Indication and Technical Application of Stripping

SUMMARY

Interproximal enamel reduction is a technique used for creating space in cases of mild or moderate crowding. There are several indications and contraindications determined by the tooth shape and the percentage of the caries index. The instruments used for the technique are diamond-coated metal strips, diamond discs and burs, each with advantages and disadvantages. Another way of interdental enamel reduction is using chemical products such as orthophosphoric acid. There are opposite impacts on the enamel surface and the periodontal tissues, based on the literature review.

Keywords: stripping, indications, methods

Introduction

Dental crowding is one of the commonest problems in dental practice and, particularly, in orthodontics. The main ways of resolving this problem are to increase the length of the dental arches and to reduce tooth mass, which is achieved through tooth extractions or by using the method of interproximal enamel reduction. Interproximal enamel reduction (stripping) is not a painful way to reduce enamel thickness at the contact points of the teeth, usually in order to create the space necessary to settle moderately crowded teeth or to change teeth morphology. The main role of the enamel is to protect teeth from abrasion and chemical or thermal stimuli. Stripping, as a way of resolving crowding problems in orthodontics, should be used when appropriate conditions, indications and criteria exist, and after informing the patient about potential consequences.

In 1944, Ballard first described enamel reduction to eliminate dental abnormalities responsible for crowding in the dental arch in the future, while Hudson, in 1956, presented a study in interproximal enamel reduction, involving lower anterior teeth.

In 1985, Sheridan described the technique of enamel reduction using a high speed air-rotor (Air-Rotor Stripping) and, since then, several studies have dealt with stripping, the space that may be gained using this technique and its potential biological consequences affecting the teeth and the periodontal tissues.

Indications

Favourable stripping factors are a triangular shape of teeth and a low caries risk index. A triangular shape of teeth allows gaining more space with less enamel reduction. The technique is applied in cases of mild or moderate crowding of both anterior and posterior teeth. As for the amount of crowding that may be tackled, options vary. It is claimed that up to 6.4mm or up to 9.8mm may be gained with molar and premolar stripping, removing almost 50% of the enamel of mandibular premolars and first and second mandibular molars.

Another view supports that the suitable size of crowding that can be resolved through interdental enamel reduction is 5-6mm. It is important to consider: a) that enamel thickness is not necessarily related to tooth size and diminishes from the contact point to the cementoenamel junction; b) that enamel thickness of upper first premolars seems to be distal rather than
stripping (ARS), especially in cases of moderate crowding, due to greater quantity of enamel at this site\textsuperscript{10}.

In addition to crowding, the ARS technique can also be applied in cases of mild middle line deviation by a dental problem, cases of increased overjet or overbite or for aesthetic reasons, especially when the phenomenon of ‘black triangles’ appears in anterior areas (Fig. 1).

Cases involving Bolton discrepancies are an indication for implementing the ARS technique, particularly when the discrepancy exceeds 1.5mm. A negative unilateral canine relationship may be caused by excessive second mandibular bicuspid width, where stripping can offer a solution\textsuperscript{17}. Moreover, stripping may be applied when a second deciduous molar remains longer than necessary and the space for adaptive manoeuvring should be exploited, e.g. when second premolars are congenitally missing\textsuperscript{19}. It is useful to consider that occlusal relations may be corrected or negatively affected after stripping and, therefore, it is necessary to evaluate beforehand the (occlusal) relationship of canine and molar cusps. Furthermore, the lateral occlusion of dental arches is usually determined by interproximal width of maxillary lateral incisors and maxillary incisors. According to C. F. Gugino, 70% of orthodontic cases are in need of stripping\textsuperscript{17}.

Contraindications

Nevertheless, stripping should be avoided in patients with a high caries risk index\textsuperscript{23} and in cases of dysplasia or malformation when teeth have parallel adjacent surfaces - as stripping might cause root contact with consequent damage to the periodontium since alveolar and mid-alveolar bone resorption resistance is proportional to the interproximal width of the tooth crown\textsuperscript{17} - and, of course, in cases when clinical and laboratory examination indicate that enamel reduction offers an insufficient solution to the problem.

As always, cases indicated for stripping should be treated in accordance with protocols appropriate for the technique used.

Stripping Techniques

Stripping techniques include the use of diamond discs, diamond-coated metal strips and burs. Firstly, thin metal strips or single coated diamond discs, which are both accurate and safe, are used to separate the teeth contact point. Additionally, separation may be effected by small separation rubber rings or brass wire, placed at adjacent dental surfaces. Diamond discs for interdental enamel reduction are available in several sizes and various surface diamond grains. Disc coating may be single or double.
Conventional low speed handles do not provide sufficient torque to the discs. Handles, instead, must operate at a speed of 4000-20000 rpm to generate the necessary torque, so that enamel reduction may be more effective12.

A disadvantage of this method is that it entails a risk of injury to the cheek or the tongue; this is limited by using protective equipment that covers ¾ of the disc and leaves the disc cutting area uncovered (Fig. 1B).

Unfortunately, such equipment reduces working field visibility and, therefore, special care is required so as to avoid injuring the gingiva, to control the amount of enamel reduction and to avoid destroying the anatomical contour of the teeth. Wedging the disc between the teeth should also be avoided, because it may have negative consequences for the patient (e.g. tongue injury). Stripping with diamond coated discs should be completed by polishing the surface with a Sof-Lex disk; this results in a smooth enamel surface and removes enamel surface furrows that favour plaque concentration, as indicated in a recent study comparing different stripping methods in deciduous and permanent teeth1. It has been observed that enamel roughness, following the use of diamond disks and polishing with Sof-Lex discs, is so mild that it is comparable with the enamel surface of teeth that have not undergone any stripping (with intact enamel surfaces). Another advantage of this method is its short duration, since it can be limited to 2.2 minutes per session32.

Diamond-coated metal strips provide another method for interproximal enamel reduction. They are indicated in cases of mild crowding, when a small amount of enamel needs to be removed. Metal strip coating may be single or double and, of course, medium or fine grain size. The strips can be used manually with the assistance of special handles or be motorized with a special low speed handpiece (Fig. 2A). First of all, metal strips are placed between teeth contact points. Then the strips are forced to perform buccal-to-lingual movements until a sufficient amount of enamel has been removed.

Diamond-coated metal strips include the more advanced intensive ortho-strips. Specifically, these are strips used with low speed handles and they reduce enamel through anterior-posterior movements. Depending on their function, type and grain size, such strips may be selected from a wide range available9. The thinner ones are capable of reducing enamel from 0.140 to 0.160mm and may be used to separate the contact point of teeth or to polish at the final stage of the procedure. The medium ones, that can reduce enamel from 0.270 to 0.330mm, are used both for enamel reduction and for contouring the tooth after the procedure. Finally, coarse grain strips can cut enamel from 0.370 to 0.560mm and are used for the main enamel reduction in cases of crowding and for the removal of dental materials, such as composite resin or amalgam. A very important advantage of metal strips is that they can access areas regardless of the slope and shape of the teeth, which is an advantage discs do not offer. Appropriate care and attention are necessary on the part of the dentist during the procedure, so as to avoid any injury to the gingiva and periodontal tissues. Moreover, special attention should be paid to the fact that the area gained after interdental enamel reduction may be misleading because teeth move away from each other due to the movements and tools used during the procedure. After removing the strip, the teeth move back to their normal position in the periodontium (rebound phenomenon) and that is when the actual space gained through interdental enamel reduction becomes apparent23 (Fig. 2B).

Figure 2. A) Stripping with a motorized metal strip; B) The real space gained (after stripping and rebound-phenomenon)
Burs placed on electric handpieces or air rotors provide another method for stripping. Sometimes there is a problem of controlling and regulating the speed of the handpiece when an air rotor is used and this entails the risk of damaging the tooth or soft tissues. An electric handpiece, on the other hand, can achieve the same speed as an air rotor while being capable of controlling and regulating speed at levels as low as 100rpm\(^{12}\). Burs used in stripping are appropriately designed so as to leave thin and smooth interproximal enamel surfaces. Burs should be safe-tipped, as this provides the advantage of creating a ledge on the enamel surface because their tips have no cutting edge.

Unlike strips and discs, for which a 50% enamel reduction is recommended, the ARS method is much more conservative and offers only a 1/3 decrease in the contact area. This corresponds to 0.5 mm in the widest area and 1 mm at the contact point\(^{1}\). More specifically, the stages of the technique using burs described by Sheridan are the following: First, a safe-tipped crosscut fissure carbide 699L bur is used for initial enamel reduction between teeth. Then, a 100 micron medium-grit, tapered diamond bur is used for smoothening and contouring teeth, followed by a 30 micron fine-grit, tapered diamond bur for extra smooth surface. Finally, a 15 micron extra-fine grit, tapered diamond bur is used to complete polishing.

In order to control the amount of enamel reduction at contact points, it is recommended to use a 0.40” steel indicator in the form of an open spring placed under the contact point between teeth. Enamel reduction is performed up to the point that allows the indicator to be removed. If more enamel reduction is required, stripping continues after the indicator has been removed. In this method, a water spray is necessary to avoid overheating; this also flushes the area, cleans the contact point and extends bur life. The highest amount of enamel reduction recommended at each contact point is 1mm. Enamel is thinner in mandibular incisors and maxillary lateral incisors; in these cases, the amount of enamel that can be removed is limited to 0.5mm at each contact point\(^{9,24}\). However, in a previous study, Hudson limits the enamel that can be removed to 0.2mm at each contact point for central incisors, 0.25mm for lateral incisors and 0.3mm for canines, thus gaining a space of 3mm\(^{15}\). Furthermore, there are views that up to 4mm crowding among anterior teeth may be resolved by reducing 0.3mm of enamel at each adjacent surface of each incisor (central and lateral) and 0.4mm at each canine surface\(^{27}\).

Another way of achieving enamel reduction is through the use of chemical products. The particular chemical process followed is using 37% orthophosphoric acid on adjacent surfaces resulting in etching and further facilitating mechanical reduction. This method leaves a smoother enamel surface and increases potential enamel remineralisation in the area\(^{16}\).

The structure and morphology of teeth that have undergone the procedure should be as close as possible to that of normal teeth so that proper contact points may be achieved following tooth alignment. An additional aim is to create a larger contact area and to avoid a conical tooth shape on the gingiva side, because this is a factor that favours plaque accumulation\(^{23}\).

**Effects of the Technique**

In the past, stripping was suspected as a risk factor for future dental caries of teeth that had undergone this procedure, because, after the end of stripping, several furrows remain on the enamel surface, a fact that favours plaque accumulation\(^{16,18,20}\); besides, enamel that has been stripped is more vulnerable to demineralisation\(^{7}\). Therefore, finer diamond tools should be used for enamel reduction, since they leave shallower furrows than coarse grain, and the enamel surface should be polished after stripping\(^{9,22}\).

A disadvantage of the technique is that pulp temperature may increase during stripping. Particular attention should be paid to the fact that during stripping with carbide burs, pulp temperature rises above the critical 5.5°C. This requires taking precautions to cool the teeth during the procedure, especially when the dentist uses a high speed handpiece\(^{4}\). It has been proved that the use of an 8-blade tungsten carbide bur for enamel reduction, in combination with a Sof-Lex disc for polishing, provides the advantage of leaving an enamel surface that is smoother than one that had not been stripped at all\(^{1}\).

Moreover, it has been shown that enamel surfaces that have undergone the procedure of enamel reduction using stripping in accordance with appropriate method protocols did not become more vulnerable to decay than teeth that had not undergone stripping, since new caries occurred in 2.5% of the teeth stripped as compared to 2.4% of intact enamel surfaces in a total of 43 patients\(^{30}\). This fact is supplemented by another research study indicating that stripping leads to enamel demineralisation followed by remineralisation over a period of 9 months\(^{10}\).

However, the dentist should take into consideration caries and caries risk index of each patient. A local fluoride compound should be applied on surfaces that have been subjected to the procedure\(^{28,30}\). Other authors suggest application of sealants after interproximal enamel reduction\(^{25}\). Furthermore, it has not been proven that conditions like tooth hypersensitivity, reaction to hot or cold stimuli, periapical lesions or bone loss during orthodontic tooth alignment are a result of stripping, and no negative effects on periodontal health have been
found. Due to the correction of the crowding, tooth surfaces in interproximal areas can be cleaned better, thus reducing plaque accumulation and, therefore, periodontal disease. It has also been proved that there is no difference in periodontal tissues after stripping, while, in some cases, stripping improves periodontal health, even in teeth that have been orthodontically aligned. Particular attention should be paid to the fact that, unlike the extraction method, neither canine-to-canine distances nor the perimeter of dental arches change but remain almost the same after stripping in class I patients. In addition, stripping does not alter a patient’s profile (something that might be caused by tooth extraction), while it improves tooth size and shape, thus helping eliminate the phenomenon of ‘black triangles’.

Moreover, air-rotor stripping (ARS) helps create flat surfaces at mandibular incisor contact areas, reduces incisor labial tipping, and, therefore, reduces potential future relapse. Additionally, ARS helps perfect tooth alignment as opposed to tooth extraction. A final point to be noted is that the time of the overall orthodontic treatment period is reduced, as compared to extraction method.

References


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