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REVIEW ARTICLE

Intrusive luxation in primary teeth – Review of literature and report of a case

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Abstract Luxation injuries such as intrusion are commonly seen in the primary dentition. Intrusion drives the tooth deeper into the alveolar socket, which results in damage to the pulp and periodontium. Difficulty in gaining compliance from a very young child and the risk of damaging the permanent tooth germ makes the management of these injuries challenging. Careful clinical and radiographic examination along with regular follow-up is essential. A case of intrusive luxation to the maxillary central incisor in a 3-year-old patient is reported. Spontaneous reeruption was noted 4 months after injury, but the tooth had developed an abscess and external root resorption. Hence, extraction of the tooth was done and an anterior esthetic fixed space maintainer was placed. Traumatic injuries to the primary dentition should not be ignored by the parents or by the dentist. The paper also includes a literature review of intrusive luxation in the primary dentition.

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Contents

1. Introduction

Trauma to the oral hard and soft tissues is commonly seen in children. Among all facial injuries, dental injuries are the most common. As much as 18% of all injuries in children up to 6 years of age are seen in the oral region (Andreasen et al., 2007). Injuries to the primary dentition are common, occurring with a significantly higher annual incidence than in the permanent dentition (Andreasen and Ravn, 1972; Glendor, 2000). One third of all children in the primary dentition stage suffer from traumatic injuries to the mouth. This is possibly related to poor motor coordination and is sometimes due to the child's inability to evaluate risks (Andreasen and Andreasen, 1994). Resilience of the alveolar bone in young children causes dental luxations of the intrusive type to be more common than crown fractures (Bennett, 1964; Taintor et al., 1979; Joho and Marechaux, 1980). Traumatic injuries to the primary dentition are often overlooked by parents mainly because less attention is given to the primary dentition and to the child's inability to cope with the situation.

2. Review of the literature

2.1. Terminology

Intrusive luxation has been defined as dislocation of a tooth in an axial direction into the alveolar bone. This dislocation is considered complete when the tooth is enveloped by surrounding tissues or partial when the incisal border of the crown is visible (Andreasen, 1984).

2.2. Epidemiology

2.2.1. Prevalence

The reported prevalence of traumatic injuries in primary teeth varies among different studies and ranges between 11% and 30% (Andreasen and Ravn, 1972; Zadic, 1976; Ferguson and Ripa, 1979; Bijella et al., 1990). Traumas of the deciduous dentition, which occur mostly in the anterior region, result in luxation in 62–69% of cases (Andreasen, 1970; Andreasen and Ravn, 1972).

Intrusion comprises 8–22% of all luxation injuries of primary anterior teeth (Andreasen and Ravn, 1972). Other authors have reported prevalence rates as 15.3% (Soporowski et al., 1994), 21% (Onetto et al., 1994), 34% (Garcia-Godoy et al., 1987), and 54% (Robertson et al., 1997).

2.2.2. Age of occurrence

Traumatic injuries are less frequent during the first year of life (Garcia-Godoy et al., 1987; Bijella et al., 1990). Their frequency increases during the toddler stage, when the child starts crawling, walking, and exploring the surrounding environment. There is also a lack of motor coordination at this age (Harrington et al., 1988). One to 3 years is the most susceptible age group for intrusion injuries of primary incisors. This is explained by the tendency for intrusion to occur when primary incisor roots have been fully formed (Andreasen and Ravn, 1972; Borum and Andreasen, 2001). Older children have incisors with less root structure due to resorption by the permanent successors, thus making them more easily dislodged. After the beginning of root resorption around the age of 4

years, other luxation injuries such as avulsion, extrusion, and lateral luxation become more frequent (Ravn, 1976).

2.2.3. Teeth involved

The primary teeth most frequently injured are the maxillary central incisors, ranging between 63% and 92% (Andreasen and Ravn, 1972; Bijella et al., 1990; Borum and Andreasen, 1998; Gondim and Moreira Neto, 2005).

2.3. Etiology

The predominant cause of dental injuries in younger age groups is falls, such as falling from baby carriages, falling down stairs, or falling against hard objects, and is mainly indoor injuries (Andreasen et al., 2007). In other studies, 71% (Soporowski et al., 1994), 79.8% (Garcia-Godoy et al., 1987), and 82% (Onetto et al., 1994) of cases of intrusive luxation were reported to be due to falls. Less frequently, injuries occur while a child is playing outdoors or as a result of road accidents. In addition, child abuse is highly associated with head and tooth injuries (Andreasen et al., 2007).

2.4. Pathogenesis

The difference in the trauma pattern favoring luxation rather than fracture has been found to be typical for the primary dentition, since the surrounding bone is less dense and less mineralized. In older children, the probability of a root or crown fracture increases because of mineralization and increased rigidity of the alveolar bone (Crespi, 1992). Large bone marrow spaces, which are the characteristic of growing skeletal tissues, result in elasticity of the alveolar bone surrounding the primary teeth. This implies that a tooth hit by traumatic impact can easily be displaced instead of fractured (Ravn, 1968; Andreasen, 1970; Galea, 1984; Meadow et al., 1984). In addition, the short roots, resorbing roots, and high crown-root ratio of primary teeth offer less resistance to intrusive displacement (Von Arx, 1993).

In falls wherein the impact has an axial component, the tooth will be intruded due to the labial curvature of the root; the intrusion will usually result in an axial and labial displacement in which the apex penetrates the labial bone plate. Cases in which the impact direction has a strong lingual component typically occurs when the child falls with an object in the mouth (e.g., pacifier or toy). In these cases, the apex of the injured tooth may be forced into the follicle of the permanent successor, sometimes resulting in severe injury to the developing permanent tooth germ (Andreasen et al., 2007).

Oral luxation causes rupture of the gingival fibers and the periodontal ligament on the palatal aspect of the root as well as compression of the periodontal ligament on the labial aspect. Detachment of the gingival fibers allows invasion of oral microorganisms along the root surface and infection of the periodontal ligament (Holan, 1999).

Changes are seen in the pulp soon after injury that include edema and disorganization of the odontoblastic layer as well as nuclear pyknosis of the pulp cells. This response is related to either partial or total rupture of the pulpal neurovascular supply. If the pulp survives or becomes revascularized, a number of regressive changes can occur such as hyalinization and deposition of amorphous, diffuse calcifications (Andreasen et al., 2007). The probability that the pulp will remain vital following severe displacement of the apex is very low (Holan, 1999).

2.5. Examination protocol

2.5.1. History

The child's medical history should always be discussed with the parents. The need for prophylactic antibiotic coverage against infective endocarditis as well as the current tetanus immunization status should be determined. Children gain active immunity from diphtheria-pertrussis-tetanus (DPT) vaccine at 18 months of age. After a traumatic injury and contact with soil, a booster dose is indicated if the patient has not received an immunization within the prior 5 years.

A dental history would indicate any past traumatic injury or other dental experience, which helps determine the child's maturation and ability to cooperate during treatment. The history of the injury should be discussed with the parents. When, where, and how the injury happened should be recorded in detail.

2.5.2. Behavioral considerations

Injury to the child patient is a traumatic experience on the physical level as well as emotional and psychological levels. Making the task more difficult is the child's age.

Children younger than 3 years have a limited vocabulary that restricts their ability to communicate. Hence, the children should be allowed to adapt to the new dental environment by handling and touching objects like the mouth mirror, explorer, and handpiece, so that they will be familiar with these instruments when they are used and be less anxious. Further, separating these young children from the parents is not advised. Parents should be informed that the child is expected to cry during the procedure and that gentle restraint might be necessary.

2.5.3. Clinical examination

Clinical examination should commence with a neurologic assessment to detect signs of central nervous system damage. Cyanosis, nausea, vomiting, seizures, and loss of consciousness may be indicators of neurological damage. Other signs are unsteadiness, abnormal respiration, slurred speech, rhinorrhea, otorrhea, and abnormal eye movements (Croll et al., 1980). In the presence of these signs, the child must be hospitalized for detailed neurological evaluation.

2.5.3.1. Extraoral examination. Examination of the head and neck, temporomandibular joint, and mandibular functions should be done. The child must be checked for facial asymmetry (indicating jaw fractures), swelling of the lips, skin lacerations and cuts, and scars. Bleeding from the nostrils and subcutaneous hemorrhage near the nostrils may indicate fracture of the alveolar bone (Andreasen et al., 2007).

2.5.3.2. Intraoral examination. Intraoral tissues must be carefully examined. The surrounding soft tissues (lips, oral mucosa, attached and free gingivae, and frenums) should be checked for lacerations and hematomas. Signs of bleeding from the sulcus surrounding the injured tooth indicate damage to the periodontal ligament. Palpation of the gingivae and vestibule may

reveal a fluctuant hematoma above the displaced tooth (Andreasen et al., 2007).

Contusions of the lower lip and chin are more frequent with intrusion injuries (Andreasen, 1970). A soft tissue radiograph may be helpful in detecting the presence of foreign bodies that may have been impacted within lip or tongue lacerations (Fried and Erickson, 1995).

Visual intraoral examination of an intruded incisor shows a tooth that is submerged in the alveolar bone away from the normal line of occlusion. The tooth may be completely intruded and invisible as a result of a blood clot or gingival edema surrounding the incisal edge, in which case the parent or even the dentist might think that the tooth is lost.

The degree of intrusion can be divided into 3 grades (Von Arx, 1995)

- Grade I. Mild partial intrusion in which more than 50% of the crown is visible.
- Grade II. Moderate partial intrusion in which less than 50% of the crown is visible.
- Grade III. Severe or complete intrusion of the crown.

When the tooth is partially intruded, the orientation of displacement can be assessed. A labial crown orientation indicates a palatal intrusion of the root toward the permanent tooth germ. Conversely, a palatal crown inclination indicates a buccal intrusion of the root away from the successor germ (Andreasen et al., 2007).

Crushing and compression of the alveolar bone is an integral part of an intrusive luxation injury. Fracture of the alveolar socket may accompany intrusion injuries of high impact, such as falling down a staircase. Signs of alveolar fracture can be detected by gentle palpation of the mucosa in the traumatized area. In this case, the injured teeth and cortical bone will move as a unit (Josell, 1995).

2.5.4. Radiographic examination

Radiographs are an important adjunct to the clinical examination, providing valuable information that may affect the treatment plan for the injured primary tooth.

It shows the degree of development of the primary tooth and its permanent successor and the relationship between the two. Furthermore, physiological and pathological root resorption and the position of displaced primary teeth can be seen.

On the radiographic examination, if the tooth appears foreshortened compared with its noninjured antimere, then one can assume labial displacement of the root with minimal risk for the permanent successor. On the other hand, if a displaced primary tooth appears elongated radiographically, the tooth has most likely been intruded into the follicle of the permanent tooth and must be removed (Wilson, 1995). These guidelines apply only when the central beam is oriented exactly at the midline between the 2 incisors to be compared. If there is doubt about the position of a displaced primary incisor in relation to the nasal floor, a lateral exposure can be of value (Andreasen et al., 2007).

In addition, an extraoral, anterolateral exposure helps to determine the exact position of the intruded primary incisor and shows whether the apex has pierced the labial cortical plate and the proximity of the intruded incisor to its permanent successor. This view can be taken by taping an occlusal film on the child's cheek. The X-ray beam is directed from the opposite side of the face perpendicular to the film, and the exposure time is doubled from the normal periapical exposure time (Crespi, 1992; Andreasen and Andreasen, 1994; Harding and Camp, 1995; Fried and Erickson, 1995).

According to "Guidelines for the Management of Traumatic Injuries to Primary Teeth" (Flores et al., 2007), the extraoral lateral view of the tooth in question is useful to reveal the relationship between the apex of the displaced tooth and the permanent tooth germ as well as the direction of dislocation (size 2 film, vertical view). Any horizontal fracture line to the apex of the primary tooth and its permanent successor will also be disclosed. Holan and Ram (1999) used the lateral extraoral radiograph to disclose fractures of the labial plate in cases of intrusive luxation.

However, in their study, Holan et al. (2002) concluded that the lateral extraoral radiograph should no longer be routinely used for diagnostic purposes in intrusion cases, because it was found to have limited value in showing labial alignment. Diagnosis should be based on clinical findings and examination of a periapical radiograph.

As a general rule, therefore, to disclose the labial position of the apex to allow spontaneous reeruption, a lateral extraoral radiograph should be taken in cases of 1 intruded tooth when the crown has completely disappeared and clinical findings are inconclusive (Flores, 2002).

Drawbacks of two dimensional (2-D) imaging include inherent magnification, distortion, superimposition of overlying structures and it gives a two dimensional image of a three-dimensional object (Webber et al., 1997). To avoid these problems, cone beam computed tomography can be helpful in dentoalveolar trauma evaluation. Its advantages are shorter exposure time, high resolution, reduced image artefact, low radiation dose and high accuracy than 2-D radiography (Patel et al., 2007). However, the high cost of this technology prohibits its use in most dental offices. Its use also requires education regarding the correct interpretation of data and training in the scanning process (Howerton and Mora, 2008).

2.6. Factors influencing the selection of treatment for injured primary teeth

The proximity of the root of a primary tooth to its developing permanent successor is a critical factor. This implies that damage to the permanent tooth may be inflicted not only when the primary tooth is injured but also later as a result of the treatment rendered (Andreasen et al., 2007). Hence, the treatment with the least likelihood of having a deleterious effect on the permanent tooth should be considered. Attempts should also be made to save the injured primary teeth.

Another important factor is the relatively short period primary teeth function in the child's mouth, because of which the parents may be reluctant to seek treatment. Last but not least, traumatic injuries to primary teeth more often occur in very young children, posing a problem in cooperation during examination and implementation of treatment. But the lack of cooperation should not be considered an argument against conservative treatment of injured primary teeth (Andreasen et al., 2007).

2.7. Objectives of trauma management in the primary dentition

- To comfort the child and parents during this trying episode.
- To avoid inducing dental fear and anxiety in young children who may be experiencing their first dental problem.
- To minimize the risk of further damage to the permanent teeth (Andreasen et al., 2007).

2.8. Treatment regimens

The overall principle of treatment is not to take any risk of damage to the permanent successor, which usually implies a very conservative approach.

Use of topical anesthetics, local anesthesia, and sedation should be considered. Analgesics may improve the quality of care when pain is anticipated. The administration of a single dose of analgesic 1 h before injection and the use of a topical anesthetic will reduce the discomfort of a local anesthetic (Hallonsten et al., 2001). Adequate oral hygiene and a soft diet should be prescribed.

Management of an intruded primary incisor depends on the following variables:

1. Direction of intrusion,
2. Degree of intrusion,
3. Presence of alveolar bone fracture.

2.8.1. Direction of intrusion

The root of the primary incisor has a labial curvature. So, the primary incisor is frequently forced through the labial bone away from the permanent tooth germ (Ravn, 1976). In this case, spontaneous reeruption should be anticipated within 1–6 months (Soporowski et al., 1994; Harding and Camp, 1995; Fried and Erickson, 1995; Borum and Andreasen, 1998). Pulp necrosis, periapical inflammation, external root resorption, ankylosis, and pulp canal obliteration are possible sequelae following intrusion (Crespi, 1992).

In a retrospective study of 172 intruded teeth, the apices of more than 80% of the teeth were pushed labially. It was found that most of them reerupted and survived with no complications for more than 36 months posttrauma, even in the cases of complete intrusion and fracture of the labial bone plate (Holan and Ram, 1999).

Altun et al. (2009) studied 78 children presenting with intrusive luxation in which 138 primary incisors were present for follow-up examination. One hundred two intruded primary incisors were managed conservatively; of these, 78% fully erupted, 15% partially erupted, and 7% remained impacted.

Gondim and Moreira Neto (2005) evaluated 16 patients who suffered intrusive luxation to the primary anterior teeth. In all cases, the treatment indicated was to await spontaneous reeruption; total reeruption occurred in 42.5% of cases, partial reeruption in 47% of cases, and in 10.5% there was no reeruption. Fifty-seven percent exhibited healthy pulps independent of degree of reeruption. Twenty-three percent of the teeth underwent necrosis, while 33% had either internal or external root resorption.

When reeruption of an intruded incisor is expected, the parents should pay particular attention to the development of signs and symptoms, such as swelling of the surrounding gingival tissues, redness, pain, purulent exudate, and systemic symptoms such as fever. If any of the aforementioned signs is noticed, the parents should contact the treating dentist immediately. In these cases, immediate extraction and antibiotic therapy are essential to prevent the spread of inflammation to the permanent tooth germ.

On the other hand, a lingually directed impact forces the root palatally, resulting in possible contact with or invasion of the permanent tooth follicle and encroachment on the developing tooth germ (Taintor et al., 1979). In this case, the preferred treatment would be careful removal of the tooth to relieve the pressure on the odontogenic tissues within the developing follicle.

Proper surgical technique should be employed so as to avoid further injury to the developing dentition.

Elevators should never be used due to the risk of their entering the follicular space. Moreover, it is necessary that the intruded incisor be grasped proximally with narrow forceps and removed with the root pointing in a labial direction (Andreasen et al., 2007). These precautions are necessary to avoid collision with the developing tooth germ. Finally, once the tooth has been removed, the palatal and facial bone plates should be repositioned with slight digital pressure (Andreasen et al., 2007).

In more severe injuries, especially when there is bleeding of the lips or intraoral soft tissue or fracture of the facial and lingual plates, suturing may be needed (Flores et al., 2007). Suturing should start in the skin area and later shifting to the mucosa (Flores, 2002).

2.8.2. Degree of intrusion

Spontaneous reeruption is anticipated when the intrusion is mild (grade I or less than 50% of the crown length). Whenever the intrusion is moderate or severe (grade II or III), the tooth rarely reerupts and may become necrotic, indicating the need for extraction (Ravn, 1968; Wilson, 1995).

If signs of reeruption are not evident after 4–8 weeks, ankylosis should be suspected, and extraction should be considered (Harding and Camp, 1995; Borum and Andreasen, 1998).

However, the child with a digit or thumb habit may apply pressure, preventing the intruded tooth from reerupting (Wilson, 1995).

2.8.3. Presence of alveolar bone fracture

If the intrusion leads to perforation of the buccal cortical plate or if the intruded primary incisor becomes positioned entirely buccal to the cortical plate within the soft issue of the mucobuccal fold, extraction of the intruded tooth should be considered (Wilson, 1995). If the alveolar bone is fractured, the intruded incisor will most likely fail to reerupt (Josell, 1995), in which case the fractured cortical bony plate should be repositioned immediately with gentle digital manipulation and the intruded tooth extracted (Josell, 1995).

According to the current guidelines, treatment regimen of the intruded primary incisor can be broadly of two types depending on the radiographic examination (Andreasen et al., 2007; Flores et al., 2007). If the apex is displaced towards or through the labial bone plate, than the intruded tooth is left for spontaneous eruption. We should re-examine the tooth clinically and radiographically monthly to monitor healing.

But, if the intruded tooth has been forced into the follicle of the permanent tooth germ, extraction of the primary tooth is indicated.

Hence, the prognosis depends on many factors which include the direction, severity, and intensity of intrusion. Ninety percent of primary intruded teeth will reerupt spontaneously (either partially or completely) in 1–6 months. Ankylosis may occur, however, if the periodontal ligament of the affected tooth is severely damaged, thereby delaying or altering eruption of the permanent successor (AAPD Reference Manual, 2010–11). Cunha et al. (2001) concluded that the time elapsed between the dental trauma and seeking treatment is an important factor in establishing a prognosis. This time lapse is also strongly associated with the educational and awareness level of the parents with respect to oral care (Onetto et al., 1994).

A space maintainer for the extracted tooth is recommended to serve the purpose of aesthetics and phonetics and to prevent the development of any deleterious oral habit such as tongue thrusting. Above all, it will benefit the child psychologically.

2.9. Follow-up

Intrusion injuries of primary teeth should be carefully followed up. Recall examinations can be performed regularly every 2 weeks during the first month, then every month for the next 2 months, and then every 6 months (Welbury, 1997). At each visit, a complete examination should be done to check for any unusual symptoms such as spontaneous pain, abscess, fever, fistula, and soft tissue swelling (Josell, 1995; Fried and Erickson, 1995). The progress of reeruption should be evaluated. Lack of reeruptive movement or absence of physiological mobility may indicate ankylosis (Diab and El Badrawy, 2000).

The follow-up schedule for traumatized primary teeth, according to the guidelines of the International Association of Dental Traumatology (Flores et al., 2007) is as follows:

- 1 week: Clinical
- 3–4 weeks: Clinical, radiographic
- 6–8 weeks: Clinical
- 6 months: Clinical, radiographic
- 1 year: Clinical, radiographic

Each subsequent year until exfoliation. Clinical, radiographic monitoring until eruption of permanent successor.

Figure 1 Grade 1 intrusion seen wrt. upper left central incisor, tooth no. 61, 1 day after trauma occurred.

3. Case report

A 3-year-old boy was brought to the Department of Pedodontics and Preventive Dentistry, Vyas Dental College and Hospital, Jodhpur, Rajasthan, India, 1 day after suffering dental trauma. The chief complaint was pain in the maxillary anterior region. The parents stated that a front tooth had moved inside the jaw. The child was in good general health and had no neurological problems. There were no signs of head injury or trauma to other parts of the body. The patient's tetanus immunization was complete. On questioning the parents, I was told that the boy had fallen on the floor the day before. This was the patient's first dental visit.

The initial examination was done with the child on the parent's lap. This position was adequate for both the clinical and the radiological examinations and it allowed the parent to help restrain the child's movements and hold the radiographic films. The modality of "tell, show, do" was practiced at all appointments to gain the child's cooperation.

Extraoral examination revealed a contusion on the chin just below the lip, which was first washed with running water and then an antiseptic solution was applied. The visual intraoral inspection showed that the maxillary left central incisor was submerged in the alveolar bone away from the line of occlusion (Fig. 1), as a grade I intrusion (Von Arx, 1995). Bleeding from the gingival sulcus was associated with the intruded tooth. The tooth was not mobile, but was tender to palpation and percussion. No signs of alveolar fracture were detected by gentle palpation of the mucosa in the traumatized area.

Intraoral periapical radiographs taken of the maxillary anterior region showed the presence of an intruded incisor (Fig. 2), appearing foreshortened on the radiographic image. It was slightly palatally inclined as seen clinically. This implies that the intruded tooth was displaced away from the developing tooth germ.

Figure 2 Intra-oral periapical radiograph of the upper front tooth region showing the intruded tooth, i.e. upper left central incisor, tooth no. 61 taken 1 day after trauma occurred.

One of the most severe complications of an injury is infection. The supporting apparatus of a healthy tooth is protected against invasion of oral microorganisms by the attached gingiva. As the tooth is pushed into the tissues, rupture of this attachment is unavoidable. Oral bacteria can now infiltrate and infect the wounded tissue. If there is no definite policy for antibiotic therapy in case of traumatic injury to primary teeth, the decision must be made by the clinician based on his or her own experience (Holan and Ram, 1999). Also, when reduction of oral bacteria is required, children 2–4 years of age, unlike adults, are unable to rinse their mouth with a chlorhexidine preparation.

In addition, to minimize the possibility of pulpal necrosis or pathologic root resorption after intrusive luxation injuries, Kenny and Yacobi (1988) and Spinosa (1990) advocated antibiotic therapy such as penicillin or erythromycin.

Figure 3 Re-eruption of the intruded tooth no. 61 seen at the end of 4 months post-trauma.

Figure 4 Intra-oral periapical radiograph of the upper front tooth region showing the re-erupted tooth, i.e. upper left central incisor, tooth no. 61, seen at the end of 4 months post-trauma.

Hence, it was decided to wait for spontaneous reeruption of the intruded tooth. Meanwhile, the patient was placed on oral amoxicillin and Ibugesic for 3 days. The parents were also instructed to maintain good oral hygiene, brushing with a soft brush after each meal, and a soft diet for 10–14 days was prescribed. They were advised to bring the child for a regular check-up twice a week for the first 2 weeks, then every month while awaiting spontaneous reeruption. This would also help the child become familiar with the dental clinic, so that future cooperation could be expected.

The appointments were kept short and scheduled in the morning so as to gain maximum cooperation of the child. Spontaneous reeruption was noticed during subsequent visits.

Figure 5 Intra-oral periapical radiograph of the upper front tooth region, taken after 4 months and 1 week of trauma confirming the external inflammatory root resorption. Access opening done w.r.t. 61 can also be seen.

Figure 6 Extracted tooth (4 months, 1 week post-trauma) showing external root resorption involving the whole root length.

Figure 7 Post-extraction intra-orally.

Figure 8 Anterior esthetic fixed space maintainer.

Figure 9 Anterior esthetic fixed space maintainer cemented in the oral cavity (1 week after extraction).

At the end of the fourth posttrauma month, approximately 90% of the tooth had reerupted (Fig. 3), which was confirmed by intraoral periapical radiography (Fig. 4). At this time, however, the patient complained of pain and swelling around the reerupted tooth. In an attempt to save the tooth, an emergency access opening was made to relieve the pain. But the pain and abscess persisted, and another radiograph revealed extensive root resorption (Fig. 5). Hence, the tooth was extracted under local anesthesia, using 2% lignocaine hydrochloride with vasoconstrictor 1:200000 adrenaline. Postextraction instructions were given and antibiotics prescribed. The extracted tooth showed extensive inflammatory root resorption involving the entire root (Fig. 6).

The loss of an anterior tooth (Fig. 7) poses not only an esthetic problem, but also difficulty in speech and a great deal of psychological stress to the child. Considering these factors, a fixed aesthetic space maintainer was designed. To restore the patient's self-confidence, his own tooth was used as the pontic. Accordingly, the root fragment was sectioned away from the tooth crown. Stainless steel bands were fitted to the maxillary deciduous second molars, and a round, 0.036-inch stainless steel wire was adapted to span the palate, leaving 1 mm of clearance to prevent tissue impingement. A V-bend was made in the wire at the edentulous space to provide retention for the pontic, on which a corresponding notch was carved on its palatal aspect. The pontic was attached to the wire segment by means of acrylic resin (Fig. 8). The space maintainer was cemented with glass ionomer cement and postinsertion instructions given.

Thus the prosthetic replacement not only enhanced the phonetics and aesthetics but it also boosted the patient's confidence (Fig. 9).

4. Discussion

Injury to the child patient is a traumatic experience on a physical as well as emotional and psychological level. In view of the patient's tender age and the likelihood that the dental visit will be the patient's first, managing the child's traumatic injuries is a demanding task.

The close relationship between the apex of the injured primary tooth and the underlying permanent tooth germ must be kept in mind. In this case, clinically and radiographically the tooth was displaced away from the permanent tooth germ, so we decided to wait for spontaneous reeruption—the most widely accepted treatment for an intruded primary tooth. Spontaneous reeruption was seen by 4 months, as was also reported by Bennett, 1964 and Soporowski et al. (1994). During reeruption, there is a risk of acute inflammation around the displaced tooth (Andreasen et al., 2007).

In the present case, too, an acute abscess was seen following reeruption. The patient also had fever, malaise, and pain resulting from a bacterial infection of the trauma site. There was also pulpal necrosis and/or pathological root resorption due to injury to pulp tissue and periapical structures (Crespi, 1992). To relieve the pain, pulp therapy was initiated on the day the patient reported the reeruption. This was also done in an attempt to save the young primary tooth for cosmetic and space maintenance purposes. (Soporowski et al., 1994). But pulp therapy was not successful, probably because of the extensive inflammatory root resorption. Therefore, we extracted the tooth and gave postextraction instructions. Antibiotic therapy was prescribed to prevent the spread of inflammation to the permanent tooth germ, as advocated by Kenny and Yacobi (1988), Andreasen and Andreasen (1994), Wilson (1995), and Andreasen et al. (2007). After extraction, the irregularity of the resorbed root surface was evident, which

was due to external inflammatory root resorption, confirming the radiographic diagnosis.

Anterior tooth loss results in difficulty in speech development, especially in the young child (Riekman and ElBadrawy, 1985; Pinkham et al., 2005). It is also a setback for a child to have lost a tooth at an early age, and it may lead to the development of tongue habits. In such patients, a fixed space maintainer benefits speech, aesthetics, and self-esteem. Hence, a fixed esthetic space maintainer with a natural tooth pontic was designed. The patient's natural tooth was chosen as a pontic, since it would be of the same size and contour as the contralateral tooth. Readily available primary typodont teeth or acrylic teeth can also be used, but they do not provide as natural contour or size as does a natural tooth.

A removable palatal retainer with a tooth (removable functional space maintainer) is satisfactory in an older and mature child who can adapt to the bulk and is cooperative (Nakata and Wei, 1988). However, for a toddler, we decided that a fixed space maintainer would be more suitable.

In the case of avulsion of a permanent tooth, glass-fiber-reinforced composite resin can be used to replace the patient's own tooth as a pontic. Its advantages include saving of time, elimination of second visit, ease of application, absence of metal allergy, ease of cleaning, and naturalness of feel (Avdin and Kargul, 2004). However, it could not be used in the present case because less surface area is available on primary teeth for bonding. Regular follow-up and maintenance of good oral hygiene was emphasized.

5. Summary

Intrusive luxation of the primary central incisor in a 3-year-old patent was reported. A thorough clinical and radiographic examination was done to locate the position of the intruded tooth in relation to the developing permanent tooth germ. The direction and severity of intrusion and the absence of an alveolar bone fracture determined the treatment regimen. As the intruded tooth was displaced away from the permanent tooth germ, spontaneous eruption was awaited, which took place after 4 months.

Short appointments, presence of parents in the operatory, and the modality of "tell, show, do," was practiced to gain maximum cooperation from the child.

Due to the presence of external inflammatory root resorption and acute abscess after reeruption, the tooth was extracted. The need for replacement of a primary anterior tooth was emphasized for aesthetics, self-esteem, and speech development. Hence, a fixed space maintainer with a natural tooth pontic was designed and delivered. Regular follow-up visits and maintenance of oral hygiene were advised.

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