A SCANNING ELECTRON MICROSCOPIC COMPARISON OF RE-PROXIMATED ENAMEL SURFACES AFTER VARIOUS STRIPPING AND POLISHING METHODS – AN IN VITRO STUDY

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Abstract: This study was divided into 3 Parts. The 1st Part of the study was designed to compare with Scanning Electron Microscope the surface characteristics of Enamel surfaces after stripping with 16-Bladed TC burs, 8-Bladed TC burs and Coarse Diamond burs. The 2nd part of the study compares the enamel surfaces after polishing the stripped surfaces with Soft-Lex Discs or Fine and Ultra fine Diamond burs. In the 3rd part of the study the bond between the Resin based light cured Sealant which was used for sealing proximally stripped etched and Non-etched surfaces was compared. The smoothness between the sealed surfaces, stripped and polished surfaces by various methods and unaltered enamel are also compared.

Results showed that surfaces produced by stripping with TC burs are smoother than those of Coarse diamond burs. Soft-Lex discs are more efficient than fine diamond burs in polishing stripped enamel surfaces. Mechanically roughened surfaces do not have sufficient retentive capacity to make etching un-necessary. Sealed proximal surfaces were as smooth as unaltered enamel.

In conclusion, given the current emphasis on non-extraction treatment in orthodontics today, stripping is a technique that can increase space but must be performed with the best possible finishing of the inter-proximal enamel surface.

Key Words: Re-proximation, TC burs, Sof-lex Discs, Resin based light cure sealant.
INTRODUCTION

Patients with good profile and moderate degree of crowding are not ideal cases for extraction treatment and should be managed by non-extraction protocol.

Re-proximation is a clinical procedure for correction of tooth-shape deviations, tooth size discrepancies and to gain space for correction of moderate crowding. Slenderizing or stripping creates flat contact surfaces, which helps resist labio-lingual crown displacement, and eliminates the need for lower retention. Stripping procedures are being carefully tested and progressively improved by several researchers, owing to the increased application of the procedure in orthodontics considering its cariogenic and periodontal implications.

Conventional techniques using hand-held or motor-driven abrasive strips are normally limited to minor enamel reduction of the anterior teeth. The strips are forced between the contact points of the teeth, which creates patient discomfort and the risk of cutting gingival tissue. Hand piece-mounted abrasive discs can substantially reduce inter-proximal surfaces but, has the drawback of tissue injury and inadequate contouring. Air-rotor stripping (ARS) introduced by Sheridan can create substantially more space than is usually obtained by conventional inter-proximal reduction procedures, without discomfort to the patient.

Studies by Radlinski and Twesme, have shown that mechanical reduction of inter-dental areas could result in roughened proximal surfaces that might retain plaque and therefore lead to dental caries. Studies by Tal, Heins, Thomas, Newton and Weider, concluded that the periodontal structures show robust adaptability and primarily correlated with the presence of plaque, not the effects of reduced interdental tissue or altered contact points. El-Mangoury and Brudevold have reported that posterior inter-proximal enamel reduction does not expose the enamel to pathological changes that could lead to caries, but result in demineralization followed by re-mineralization within 9 months of stripping.

Air-rotor stripping can be done with Tungsten carbide or diamond burs. Any stripping procedure removes the caries-resistant, fluoride-rich layer of surface enamel, which can readily be re-established to a certain extent by employing various methods ranging from finishing the cut enamel with different grades of polishing disc or burs, applying sealant or using fluoride varnishes or rinses.

It would be interesting to study and compare with Scanning Electron Microscope the surface characteristics of enamel after Stripping and polishing with commonly used burs and discs. For this purpose this article has been divided into 3 parts. In Part I of the study the surface characteristics after stripping are compared. Part II of the study deals with surface characteristics after stripping and polishing. In Part III the enamel sealant bond between etched and non etched stripped surfaces is compared. Smoothness between the sealed surfaces, stripped and polished surfaces by various methods and unaltered enamel are also compared.

The present study was undertaken with following aims and objectives.

Part I - Stripping procedures

1. To study and compare the surface characteristics of the stripped enamel produced by 16-Bladed TC bur, 8-bladed TC bur and coarse diamond burs using SEM.

Part II - Polishing procedures

1. To study and compare the surface characteristics of stripped enamel by 16-bladed, 8-bladed and coarse diamond burs followed by polishing with fine diamond burs using SEM.

2. To study and compare the surface characteristics of stripped enamel by 16-bladed and coarse diamond burs followed by polishing with Sof-Lex discs using SEM.

3. To study and compare the surface characteristics of stripped and polished enamel between Sof-Lex discs and fine diamond burs using SEM.

The objective of the part II of the study is to compare the various polishing methods and identify the method, which is most efficient.

Part III - Sealing procedures

1. To study and compare using SEM the enamel sealant bond between etched and non etched stripped surfaces, produced by 16-bladed TC burs, 8-Bladed TC burs or coarse diamond bur and sealed.

2. To study and compare using SEM the smoothness between the sealed surfaces, stripped and polished surfaces by various methods and unaltered enamel.

Thus, this study is primarily aimed to suggest the appropriate procedure of stripping, polishing or sealing that produces an enamel surface close to unaltered enamel so that plaque retention which is a major factor after stripping is minimized.
MATERIALS AND METHODS

58 healthy human upper permanent premolars, extracted for orthodontic and periodontal reasons from patients less than 40 years were used. Only upper premolars were used as they have definite anatomy and a good contact can be achieved between the two upper premolars when compared to lower premolars. The samples were stored in 70% ethanol for no longer than 3 days and subdivided into 7 groups labeled from Group I to Group VII.

The teeth are mounted in typhodonts (Fig 1) in a well-aligned arch setup to simulate clinical conditions and are treated with different stripping procedures. The two upper premolars on each side are removed from the typhodont after the stripping, polishing or sealing procedure is complete and are replaced by teeth from the sample. The remaining teeth in both upper and lower arches of the typhodont are of acrylic. To have comparable operative conditions a single arch (maxillary arch) was used for each type of procedure to be assessed. Inter-proximal stripping was performed on teeth in all the groups. A new bur was used for stripping each pair of teeth (two premolars on each side). This prevents variation of SEM results because of the wear of the bur. The air-rotor pressure during stripping procedure is monitored. It is maintained within the range of 1.8 to 2.2 Kg/cm².

PROCEDURE OF AIR ROTOR STRIPPING

For inter proximal stripping the method introduced by Sheridan[12] is followed. A 0.020" stainless steel indicator wire is placed under the contact point of inter-proximal surface to be reduced. The indicator wire acts as a guide for the ARS bur and prevents lodging of the interproximal walls. The ARS bur in the air-rotor hand piece is placed on the indicator wire (Fig 2) and moved parallel to the plane of the wire occlusally or incisally with a light wiping motion. The position of the hand piece is alternated from buccal to lingual, and the interproximal surfaces are reduced until the indicator wire can be lifted occlusally between the contact points, without any interference.

PART I

Proximal stripping is done with different types of burs:

Group I: 4 teeth are stripped with 16-Blade TC bur (Flat end, tapered shape, 5.2mm length, 0.009 inch diameter - Komet H 231) - Fig 3.

Group II: 4 teeth are stripped with 8-Straight blade TC bur (Pointed tip, tapered shape, 9mm length, 0.014 inch diameter - Komet H135) - Fig 4.

Group III: 4 teeth are stripped with Coarse diamond bur (Pointed tip, tapered shape, 11mm length, 0.010 inch diameter - Komet 859) - Fig 5.

In each group 3 teeth were used for SEM evaluation of surface characteristics and 1 tooth was discarded by random. This minimizes the operator error in the stripping procedure.

PART II

Group IV: Four teeth in group IV are initially stripped with 16-TC and the other four with coarse diamond burs. After the initial stripping all the 8 teeth in group IV, are polished first with extra-fine (pointed tip, flame shaped, 8mm length, 0.012 inch diameter - Komet 862 EF) - Fig 6, followed by ultra-fine diamond burs (pointed tip, flame shaped 8mm length, 0.010 inch diameter, Komet 862 UF) - Fig 7.

Group V: Of the 12 teeth in Group V, 4 teeth each are stripped initially with 16 - TC, 8 - TC and coarse diamond burs. After the initial stripping all the 12 teeth in group V are polished first with medium followed by fine and super-fine Sof-Lex discs (Plastic discs with Aluminum oxide abrasive particle, extra thin in thickness) - Fig 8, which are mounted on a mandrel attached to a micro motor hand-piece at which is run at a constant speed.

One sample from each group (group IV and V) is discarded and a total of 18 samples were taken for SEM evaluation of surface characteristics.

PART III

Group VI: Of the 12 teeth in Group VI, 4 teeth each are stripped initially with 16 - TC, 8 - TC and coarse diamond burs, Embrace pit and fissure fluoride releasing light cure sealant was applied without acid etching (Part III WE).

Group VII: Of the 12 teeth in Group VII, 4 teeth each are stripped initially with 16 - TC, 8 - TC and coarse diamond burs. Stripped surfaces in group VII are etched for 20 seconds, rinsed and dried for 15 seconds. No surfaces were pumiced prior to etching, because the reducing burs would have removed any surface debris. Embrace pit and fissure fluoride releasing light cure sealant was applied (Part III E).
Light curing (Fig 9) was done with a halogen light (3M Unitex Ortholux XT visible light cure unit) for 20 seconds. 3 teeth which were stripped with each type of the three burs were taken from each group resulting in a total of (9 X 2) -18 samples for SEM evaluation of the enamel sealant bond. 9 teeth from each of the groups VI and VII are fractured mesio-distally with the help of a diamond disk.

The enamel resin interface of these teeth is observed by SEM to compare the enamel sealant bond between stripped surfaces sealed with or without acid etching. One sample in which the sealant was applied was taken for sealant surface evaluation. One additional extracted teeth was selected for SEM examination of the surface characteristics of the unaltered enamel.

**Method of SEM examination**

Specimens for scanning electron microscopy must be handled with care to ensure that the surface is not damaged. Specimens for which surface examination has to be done, the tooth was sectioned to remove the roots with the help of a diamond disk. For specimens where enamel sealant interface had to be examined with SEM, the crowns after sectioning of the roots were fractured mesio-distally through the proximal sealant. The specimen should not be larger than 1cm². Specimens with larger surface area, even after coating are poor electrical conductors and are prone to charging as explained later.

Dehydration is done to remove water from the specimen by an organic solvent. Dehydration facilitates drying of the specimen. Dehydration is done in an ascending series of ethanol.

Dehydration protocol:
1. 25 per cent ethanol, 10 min.
2. 50 per cent ethanol, 10 min.
3. 70 per cent ethanol, 10 min.
4. 90 per cent ethanol, 10 min.
5. 95 per cent ethanol, 10 min.
6. 100 per cent ethanol, 5 min.

Once dehydration is completed, the specimen must be dried. The method chosen should not distort the surface to be examined and should cause minimal shrinkage. The specimens are dried by putting the specimen in hot air Oven at 50°C for 10 minutes. Once dried the specimen was mounted on a brass stub (Fig 10) with the help of a double sided sticker. The specimen was coated with platinum (carbon, gold, palladium or silver can be used).

Coating of the specimens is done with a ‘sputter’ coater (JEOL JF-1600 Auto-fine Coater) as it produces a uniform and reproducible coating (Fig11). The specimens are then viewed in the scanning electron microscope (JEOL JSM - 5610 LV) (Fig 12). The specimens are viewed at an accelerating voltage of 15 KV and magnifications 370X and 1000X. Representative photomicrographs of the surface features were viewed on the display unit (Fig 13) and then recorded.

**OBSERVATIONS**

**Part I**

Comparison is made with SEM photomicrographs between the surface characteristics of the stripped enamel surfaces (Photomicrograph 1, 2, 3) to identify the bur which produces the smoothest surface. SEM photomicrographs of the enamel stripped with 16-bladed tungsten carbide bur (Photomicrograph 1) showed furrows that were the result of the passage of the bur. They appeared irregular and were uniformly distributed on the stripped enamel surface. The surface had a waterfall on glass appearance. SEM photomicrographs of the enamel surface after stripping with 8-bladed tungsten carbide bur (Photomicrograph 2) showed an enamel surface that appears finely rough without grooves or furrows. SEM photomicrographs of the enamel surface after stripping with coarse diamond bur (Photomicrograph 3) show deep and irregular furrows that form hills and valleys. On comparing the SEM photomicrographs of the enamel surface (Photomicrograph 1, 2, 3) stripped in Part I of this study it is seen that the surface produced by 8-bladed tungsten carbide bur (Photomicrograph 2) is smoother as the surface it produces is only a finely rough, as compared to the surfaces produced by 16-bladed tungsten carbide bur and Coarse diamond bur.

**Part II**

SEM photomicrographs of stripped and polished enamel surfaces are observed (Photomicrograph 4, 5, 6, 7, 8). Comparison is made with SEM photomicrographs between the surface characteristics of the stripped enamel surface (Photomicrograph 1, 2, 3), and Stripped and polished enamel surfaces (Photomicrograph 4, 5, 6, 7, 8) to identify the most efficient finishing procedure in producing a smooth surface. Comparison is made within surface characteristics of the stripped and polished enamel surfaces to identify the smoothest surface produced within the group.

SEM photomicrographs of the enamel surface after stripping with 16-bladed tungsten carbide bur and
polishing with fine and ultra-fine diamond burs (Photomicrograph 4) showed furrows crossing the surface at different depths. SEM photomicrographs of the enamel surface after stripping with 16-bladed tungsten carbide bur and polishing with medium, fine and super-fine Sof-Lex discs (Photomicrograph 5) showed a finely rough surface where the furrows left by the first bur (16-bladed TC bur) were still visible. SEM photomicrographs of the enamel surface after stripping with 8-bladed tungsten carbide bur and polishing with medium, fine and super-fine Sof-Lex discs (Photomicrograph 6) showed fine furrowing alternating with well-polished areas. SEM photomicrographs of the enamel surface after stripping with coarse diamond bur and polishing with fine and ultra-fine diamond burs (Photomicrograph 7) showed deep furrows crossing the polished enamel surface. SEM photomicrographs of the enamel surface after stripping with coarse diamond bur and polishing with medium, fine and super-fine Sof-Lex discs (Photomicrograph 8) showed deep furrows crossing the polished enamel surface. When comparison is made between the efficiency of fine diamond burs and Sof-Lex discs it was observed that Sof-Lex discs were more efficient in polishing the stripped enamel. On comparing the SEM photomicrographs of the enamel surface stripped and polished in Part II of this study, it can be observed that stripping with 8-bladed tungsten carbide bur and polishing by Sof-Lex disks (Photomicrograph 6) produces surface which is well polished when compared to other polishing methods.

Part III

The photomicrographs of part III of the study were divided into three parts. The first part shows SEM photomicrographs of enamel sealant bond after stripping and sealant application without etching (Photomicrograph 9, 10, 11) of the stripped surface (Part III WE). The second part shows SEM photomicrographs of enamel sealant bond after stripping and sealant application of the etched (Photomicrograph 12, 13, 14) stripped surface (Part III E). The third part shows SEM photomicrographs of the surface characteristics of enamel sealant (Photomicrograph 15) and un-altered enamel (Photomicrograph 16).

SEM photomicrographs of the enamel sealant interface after stripping and sealant application without acid etching in Part III WE of this study showed that the Sealant adhered to the stripped proximal enamel surface. No gap was seen between the stripped surface and the sealant (Photomicrograph 12, 13, 14).

When SEM photomicrographs of Part IIIWE (Photomicrograph 9, 10, 11) are compared with Part E (Photomicrograph 12, 13, 14) it can be observed that the mechanically roughened surfaces do not have sufficient retentive capacity to make etching unnecessary. When SEM photomicrographs of surfaces of the best-polished enamel in Part II of the study is compared with Sealant surface (Photomicrograph 15) and unaltered enamel surface (Photomicrograph 16) it could be observed that both the polished and sealed surfaces were as smooth as the unaltered enamel.

DISCUSSION

Tooth re-proximation can be defined as a clinical procedure involving the reduction, anatomic recontouring, and protection of the mesial and/or distal surfaces of a permanent tooth. The enamel stripping procedure gained favour as early as 1944 when Ballard advocated judicious stripping of proximal surfaces when lack of balance existed. It is common today to reshape the approximal contacts to solve both crowding and Bolton discrepancy problems, as well as to stabilize the dental arch.

It has been advocated that this technique should be selectively used on patients with good oral hygiene and low caries susceptibility. The disadvantageous effect of stripping is that it is not possible to produce an enamel surface free of furrows, which are 10 to 25 m in depth, 0.3 to 0.4 mm of enamel per tooth can be removed without jeopardizing the health of the teeth.

To prevent inter-dental caries the stripped enamel surface must be smooth without any grooves. This can be achieved by either polishing the stripped surface or by applying sealant over the stripped surface. As the grooves produced by the initial bur cannot be removed by polishing, the stripping produced by the initial bur should have minimal grooves. To observe the stripped and polished enamel surfaces a morphological evaluation with Scanning electron microscope can be done. Thus, an in-vitro Scanning electron microscopic evaluation of the stripped, stripped and polished, and stripped and sealed surface was conducted to study the enamel surface.

On comparing the SEM photomicrographs of the enamel surfaces stripped in Part I of this study (Photomicrograph 1, 2, 3) it is seen that the surface produced by 8-bladed tungsten carbide bur (Photomicrograph 2) is smoother as the surface it
produces is only a finely rough, as compared to the surfaces produced by 16-bladed tungsten carbide bur (Photomicrograph 1) and diamond bur (Photomicrograph 3). Tungsten carbide burs produce enamel reduction by brittle fracture, associated with crack production if excessive forces are applied. The greater the number of blades smoother will be the surface produced at low speeds. But at high speeds, only one blade cuts effectively at any one time, and the reminder are in effect sparses. Hence, at high speeds the number of blades does not influence the smoothness produced. The difference in smoothness encountered in the present study could be attributed to the design and configuration between 8 and 16 bladed TC burs. Diamond burs cut brittle materials like enamel by tensile fractures that produce a series of subsurface cracks. The diamond bur showed the roughest surface with deep grooves and furrows. The surface had a blizzard appearance. This is attributed to the mechanism of cutting with diamond burs. Radalsanki reported similar results where reduction of enamel surface with coarse diamond bur left furrows of approximately 10\(\mu\)m depth and width.

Part II of our study was used to compare the surface characteristics of stripped and polished enamel surfaces (Photomicrograph 4, 5, 6, 7, 8). SEM photomicrographs of the enamel surface after stripping with 16-bladed tungsten carbide bur and polishing with fine and ultra-fine diamond burs (Photomicrograph 4) showed furrows crossing the surface at different depths. Though the roughness caused by the stripping bur was considerably reduced by the diamond finishing bur, new grooves were created by the finishing bur and thus a completely smooth surface could not be attained. SEM photomicrographs of the enamel surface after stripping with coarse diamond bur and polishing with fine and ultra-fine diamond burs (Photomicrograph 7) showed deep furrows crossing the polished enamel surface. The furrows left after polishing the coarse diamond bur stripped surfaces are deeper than those left after polishing the 16-TC bur stripped surface. Radalsanki reported that finishing of the surface with fine diamond burs leads to certain leveling of the roughened surface, but leaves furrows due to abrasion by fine diamond particles. Sheridan and Ledoux have reported similar findings with grooves of 25\(\mu\)m in depth.

SEM photomicrographs of the enamel surface after stripping with 16-bladed tungsten carbide bur and polishing with medium, fine and super-fine Sof-Lex discs (Photomicrograph 5) showed a finely rough surface where the furrows left by the first bur (16-bladed TC bur) were still visible. Finishing with Sof-Lex discs led to considerable smoothening of furrows but was not able to completely eliminate the furrows.

SEM photomicrographs of the enamel surface after stripping with 8-bladed tungsten carbide bur and polishing with medium, fine and super-fine Sof-Lex discs (Photomicrograph 6) showed fine furrowing alternating with well-polished areas. At higher magnification the furrows reveal themselves as fine and shallow. In a study by Piacentini where different polishing methods are compared with SEM similar result were obtained when 8-TC bur is used for stripping and Sof-Lex disc for polishing. SEM photomicrographs of the enamel surface after stripping with coarse diamond bur and polishing with medium, fine and super-fine Sof-Lex discs (Photomicrograph 8) showed deep furrows crossing the polished enamel surface. Sof-Lex discs were not able to completely eliminate the furrows produced by the initial bur but have reduced the roughness considerably. Sof-Lex discs have a thin layer of abrasive (aluminum oxide) cemented to a flexible backing. Radalsanki has reported that subsequent careful finishing with medium to superfine Sof-Lex discs leads to a considerable smoothening of the roughened enamel surface. When comparison is made between the efficiency of fine diamond burs and Sof-Lex discs it was observed that Sof-Lex discs were more efficient in polishing the stripped enamel. This can be attributed to the abrasive points of Sof-Lex discs which are less rigid, fine textured and less porous compared to fine diamond abrasive points.

On comparing the SEM photomicrographs of the enamel surface stripped and polished in Part II of this study (Photomicrograph 4, 5, 6, 7, 8) it can be observed that stripping with 8-bladed tungsten carbide bur and polishing by Sof-Lex disks (Photomicrograph 6) produces surface which is well polished when compared to other polishing methods. The use of 8-TC bur for initial stripping allowed a very precise first stripping and left only surface roughness with very fine furrows. This was easily removed with the use of Sof-Lex discs. These results are in concurrence to a similar study conducted by Piacentini et al.

In Part III of the study when SEM photomicrographs of Part IIIWE (Photomicrograph 9, 10, 11) are compared with Part E (Photomicrograph 12, 13, 14) it can be observed that the mechanically roughened surfaces do not have sufficient retentive capacity to make etching unnecessary. Sheridan and Ledoux reported similar results. When SEM photomicrographs of surfaces of the best-polished enamel in Part II of the study (8-bladed TC followed by polishing with Sof-Lex discs - Photomicrograph 6) is compared with unaltered (Photomicrograph 16) and sealant surfaces (Photomicrograph 15) it could be observed that both the polished and sealed surfaces were as smooth as the unaltered enamel. The unaltered enamel
Fig. 1: Typhodont setup

Fig. 2: Bur in the air-rotor hand piece is placed on the indicator wire which acts a guide

Fig. 3: 16-Blade TC bur (Flat end, tapered shape, 5.2mm length, 0.009 inch diameter - Komet H 23L)

Fig. 4: 8-Straight blade TC bur (Pointed tip, tapered shape, 9mm length, 0.014 inch diameter - Komet 135)
Fig. 5: Coarse diamond bur (Pointed tip, tapered shape, 11mm length, 0.010 inch diameter - Komet 859)

Fig. 6: Extra-fine Diamond bur (pointed tip, flame shaped, 8mm length, 0.012 inch diameter - Komet 862 EF)

Fig. 7: Ultra-fine diamond burs (pointed tip, flame shaped 8mm length, 0.010 inch diameter)

Fig. 8: Super-fine Sof-Lex discs (Plastic discs with Aluminum oxide abrasive particle, extra thin in thickness)
Fig. 9: Stripped surfaces are etched for 20 seconds and light curing done for 20 seconds with halogen light.

Fig. 10: Specimen was mounted on a brass stub with a double sided sticker and was coated with platinum.
Fig. 11: 'Sputter' coater (JEOL JF-1600 Auto-fine Coater) – Coats the specimen uniformly with platinum.

Fig. 12: Scanning electron microscope (JEOL JSM-5610 LV)

Fig. 13: Display unit
Photomicrograph 1: SEM photomicrographs of the enamel surface after stripping with 16-bladed tungsten carbide bur.

Photomicrograph 2: SEM photomicrographs of the enamel surface after stripping with 8-bladed tungsten carbide bur.

Photomicrograph 3: SEM photomicrographs of the enamel surface after stripping with coarse diamond bur.

Photomicrograph 4: SEM photomicrographs of the enamel surface after stripping with 16-bladed tungsten carbide bur and polishing with extra-fine and ultra-fine diamond burs.

Photomicrograph 5: SEM photomicrographs of the enamel surface after stripping with 16-bladed tungsten carbide bur and polishing with medium, fine and super-fine Sof-Lex discs.

Photomicrograph 6: SEM photomicrographs of the enamel surface after stripping with 8-bladed tungsten carbide bur and polishing with medium, fine and super-fine Sof-Lex discs.

Photomicrograph 7: SEM photomicrographs of the enamel surface after stripping with coarse diamond bur and polished with extra-fine and ultra-fine diamond burs.

Photomicrograph 8: SEM photomicrographs of the enamel surface after stripping with coarse diamond bur and polished with medium, fine and super-fine Sof-Lex discs.

Photomicrograph 9: SEM photomicrographs of the enamel sealant interface after stripping with 16-bladed tungsten carbide bur and sealant application without acid etching.

Photomicrograph 10: SEM photomicrographs of the enamel sealant interface after stripping with 8-bladed tungsten carbide bur and sealant application without acid etching.
(Photomicrograph 16) when observed under SEM showed a pattern of perikymata consisting of crests and troughs of relatively equal proportions⁵. Sheridan and Ledoux⁶ reported that sealed surfaces are as smoother than unaltered enamel.

There are two ways to protect the stripped surface. One is by stripping with an instrument, which produces minimal grooves and surface roughness, so that on polishing these can be removed. The morphological analysis of our findings showed that satisfactory results might be achieved by using tungsten carbide bur as the first bur and polishing with Sof-Lex discs. The best results were obtained with a method using 8-straight blade tungsten carbide bur for first stripping followed by polishing with medium, fine and super-fine Sof-Lex discs. The advantage of this procedure was that a permanently polished surface, which is as good as unaltered enamel, could be achieved without adding sealant to the armamentarium. During initial stripping if ledges are formed at the gingival area due to improper technique, their removal becomes very difficult by polishing, as proximal gingival contours are inaccessible.

The second technique as proposed by Sheridan and Ledoux⁶, was to apply a sealant after etching. It was advantageous to the clinician in the sense that chairside time could be saved which was needed to finish stripped surfaces with a series of abrasives. The technique is faster but raises questions as how long the sealant lasts and what condition the enamel would be in once the sealant has dissipated. Improper application of the sealant (applied as a bulky layer instead of a thin layer) leads to plaque accumulation; pocket formation in the undercut formed after closure of the stripped space and limits the space available for decrowding.

The study can be further improved by evaluating the procedure in an in-vivo situation. Long term studies on the caries susceptibility, fluoride uptake, and efficacy of the sealant can provide an insight into the benefits and ill effects of proximal stripping.
SUMMARY AND CONCLUSION

The SEM photomicrographs are observed and the following conclusions were drawn in each part of this study:

1. The surfaces produced by stripping with TC burs are smoother than those produced by the use of coarse diamond burs. Within the TC burs 8-TC bur produces a smoother surface compared to 16-TC burs.
2. Sof-Lex discs are more efficient than fine diamond burs in polishing the stripped enamel surface and, the surfaces polished with Sof-Lex discs after initial stripping with 8-TC bur are found to have a surface smoothness equal to that of unaltered enamel.
3. Mechanically roughened surfaces do not have sufficient retentive capacity to make etching un-necessary. Sealed proximal surfaces were as smooth as unaltered enamel.

We infer from this study that best results would be obtained if initial stripping is done with 8-TC bur, followed by polishing with medium, fine and superfine Sof-Lex discs. The other choice is to strip the enamel surface by TC or diamond bur followed by sealant application. If diamond burs are used for stripping due to non-availability of TC burs then a smooth surface can be obtained if a pit and fissure sealant is used for sealing after etching of the stripped surface. Both the above techniques produce surfaces that are comparable to unaltered enamel.

In conclusion, given the current emphasis on non-extraction treatment in orthodontics today, stripping is a technique that can increase space but must be performed with the best possible finishing of the interproximal enamel surface that meets the biological requirements of the oral cavity.

REFERENCES