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Management of subluxation injury in a thumb-sucking child: a case report

CASE REPORT

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Abstract –This case report presents use of a custom trauma splint that was fabricated to prevent excessive thumb-sucking trauma to a previously-subluxated permanent incisor. A 10-year-old boy was referred to the clinic 10 days after falling in the schoolyard that resulted in a trauma to his maxillary left central incisor. The extent of clinical mobility stipulated fabrication of a custom trauma splint that would prevent further trauma to the incisor caused by excessive pressure of the thumb. A light-cured resin composite splint, covering the incisal edges of the central incisors and labial surfaces of the lateral incisors was made, and approximately 1-mm composite within the impressions of central incisors were trimmed off. The splint was bonded to the neighboring lateral incisors with flowable resin composite and root canal therapy was initiated on the subluxated incisor. After one week, the patient stopped his sucking habit completely. The treatment not only allowed for complete healing of the subluxated incisor without being exposed to further trauma, but also for spontaneous eruption of the tooth and closure of the existing open-bite.

Traumatized teeth should undergo treatment without being exposed to excessive occlusal trauma for optimal post-traumatic healing. Nevertheless, premature contact in the traumatized tooth area is frequently seen because of movement of the traumatized tooth in the periodontal space or due to temporary malocclusions in the developing child (1–3). Early contacts result in occlusal distress, and may cause additional trauma to the periodontal tissues, possibly harming the prognosis of traumatized teeth. In the presence of oral habits, the results may be even more severe, since such chronic behavior patterns are often associated with excessive forces that are applied intermittently on dento-alveolar structures. Even healthy teeth can undergo pathological tooth migration due to oral habits (4). Thus, treatment of traumatized teeth with accompanying oral habits requires special care.

By definition, subluxation is an injury to the tooth supporting structures with abnormal loosening, but without displacement of the tooth (5). Sensitivity to percussion, slight horizontal mobility and bleeding from the gingival sulci are usually present (6), and radiographic abnormalities are not expected (7). The treatment of subluxated permanent teeth involves stabilization of the tooth and occlusal adjustments to minimize discomfort on biting contact (5, 8). Flexible splinting can be used for a maximum of two weeks (9). The incidence of pulp necrosis following subluxation injuries in teeth with closed apices was shown to be 15% (10). Thus, all subluxated mature permanent teeth should be monitored for delayed pulpal necrosis (9, 11, 12).

The present report describes use of a custom trauma splint that was made to prevent thumb-sucking trauma to a previously-subluxated permanent maxillary incisor.

Case report

A healthy 10-year-old boy was referred to the clinic with a chief complaint of pain in his maxillary right central incisor. Reportedly, he had fallen in the schoolyard 10 days ago and traumatized his front teeth, but failed to inform his parents about the accident. As episodes of spontaneous pain became frequent, the situation was noticed by his mother, who finally decided to take help from a dentist.

Intraoral examination revealed an anterior open-bite due to the patient's thumb-sucking habit (Fig. 1). There was no sign of soft tissue injury, but the maxillary left central incisor showed mobility and tenderness to palpation, and the tooth did not respond to electrical pulp testing. Periapical radiograph of the tooth revealed widened lamina dura in association with a periapical radiolucency (Fig. 1). In light of both clinical and radiographic findings and the patient's history, the tooth was judged to have experienced a subluxation trauma. Apparently, the healing of the tooth had been adversely affected due to the intermittent pressure generated by the thumb, as evidenced by movement of incisors in the labial direction when the thumb was placed in its habitual position. There was no clinical or radiographic sign of trauma to other teeth.

The use of the crib appliance in conjunction with a semi-rigid splint was proposed as the initial treatment

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Fig. 1. Clinical appearance of the subluxated incisor. Note the extent of open-bite due to thumb-sucking. Inner picture: Radiograph of the tooth taken immediately after application of the custom splint. Note radiolucency in the periapical region and widening of the lamina dura. The extent of relief made within the composite splint is evident by the radiolucent areas along the incisal borders of central incisors.

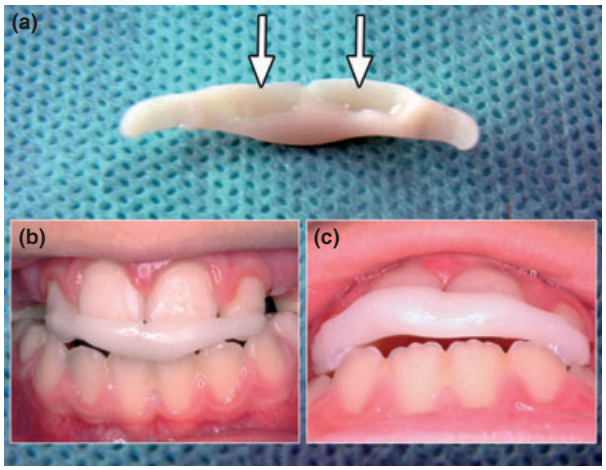

Fig. 2. (a) Custom trauma splint viewed from superior aspect. (b) Custom splint bonded in place. (c) Incisal view of the splint in occlusion, showing absence of contact with the mandibular incisors.

plan. However, the parent did not accept this treatment plan, since reportedly; two previous attempts to use the crib appliance by orthodontists had been unsuccessful since the child refused the treatments. Thus, the extent of clinical mobility stipulated fabrication of a custom trauma splint that would prevent further trauma to the incisor caused by excessive pressure of the thumb. Following approval of the parent and the patient about the treatment plan, a resin composite cylinder (Shade B1, TPH, Dentsply, Konstanz, Germany), approximately 3cm long, was placed over the incisal edges of the central incisors and labial surfaces of the lateral incisors, and light-cured. Because no adhesive pretreatment was made on tooth surfaces, the cured composite was easily removed using a U-15/30 scaler. Then, the impressions of central incisors were trimmed with a high-speed diamond bur to remove approximately 1mm composite from all surfaces of the impressions (Fig. 2a). The rationale for making this relief was to prevent contact of the traumatized tooth with composite during temporary elastic deformation of the splint by thumb pressure (Figs 1 and 2a). The splint covered almost one-third of both the labial and palatal tooth surfaces (Fig. 2b,c), and was slightly bulky on the palatal side to discourage thumb-sucking. Due to the size of the open-bite, the composite bulk did not cause any premature contact with the opposing arch (Fig. 2c). The splint was bonded to the neighboring lateral incisors with flowable resin composite (Filtek Flow, 3m-ESPE, Seefeld, Germany) following use of an etch-and-rinse adhesive (Single Bond, 3M-ESPE, Seefeld, Germany). At the same appointment, root canal therapy was initiated on the subluxated incisor and a temporary calcium hydroxide dressing was placed into the root canal.

Two weeks later, the patient attended the recall with the splint fractured. Upon investigation of the splint and supporting teeth, it was understood that due to the unsatisfactory composite thickness between the right lateral and central incisors, the splint could not further withstand the thumb pressure. However, this had fortunately happened one day ago, and reportedly, the patient had stopped thumb-sucking 1 week before breakage of the splint. Interestingly, both the patient and his mother were happier about the cessation of the habit, while clinical and radiographic findings were clearly suggestive of periodontal ligament healing due to isolation of the central incisor from further external trauma. Root canal therapy was finished one month later. At the sixth month recall, spontaneous closure of the open bite was observed (Fig. 3). The tooth was in excellent clinical and radiographic condition (Fig. 3) and there was no clinical evidence of ankylosis, (i.e., a metallic sound to percussion). Also, the splint therapy did not adversely affect the neighboring teeth, as evidenced clinically and

Fig. 3. View of the mouth 6 months after therapy. Due to cessation of the thumb-sucking habit, the open-bite has closed spontaneously. Inner picture: Radiograph of the tooth, demonstrating favorable healing.

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radiographically. Reportedly, the patient did not restart his sucking habit.

Discussion

This report presents a challenging situation in which the clinician was urged to generate an individualized treatment plan in the management of a subluxated incisor, whose healing was complicated by abnormal digit habit. Fixed splints, including acid-etch retained splints and wire-composite splints are generally used in tooth injuries. Fiber-reinforced splints (13) and titanium trauma splints (14, 15) have also been presented as viable alternatives for splinting traumatized teeth. However, these splints often cannot rectify additional trauma due to an existing malocclusion or habits such as digit sucking, tongue thrust and lip-biting (16). It has recently been shown that under vertical loading in vitro, teeth splinted with a fiber-reinforced material (Ribbond, Ribbond Inc., Seattle, WA, USA) displayed the highest compressive stress in the apical region, while titanium trauma splint had absolutely no effect on reduction of stresses (17). Thus, even in the absence of malocclusion, commonly-used adhesive splints may fail to reduce stresses on traumatized teeth (17). To overcome this problem, Qin et al. (16) treated a variety of traumatized permanent anterior teeth by removable splints that were designed to stabilize mobile anterior teeth and eliminate occlusal trauma due to malocclusion. The removable splints appeared to positively affect healing after traumatic injuries, as evidenced by the low number of complications at the 3-year-follow-up period. In the present case, occlusal distress from the opposing arch was not a problem due to the existing open-bite. A fixed splint was preferred, assuming that isolation of the traumatized tooth from thumb pressure would be a satisfactory measure to enable periodontal reorganization. It should be noted that although this splint should definitely be considered a rigid one, the rigidity of the splint had absolutely no adverse effect on the healing of the traumatized incisor, since the relief made within the composite prevented contact of the traumatized tooth with the splint. In other words, the traumatized incisor was kept 'unsplinted' within a rigid splint. Thus, the technique presented herein does not go against the standard care recommended for luxation injuries. It has not been possible to determine whether the pulp necrosis was due to the trauma itself or thumb-sucking trauma, or to a resultant of both the factors. However, the lack of treatment, which is known to affect prognosis of subluxated teeth adversely (18), was evident. Thus, the treatment plan comprised both splinting and endodontic therapy.

There is clear evidence in the dental literature that digit habits can have serious consequences on the occlusion of children (19). Depending on its nature and intensity, the habit can lead to reduced overbite or anterior open-bite; often asymmetrical protrusion of the upper incisors; and narrowing of the maxillary arch, leading to cross-bite and displacement (20, 21). Van Norman (22) has also pointed to problems in the development of speech, articulation, and socialization skills. Despite a plethora of habit-breaker appliances, there is no consensus as to which is the best type of appliance to use, or even how long to use them in treatment. Further, due to the restrictive and uncomfortable nature of most appliances used, the potential of initiating psychiatric trauma to the child is another major concern (19). The splint presented herein was not intended for use as a habit-breaker, although it did aid in cessation of thumb-sucking. While it was apparent that the slight palatal bulk of the splint functioned as a reminder to refrain placement of the thumb, it did not entirely restrict the patient's habit since this would be perceived as being punitive and, thus, complicate the treatment outcome. Moreover, before approval of the treatment plan, the parent was fully informed about the necessity of seeking further behavioral counseling from a child psychologist, and that the splint was just a temporary preventive therapeutic approach; rather than being interceptive.

The treatment presented herein not only allowed for complete healing of the subluxated incisor without being exposed to further trauma, but also for breaking the digit habit that resulted in spontaneous eruption of the tooth and closure of the existing open-bite. The splint fracture which occurred a day before removal indicates that optimization of load-partitioning should be made by increasing the composite thickness. While such reinforcement would definitely increase the rigidity of the splint, the traumatized teeth would not be affected adversely due to their rest condition provided by the relief made within composite impressions. Provided that outcome of the present treatment is supported by long-term follow-up data, modifications of this bonded splint could also be used in a variety of chronic childhood habits to prevent further exposure to abnormal forces that could jeopardize the prognosis of traumatized teeth.

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