

TREATMENT OF CLINICAL COMPLICATIONS FROM DENTAL TRAUMA WITHOUT APPROPRIATE REIMPLANTATION AND APPLIED SPACE MAINTAINER

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Abstract

Purpose is to emphasize the danger and necessity for the treatment of clinical complications from dental trauma without appropriate reimplantation and applied space maintainer.

Two clinical cases with dental trauma without appropriate reimplantation and used space maintainer resulting in complications of the dental arch were treated with different orthodontic techniques. The first clinical case with missing maxillary right incisor and consequential loss of its' space in the dental arch at the age of 10 was treated with mobile orthodontic appliance equipped with active space maintainer. The second clinical case with missing maxillary left incisor and consequential loss of its' space in the dental arch as well as occlusal discrepancies in the transversal, sagittal and vertical plane at the age of 20 was treated by application of fixed orthodontic appliance.

In the first clinical case, the space for placement of the right incisor was increased from 3mm to 7mm. After reaching the age of 18, an implant and corresponding prosthodontic suprastructure were inserted on the space designated for the right incisor. In the second clinical case the space for the placement for the lateral incisor was also increased, the occlusal discrepancies were corrected and the patient was scheduled for surgical correction of the malocclusion.

The timely treatment of dental trauma with reimplantation of the lost tooth and use of appropriate space maintainers should not be neglected and patients that suffered dental trauma should be continuously followed until maturity when a proper prosthodontic solution can be made.

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Introduction

Traumatic avulsion is a type of dental trauma that refers to the complete removal of the tooth from the alveolar socket due to a suffered injury¹.

The treatment of traumatic avulsion is preformed with two methods: reimplantation when the avulsed tooth can be obtained or in cases of absence of the avulsed tooth fabrication

and application of appropriate space maintainer².

The reimplantation as a method is divided in several steps: initially the patient is given first aid, then a reinsertion of the avulsed tooth in the alveolar socket is preformed, if necessary an endodontic treatment is done as well as splinting of the teeth and suturing of the soft tissues around the avulsed tooth³.

The application of space maintainer is a procedure that consists of three steps: fabrication of the space maintainer, readaptation of the space maintainer, and after the patient reaches maturity fabrication of a suitable prosthetic construction⁴.

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Material and Methods

As a material for this paper we used two of our ongoing cases from our clinical practice with premature loss of permanent teeth due to occurred traumatic avulsion.

Clinical case No.1: Patient at the age of 10, from male gender for the first time appeared on an appointment for orthodontic treatment, several years after the occurrence of the traumatic avulsion (Fig 1.).



Fig 1. Clinical case 1: Space of the avulsed tooth before and after preformed active orthodontic treatment

After the first examination, an absence of maxillary left central incisor caused by traumatic avulsion and consequent loss of space in the dental arch because of delayed orthodontic treatment have been detected. The patient initially has been treated by application of an active space maintainer with spring between maxillary right central incisor and maxillary left lateral incisor and after gaining sufficient space for placement of the central incisor and maximal expansion of the maxillary dental arch the active space maintainer has been replaced with passive

aesthetic mobile space maintainer. The mobile space maintainer was fabricated with the minimal number of dental clasps that were placed freely on the alveolar ridge and the palate. The procedure began by taking alginate impressions from the upper and lower dental arch for fabrication of the mobile space maintainer, because of the premature loss of permanent frontal teeth. A working cast with precise reproduction of the anatomical features of the place of the missing teeth, the oral surfaces of the remaining teeth, the vestibulum and the palate was carefully constructed. An impression from the opposing dental arch and wax bite were also taken. Using a ball pointed pen, the boundaries of the future space maintainer were outlaid on the working cast. A heated wax plate was molded to expand palatally and orally to the anatomical equator of the premolars and above the anatomical equator of the molars and distally to make a bend at the level of the first permanent premolars. In the frontal area that used to be the location of the missing teeth, a bite plate was molded from wax with height of 5 mm. Artificial acrylic teeth, appropriate to the morphology of the teeth from the patient were selected and placed on the molded bite plate in a way that the lower frontal teeth with their vestibular surfaces would occlude with the palatal surface of the upper artificial acrylic teeth. In this manner, the vertical dimension of occlusion was preserved that disabled the lower frontal teeth to erupt in supraocclusion, simultaneously closing the space for the tongue and disrupting the harmful resilient oral habit of tongue thrusting. All of the parts from the mobile space maintainer were carefully cleaned and polished not to irritate the delicate mucosa of the child and cause pathological alterations. The acrylic base plate of the space maintainer did not cover the alveolar ridge on the vestibular side not to disrupt the transversal growth of the jaw. The retention of the mobile space maintainer was ensured by the coverage of the palatal surfaces of the upper teeth and intimate inclusion of their interproximal spaces. Additional retention of the mobile space maintainer was ensured by wire clasps. The mobile space maintainer was also equipped with labial arch which gave it features of an active mobile orthodontic appliance.

On the subsequent control appointments, consistent readaptations of the mobile space maintainer were preformed in order for the

growth of the teeth and jaws not to be disrupted. A systematic fabrication and replacement of a new space maintainer that followed the growth of the jaws and the teeth was also preformed. In the lateral region the space maintainer was replaced with new one each year. In the frontal region the fabrication and replacement of new space maintainer was preformed on each 6-8 months. On the regular scheduled appointments, the growth of the jaws and the teeth was being controlled. Each time some of the permanent teeth had began its' eruption, a space for its placement was obtained by gradual removal of parts from the acrylic base plate.

Clinical case No.2: The patient at the age of 20 years, male gander appeared on an appointment for orthodontic treatment for the first time 8 years after the occurrence of the traumatic avulsion (Fig.2.).



Fig 2. Clinical case 1. Space maintainer used before and after preformed orthodontic treatment

An anamnestic data was recorded that the patient immediately after the traumatic avulsion was subjected to dental treatment on which a reimplantation of the maxillary left central incisor was preformed while the maxillary left lateral incisor could not be found. Because of delayed fabrication of space maintainer, the space for placement of the maxillary left lateral incisor was almost completely lost and teeth spacing in the dental arch has occurred. The gnathometric analysis in sagittal direction showed: negative over jet – 3mm, the patient gnathometricly has dental first class interarch relationships determined by the position of the canines, the occlusion could not be determined by the molars because of their bilateral extraction. In the vertical dimension, the measured overbite was 3mm, while the curve of Spee was 4mm. A bilateral cross bite, narrow dental arch and misalignment of the interarch midlines were diagnosed in the transversal occlusal plane. On the chephalometric analysis the patient showed

normoposition of the maxilla and anteposition of the mandibula and skeletal third class of interarch relationships with deep skeletal bite. The findings from the chephalometric analysis lead to the confirmation of the presence of progenia vera in the patient, but there is a lingering impression that if on an earlier stage from the development of the occlusal anomaly the radiographs were made, they would have been less conclusive in the direction of progenia vera and more conclusive towards pseudoprogenia that had been radicalized by the previous extraction of the left maxillary first permanent molar and avulsion of the maxillary left lateral incisor without proper treatment. The orthopantomographic RTG-s confirm the absence of maxillary left lateral incisor and showed proper and physiological restoration of the periodontal ligament of the maxillary left central incisor. The orthopantomographic RTG also depicts microdontia of the present teeth and fusion of the roots of the molars which makes the patient more challenging for orthodontic treatment.

Results

The results from the complications of the two clinical cases without preformed reimplantation and timely application of space maintainers are satisfactory in both of the clinical cases although their achievement required a long time period.

Clinical case No.1: The results from the treatment of the patient included maximal expansion of the transversal dimensions of the palate and increase of the space required for the placement of the maxillary right central incisor from 2mm to 7 mm. The obtained place was later maintained until the age of 18 when the patient reached maturity. After reaching the 18th year, an application of dental implant with porcelain crown was preformed on the patient (Fig 3.).

Clinical case No. 2: A fixed orthodontic appliance was placed on the patients' teeth and thus a sufficient space for placement of the maxillary left lateral incisor, reduction of the negative overjet, reduction of depth of the curve of Spee from 4mm to 2 mm and tete a tete sagittal interarch relationship were obtained. The bilateral cross bite and the midline of the dental

arch were improved. The treatment will continue until optimal occlusal relationships will be obtained and afterwards the patients will undergo a surgical correction of progenia vera and prosthetic rehabilitation (Fig 4.).



Fig 3. Clinical case 1: Retention phase of orthodontic treatment with mobile space maintainer and prosthodontic rehabilitation



Fig 4. Clinical case 2: Patient before and after orthodontic treatment

Discussion

Half of the periodontal cells of the avulsed tooth die out after 30 minutes from exposure to the external conditions. A complete necrosis of

the periodontal ligament from the tooth occurs after 2 hours spent in dry environment⁵. This is the reason why the critical period for reimplantation of the tooth is 20-30 minutes after its' avulsion. When the tooth had been avulsed, it should be properly kept until the moment of its' reimplantation. The resorption of the root of the avulsed tooth after its' reimplantation depends on: the time spend in the external environment, the speed of reimplantation, the stadium of the tooth development and the success of the impending endodontic treatment. The healing process of the periodontal ligament may finish with the development of the physiological and functional periodontal ligament, ankylosis, surface root resorption, inflammatory root resorption, necrosis of the dental pulp in teeth with closed apex and revascularization of the dental pulp in teeth with open apex of the dental root⁶. The surface resorption is characterized by the appearance of excavations on the surface of the dental root without disruption of the integrity of lamina dura. The replacement resorption is manifested by the disappearance of the periodontal space and its' substitution with bone tissue. The replacement resorption occurs as a result of an injury of the periodontal ligament that leads to its' inflammation, activation of the osteoclasts and fusion of the bone with the surface of the dental root⁷. The inflammatory resorption of the dental root is characterized by the appearance of cavities in the dental root and radiolucency of the lamina dura⁸.

If the avulsed tooth could not be found, the space for the missing tooth should be kept from being covered with the adjacent teeth by the fabrication of an appropriate space maintainer until the patient reaches mature age when a prosthetic solution could be contemplated⁹. Indication for fabrication of a space maintainer are present when their application simplifies and shortens the future orthodontic treatment, the patient has no malocclusion (i.e. progenia vera in the lower jaw or protrusion in the upper jaw), there is an avulsion of a deciduous teeth and the permanent teeth should erupt in two or more years, the supraeruption of the opposing teeth to the space of the missing tooth is being disrupted, there is an impairment of the masticatory, speaking and aesthetic function of the orofacial system¹⁰.

Contraindications for fabrication of space maintainers are present when there is a

possibility for reimplantation of the avulsed tooth, a deciduous tooth was avulsed but the permanent tooth successor has nearly erupted, the available space is larger than the space needed for prosthetic reconstruction of the avulsed tooth, there is no alteration in the magnitude of the space from the missing tooth or clinical cases in which a serial extraction of the teeth has been planed¹¹.

The space maintainers can be classified by their activity as active when they open the space of the missing tooth and passive when they maintain the space of the missing tooth in its' original dimensions¹². According to the manner of retention, they could be fixed, semi-fixed or mobile, according to the region of application they are aesthetic when they are used in in the frontal area or functional in the side region of the dental arch and according to the manner of fabrication they could be divided into factory made and individual that can be subdivided into immediate or made in the dental office and laboratory made on a dental cast¹³.

The fixed space maintainers are constructions that are cemented to the adjacent teeth to the space of the missing tooth and are not removed from their space in the dental arch during the orthodontic treatment¹⁴. The fixed space maintainers consist from the following parts: metal band or crown, rod, loop or arch, additional elements and soldering spot¹⁵.

The most popular fixed space maintainers and more frequently used are: metal band with loop, metal band with rod, metal crown with loop, metal crown with rod, transpalatal arch, lingual arch and frontal aesthetic space maintainer¹⁶.

The metal band with ring space maintainers are used in rare cases of avulsion of particular teeth from the side region of the dental arch¹⁷. They consist of a metal band around the abutment tooth i.e. molar or premolar and wire loop that expands over the space of the missing tooth¹⁸.

The metal crown with loop space maintainers are also used in rare cases of avulsion to the lateral teeth when the adjacent tooth to the edentulous space is severely destructed by caries and could not be banded¹⁹. It consists of a metal dental crown that is fixed onto the abutment tooth and wire loop that expands over the edentulous space²⁰.

The transpalatal arch consists of stainless steel wire that expands over the curvature of the

hard palate and connects the molar bands on the both sides of the dental arch²¹. Its' function is to hinder the mesial migration of the molars and because of this it is used in cases with avulsion to the lateral teeth in the maxilla. The primary indication for its' use are cases with unilateral avulsion to the lateral teeth. This space maintainer uses the intact side of the dental arch as an anchorage to prevent mesial migration of the molars to the opposite side of the dental arch with the avulsed tooth²².

The lingual arch consists of stainless steel wire that follows the contours of the mandibular teeth and connects the molar rings on both sides of the dental arch. Other than in the mandibular dental arch, the lingual arch can be also used the maxilla. The basic application for the lingual arch are clinical cases in which because of unilateral or bilateral avulsion of the lateral teeth in the maxillary or mandibular arch there is danger from mesial migration of the permanent first molars and loss of available space in the dental arch²³.

The frontal aesthetic space maintainer consists of temporary dental crowns that are applied to the canines, horizontal rod that attaches to the first temporary crown on one side and to the second temporary crown on the other side of the dental arch as well as artificial teeth placed vestibular to the horizontal rod with size appropriate to the edentulous space²⁴.

Advantages of the fixed space maintainers are that they are used with or without minimal preparation of the abutment teeth, they don't disrupt the eruption of the abutment teeth, the permanent teeth and the skeletal growth of the jaws, they can be used on patients that don't adhere to the therapeutic instructions and they restore the mastication function²⁵.

Disadvantages of the fixed space maintainers are that their fabrication requires the use of specialized equipment and cause decalcification of the dental tissue under the metal band.

The mobile space maintainers are construction that adhere to the adjacent teeth to the edentulous space with the use of dental clasps and can be removed and reinserted back to their place in the dental arch during the orthodontic treatment²⁶.

The mobile space maintainers are constructed from the following parts: acrylic base and dental clasps as well as artificial teeth and additional elements²⁷.

The most popular mobile space maintainers and more frequently used are: singular acrylic space maintainers that substitute only one missing tooth, partial acrylic space maintainers that substitute few missing teeth and total acrylic space maintainers that cover the entire dental arch and have openings for guiding the eruption of individual teeth²⁸.

Advantages of the mobile space maintainers are that they are easy for cleaning and maintaining oral hygiene, they maintain the vertical dimension of occlusion, they can be removed from the mouth and thus don't disrupt the blood circulation of the soft tissues, they are easily adapted not to disrupt the eruption of the permanent teeth and they disable the harmful oral habit of tongue trusting toward the space of the missing tooth.

Disadvantages of the mobile space maintainers are that they could easily be broken, they require good cooperation with the patient, they hinder the lateral growth of the patients' jaws and they irritate the soft oral tissues of the patient²⁹.

Conclusion

By correcting the complications of the unperformed reimplantation and timely application of space maintainers and analysis of the results obtained after treatment with space maintainers, the following can be concluded:

1. Each time when the avulsed tooth can be located, it should be reimplanted at the first given opportunity;

2. The procedure of reimplantation is different for avulsed teeth that have been exposed to external conditions a longer period of time and teeth that have been immediately reimplanted as well as between teeth with and without finished growth of the root;

3. Each time when the avulsed tooth cannot be located, an appropriate space maintainer should be fabricated and applied;

4. The unperformed treatment with space maintainers after traumatic avulsion of a permanent or a premature avulsion of deciduous tooth has serious complications for the dental arch and complicates the future orthodontic treatment;

5. The prosthetic rehabilitation and fabrication of prosthetic constructions in the

childhood age is postponed after reaching 18 years when the growth of the dentofacial structures is at its' final stage.

Declaration of Interest

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