

A Review On Inter Proximal Enamel Reduction - An Adjunct In Orthodontics

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Abstract:

In orthodontics interproximal reduction is carried out in certain cases to create space for ideal tooth alignment during the course of treatment and to give teeth a suitable shape whenever problems of shape or size require attention. This article reviews the indications and need for performing IPR in orthodontics.

Keywords: *Inter, Proximal, reduction, stripping, alignment*

INTRODUCTION:

Inter-proximal reduction is the removal of a small amount of enamel from between the teeth to reduce their width. Inter-proximal enamel reduction (also known as slenderizing, stripping, enamel reduction, reproximation and selective reduction) is a useful tool for space creation, achieving ideal aesthetics for tooth size discrepancies (Bolton's) for maxillary to mandibular dental arch compatibility in Class I occlusion and interdigitation of teeth during orthodontic finishing.¹

IPR can be used as an option where extractions or overexpansion in non-extraction cases are unwanted. It can assist with increasing treatment efficiency, conservation of transverse arch widths and ideal incisor inclinations. IPR is also useful in prevention of gingival papilla retraction commonly known as the "black triangles" of particular relevance to adult patients.²

Definition:

Inter proximal Reduction is the reduction of Mesiodistal width of teeth by removal of inter proximal enamel in controlled increments. Peck & Peck use the term reproximation as it is "the act of 'redoing' the approximal surfaces". They define tooth reproximation as involving the reduction, anatomic recontouring and protection of the mesial and or distal enamel surfaces of a permanent tooth (where protection refers to the post procedural topical cariostatic agents)³ IPR however can be performed in deciduous and permanent teeth. Keystoning refers to oblique IPR of the lower incisors to "lock" them together to prevent rotational relapse.

INDICATIONS AND USES OF IPR IN ORTHODONTICS:

1. Improvement Of Microaesthetics And Smile Appearance⁴

Sarver (2011) describes the importance of including tooth shape and form assessment in the diagnosis and treatment of orthodontic problems and how enamoplasty is a key component to achieving ideal microaesthetic characteristics in orthodontic finishing. Microaesthetics refers to tooth morphology, ideal ratios for dimensions, shape and contour, contacts, connectors embrasures, gingival margin form etc. Enamoplasty can be used to an advantage when one understands the principles of ideal tooth shape and morphology. Contact points are where the teeth touch and the connector is defined as the interdental contact area. 'Black triangles' or open gingival embrasures is a lack of interdental papilla. The papilla height is 49% of crown height and contact point to incisal edge is 51%. Prevalence in treated adolescents is 42% and in treated adults approximately 38%. Possible contributing factors include contact points located incisally,

interdental papilla and alveolar bone height loss (e.g. related to periodontal disease), triangular crown shape, divergent roots and severely maligned incisors. However, rather than crowding it is more to do with undetected incisal attrition leading to incorrect bracket positioning. The presence of interproximal papilla is shown to be related to the distance from the contact point to the alveolar crest. A distance ≤ 5 mm resulted in 98% presence of papilla, 6mm resulted in 56% papilla presence and >7 mm resulted in 27% papilla presence. Thus IER may be used to move incisal contact points to a better position for correct tooth proportions and improved interdental papilla.

Ensure that the teeth are well aligned prior to reshaping as rotations can conceal the true height:width ratio. The steps to correct microaesthetics as listed by Sarver is as follows:⁵

1. Establish ideal root divergence
2. Establish Height: The gingival margins should be corrected (with confirmation of periodontal probing) whether gingivectomy is required to correct the tooth height
3. Address Width: After gingival margin healing to final position, the width of the teeth can be reduced with a fine carbide bur (with rounded "safe tip" that avoids gouging a ledge) first recontouring the connectors in short vertical motion.
4. Check Connector Length: Squeeze the teeth together to show any interferences and contact length, adjust accordingly.
5. Round Line Angles: Once the carbide bur has cleared from Line angle-Point angle, use discs or hand held strips (better suited for interproximal polishing) or cone-shaped diamond and follow the connector to round the line angles.
6. Close Space From IER: Power chain over the fixed appliances can be used to close the space.
7. Create & Refine Embrasures: Using the cone shaped diamond as above refine embrasures and line angles once spaces closed.
8. Polish :A carbide long flame followed by rubber polishing tip is used to finish and polish the enamel.

It is this microaesthetic feature of IPR that may initially not seem a significant complimentary orthodontic finishing tool, but in fact can transform a case that may look average to one with optimal aesthetic and finishing outcomes.

2. Correction Of Dental Midlines⁶

IPR can assist in correction of midlines to establish symmetry of the anterior dentition and achievement of perfect Class I canine relationship.

Achieving a coincident dental midline to the true vertical (facial midline) allows any deviation <4 mm to be unnoticeable. When midlines deviate from the true vertical, then dental midline discrepancies >2 mm are noticed. Thus dental midline discrepancies of 2-4mm may be corrected with IPR rather than having to resort to extraction (>4 mm deviation).

3. Retraction Of Upper Anteriors Where There Is Lack Of Overjet And Overbite⁷

IER can assist in more favourable overbite and overjet resulting in improved anterior function and a mutually protected occlusion. IER can assist in retraction of upper incisors when there is not enough overjet for the retraction to occur, thus via lower incisor IER this can create the overjet required for further upper incisor retraction. There is a positive correlation between an increase in overbite with increase of IPR. Sometimes, the occlusion may provide "Class I" relationships but with the face the aesthetics don't appear correct. Sarver mentions the importance of the $\frac{3}{4}$ profile smile photo as this can identify smile aesthetics and incisor

proclination. If the incisors appear overproclined with no spaces remaining and retraction is required but there is no overjet for this i.e. the lower incisors are contacting the marginal ridges and cingulum of the upper incisors, IER in the upper and lower will assist in attaining ideal incisor angulations. In addition during space closure after IER with powerchain, stainless steel round wire can be used to allow retroclination of the incisors with some extrusion for improved tooth display on smiling, increasing a minimal overbite and for consonance to the lower lip.

4. Providing Additional Space Requirements⁸

IER can also be used as an adjunctive tool to proclination, expansion, extraction, distalisation and use of Leeway space for space creation.

Sheridan uses 50% of interproximal enamel reduction as a guide from other references and quantifies this as:

Posterior segment IER available: 0.8mm/contact x 8 Buccal contacts = 6.4mm space

Anterior segment IER available: 0.5mm/contact x 5 anterior contacts = 2.5mm space

Total space available from conservative IER = 8.9mm.

More conservative amounts include recommendations of <4mm thus in cases with mild crowding where extractions are unwarranted IER can assist in correcting slight arch length discrepancies and reduce the need for extractions or canine expansion.

With large ranges of enamel reduction reported in the literature, Zachrisson et al finds mm values useless clinically due to the wide variation in enamel morphology and thickness for each tooth. Clinically relevant judgements involve removing enamel conforming to the shape of the teeth. Thus those teeth that deviate from the normal may have more enamel available for removal compared to “screw-driver” shaped teeth, round premolars and incisors with parallel mesio-distal surfaces which may be non-ideal candidates for IER.

5. Bolton’s discrepancies⁹

IER is useful for achieving ideal aesthetics for tooth size (MD) discrepancies (Bolton’s) for maxillary to mandibular dental arch compatibility in Class I occlusion and interdigitation of teeth during orthodontic finishing. There may be a maxillary excess +/- mandibular deficiency, maxillary deficiency +/- mandibular excess. It is common for orthodontic patients to exhibit a Bolton’s tooth size discrepancy. A Bolton’s analysis (deviations from an ideal anterior ratio 77.2%; posterior ratio 91.3%) would identify this prior to starting treatment so that plans are in place for final modifications. Mandibular incisor IER will affect maxillary anterior tooth size relationships, however it is often required in cases with unfavourably large lower incisor mesiodistal/faciolingual ratios with Bolton’s discrepancies involving anterior mandibular excess. IER can correct Bolton’s discrepancies and allow for well aligned and ideally occluding teeth.

6. As an adjunct to clear aligner treatment for space gain in non-extraction cases, minor crowding and rotations¹⁰

IER is used more frequently during clear aligner treatment than fixed appliances. In mild relapse cases where space is required, technicians would recommend IER to assist alignment as they were instructed to maintain lower intercanine width and not to flare the lower incisors. “Virtual collisions” where the setup causes one tooth’s interproximal surface to virtually pass through the adjacent tooth’s interproximal surface was another reason for IER so that desired tooth movement could occur without physical interference. Collisions < 0.5mm are considered insignificant as the aligner “stretches” this amount, however if there are multiple collisions, although align would recognise this as insignificant this could be clinically significant as the tooth mass is greater than the space allowed for the aligner and teeth will be intruded to reduce arch length often at the last molar. The clinician should choose the best IER option for the patient as the options available are “primarily”, “if needed” and “none”. “If needed” may not be the best as it gives the technician freedom to control the amount of IER, thus this should only be selected if the orthodontist gives specific instructions on the conditions IER is allowed. You can also request “no collisions” to ensure there are no insignificant collisions so that treatment imitates fixed appliance treatment.

7. IER & retainers for mild relapse or as adjunct to finishing

Custom-made positioners can correct minor corrections in tooth position and occlusal relationship. Positioners are made on articulated models where the teeth are sectioned, aligned and waxed into ideal and elastomeric or rubber material is contoured around the teeth and the coronal portion of the gingiva.

When debanding, IER can be performed prior to taking an impression for a positioner (for minimal crowding), or document the precise amount of IER for the technician to complete on the set-up and clinically repeat when inserting positioned. Positioners are worn full time for the first 2 days, followed by 4hrs/day plus nightly. Patients should bite and clench cyclically for 20sec followed by 20sec rest intervals during the first 4hrs to enable desired tooth movement in 3weeks, where its use becomes a passive rather than active appliance.

8. Reproximation to assist in post-treatment stability¹¹

“Stripping” mesial +/- distal enamel along with orthodontic treatment to minimise postretention crowding has a long history. IER of the lower incisors is often the last resort at maintaining alignment and often used after other conventional methods have failed. With reductions in inter canine width, arch length and depth continuously decreasing throughout life, crowding often ensues and IER can assist in long-term maintenance of lower incisor alignment Boese (1980) suggest serial reproximation to compensate for natural arch length reduction which appears to be common during increased horizontal mandibular growth. They state two main benefits of reproximation; first providing a broader contact point harnessing greater contact stability and secondly increasing space available in the lower anterior region particularly useful seeing as the biological framework limits increases in arch length or arch form

9. IER In Deciduous Teeth

IER can be used on occasions for interceptive guidance where no extractions of permanent teeth are planned and a local interference causes a shift leading to an anterior crossbite or rotation of a lateral incisor where the mesial of deciduous canine can be reduced. Cases with prolonged retention of deciduous second molars can have their mesial and distal surfaces reduced, for example where the lower E forces the lower first premolar in a mesial position crowding out the canine, the mesial surface of the E can be reduced by the amount of the leeway space to allow space for the 1st premolar to move distally and allow space for the canine to erupt into the arch. A flush terminal plane can be converted to mesial step by IER on the distal of the lower E aiming for a Class I molar relationship. Congenitally missing lower 2nd premolar cases where the future plan is for implant replacement can have IER of the lower E's (depending on pulp proximity) to simulate the space maintenance needed for a 2nd premolar whilst holding bone until the child is of ideal age for implant replacement.

CONCLUSION:

Interproximal enamel stripping has become an effective adjunct in orthodontic treatment planning to regain space, improve micro aesthetics as well as to maintain post-treatment stability. So we as orthodontists should choose appropriate indications by weighing the pros and cons. With cautious treatment planning, appropriate methodology and post-treatment protection, IPR possesses better advantages in establishing better treatment outcome in a more conservative way without harming dental or periodontal tissue.

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