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Case Report

An alternative method for splinting of traumatized teeth: case reports

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Abstract – Injuries to the dentoalveolar complex are fairly common and can be caused by a number of reasons. There are many techniques for repositioning and stabilizing traumatically luxated or avulsed teeth. Many of the splinting techniques previously advocated were time-consuming. Not only were the splints difficult to fabricate and difficult to remove, they also contributed to injury of the soft and hard supporting tissues. *Ribbond* (Ribbond Inc., Seattle, Wash) is basically a reinforced ribbon which is made from ultrahigh molecular weight polyethylene fiber having an ultrahigh modulus. It is used in dentistry for various purposes. The use of Ribbond appears to be an adequate and easy method for stabilization and fixation. It can be used in the treatment of dental injuries. In this article the use of Ribbond for the treatment of dentoalveolar injuries is described.

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Key words: Ribbond; fixation techiques; dental trauma

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Dental trauma is a common injury, especially in children. Approximately every one of three children will also suffer trauma to the permanent teeth before leaving school age (1–3). Usually it represents a serious problem associated with many aspects of the patient's life. In the international literature, there are many studies investigating different parameters of dental trauma. The most commonly investigated parameters are frequency, etiology, appropriate treatment plan, and methods for prevention of the dental trauma (4, 5).

The nature of dentoalveolar fracture also varies with age, possibly due to the anatomic differences between the teeth and supporting structures of adults and children. Trauma to the primary dentition most often affects the supporting structure, whereas trauma to the permanent dentition mostly affects the teeth themselves (6). In his review of the causes and pathogenesis of dental injuries, Andreasen (7) reported that, of trauma to the primary dentition, 10% involved crown or crown-root fracture, whereas 75% involved luxations and avulsions. A similar assessment of injuries to the permanent dentition showed crown or crown-root fractures were 39%. It is possible that this difference again is due partly to the anatomic differences between adult and pediatric teeth and supporting structures.

Once the diagnosis of a dentoalveolar injury is confirmed, the injury should be classified. The purpose of such classification is to provide a comprehensive and universal description of the injury for communication and treatment planning purposes. In this classification, dentoalveolar injuries are divided into four major categories: injuries to the dental tissues and pulp, injuries to the periodontal tissues, injuries to the supporting bone and injuries to the gingiva or oral mucosa (6).

Dental splinting is frequently needed following traumatic injuries to stabilize subluxated, luxated, avulsed and root fractured teeth. In all cases of dental injury, proper treatment is important for the subsequent healing period.

Treatment of such injuries can be complex and costly. Fixation methods used for dental splints vary

according to authors and with the type of dental trauma. Many different types of splinting techniques have been described in the literature (8–11).*Ribbond* (Ribbond Inc., Seattle, Wash) is a bondable, reinforced polyethylene fiber material (Fig. 1). It can be used in the treatment of multiple displaced teeth. The use of Ribbond is an acceptable and easy method for stabilization and fixation. In this report; usage of Ribbond for splinting traumatized teeth, is presented.

Case reports

The sample consisted of six patients treated in a Selcuk University, Faculty of Dentistry, Departments of Oral and Maxillofacial Surgery and Orthodontics. The age of the sample was between 10 and 12 years and included four males and two females. Records of each trauma according to the age, sex, history of trauma, repositioned teeth, type of hard tissue injury, number of teeth involved the splint can be seen in Fig. 2.

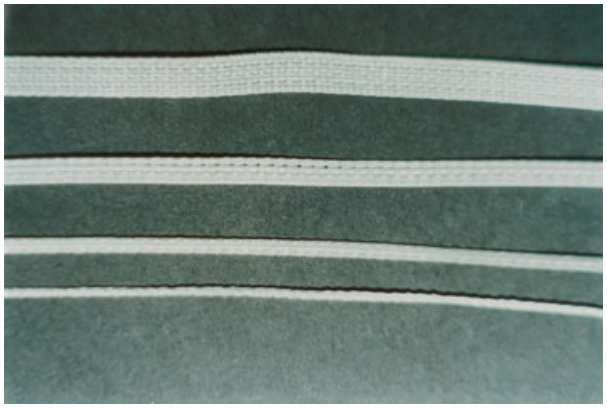

Fig. 1. Different size of Ribbond.

Age	Sex	Cause	Complication	Fixation time	Number of traumatized teeth	Number of teeth involved the splint	Type of hard tissue trauma
11(Case A)	Male	Traffic accident	–	4 weeks	2	5	1 Buccal and 1 palatal displacement
12	Male	Traffic accident	Necrosis	4 weeks	3	5	3 Extrusions
11	Male	Fall	–	4 weeks	2	4	2 Palatal displacements
10(Case B)	Female	Bicycle accident	–	4 weeks	2	4	1 Avulsion and 1 buccal displacement
12	Male	Traffic accident	–	4 weeks	2	4	2 Buccal displacements
11	Female	Traffic accident	–	4 weeks	2	4	2 Buccal displacements

Fig. 2. Records of each trauma.

Ribbond was employed for tooth splinting in these patients (Figs 3 and 7). For this purpose, labial surfaces of the traumatized teeth and at least one adjacent tooth on both sides were etched with 36% phosphoric acid gel for 30 s, rinsed off the gel and dried the etched enamel surfaces. After applying flowable composite to enamel surfaces, fibers are coated with a light cured composite (Figs 4 and 8). Displaced teeth were repositioned and during the light curing of ribbon held in position by finger pressure (Figs 5 and 9). At this time the practitioner should be sure that the displaced tooth is in its correct position. Approximately 4 weeks later, it is observed that the stabilization of the traumatized teeth was achieved. Following the healing period, Ribbond material is debonded with tungsten carbide bur which can be used with a micromotor. The tooth surfaces were refined with polishing disks (Figs 6 and 10).

Discussion

Splinting teeth for periodontal, orthodontic or posttraumatic reasons is a common procedure (12). The

Fig. 3. Traumatic anterior segment of Case A.

Fig. 4. Frontal view of the segment after stabilization with Ribbond (Case A).

Fig. 5. Occlusal view of the segment after repozition (Case A).

Fig. 6. Postoperative view of the segment (Case A).

Fig. 7. Traumatic anterior segment of Case B.

Fig. 8. Frontal view of the segment after stabilization (Case B).

Fig. 9. Occlusal view of the segment after repozition (Case B).

Fig. 10. View of the segment after the healing period (Case B).

requirements of modern tooth splinting, as summarized by Oikarinen (8), are as follows: it should be possible to make dental splints without a laboratory, they should not cause trauma to the teeth, should help teeth regain their original position, and provide adequate fixation during the period of immobilization. Dental splints should neither damage gingival tissue nor increase the risk of caries. Splints should be easy to clean and they should be esthetic and not interfere with occlusion. Endodontic treatment and sensitivity testing should be possible during the fixation period. The splint should allow slight mobility to aid the functional reorientation of the periodontal membrane fibers

(8, 9). Weisman (13) has proposed supplementary requirements and states that dental splints should not injure the pulp of the traumatized or adjacent teeth, nor interfere with intra-oral radiographic techniques, allow placement of a rubber dam, be applicable to primary, mixed and permanent dentitions, should not interfere with proper oral hygiene, nor promote root resorption, and should be economical and require a minimum of specialized equipment. In addition, trauma splints should have optimal properties for handling, application and removal (14). From the patient's perspective, the splint should not interfere with occlusion, oral hygiene and speech (15).

Many techniques can be used for the stabilization and fixation of dentoalveolar injuries. Some techniques have been used for many years, whereas others are more recent and have become possible as a result of the development of new dental restorative materials (16).

The fixation and stabilization methods with the longest history of usage are arch bar and wire fixation. Arch bars are indicated only for injuries involving bone fractures in which rigid stabilization is required (16).

Acid-etched composite dental materials can be used for stabilization and fixation. The advantage of this technique is that it is much less stressful to the injured area because the forces needed to apply the material are far less intense than those needed to apply wires or arch bars (16). An acid-etched resin splint is easy to fabricate but does not allow the teeth much mobility (6). Resin splint is difficult to clean and therefore leads to greater irritation of the gingival margin (14).

Many of the splinting techniques previously advocated were time-consuming. Not only were the splints difficult to fabricate and difficult to remove, they also contributed to injury of the soft and hard supporting tissues (16).

Ribbond is a biocompatible, esthetic material made from a high-strength polyethylene fiber. The use of Ribbond appears to be adequate and easy method for splinting teeth. The various advantages of this material include ease of adaptation to dental contours and ease of manipulation during the bonding process. Because it is relatively easy and fast technique (no laboratory work is need). It also has acceptable strength because of good integration of fibers with the composite resin; this leads to good clinical longevity. Because a thinner composite resin is used, the volume of the retention appliance can be minimized. In addition, in case of fracture during wear, the appliance can be easily repaired. There is no need for removal of significant tooth structure, making the technique reversible and conservative. It also meets the patients' esthetic expectations (12). This material is expensive and this is Ribbond's disadvantage.

In our cases displaced teeth's apex have yet closed. These teeth were observed both clinically and radiographically. In our one case the central incisors showed pulpa necrosis at the end of the healing period. The patient referred to the department of endodontics for root-canal treatment. Endodontic treatment continued uneventfully.

Bearn (17) stated that reinforcement fibers have the disadvantage of a rigid splint, which limits physiologic tooth mobility and contributes to a higher clinical failure rate. It has been shown in experimental studies that replanted teeth stabilized with a physiologic semi-rigid or flexible splint show less replacement resorption and better organized ligament fibers compared to rigidly fixed teeth (18, 19). We also plan to analyze the benefits and long term clinical outcomes of the Ribbond on a larger sample.

This study indicated that Ribbond is an easy and good method for splinting and stabilizing teeth. Ribbond can be particularly recommended for splinting of traumatized teeth and is well tolerated by the patients. Further, ease of application and removal represented by shorter chair time may benefit patient and practitioner alike.

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