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An Application of a Splint Purposeful Resin-Bonded Fixed Partial Denture after Orthodontic Treatment: A Case Report

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Abstract

An adult male patient who had lost his maxillary left central incisor seven years ago in a traffic accident presented with a chief complaint about his unaesthetic appearance associated with the loss of his maxillary left central incisor space, a Class III molar occlusion, and an anterior open bite malocclusion due to tongue-thrust swallowing. Fixed orthodontic treatment was rendered following fan-type expansion of the maxilla. A Maryland bridge as a minimally invasive dentistry approach was used as a retention appliance and the patient's aesthetic appearance was restored.

Keywords: Resin-bonded fixed partial denture, RBFPD, orthodontic treatment, fixed retainer

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Introduction

Minimally invasive dentistry is the application of "a systematic respect for the original tissue." The introduction of predictable adhesive technologies has led to a giant leap in interest in minimally invasive dentistry.[1]

When single-tooth implants are inappropriate, the use of a resin-bonded fixed partial denture (RBFPD) is the preferred option of treatment when the abutments are relatively intact.[2] RBFPD applications are used following orthodontic treatment to reestablish normal spacing in the anterior segment. Loss of space can be due to lateral drifting of adjacent teeth into an extraction site or space created by congenitally missing anterior teeth.[3] Assessment of function and patient satisfaction with their restorations revealed 88% rated the appearance as good, while 94.9% regarded the function as good.[4]

Teeth moved within the bone by means of mechanical apparatus tend to return or relapse to their original positions.[5] To prevent relapse following the orthodontic treatment, the teeth are usually stabilized with fixed or removable retainer appliances. This is especially important in cases with an open bite and a narrow maxilla. A fixed retainer also prevents crowding that is likely to appear later in the mandibular incisor area or relapse that is likely to appear vertically in the anterior area. Usually applied to the space between the canines in the mandible, such appliances can also be extended to the mandibular first or second premolars.[6]

Case Report

The History of the Patient and Clinical Examination

A 19-year-old male patient who had lost his maxillary left central incisor seven years ago in a traffic accident applied to the Department of Orthodontics of the Faculty of Dentistry at Atatürk University. His main complaint was his unaesthetic appearance. A clinical evaluation revealed desirable function and esthetics could not be achieved using a direct prosthetic approach. As a result, the patient received an orthodontic evaluation and treatment was planned for an orthodontic phase followed by a prosthetic to achieve favorable function and esthetics.

Orthodontic Treatment Phase

In addition to the missing maxillary left central incisor a Class III molar relationship and an anterior open bite malocclusion due to tongue-thrust swallowing was observed (Figure 1). For motivation purposes, the patient was taught swallowing exercises before beginning orthodontic treatment.

Figure 1. Pretreatment orthodontic cast.

A fan-type expansion was planned so the horizontal narrowness caused by the absence of the maxillary left central incisor in the premaxilla would be corrected. A removable appliance was fabricated to accomplish the expansion of the maxilla. The appliance was activated by turning the expansion screw one quarter-turn once every five days for four months to achieve a radial expansion. The left maxillary central space, which was 2 mm at the beginning, reached to 5 mm (Figure 2).

Figure 2. After fan-type expansion treatment.

Afterwards, fixed edge-wise mechanics (0.018 Roth type brackets) were used for leveling by means of 0.014 inch NiTi (nickel titanium) rounded wires applied to mandibular and maxillary teeth. At the same time, in order to protect the maxillary

left central incisor space caused by the fan-type expansion, an open NiTi coil-spring was applied to this area. Box elastics were also applied vertically between the mandibular and maxillary canines to close the open bite.

In the third month 0.016 inch rounded arch wires were applied. After the fifth month, treatment was accomplished with square-cut wires (0.016 x 0.016 inch NiTi) (Figure 3). The length of the arch placed to create the maxillary left incisor space was also increased.

Figure 3. During fixed orthodontic treatment.

After the eighth month, 0.016 x 0.022 inch stainless steel (rectangular preformed) finish arch wires were placed with vertical direction elastics applied to the anterior and posterior regions so the occlusal correlation would result in a better fit. It was determined by measurement the dimension required for the maxillary central incisor was ensured and then a closed coil spring was applied to this area to preserve the necessary space.

At the end of the eleventh month the maxillary left central incisor space previously lost was regained, the open bite was corrected, and the molar and canine closure was brought into a Class I relationship ending the orthodontic phase of treatment. The patient was now ready for the prosthetic phase (Figures 4-5). Pre-and post-treatment measurements and superimpositions are given in Table 1 and Figures 6-7, respectively.

Prosthetic Treatment Phase

The aim of preventing the recurrence of the corrected open bite and restoring the edentulous space was accomplished using a fixed partial denture (FPD) placed between the maxillary canines to fill the space of the missing maxillary left central incisor. A RBFPD was chosen as a conservative approach because the abutment

Figure 4. Before the prepared RBFPD luting.

Figure 5. Frontal appearance of patient after orthodontic treatment.

teeth were healthy and intact. Using complete crown preparations was not in accordance with a minimally invasive dentistry approach, and the patient did not consent to the preparation of his teeth for the FPD. Five incisors in the area between the maxillary canines were included in the prosthetic treatment plan. The orthodontic appliance was kept in place to prevent the teeth from drifting during the fabrication of the RBFPD. This did not present a problem during preparation of the teeth since this was limited to the palatal aspect of the involved teeth. However, the upper arch wire was removed during the impression-making and was remounted following the making of the impression to preserve the retention effect of the appliance.

Because the interocclusal clearance was sufficient for the fabrication of the RBFPD as planned during the orthodontic phase, minimal preparations were made in the lingual surface of

Table 1. Cephalometric and model analysis.

Measurements	Pre-treatment	Post-treatment
SNA (°)	80	82
SNB (°)	79	80
ANB (°)	1	2
Convexity (°)	174	174
GoGn – SN (°)	45	43
Occlusal Plane – SN (°)	15	13
Gonion Angle (°)	136	135
Post. Face Height (mm)	87	86
Ant. Face Height (mm)	141	140
Ant. Cranial Base (mm)	75	76
Mand. Body Length (mm)	75	75
Mx 1 – SN (°)	114	105
Md 1 – MP (°)	91	83
Interincisor Angle (°)	110	129
Ls – E Plane (mm)	0	-2
Li – E Plane (mm)	2	1
Nasolabial Angle (°)	87	99
Max. Intercanine Width (mm)	28	32
Man. Intercanine Width (mm)	25	25
Max. Intermolar Width (mm)	45	45
Man. Intermolar Width (mm)	39	39
Overjet (mm)	-1	2
Overbite (mm)	-4	2
Mx. Arch length deficiency (mm)	-8	0
Mn. Arch length deficiency (mm)	0	0

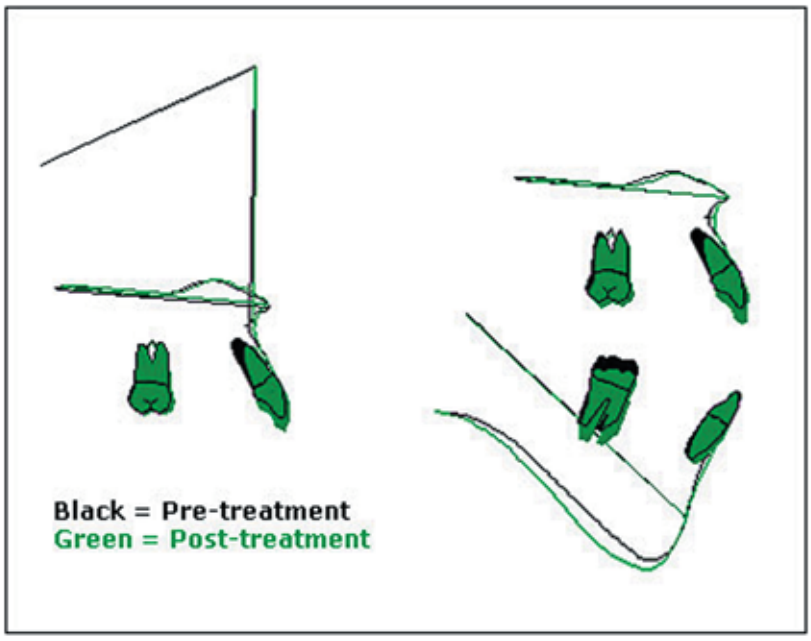

Figure 6. Local superimposition of pre-post cephalometric radiography.

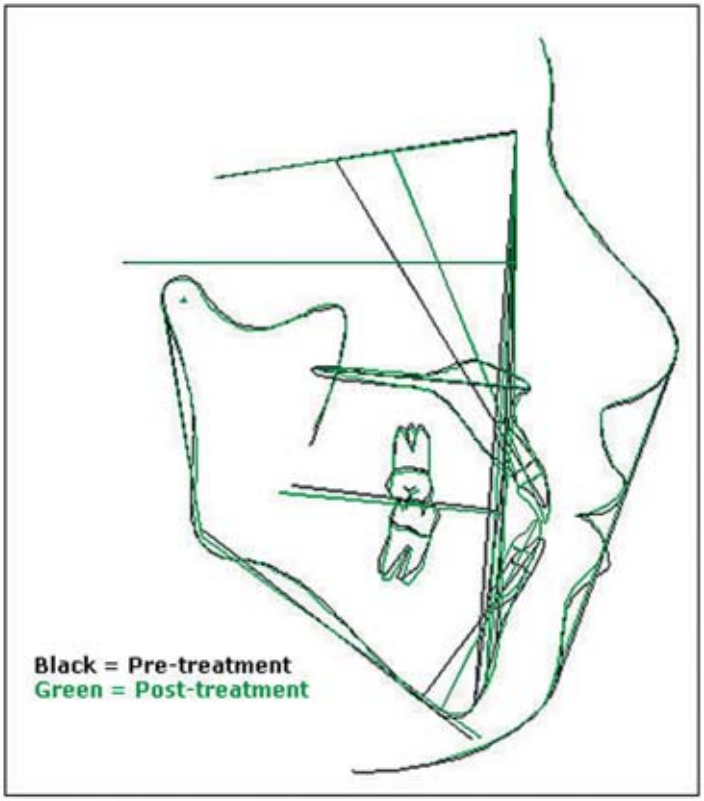

Figure 7. Total superimposition of pre-post cephalometric radiography.

the right canine, lateral incisor, and central incisor as well as of the left lateral incisor and canine. The gingival part of the tooth preparation in the lingual surface was ended at the level of free gingival margin with a chamfer. In the proximal regions, however, reduction was restricted in the lingual embrasure before reaching the interproximal contacts. All reductions of the supporting teeth were finished within the enamel. The tooth preparations were ended in the gingival two-third region without extending to the incisal edge of the teeth.

The whole arch impression of the maxilla was made with the addition type silicone-based impression material (Panasil putty, Panasil contact plus, Kettenbach GmbH &Co. KG. Im Heerfeld 7 D-35713 Eschenburg-Germany) and the closure impression of the mandible was made by using alginate impression material. On the master model obtained, a framework of the RBFPD was made by using Cr-Co alloy.

After enabling the metal framework to be seated on the passively prepared teeth on the master

Figure 8. The lingual aspect of the metal framework and porcelain facing on the master cast obtained during orthodontic treatment.

cast on the proof at chair side, the porcelain facing of the maxillary left central tooth was fabricated (Figure 8).

After the adjustment of the occlusion, the glaze of the porcelain was done. Sandblasting was carried out so as to increase the micromechanical retention on the inner surface of the RBFPD retainer. The RBFPD was cemented by using the

dual cure adhesive system (Panavia F, Kuraray Co., Ltd. 1-12-39, Umeda, Kita-ku, Osaka 530-8611, Japan). Biologic contamination was avoided after the reduced lingual surface of the teeth was processed with acid and rinsed. Oxyguard® (Kuraray Co., Ltd. 1-12-39, Umeda, Kita-ku, Osaka 530-8611, Japan) was used to prevent exposure to oxygen during the cementation and the following five minutes. To each of the abutment teeth, photo activation of the cement was done to the lingual and vestibule with a light source for 20 seconds. The patient was instructed not to eat hard food with his anterior teeth for the following 24 hours (Figures 9-10).

Figure 9. Completion of treatment.

Figure 10. Frontal view of patient at the completion of treatment.

Discussion

A certain amount of relapse is unavoidable with orthodontic treatments. In the present case, anterior part of the maxilla was widened transversely and then upper and lower incisors were vertically extruded in order to correct the open bite. Considering that both applications are in need of long-term stabilization,[6] RBFPD was a favorable choice to stablize the region between canines using five support teeth. This approach addressed the patient's needs for retention to prevent relapse, while at the same time addressing esthetic and functional needs.

The current trend in dentistry is to conserve tooth structure. In certain situations RBFPDs are an alternative to FPDs and can be used in tooth replacement, aesthetics, and occlusal, orthodontic or periodontal therapy.[1,7,8] Splinting, the joining of two or more teeth into a single rigid unit by means of fixed or removable restorations or devices[9], is a common but controversial treatment modality. Splinting is used to provide positional and functional stability for the teeth and is useful in the prevention of relapse of an orthodontically corrected malposition.

Even though implant treatment is a proper approach in the replacement of a missing tooth, splinting is not possible when a tooth space has been created orthodontically. Therefore, this case necessitated the use of a FPD. Selection of a RBFPD instead of an FPD was done to adhere to the principle of using a minimally invasive approach to conserve tooth structure and to take advantage of adhesive dentistry.

The survival rates of RBFPDs reported in literature vary widely, and the conclusions are sometimes conflicting. Reported RBFPD survival rates range from 74 to 95%.[8] In their study Zalkind et al. reported even though the amount of debonding was high in the RBFPDs made after orthodontic treatment the overall complete survival level of the study population at the end of the follow-up period was 85 months ± 13%. They also reported rebonding the RBFPDs once increased the overall functional survival rate to 112 months ± 10% and multiple rebonding led to a further increase to 131 months ± 8%.[10] Ketabi et al. reported a mean survival rate greater than 69% after a 13-year observation period was

calculated. A mean functional survival rate of 83% was estimated with rebonded restorations. A total of 18 failures (24.3%) of all restorations were observed with the primary cause being loss of retention.[11]

Conclusion

The RBFPD restorative approach should be considered the treatment of choice among prosthetic restorations in that it requires minimal preparation, it is less expensive, and requires less chair side time compared with an FPD restoration. In the case presented here tooth preparations were made in the lingual surface making it possible for the orthodontic patient to have the prosthetic restoration finished before their orthodontic treatment was completed. Thus, the patient is provided with esthetics, support, and function optimally as soon as the orthodontic appliances are removed.

In this case the RBFPD replaced the function of the traditional removable retainers commonly used in such cases with a narrow maxilla and an open bite. It served as a long post-treatment retainer, while at the same time providing esthetic and masticatory and speech functions.

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