



Management of primary tooth luxation injuries

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Abstract

In children, traumatic dental injuries from a fall are more likely to result in a tooth being displaced than fractured, because the supporting bone is less dense than in the permanent dentition. The direction of the displacement and severity of the injury will influence the risk of injury to the developing permanent teeth. This manuscript will discuss each type of primary tooth luxation injury, how they should be managed, the prognosis and sequelae that are likely and what behavior guidance techniques may need to be used to provide safe treatment.

Keyword Dental trauma · Primary tooth · Luxation · Pediatric · Injury

Quick reference/description

Displacement of a tooth out of the alveolar socket due to trauma is known as a luxation injury. Luxation injuries of primary teeth can adversely affect the developing permanent teeth. The risk of injuring the underlying permanent tooth depends on the direction of displacement and severity of the luxation injury. The management of luxated primary teeth should have a safe approach so as not to interfere with the development of permanent teeth.

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Overview

Treatment modality	Indications	Rationale
Observation	<p>Management of concussion and subluxation</p> <p>Allowing spontaneous repositioning of laterally luxated teeth with minor displacement and no occlusal interference</p> <p>Allowing spontaneous re-eruption of a tooth with intrusive luxation, if the apex of the intruded tooth is positioned toward or through the buccal bone</p>	<p>Prognosis is good for concussion and subluxation without the requirement of any specific treatment modality</p> <p>Spontaneous repositioning of laterally luxated teeth can occur if there is no occlusal interference</p> <p>Spontaneous re-eruption of intruded teeth can occur if the tooth is still in the developing phase with only minor intrusion</p>
Maintenance of good oral hygiene	<p>Prevention of potential infection and other plaque-associated sequelae following luxation injuries</p> <p>Only treatment required for concussion and subluxation</p>	<p>Good oral hygiene promotes healing of the injury and surrounding tissues as it minimizes plaque accumulation in the region of trauma</p>
Repositioning of luxated tooth	<p>Management of laterally luxated tooth causing occlusal interference</p> <p>Management of extrusive luxation in an immature tooth with an open apex and an extrusion of less than 3 mm</p>	<p>Occlusal interference due to lateral or extrusive luxation increases the risk of additional trauma to the injured tooth and the underlying permanent tooth bud requiring repositioning of the injured tooth</p>
Extraction	<p>Management of teeth with severe lateral luxation</p> <p>Management of extrusive luxation in a mature tooth with a closed apex and an extrusion of more than 3 mm</p> <p>Treatment of extrusive luxation in children with non-nutritive sucking habits or pacifier usage</p> <p>Delay in the conservative management of extruded teeth</p> <p>Management of teeth with intrusive luxation that present with the tooth apex through the gingiva covering the alveolar bone or towards the developing tooth bud</p>	<p>Severe lateral luxation can cause additional trauma to the developing permanent successor requiring extraction</p> <p>In children using pacifiers or having non-nutritive sucking habits, extraction is the treatment of choice for extruded teeth as gaining stability by repositioning the teeth has questionable prognosis</p>
Replacement of missing teeth	<p>Esthetic concerns associated with missing anterior teeth due to luxation injuries or their treatment</p> <p>Maintenance of space in the anterior maxilla</p> <p>Speech-related problems</p>	<p>Concerns of the caregivers that missing anterior teeth will lead to physical and emotional impairment in the child</p> <p>Allowing normal eruption of permanent anterior teeth</p>

Treatment modality	Indications	Rationale
Follow-up	Monitoring of teeth with luxation injuries for pulp vitality, and spontaneous repositioning or re-eruption of injured teeth Monitoring of root development and eruption path of permanent successors of injured teeth	To assess healing and predict potential complications of luxation injuries For early intervention in case of damage to permanent teeth

Materials/instruments

Dental management

- 0.12% chlorhexidine oral solution
- Narrow forceps
- Nitrous oxide

Post-trauma care

- Ibuprofen or acetaminophen
- 0.12% chlorhexidine oral solution
- Cotton swab
- Soft bristle toothbrush

Procedure

A luxation injury involves partial or complete displacement of a tooth out of the alveolar socket because of trauma. These injuries to primary teeth can negatively impact the developing permanent teeth. The risk of injuring the underlying permanent tooth depends on the displacement direction and severity of the luxation injury. A meticulous approach should be followed for the management of luxated primary teeth to prevent interference with development of permanent teeth.

Clinical and radiographic examination

Accurate diagnosis of luxation injuries is usually established from the clinical features and description of the injury. Clinical and radiographic findings are crucial for the evaluation of teeth subjected to trauma and subsequent treatment planning. In case of luxation injuries, a thorough clinical examination of the child of any age along with those having special health care needs is essential and should be possible. A knee-to-knee examination with the child's caregiver allows enhanced visibility of the mouth in very young children. During the examination, the caregivers should help in managing the child's hands and feet.

Intraoral radiographic examination is necessary for establishing a definitive diagnosis of luxation injuries. In any luxation injury, an intraoral radiograph should be obtained to exclude root fracture and determine a baseline for the injury. An intraoral radiograph is essential in case of intrusive luxation to distinguish it from avulsion and evaluate the severity of the injury. Occlusal radiographs allow assessment of the position of primary tooth roots in relation to the permanent successor, and its root development and eruption. Radiographic examination can require assistance from caregivers. In very young children, an occlusal radiograph can be obtained while the child is sitting on the caregiver's lap. The caregiver is instructed to stabilize the child's head and the X-ray film when it is positioned in the oral cavity.

A lateral extraoral radiograph may also be required in case of intruded teeth to determine the position of the primary tooth root. This is accomplished using a number 4 film positioned against the child's cheek and perpendicular to the central beam. The central beam is parallel to the occlusal plane and is positioned against the opposite cheek. The exposure is made at the typical setting for the size of the child. In a periapical or occlusal radiograph, if the root appears shortened, the root apex is placed through the buccal bone, and if the root appears elongated, the root apex is positioned towards the permanent tooth bud.

Concussion and subluxation

Concussion and subluxation are luxation injuries that occur without displacement or fracture of the affected teeth. A concussive injury can occur in one or more teeth due to trauma. Subluxation causes loosening of the tooth resulting in mild mobility (Fig. 1). Concussion injuries have no increased mobility and no sulcular bleeding. They do often demonstrate sensitivity to percussion. In comparison, subluxation injuries do have sulcular bleeding and increased mobility.

Management of concussion and subluxation

Following thorough clinical and radiographic examination, a definitive diagnosis of concussion or subluxation is established. These types of luxation injuries have a good prognosis. Usually, concussion and subluxation do not require any specific treatment.

Fig. 1 Subluxation injury to primary maxillary incisors. (Courtesy of Dr. Simon Jenn-Yih Lin)



Good oral hygiene maintenance As concussion and subluxation are not very serious injuries, maintenance of good oral hygiene and consumption of a soft diet by the child for a few days are the most important instructions for caregivers. Effective management of plaque around injured teeth can be assisted with the use of 0.12% chlorhexidine. In young children, chlorhexidine can be applied with a cotton swab or brushed onto the injured teeth. Older children can be asked to swish it around the mouth and expectorate.

Follow-up In case of concussion or subluxation of primary teeth, follow-up clinical examinations at 1 week and at 6–8 weeks are recommended as per the guidelines of the International Association of Dental Traumatology (IADT). Discolored teeth should be evaluated annually. Clinical follow-up is essential to monitor the vitality of the tooth and development of permanent successors.

Lateral luxation

Lateral luxation is a dental injury that causes palatal or labial displacement of the tooth affected by trauma. Efficient management of lateral luxation is essential as it can cause occlusal interference. Following a definitive diagnosis of lateral luxation, the tooth can be allowed to reposition spontaneously or can be treated with forced repositioning or extraction.

Management of lateral luxation

Management of lateral luxation depends on several factors like:

- Extent and severity of luxation
- Time elapsed since the trauma
- Position of the root relative to the permanent successor
- Medical conditions
- Behavior of the child

Observation and spontaneous repositioning The laterally luxated tooth is allowed to reposition spontaneously if there is only minor displacement without occlusal interference.

Repositioning of tooth Repositioning of the luxated tooth is required if occlusal interference occurs. This forced repositioning of the tooth should be performed under local anesthesia. In case of palatal displacement of the tooth, there is a possibility that the apex of the root has invaded through the buccal bone. Prior to repositioning the tooth in the socket, slight extrusive pressure is applied to straighten the tooth. A combination of non-pharmacologic and pharmacologic behavior management techniques like nitrous oxide inhalation or minimal sedation can be used during treatment. The prognosis of repositioned teeth depends on the severity of luxation and the rate of

tooth repositioning. If there is a delay in treatment, resulting in additional trauma to the luxated tooth, the prognosis is worse than a tooth that is managed in a timely way.

Extraction Extraction is the treatment of choice for severe lateral luxation causing major occlusal interference and teeth with significant mobility (grade 3) that could pose an aspiration risk. Extraction of laterally luxated teeth is also indicated to prevent further trauma to the underlying permanent tooth (Fig. 2). Non-pharmacologic and pharmacologic behavior management techniques such as minimal sedation or nitrous oxide inhalation can be used during extraction.

Follow-up In case of lateral luxation of primary teeth, follow-up clinical examinations are recommended at 1 week and at 2–3 weeks. Additional clinical and radiographic examinations are also advised at 6–8 weeks and at 1 year. Follow-up examinations usually monitor the vitality of primary teeth, and root development and eruption path of permanent successors.

Extrusive luxation

Extrusive luxation is an injury that results in extrusion of the affected tooth partly out of the alveolar socket. This type of luxation can cause significant occlusal interference. Extrusive luxation can be treated with tooth repositioning or extraction of the affected tooth.

Management of extrusive luxation

A conservative management approach is recommended for extrusive luxation. Along with the management, a strict follow-up schedule allows easy detection and treatment of complications associated with extrusive luxation. The treatment of choice for management of extrusive luxation is based on:

- Severity of extrusion

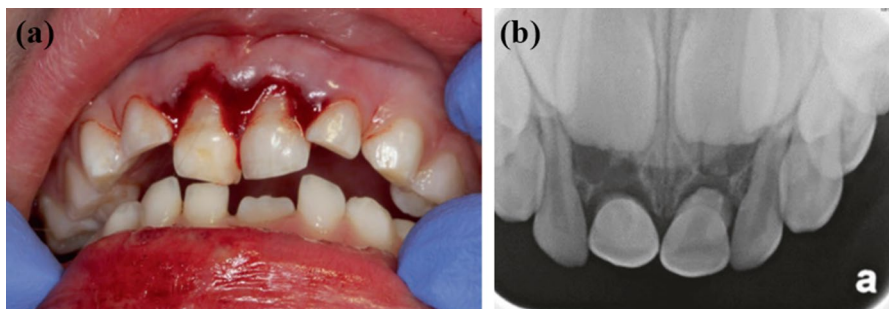


Fig. 2 **a** Lateral luxation of primary incisors resulting in occlusal interference. **b** In the occlusal radiograph, the roots appear shortened due to the palatal position of the crowns. Extraction is indicated due to the severity of luxation

- Degree of root development of permanent successor
- Time elapsed since the trauma
- Medical conditions
- Behavior of the child
- Nutritive and non-nutritive habits

Repositioning of tooth Repositioning of a tooth with extrusive luxation is advised in case of an immature tooth with an open apex and less than 3 mm of extrusion (Fig. 3). A combination of non-pharmacologic and pharmacologic behavior management techniques like nitrous oxide inhalation or minimal sedation can be used during treatment. Gaining stability of the repositioned tooth is difficult if the child has a habit of digit sucking or using pacifiers.

Extraction The IADT guidelines recommend extraction of teeth with extrusive luxation if the affected tooth has a completely formed, closed apex and greater than 3 mm of extrusion. Extraction is also advised in children with habits of digit sucking or using pacifiers. In case a significant amount of time has elapsed since the traumatic injury, extraction of the tooth should be considered as tooth repositioning is difficult due to the presence of the coagulum in the socket. Non-pharmacologic and pharmacologic behavior management techniques such as minimal sedation or nitrous oxide inhalation can be used during extraction.

Follow-up In case of extrusive luxation of primary teeth, follow-up clinical examination is recommended at 1 week. Additional clinical and radiographic examinations are advised at 6–8 weeks, at 6 months and at 1 year. Follow-up examinations usually monitor the vitality of primary teeth, and root development and eruption path of permanent successors.

Intrusive luxation

Intrusive luxation occurs when a traumatic injury causes displacement of a tooth into the socket. This intrusion further causes the root apex to break through the buccal alveolar bone. Intrusive luxation causes severe injury to the primary tooth

Fig. 3 Extrusion of primary central incisors requiring repositioning of the teeth



as well as the permanent tooth bud. Accurate diagnosis is required to differentiate between severe intrusion and avulsion.

Management of intrusive luxation

Effective management of intrusive luxation should be planned after an accurate diagnosis, as it can mimic avulsion in severe cases.

Observation for spontaneous re-eruption If the apex of the intruded tooth is positioned through or toward the buccal alveolar bone, spontaneous re-eruption of the tooth is permitted (Fig. 4). The extent of intrusive luxation can be determined by measuring the level of the intruded tooth in relation to the adjacent teeth. This helps to anticipate whether spontaneous re-eruption can occur. Spontaneous re-eruption to the original level is expected to occur in approximately 3 months. The time required for spontaneous re-eruption is variable and depends on:

- Age of the patient
- Extent of intrusion
- Extent of injury to alveolar bone

Extraction Extraction of the intruded tooth is indicated in case of a decreased likelihood of spontaneous re-eruption when the apex of the primary tooth is visible through the gingiva lying over the alveolar bone. Extraction of the intruded primary tooth is also advised when its apex is placed towards the permanent successor to prevent additional damage to the developing tooth bud.

Combined non-pharmacologic and pharmacologic behavior management techniques like minimal sedation or nitrous oxide inhalation can be used during extraction. To reduce the risk of damage to the permanent successors, extraction of intruded primary incisors should be performed carefully. Use of elevators should be avoided in such cases, and narrow forceps should be used to prevent contact with the permanent tooth bud.

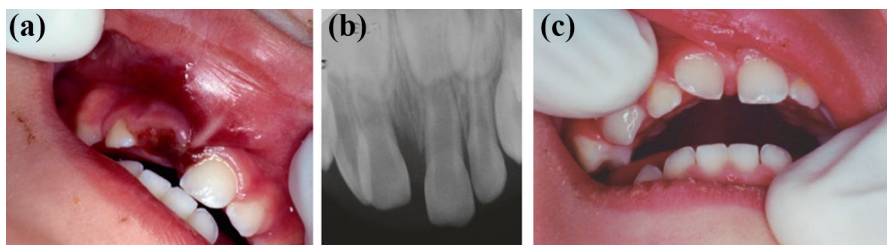


Fig. 4 Intrusive luxation of primary right maxillary central incisor. **a** Clinical examination appears as avulsion. **b** Radiographic examination showing intrusion. **c** Spontaneous re-eruption of the intruded tooth

Follow-up In case of intrusive luxation of primary teeth, follow-up clinical examinations are recommended at 1 week and at 6–8 weeks. Additional clinical and radiographic examinations are also advised at 3–4 weeks, at 6 months, at 1 year and annually after the first year till tooth exfoliation. Follow-up examinations usually monitor re-eruption, vitality of the primary tooth, and root development and eruption path of permanent successors.

Avulsion

When a tooth is completely displaced out of the socket, it is known as avulsion. It is crucial to distinguish between avulsion and complete intrusion prior to initiation of treatment. In case of avulsion, aspiration or ingestion of the avulsed tooth should be ruled out.

Management of avulsion

In case of avulsion of a primary tooth, replantation of the tooth is not recommended by the IADT guidelines due to the probability of damaging the underlying permanent successor. Replantation of an avulsed tooth followed by splinting and pulp therapy also carries a risk of subjecting the child to emotional trauma that can cause post-traumatic stress disorder (PTSD).

Replacement of missing teeth Missing teeth due to avulsion can be replaced using a fixed appliance or a removable partial denture. The primary indications for replacement of missing primary teeth are the associated esthetic concerns of the caregivers that missing anterior teeth will physically and emotionally impair the child, maintenance of space in the anterior maxilla and speech-related problems. Replacement of teeth should only be considered in cooperative patients willing to tolerate the prostheses fabrication procedures for fixed or removable prostheses.

Patients and caregivers are instructed to ensure that the child avoids biting into hard or chewy food items with the prosthesis, maintain good oral hygiene and adhere to a stringent routine follow-up schedule. A fixed appliance is similar to a Nance space maintainer with the addition of acrylic teeth (Fig. 5). The fabrication

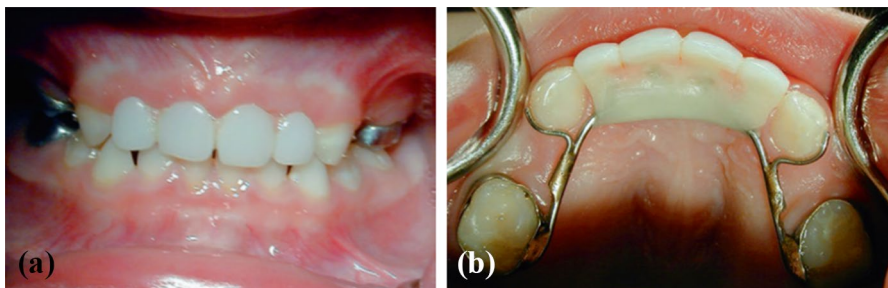


Fig. 5 Fixed partial denture to replace anterior teeth. **a** Frontal view. **b** Palatal view

procedure for fixed appliances includes fitting of orthodontic bands around primary second molars, obtaining impressions of both arches and laboratory fabrication. A removable partial denture is similar to an orthodontic retainer with acrylic anterior teeth, retentive clasps on the molars and an acrylic plate on the palate (Fig. 6).

Follow-up In case of avulsion of primary teeth, follow-up clinical examination is recommended at 1 week. Additional clinical and radiographic examinations are advised at 6 months, at 1 year and annually after the first year till eruption of the permanent tooth. Follow-up examinations are performed to monitor the development and eruption path of permanent teeth.

General instructions for patients with luxation injuries

- Consumption of soft food and liquids for 1.5–2 weeks. Avoid using the injured teeth to bite into food items. Small morsels of solid food can be eaten after 14 days.
- Preferably use a cup without a lid for consumption of liquids. If the child is habitual to a sippy cup, undue pressure on the anterior teeth should be avoided.
- Non-nutritive sucking habits and use of pacifiers should be restricted or completely avoided to prevent additional trauma to the injured teeth during healing.
- Maintenance of good oral hygiene is crucial for accelerating healing and preventing complications. Use of a soft toothbrush to clean plaque and food debris is recommended after every meal. Additional softening of the bristles can be achieved by running warm water over the bristles prior to use. In young children, a cotton swab or soft brush can be used to apply alcohol-free chlorhexidine to the injured teeth and surrounding areas. Older children are advised to swish and expectorate the chlorhexidine solution 2–3 times daily. Chlorhexidine should be used for 1 week and parents should be advised that they may notice staining on the teeth that can be removed at a future visit.
- Prevention of a second injury during the healing phase of the first injury is crucial in very young children. Older children should avoid sports activities for 2–3 weeks and should use a mouth guard during the activity after 3 weeks.

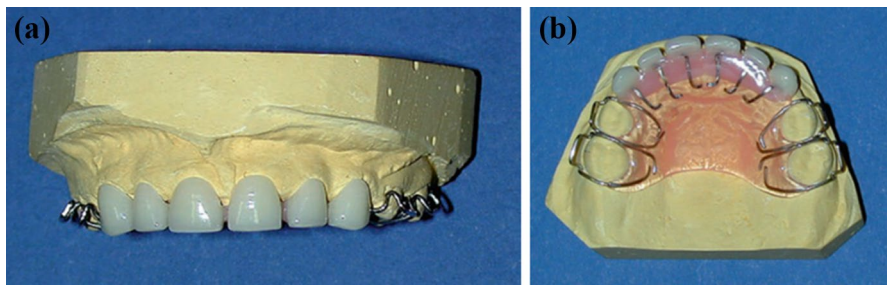


Fig. 6 Removable partial denture to replace anterior teeth. **a** Frontal view. **b** Palatal view

- It is absolutely necessary to inform the caregivers about potential complications and sequelae of luxation injuries. This information should be provided in verbal and written form. The caregivers should be vigilant about development of pain, tooth discoloration, swelling, increased mobility, infection, abscess, draining fistula, erythema and splint detachment (if present). These sequelae should be reported to the clinician immediately.
- The caregivers should be advised to administer a suitable dose of acetaminophen or ibuprofen to keep the child comfortable in case of pain.

Pitfalls and complications

- If repositioning of luxated primary teeth results in the tooth contacting the underlying permanent tooth crown, there is a risk of enamel defects in the permanent tooth like opacity or enamel hypoplasia.
- Gaining stability of the repositioned tooth is difficult if the child has a habit of digit sucking or using pacifiers.
- Replantation of avulsed teeth, splinting and pulp therapy carries the risk of subjecting the child to emotional trauma that could result in PTSD.

Further reading

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