ, estetik ve fonksiyonel sonuçlarıyla önemli bir periodontal sorun olup, epidemiyolojik çalışmalarda yeterince temsil edilmeyen genç bir yaş grubuna odaklanılmıştır. Gereç ve Yöntem: PRISMA kılavuzlarına uygun olarak önceden planlanan bir protokole göre, son 20 yılda yayımlanan çalışmalar PubMed, Web of Science, Cochrane ve EBSCO veri tabanlarında sistematik bir arama stratejisi ile taranmıştır. Uygunluk kriterleri PICO çerçevesine göre belirlenmiştir: Popülasyon—üniversite öğrencileri; Müdahale/Maruziyet—DÇ varlığı; Karşılaştırma—DÇ olmayan öğrenciler; Sonuç—prevalans oranları olarak tanımlanmıştır. Çalışmaların metodolojik kalitesi ve yanlılık riski, çalışma tasarımına uygun Joanna Briggs Institute (JBI) kontrol listeleri ile değerlendirilmiştir (kesitsel, kohort, olgu-kontrol ve randomize kontrollü çalışmalar). Bulgular: Başlangıçta belirlenen 299 makaleden dokuzu dahil edilme kriterlerini karşılamış ve toplam 1.619 katılımcıyı kapsamıştır. Dahil edilen çalışmaların tasarımı, örnekleme, ölçüm yöntemleri ve bildirilen prevalans oranları açısından önemli farklılıklar göstermektedir ve prevalans %29,4 ile %82,6 arasında değişmektedir. Yaş, cinsiyet, ağız hijyeni alışkanlıkları, fırçalama tekniği ve basıncı, oklüzal interferanslar ve anatomik faktörler DÇ ile ilişkilendirilen risk unsurları olarak öne çıkmaktadır. Sonuç: Bu sistematik derleme, üniversite öğrencileri arasında yüksek oranda dişeti çekilmesi görüldüğünü göstermektedir. Bu durum, bu yaş grubunda hedefe yönelik koruyucu stratejiler ve eğitici müdahalelerin önemini vurgulamaktadır. Nedenselliği netleştirmek ve uygun koruyucu programları şekillendirmek için iyi tasarlanmış ileriye dönük çalışmalara ihtiyaç vardır. Anahtar Kelimeler: dişeti çekilmesi, sistematik derleme, prevalans, üniversite öğrencileri, PRISMA tasarımı*

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Introduction

Periodontal health is a crucial aspect of overall oral well-being, and any compromise to the integrity of the gingival tissues can have profound implications for an individual's oral health. Such conditions may also raise concerns about smile aesthetics due to their social impact. Gingival recession (GR) is defined as the apical displacement of the gingival margin from the cementoenamel junction (CEJ), resulting in root surface exposure (1,2). In affected individuals, GR is often considered aesthetically undesirable and may contribute to increased sensitivity and pain, raising the risk of root caries due to greater dental plaque accumulation (2–5). This condition can be localized or generalized, affecting one or more tooth surfaces depending on the presence of periodontal disease (2,6).

There are various ways to classify GR, but the classification proposed by Cairo *et al.* (7) is the most widely used today. This system divides recessions into type 1 (RT1), type 2 (RT2), and type 3 (RT3). RT1 describes recessions with no interproximal attachment loss and has the best prognosis. RT2 involves interproximal attachment loss that is less than or equal to the buccal attachment loss. RT3 describes cases where the interproximal attachment loss is greater than the buccal attachment loss and typically has the worst prognosis (7).

The etiology of gingival recession is considered multifactorial, with several contributing factors (2,4,8–10). Anatomical factors are regarded as predisposing elements and include fenestration and dehiscence of the alveolar bone, gingival biotype, tooth shape, abnormal tooth position within the arch, aberrant eruption pathways, and frenulum insertion near the cervical gingiva. These factors can result in a thinner than normal alveolar bone plate, making the tissue more susceptible to resorption.

Triggering factors, such as inflammation caused by bacterial biofilm accumulation, play a significant role in the development of GR. Additionally, traumatic toothbrushing and the type of toothbrush used are often linked to the onset and progression of localized non-inflammatory GR. Other aggravating factors include non-carious cervical lesions—such as abrasion, abfraction, erosion, attrition, and resorption—along with the use of oral piercings, occlusal trauma, tobacco use, and physiological factors like orthodontic therapy or surgical procedures.

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Several studies have investigated the prevalence of GR in adults, but the findings are inconsistent. Reported prevalence rates range from 15% in a Swiss sample, to 58% in a large study of 9,689 adults in the USA, to 84.65% in France, and up to 99.75% in a rural area of Brazil (3,9). Smaller cross-sectional studies focusing on young students have reported lower prevalence rates, such as 29.4% in Poland (11) and 39% in Italy (9), while higher rates have been observed in Chile (68.4%) (4) and Bologna (82.6%) (12).

In children and young adults, gingival recession is often linked to gingivitis, whereas in older adults it is strongly associated with periodontal disease (10). Therefore, GR frequently leads to dental visits, and it is essential to identify its causes and determine appropriate treatments, as this condition affects a significant portion of young populations (8).

The protocol for this systematic review was developed in accordance with the PRISMA-P (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols) guidelines. The target population of this study is university students. The exposure of interest is the presence of gingival recession compared to students without this condition, with the primary outcome being the prevalence of GR in this population.

Materials and methods

Ethical Statement

This project was reviewed and approved by the Institutional Review Board of the Instituto Universitário de Ciências da Saúde (CE/IUCS/CESPU-23/23).

Study Protocol

The protocol for this systematic review was developed in accordance with the PRISMA-P (Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols) guidelines. The eligibility criteria were structured using the PICO framework as follows: P (Population): University students, I (Intervention / Exposure): Presence of gingival recession, C (Comparison): Students without gingival recession, O (Outcome): Prevalence of gingival

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recession among university students. This review aims to answer the following question: What is the prevalence of gingival recession among university students?

Research strategy

A comprehensive search was conducted in the Web of Science, Cochrane, PubMed, and EBSCO databases for all relevant literature published in the last 20 years. The following MeSH terms were used: [(gingival recession) AND (student) OR (gingival recession) AND (student) AND (prevalence) OR (gingival recession) AND (student) AND (epidemiology)].

Eligibility criteria

Inclusion criteria: Studies published in English, Spanish, or Portuguese that investigated the prevalence of gingival recession in university students. Exclusion criteria: Studies involving animals, non-university populations, studies lacking clear outcome measures, ongoing studies, or review articles not written in English, Spanish, or Portuguese.

Study selection and data collection

Articles were screened based on the eligibility criteria, beginning with a review of the title and abstract. Full texts of potentially relevant articles were then assessed to determine whether they met the inclusion criteria. Relevant data from each included study were extracted and organized in a results table, detailing the study design, objectives, study population (including sample size and mean age or age range), and findings.

Risk of bias in included studies

The methodological quality and risk of bias for each study were assessed according to the Joanna Briggs Institute (JBI) 2017 guidelines for the respective study design (six cross-sectional studies, one case-control study, one cohort study, and one randomized controlled trial). A standardized checklist with response options (Yes, No, Unclear, or Not Applicable) was used for each study type. Intra- and inter-examiner reliability were verified by two independent reviewers.

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Results

Database search

A total of 299 records were initially identified through database searches. After removing 102 duplicates, 197 articles remained for abstract screening, of which 126 were excluded. The full texts of the remaining 71 articles were then reviewed in detail. Following the application of the inclusion and exclusion criteria, 49 studies were deemed potentially eligible. However, 40 of these were excluded due to differences in study population, resulting in a final inclusion of 9 studies. Figure 1 illustrates the detailed article selection process.

Characterization of the sample for the quality of the study

The quality assessments are presented in Table 1 for cross-sectional studies, Table 2 for case-control studies, Table 3 for randomized controlled trials, and Table 4 for cohort studies. Overall, the methodological quality of the included studies, based on the appraisal criteria and the number of positive responses, is generally high for four studies (4,5,8,13). However, three studies (9,14,15) were rated as providing moderate evidence, while two studies (12,16) were considered to be of lower quality.

Characteristics of the included studies

We collected data on the general characteristics of all eligible studies included in this systematic review, such as the study population (including sample size and average age), study design, objectives, and results Table 5)).

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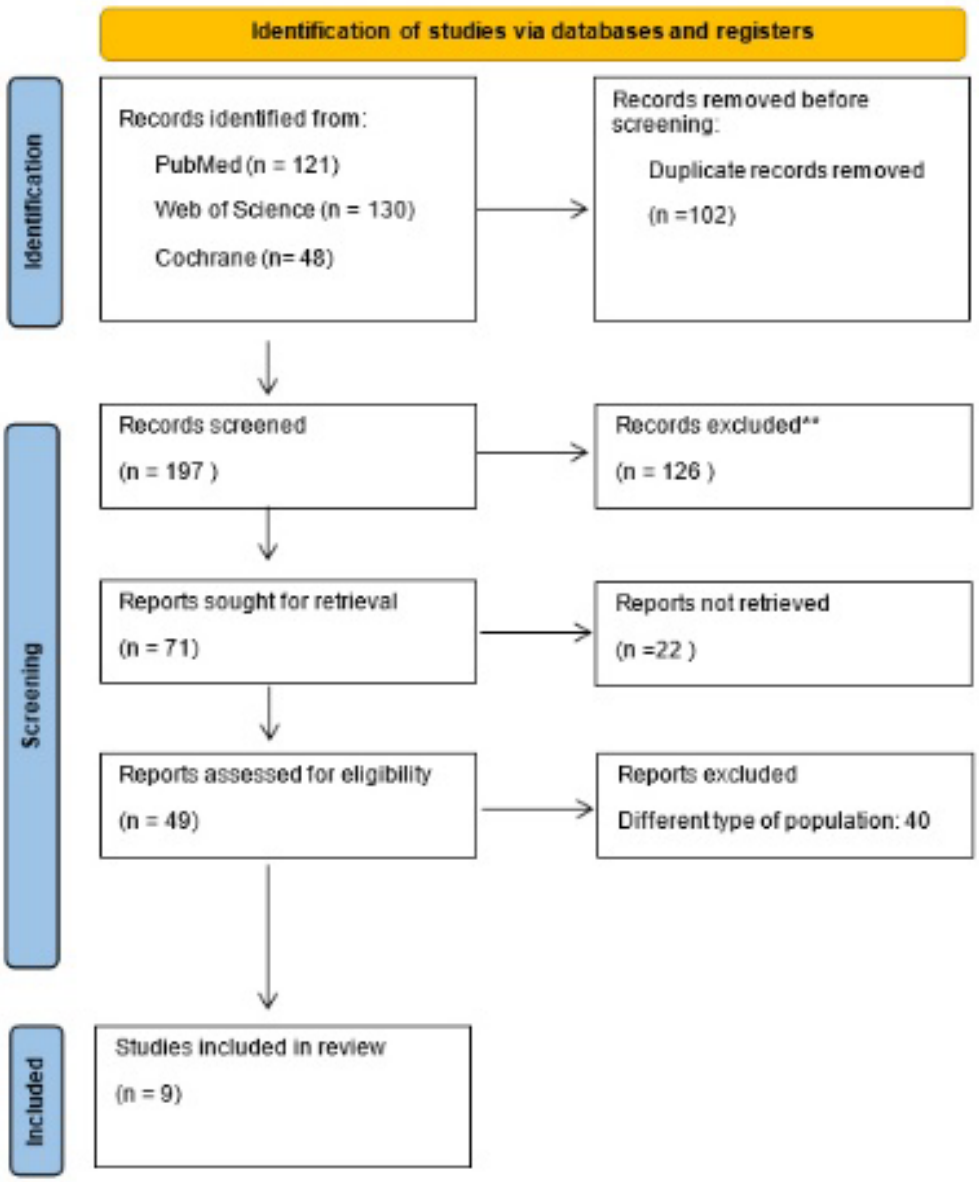


Figure 1. *Flow diagram of study selection process.*

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Table 1. *Joanna Briggs Institute critical appraisal checklist for analytical cross-sectional studies.*

Joanna Briggs Institute Critical Appraisal Checklist for Analytical Cross-Sectional Studies.	**1. Were the Criteria for Inclusion in the Sample Clearly Defined?**	**2. Were the Study Subjects and the Setting Described in Detail?**	**3. Was the Exposure Measured in a Valid and Reliable Way?**	**4. Were Objective, Standard Criteria Used for Measurement of the Condition?**	**5. Were Confounding Factors Identified?**	**6. Were Strategies to Deal with Confounding Factors Stated?**	**7. Were the Outcomes Measured in a Valid and Reliable Way?**	**8. Was Appropriate Statistical Analysis Used?**
Krishna Prasad *et al.* (16) *2013*	N	N	UN	Y	N	N	UN	UN
Souza *et al.* (8)*2019*	Y	Y	Y	Y	Y	Y	Y	Y
Amaro-Rivera *et al.*(4), *2020*	Y	Y	Y	Y	Y	Y	Y	Y
Vignoletti *et al.*(9) *2020*	N	UN	Y	Y	Y	Y	Y	Y
Domenico *et al.* (14), *2022*	N	Y	Y	Y	Y	UN	Y	Y
Kozłowska *et al.* (12), *2005*	N	UN	UN	Y	UN	UN	UN	Y

Table 2. *Joanna Briggs Institute critical appraisal checklist for case control studies.*

Joanna Briggs Institute Critical Appraisal Checklist for Case Control Studies.	**1. Were the Groups Comparable other than the Presence of Disease in Cases or the Absence of Disease in Controls?**	**2. Were Cases and Controls Matched Appropriately?**	**3. Were the Same Criteria Used for Identification of Cases and Controls?**	**4. Was Exposure Measured in a Standard, Valid, and Reliable Way?**	**5. Was Exposure Measured in the Same Way for Cases and Controls?**	**6.Were Confounding Factors Identified?**	**7.Were Strategies to Deal with Confounding Factors Stated?**	**8. Were Outcomes Assessed in a Standard, Valid, and Reliable Way for Cases and Controls?**	**9. Was the Exposure Period of Interest Long Enough to be Meaningful?**	**10. Was Appropriate Statistical Analysis Used?**
Gürbüz *et al.* (5), *2023*	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

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Table 3. *Joanna Briggs Institute critical appraisal checklist for randomized controlled trials.*

Joanna Briggs Institute Critical Appraisal Checklist for Randomized Controlled Trials.	1. Was True Randomization Used for Assignment of Participants to Treatment Groups?	2. Was Allocation to Treatment Groups Concealed?	3. Were Treatment Groups Similar at the Baseline?	4. Were Participants Blind to Treatment Assignment?	5. Were Those Delivering Treatment Blind to Treatment Assignment?	6. Were Outcomes Assessors Blind to Treatment Assignment?	7. Were Treatment Groups Treated Identically Other than the Intervention of Interest?	8. Was Follow up Complete and If Not, Were Differences between Groups in Terms of Their Follow up Adequately Described and Analyzed?	9. Were Participants Analyzed in the Groups to Which They Were Randomized?	10. Were Outcomes Measured in the Same Way for Treatment Groups?	11. Were Outcomes Measured in a Reliable Way?	12. Was Appropriate Statistical Analysis Used?	13. Was the Trial Design Appropriate, and any Deviations from the Standard RCT Design (Individual Randomization, Parallel Groups) Accounted for in the Conduct and Analysis of the Trial?
Cifcibasi et al. (15), 2014	Y	Y	Y	UN	Y	Y	Y	N	N	Y	UN	Y	Y

Table 4. *Joanna Briggs Institute critical appraisal checklist for cohort studies.*

Joanna Briggs Institute Critical Appraisal Checklist for Cohort Studies.	1. Were the Two Groups Similar and Recruited from the Same Population?	2. Were the Exposures Measured Similarly to Assign People to both Exposed and Unexposed Groups?	3. Was the Exposure Measured in a Valid and Reliable Way?	4. Were Confounding Factors Identified?	5. Were Strategies to Deal with Confounding Factors Stated?	6. Were the Groups/Participants Free of the Outcome at the Start of the Study (or at the Moment of Exposure)?	7. Were the Outcomes Measured in a Valid and Reliable Way?	8. Was the Follow up Time Reported and Sufficient to Be Long Enough for Outcomes to Occur?	9. Was Follow up Complete, and If Not, Were the Reasons to Loss to Follow up Described and Explored?	10. Were Strategies to Address Incomplete Follow up Utilized?	11. Was Appropriate Statistical Analysis Used?
Daprile *et al.*(13) *2007*	Y	Y	UN	Y	UN	Y	Y	Y	Y	UN	Y

Table 5. *The main characteristics of the included studies.*

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Author, Year of Publication	Title	Population	Type of study	Aim of the study	Conclusions	Results
Daprile *et al.* (13)2007	The Evolution of Buccal Gingival Recessions in a Student Population: A 5-Year Follow-Up	10 males and 13 females, ranging in age from 23 to 25 years	Cohort	follow up on the evolution of gingival recession at buccal tooth surfaces in a student population attending the fifth year at Bologna University Dental School who had been examined in a study 5 years earlier.	The percentage of affected sites increased with the level of oral hygiene education, and this increase developed despite a reduction in the Frequency of dangerous toothbrushing habits.	The number of subjects with at least one recession and the total number of recessions had increased significantly. Comparing data from the baseline and the present study, no significant differences were observed for toothbrush type and frequency of toothbrushing, whereas the use of correct brushing techniques increased to 87% of the subjects.
Krishna Prasad *et al.* (16), 2013	The Influence of Occlusal Trauma on Gingival Recession and Gingival Clefts	50 subjects showing gingival recession and 10 subjects showing gingival clefts were obtained.	Cross-sectional	Investigate the centric occlusal contact pattern in maximum intercuspation and to study the nature of occlusal contacts during maximum intercuspation to protrusive, lateroprotrusive and lateral excursive movements.	Occlusal interferences in maximum intercuspation and eccentric movements in one form or the other and absence of mutually protected occlusion can contribute to gingival lesions such as gingival recession and clefts.	Among the three occlusal concepts, gingival recession was more commonly related to group function than to canine protected occlusion. Canine protected occlusion was associated with gingival recession on the labial surface while in group function occlusion; the recession was distributed equally on the facial surface of the anterior as well as posterior teeth. Nearly all subjects showed interferences in protrusive, lateroprotrusive and lateral excursive movements on teeth showing gingival recession and gingival clefts. Occlusal wear was seen on all teeth having gingival clefts and, on most teeth, having gingival recession
Cifcibasi *et al.* (15) 2014	Comparison of manual toothbrushes with different bristle designs in terms of cleaning	A total of 40 healthy dental students (25 females and 15 males;	Rrandomized controlled trial	compare the efficacy of plaque control and potential effects on gingival recession of the toothbrushes with	Bristle design has little impact on plaque removal capacity of a toothbrush. Both designs are safe enough to prevent	Plaque scores were reduced significantly at 6 months compared to baseline in both groups ($P < 0.05$ and $P < 0.005$ in criss-cross and

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Author, Year of Publication	Title	Population	Type of study	Aim of the study	Conclusions	Results
	efficacy and potential role on gingival recession	age range: 21–25 years		angled and straight bristles.	GR as long as soft bristle material is used.	standard design brushes, respectively). Mean GI scores of the criss-cross design were reduced significantly at 6 months ($P < 0.05$). Inter-group comparisons revealed that gingival recession (GR) values were not statistically significant ($P > 0.05$) at baseline, 3 and 6 months suggesting no pronounced impact of bristle design in terms of GR (VR = 0.596, HR = 0.572; VR = 0.884, HR = 0.572; VR = 0.884, HR = 0.572 in the groups)
Souza *et al.* (8) 2019	Prevalence of Gingival Recession in Dental Students from the Federal University of Juiz de Fora – Brazil	A total of 80 dental students (450 students enrolled) from the Federal University of Juiz de Fora, Brazil, randomly selected 18 and 35 years,	Cross sectional	Evaluate the prevalence of gingival recession and dentine hypersensitivity of dental students of Federal University of Juiz de Fora, Brazil	62.5 % of the students had at least one gingival recession. Lower premolars were the most affected by the recession, followed by upper premolars and lower incisors. Gingival recessions were more frequent on the buccal surface, with measures more prevalent between 1 and 2 mm and almost all classified as Miller Class I. Dental hypersensitivity was observed in 28 students, with a higher frequency of mild intensity.	Fifty students had at least one gingival recession and dentine hypersensitivity was observed in 28 students. Buccal surface was the most prevalent (86.6 %), with measures mostly between 1 and 2 mm (92 %) and classified as Class I Miller (96.25 %
Amaro-Rivera *et al.* (4) 2020	Prevalence and risk indicators of gingival recessions in school senior students in the city of Valdivia in 2018.	310 students 53.5% were women and 46.2% were men	Cross sectional	Determine the prevalence of gingival recessions and identify risk indicators in school senior students in the city of Valdivia in 2018.	There is a high prevalence of gingival recessions in the population studied. Students in public establishments have a higher prevalence of recessions and a lower frequency of tooth brushing.	310 students were examined. The prevalence found of at least one gingival recession was 68.4%. Miller's Class I was present in 97.7%. The jaw presented a higher prevalence of gingival recessions with 64.8% and the lower premolars

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Author, Year of Publication	Title	Population	Type of study	Aim of the study	Conclusions	Results
						were the most affected teeth with 47.7%.
Vignoletti *et al.* (9), 2020	Prevalence and risk indicators of gingival recessions in an Italian school of dentistry and dental hygiene: a cross-sectional study	264 students attending dentistry and dental hygiene school.	cross-sectional study	(i) determine the prevalence, extent, severity, and distribution of gingival recessions and patient perception in a young population and (ii) to identify potential risk indicators.	There is a low prevalence of buccal gingival recessions in this sample of Italian students. More than 50% of the sample was aware of the problem. Almost all patients presenting symptomatology or aesthetic concern requested appropriate therapy.	The prevalence of gingival recessions at patient and tooth level was 39% and 5.2%, respectively. The only factor associated with the presence of GR was age. On the other hand, age and smoking were associated with the extent, whereas BOP, NCCLs and KT were associated with the severity. Out of 98 subjects presenting at least one GR, 63 (64%) were conscious of the presence of the GR. NCCLs were also strongly associated with the perception of the recession by the patient.
Domenico *et al.* (14), 2022	Prevalence and Periodontal Conditions of Developmental Grooves in an Italian School of Dentistry and Dental Hygiene: A Cross-Sectional Study	Two hundred and fifty-one students with a mean age of 22.9 ± 4.7, attending the School of Dentistry and Dental Hygiene of Vita-Salute San Raffaele University	cross-sectional study	(i) determine the prevalence and distribution of developmental grooves in a young population and (ii) to evaluate the local periodontal conditions.	The presence of radicular grooves increases the possibility of developing gingival inflammation by acting as a plaque retentive factor.	The prevalence of radicular grooves at patient and tooth level was 15.9% and 5%, respectively. When compared to control sites, the number of teeth with a radicular groove that presented plaque and bleeding on probing was higher. The logistic regression analysis showed that the presence of radicular grooves was significantly associated with the presence of plaque (OR, 6.14, $p <$ 0.001) and of bleeding on probing (OR, 2.91, $p = 0.01$).
Gürbüz *et al.* (5), 2023	Evaluation of mid-buccal gingival recessions and occlusal interferences	149 students (18–25 years; 55 male, 36.9%; 94 female, 63.1%)	case–control study	Evaluate the relationships be-tween the presence, extent and severity of mbGRs to dental	Increase in the occlusal interferences in premolars/molars during lateral and anterior guidance	The mean of the number of teeth with mbGR(s) per subject was 4.3. The mean of the overall extent of teeth with

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Author, Year of Publication	Title	Population	Type of study	Aim of the study	Conclusions	Results
		attend- ing the Dental Faculty		malocclusions, occlusal interferences in anterior (AG) and lateral guidance (LG) and to determine the potential risk indicators in a young population.	may have an effect on the presence and severity of mbGR. Further studies should be designed to confirm these findings.	mbGR(s) was 14.2%. FMBS, decreased KTW, self-reported bruxism, group function occlusion, increased contact number of all teeth and only premolars/molars in AG or LG and Class III malocclusions were significantly associated with the presence of mbGR. Decreased KTW presenting mbGR in the mandible and non-carious cervical lesion adjunct to mbGR significantly increased the odds of the severity of mbGR. Group function occlusion revealed higher mbGRs in premolar/molars than canine guided occlusion.

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Author, Year of Publication	Title	Population	Type of study	Aim of the study	Conclusions	Results
Kozłowska *et al.* (12), 2005	The oral cavity hygiene as the basic element of the gingival recession prophylaxis	455 students of The Den- tistry Department and The Medical Department of The Medical University of Białystok. The age of the subjects ranged from 18 to 32 years.	Cross-sectional	Evaluation of the dental plaque and the influence of determined hygienic factors on gingival recession occurrence in 455 students of The Medical University of Bialystok	The increase in the gingival recession in students is con- nected with large pressure on the brush while toothbrushing, too frequent brushing and toothbrush change, the use of hard toothbrush and additional hygienic items, movements while brushing, the age (the number of recession elevates with the age), and sex (women showed more recession than men).	The dental plaque was not present in 71 people. Gingi- val recession was revealed in 134 out of 455 subjects. The majority of medical students brushed their teeth twice a day, using medium hard toothbrush or electric toothbrush with appropriate movements and medium strength while brushing.

Legend: GR- Gingival Recession; GI- Gingival Index; VR- Vertical Recession; HR- Horizontal Recession; BOP- Bleeding On Probing; NCCLS- Non Carious Cervical Lesions; KT- Keratinized Tissue; OR- Odds Ratio; mbGR- Mid-Bucal Gingival Recession; AG- Anterior Guidance; LG- Lateral Guidance; FMBS- Full Mouth Bleeding Score; KTW- Keratinized Tissue Width

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Discussion

Gingival recession, defined as the downward movement of the gingival margin leading to root surface exposure, is a prevalent oral health concern with implications for both aesthetics and periodontal health. While numerous studies have investigated its prevalence in various populations, there remains a lack of research specifically focused on its occurrence among university students.

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Understanding the prevalence, extent, severity, distribution, and related risk or predisposing factors in this demographic is essential for informing targeted oral health interventions and promoting effective prevention strategies. In this review, we aim to synthesize the available evidence regarding the prevalence of gingival recession among university students and discuss its implications for oral health promotion in this population. Our review identified a total of nine studies that met the inclusion criteria.

Prevalence

The lowest prevalence was reported in a cross-sectional study by Kozłowska *et al.* (12), which assessed the impact of specific hygiene factors on the development of gingival recession and dental plaque in 455 students at the Medical University of Białystok (aged 18–32 years). They found a prevalence of 29.4%, similar to the 39% reported by Vignoletti *et al.* (9) in a comparable study involving 251 students aged 19–50 years from the School of Dentistry and Dental Hygiene in Milan. Their study aimed to assess the prevalence, extent, severity, distribution, and patient perception of gingival recession, as well as to identify potential risk factors.

This relatively low prevalence contrasts with findings from other studies. For example, De Souza *et al.* (8) reported that at least one site of gingival recession was present in 62.5% of a sample of 80 dental students at a Brazilian university (aged 18–35 years). Similarly, Amaro-Rivera *et al.* (4) found a prevalence of 68.4% in a sample of 310 students from Valdivia (aged 16–21 years).

The highest rates were reported by Daprile *et al.* (13), who followed the progression of gingival recession in dental students at Bologna University Dental School over five years. They

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found a baseline prevalence of 47.8%, which increased to 82.6% after five years. This trend is consistent with Gürbüz *et al.* (5), who reported 47% prevalence of mid-buccal gingival recession in 149 dental students at Gazi University. Their longitudinal data also suggest a strong correlation between improved oral hygiene training and an increase in detected recessions among dental students. Minor differences between studies may be attributed to variations in the age range of participants and sample sizes.

Extent and severity

Another important aspect reported in the studies is the severity of recession at both the patient and site levels (9,12). De Souza *et al.* (8) reported that 96.25% of sites were classified as Miller Class I, with only 0.1% as Class II and none as Class III. These results are consistent with Amaro-Rivera *et al.* (4), who found similar distributions (97.7% Class I, 1.4% Class II, 0.9% Class III).

Severe recession depths (>4 mm) were found in only 1% of individuals assessed by Vignoletti *et al.* (9), while 14% presented with 3 mm depths and half of the sample (50%) had shallow recessions of about 1 mm. Consistently, Gürbüz *et al.* (5) reported similar patterns, with 61.4% of sites at 1 mm and 5.6% at 3 mm; no sites with 4 mm recessions were found in their sample. These findings likely reflect the younger age of the study populations.

Distribution

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Most studies reported a higher prevalence of gingival recession in the lower jaw. Amaro-Rivera *et al.* (4) observed the highest frequency at the lower premolars (47.7%), a pattern also seen by De Souza *et al.* (8), who found 37.35% at the same sites. These results align with findings from Kozłowska *et al.* (12) and Daprile *et al.* (13).

In contrast, Gürbüz *et al.* (5) found a higher prevalence on the mandibular canines and incisors (62%). Moreover, Vignoletti *et al.* (9) reported higher prevalence in the maxilla (60%), with the first premolars being the most affected. Regarding the most affected surface, the buccal surface was consistently the most reported in studies by Kozłowska *et al.* (12) and De Souza *et al.* (8). Variations in hygiene habits or anatomical differences may explain these discrepancies.

Perception

The perception of gingival recession was investigated by Vignoletti *et al.* (9) using a patient questionnaire. They found that 36% of subjects were unaware of the condition, while 64% recognized it. Of those aware, 24% were concerned about aesthetics, 16% reported air sensitivity, and 11% reported both. Of the 63 patients who noticed the condition, only 24 sought treatment. Similarly, De Souza *et al.* (8) found that 28% of students reported air sensitivity, with mild pain being most common.

Risk indicators

Age has frequently been analyzed as a potential risk factor. Vignoletti *et al.* (9) and Kozłowska *et al.* (12) found a significant correlation between age and GR prevalence, whereas Cifcibasi *et al.* (15), who compared different toothbrush designs, found no such correlation. Sex was another factor noted in multiple studies. Kozłowska *et al.* (12) reported a higher incidence of GR among women (34.74%) than men, which contrasts with Gürbüz *et al.* (5), who found a significant association between male gender and the extent or presence of gingival recession. Smoking was considered only by Vignoletti *et al.* (9), who noted it as a potential factor contributing to increased recession, though few smokers were included in the other studies.

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Full-mouth bleeding score (FMBS) was examined by Gürbüz *et al.* (5), who found that it increased both the presence and extent of GR, similar to Vignoletti *et al.* (9), who observed a link between bleeding on probing (BOP) and severity. Both studies also concluded that non-carious cervical lesions (NCCLs) and low keratinized tissue width (KTW) strongly influence the severity or presence of recession.

Brushing technique and habits can also have a significant impact on GR. Kozłowska *et al.* (12) found that brushing pressure, technique, toothbrush hardness, and frequency of brush replacement were all significantly associated with an increased number of recessions. Gürbüz *et al.* (5) found that poor brushing frequency increased the extent of lesions, with infrequent brushing increasing the likelihood of mid-buccal gingival recessions (mbGR) by 7.5 times. Amaro-Rivera *et al.* (4) reported that 89.18% of participants who brushed once a day or less, and had low interproximal hygiene habits, showed signs of GR; notably, 40.3% were unaware of their toothbrush hardness. Cifcibasi *et al.* (15) compared criss-cross and flat-trim bristle designs, concluding that brush design had little effect on GR but that the criss-cross bristles were slightly more effective at reducing inflammation.

Occlusal factors also play a role. Krishna Prasad *et al.* (16) examined the influence of occlusal trauma on GR and gingival clefts in 60 dental students, finding that clefts were more frequent in the maxillary posterior region. Occlusal interferences—such as protrusive, mediotrusive, and laterotrusive contacts—were linked to GR, particularly in subjects with group function occlusion and without mutually protected occlusion. *Gürbüz et al.* (5) confirmed similar correlations between occlusal interferences and mbGR in molars and premolars. Di Domenico *et al.* (14) investigated developmental grooves, concluding that radicular grooves retain plaque six times more and double the likelihood of inflammation, acting as significant risk factors for recession development.

Socioeconomic factors were addressed by Amaro-Rivera *et al.* (4), who found that students attending public institutions had a higher prevalence of GR, likely due to reduced access to education and professional care.

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Finally, the influence of knowledge and training was demonstrated by Daprile *et al.* (13), whose five-year follow-up of dental students showed that improved oral hygiene education (e.g., increased use of the Bass technique) correlated with a rise in GR prevalence from 47.8% to 82.6%, suggesting that greater awareness and technique mastery can paradoxically increase detection and reporting of GR.

Conclusion

This systematic review provides valuable insights into the prevalence of gingival recession among university students. Through the comprehensive analysis of these nine studies, a wide range of reported prevalence rates was identified. While some studies reported relatively low prevalence, others indicated significantly higher rates of GR in this population. The majority of the studies demonstrated that demographic factors such as higher age, lower socioeconomic status, female gender, and poor oral hygiene behaviors are associated with an increased prevalence of gingival recession among students. This population represents an important target group for oral health promotion and preventive interventions. Implementing targeted educational programs, promoting regular dental care, and encouraging effective oral hygiene practices can help reduce the incidence of this condition and improve oral health outcomes among university students.

Ethics Committee Approval: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board of Instituto Universitario Ciências Saúde (CE/IUCS/CESPU-23/23).

Informed Consent: Participants provided informed constent.

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Author contributions: CTC, MR participated in designing the study. AF, CTC, MRparticipated in generating the data for the study. AF, CTC participated in gathering the data for the study. AF, EF participated in the analysis of the data. AF wrote the majority of the

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original draft of the paper. AF, CTC, MR participated in writing the paper. AF, CTC, EF, MR have had access to all of the raw data of the study. AF, MR have reviewed the pertinent raw data on which the results and conclusions of this study are based. AF, CTC, EF, MR have approved the final version of this paper CTC guarantee that all individuals who meet the Journal's authorship criteria are included as authors of this paper.

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