International Journal of Science Academic Research
Vol. 03, Issue 09, pp.4366-4369, September, 2022
Available online at http://www.scienceijsar.com

ISSN: 2582-6425

Research Article

INTER-PROXIMAL ENAMEL REDUCTION AS A PART OF ORTHODONTIC TREATMENT

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Received 19th July 2022; **Accepted** 28th August 2022; **Published online** 20th September 2022

Abstract

Inter-proximal enamel reduction is a part of orthodontic treatment for create more space for incisor alignment and to maintain alignment in the long term. Today inter-proximal reduction has become a viable alternative to the extraction of permanent teeth, and helps to adjust the arches discrepancy.

Keywords: Interdental stripping, Interproximal enamel reduction, Reproximation, Air-rotor stripping.

INTRODUCTION

Inter-proximal reduction was formerly limited to mandibular incisors, with 2-4 mm of proximal enamel removed,1 but was later extended primarily, but not exclusively, to posterior teeth with a technique called air-rotor stripping.[1,2] Air-rotor stripping (ARS) is a technique for the controlled removal of proximal enamel in the posterior region to gain arch length for retraction and alignment of the anterior teeth.[1-3]This treatment philosophy is based on overcoming the difficulties of adult extractions and the instability of over-expansion in non-extraction cases.[3]Air-rotor stripping (ARS) was first described by Sheridan in 1985,[2] and subsequent reports and encouraging clinical observations have contributed to its growing acceptance.[1,4-8] Sheridan defined the amount of space gained by ARS as 6.4 mm per arch.[1,2] Interdental stripping or inter-proximal enamel reduction is a commonly used technique in orthodontic treatment to create more space for incisor alignment and to maintain alignment in the long term.[2,9-11] Air rotor stripping (ARS) of the proximal enamel surfaces on the posterior teeth has become an accepted treatment option in resolving cases with 4-8 mm of mild to moderate (borderline) arch length discrepancy.[1,5] Stripping with a high-speed air turbine hand-piece offers an alternative to extraction or expansion in selected cases. ARS can resolve significant tooth size/arch length discrepancies, and the technique can become an alternative to extraction or expansion.[1,2]Studies found that 22.9% - 30.6% of orthodontic patients had a significant discrepancy in anterior tooth size.[12,13]Inter-proximal enamel reduction can be used to correct the ratio and ensure a well-aligned and correctly occluding dentition. Inter-proximal reduction indicated in patients with good oral hygiene who have either Class I arch length discrepancies with orthognathic profiles, minor Class I dental malocclusions (especially in patients who have stopped growing), or Bolton tooth size discrepancies.[14] The comprehensive reduction technique was originally performed in adults but is now also used in younger patients. Proximal enamel thickness is constant throughout life, so there is no reason to limit treatment to adults. Stripping is valuable for eliminating triangular spaces in adult patients.[15]

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Such a space can be deemphasised by excessive parallelisations of the roots adjacent to the extraction site, by proximal enamel reduction to reduce the bell-shaped contours of the teeth adjacent to the missing tooth, or by building up the proximal surfaces with composite.[6] Precaution to maintain correct inter-proximal anatomy, stripping should begin at the least crowded areas. The proximal surfaces of the teeth must be as naturally shaped as possible to avoid wide contacts that restrict the space of the papillae.[15]Highly rotated teeth or severely inclined teeth where the contact points are subgingival are also more difficult to strip without excessive removal of tooth structure and trauma to the gingival tissue. In these cases, stripping is performed only after the initial alignment.[16] Stripping is not advisable in patients with poor oral hygiene as it may increase the risk of developing inter-proximal caries. Inter-proximal stripping is absolutely contraindicated in patients with gingivitis that needs to be corrected before enamel reduction.[15] The amount may be significant in teeth with deviated morphology, while incisors with parallel proximal surfaces, screwdriver-shaped teeth and round premolars may not be candidates for stripping.[16] Other possible contraindications to stripping in selected situations include severe crowding, small teeth, hypersensitivity to temperature changes, and inadequate oral hygiene and awareness of orthodontic treatment.[17] The purpose of ARS is to reduce enamel in the areas where there is the greatest amount of enamelis present, distal to the canines.[4,5] The teeth in the buccal region have a greater taper and therefore thicker enamel walls than the anterior teeth.[5]Study found significant differences in enamel thickness depending on tooth type and surface, as well as race. Lateral incisors had greater proximal enamel thickness than central incisors. Enamel thickness on distal surfaces was greater than that on mesial surfaces. Black subjects had thicker enamel on average than white subjects. The overall width of the teeth correlated positively with the enamel thickness of the mesial and distal surfaces. However, they found no statistically significant differences between male and female subjects.[18] As a rule of thumb, the thickest enamel on the mandibular anterior teeth is found on the mesial and distal surfaces of the canines and the distal surfaces of the lateral incisors. In the maxillary anterior region, the thickest enamel is found on the mesial and distal surfaces of the canines and the distal surfaces of the central incisors.[15] The differences in enamel thickness suggest that there is no

protective advantage to maintaining thick enamel inter proximally when comparatively thin enamel occurs naturally on the labial, buccal and lingual surfaces.[2] The lower incisors have a large thickness of enamel. In general, the average thickness of inter-proximal enamel in mandibular central incisors, mandibular lateral incisors and mandibular canines is 0.52 to 0.54 mm, 0.65 to 0.68 mm and 0.76 to 0.90 mm, respectively.[16] The caries-resistant, fluoride-rich layer of surface enamel is removed during any stripping treatment. Commercially available, office-applied fluoride rinses make it simple to restore this.[15,19]Duraphat fluoride varnish is the recommended fluoride vehicle because it is simple to use, more accurate to apply, less sensitive to moisture control, and has a more pleasant taste. Also frequently suggested for 45 days following interproximal stripping are fluoride mouthwashes.[15,16] According to studies, interproximal reduction can promote non-pathological adaptation in hard and soft tooth tissues, and an ARS site may be more resistant to caries and periodontal disease than unmodified enamel surfaces are.[1,5,7] In the buccal segments of one dental arch, up to 8 mm of space can be created by applying the rule of thumb of 1 mm of inter-proximal reduction at each point of contact.[20]In order to close extraction spaces or to coordinate larger arches, both extraction and expansion procedures frequently lengthen active therapy. Inter-proximal stripping, on the other hand, can speed up the treatment since it only removes enamel to the extent necessary to correct the arch-length disparity.[1-3] Additionally, the maintained inter-canine breadth and widened contact surfaces can aid in preventing post-treatment relapse.[21] The fact that stripping will prevent or reduce interdental gingival papilla retraction is an obvious benefit.ie, thedevelopment of black triangles between teeth. Optimalgingival fill in is, of course,particularly important whentreating adult orthodontic patients.[22] ARS can be performed at any point during treatment without causing the patient any discomfort and without negatively affecting the function of the dentition, interocclusal relationships, or tooth form.[2] It can also create a significant amount more space than is typically obtained by conventional inter-proximal reduction procedures. According to Germes and Taner (2008),[23]Non-extraction therapy along with ARS shortens the course of treatment by 8 months. In a research by Sheridan in 1987,[1] the removal of mechanical techniques required to close extraction sites or coordinate larger arches resulted in a mean treatment period that was 9.4 months shorter than that of conventional treatments.The enamel can act as a cover for underlying tissues because of its extensive mineralization. The surface is where this mineralization is most noticeable. Therefore, inter-proximal reduction of the enamel may reduce its resistance,[24] as well as make the tooth sensitive.[25]In general, this is important in regards to the tooth's resistance against caries, so many authors advise a reduction of no more than half the original thickness of the enamel coating to avoid excessivedegradation.[2,26] When stripping is restricted to one arch, potential negative consequences such the development of inter-arch tooth mass discrepancy and periodontal issues linked to close root proximity have been determined to be of minimal clinical significance.[1,27] Although it is impossible to properly polish inter-proximal surfaces that have been stripped using standard techniques,[7] recent research suggests that, when caries and periodontal state are taken into account, stripping of enamel has no negative side effects. "The health of the teeth can be left unaffected by removing the 0.3 to 0.4 mm of reduced enamel from each tooth.[11]Radiographically, there is enough enamel to permit peeling without significantly thinning the enamel.[28] Sheridan 1987,[1] asserts that the presence of plaque, rather than the consequences of decreased inter-proximal tissue or altered contact point structure, is what causes periodontal problems and caries to occur. When grinding teeth inter proximally, steps must be prevented. It is simple to unintentionally produce steps. They can cause plaque to build up, cavities to develop, and they can also encourage inflammatory cell infiltration in the pulp. Future cavities may result from inter-proximal steps created unintentionally during stripping.[29] The interdental space filled by tissue is reduced by 1-1.5 mm when the space made by enamel reduction is used to align the teeth. Because the result is the samea compression of the interdental soft tissues and the crestal boneclosing minor, naturally existing posterior spaces is also suspect from a periodontally standpoint.[30] Since soft tissue adapts easily and interdental medullary bone is the most adaptable bone in the body, clinicians frequently close minor, naturally occurring posterior spaces without considering the possibility of causing pathology.[10,11,26, 30] Patients whose gingival papillae significantly improved following the treatment of dental misalignment by selective stripping have been documented by Bose 1969,[31] Geigerich1971,[32] Tuverson 1980,[11] and Sheridan 1987,[1]. As a result, after orthodontic treatment, close root contact does not increase sensitivity to bone loss in the absence of inflammation. However, patients with inflammation may be more susceptible to a more rapid advancement of periodontal disease due to the closer spacing between the roots of inter proximally reduced teeth.[27] Plaque is predominantly responsible for periodontal problems and caries, not decreased inter-proximal tissue or changed contact point morphology.[33,34] The changes in enamel morphology after mechanical strippinghave been thoroughly documented.[28,35,36]

It has been suggested that the mechanical reduction of interdental spaces can leave proximal surfaces roughened, which might retain plaque and cause dental caries. These 10 to 25 um furrows are caused by the abrasive stripsroughness during the enamel reproximation process.[4] If stripped surfaces could be as smooth and caries-resistant as unaltered enamel, clinicians and patients might still be more confidence with ARS. The use of coarse strips or burs left uneven surfaces that could not be properly smoothed by later polishing. However, Profin, Ortho-Strips, and O-Drive D30automatic oscillation systems achieved the best outcomes.[24] Study compared ARS-treated and untreated tooth surfaces clinically and radiographically 2 to 5 years after enamel reduction, and the results showed no significant difference in the percentages of new caries between the stripped and intact surfaces. The equilibrium between demineralization and remineralization of abrasive surfaces must be evaluated, according to cariologists.[5] Some author reported the roughness produced by ARS does not predispose to caries. Posterior inter-proximal enamel reduction does not appear to expose the enamel to pathological changes that could lead to caries, but to a period of demineralization followed by remineralization.[7]the results of this study establish a sound biologicalfoundation for Sheridan' air-rotor strippingtechnique. Brudevold 1982,[37]found that smooth-surfaceenamelabrasion initially causesrapid demineralization, which opensnucleation sites for accelerated remineralization. Within minutes, salivary buffers are neutralizing the abraded sites,and remineralizationcan begin within one hour. Whenremineralization is complete, the enamel face is moreresistant to acid attack.[30] It has been demonstrated that fluoride reacts with enamel apatite crystals at fluoride levels of 500 to 1000 ppm at neutral pH to create

calcium fluoride, which when dissolved provides enough fluoride in solution to prevent severe enamel demineralization. When used with fluoride-based toothpaste, daily sodium fluoride (0.05%) rinses or weekly applications of acidulated phosphate fluoride gel were found to either prevent demineralization or encourage remineralization over the course of four weeks. To establish if fluoride supplementation is required following ARS, it is crucial to evaluate the patient's caries risk and level of fluoride exposure.[21] Evidently, patients do not experience an increased incidence of cavities when caution is taken and topical fluoride is used.[15]InClass I borderline patients with moderate crowding, non-extraction treatment with ARSpreserved the maxillaryand mandibular inter-canine widths and arch perimeters.Therefore,ARS might be a useful non-extraction treatmentalternative when anteroposterior and lateral expansion of thedental arches needs to be avoided.[38] In a study by Germeg and Taner 2008,[23] The main soft-tissueprofile differences betweenextraction and ARS groups werethe upper and lower lips that were retruded 1 to 1.5 mm moreretruded in the extraction patients, stripping allows dental alignment with minimal change in thefacial profile and no arch expansion.[15]

Conclusion

The justification for tooth extraction is still present despite ARS. Extractions are required to make up for extreme crowding. After moderate crowding has been resolved, ARS might be preferable to extractions.30 ARS requires adherence to the following published recommendations:[1,2] Limit interdental reduction to 1mm per contact point. Measure and chart the accruing space. Make sure the enamel walls are parallel. Finish the proximal walls as smoothly as possible. Curve the teeth to resemble the original morphology. Above all, ARS requires adherence to the criteria of well-finished cases.Because air-rotor stripping is more exact than extractions,there is no excess space to beclosed.[39]Twesme 1994,[3] recommended that the caries potential (DMFscores) of each patient be evaluated before removingproximal enamel.Researchers have shown no greater vulnerability to caries or periodontal disease in reduced proximal enamel surfaces, however their research have only been performed on anterior teeth.[9,10, 19, 26] The longer treatment time of extraction therapy, the limitations of ARS combined with nonextraction treatment (enamel thickness, tooth morphology, convexity of proximal tooth surfaces), and the additional effects of postadolescent growth should all be taken into account by the clinician when deciding whether to extract in borderline patients.[23]

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