



## Emergency Management of Traumatic Dental Injuries in Children & Adolescents: A Systematic Approach



Ehsan Azadani, DDS, MS

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### Conflict of Interest Statement

The speaker declares that neither he nor any family member has a financial arrangement or affiliation with any corporate organizations offering financial support for this continuing education program.

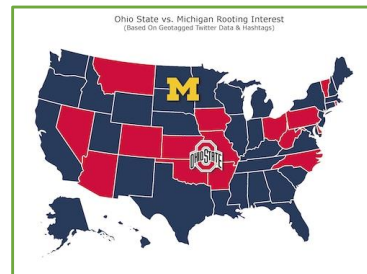


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Dental Degree: University of Michigan  
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## References for Dental Trauma:

- Textbook and Color Atlas of Traumatic Injuries to the Teeth
  - Textbook by Frances M. Andreasen, Jens O Andreasen, and Lars Andersson
- Pediatric Dentistry: Infancy through Adolescence
  - By Arthur Nowak, John R. Christensen, Tad R. Mabry, Janice Alisa Townsend, Martha H. Wells
  - Chapters 16 and 35
- International Association of Dental Traumatology (IADT) guidelines
  - Guidelines for the Management of Traumatic Injuries: Parts 1, 2, and 3
- DentalTraumaGuide.org
  - Free version versus paid subscription



## Epidemiology of Traumatic Dental Injuries (TDI)

- **Males** experience more TDI to the permanent dentition than females
- Accidents **within and around the home** are the major cause of TDI in the **primary dentition**
- Accidents at **home and school** accounted for most TDIs to the **permanent dentition**
- The **maxillary central incisors** were the most frequently injured teeth followed by maxillary lateral incisors
- Factors associated with increased risk of TDI: **maxillary overjet greater than 3mm, incomplete lip closure, lack of properly fitted mouth-guard or face-guard.**

*(Bastone et al. 2000)*

- Prevalence in permanent dentition: 15.2%
- Prevalence in primary dentition: 22.7%
- More than 1 billion people in the world have had TDIs

*(Petti et al. 2018)*

These reports are only some of the many in the literature





**Trauma** is defined as an injury caused by a physical force; examples include the consequences of motor vehicle accidents, falls, drowning, gunshots, or physical assault.



## How are these different?



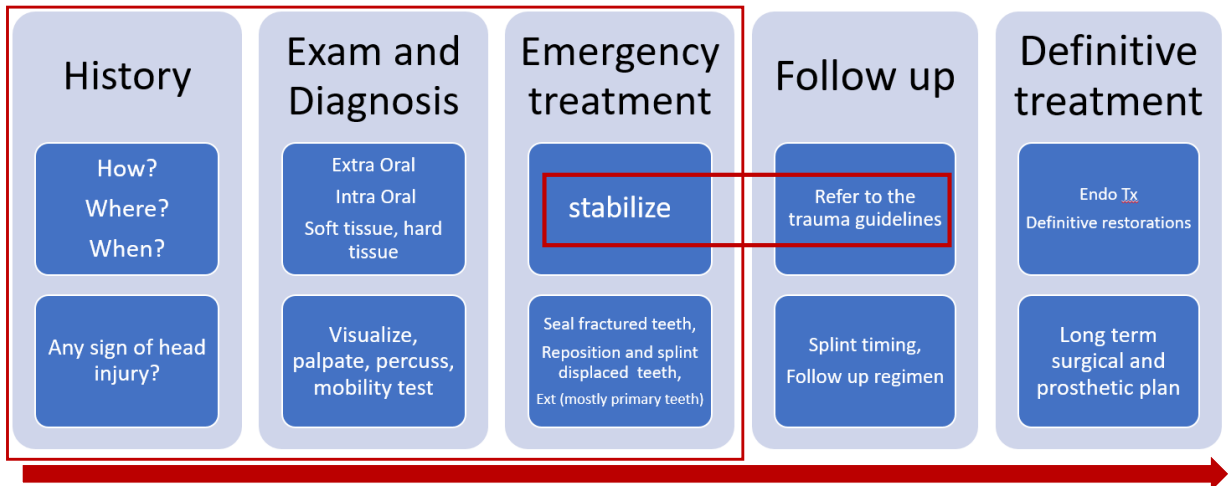
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# How do we approach this?



## Management of traumatic dental injuries



# Brain Injury

The minimum non-dental question that we as dentists want to ask for all traumatized patients:

**Did the patient have any loss of consciousness, headache, vomiting, loss of memory, altered behavior?**

- Azadani EN, Evans J, Peng J, McTigue D, Townsend J. Risk of concomitant traumatic brain injuries in children with traumatic dental injuries in a pediatric emergency department: A case-control study. *The Journal of the American Dental Association*. 2023 Sep 1;154(9):805-13.
- Azadani EN, Townsend J, Peng J, Wheeler K, Xiang H. The association between traumatic dental and brain injuries in American children. *Dental traumatology*. 2021 Feb;37(1):114-22.



## Tetanus immunization



CDC guide for clinicians:

"Clinicians should consider wounds dirty if contaminated with dirt, soil, feces, or **saliva**"

Guide to Tetanus Prophylaxis with TIG in Routine Wound Management

History of adsorbed tetanus toxoid-containing vaccines (doses)	Clean, minor wound		All other wounds*	
	DTaP, Tdap or Td <sup>†</sup>	TIG <sup>‡</sup>	DTaP, Tdap or Td <sup>†</sup>	TIG <sup>‡</sup>
Unknown or <3	Yes	No	Yes	Yes
≥3	No <sup>§</sup>	No	No <sup>§</sup>	No

If the last dose of a tetanus toxoid-containing vaccine was received **5 or more years earlier**, then administer a booster dose of an age-appropriate tetanus toxoid-containing vaccine.

<https://www.cdc.gov/tetanus/clinicians.html>

McTigue DJ, Thikkurissy S. Orofacial Trauma. *Clinical Cases in Pediatric Dentistry*. 2012 Apr 30;1:137.



# FREQUENCY OF HEAD AND FACE INJURIES IN CHILD ABUSE

Cavalcanti	56%
Da Fonseca	75%
O'Neill	38%
Skinner	42%
Cameron	47%
Becker	49%

**Dentists in every state are mandated reporters of child abuse**

Cavalcanti, Alessandro Leite. "Prevalence and characteristics of injuries to the head and orofacial region in physically abused children and adolescents—a retrospective study in a city of the Northeast of Brazil." *Dental traumatology* 26.2 (2010): 149-153.  
da Fonseca, Marcio A., R. J. Faigal, and R. W. Ten Bensel. "Dental aspects of 1248 cases of child maltreatment on file at a major county hospital." *Pediatr Dent* 14.3 (1992): 152-7.



## 1- General evaluation of the patient

- a) General appearance and vital signs
- b) Brain injury screening: Any headache, loss of consciousness, vomiting, change of behavior?

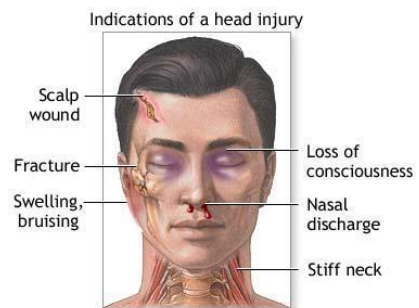
## 2- Extra Oral Exam

- a) Nasal clear fluid discharge
- b) Bruise, laceration, abrasion
- c) Swelling
- d) Neck movements
- e) Steps at the borders of bones
- f) Mandibular movements

## 3- Evaluate cranial nerves:

- a) Eye movements, vision, pupil constriction
- b) Olfactory; Can they smell?
- c) Auditory; Can they hear?
- d) Have the patient: Talk, swallow, open mouth and stick tongue out, raise eyebrows, squeeze eyelids, smile, pucker lips, shrug shoulders

## Extra-Oral Evaluation



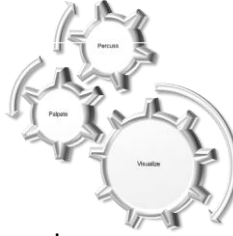
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## Intra-Oral Evaluation

### 1- Soft tissue

- Contusion
- Laceration
- Need for Radiography?



### 2- Occlusion

- Alignment of the teeth in each arch
- Inter-arch alignment
- Any steps at the alveolar process?



### 3- Teeth

- All teeth present ?
- Crack or fracture? Is any part of the tooth lost?
- Has the tooth been displaced? Bleeding from gingival sulcus?



## What do we look for?

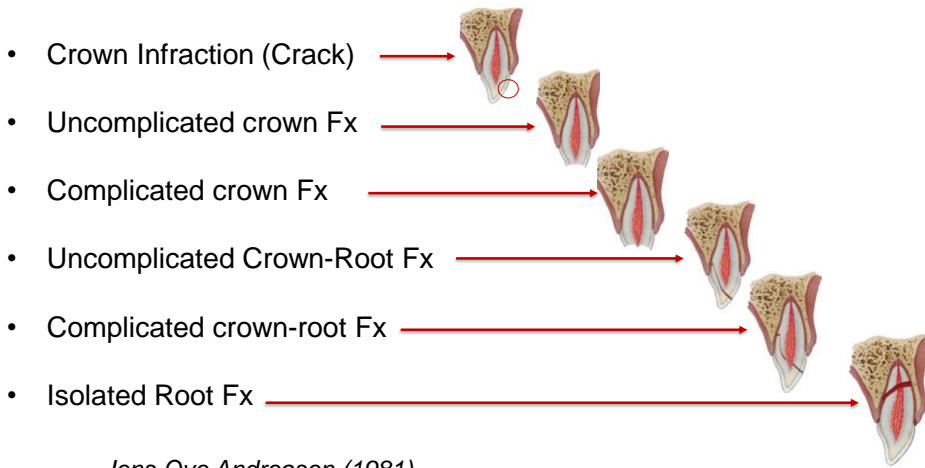
- Crack on the teeth
  - Fractured teeth
  - Pulp exposure
  - Color change
- } Dental hart tissue injury
- Displacement of teeth
  - Mobility of teeth
  - Mobility of alveolar fragments
  - Occlusion abnormality
  - Percussion sensitivity
  - Bleeding
- } Supporting tissue injury

## Intra-Oral Evaluation





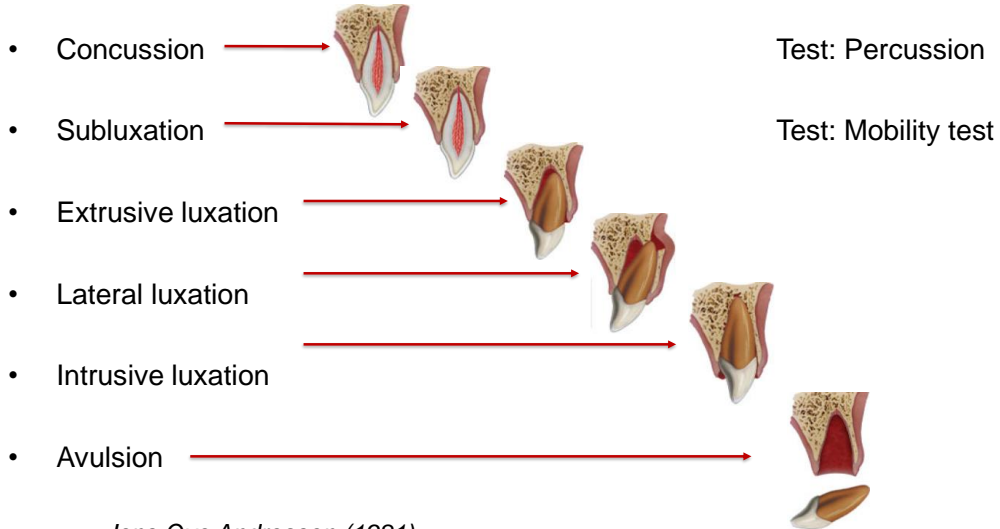
# Classification of Dental Injuries - Fractures



*Jens Ove Andreasen (1981)*






# Classification of Dental Injuries – Luxation injuries (periodontal injuries)

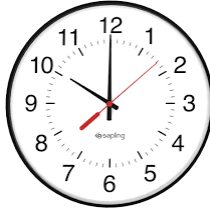


*Jens Ove Andreasen (1981)*




# Classification of Dental Injuries – Luxation injuries (periodontal injuries)

- Extrusive luxation 
- Lateral luxation 
- Avulsion 



*Jens Ove Andreasen (1981)*

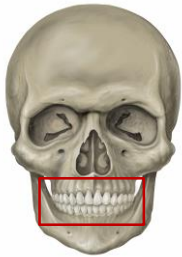


- Alveolar Fracture 

- Jaw Fracture and facial bone fracture 

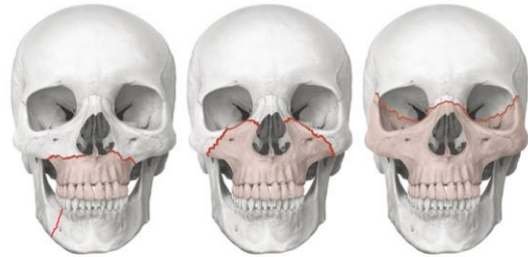


## Dento-Alveolar Injuries



General Dentistry  
Pediatric Dentistry  
Endodontics

## Jaw or facial bone fractures



Oral & Maxillofacial Surgery  
ENT  
Plastic Surgery



## Diagnostic Methods

**Initial trauma evaluation:** Visualize, Palpate, Percuss, Mobility Test, Radiographs  
**Follow up trauma evaluation:** All the above + Vitality Test (EPT and Cold test)



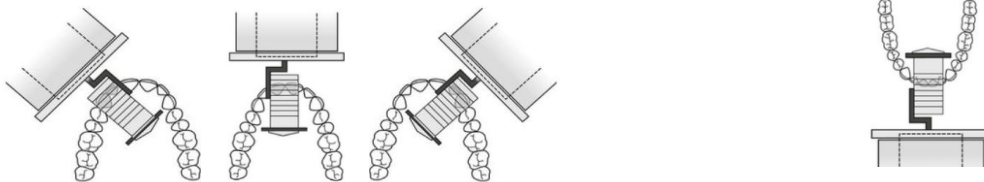
	#8	#9	#23	#24	#25	#26
<b>EPT</b>	1-50	1-50	1-50	1-50	1-50	1-50
<b>Cold Test</b>	Normal	Normal	Normal	Delayed	Normal	Normal
<b>Percussion</b>	Normal	Normal	Normal	Normal	Normal	Normal
<b>Palpation</b>	Normal	Normal	Normal	Normal	Normal	Normal
<b>Mobility</b>	1	1	0	0	1	1
<b>Sinus tract</b>	No	No	No	No	No	No
<b>X-ray</b>	Normal	Normal	PDL- W	PDL- W	PDL- W	PDL- W
<b>Initial injury</b>	Concussion w/ fracture	Concussion w/ fracture	Concussion	Lateral Luxation	Lateral Luxation	Lateral Luxation



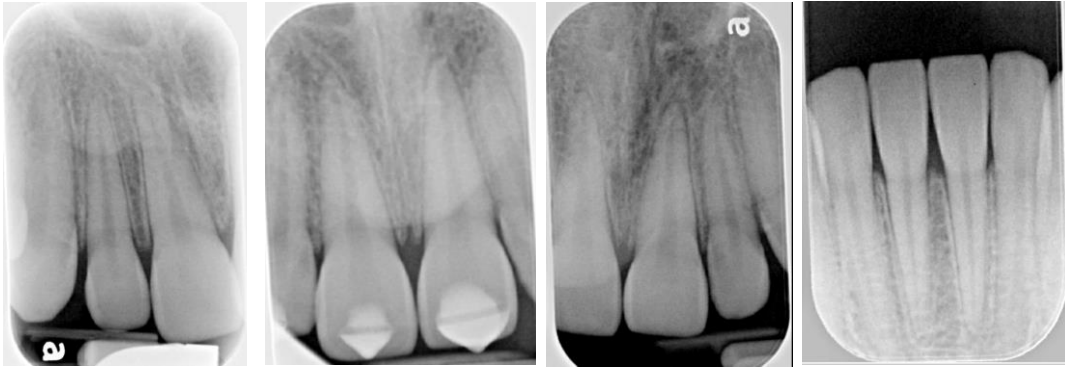
## Radiographic Examination

MORE IMPORTANT FOR PERMANENT TEETH

- **Multiple** radiographic procedures are needed
- IADT guidelines recommendation for upper incisors:
  - **3 films with parallel technique supplemented with one film with steep occlusal exposure.**
- Lip laceration: soft tissue x-ray with reduced exposure (one third of normal exposure)



## Radiographic Examination



## Radiographic Examination



Courtesy of Dr. McTigue



## Important questions to ask before treating TDI

Primary **vs** Permanent tooth  
Fracture Injury **vs** Periodontal Injury  
Open Apex **vs** Closed Apex (for permanent teeth)  
Cooperative **vs** Non-Cooperative



## Management of TDI in **Permanent** Dentition

**Most important goals:** Preservation of pulp vitality and tooth structure, continued root development

What does Immature versus Mature root (or apex) mean?

Weaker root ----- > stronger root  
Pulp survival more likely ----- > pulp survival less likely




Closed apex or  
mature root



## Management of fractures in Permanent Dentition

**Most important goals:** Preservation of pulp vitality and tooth structure, continued root development

**Fractures:** Determining factors: size of fracture, pulp exposure, status of root development (mature vs immature)

Injury	Emergency Tx	Follow up and Definitive Tx
Uncomplicated fracture 	Cover the exposed dentin with GI or composite	Final restoration 6-8 wk, 1 y
Complicated fracture 	Cover the exposed pulp/dentin w/ Calcium Hydroxide, GI and composite	Mature apex: RCT if needed and final restoration Immature apex: Partial pulpotomy (Cvek) and final restoration
	<b>Mature (closed apex):</b> Direct pulp cap and restoration <b>Immature (open apex):</b> Partial Pulpotomy (Cvek), or DPC and follow with Cvek later	Follow ups: 6-8 wk, 3 mo, 6 mo, 1 y
Isolated root fracture 	Flexible splint, Reposition the coronal fragment IF displaced	4 wk, 6-8 wk, 4 mo, 6 mo, 1 y, yearly for 5 years No RCT, but monitor

### Favorable Outcomes

Normal color of the crown  
No pain  
No signs of pulp necrosis or infection  
Continued root development

### Unfavorable Outcomes

Crown discoloration (pulpal necrosis)  
Pain  
Infection  
Sinus tract

} Endodontic Tx

*Hsan Azadani*



## Management of fractures in Permanent Dentition



### Temporary coverage of a crown fracture (band-aid restoration):

**No pulp exposure:** GI + etch, bond, flowable composite

**Pulp exposure:** Dycal + GI + etch, bond flowable composite



## Management of Periodontal Injuries in Permanent Dentition



**Most important goals:** Preservation of PDL, pulp vitality and continued root development

**Periodontal injuries (Luxations):** Determining factors: type of movement, degree of displacement, stage of root development

Injury	Emergency Tx	Follow up and Definitive Tx
Concussion	No Tx	4 wk, 1 yr
Subluxation	No Tx; splint if too mobile (>2mm in each direction)	2 wk, 12 wk, 6 mo, 1 yr
Extrusion	Reposition asap + flexible splint for 2 weeks	2 wk, 4 wk, 8 wk, 12 wk, 6 mo, 1 yr, then yearly for at least 5 years
Lateral luxation	Reposition asap + flexible splint for 4 weeks	Mature apex: Pulpectomy usually indicated Immature apex: monitor very closely
Intrusion	Immature root: allow re-eruption at least for 4 weeks	Immature apex: pulp may revascularize
	Mature root	Mature apex: pulpectomy indicated
	1-3 mm: allow re-eruption at least for 8 weeks	
	4-6 mm: reposition surgically or orthodontically	
	>6 mm: reposition surgically + splint 4 weeks	2 wk, 4 wk, 8 wk, 12 wk, 6 mo, 1 yr, then yearly for at least 5 years
Avulsion	Rinse the tooth with normal saline, handle the root with extreme caution, replant asap + splint for 2 weeks, check tetanus status	Pulpectomy must initiate within 2 weeks 2 wk, 4 wk, 3 mo, 6 mo, 1 yr, then yearly for at least 5 years



## Management of Periodontal Injuries in Permanent Dentition



**Most important goals:** Preservation of PDL, pulp vitality and continued root development

**Periodontal injuries (Luxations):** Determining factors: type of movement, degree of displacement, stage of root development

### Favorable Outcomes

Normal color of the crown  
No pain  
No signs of pulp necrosis or infection  
Continued root development in immature teeth

### Unfavorable Outcomes

Pulp necrosis  
Crown discoloration (pulpal necrosis)  
Pain  
Infection  
Sinus tract  
Root resorption  
Replacement resorption (Ankylosis)  
Tooth loss

*Hasan Azadani*





## Emergency Management of **Luxations** in **Permanent** Dentition



### Repositioning of displaced teeth (Lateral luxation or Extrusion):

- Local anesthesia
- Two-digit technique or forceps
- Throat screen
- **Flexible** splint using acid-etch technique



## Emergency Management of **Luxations** in **Permanent** Dentition

### Splint:

1. **Flexible** (50 lb monofilament fishing line)
2. Hygienic and Smooth
3. Middle third of the crown





Titanium Trauma Splints



014 NiTi – If in Active Orthodontic TX



16/25 or 18/25 SS Wire - For Alveolar Fractures



## Isolation, Good Access & Good Visibility

Bite Blocks



Isolite/Isovac System Mouthpiece



OpraGate

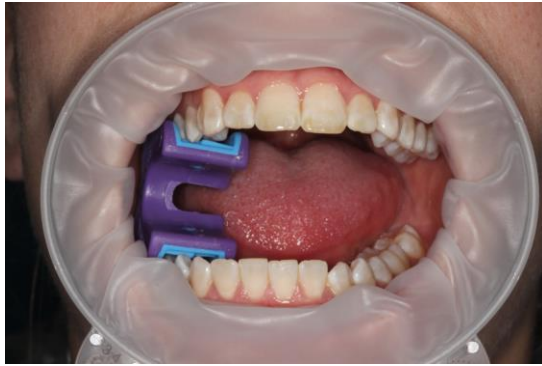


Cotton rolls and 2X2 gauze



# OptraGate

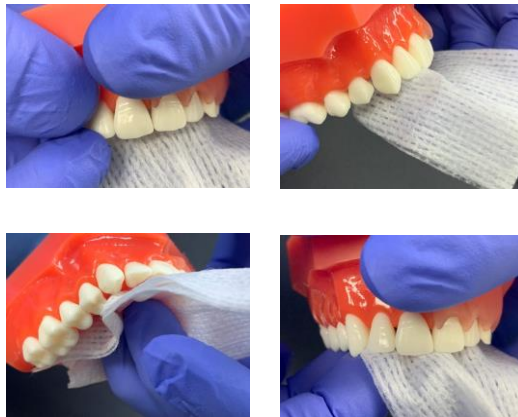
OptraGate with Bite Block



OptraGate with IsoLite Mouthpiece



## Using a 2X2 gauze as throat screen

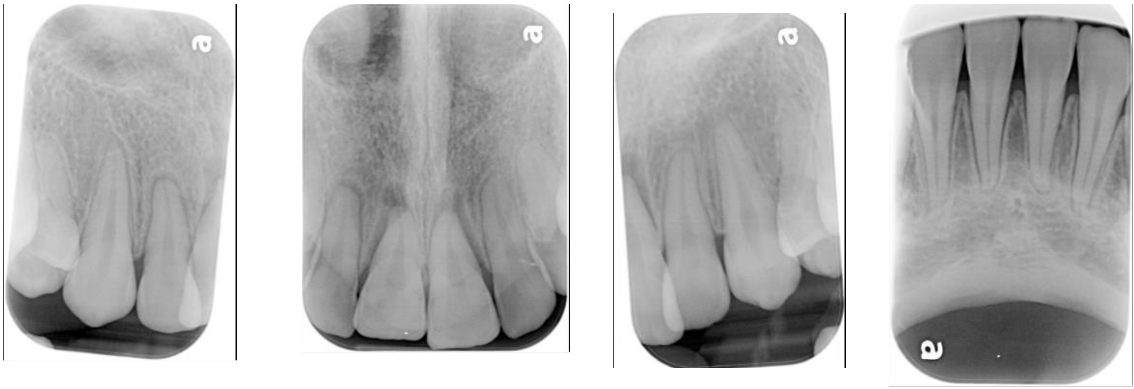




What radiographs would we take?

**Every tooth that has been traumatized  
or you suspect it was traumatized!**

# Describe the findings



## Why do we need to follow up for traumatized teeth?

### Dental Trauma Sequelae:

- Pulp necrosis
- Discoloration
- Root resorption
- Ankylosis (replacement resorption)
- Pulp canal obliteration
- Tooth loss



Courtesy of Dr. McTigue



## Hello Doctor! My child just **knocked out** his/her tooth!

1. Please put the tooth back in the socket! **Yes you can!**
2. No? Please have the child or someone put the tooth **back in the socket!**
3. Have the child gently bite on a cloth/gauze!
4. Bring your child to the office asap!
5. If absolutely cannot re-implant, then place the tooth in **Cold Milk** and bring your child to the office!



This is the **single most important thing** you need to know about trauma to permanent teeth!



## Storage media for transferring avulsed teeth



1. Hanks Balanced Salt Solution (HBSS); Commercially known as Save-A-Tooth
2. Cold milk
3. Normal saline
4. Saliva
5. ...
6. ...
7. ...
8. Water is not good! Why?
9. Worst is to keep dry!



## Management of TDI in **Primary** Dentition

**Most important goal:** Preservation of permanent tooth bud

**Fractures:** Determining factors: size of fracture and child's cooperation

Injury	Emergency Tx	Follow up and Definitive Tx
Uncomplicated fracture 	Depending on the size of fracture: None; or smooth the sharp edges; or cover the exposed dentin with GI or composite	Final restoration Usually no follow ups needed
Complicated fracture 	Small exposure: Direct pulp cap and restoration	Complete pulpotomy and final restoration  Follow ups: 1 wk, 6-8 wk, 1 y
	Large exposure: Pulpotomy (cervical); if not possible	
	Uncooperative child : Extraction	

### Favorable Outcomes

Normal color of the crown  
 No pain  
 No signs of pulp necrosis or infection  
 Continued root development

### Unfavorable Outcomes

Crown discoloration (pulpal necrosis)  
 Pain  
 Infection  
 Sinus tract } Extraction

*Ehsan Azadani*



# Management of TDI in **Primary** Dentition

**Most important goal: Preservation of permanent tooth bud**

**Periodontal Injuries (Luxations):** Determining factors: Displacement (mm), mobility, occlusal interference

Injury	Emergency Tx	Follow up and Definitive Tx
Concussion & Subluxation	No treatment; observation only	1 wk, 6-8 wk
Lateral luxation & Extrusion	<3mm displacement, no occlusal interference: No Tx, allow spontaneous repositioning	1 wk, 6-8 wk, 6mo, 1 yr
	>3 mm displacement, occlusal interference, severe mobility (>2mm in each direction): Extraction	
Intrusion	No Tx - Allow spontaneous eruption; Usually within 6 months, but may take up to 12 months	1 wk, 6-8 wk, 6mo, 1 yr
Avulsion	No Tx – Do NOT replant an avulsed primary tooth	

### Favorable Outcomes

Normal color of the crown  
No pain  
No signs of pulp necrosis or infection  
Continued root development  
No disturbance to the developing permanent tooth  
Re-eruption in case of intrusion

### Unfavorable Outcomes

Crown discoloration (pulpal necrosis)  
Pain  
Infection  
Sinus tract } Extraction

*Ehsan Azadani*



# Management of TDI in **Primary** Dentition

## Determining factors in Tx planning of Emergency and Definitive care

- Child's age (how long is the primary tooth going to stay before exfoliation)
- Child's cooperation
- Severity of injury
- Danger to the permanent successor
- Parental desire
  
- Do NOT replant/reposition and splint primary teeth!
- "When in doubt, take it out!"





## ALL of us should know how to:



1. Identify the traumatic injury
2. Recognize emergency vs non-emergency
3. Provide emergency care
4. Educate the family about post-trauma care and importance of follow up

Then for the rest of the care:

Refer to IADT Guidelines or refer to specialist



## Questions?

Email me at: [Azadani.2@osu.edu](mailto:Azadani.2@osu.edu)

Ehsan Azadani, DDS, MS

We will review several clinical cases in Part 2 (no handouts)

Fri 4/19/24 1:00 – 3:00 pm

Traumatic Injuries to the Permanent Teeth: High Stakes and Limited Time

Room 201

