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A Technique for Post-Orthodontic Retention of Maxillary Anterior Teeth in the Restored Dentition: A Case Report

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Abstract - *Retention is one of the most important factors in the long term success of orthodontic treatment. In the adult patient when orthodontic movement is part of an overall treatment plan involving other disciplines, the provision of permanent retention can be complicated. Several methods have been proposed in the literature to date, all with their own problems and risks. This case report presents a technique that may solve this problem for suitable patients in a way that is both non-invasive and has excellent long-term maintenance potential.*

KEYWORDS: Orthodontic, Adult, Fixed Retention, Anterior teeth

INTRODUCTION

Retention is one of the most important factors in the long term success of orthodontic treatment[1,2]. From the literature available it would appear that there is no guarantee for life-long stability after orthodontic tooth movement without a specific phase of retention, especially in adults[3] and it would appear that the general consensus within the profession is that this should be long-term. In certain situations this should be with a fixed retainer, e.g. to maintain closure of a median diastema, to maintain a pontic space after extraction and after correction of severe rotations[4,5,6].

There have been many techniques described for providing fixed retention. Methods described to date include; custom-made resin retained linked metal palatal backings; multistrand wire and composite resin[7,8], glass reinforced composite wire[9], polyethylene ribbon-reinforced resin composite[10], mesh with composite resin[11], pre-manufactured one piece metal retainers with mesh pads and composite resin[12], full coverage linked restorations. All of these methods have their own limitations and problems.

CASE PRESENTATION

A 59 year old female was referred for management of her heavily restored and failing dentition. Her complaints were of the poor appearance of her upper anterior teeth owing to their worn and chipped incisal edges, colour and position and that her extensively restorations posterior teeth were frequently fracturing (*Figures 1, 2, 3*).

After a joint Restorative / Orthodontic consultation and discussion of all possible treatment options, the patient agreed to having fixed orthodontic therapy to realign the upper anterior teeth but declined an ideal orthodontic treatment plan which also involved management of the crowded lower incisors as well due to the additional length of treatment time needed.

The treatment involved a reorganised full mouth rehabilitation restoring the patient at an increased vertical dimension, due to lack of posterior crown height even after crown lengthening. The maxillary anterior sextant was initially treated with fixed orthodontic therapy. This involved the use of a fixed brace from 15 to 14 for 9 months to realign, close the diastemata's and de-rotate 22. After which an upper Hawley retainer was worn during the interim while the fixed palatal retainer developed in our laboratory and discussed in detail below was constructed. Additional treatment to these teeth involved recontouring of the chipped incisal edges of 11 and 21 and correction of the mesial line angle of 22 with composite resin. Once the anterior sextant had been restored at the increased vertical dimension the posterior sextants were restored with conventional full coverage cast restorations.

TECHNIQUE

Clinical Stage 1

After the fixed orthodontic treatment was completed (*Figures 4, 5*), the patient was provided with a removable retainer. Of the six maxillary anterior teeth, 12, 11, 22, 23 all had minimum Class III composite resin restorations. These were replaced to ensure that there was neither secondary caries nor microleakage. The palatal aspects of all these teeth were now assessed and if necessary prepared with finishing burs to achieve a smooth surface that would ease the construction and seating of the definitive restorations. A working impression was taken using an addition cured silicone material, with the aid of retraction cord (Ultrapak no.000), placed into the palatal gingival sulcus to expose the full extent of the cingulum enamel. Determination of the working jaw registration. The dentition was to be restored at an increased occlusal vertical relationship which

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Figure 1.

Figure 2.

Figure 3.

Figure 4.

Figure 5.

Figure 6.

Figure 7.

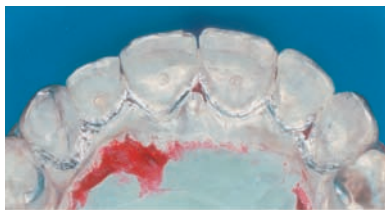

Figure 8.

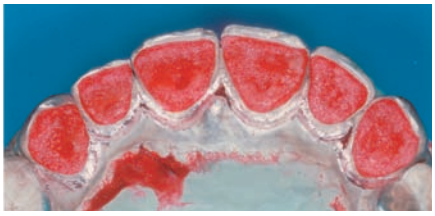

Figure 9.

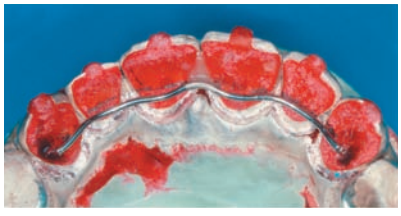

Figure 10.

had been determined by the diagnostic wax up. This had been completed on duplicate casts made from impressions taken directly after the orthodontic treatment. The interocclusal space created by this increased occlusal vertical dimension was assessed by replacing the untouched casts onto the articulator with the incisal pin locked at the vertical height for the diagnostic wax up casts. This space was transferred to the patient using a laboratory constructed anterior jig made with acrylic resin (DuraLay) (*Figure 6)*. Recording the working jaw relationship. The jig was then positioned onto the upper anterior teeth. The retruded axial position was confirmed using a gothic arc tracing of the lower incisal teeth onto the occlusal surface of the jig with articulating paper. This jaw relation and the predetermined occlusal vertical relationship were recorded using Moyco Extra Hard Beauty wax (*Figure 7*). Three records were made for verification.

Laboratory stage

The working casts were constructed. In this case the maxillary cast was electro-plated to facilitate the construction of cast metal backings on the thin incisors (*Figure 8*). The maxillary cast was mounted in an articulator (Denar MKII articulator) employing the cross mounting technique, using the previously mounted mandibular post-orthodontic cast and the preferred wax registration record determined by comparison in a Denar VeriCheck. The incisal pin was set at zero. The mandibular cast was now mounted using the same wax record, again with the incisal pin at zero. Acrylic resin (DuraLay Inlay Pattern Resin) was built up onto these surfaces to form the fit surfaces of individual backings each with a small incisal hook to aid in relocation. Maximal palatal coverage, including partial extension onto the incisal edges was provided. Once set these foundations were removed and trimmed using a bur to be a uniformed thickness of 0.5mm (*Figure 9*). They were then repositioned onto the working cast and checked that none were in occlusion. A piece of softened stainless steel wire of 0.7mm diameter was bent in such a shape that it would link all of the backings through their future cingulum stops without touching the interproximal gingivae nor passing closer than 0.5mm to the opposing incisal edges with the articulator closed. The wire was initially tacked into place using sticky wax (*Figure 10 and 11*) and once its position was finalised it was secured into position with a layer of acrylic resin (*Figure 12*). The final contour of the backings was established using inlay wax, ensuring that they provided:

- Parallel approximal contacts for stability.
- A maximum "tunnel" width of 3mm embedded in the pattern.
- A recessed area built into the backings on the most distal teeth (in this case 13 and 23) where the ends of the wire would be positioned.
- 3mm of wire exposed between each pattern.
- ICP contacts with smooth excursive guidance for the incisal edges of the lower incisal teeth.

The backings were separated by cutting through the wire in the interproximal areas using a fine carborundum disc (*Figure 13*). Care was necessary to avoid overheating the wax. At least 1mm of wire was left protruding from both sides of each pattern for anchorage in the casting investment. Each backing was then positioned onto individual stone dies poured from a second pour and the margins and approximal contact guide planes were refined using inlay wax. This obviated the need to section the silver plated master cast and introduce the possible errors. The completed waxed up backings were cast using a Type III Gold alloy. Once cast the backings still had the stainless steel wire incorporated into them. This was removed by corroding in a dilute solution of hydrochloric acid at room temperature for two days. After this time the wire had corroded enough for it to be easily pulled from each backing. The backings were seated back onto the working cast. When finishing them attention was paid to maintaining parallel approximal contacts. Once they were all seating they were held in position onto the cast using a plaster index (*Figure* 14) and the occlusion refined (*Figure 15*). Finally they were polished (*Figure 16 and 17*). 0.5mm twist-flex stainless steel wire (to be used clinically to splint the backings) was tried through each backing.

Clinical stage 2

Having anaesthetised the maxillary labial segment teeth, each backing was tried in place to ensure an accurate fit. The fit surface was sandblasted, steam cleaned and heat treated in an air furnace at 400°C for 4 minutes to maximise the bond strength with the resin cement[13,14]. Under rubber dam with each tooth adequately exposed in sequence using a modified 212 clamp and interproximal cellulose acetate strips in place (*Figure 18*). The backings were individually bonded to the teeth using Panavia OP resin cement. For ease of handling the backings while seating they were attached to a ball ended burnisher with white gutta-percha and an additional piece of gutta-percha endodontic cone (size #70) was placed through the wire access hole so that no excess cement could enter (*Figure 19*). After all the backings were bonded they were polished with a rubber point to remove their blackened oxide appearance as a result of the heat treatment and the occlusal refined (*Figure 20*). A length of twist-flex wire was annealed to ensure that it would not inadvertently become an active spring and disturb tooth alignment. It was then threaded through the backings. To aid in placement an occlusal photographic mirror was used to give a better overview. The wire was then threaded through each backing. Once passed through the first backing a pair of mosquito forceps was used to help thread the wire through the next hole. Insertion of the wire was facilitated by the 3mm of wire exposed between the cingulum stops. There is the potential for this to be made difficult if the distance between the cingulum stops is less than 3mm. With the wire in position any excess at the ends was cut off using a diamond bur in an air turbine handpiece, ensuring that the wire ends would sit within the recess of the distal backings (*Figure 21*). Each recess was filled with DuraLay resin. This material was chosen for its free-flowing properties when applied with a brush-on technique. Composite resin could have been used but light cured materials would not reliably polymerise inside the casting. The resin were contoured and polished. With the backings fitted, the newly created posterior interocclusal space was stabilised with composite resin on the occlusal surfaces of the posterior teeth, prior

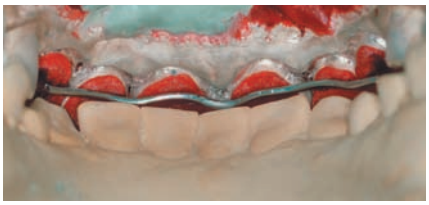

Figure 11.

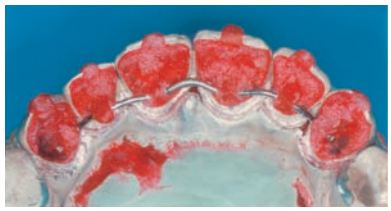

Figure 12.

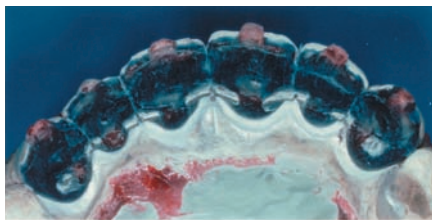

Figure 13.

Figure 14.

Figure 15.

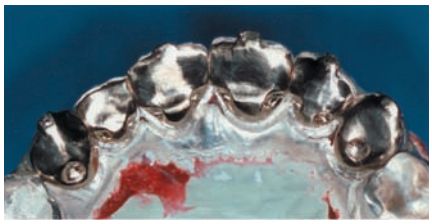

Figure 16.

Figure 17.

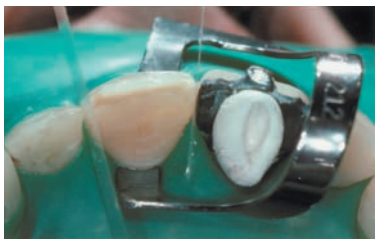

Figure 18.

Figure 19.

Figure 20.

Figure 21.

Figure 22.

Figure 23.

to them being prepared, provisional crowns fitted and subsequently restored with definitive restorations. Oral hygiene instruction including tooth brushing and the use of floss was given to the patient.

The patient has been reviewed at six monthly intervals for eighteen months with no maintenance problems being evident (*Figure 22 and 23*). It is recognised that this is a relatively short time and a single case but the method appears to merit further application.

DISCUSSION

The case report describes a novel technique for providing fixed post-orthodontic retention for the maxillary anterior teeth in situations where the anterior guidance will need to be recreated using restorations. In this particular case the final reconstruction was to be restored at an increased vertical dimension; such that the anterior guidance had to be re-established. In this type of case there are two "established" restorative approaches for providing permanent retention of anterior teeth after orthodontic therapy. One is to prepare the anterior teeth for full coverage splinted crowns; the other is to use resin retained palatal backings that are rigidly splinted together. In the case presented, provision of crowns would have been extremely destructive, considering that the teeth were either unrestored or only had minimal restorations present. Additionally, the long term problem of exposure of anterior crown margins is well documented and can detract from the improved appearance that was the reason for treatment.

The major problem with extensive, rigidly connected retainers of the Rochette or subsequent types is the difficult management challenge should partial de-bonding of the splint occur. Removal of a six unit anterior retainer to prepare it for re-bonding or remake is often clinically demanding, unpleasant for the patient and expensive. Removal takes considerable time and as a result it is not uncommon to encounter retainers that have been sectioned in order to re-bond only part; resulting in a retainer that is then no longer performing the full function for which it was intended.

The splint described here has been designed to address some of the problems of the rigidly splinted resin bonded palatal retainers. As the backings are separate and connected only by the wire, if one were to debond then it can be managed independently of the others. The wire can simply be removed and the individual backing cleaned and rebonded, after which a new wire is easily installed. This ease of maintenance will mean that the repair time and cost are minimal compared to rigidly splinted backings and comfort for the patient is far greater. With regards to oral hygiene the patient can easily clean through the interproximal contacts using floss (or interdental brushes for larger embrasures) without any compromise. Finally, the slight flexibility introduced by the wire connection means that the castings can be made from gold alloy rather than demanding the rigidity in thin section of nickel-chromium alloy. Most clinicians would prefer to place gold alloy in an anterior guidance relationship to natural teeth since it produces less antagonist wear and may be aesthetically preferable.

MANUFACTURER'S DETAILS

'Ultrapak #000'; Ultradent Products, Inc., 505 West 10200, South Jordan, Utah 84095, USA

'DuraLay'; Reliance Dental Manufacturing Co., Worth, Illinois 60482, USA

'Moyco Extra Hard Beauty wax'; Moyco Industries Inc., Philadelphia PA 19132, USA

'Denar MKII articulator'; WaterPik Corporation, Fort Collins, CO 80553, USA

'Denar VeriCheck'; WaterPik Corporation, Fort Collins, CO 80553, USA

'DuraLay Inlay Pattern Resin'; Reliance Dental Manufacturing Co., Worth, Illinois 60482, USA

'Panavia OP resin cement'; Cavex Holland BV, PO Box 852, Haarlem, Holland

SUMMARY

A novel multi-unit retainer is presented that addresses the problems of post-orthodontic retention when the restorative phase will require restoration of the palatal surfaces of the maxillary anterior teeth in order to redevelop the anterior guidance. This method offers the benefits of conservation of tooth structure, ease of maintenance due to its retrievable nature and good oral hygiene potential.

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