Management of Traumatically Injured Primary Teeth: A Review of Literature and Recent Update

Tavleen Kour, Virinder Goyal, Puneet Goyal, Shaveta, Burhan Altaf Misgar, Deeksha Sharma

Department of Pedodontics and Preventive Dentistry, Guru Nanak Dev Dental College & Research Institute, Sunam, India

Trauma to the primary dentition present special problems, and the management is often different as compared with permanent teeth. An appropriate emergency treatment plan is important for a good prognosis. Guidelines are useful for delivering the best care possible in an efficient manner. The International Association of Dental Traumatology has developed a consensus statement after a review of the dental literature and group discussions. The guidelines represent the current best evidence based on literature research and professional opinion.

Keywords: dentition, injury, trauma, primary teeth

Introduction

Injuries to children is a major threat to their health, and they are generally a neglected public health problem [1]. In preschool injuries, head injuries make up as much as 40% of all somatic injuries [2]. Among all facial injuries, dental injuries are the most common [3]. Traumatic dental injuries (TDIs) occur frequently in children and young adults, comprising 5% of all injuries [4]. The vast majority of TDIs occur in children and teenagers where loss of a tooth has life-time consequences [5]. Luxation injuries are the most common TDIs in the primary dentition, whereas crown fractures are more commonly reported for the permanent teeth [4]. An appropriate treatment plan after an injury is important for a good prognosis. Guidelines are useful for dentists and other

healthcare professionals in delivering the best care possible in an efficient manner. The International Association of Dental Traumatology (IADT) has developed a consensus statement after a review of the dental literature and group discussions [2]. The Present 2020 guidelines present a core outcome set that include outcomes that were relevant to all TDIs and outcomes related to only one or several TDIs. The Areas of TDIs have been separated into separate sections with a tabular format highlighting the main changes in the emergency management from the previous version in 2012. The guidelines represent the current best evidence based on literature research and professional opinion. As is true for all guidelines, the healthcare provider must apply clinical judgment dictated by the conditions present in the given traumatic situation. The IADT does not guarantee favourable outcomes from following the guidelines, but using the recommended procedures can maximize the chances of success [2].

Management of TDIs in children is distressing for both the child and the parents. It can also be challenging for the dental team. A TDI in the primary dentition often may be the reason for the child's first visit to the dentist. Minimizing anxiety for the child and parents, or other caregivers, during the initial visit

Corresponding author **Tavleen Kour**

E-mail: ishartavleen@gmail.com

<https://orcid.org/0000-0002-5509-4994>

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is essential. At this young age, the child may resist co-operating for an extensive examination, radiographs, and treatment [6-8]. Wherever possible, the acute and follow-up dental care should be provided by a child-oriented team that has experience and expertise in the management of pediatric oral injuries [9].

It is essential that clinicians adopt a structured approach to managing TDIs. This includes history taking, undertaking the clinical examination, collecting test results, and how this information is recorded [10,11]. Extra-oral and intra-oral photographs act as a permanent record of the injuries sustained and are strongly recommended [12].

Several studies have been conducted from time to time on anterior tooth trauma in primary dentition which covers the various aspects of TDIs. Some of them have been discussed below.

Qassem et al. [13] conducted a longitudinal retrospective study to determine the kinds of sequelae resulting from intrusive luxation and subluxative injuries in primary anterior teeth as well as the timing of such sequelae. They found that Crown discoloration was the most prevalent sequelae. Among the subluxated teeth, <50% of infection related resorption (IRR), fistula, crown discoloration, and pulp canal obliteration (PCO) occurred within 180 days after TDI; however, the sequelae were also diagnosed after longer periods. Majority of sequelae of intrusion were diagnosed within the 181-365 days and 1-2 years periods but were also observed after more than 4 years of follow-up [13].

A retrospective study was conducted by Lauridsen et al. [14] to report the risk of pulp necrosis (PN), PCO, repair related resorption (RRR), IRR, ankylosis related resorption (ARR), premature tooth loss (PTL) in primary teeth following concussion, subluxation injuries, and to identify possible risk factors for PN, PCO, and PTL following subluxation. It was found that most complications (95%) were diagnosed within the first year. Most cases of PN (65%) and PTL (85%) were seen in patients aged 4 years or more [14].

Miranda et al. [15] published a case series to determine the consequences of dental trauma to the primary teeth on the permanent dentition. The severity of the post-traumatic sequels shown by the permanent teeth kept a direct relationship with the extent of the impact and patient's age at the accident. These sequels resulted in whitish or brownish opacities, enamel hypoplasia, root dilacerations, and total arrest of root development. It was concluded that the protocols for patients who had experienced dental trauma must observe a systematic clinical and radiographic follow-up as well as alternatives of treatment for the primary and permanent teeth involved [15].

A study conducted by Chae et al. [16], investigate the characteristics of intrusion in primary dentition and evaluate factors influencing complications of primary and permanent den-

tition during long-term follow-up period. It was found that intrusion in primary anterior teeth was predominant in males over females and fall was the most common cause of trauma. It was most common at home and occurred most in the primary maxillary central incisors. Severity had an effect on the incidence of sequelae in permanent successors ($p=0.014$). The incidence of complications was significantly lower in patients with soft tissue injuries than in patients with other periodontal injuries ($p=0.000$) [16].

Latest Guidelines for Management of Anterior Tooth Trauma [4]

1. Enamel fracture

In this, the fracture involves enamel only. Generally, no radiograph is recommended for this.

1) Treatment

- Any sharp edge present should be smoothened.
- Patient/Parent education.

Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.

Gingival healing is encouraged, and plaque accumulation is prevented by parents by cleaning the affected area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free chlorhexidine gluconate (CHX) gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- No follow-up is required for this condition.

3) Favourable outcomes

- Asymptomatic tooth.
- Pulp healing should be of same colour as of the remaining crown.
- No infection and no PN.

4) Unfavourable outcomes

- Symptomatic tooth.
- Crown discoloration.
- No further root development of immature teeth.
- Presence of pulpal necrosis and other infections such as sinus tract, gingival swelling, abscess or increased mobility. Dark gray discoloration with one or more signs of infection. Radiographic signs of pulpal infection and necrosis.

2. Enamel dentin fracture (with no pulp exposure)

In this, fracture involves enamel and dentin without pulp exposure.

The location of missing tooth fragments should be explored during trauma history and examination. If there is fragment loss, there is a risk that they can be embedded in the soft tissues, ingested or aspirated.

Radiograph of soft tissue is taken if fractured fragment is suspected to be embedded in the lips, cheeks or tongue.

1) Treatment

- Exposed dentin is covered with Glass Ionomer Cement (GIC) or composite.
- Lost tooth structure can be restored using composite immediately or at a later appointment.
- Parent/patient education.

Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.

Gingival healing is encouraged and plaque accumulation is prevented by parents by cleaning the affected area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free CHX gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- Clinical examination after 6-8 weeks.
- Radiographically (R/G) follow up is necessary only if there are clinical signs of pathosis.
- If any unfavourable outcome, child needs to return to clinics and should be given proper treatment.
- Follow-up treatment requiring expertise of a child oriented team, is beyond the scope of these guidelines.

3) Favorable outcomes

- Asymptomatic tooth.
 - Pulp healing should be of same colour as of the remaining crown.
- No infection and no PN.

4) Unfavorable outcomes

- Symptomatic tooth.
 - Crown discoloration.
 - No further root development of immature teeth.
 - Presence of PN and infections such as sinus tract, gingival swelling, abscess or increased mobility.
- Dark gray discoloration with one or more signs of infection.
Radiographic signs of pulp infection and necrosis.

3. Complicated crown fracture (with exposed pulp)

In this, fracture involves enamel, dentin and pulp. The location of missing tooth fragments should be explored during trauma history and examination. If there is fragment loss, there is a risk that they can be embedded in the soft tissues, ingested or aspirated.

A Periapical (PA) radiograph or an occlusal radiograph should be taken at the time of initial presentation for diagnostic purposes. Radiograph of soft tissue is taken if fractured fragment is suspected to be embedded in the lips, cheeks or tongue.

1) Treatment

- Partial pulpotomy should be done to preserve the pulp. A non setting calcium hydroxide paste should be applied over the pulp and covered with GIC followed by composite. If the exposure is large, Cervical pulpotomy is indicated. Biomaterials such as non staining calcium silicate based cements have been recommended.
- Treatment also depends on child's maturity and ability to tolerate procedure. Treatment is best performed by a child-oriented team with experience and expertise in the management of pediatric dental injuries. In emergency situation, treatment is performed only when there is the potential for rapid referral (within several days) to the child oriented team.
- Parent/patient education:
 - ✓ Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.
 - ✓ Gingival healing is encouraged and plaque accumulation is prevented by parents by cleaning the affected area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free CHX gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- Clinical examination should be done after 1 week, 6-8 weeks, and after 1 year.
- R/G follow up at 1 year following pulpotomy or randomized control trial (RCT). Other R/G follow up is necessary only if there are clinical signs of pathosis.
- If any unfavourable outcome, child needs to return to clinics and should be given proper treatment.
- Follow-up treatment requiring expertise of a child oriented team, is beyond the scope of these guidelines.

3) Favourable outcomes

- Asymptomatic tooth.

- Pulp healing should be of same colour as of the remaining crown.
- No infection and no PN.

4) Unfavourable outcomes

- Symptomatic tooth.
- Crown discoloration.
- No further root development of immature teeth.
- Presence of PN and infections such as sinus tract, gingival swelling, abscess or increased mobility.
- Dark gray discoloration with one or more signs of infection.
- Radiographic signs of pulp infection and necrosis.

4. Crown root fracture

In this, fracture involves enamel, dentin and root. Pulp may or may not be exposed. Additionally, there can be loose but still attached tooth fragment.

A PA radiograph or an occlusal radiograph should be taken at the time of initial presentation for diagnostic purposes and to establish a baseline.

1) Treatment

- In emergency situation, treatment is performed only when there is the potential for rapid referral (within several days) to the child oriented team.
- If treatment is done at emergency appointment, Local Anesthesia (LA) will be required.
- Loose fragment is removed and determine if the crown can be restored.
- ✓ Option A:
If the tooth is restorable without any pulp exposure, dentin is covered with GIC.
If restorable with pulp exposed, pulpotomy or RCT should be performed, depending on stage of root development and the level of fracture.
- ✓ Option B:
- If non restorable, extract all loose fragments taking care not to damage the permanent successor tooth and leave any firm root fragment in situ, or extract the entire tooth.
- Treatment also depends on child's maturity and ability to tolerate procedure. Treatment is best performed by a child-oriented team with experience and expertise in the management of pediatric dental injuries.
- Parent/patient education:
- ✓ Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.
- ✓ Gingival healing is encouraged and plaque accumulation is prevented by parents by cleaning the affected

area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free CHX gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- Clinical examination should be done after 1 week, 6-8 weeks, and after 1 year.
- R/G follow up at 1 year following pulpotomy or RCT. Other R/G follow up is necessary only if there are clinical signs of pathosis.
- If any unfavourable outcome, child needs to return to clinics and should be given proper treatment.
- Follow-up treatment requiring expertise of a child oriented team, is beyond the scope of these guidelines.

3) Favourable outcomes

- Asymptomatic tooth.
- Pulp healing should be of same colour as of the remaining crown.
- No infection and no PN.

4) Unfavorable outcomes

- Symptomatic tooth.
- Crown discoloration.
- No further root development of immature teeth.
- Presence of PN and infections such as sinus tract, gingival swelling, abscess or increased mobility.
- Dark gray discoloration with one or more signs of infection.
- Radiographic signs of pulp infection and necrosis.

5. Root fracture

In this, coronal fragment may be mobile and may be displaced. Occlusal interference may be present.

A PA radiograph or an occlusal radiograph should be taken at the time of initial presentation for diagnostic purposes and to establish a baseline. The fracture is usually located mid root or in the apical third.

1) Treatment

- No treatment is required, if the coronal fragment is not displaced.
- If coronal fragment is displaced and not excessively mobile, leave the coronal fragment to spontaneously resorption even if there is some occlusal interference.
- If coronal fragment is displaced and excessively mobile with occlusal interference, two options are available and both required LA.
- ✓ Option A:
Extract the loose coronal fragment and left the apical

portion as such for resorption.

✓ Option B:

Gently reposition the loose coronal fragment. If the fragment is unstable in its new position, stabilize the fragment with a flexible splint attached to the uninjured adjacent teeth and leave the splint for 4 weeks.

- Treatment also depends on child's maturity and ability to tolerate procedure. Treatment is best performed by a child-oriented team with experience and expertise in the management of pediatric dental injuries. In emergency situation, treatment is performed only when there is the potential for rapid referral (within several days) to the child oriented team.
- Parent/patient education:
 - ✓ Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.
 - ✓ Gingival healing is encouraged and plaque accumulation is prevented by parents by cleaning the affected area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free CHX gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- When no coronal displacement, examination is done after 1 week, 6-8 weeks, and 1 year. When there are clinical concerns that an unfavourable outcome is likely, then follow-up is continue each year until eruption of permanent teeth.
- If coronal fragment has been repositioned and splinted, clinical examination is done after 1 week, 4 weeks for splint removal, 8 weeks, and 1 year.
- If coronal fragment extracted, clinical examination after 1 year. When there are clinical concerns that an unfavourable outcome is likely, then follow-up is continue each year until eruption of permanent teeth.
- R/G follow-up is necessary only if there are clinical signs of pathosis.
- Parents should be informed to watch any unfavourable outcomes.
- Follow-up treatment requiring expertise of a child oriented team, is beyond the scope of these guidelines.

3) Favourable outcomes

- Asymptomatic tooth.
- No mobility.
- Resorption of the apical fragment.
- Realignment of the tooth fractured tooth.
- Pulp healing should be of same colour as of the remaining

crown.

No infection and no PN.

4) Unfavorable outcomes

- Symptomatic tooth.
- Crown discoloration.
- No further root development of immature teeth.
- No improvement in the position of root fractured tooth.
- Presence of PN and infections such as sinus tract, gingival swelling, abscess or increased mobility.
- Dark gray discoloration with one or more signs of infection.
- Radiographic signs of pulp infection and necrosis.

6. Alveolar fracture

The fracture involves the alveolar bone and may extend to the adjacent bone. Mobility and dislocation of the segment with several teeth moving together are the common findings along with occlusal interference.

A PA radiograph or an occlusal radiograph should be taken at the time of initial presentation for diagnostic purposes and to establish a baseline. Lateral R/G may give information about relationship between maxillary and mandibular dentition and if the segment is displaced in a labial direction.

Fracture line may be located at any level from the marginal bone to the root apex or beyond and they may involve the primary teeth and/or their permanent successors.

Further imaging may be needed to visualize the extent of the fracture but only where it is likely to change the treatment provided.

1) Treatment

Reposition any displaced fragment which is mobile and/or causing occlusal interference.

Stabilize with a flexible splint to the adjacent uninjured teeth for 4 weeks.

- Treatment should be performed by a child-oriented team with experience and expertise in the management of pediatric dental injuries.
- Parent/patient education:
 - ✓ Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.
 - ✓ Gingival healing is encouraged and plaque accumulation is prevented by parents by cleaning the affected area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free CHX gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- Clinical examination is done after 1 week, 4 weeks for splint removal, 8 weeks, and 1 year. Further follow-up at 6 year of age is indicated to monitor eruption of permanent teeth.
- R/G follow-up at 4 weeks and 1 year to assess impact on the primary tooth and permanent tooth germs in the line of alveolar fracture. This R/G may indicate a more frequent follow up regimen is needed. Other R/G are indicated only where clinical findings are suggestive of pathosis.
- If the fracture line is located at the level of primary root apex, an abscess can develop. PA (Radiolucency) R/L can be seen on R/G.
- Parents should be informed to watch any unfavourable outcomes.
- Follow-up treatment requiring expertise of a child oriented team, is beyond the scope of these guidelines.

3) Favorable outcomes

- Asymptomatic tooth.
 - Periodontal healing.
 - Realignment of the alveolar segment with the original occlusion restored.
 - No disturbance to the development and/or eruption of the permanent successor.
 - Pulp healing should be of same colour as of the remaining crown.
- No infection and no PN.

4) Unfavorable outcomes

- Symptomatic tooth.
 - No further root development of immature teeth.
 - Limited or no improvement in the position of the displaced segment and the original occlusion is not re-established.
 - Negative impact on the development and/or eruption of the permanent successor.
 - Presence of PN and infections such as sinus tract, gingival swelling, abscess or increased mobility.
- Dark gray discoloration with one or more signs of infection.

7. Concussion

In this condition, tooth is tender to touch but not displaced. It has normal mobility and no sulcular bleeding.
No baseline R/G is recommended for this.

1) Treatment

- No treatment is required and observation is done.
- Parent/patient education:

- ✓ Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.
- ✓ Gingival healing is encouraged and plaque accumulation is prevented by parents by cleaning the affected area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free CHX gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- Clinical examination is done after 1 week, and 6-8 weeks.
- R/G are indicated only where clinical findings are suggestive of pathosis.
- Parents should be informed to watch any unfavourable outcomes.
- Follow-up treatment requiring expertise of a child oriented team, is beyond the scope of these guidelines.

3) Favorable outcomes

- Asymptomatic tooth.
 - No disturbance to the development and/or eruption of the permanent successor.
 - Continued root development in immature teeth.
 - Pulp healing should be of same colour as of the remaining crown.
- No infection and no PN.

4) Unfavorable outcomes

- Symptomatic tooth.
 - R/G signs of PN and infection.
 - No further root development of immature teeth.
 - Negative impact on the development and/or eruption of the permanent successor.
 - Presence of PN and infections such as sinus tract, gingival swelling, abscess or increased mobility.
- Dark gray discoloration with one or more signs of infection.

8. Subluxation

In this condition, tooth is tender to touch with increased mobility, but not displaced. Bleeding from gingival crevice may be present.

A PA radiograph or an occlusal radiograph should be taken at the time of initial presentation for diagnostic purposes and to establish a baseline. Normal to slight widening of periodontal ligament (PDL) space will be seen.

1) Treatment

- No treatment is required and observation is done.
- Parent/patient education:

- ✓ Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.
- ✓ Gingival healing is encouraged and plaque accumulation is prevented by parents by cleaning the affected area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free CHX gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- Clinical examination is done after 1 week, and 6-8 weeks.
- When there are clinical concerns that an unfavourable outcome is likely, then follow-up is continue each year until eruption of permanent teeth.
- R/G are indicated only where clinical findings are suggestive of pathosis.
- Parents should be informed to watch any unfavourable outcomes.
- Follow-up treatment requiring expertise of a child oriented team, is beyond the scope of these guidelines.

3) Favorable outcomes

- Asymptomatic tooth.
- No disturbance to the development and/or eruption of the permanent successor.
- Continued root development in immature teeth.
- Pulp healing should be of same colour as of the remaining crown.
- No infection and no PN.

4) Unfavorable outcomes

- Symptomatic tooth.
- R/G signs of PN and infection.
- No further root development of immature teeth.
- Negative impact on the development and/or eruption of the permanent successor.
- Presence of PN and infections such as sinus tract, gingival swelling, abscess or increased mobility.
- Dark gray discoloration with one or more signs of infection.

9. Extrusive luxation

In this condition, tooth is partially displaced out of its socket. Tooth appears elongated and can be excessively mobile. Occlusal interference may be present.

A PA radiograph or an occlusal radiograph should be taken at the time of initial presentation for diagnostic purposes and to establish a baseline. Slight increase to substantially widening of PDL space will be seen.

1) Treatment

It is based on degree of displacement, mobility, interference with the occlusion, root formation and the ability of child to tolerate the emergency situation.

If tooth is not interfering with occlusion – spontaneous repositioning of tooth is encouraged.

If tooth is excessively mobile or extruded >3 mm, extraction under LA is done.

- Treatment should be performed by a child-oriented team with experience and expertise in the management of pediatric dental injuries. Extractions can cause long term dental anxiety.
- Parent/patient education:
 - ✓ Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.
 - ✓ Gingival healing is encouraged and plaque accumulation is prevented by parents by cleaning the affected area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free CHX gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- Clinical examination is done after 1 week, 6-8 weeks, and 1 year.
- When there are clinical concerns that an unfavourable outcome is likely, then follow-up is continue each year until eruption of permanent teeth.
- R/G are indicated only where clinical findings are suggestive of pathosis.
- Parents should be informed to watch any unfavourable outcomes.
- Follow-up treatment requiring expertise of a child oriented team, is beyond the scope of these guidelines.

3) Favorable outcomes

- Asymptomatic tooth.
- No disturbance to the development and/or eruption of the permanent successor.
- Realignment of the extruded tooth.
- No occlusal interference.
- Continued root development in immature teeth.
- Pulp healing should be of same colour as of the remaining crown.
- No infection and no PN.

4) Unfavorable outcomes

- Symptomatic tooth.
- R/G signs of PN and infection.

- No further root development of immature teeth.
- No improvement in the position of the extruded tooth.
- Negative impact on the development and/or eruption of the permanent successor.
- Presence of PN and infections such as sinus tract, gingival swelling, abscess or increased mobility.
- Dark gray discoloration with one or more signs of infection.

10. Lateral luxation

In this condition, tooth is displaced usually in a palatal/lingual or labial direction. Tooth will be immobile and occlusal interference may be present.

A PA radiograph or an occlusal radiograph should be taken at the time of initial presentation for diagnostic purposes and to establish a baseline. PDL space is increased apically.

1) Treatment

If there is minimal or no occlusal interference, tooth should be allowed to spontaneously reposition itself which usually occurs within 6 months.

In severe displacement, two options are available and both requires LA.

✓ Option A:

When there is risk of ingestion or aspiration of tooth, extraction is done.

✓ Option B:

Gently reposition the tooth. If tooth is unstable in its new position, splinting is done for 4 weeks using a flexible splint attached to the adjacent uninjured teeth.

- Treatment should be performed by a child-oriented team with experience and expertise in the management of pediatric dental injuries. Extractions can cause long term dental anxiety.
- Parent/patient education:
 - ✓ Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.
 - ✓ Gingival healing is encouraged and plaque accumulation is prevented by parents by cleaning the affected area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free CHX gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- Clinical examination is done after 1 week, 6-8 weeks, 6 months, and 1 year.
- If tooth is repositioned and splinting is done, then examination is done after 1 week, 4 weeks for splint removal, 8 weeks, 6 months, and 1 year.

- When there are clinical concerns that an unfavourable outcome is likely, then follow-up is continue each year until eruption of permanent teeth.
- R/G are indicated only where clinical findings are suggestive of pathosis.
- Parents should be informed to watch any unfavourable outcomes.
- Follow-up treatment requiring expertise of a child oriented team, is beyond the scope of these guidelines.

3) Favorable outcomes

- Asymptomatic tooth.
- No disturbance to the development and/or eruption of the permanent successor.
- Continued root development in immature teeth.
- Periodontal healing.
- Realignment of laterally luxated tooth.
- Normal occlusion.
- Pulp healing should be of same colour as of the remaining crown.
- No infection and no PN.

4) Unfavorable outcomes

- Symptomatic tooth.
- R/G signs of PN and infection.
- Ankylosis.
- No further root development of immature teeth.
- Negative impact on the development and/or eruption of the permanent successor.
- No improvement in position of laterally luxated tooth.
- Presence of PN and infections such as sinus tract, gingival swelling, abscess or increased mobility.
- Dark gray discoloration with one or more signs of infection.

11. Intrusive luxation

In this condition, tooth is usually displaced through the labial bone plate or it can impinge on the permanent tooth bud. Tooth has almost or completely disappeared into the socket and can be palpated labially.

A PA radiograph or an occlusal radiograph should be taken at the time of initial presentation for diagnostic purposes and to establish a baseline.

When the apex is displaced towards or through the labial bone plate, the apical tip can be seen and tooth image will appear shorter than the contralateral tooth.

When the apex is displaced towards the permanent tooth germ, apical tip cannot be visualized and the image of the tooth will appear elongated.

1) Treatment

Spontaneous repositioning of tooth is allowed irrespective of displacement direction which occurs usually within 6 months, but in some cases it can take 1 year.

A rapid referral to a child oriented team that has experience and expertise in the management of pediatric dental injuries should be arranged.

- Parent/patient education:
 - ✓ Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.
 - ✓ Gingival healing is encouraged and plaque accumulation is prevented by parents by cleaning the affected area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free CHX gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- Clinical examination is done after 1 week, 6-8 weeks, 6 months, and 1 year.
- Further follow-up at 6 years of age is indicated for severe intrusion to monitor eruption of the permanent tooth.
- R/G are indicated only where clinical findings are suggestive of pathosis.
- Parents should be informed to watch any unfavourable outcomes.
- Follow-up treatment requiring expertise of a child oriented team, is beyond the scope of these guidelines.

3) Favorable outcomes

- Asymptomatic tooth.
 - No disturbance to the development and/or eruption of the permanent successor.
 - Continued root development in immature teeth.
 - Periodontal healing.
 - Realignment/ Re-eruption of the intruded tooth.
 - Pulp healing should be of same colour as of the remaining crown.
- No infection and no PN.

4) Unfavorable outcomes

- Symptomatic tooth.
- R/G signs of PN and infection.
- Ankylosis.
- No further root development of immature teeth.
- Negative impact on the development and/or eruption of the permanent successor.
- No improvement in position of laterally luxated tooth.

- Presence of PN and infections such as sinus tract, gingival swelling, abscess or increased mobility.

Dark gray discoloration with one or more signs of infection.

12. Avulsion

In this condition, tooth is completely out of the socket. The location of missing tooth should be explored during trauma history and examination, especially when the accident was not witnessed by an adult or there was loss of consciousness. In avulsed teeth, there is a risk that teeth can be embedded in soft tissues of lip, cheek or tongue, pushed into the nose, ingested or aspirated. If avulsed tooth is not found, child should be referred for medical evaluation to an emergency room for further examination.

A PA radiograph or an occlusal radiograph should be taken at the time of initial presentation for diagnostic purposes and to establish a baseline. R/G will also provide a baseline for assessment of the developing permanent tooth and to determine whether it has been displaced.

1) Treatment

Avulsed primary teeth should not be replanted.

- Parent/patient education:
 - ✓ Care should be taken while eating so that no further damage to tooth which it should be encouraged to return to normal function as soon as possible.
 - ✓ Gingival healing is encouraged and plaque accumulation is prevented by parents by cleaning the affected area with soft brush or cotton swab combined with 0.1% to 0.2% alcohol free CHX gluconate mouth rinse applied twice a day for 1 week.

2) Follow-up

- Clinical examination is done after 6-8 weeks. Follow-up at the age of 6 years is indicated to monitor eruption of permanent tooth.
- R/G are indicated only where clinical findings are suggestive of pathosis.
- Parents should be informed to watch any unfavourable outcomes.
- Follow-up treatment requiring expertise of a child oriented team, is beyond the scope of these guidelines.

3) Favorable outcomes

- No signs of disturbance to the development and/or eruption of the permanent successor.

4) Unfavorable outcomes

- Negative impact on the development and/or eruption of

the permanent successor.

Conclusion

Although there are well-coded international prevention guidelines, TDIs are still very relevant in pediatric patients. Therefore, there is a need for the development of training and prevention programs for TDI, organizing adequate emergency services, and planning awareness campaigns.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

ORCID

Tavleen Kour, <https://orcid.org/0000-0002-5509-4994>
 Virinder Goyal, <https://orcid.org/0000-0001-5747-466X>
 Puneet Goyal, <https://orcid.org/0000-0001-7957-8160>
 Burhan Altaf Misgar,
<https://orcid.org/0000-0003-2526-956X>
 Deeksha Sharma, <https://orcid.org/0000-0002-3155-8010>

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