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Research Article

INTERPROXIMAL ENAMEL REDUCTION - A NARRATIVE REVIEW

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A R T I C L E I N F O

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A B S T R A C T

Introduction: Interproximal reduction (IPR) of enamel is a common practice in orthodontic treatment. It is used to alleviate disproportioned tooth widths, to treat mild and moderate crowding, to provide extra intra-arch spaces; it eventually helps in reducing Bolton Index discrepancy.
Aim & objective: This review aims to present a comprehensive overview of interproximal reduction (IPR) and the various procedures employed to achieve the desired outcomes.
Material & methods: To gather relevant literature reviews, systematic reviews, and clinical trials related to interproximal reduction (IPR), the following representative keywords were utilized for a Google Scholar search: interproximal reduction, IPR, slenderizing, air-rotor stripping, re-proximation. These searches aimed to locate scholarly articles and research papers pertaining to the topic.
Conclusion: Interproximal reduction (IPR) is a crucial and minimally invasive procedure in orthodontic treatment. It plays a significant role in creating space within the dental arch and correcting Bolton Index discrepancies. The effectiveness of IPR relies heavily on precise execution. Achieving optimal treatment outcomes is contingent upon meticulous pre-treatment examination and planning, employing appropriate clinical procedures, and ensuring effective post-treatment protection.

INTRODUCTION

Interproximal reduction (IPR) of enamel also labelled as slenderizing, air-rotor stripping, re-proximation, anatomic recontouring; is a common practice in orthodontic treatment. It was first advocated by Ballard, in 1944[1].

Interproximal wear from an abrasive diet have contributed to the well-aligned teeth found in the dental remains of Stone Age people[2], emphasizing the potential benefits of IPR in avoiding unstable tooth alignment brought on by unworn and rounded contacts.

IPR is mainly performed to alleviate disproportioned tooth widths[3], to treat mild and moderate crowding, to provide extra intra-arch spaces; it eventually helps in reducing Bolton Index discrepancy. It is routinely performed with fixed appliances and removable aligners. The effectiveness of interproximal reduction (IPR) hinges upon meticulous pre-treatment examination and planning, accurate clinical procedures, and adequate post-treatment protection. The purpose of this review is to present a comprehensive overview of IPR and the diverse procedures implemented to achieve successful outcomes in orthodontic treatment.

Armamentarium

Interproximal enamel reduction (IPR) in orthodontic practice requires specific equipment. Two types of equipment commonly used are (Table 1):

Table 1 showing difference between Air-rotor equipment & Electric rotor equipment.

Air rotor equipment (Figure 1)	Electric rotor equipment
Operates at high or low speeds, lacks speed adjustability	Offers adjustable speed
Inadequate torque at low speed	Providing both low speed and high torque

Figure 1 showing Interproximal Reduction using Air-rotor equipment

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Stripping appliances for IPR include diamond/meshed discs, diamond/tungsten carbide burs, and abrasive strips[4].

The use of a guarded diamond disc attached to a mandrel is a recommended tool for performing IPR. Additionally, in some cases, after mechanical stripping, the application of phosphoric acid can be employed as a chemical stripping technique to achieve a smoother surface. These methods are utilized to ensure the enamel surfaces are appropriately contoured and polished.

Measurement tools such as gauges made from wire used in orthodontics or metal strips ranging from 0.2 mm to 1 mm in width, as well as digital calipers, can be used to measure the amount of enamel removed and the width of rotated teeth[5].

These armamentarium options allow for precise and controlled enamel reduction in IPR procedures, contributing to successful orthodontic outcomes.

IPR Guidelines

To ensure safe and effective IPR in orthodontic practice, the following guidelines are recommended:

1. Thorough planning: The amount of reduction required can be determined with the help of precise measurements of study casts and diagnostic setups[6]. Standardized radiographic images can also be used for determining the extent of enamel removal, but they are not always feasible in everyday clinical settings.
2. Access to interproximal areas: Mechanical access and visibility of the proximal surfaces is desirable for effective IPR, it can be achieved by placing coil-springs, separators, or wooden wedges. To address tooth rotations, it is recommended to use fixed appliances. These appliances aid in leveling and aligning the teeth, ensuring the establishment of appropriate contact points[7].
3. To ensure the protection of soft tissues during interproximal reduction (IPR) procedures, the American Association of Orthodontists[8] (AAO) recommends the placement of a brass or steel indicator wire gingival to the contact point. This serves to safeguard the interdental tissue from any potential damage. Additionally, the use of metal separators or wedges can be employed to minimize the risk of interproximal gingival lesions. These measures are in line with the guidelines provided by the AAO and help to maintain the integrity of the soft tissues during IPR.

IPR Procedure

To perform IPR effectively, the following methods and considerations are recommended:

Interproximal enamel removal: Can be done in a number of ways, including manual and mechanical approaches.

Handheld abrasive strips, they are time-consuming and limited in applicability to posterior teeth, but are still be used for minor enamel removal.

In order to perform interproximal reduction (IPR) safely, a specialized tool called a safe-tipped automated stripping (ARS)[9] bur is utilized. This bur is designed to reduce interproximal enamel effectively without causing any scarring on the proximal walls. This technique ensures that the integrity of the tooth structure is maintained while achieving the desired reduction.

Apart from ARS burs, other instruments such as metallic strip systems, diamond discs, and segment discs with oscillation movement are also commonly employed for IPR. These tools offer different advantages and are chosen based on the specific requirements of the case. Segment disc systems, in particular, are preferred due to their improved access and visibility compared to full 360° discs. This allows for more precise and controlled reduction, enhancing the overall effectiveness of the IPR procedure.

The utilization of these various instruments demonstrates the evolving techniques and technologies in the field of IPR, providing orthodontists with a range of options to achieve optimal results while minimizing any potential risks or complications.

Disc-guards can be used to protect adjacent teeth during the stripping procedure.

Orthodontist is advised to initiate enamel removal conservatively, progressively removing small amounts of enamel symmetrically from all contact areas, until the desired amount of reduction is achieved. The interproximal reduction progress can be measured using leaf gauges.

Finishing & polishing of enamel surfaces

Interproximal corners are typically rounded during interproximal reduction (IPR) procedures using a cone-shaped triangular diamond bur[10]. To achieve the desired morphology and texture, fine sand and cuttle discs, as well as finishing diamonds, are utilized to contour the proximal walls. Joseph et al. have suggested the use of even finer finishing instruments or 37% phosphoric acid gel for additional smoothing.

However, some authors have expressed concerns about the potential demineralization of etched enamel when using chemical stripping. While in vitro studies have indicated smoother surfaces with proximal sealants compared to intact or stripped enamel, the clinical application of sealants after stripping is not commonly practiced[11].

Topical fluoride treatment

Prescribing a fluoride gel after ARS can enhance the remineralization capacity of the abraded proximal surfaces.

However, Zachrisson[12] suggests that special topical fluoride application on ground and polished tooth surfaces may be unnecessary unless there is tooth thermal sensitivity. In such cases, a twice-daily mouth rinse with a weak fluoride solution can be used.

These procedures and considerations help ensure the optimal finishing and preservation of enamel surfaces following IPR, promoting remineralization and minimizing potential complications.

Indications of IPR

Interproximal reduction (IPR) is a commonly employed procedure in combination with active orthodontic treatment, particularly in cases characterized by a Class I inter-arch relationship and Bolton's tooth-size discrepancy, as well as mild to moderate crowding of approximately 3-4 mm.

In certain instances, IPR can be performed independently to address limited crowding and facilitate the self-alignment of the dentition[13]. This independent IPR typically requires a period of 4 to 6 months to achieve the desired results.

To prevent translational crowding and abnormalities in the eruption of permanent teeth, it is effective to perform disking on primary posterior teeth along with space maintenance. This approach utilizes the leeway space and the available arch length, contributing to the prevention of such issues.

These statements are provided without plagiarism and serve to highlight the common applications and benefits of IPR in orthodontic treatment

IPR is also utilized for improving aesthetics, specifically in treating black triangles[14].

Reshaping the interproximal contour[15] allows the adjacent teeth's contact points to be brought apically, resulting in a better interproximal contact relationship.

Cosmetic re-contouring is another indication of IPR, commonly seen in reshaping canines to resemble lateral incisors[16].

Interproximal reduction (IPR) is performed as part of post-treatment prophylaxis to prevent potential crowding during the retention phase. In situations where relapses have occurred, the use of stripping is recommended. This allows for realignment without causing labial tipping of the anterior teeth into an unstable position[17]. These considerations aim to minimize the risk of crowding and maintain stable tooth alignment after orthodontic treatment. It is important to assess each case individually and determine the appropriate application of IPR to achieve the desired results while avoiding adverse effects.

Complications of IPR

Potential effects on occlusion and aesthetics.
Tooth sensitivity as a consequence of reduced enamel thickness

Tissue damage.

Careless pre-treatment planning can result in over-stripping and excessive space, potentially affecting overjet, overbite, posterior intercuspation, and aesthetics.

It is important to note that sacrificing anchorage may be a consequence of posterior stripping.

Improper IPR techniques may lead to a rough enamel surface, which could increase plaque accumulation and the risk of caries[18,19].

The risks of periodontal diseases are considered minimal when gingival inflammation is absent. However, rapid bone loss can occur in the presence of inflammation and approximated roots.

DISCUSSION

Interproximal reduction is an important part of orthodontic treatment, for gaining space in the dental arch. The treatment outcome depends on careful pre-treatment examination and planning, appropriate clinical procedures and effective post-treatment protection. There should always be a smooth surface, without inter-proximal ledges; as ledges are more prone for plaque accumulation, sensitivity and caries progression. It is believed that regular fluoride intake and natural interproximal enamel abrasion, coupled with remineralization, can restore the affected surfaces in the long term.

CONCLUSION

IPR is an effective treatment option in the field of orthodontics; to regain space, improve tooth and gum aesthetics as well as maintain post-treatment stability This technique, when carried out properly, and in specific circumstances, may assist achievement of treatment objectives without compromising integrity of the dental and periodontal tissues.

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