

Interproximal Enamel Reduction [IPR] - A review

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ABSTRACT - Interproximal enamel reduction is a part of orthodontic treatment for gaining a modest amount of space in the treatment of crowding. IPR is safe and effective for alleviating mild to moderate crowding, improving dental and gingival aesthetics as well as facilitating post-treatment stability. The widespread recognition of enamel stripping technique was initiated by the advent of bonded orthodontic attachments and a 2-article series in the 80's.

Nowadays interproximal enamel reduction has become a viable 'space-gaining' alternative to extractions in mild to moderate cases, and helps to adjust the Bolton Index discrepancy. This review discusses the evolution, technical aspects and clinical enamel reduction procedures.

KEYWORDS: Interproximal reduction, Air-Rotar stripping, Crowding, Tooth alignment, Boltans discrepancy

I. INTRODUCTION

Dental crowding in the anterior region is one of the most common findings in orthodontic patients. Transverse arch expansion, proclination of the anterior teeth, distalization of the teeth in the arch, extraction of the tooth, interproximal enamel reduction, derotation of posterior teeth these are the method for gaining of space. Interproximal enamel reduction also described as "Air rotar stripping", "Slenderizing", "reproximation" has been used in clinical orthodontics.^[1-2] Ballard first used interproximal enamel reduction for the anterior segment in 1944.^[3] It is a clinical procedure that involves the reduction, anatomic re-contouring, and protection of interproximal enamel surfaces of permanent teeth. For patients with mild to moderate crowding (4-8 mm), Interproximal enamel reduction (IER) is an alternative to dental extraction.⁴

II. THE BACKGROUND OF IPR

IPR was first introduced in 1944, Ballard^[5] advocated stripping of the proximal surfaces of the mandibular anterior segment to correct a lack of harmony in tooth size. A decade later, Begg found that crowding was absent in Stone Age man's dentition where wearing in occlusal and interproximal surfaces widely presented.^[6] Hudson described in detail a stripping technique utilizing metallic strips, followed by polishing and fluoride preventive measures.^[7] Peck and Peck developed an index indicating the relationship between tooth morphology and dental alignment to facilitate treatment planning in 1970s.^[8] Sheridan published articles on air-rotor stripping in the 1980s marked the turning point of IPR technique.^[9,10] Later, this technique was also employed in tooth reshaping and black triangle reduction.^[3] Indicative of the ongoing development of enamel reduction techniques is the almost two times increase of clinical use of anterior stripping

between 1986 and 2008 in a United States survey of orthodontic diagnosis and treatment procedures.^[11]

III. CLINICAL INDICATION FOR IPR

1. IPR should be carried out only in patients with low caries risk profile and good oral hygiene to avoid increased susceptibility to caries.
2. The main indications for IPR in the treatment of adults are crowding, when the lack of space in the dental arch is 4 to 8 mm
3. Boltans Index discrepancy, the ability to safely obtain sufficient space for tooth movement without the need for extractions,
4. changes in tooth shape, macrodontia, normalization of gingival contour and elimination of black gingival triangles, enhancement of retention and stability after orthodontic treatment,² and correction of the Curve of Spee.

CONTRANDICATIONS FOR INTERPROXIMAL ENAMEL REDUCTION

1. IER should not be carried out in patients with a high risk for caries and poor oral hygiene to avoid the risk of development of caries.
2. The major contraindications are when crowding is more than 8 mm per arch, active periodontal diseases, enamel hypoplasia, multiple restorations, round-shaped premolar^[13] and young patients with large pulp chambers.
3. Sensitivity may be induced after IPR because of reduced amount of enamel.
4. Over-stripping caused by careless pre-treatment planning can lead to excessive space.
5. Improper planning may also affect overjet, overbite, posterior intercuspation and aesthetics.^[12]

IV. ARMAMENTARIUM OF IPR

Clinically most accepted IER techniques include-

1. The air-rotor stripping technique (ARS) with fine tungsten-carbide or diamond burs and diamond coated strips.
2. Hand-piece or contra-angle-mounted diamond- coated disks.
3. Handheld or motor-driven abrasive metal strips.

The commonly used materials for the purpose are:

Metal abrasive strip- It is a manual instrument for anterior teeth enamel reduction. The strip can be used in an operator's hand, the Mathew haemostat, or in special strip holder. It can be used when the teeth are so rotated that a disk is not appropriate & for re-contouring teeth after IER. But sometimes it may become impractical, unproductive, and time-consuming when used for buccal teeth and leaves a part of strip lodged between the teeth.

Diamond disks- They are abrasive diamond-coated disks available in varying thicknesses and grits, similar to strips.

They can be single/double-sided and are used with contra angled handpiece. It provides the smoothest enamel surface with polishing after IER, but if not used properly may leave deep undercuts on the enamel and sometimes can become dangerous while working in close proximity to a patient's tongue, cheeks and lips.

Air-rotor stripping (Burs) - It was first described by Sheridan as an alternative to extraction or expansion in borderline cases.^[14] While performing ARS it is recommended to use burs with safety-tipped non-cutting areas to prevent furrows of the proximal walls, this can be done by using conventional burs with squared off tips. This technique is that it leaves the roughest enamel surface after IER compared to diamond discs and metal strips.

Ortho-strips- These are thin, semi-flexible strips used with a holder. Intensive Proxo shapes are flexible thin blades that removes a small amount of the intermolar enamel to provide banding space if separation has not been effective. This technique requires more time than ARS, but the results obtained are more predictable, and the enamel surface obtained is smoother than that achieved when using burs.

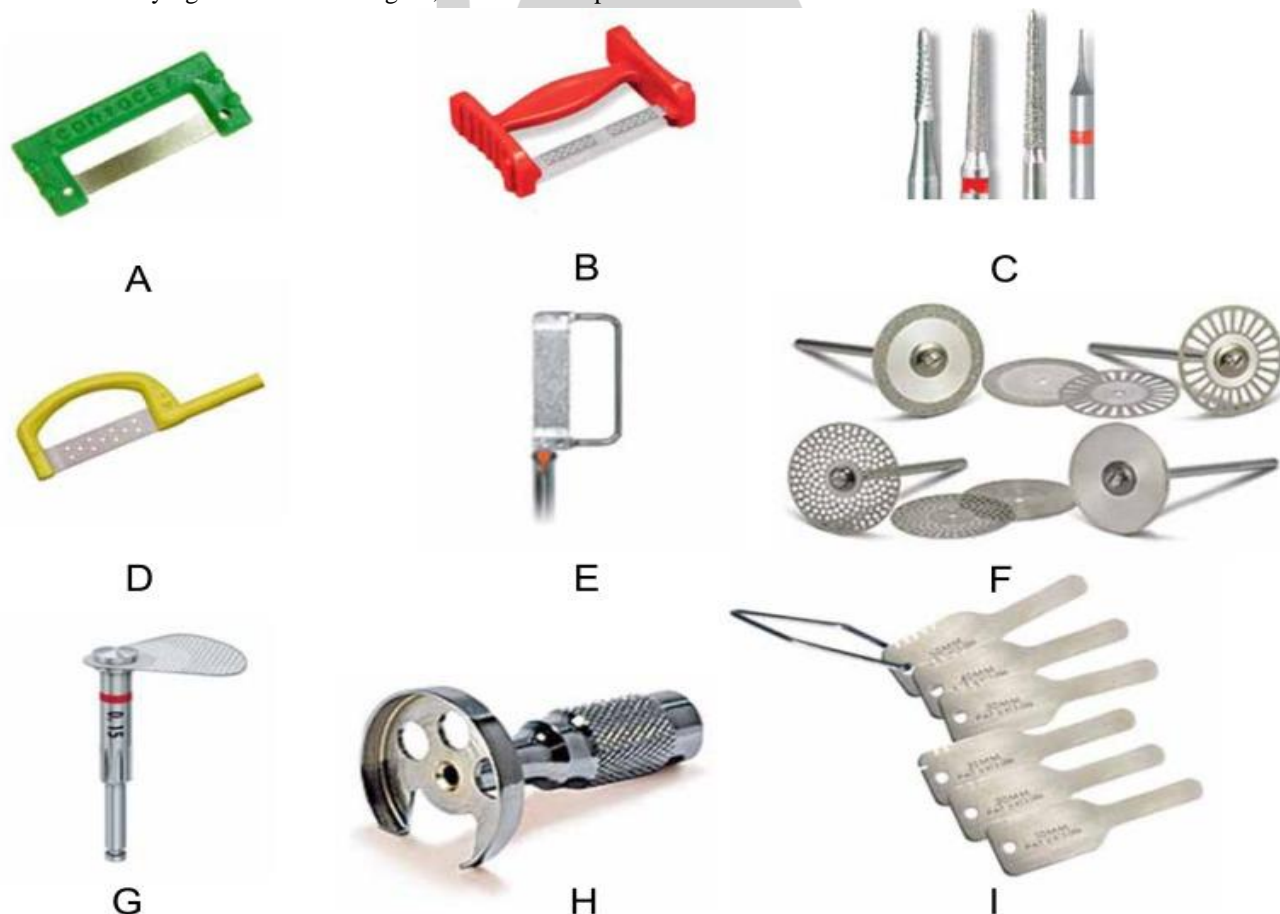


Fig. (1). Commercially available enamel reduction accessories. (A) ContactEZ Dental Strip, ContactEZ Company, Vancouver, WA, United States. (B) ET Flex™ Brasseler USA, Savannah, GA, United States. (C) Safe tipped ARS (STARS) burs, Raintree Essix, Inc. Metairie, LA, United States. (D) IDEAL® Interproximal Strip, Dentsply International, York, PA, United States. (E) Intensiv Ortho Strip System, Axis Dental, Coppell, TX, United States. (F) Galaxy™ Diamond Discs: Double sided-, double sided perforated-, double sided mesh, single sided diamond discs, Ortho Technology, Inc.; Tampa, FL, United States. (G) Oscillating segment disc, KOMET USA, Rock Hill, SC, United States. (H) Diamond Disc Safety Guard, Ortho Technology, Inc.; Tampa, FL, United States. (I) Interproximal Gauge Set, KOMET USA, Rock Hill, SC, United States.

V. CLINICAL KEYS FOR IPR

Key1- Case selection

- IPR should be carried in patient with good oral hygiene, patients with class I arch length discrepancy with orthognathic profiles and minor class II or class III dental malocclusions [particularly non-growing patients]
- Arch length discrepancies less than the size of two premolars.
- Boltan tooth size discrepancies.
- Peck and peck Analysis is given by Harvey Peck and Sheldon peck in 1972

$$\text{Index} = \frac{\text{Mesiodistal crown diameter} \times 100}{\text{Faciolingual crown diameter}}$$
 The maximum limit of desirable MD/FL index value for mandibular lower central incisor 88-92 and for mandibular lateral incisor 90-95.

Key 2- Amount of Proximal stripping

- To begin with, rotated teeth should be aligned prior to reduction if possible to arrange the contact points in a more favorable position. It is optional to separate the teeth 3-4 days before IPR.^[1,15]
- Coil spring or separators can be used to open space, improving visual and mechanical access and depressing dental papillae to reduce trauma . This step is often done when the teeth are too rotated and for reduction to be performed prior to alignment.^[1,15] Space opened by coil spring or separator should be measured before reduction to avoid over-stripping. Interdental papillae should be protected with thin brass or steel indicator wire.^[1,15]
- Amount of proximal stripping suggested by various authors:

Hudson [1965] suggested a maximum removal of 0.25mm per surface from the incisor and 0.3mm from canine.

Barrer [1975] allowed as much as 0.5mm per surface to be stripped from the mandibular incisors.

Peck and peck [1975] ,Boese [1980], Sheridan reduction of 50% of Interproximal enamel.

Tuverson [1980] 0.3mm on lower incisor, 0.4mm on canine.

Fillion [1995] warned against removing more than 0.2mm of enamel.

- Various materials are available for this purpose:

1. Initial reduction

2. Polishing of tooth surface

Various materials are available for this purpose:

Abrasive strips, Diamond coated metal, Abrasive disks, long thin burs [Diamond coated, Tungsten carbide] are use for reduction.

- In the process of IPR, an ultra-fine diamond disc should be placed in the inter-dental space at first followed by reducing mesiodistal widths to the desired dimension.^[16] Subsequently, the disc should be inserted below the contact point and swept occlusally. It is suggested that measurement tools be applied to ensure adequate enamel reduction is performed as planned previously. It is also important to ensure that the contact point remains 4.5-5 mm away from the bone crest.^[15] If it is too far from bone crest, black triangle may be visible. However, if it is too close, the size of col will become larger, leading to increased periodontal pocket.^[15]

Key 3- Materials used for the procedure

- After reducing the enamel, it is necessary to contour the tooth to normal shape with appropriate embrasure width suitable for oral hygiene.^[16] It is also recommended to restore the contact point since it is brought more apically after reduction.^[17]
- These procedures can be carried out with a bur, an ultra-thin diamond disc. Next, polishing paste should be used to make the surface smoother.^[11] Some researchers suggested 35% phosphoric acid in conjunction with fine abrasive strip for better re-contouring.^[1,15]
- Subsequent to re-contouring, steps should be performed to protect the enamel from increased risks of caries.

Key 4-Maintaining Tooth Morphology

- Restoring the normal anatomy of the teeth is the most critical factor in attaining good contact points and intercuspation after Interproximal stripping.
- The teeth should not have excessively angular contact areas ones the spaces are closed.

Key 5- Fluoride Application

- Various strategies have been suggested, including 8% stannous fluoride for 4 minutes, fluoride mouth rinses for 45 days¹⁹ and 0.05% neutral sodium fluoride mouth rinses once daily.^[2]
- Some researchers also recommended the use of regular professionally-applied fluoride (1.23% acidulated phosphate fluoride) for 4 minutes together with fluoridated dentifrice daily.^[18,19]

Others suggested casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) tooth mousse for enamel's re-mineralization into subsurface layers.²⁰

- Applying sealant (e.g. fissure sealant) after etching for 20seconds is another approach, yet it may not last long. Chudasama and Sheridan suggested posterior stripping be performed one site at a time from the most posterior site.
- After enamel was reduced at one site; space should be closed before another stripping on the subsequent visit in order to gain better control and prevent over-stripping. Special attention should be paid to anchorage control at the same time.

VI. CONCLUSION

Reduction of Interproximal enamel surfaces represents a valid therapeutic modality in the hands of the orthodontist. 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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