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Systematic Review

The Role of the Interproximal Enamel Reduction in Orthodontics: A Systematic Review

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Abstract

Background: The aim of this systematic review was to critically evaluate the clinical indications, the techniques, and the effects of interproximal enamel reduction (IPR). **Methods**: A systematic review of the existing literature was carried out following the PRISMA guidelines in the following databases: PubMed-Medline, Scopus, Embase, Web of Science, and Cochrane. The search was conducted according to the established inclusion and exclusion criteria until March 2025. **Results**: A total of 420 articles were identified. Only 23 were selected for the analysis. The efficiency and validity of IPR as a non-extraction protocol adopted in several orthodontic cases was reported in all selected studies. No negative effects in terms of enamel demineralization, residual irregularities, caries incidence, and periodontal damages were reported. Using oscillating mechanical techniques was more efficient than using manual ones in terms of efficiency, predictability, and respect of enamel surfaces. Overall, the quality of the selected articles was low. More randomized controlled clinical trials with in vivo tests, research with longer follow-up times, and high-quality studies are needed to assess more valid statements. **Conclusions**: Higher accuracy of enamel reduction is achieved by means of oscillating mechanical techniques, which allows for more effective and predictable IPR procedures, as well as more preserved residual enamel surfaces.

Keywords: interproximal enamel reduction; enamel surfaces; IPR procedures

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1. Introduction

Interproximal enamel reduction (IPR), also known as interproximal reduction or stripping, was introduced in 1944 as a technique to manage tooth size discrepancies [1,2]. The concept of IPR has been discussed for decades [1–7], and over time several techniques have been proposed and refined to improve clinical efficiency and safety [8–14]. More recently, technological developments and new clinical investigations have focused on the biological effects and surface alterations associated with different IPR methods [12,15] highlighting both advancements and persistent controversies that justify the need for an updated systematic review. Over the years, its applications have expanded to address late secondary crowding, prevent relapse by stabilizing dental contacts, and serve as

an alternative to extractions in borderline cases [3–5]. Additionally, IPR has been used to reshape teeth and reduce black triangles in periodontal patients [6–8]. Nowadays, IPR represents one of the primary space-gaining techniques in orthodontic treatment, particularly in cases treated with clear aligners [4,6]. Combined with proclination and transversal expansion, IPR serves as a valuable alternative to extractions for resolving mild-to-moderate crowding [7–10]. In these cases, the amount of enamel to be removed should be calculated considering the space required. Several IPR techniques have been introduced over the years, with mechanical oscillating abrasive strips gaining popularity because of their precision, efficiency, reduced chairside time, and minimally invasive effects on enamel surfaces [6,9]. Recent studies have demonstrated that mechanical oscillating diamond strips provide higher efficiency and produce more regular enamel surfaces compared to manual systems [6]. Furthermore, it has been widely established that the polishing phase after IPR is crucial in achieving smoother enamel surfaces and minimizing the risk of plaque accumulation [11]. Despite its long-standing clinical use, concerns have been raised regarding potential iatrogenic effects, such as an increased risk of caries, periodontal disease, and dentin hypersensitivity [12,13]. However, recent studies suggest that dentin hypersensitivity represents a rare long-term side effect, and that reduced interproximal width does not predispose teeth to accelerated periodontal breakdown [14,15]. While IPR may initially increase enamel surface roughness, this effect is mitigated by proper finishing and polishing techniques, as well as natural remineralization over time [6,13,15–22]. A clinically relevant aspect to consider is the need of a standardized protocol to ensure both accuracy and safety during IPR. A standardized clinical sequence—including initial space creation, enamel removal, quantitative evaluation, and final polishing—ensures the predictability of clinical results while preserving enamel integrity [12]. Regardless of the method used, adherence to a systematic approach is essential to control the amount of enamel removed and to prevent undesirable surface roughness. Despite the widespread use of IPR in orthodontic treatment, there are still controversies regarding its effectiveness and long-term effects on enamel structure. Indeed, previous systematic reviews have reported high heterogeneity among available studies, with conflicting conclusions as to whether IPR contributes to an increased risk of caries and enamel demineralization [7,12,23]. Given these uncertainties, this systematic review aims to critically evaluate the effectiveness of IPR, in terms of predictability and efficiency of the different techniques, and its safety, in terms of biological effects on enamel, dental sensitivity, caries risk, and periodontal outcomes, by analyzing the existing literature and assessing the risk of bias in the included studies.

2. Materials and Methods

2.1. Protocol and Registration

The herein review was based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [24]. The protocol was registered in the PROSPERO database (Registration number: CRD420251010105). A comprehensive search of existing literature was conducted to identify all the available data on the IPR techniques and the effects related thereto. Specifically, we followed this step to address the PICO questions: (1) Is IPR safe for treated enamel surfaces? (2) What are the effects of IPR on biological structures? (3) Which IPR technique features the highest predictability? (4) What is the most biologically respectful technique for IPR procedures?

2.2. Eligibility Criteria

The following eligibility criteria were applied: (1) Population: studies evaluating stripping in orthodontic treatment; in vitro/in vivo controlled studies; Randomized controlled trials (RCTs), cohort studies, and systematic reviews; studies including untreated

enamel control groups; SEM and/or quantitative evaluation of enamel roughness; studies with a minimum follow-up period of 6 months, as shorter observation times may not adequately capture clinically relevant outcomes; articles published in peer-reviewed journals. (2) Interventions: Interproximal enamel reduction. (3) Comparison: comparative analysis with untreated enamel surfaces and different interproximal enamel reduction techniques. (4) Outcome measure: evaluation of enamel surfaces after IPR procedures and identification of the most efficient and predictable protocol of IPR. The exclusion criteria included: case reports, case series, case–control, and cross-sectional studies, uncontrolled studies, opinion articles, studies on animals' teeth or unhealthy human teeth, lack of control group, other method of assessing enamel roughness evaluation.

2.3. Search Strategy

A comprehensive literature search was conducted on the following: PubMed-Medline, Scopus, Embase, Web of Science, and Cochrane. The search was carried out from January 2025 until March 2025 to include the most recent studies. The strategy included three "MeSH" terms (Medical Subject Headings): "Interproximal reduction" OR "stripping" OR "interproximal enamel reduction" AND "IPR techniques" OR "IPR methods" OR "IPR protocols" AND "enamel surfaces" OR "enamel effects" AND "orthodontic treatment" OR "alignment" OR "protocol". Boolean operators AND/OR were used to refine search results. Moreover, the references of included studies were manually searched to identify articles not found in the database that might have met the inclusion criteria.

2.4. Screening Process and Data Collection

The articles selected on the database were screened in accordance with the Prisma Declaration Statement [24]. The inclusion in the final data collection required several steps. The articles were retrieved from several identified databases and all duplicates were removed. Then, two investigators (FG and RL) carried out the data extraction. The titles and the abstracts of the selected studies were examined. Arising inter-examiner discrepancies were tackled by means of discussion and consultation with a third author (CP). Successively, the full texts were carefully reviewed to ensure the accordance for the identified requirements to be included in the results. Several studies were excluded due to lack of necessary data or incompliance with PICO questions. Standard variables were used to extract information from each article. From each eligible study, the following variables were extracted: authors and year of publication, country, study design, sample size and characteristics, IPR technique used, follow-up duration, evaluated outcomes (enamel roughness, dental sensitivity, caries incidence, periodontal changes, efficiency/predictability), main results, and risk of bias assessment.

2.5. Risk of Bias and Quality Assessment of Individual Studies

The two investigators evaluated the risk of bias and the quality of the selected studies. For the risk of bias, the Newcastle- Ottawa quality assessment scale (NOS) [25] and the Risk of Bias 2 (RoB 2) [26] were applied. Specifically, the NOS provides nine points subdivided into three domains: (a) study group selection, (b) group comparability, and (c) exposure and outcome ascertainment. High, moderate, and low risk of bias correspond to scores 0–3, 4–6, and, 7–9 respectively [27]. RoB 2 evaluates the following: (1) bias derived from the randomization process; (2) bias related to the deviation from intended interventions; (3) bias due to missing outcome data; (4) bias in outcome measurement and selection of the reported results. Moreover, the quality of the selected studies was assessed by means of the Grading of Recommendations Assessment, Development and Evaluation (GRADE) criteria. In case of disagreement between the two investigators, the third author (CP) was consulted [28].

2.6. Summary Measures and Approach to Data Synthesis

Quantitative findings obtained from the included studies were summarized. The qualitative analysis was performed by grouping the study outcomes in the following categories: enamel surfaces, dental sensitivity, predictability and efficiency of different IPR techniques. For each outcome, the methodological heterogeneity of the included studies was thoroughly analyzed to assess the feasibility of conducting a quantitative synthesis.

3. Results

A total of 420 articles were found from the databases. After removing duplicates, 270 articles remained. Of these, 30 articles were selected for full-text eligibility assessment, and 7 were subsequently excluded with reasons. The screening of the reference lists of the included articles and relevant reviews identified two additional eligible [16,20], which were included in the review. Hence, 23 studies were included in the herein review: 6 observational studies, 4 randomized clinical trials (RCT), 10 non-randomized clinical trials (non-RCT), 3 systematic reviews. No further articles were retrieved through this manual search. The earliest study included was published in 1944 [1]. All included studies were available in English. One study [21] also provided a French abstract, but the full text was in English and was used for the analysis. The search strategy, including the databases consulted, the keywords used, the time frame, and the total number of records retrieved before duplicate removal, is summarized in Table 1. Table 2 revealed the characteristics of each selected study. The selection process is illustrated in the PRISMA flow diagram (Figure 1). Regarding the risk of bias, all the included RCT somewhat raised concerns towards the reported results. As for the observational studies, 50% showed low risk of bias, while 50% raised bias concerns. Given the variability in outcomes and measurement methods, the certainty of evidence was summarized in a narrative table (Table 3). The overall study quality ranged from low (8% of the studies) to high (20%). A meta-analysis was not conducted, and recommendations following the GRADE approach were not provided due to several factors: the heterogeneity in IPR procedures, differences in measurement units for assessing outcomes, and variable follow-up intervals across the studies. Thus, such limitations prevented data aggregation. The studies with comparable outcomes were categorized for the purposes of qualitative analysis.

Table 1. Literature search strategy and number of records retrieved from each database.

Database	Search Terms (MeSH + Keywords)	Time Frame	Records Retrieved
PubMed-Medline	(“Interproximal reduction” OR “stripping” OR “interproximal enamel reduction”) AND (“IPR techniques” OR “IPR methods” OR “IPR protocols”) AND (“enamel surfaces” OR “enamel effects”) AND (“orthodontic treatment” OR “alignment” OR “protocol”)	January 2025–March 2025	100
Scopus	(“Interproximal reduction” OR “stripping” OR “interproximal enamel reduction”) AND (“IPR techniques” OR “IPR methods” OR “IPR protocols”) AND (“enamel surfaces” OR “enamel effects”) AND (“orthodontic treatment” OR “alignment” OR “protocol”)	January 2025–March 2025	150
Embase	(“Interproximal reduction” OR “stripping” OR “interproximal enamel reduction”) AND (“IPR techniques” OR “IPR methods” OR “IPR protocols”) AND (“enamel surfaces” OR “enamel effects”) AND (“orthodontic treatment” OR “alignment” OR “protocol”)	January 2025–March 2025	80

Table 1. *Cont.*

Database	Search Terms (MeSH + Keywords)	Time Frame	Records Retrieved
Web of Science	("Interproximal reduction" OR "stripping" OR "interproximal enamel reduction") AND ("IPR techniques" OR "IPR methods" OR "IPR protocols") AND ("enamel surfaces" OR "enamel effects") AND ("orthodontic treatment" OR "alignment" OR "protocol")	January 2025–March 2025	60
Cochrane Library	("Interproximal reduction" OR "stripping" OR "interproximal enamel reduction") AND ("IPR techniques" OR "IPR methods" OR "IPR protocols") AND ("enamel surfaces" OR "enamel effects") AND ("orthodontic treatment" OR "alignment" OR "protocol")	January 2025–March 2025	30
Total			420

After removing duplicates, 270 articles remained for further screening, and 23 studies were finally included in the review.

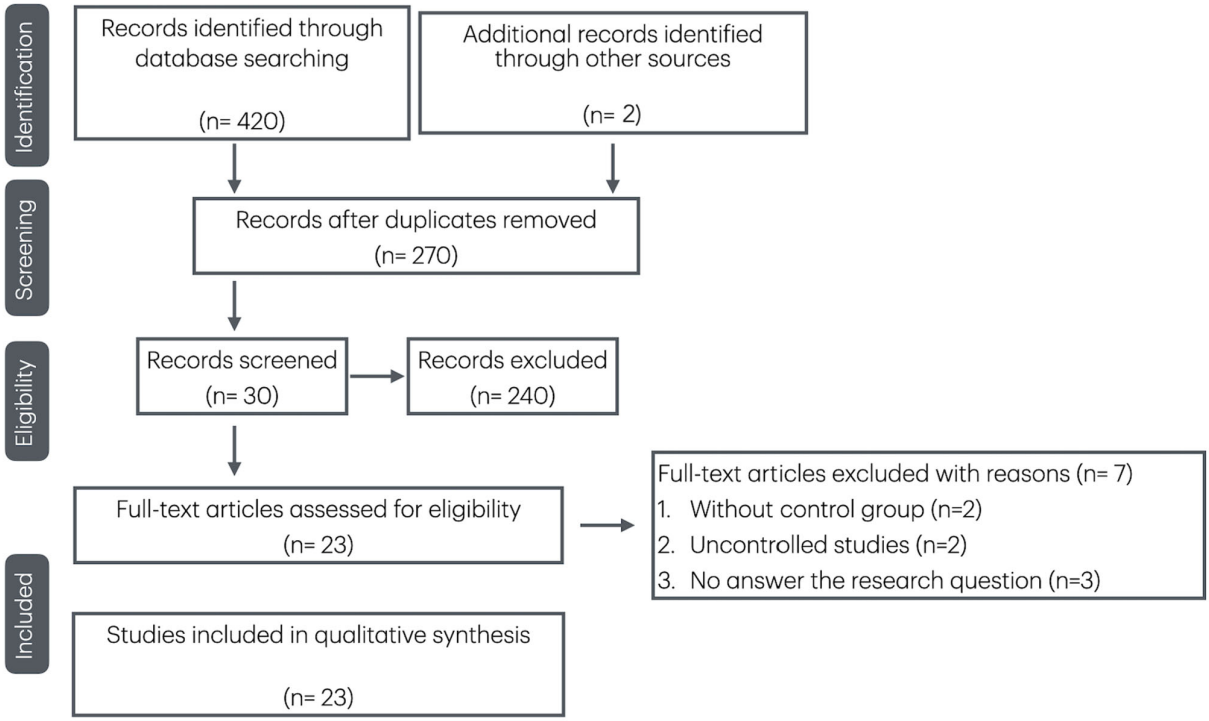

Figure 1. PRISMA flow diagram of the systematic review of the role of the interproximal enamel reduction in orthodontics.

3.1. Enamel Surfaces

11 articles assessed the enamel surfaces after IPR procedures. Obtained results concluded that all enamel reduction procedures somewhat caused surface changes without any adverse effects. Numerous authors agreed on the importance of the polishing and finishing phases to reduce the surface roughness after IPR procedures [11,12,16–20,29–38]. Moreover, several findings highlighted how the oscillating mechanical systems produce a more uniform enamel surface when compared to manual ones and diamond burs [6,11,31–33]. On the contrary, Katsigialou et al. [34] did not find any differences between manual and mechanical techniques, highlighting the importance of polishing procedures to restore enamel integrity. Two articles [13,39] emphasized the need for standardized protocols to optimize results minimizing enamel damages.

Table 2. Characteristics of each selected study and main results.

Study	Design and Population	Groups/Interventions	Outcome Measures	Main Results	Conclusion
Piacentini et al., 1996 [17]	In vitro study; 30 extracted human teeth	6 groups (n = 5 per group): G1, air-rotor stripping without polishing; G2, polishing with a green stone; G3, polishing with a white stone; G4, polishing with Arkansas stone; G5, polishing with a Sof-Lex disk; G6, polishing with a rubber cup and fluoride paste	Enamel surface evaluation using SEM (Scanning Electron Microscopy)	- Air-rotor stripping without polishing: irregular surface with deep grooves. - Green and white stone polishing: reduced roughness but residual scratches. - Arkansas stone polishing: smoother than stones but still irregular. - Sof-Lex disc: among the smoothest surfaces. - Rubber cup + fluoride paste: the smoothest surface, comparable to untreated enamel.	Polishing after air-rotor stripping minimizes enamel roughness. Sof-Lex disks and rubber cups with fluoride paste provide the smoothest results, reducing plaque accumulation and enamel demineralization risks.
Arman et al., 2006 [18]	In vitro study; 60 extracted human premolars	6 groups (n = 10 per group): 1. diamond bur; 2. fine diamond bur; 3. Sof-Lex disk; 4. steel stripping strip; 5. diamond-coated stripping strip; 6. air-rotor stripping	Qualitative and quantitative enamel evaluation using SEM Surface roughness measurement (profilometer)	Diamond bur and air-rotor stripping: highest enamel roughness and irregularities. Diamond-coated and steel strips: moderate roughness, scratches visible. Sof-Lex disk and fine diamond bur: smoothest surfaces, closest to untreated enamel.	Stripping methods significantly affect enamel roughness. The Sof-Lex disk and fine diamond bur result in the smoothest enamel surfaces, while diamond burs and air-rotor stripping cause more irregularities. Polishing after stripping is recommended.
Zachrisson et al., 2007 [8]	Observational: Cohort Study. 16 patients underwent IER procedures on mandibular anterior teeth	Group 1: Stripping (n = 61) Group 2: No stripping (n = 16)	Caries incidence; periodontal health; enamel sensitivity; esthetic evaluation	No caries incidence, and no dental sensitivity were observed in patients after IER procedures.	Interproximal enamel reduction is a safe and stable procedure in the long term. It does not increase the risk of caries or periodontal disease and maintains good esthetic outcomes.

Table 2. *Cont.*

Study	Design and Population	Groups/Interventions	Outcome Measures	Main Results	Conclusion
Bonetti et al., 2009 [13]	In vitro study; 30 Extracted human premolars	3 groups (n = 10 per group): G1. no treatment (control) G2. air-rotor stripping (ARS) without remineralization G3. ARS + CPP-ACP application.	Enamel surface evaluation using Scanning Electron Microscopy (SEM)	ARS without remineralization: irregular surface, increased porosity. ARS + CPP-ACP: partial enamel remineralization, smoother surface compared to ARS alone. Control: Intact enamel, smoothest surface.	CPP-ACP application after interproximal enamel reduction helps in surface remineralization and reduces enamel roughness. It may be beneficial in preventing demineralization after stripping procedures.
Zachrisson et al., 2011 [36]	Retrospective cohort study; 43 orthodontic patients	Group 1: Stripping surfaces. Group 2: Untreated contralateral surfaces.	Dental caries and sensitivity.	No caries incidence and no dental sensitivity were observed in patients after IER procedures.	No significant increase in caries incidence in posterior teeth after IER. No negative effects on periodontal health and minimal enamel surface changes post IER.
Koretsi et al., 2014 [12]	Systematic review; 12 selected studies	N/A	Surface roughness and caries incidence after IER	IER leads to increased enamel roughness, but the effect on caries incidence is inconclusive. Only few studies found an increase in caries risk post-IER but not significant.	IER increases enamel roughness, but the risk of caries does not appear to be significantly elevated in the long term. Proper oral hygiene is crucial to prevent caries in IER-treated areas.
Lombardo et al., 2014 [40]	In vitro study; 15 extracted human premolars	Group 1: Orthofile, mechanical system Group 2: Manual stripping Group 3: Control group (no reduction)	Enamel surface roughness and morphology (SEM analysis)	Orthofile resulted in less enamel roughness compared to traditional stripping, with more uniform surface morphology. Both IER methods caused enamel damage, but Orthofile was less abrasive	Orthofile is a less invasive and more efficient mechanical method for interproximal enamel reduction, with lower enamel roughness compared to traditional manual stripping. The method could be preferred in clinical practice for more predictable results.

Table 2. *Cont.*

Study	Design and Population	Groups/Interventions	Outcome Measures	Main Results	Conclusion
Baumgartner et al., 2015 [20]	In vitro study; 24 extracted human premolars	2 groups: Group 1: Oscillating stripping method Group 2: Manual stripping (manual reduction)	Enamel surface roughness (Ra) and enamel morphology (SEM)	Enamel morphology shower greater roughness after manual stripping. SEM analysis showed a smoother surface for the oscillating method with fewer surface irregularities	The oscillating stripping method produced lower surface roughness and smoother enamel, making it preferable to minimize enamel damage compared to the conventional stripping method
Paganelli et al., 2015 [19]	Randomized trial, split-mouth; 14 orthodontic patients	Group 1: intact enamel (control); Group 2: stripping, teeth extracted after the procedure (n = 14); Group 3: stripping, teeth removed 30 d after the procedure; Group 4: stripping + CPP-ACPF application; teeth removed 30 d after the exposure	Ca/P ratio Amount of C	The Ca/P ratio did not significantly change after either IPR procedures or CPP-ACPF application.	Ca/P ratio: No clinical relevance. Amount of C: No clinical relevance.
Zingler et al., 2016 [16]	In vitro study, 110 extracted human premolars	G1: powered systems G2: manual methods	Enamel roughness (Ra) before and after polishing; enamel morphology using SEM analysis; efficiency of powered systems	Surface roughness reduced after polishing procedures. SEM analysis showed smoother enamel surfaces after polishing with powered systems compared to manual methods.	The study concluded that powered systems for IER are more efficient, providing a smoother enamel surface and a significant reduction in surface roughness after polishing compared to manual methods.
Meredith et al., 2017 [37]	Review article	N/A	Indications for IPR in orthodontics; techniques and procedures for IPR; Amount of enamel removal; Effect on enamel	Discusses recommended amount of enamel to be removed during IPR (0.2–0.5 mm). Review of techniques for IPR: manual vs. powered methods	IPR should be performed cautiously to preserve enamel health. An optimal amount of enamel (0.2–0.5 mm) should be removed, depending on individual case factors. The choice of method (manual vs. powered) depends on the clinical situation and treatment goals.

Table 2. *Cont.*

Study	Design and Population	Groups/Interventions	Outcome Measures	Main Results	Conclusion
Lione et al., 2017 [39]	In vitro and in vivo study. Human extracted premolars	- diamond-coated oscillating strips tested under ideal conditions. - in vivo comparison	Wear performance of diamond-coated strips by means of tribological testing and SEM analysis	The strip surface after 250 m is smoother and less effective in its abrasive power. After 300 s of in vivo use of the strip, it was possible to observe a high loss of abrasive power.	It is necessary to consider that the applied load vary considerably between different operators during IPR procedures.
Gazzani et al., 2019 [6]	In vitro study; 20 human extracted premolars	Group 1: mechanical oscillating strips Group 2: manual strips	Surface roughness (Ra) before and after IPR; effectiveness in enamel removal	G1 showed lower surface roughness after IPR. Oscillating strips removed enamel more efficiently and produced smoother surfaces	Oscillating strips appeared more efficient in enamel reduction and produced smoother surfaces compared to manual strips. Oscillating strips may be more effective for IPR procedures in terms of enamel removal.
Kalemaj et al., 2021 [29]	Prospective observational study; 50 patients treated with clear aligner treatment	Clear aligner treatment with IPR	Predictability of IPR procedures	Discrepancies were found between the programmed IPR and the implemented IPR	There is a tendency to provide less IPR than prescribed. Burs provides more IPR compared to manual and contra-angle strips
Gomez-Aguirre et al., 2022 [23]	Systematic Review; 10 selected studies	Effects of interproximal enamel reduction techniques used for orthodontics	Dental caries; chemical composition of enamel; enamel roughness; dental sensitivity; periodontal changes; crowding evaluation in the long term; changes in the skeletal profile; changes in the dental arches	No effect on caries development; no demineralization processes after IPR; presence of surface roughness after IP; no increased tooth sensitivity; no periodontal modifications; no differences in crowding over time with no IPR; no changes in skeletal profile; no changes in dental arches	IPR is a useful procedure for crowding in clinical orthodontic practice without adverse effects. The use of remineralizing agents is helpful to prevent the plausible negative effects of this technique

Table 2. *Cont.*

Study	Design and Population	Groups/Interventions	Outcome Measures	Main Results	Conclusion
Katsigialou et al., 2023 [34]	In vivo study; 15 orthodontic patients	G1: mechanical oscillating stripping G2: manual stripping Control with the untreated tooth surface	Enamel surface roughness (profilometry); elemental composition (calcium, phosphorus, etc.)	Manual stripping caused a less significant increase in surface roughness compared to mechanical stripping. No significant changes in enamel composition (calcium and phosphorus levels) between groups.	Mechanical stripping resulted in greater enamel roughness than manual stripping. No significant changes in elemental composition after either method.
Shalchi et al., 2023 [33]	Retrospective cohort study; 90 Class I malocclusion patients	G1: IPR G2: IPR + flouride application G3: no IPR	Clinical attachment loss; Bleeding on probing; Incidence of caries.	No differences in clinical attachment loss; no differences in Bleeding on probing; slightly higher incidence of caries in IPR group but not statistically significant.	Enamel reduction did not significantly affect clinical attachment loss or bleeding on probing. The effect on caries incidence was minimal and not statistically significant.
Butrus et al., 2023 [31]	In vivo study; 40 extracted human teeth	Disk group Bur group Manual strips	Enamel surface roughness and nano-topography (AFM analysis)	Surface roughness was increased in all groups without polishing. Disk group revealed the greatest mean roughness The parameters were decreased after polishing in all groups The disk group only showed a statistically significant decrease in surface roughness after polishing	All methods of IPR do not influence enamel surface nano topography significantly with and without polishing. Polishing determined a significant reduction in surface roughness only in the disk group.

Table 2. *Cont.*

Study	Design and Population	Groups/Interventions	Outcome Measures	Main Results	Conclusion
Silvestrini et al., 2023 [32]	In vivo study; 160 extracted human teeth	Group A1: fine diamond bur (30 microns) Komet 862 EF. Group A2: fine diamond bur Komet 862 EF + finishing with 12 steps 3M Soft Lex medium–fine–ultrafine disks. Group B1: extra-fine diamond bur (15 microns). Group B2: extra-fine diamond bur + finishing with 12 steps 3M Soft Lex medium–fine–ultrafine disks. Group C1: tungsten carbide bur (Komet ET9-8 September 4159). Group C2: tungsten carbide bur (Komet ET9-8 September 4159) + finishing with 12 steps of medium–fine–ultrafine 3M Soft Lex disks. Group D: Horico extra-fine diamond strips (thickness 0.10 mm). Group E: controls (untreated enamel).	Enamel surfaces after different technique (SEM analysis)	Streaks were observed on all surfaces, due to the cutter used. Only Group C2 (tungsten carbide bur followed by twelve steps of medium–fine–ultrafine 3M Soft Lex disks) showed few lines, very similar to group E (untreated group), while the other groups had a lot of lines and presented rougher final surfaces.	All different IPR methods leave streaks on the enamel surfaces. The stripping technique that determines a lower morphological alteration of enamel surfaces, consists of the use of the milling cutter of tungsten carbide Komet ET9-8 Set 4159, finishing with 12 steps of 111 medium, fine, and ultrafine 3M Soft Lex disks.
Gazzani et al., 2023 [11]	In vitro study; 30 extracted human teeth	Group 1: oscillating IPR sequence Group 2: single metallic strips	Enamel surface roughness and waviness SEM analysis	G1 showed lower values of surface roughness and significant increase in waviness parameters when compared with G2 SEM evaluation showed smoothers and more regular surfaces when IPR was performed by complete IPR sequence.	The standardized oscillating IPR sequence determines more regular and harmonious enamel surfaces at the end of the procedure. An adequate polishing after IPR allows a good long-term prognosis and a good respect of biological structures.
Dahas et al., 2024 [35]	Literature review		Evaluation of different IPR techniques in clear aligner therapy	Indications, techniques, and outcomes of IPR	This study provides a comprehensive understanding of IPR's role in orthodontics with clear aligners, highlighting its importance and offering guidelines for practitioners.

Table 2. *Cont.*

Study	Design and Population	Groups/Interventions	Outcome Measures	Main Results	Conclusion
Gazzani et al., 2024 [38]	In vitro study; 75 mechanical oscillating strips	Group 1: complete oscillating IPR sequence (n = 15 sequences, 60 strips) Group 2: single metallic strips (n = 15)	Wear and friction properties of oscillating strips SEM analysis	Metallic strips showed higher resistance and a long duration of use. The loss of abrasive capacity was observed at a later stage of use. Higher friction values were observed when the metallic strips were tested singularly rather than within the entire sequence.	The application of a standardized oscillating sequence allows for more efficient wear performance of the strips with a significant impact on their abrasive power and lifetime
Serbanoiu et al., 2024 [30]	In vitro study; 42 extracted human teeth	G1: diamond burs G2: abrasive strips of 90 µm G3: abrasive strips of 60 µm G4: abrasive strips of 40 µm G5: abrasive strips of 15 µm G6: abrasive disks Control with the untreated tooth surface	Hardness of the enamel surfaces by means of a Vickers hardness tester	Enamel microhardness varied depending on the stripping instrument used. Optimal microhardness values were achieved after mechanical treatment with 15 µm abrasive strips and abrasive disks.	Dental stripping is a safe therapeutic procedure that has a relatively minor influence on the microhardness of surface enamel.

Table 3. Quality assessment of the selected studies.

Evaluations	Key Impact	Sample Size	Certainty of the Evidence (GRADE)
Piacentini et al., 1996 [17] SEM analysis of enamel surfaces after Air-rotor stripping following by polishing phase.	Polishing after air-rotor stripping is essential to minimize enamel roughness.	30 extracted teeth Observational	Moderate
Arman et al., 2006 [18] Qualitative and quantitative evaluation of enamel surfaces after various IPR techniques	Polishing is recommended to obtain smoother enamel surfaces	60 extracted teeth Observational	Moderate
Zachrisson et al., 2007 [8] Clinical and radiographical evaluation of stripping performed by ARS modified.	No caries incidence, no dental sensitivity is related to IPR procedures	61 patients Observational	Very low
Bonetti et al., 2009 [13] In vitro SEM evaluation of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) effect on stripped enamel surfaces	Application of CPP-ACP after IPR procedures allows remineralization processes and reduces enamel roughness	30 extracted teeth Observational	Low

Table 3. *Cont.*

Evaluations	Key Impact	Sample Size	Certainty of the Evidence (GRADE)
Zachrisson et al., 2011 [36] Clinical and radiographical evaluation of ARS procedure associated with 0.05% neutral sodium fluoride mouthrinses and fluoridated toothpaste daily use during the orthodontic treatment	The interdental enamel reduction did not result in increased caries risk in posterior teeth	43 orthodontic patients Observational	Very low
Koretsi et al., 2014 [12] Systematic review of enamel roughness and incidence of caries after interproximal enamel reduction (IER).	IER increases enamel roughness, but the risk of caries does not appear to be significantly elevated in the long term.	The review includes data from multiple studies, so the number of participants varies across the studies.	Moderate
Lombardo et al., 2014 [40] SEM Evaluation of enamel surfaces after IPR performed by Orthofile system.	Mechanical methods are less invasive and more efficient compared to traditional manual stripping.	15 extracted teeth Observational	Moderate
Baumgartner et al., 2015 [20] Enamel roughness evaluation after mechanical oscillating methods.	The oscillating stripping method produced lower surface roughness and smoother enamel,	24 Extracted human premolars Observational	Low
Paganelli et al., 2015 [19] SEM evaluation of enamel after IPR performed by means of cylindric burs with medium granulometry. Evaluation of tooth exposition to saliva and casein phosphopeptide amorphous calcium phosphate with sodium fluoride (CPP-ACPF)	IPR does not compromised the Ca/P ratio of the enamel	14 orthodontic patients Randomized clinical trial	Low
Zingler et al., 2016 [16] Evaluation of enamel roughness before and after polishing phase and SEM analysis of surface morphology	Powered systems for IER shows high efficiency, providing a smoother enamel surface and a significant reduction in surface roughness	110 Extracted human premolars Observational	Low
Meredith et al., 2017 [37] A review of the reasons, methods, and quantities for interproximal reduction (IPR) in orthodontics.	Evaluation of the different IPR procedures and their clinical relevance.	Review article	Moderate
Lione et al., 2017 [39] Wear performance and SEM analysis of diamond-coated strips by means tribological analysis	The application load during IPR procedures play a crucial role on the efficiency of oscillating strips	20 human extracted premolars Observational	Moderate
Gazzani et al., 2019 [6] Comparison of surface roughness and enamel removal efficiency between mechanical and manual IPR methods	Oscillating strips showed more efficiency in enamel reduction and produced smoother surfaces compared to manual strips	20 Human extracted premolars Observational	Moderate

Table 3. *Cont.*

Evaluations	Key Impact	Sample Size	Certainty of the Evidence (GRADE)
Kalemaj et al., 2021 [29] Predictability evaluation of several IPR procedures	Burs provides more IPR compared to manual and contra-angle strips	30 Patients Observational	High
Gomez-Aguirre et al., 2022 [23] Effects of interproximal enamel reduction techniques used for orthodontics	IPR is a useful procedure for crowding in clinical orthodontic practice without adverse effects.	Systematic Review	Moderate
Katsigialou et al., 2023 [34] Evaluation of enamel surface roughness and enamel composition after IPR	No significant changes in elemental composition were found after IPR	15 patients Observational	Low
Shalchi et al., 2023 [33] Evaluation of clinical attachment loss, bleeding on probing, incidence of caries after IPR	Enamel reduction did not significantly affect clinical attachment loss or bleeding on probing.	90 patients	Moderate
Butrus et al., 2023 [31] Evaluation of surface roughness and nano topography	All methods of IPR do not significantly influence enamel surface nano topography	40 Extracted human teeth Observational	High
Silvestrini et al., 2023 [32] Enamel surfaces after different technique (SEM analysis)	All IPR methods leave irregoularities on enamel surfaces	160 Extracted human teeth Observational	Low
Gazzani et al., 2023 [11] Roughness and waviness evaluation, and SEM analysis of enamel surfaces after IPR oscillating systems. Validation of a standardized protocol.	The standardized oscillating IPR sequence determines more regular and harmonious enamel surfaces at the end of the procedure.	30 Extracted human teeth Observational	High
Dahas et al., 2024 [35] The role of interproximal reduction (IPR) in clear aligner therapy: a critical analysis of indications, techniques, and outcomes. This study reviews various techniques of IPR used in clear aligner therapy and their impact on treatment outcomes.	The study provides an overview of IPR's role in aligner therapy, including its effects on treatment efficiency, alignment results, and long-term outcomes.	Literature review	Moderate
Gazzani et al., 2024 [38] Wear evaluation, friction properties, and SEM analysis of oscillating strips	The application of a standardized oscillating sequence allows for more efficient wear performance of the strips	75 Mechanical oscillating strips Observational	High
Serbanoiu et al., 2024 [30] Hardness analysis of the enamel surfaces by means of a Vickers hardness tester	IPR does not have any influence on the microhardness of surface enamel.	42 Extracted human teeth Observational	Moderate

3.2. Dental Sensitivity

Zachrisson et al. [8,36] concluded in two investigations that no increased tooth sensitivity was reported after IPR procedures. Bonetti et al. [13] highlighted the effect of the Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP) on treated enamel surfaces in enhancing enamel resistance to acid attacks and hypersensitivity phenomena. Paganelli et al. [19] analyzed the Ca/P ratio and the amount of Ca in treated enamel. The authors showed that no demineralization of teeth had occurred and, thus, it was deemed unlikely for IPR to cause hypersensitivity or a higher tendency to develop carious lesions. Meredith et al. concluded that the existing literature would not indicate any risks of dental sensitivity subsequent to IPR, similarly to what was observed by Gómez-Aguirre et al. in a more recent systematic review [23,37]. In general, all the selected studies suggested that interproximal enamel reduction would not significantly increase tooth sensitivity or caries risk.

3.3. Predictability and Efficiency of Different IPR Techniques

As a result of this systematic review, it was found that a number of studies existing in the literature focused on the effects of IPR on the tooth surfaces. By contrast, only a few studies have analyzed the validity and efficacy of the various available IPR tech niques [6,38–40]. Gazzani et al. [6], evaluating the efficiency and the abrasive properties of oscillating and manual systems, concluded that oscillating strips revealed more controlled efficiency in terms of removed enamel when compared to manual ones. In a further investigation [38], the same group evaluated the wear and friction properties of oscillating strips stating the importance of a validated standardized IPR sequence to allow a more efficient wear performance of the strips with a significant impact on their abrasive properties and lifetime.

4. Discussion

This systematic review aimed to evaluate the role of IPR in orthodontics, with a focus on the impact on enamel surfaces, dental sensitivity, and the predictability and efficiency of various IPR techniques. A total of 23 studies were included, consisting of observational studies, randomized clinical trials (RCTs), non-randomized clinical trials (non-RCTs), and systematic reviews. The findings of this review underline several key aspects of IPR, though they also highlight the substantial variability across studies and the methodological limitations that hinder the aggregation of data [23]. The results regarding enamel surface changes after IPR procedures are generally reassuring [11,16,19,30–38].

The studies consistently demonstrated that enamel reduction did not result in adverse effects, although all IPR techniques induced some degree of surface alteration (Figure 2).

The polishing and finishing stages were emphasized as crucial for minimizing surface roughness and restoring enamel integrity [11,16,19,29–34]. Notably, mechanical oscillating systems were found to produce more uniform enamel surfaces compared to manual techniques and diamond burs [6,11,38].

However, there was some disagreement, as Katsigialou et al. [34] did not report any significant differences between manual and mechanical methods, emphasizing the importance of proper polishing. These results underscore the need for standardized protocols to optimize the outcomes of IPR procedures and minimize enamel damage [12,34]. A key concern regarding IPR procedures is the potential increase in dental sensitivity. The studies reviewed here, however, consistently indicated that IPR did not result in increased tooth sensitivity or a higher risk of carious lesions [8,12,19,23,36,37]. Several studies pointed out the protective role of Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP) in reducing enamel hypersensitivity, suggesting that IPR, when performed correctly, does not lead to detrimental effects on enamel health [12]. These findings are consistent with previous systematic reviews, supporting the notion that IPR is a safe procedure in

terms of dental sensitivity [23]. The review also highlighted the efficiency and predictability of various IPR techniques (Figure 3).

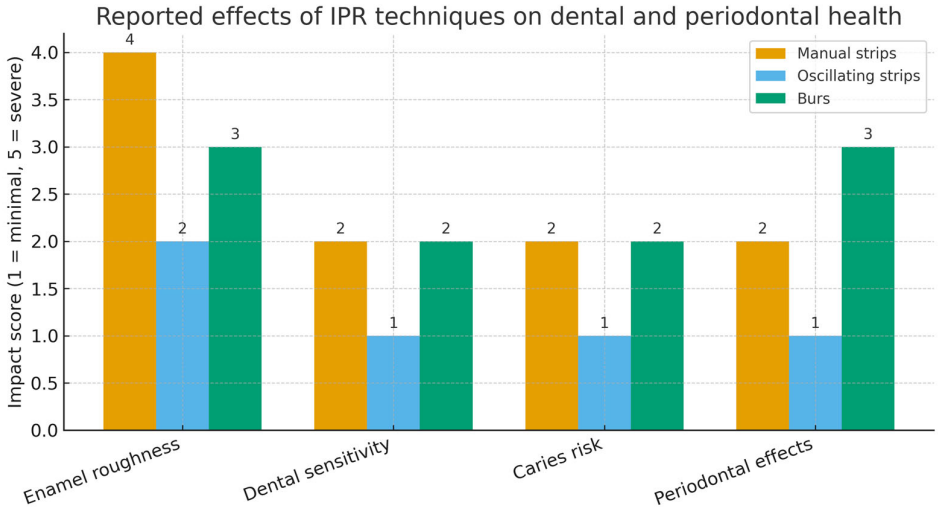

Figure 2. Biological effects of different enamel reduction (IPR) techniques. Oscillating strips are associated with lower enamel roughness, dental sensitivity, caries risk, and periodontal impact compared with manual strips and burs, supporting their safety and clinical applicability.

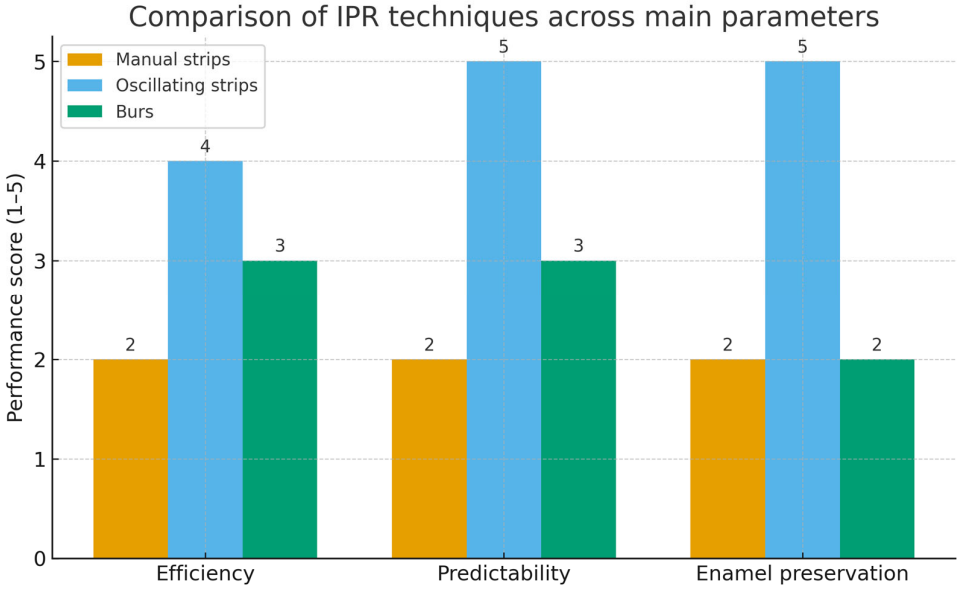

Figure 3. Performance comparison of different IPR techniques based on the main clinical parameters reported in the literature. Oscillating strips demonstrated superior efficiency, predictability, and enamel preservation compared with manual strips and burs, supporting their use as the preferred technique in clinical practice.

While many studies focused on the effects of IPR on enamel surfaces, fewer studies investigated the relative efficacy of different IPR available techniques [6,35,36,40]. The main findings reveal how oscillating strips allow a greater control and efficiency in enamel removal compared to manual strips. The same authors [8,36] also highlighted the need for standardized protocols to optimize the abrasive performance and longevity of oscillating strips. These insights are crucial for improving clinical outcomes and enhancing the predictability of IPR procedures. From a clinical standpoint, the evidence suggests that mechanical oscillating systems should be considered the technique of choice whenever available, as they provide greater precision, efficiency, and enamel preservation compared with manual strips. Nevertheless, regardless of the method employed, polishing and finish-

ing remain indispensable to reduce surface roughness and prevent plaque accumulation. These findings underline the importance of standardized protocols and adequate operator training to ensure predictable and biologically respectful outcomes in daily practice.

Several limitations of the included studies must be mentioned. The overall reliability of the findings is affected by the risk of bias in many of the included RCTs. In addition, most studies relied on small sample sizes and relatively short follow-up periods, which further reduce the strength of the available evidence. Variability in IPR procedures, measurement units, and observational intervals also contributed to the difficulty in conducting a meta-analysis. As a result, the quality of evidence was assessed as low to very low for most studies, primarily due to inconsistencies and imprecision. Future research should focus on standardizing IPR protocols and measurement methods to enable more consistent and reliable results. Moreover, long-term studies assessing the durability of enamel surfaces post-IPR and the potential risks of caries development are needed to provide further insights into the safety of this procedure. Additionally, the development of more controlled RCTs with clearer methodologies could help mitigate the current risks of bias and improve the robustness of the evidence base.

5. Conclusions

The results suggest that IPR does not significantly impact dental sensitivity or increase caries risk and that different techniques present different efficiency in enamel reduction. Despite the overall low quality of evidence, the findings support the use of IPR as a safe and effective procedure in orthodontic treatment, especially when performed by an oscillating mechanical system. The standardization of the IPR clinical sequence enhances the accuracy of enamel reduction while respecting biological structures. Furthermore, proper polishing—defined as the use of progressively finer abrasive strips or disks, followed by rubber cups or silicone points—plays a crucial role in ensuring a good long-term prognosis and preserving enamel morphological integrity. However, further high-quality studies are necessary to refine IPR protocols and better assess the long-term effects on enamel health.

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Abbreviations

The following abbreviations are used in this manuscript:

IPR	Interproximal Enamel Reduction
NOS	Newcastle–Ottawa scale
RCT	Randomized Clinical Trial
CPP-ACP	Casein Phosphopeptide–Amorphous Calcium Phosphate
N/A	Not Available

References

1. Ballard, M.L. Asymmetry in tooth size: A factor in the etiology, diagnosis and treatment of malocclusion. *Angle Orthod.* **1944**, *14*, 67–70.
2. Sheridan, J.J. Guidelines for contemporary air-rotor stripping. *J. Clin. Orthod.* **2007**, *41*, 315–320.

3. Bolton, A. Disharmony in tooth size and its relation to the analysis and treatment of malocclusion. *Angle Orthod.* **1958**, *28*, 113–130.
4. Borda, A.F.; Garfinkle, J.S.; Covell, D.A.; Wang, M.; Doyle, L.; Sedgley, C.M. Outcome assessment of orthodontic clear aligner vs fixed appliance treatment in a teenage population with mild malocclusions. *Angle Orthod.* **2020**, *90*, 485–490. [CrossRef] [PubMed]
5. Rossouw, P.E.; Tortorella, A. Enamel reduction procedures in orthodontic treatment. *J. Can. Dent. Assoc.* **2003**, *69*, 378–383.
6. Gazzani, F.; Lione, R.; Pavoni, C.; Mampieri, G.; Cozza, P. Comparison of the abrasive properties of two different systems for interproximal enamel reduction: Oscillating versus manual strips. *BMC Oral Health* **2019**, *19*, 247. [CrossRef]
7. Vignoletti, F.; Di Martino, M.; Clementini, M.; Di Domenico, G.L.; De Sanctis, M. Prevalence and risk indicators of gingival recessions in an Italian school of dentistry and dental hygiene: A cross-sectional study. *Clin. Oral Investig.* **2020**, *24*, 991–1000. [CrossRef] [PubMed]
8. Zachrisson, B.U.; Nyoygaard, L.; Mobarak, K. Dental health assessed more than 10 years after interproximal enamel reduction of mandibular anterior teeth. *Am. J. Orthod. Dentofac. Orthop.* **2007**, *131*, 162–169. [CrossRef]
9. Laganà, G.; Malara, A.; Lione, R.; Danesi, C.; Meuli, S.; Cozza, P. Enamel interproximal reduction during treatment with clear aligners: Digital planning versus Ortho CAD analysis. *BMC Oral Health* **2021**, *21*, 199. [CrossRef]
10. Lapenaite, E.; Lopatiene, K. Interproximal enamel reduction as a part of orthodontic treatment. *Stomatologija* **2014**, *16*, 19–24. [PubMed]
11. Gazzani, F.; Bellisario, D.; Fazi, L.; Balboni, A.; Licoccia, S.; Pavoni, C.; Cozza, P.; Lione, R. Effects of IPR by mechanical oscillating strips system on biological structures: A quantitative and qualitative evaluation. *Prog. Orthod.* **2023**, *24*, 9. [CrossRef]
12. Koretsi, V.; Chatzigianni, A.; Sidiropoulou, S. Enamel roughness and incidence of caries after interproximal enamel reduction: A systematic review. *Orthod. Craniofac Res.* **2014**, *17*, 1–13. [CrossRef]
13. Bonetti, G.; Zanarini, M.; Incerti Parenti, S.; Marchionni, S.; Checchi, L. In vitro evaluation of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) effect on stripped enamel surfaces: A SEM investigation. *J. Dent.* **2009**, *37*, 228–232.
14. Radlanski, R.J.; Jäger, A.; Schwestka, R.; Bertzbach, F. Plaque accumulations caused by interdental stripping. *Am. J. Orthod. Dentofac. Orthop.* **1988**, *94*, 416–420. [CrossRef] [PubMed]
15. Bayram, M.; Kusgoz, A.; Yesilyurt, C.; Nur, M. Effects of casein phosphopeptide-amorphous calcium phosphate application after interproximal stripping on enamel surface: An in vivo study. *Am. J. Orthod. Dentofac. Orthop.* **2017**, *151*, 167–173. [CrossRef]
16. Zingler, S.; Sommer, A.; Sen, S.; Saure, D.; Langer, J.; Guillon, O.; Lux, C.J. Efficiency of powered systems for interproximal enamel reduction (IER) and enamel roughness before and after polishing: An in vitro study. *Clin. Oral Investig.* **2016**, *20*, 933–942. [CrossRef] [PubMed]
17. Piacentini, C.; Sfondrini, G. A scanning electron microscopy comparison of enamel polishing methods after air-rotor stripping. *Am. J. Orthod. Dentofac. Orthop.* **1996**, *109*, 57–63. [CrossRef]
18. Arman, A.; Cehreli, S.B.; Ozel, E.; Arhun, N.; Cetinsahin, A.; Soyman, M. Qualitative and quantitative evaluation of enamel after various stripping methods. *Am. J. Orthod. Dentofac. Orthop.* **2006**, *130*, 131–136. [CrossRef]
19. Paganelli, C.; Zanarini, M.; Pazzi, E.; Marchionni, S.; Visconti, L.; Bonetti, G. Interproximal enamel reduction: An in vivo study. *Scanning* **2015**, *37*, 73–81. [CrossRef]
20. Baumgartner, S.; Iliadi, A.; Eliades, T.; Eliades, G. An in vitro study on the effect of an oscillating stripping method on enamel roughness. *Prog. Orthod.* **2015**, *16*, 1. [CrossRef] [PubMed]
21. Lione, R.; Gazzani, F.; Moretti, S.; Danesi, C.; Cretella Lombardo, E.; Pavoni, C. Gingival margins' modifications during orthodontic treatment with Invisalign First®: A preliminary study. *Children* **2022**, *9*, 1423. [CrossRef]
22. Kaaouara, Y.; Mohind, H.B.; Azaroual, M.F.; Zaoui, F.; Bahije, L.; Benyahia, H. In vivo enamel stripping: A macroscopic and microscopic analytical study. *Int. Orthod.* **2019**, *17*, 235–242. [CrossRef]
23. Gomez-Aguirre, J.N.; Argueta-Figueroa, L.; Castro-Gutierrez, M.E.M.; Torres-Rosas, R. Effects of interproximal enamel reduction techniques used for orthodontics: A systematic review. *Orthod. Craniofac Res.* **2022**, *25*, 304–319. [CrossRef]
24. Moher, D.; Liberati, A.; Tetzlaff, J.; Altman, D.G.; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *BMJ* **2009**, *339*, b2535. [CrossRef] [PubMed]
25. Peterson, J.; Welch, V.; Losos, M.; Tugwell, P. *The Newcastle-Ottawa Scale (NOS) for Assessing the Quality of Non-Randomised Studies in Meta-Analyses*; Ottawa Health Research Institute: Ottawa, ON, Canada, 2011.
26. Sterne, J.A.C.; Savović, J.; Page, M.J.; Elbers, R.G.; Blencowe, N.S.; Boutron, I.; Cates, C.J.; Cheng, H.Y.; Corbett, M.S.; Eldridge, S.M.; et al. RoB 2: A revised tool for assessing risk of bias in randomised trials. *BMJ* **2019**, *366*, l4898. [CrossRef] [PubMed]
27. Lo, C.K.L.; Mertz, D.; Loeb, M. Newcastle-Ottawa Scale: Comparing reviewers' to authors' assessments. *BMC Med. Res. Methodol.* **2014**, *14*, 45. [CrossRef] [PubMed]
28. Schünemann, H.; Brożek, J.; Guyatt, G.; Oxman, A. *GRADE Handbook: Grading of Recommendations Assessment, Development and Evaluation*; GRADE Working Group: Barcelona, Spain, 2014.
29. Kalemaj, Z.; Levrini, L. Quantitative evaluation of implemented interproximal enamel reduction during aligner therapy. *Angle Orthod.* **2021**, *91*, 61–66. [CrossRef]

30. Serbanoiu, D.C.; Vartolomei, A.C.; Ghiga, D.V.; Pop, S.I.; Panainte, I.; Moldovan, M.; Sarosi, C.; Petean, I.; Boileau, M.J.; Pacurar, M. Comparative evaluation of dental enamel microhardness following various methods of interproximal reduction: A Vickers hardness tester investigation. *Biomedicines* **2024**, *20*, 1132. [CrossRef]
31. Butrus, D.J.; Chawshli, O.F.J. Evaluation of the enamel nano-topography influenced by different techniques of interproximal reduction: An atomic force microscopic study. *J. Orthod.* **2023**, *50*, 196–204. [CrossRef]
32. Silvestrini Biavati, F.; Schiaffino, V.; Signore, A.; De Angelis, N.; Lanteri, V.; Ugolini, A. Evaluation of enamel surfaces after different techniques of interproximal enamel reduction. *J. Funct. Biomater.* **2023**, *14*, 110. [CrossRef]
33. Shalchi, M.; Abdollahi, N.; Shafiei Haghshenas, E.; Khabbaz, S.; Olyaee, P. Effect of interdental enamel reduction on clinical attachment loss, bleeding on probing, and incidence of caries in treating Class I malocclusion cases: A retrospective cohort study. *Cureus* **2023**, *15*, e35018. [CrossRef]
34. Katsigialou, N.; Sifakakis, I.; Zinelis, S.; Papageorgiou, S.N.; Eliades, T. Manual and mechanical stripping-induced enamel roughness and elemental composition in vivo. *Eur. J. Orthod.* **2023**, *45*, 250–257. [CrossRef] [PubMed]
35. Dahas, F.Y.; Almutairi, N.S.; Almutairi, R.S.; Alshamrani, H.A.; Alshyai, H.S.; Almazyad, R.K.; Alsanouni, M.S.; Gadi, S.A. The role of interproximal reduction (IPR) in clear aligner therapy: A critical analysis of indications, techniques, and outcomes. *Cureus* **2024**, *16*, e56644. [CrossRef]
36. Zachrisson, B.U.; Minster, L.; Ogaard, B.; Birkhed, D. Dental health assessed after interproximal enamel reduction: Caries risk in posterior teeth. *Am. J. Orthod. Dentofac. Orthop.* **2011**, *139*, 90–98. [CrossRef]
37. Meredith, L.; Mei, L.; Cannon, R.D.; Farella, M. Interproximal reduction in orthodontics: Why, where, how much to remove? *Australas. Orthod. J.* **2017**, *33*, 150–157. [CrossRef]
38. Gazzani, F.; Bellisario, D.; Fazi, L.; Balboni, A.; Licoccia, S.; Pavoni, C.; Cozza, P.; Lione, R. Friction and wear behavior of a mechanical oscillating strip system used for interproximal enamel reduction: A quantitative and qualitative scanning electron microscope evaluation. *Angle Orthod.* **2024**, *94*, 336–345. [CrossRef] [PubMed]
39. Lione, R.; Gazzani, F.; Pavoni, C.; Guarino, S.; Tagliaferri, V.; Cozza, P. In vitro and in vivo evaluation of diamond-coated strips. *Angle Orthod.* **2017**, *87*, 455–459. [CrossRef]
40. Lombardo, L.; Guarneri, M.P.; D'Amico, P.; Molinari, C.; Meddis, V.; Carlucci, A.; Siciliani, G. Orthofile®: A new approach for mechanical interproximal reduction: A scanning electron microscopic enamel evaluation. *J. Orofac. Orthop.* **2014**, *75*, 203–212. [CrossRef]