Virtual PediaRaRe 5.0

MANAGEMENT OF LUXATION INJURIES & AVULSION

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Areas of Interest:

- Dental Traumatology
- Dentofacial Orthopaedics
- Dental chemo therapeutics

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Previous QP

Explain in detail about the various storage media available for avulsed tooth and its clinical management.

Discuss classification of fractures of anterior teeth. What are the treatment modalities of avulsion of Incisors.

Classify traumatic injuries and write about management of luxation injuries.

Management of avulsed teeth

Replantation of an avulsed tooth

Avulsion management.

Intrusion

Splints in traumatic Injuries

Critical appraisal of IADT 2020 guidelines

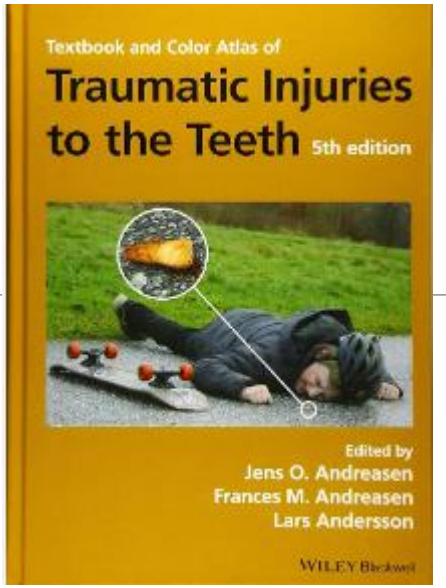
-Textbooks

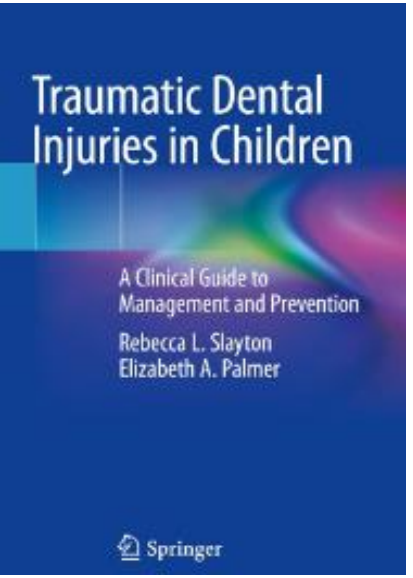
- Colour Atlas

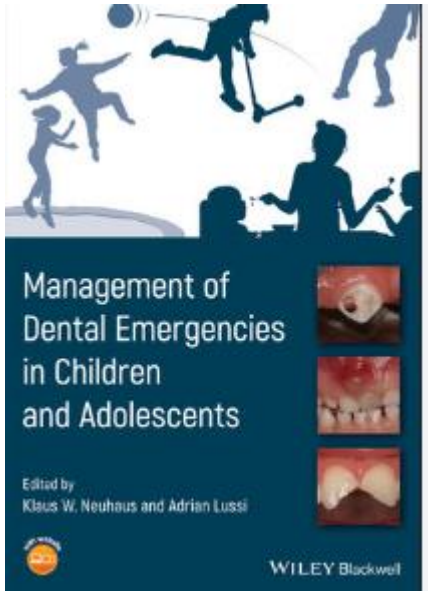
-IADT Guidelines 2020

-AAE Guidelines 2015

- Journals







Classification

Ellis and Davey

Type of injury (code according WHO)
Injuries to the hard dental tissues and the pulp
Enamel infraction (N 502.50)
Enamel fracture (N 502.50)
Enamel- dentin fracture (N 502.51)
Complicated crown fracture (N 502.52)
Uncomplicated crown- root fracture (N 502.54)
Complicated crown-root fracture (N 502.54)
Root fracture (N 502.53)
Injuries to the periodontal tissues
Concussion (N 503.20)
Subluxation (N 503.20)
Extrusive luxation (N 503.20)
Lateral luxation (N 503.20)
Intrusive luxation N 503.21
Avulsion (N 503.22)
Injuries to supporting bone
Comminution of the maxillary alveolar socket (N 502.40)
Comminution of the mandibular alveolar socket (N 502.60)
Fracture of the maxillary alveolar socket (N 502.40)
Fracture of the mandibular alveolar socket (N 502.60)
Fracture of the maxillary alveolar process (N 502.40)
Fracture of the mandibular alveolar process (N 502.60)
Fracture of the maxillae (N 502.42)
Fracture of the mandible (N 502.61)
Injuries to gingiva or oral mucosa
Laceration of gingiva or oral mucosa (S 01.50)
Contusion of gingiva or oral mucosa (S 00.50)
Abrasion of gingiva or oral mucosa (S 00.50)

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DOI: 10.1111/edt.12753

SHORT COMMUNICATION

Dental Traumatology WILEY

NA0D – The new Traumatic Dental Injury classification of the World Health Organization

Stefano Petti[1] | Jens Ove Andreasen[2] | Ulf Glendor[3] | Lars Andersson[3]

Injury of periodontal tissues	NA0D.1
Concussion of periodontal tissue	NA0D.10
Subluxation of tooth	NA0D.11
Extrusive luxation of tooth	NA0D.12
Lateral luxation of tooth	NA0D.13
Intrusive luxation of tooth	NA0D.14
Avulsion of tooth	NA0D.15
Other specified injury of periodontal tissues	NA0D.1Y
Injury of periodontal tissues, unspecified	NA0D.1Z
Other specified injury of teeth or supporting structures	NA0D.Y
Injury of teeth or supporting structures, unspecified	NA0D.Z

Petti S, Andreasen JO, Glendor U, Andersson L. NA0D - The new Traumatic Dental Injury classification of the World Health Organization. Dent Traumatol. 2022 Jun;38(3):170-174

IADT Guidelines 2020

4th edition released 2020 consists of 4 papers:

General Introduction Dental Traumatology 2020: 10.1111.edt.12574

1: Fractures and luxations of permanent teeth Dental Traumatology 2020: DOI 10.1111/edt.12578

2: Avulsion of permanent teeth Dental Traumatology 2020: DOI 10.1111/edt.12573

3:Traumatic injuries to primary dentitionDental Traumatology 2020: DOI 10.1111/edt.12576: DOI 10.1111/edt.12576

Assessing the status of the traumatized tooth

- History
- Clinical Examination
- Documentation
- Photographic documentation
- Conventional 2D X rays
- Cone-beam computed tomography (CBCT)

Sensibility tests

Commonly used sensibility tests are based on **thermal or electric stimulation**

Patient compliance

Post trauma Inflammation

temporary loss of sensibility occurs frequently due to pulpal oedema after luxation injuries

Stage of root development

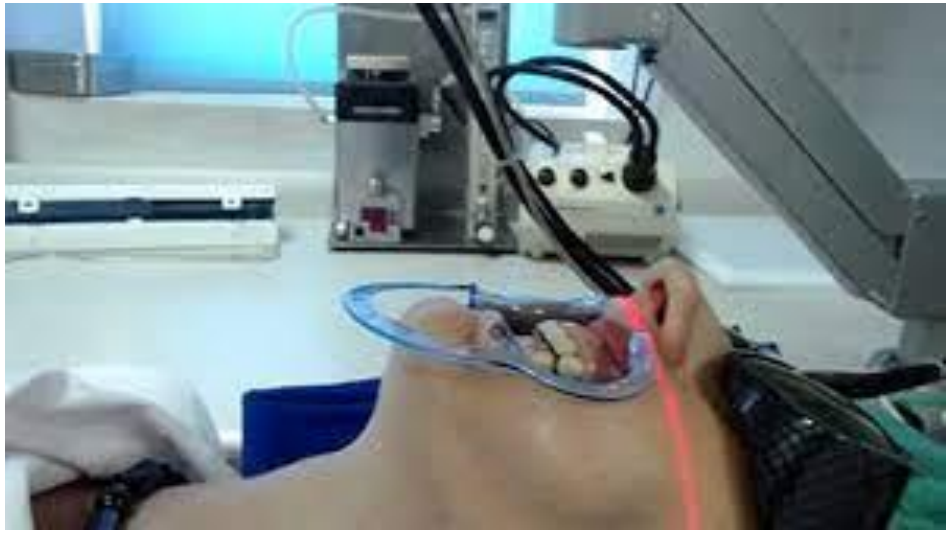
Delay in the full development of the plexus of Rashkow, which has been shown to take place up to 5-years post tooth eruption

Immature teeth are not fully innervated and therefore associated with an increased excitation threshold (Fulling & Andreasen 1976),

Jafarzadeh H, Abbott PV. Review of pulp sensibility tests. Part I: general information and thermal tests. Int Endod J. 2010 Sep;43(9):738-62.

Vitality tests

Laser Doppler Flowmetry,
-Ultrasound Doppler Flowmetry,
- Pulse oximetry

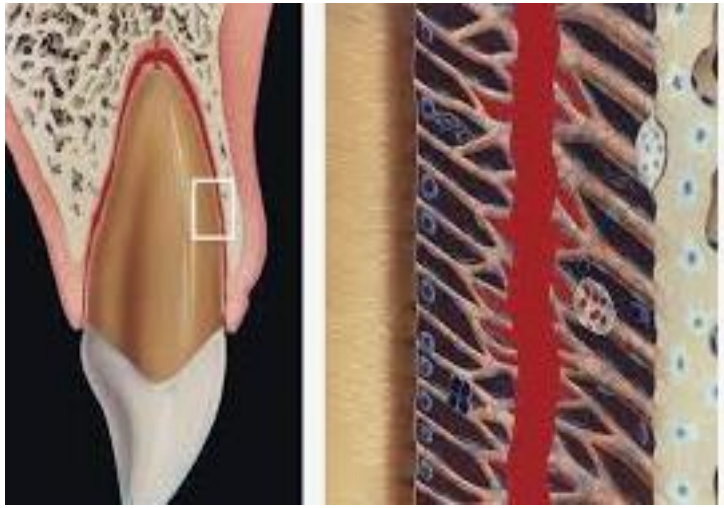


Krastl, G., Weiger, R., Ebeleseder, K. & Galler, K. (2021) Present status and future directions –endodontic management of traumatic injuries to permanent teeth. International Endodontic Journal, 00, 1–17.

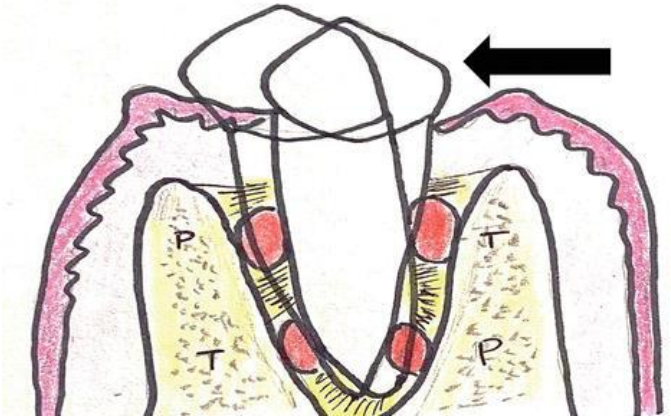
Displacement of tooth

Concussion
Subluxation
Intusive Luxation (Cental dislocation)
Lateral luxation: **Extrusive luxation(**Peripheral dislocation, Partial Avulsion):
Avulsion(exarticulation)

Injury in Luxation injuries



Compression of periodontal ligament



PULP

NEURO VASCULAR BUNDLE DAMAGE

Non Vital

External resorption

CEMENTUM

The loss or alteration of the protective layer

The post traumatic inflammatory response

ALVEOLAR PROCESS

Ischemic and crushing injuries

Alveolar bone surrounding the tooth in children is known to be more resilient

Concussion

- Normal mobility
- The tooth is tender to percussion and touch
- Adv IOPA
- No treatment is needed
- Monitor pulp condition for at least one year, but preferably longer

IADT guidelines 2020

Subluxation

- **Tooth is not displaced**
- The tooth is tender to touch or light tapping
- Bleeding from the gingival crevice may be present
- The tooth may not respond to pulp sensibility testing initially indicating transient pulp damage
- **Normally no treatment is needed**
- A passive and flexible splint to stabilize the tooth for up to 2 wk may be used but only if there is excessive mobility

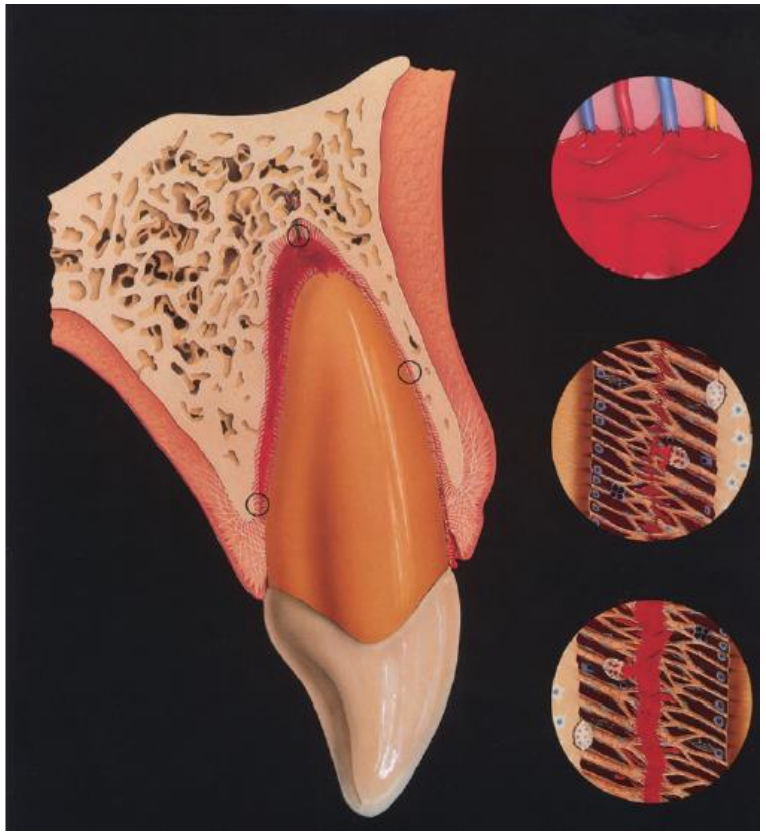
IADT guidelines 2020

Lateral luxation

- **The tooth is displaced,**
- Associated fracture of the alveolar bone
- The tooth is frequently immobile
- Likely to have no response to pulp sensibility tests.
- Multiple radiographs may be necessary.
- **Stabilize the tooth for 4 wk using a passive and flexible splint.**

IADT guidelines 2020

EXTRUSION



- Reposition the tooth
- Stabilize the tooth for 2 weeks
- Monitor the pulp condition with pulp sensibility tests
- If the pulp becomes necrotic and infected, endodontic treatment appropriate to the tooth's stage of root development is indicated

Intrusion

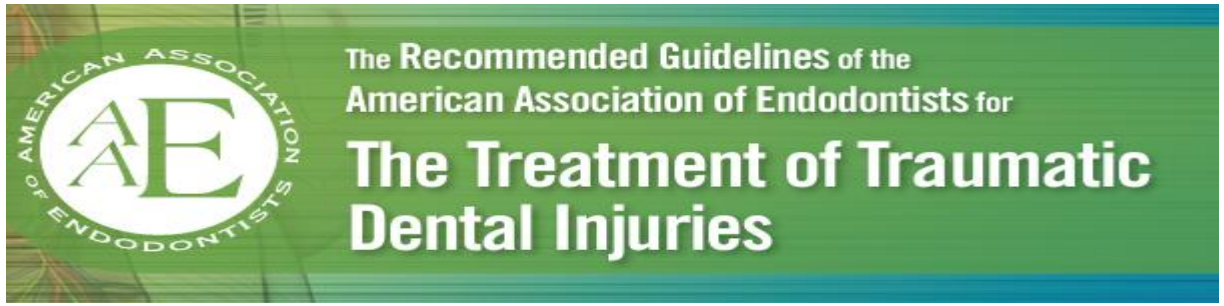
Grade I. Mild partial intrusion in which more than 50% of the crown is visible.
Grade II. Moderate partial intrusion in which less than 50% of the crown is visible.
Grade III. Severe or complete intrusion of the crown. **Von Arx, 1995**

- Primary teeth: To allow spontaneous re-eruption except when displaced into the developing successor.
- Extraction is indicated when the apex is displaced toward the permanent tooth germ

Intervention Guidelines (UK guidelines)

Teeth with incomplete root formation: -

- Allow re-eruption without intervention (spontaneous repositioning) for all intruded teeth independent of the degree of intrusion If no re-eruption within 4 weeks, initiate orthodontic repositioning



Teeth with complete root formation:

Intruded less than 3 mm.

- Allow re-eruption without intervention
- If no re-eruption within 8 wk, reposition surgically and splint for 4 wk
- Alternatively, reposition orthodontically before ankylosis develops

If the tooth is intruded 3-7 mm,

- Reposition surgically (preferably) or orthodontically

If the tooth is intruded beyond 7mm, reposition surgically

Splint for 4 wk with a passive and flexible splint

Sequalae of Intrusion

- Pulpal necrosis 88%–98%
- External resorption
- Marginal Bone loss

Follow Up Protocol 2,4,6,8 weeks, 3 months 6 months , 1 year and annually for 5 years

Andreasen JOVE, Vinding TR, Christensen SSA. Predictors for healing complications in the permanent dentition after dental trauma. Endod Topics 2006;14:20–7

IADT Guidelines 2020

ENDODONTIC CONSIDERATIONS FOR LUXATED TEETH

OPEN APEX

Root canal treatment should be avoided unless there is clinical or radiographic evidence of pulp necrosis or periapical infection on follow-up examinations

CLOSED APEX

Early endodontic treatment advised for severely Intruded, extruded teeth after it is surgically repositioned

Calcium hydroxide, corticosteroid/antibiotic paste is recommended as an intra-canal medicament to be placed 1-2 weeks after trauma for up to 4-6 weeks followed by root canal filling.

Infection-related (inflammatory) external resorption, root canal treatment should be initiated immediately

PROGNOSIS

Immature root development had a superior healing potential

If pulp becomes revascularized, pulp canal obliteration was almost always a standard sequel to injury.

- **Pulp Necrosis and resorption. was quite common,**
- **Ankylosis rare**

Table 15.2 Pulp and periodontal healing complications following lateral luxation.

Author	Stage of root development	No. of teeth	Pulp necrosis	Pulp canal obliteration	Pulp survival	Root resorption	Marginal breakdown
Andreasen & Vestergaard Petersen (2) 1985	Open apex	34	3 (9%)	24 (71%)	7 (20%)	3 (9%)	9 (7%)**
Andreasen (3) 1995	Closed apex	88	68 (77%)	10 (11%)	10 (11%)	34 (39%)	
Nikoui et al. (5)* 2003	Open + closed apex	58	23 (40%)	23 (40%)	12 (20%)	?	?

* Only children and adolescents. ** Open and closed apices.

Extrusive Luxation and Lateral Luxation F. M. Andreasen & J. O. Andreasen
Ch 15. In: J Andreasen, F Andreasen, L Andersson, editors. Textbook and color atlas of traumatic injuries to the teeth, 4th edn. Oxford: Blackwell Munksgaard; 2007. p. 411-427

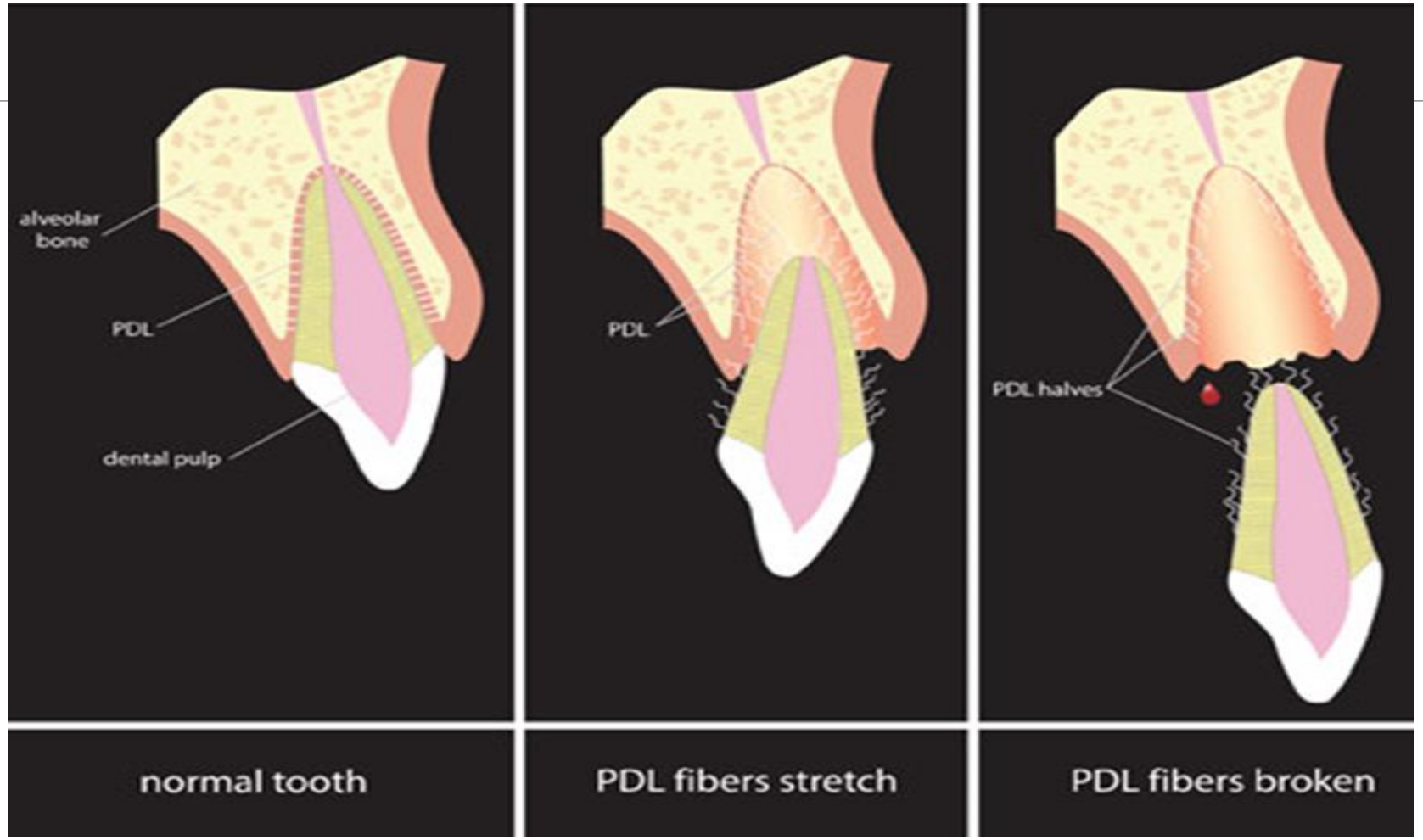
Avulsion

Avulsion of a permanent tooth - 0.5% to 16% of all dental injuries (Andreasen, Andreasen, Andersson, 2007).

-Ages of 7 to 14 years, affecting the maxillary central incisors (Trope, 2011)

Avulsion of primary teeth has been reported to comprise between 5.8% and 19.4% Holan G 2013)

Male to female ratio of 2:1(Zaleckiene V,2014)


alveolar bone
PDL
dental pulp
PDL
PDL halves
normal tooth
PDL fibers stretch
PDL fibers broken

	General Instructions:
1	Keep the patient calm.
2	Find the tooth and pick it up by the crown
3	If the tooth is dirty, rinse it gently in milk, saline or in the patient's saliva and replant or return it to its original position in the jaw... The tooth can then be brought with the patient to the emergency clinic
4	It is important to encourage the patient/guardian/teacher/otherperson to replant the tooth immediately at the emergency site
5	Once the tooth has been returned to its original position in thejaw, the patient should bite on gauze, a handkerchief or a napkinto hold it in place
6	If replantation at the accident site is not possible, Keep in a storage medium
7	Emergency replantation by dentist

Ideal requirement of a storage media for an avulsed tooth

Low Bacterial Content

Physiological Osmolarity 290- 330 mSol/l

Neutral Ph 6.6-7.8

Essential Nutrients, Antioxidants

Not react with body fluids.

Not produce any antigen antibody reactions.

Reduce the risk of post-reimplantation root resorption or ankylosis.

Vineet IS Khinda et al. Clinical and Practical Implications of Storage Media used for Tooth Avulsion. IJCPD. 2017;10(2):158-165.

Tooth storage mediums

NATURAL SOURCE

- Milk
- Saliva
- Coconut water
- Propolis
- Emdogain
- Green tea extracT
- Water
- Patients own serum
- Soy Milk
- Red Mulberry
- Aloevara

LABORATORY PREPARED

- HBSS Solution
- Normal saline
- Viaspan
- Eagles Medium
- Gatorade
- Contact Lens Solution
- Growth Factors
- Ascorbic Acid
- L dopa
- Catalase supplements
- Custodial
- Conditioned medium
- Euro Collins
- Media supplemented with growth factors
- Cryoprotective agents
- CPP- ACP
- Probiotics

Based on cell viability

Intermediate
(Upto 1 hour)
Saliva
Normal Saline
Tap Water

Short Term
(2to 6 hrs)
Milk
Propolis
Green tea
Egg white
ORS

Long term
(upto 48 hours)
HBSS
Viaspan
Eurocollins

HANK'S BALANCED SALT SOLUTION (HBSS)

Sterile, physiologically balanced isotonic

Solution is nontoxic

pH – 7

Osmolarity – 270 – 290 m Osm / litre

Ability to preserve and reconstitute pdl cells

Desirable storage medium – even when extra-oral time is between 72-96hrs

DISADVANTAGE:

- Costly
- Not available usually at accident site
- Freshly prepared has better results

Milk (Lekic PC, etal 1998	**6.7**	**286**	**pH and osmolality compatible to PDL cells, easy availability,, presence of nutritional substances**	**Cannot revive the degenerated cells**	**Excellent**
Egg white (Khademi etal 2008)	6.6	251-258	Better incidence of repair than milk for up to 6-10 h, easily available at the traumatic site		Excellemt
Propolis (Saxena et al 2006)	6	330	Prevents resorption by its anti-inflammatory, antimicrobial and anti-oxidant properties	Higher concentration declines cell viability due to its own cytotoxic responses	Excelllent
Coconut water (Gopikrishna et al 2008)	5	288	Sterile, rich in Nutrients	Acidic pH-	Excellent

Greentea extract (Poi etal 2008)	**5.9**	**139**	**Potent antioxidant, anti-inflammatory and anti-carcinogenic**	**Acidic pH and hypotonicity - detrimental to PDL cells**	**Excellent**
Saline solution	7	280	pH and osmolality are biocompatible to PDL cells	Lacks nutrients - calcium, magnesium and glucose for cell metabolism	Poor
ViaSpan	7.4	320	Effective storage media, biocompatible, potent anti-oxidant	Short vitality expiration date, expensive and is not readily available	Excellent
Contact lens solution (Singlas 04)	7-7.36	275-310	-Availability	Presence of preservative is harmful to the cells of PDL cells	poor

Tap water	7.3	3	Atleast protects the tooth from dehydration	Hypotonicity cellular swelling	very Poor
Saliva (Blomlof 1981)	6.3	60-70	Easy availability, transporting the tooth is better than dry condition	Hypotonic. High Bacterial content	very poor

TOOTH RESCUE BOX (DENTOSAFE)

Contains salts, amino acids, glucose, and vitamins.

It has been shown to maintain the vitality of PDL cells for up to 48 hours at room temperature in vitro

Eagle's Minimal Essential Medium

4 ml of L-Glutamine; 105 IU/L of Penicillin; 100µg/ mL of Streptomycin, 10µg/mL of Nystatin and calf serum (10% v/v).

Eagle's medium had relatively high viability, mitogenic and clonogenic capacity up to 8 hours of storage at 4◦C.

Eagle's medium was less effective than milk or Hank's balanced salt solution.

Udoye CI, Jafarzadeh H, Abbott PV. Transport media for avulsed teeth: a review. Aust Endod J. 2012 Dec;38(3):129-36.

Patients own serum
Soy Milk
CPP- ACP
Red Mulberry

Probiotics - L. reuteri DSM 17938 and L. reuteri ATCC PTA 5289
Media supplemented with growth factors
Ascorbic Acid
Ricethral
L Dopa
Cryoprotective agents
Catalase supplements
Custodial
conditioned medium
Euro Collins
Emdogain
Aloevara

Recently Studied

Dragons Blood sap (Martins CM ,Braz Dental J 2016)

Cling film (Zeissler-Lajtman A, Swiss Dental J 2017)

Delphinidin (DP), an anthocyanidin found in blueberries (Nam OH, BMC Oral Heath 2023)

Utilizing periodontal ligament stem cells (PDLSCs) to regenerate PDL (Aksel H, Stem Cell Res Ther. 2022)

Media	Authors	Conclusion
Tap water, normal saline and human saliva	Andreasen et al 1981	Ankylosis was rarely found with saline or saliva, increased among tap water
Milk and saliva	Blomlof et al. 1980	Milk was found to be superior to saliva as storage medium
Long shelf-life milk, pasteurized milk, save-a-tooth system	Marino et al. 2000	Long shelf-life milk is more effective than Save A Tooth
Powdered milk, evaporated milk, or one of two baby formulas (similar or enfamil) compared to whole milk	Pearson et al. 2003	Enfamil is more effective storage medium for avulsed teeth than pasteurized milk for at least 4 h
Soymilk, powdered milk, and HBSS	Moazami et al. 2012	Soymilk and powdered baby formula recommended as suitable storage media upto 8 h
Custodial and HBSS	Alacam et al. 1996	Custodial is comparable to HBSS for cell preservation
Opti-Free, K-Mart contact lens solution, milk, saline and HBSS	Huang et al. 1996	Saline was superior to all contact lens solutions. Milk at 4 degree a good short term storage medium
Soft wear contact lens solution, Gatorade, milk and HBSS	Chamorro et al.2008	Gatorade and the contact lens solution were less effective when compared to milk and HBSS
Oral rehydration fluid, gatorade and fat content of milk	Harkacz et al. 1997	Oral rehydration fluid was not suitable and lower fat content milk may be more appropriate
Gatorade, milk, Save-A-Tooth, Save-A-Tooth with PDGF	Olson et al 1997	Milk and save a tooth with PDGF are suitable, gatorade was unsuitable as a transport medium
Oral rehydration solution “Ricetral,” HBSS and milk	Rajendran et al.2011	Cell vitality was higher with Ricetral and HBSS but poor with milk
Egg albumen, bovine milk, human saliva, and tissue culture medium MEM	Rozenfarb et al. 1997	Milk and albumin showed high cell viability, saliva showed decreased cell viability
Chicken egg white, saliva, milk, milk packed in ice	Layug et al. 1998	Egg white is suitable milk packed in ice seems to be the best alternative
Egg albumin and milk	Khademi et al. 2008	Egg albumin is an excellent storage media for up to 10 h
Egg white, milk, HBSS	Khademi et al.2008	Egg white and HBSS media were equally effective
HBSS, ViaSpan	Pettiette et al. 1997	Teeth dried for 45 or 60 min would benefit from soaking for 30 min in ViaSpan when compared with HBSS
Culture medium, alpha minimal essential medium (alpha-MEM), milk, HBSS, ViaSpan	Ashkenazi et al.1999	HBSS and milk were the most effective media for up to 24h at 4 degree cell.
HBSS culture medium, alpha (alpha-MEM) and ViaSpan	Ashkenazi et al. 2000	Culture medium, followed by HBSS and ViaSpan, was the most effective media, lowest PDL vitality with alpha-MEM

HBSS, with no antioxidant), ViaSpan, and HBSS with catalase	Buttke and Trope 2003	Teeth stored in media containing antioxidant undergo less surface resorption
HBSS storage time	de Souza et al. 2010	6 h - HBSS was significantly more effective than HBSS 6 M, HBSS 12 M and save a tooth
Condition medium, HBSS and ViaSpan	Pettiette et al.1997	Healing rates were lower for roots that had been soaked in condition medium compared with ViaSpan and HBSS
Enamel matrix derivative (EMD)	Iqbal and Bamaas, 2001	Effect of emdogain was more pronounced at the 12 weeks interval
EMD	Ashkenazi and Shaked2006	EMD can delay, but not stop the development of replacement resorption
EMD	Fridström et al. 2008	Emdogain might still be of value for an uncomplicated healing after replantation
Propolis (50% and 100%),HBSS, milk, saline	Martin and Pileggi 2004	Propolis appeared to be a better alternative to HBSS, milk or saline
Propolis (10% and 20%)	Ozan et al. 2007	10% propolis was a more effective storage medium but not 20% propolis
Propolis, milk, saliva, HBSS, and DMEM and water	Casaroto et al. 2010	Propolis was effective in maintaining the viability of human PDL cells
Combination of propolis 10%+DMEM, propolis 20%+DMEM and DMEM alone	Payal Saxena et al. 2011	Combination of propolis 10% + DMEM, propolis 20% + DMEM, and DMEM alone are equally good up to 24 h
Coconut water, propolis, HBSS, and milk	Gopalkrishna et al. 2008	Coconut water can be used as a superior transport medium for avulsed teeth
Coconut water, HBSS, and milk	Gopikrishna et al. 2008	Coconut water may be better alternative to HBSS, milk
Coconut water, coconut water with sodium bicarbonate, milk, saline and still mineral water	Moreira-Neto et al. 2009	Coconut water was worse compared to milk, coconut water with sodium bicarbonate and saline
Saliva extract, HBSS, phosphate buffered saline and tap water	Ozan et al. 2008	PDL cells were more viable in salvia extract than in HBSS, phosphate buffered saline and tap water over 3, 6,12 or 24 h
Novel probiotic solution, HBSS, saline and milk	Caglar et al. 2010	Probiotic may be able to maintain PDL cell viability as HBSS, milk, or saline
M. rubra fruit	Ozan et al. 2008	4% juice of the M. rubra could be recommended as a suitable transport medium
GTE, commercial green tea, HBSS, tapwater, milk	Hwang et al. 2011	GTE could be a suitable, alternative storage medium for avulsed teeth

Contemporary Pediatric Dentistry

Review
Contemp Pediatr Dent 2024:0(0):1-18
DOI: 10.51463/cpd.2024.6

Storage medium for avulsed teeth: A narrative review

Rutuja Shinde[1], Dinesh Rao[2] ✉, Sunil Panwar[3], Remi RV[4]

Highlights

- Immediate replantation is essential for achieving optimal treatment success and a favorable prognosis in avulsed permanent teeth.
- The biological properties of storage mediums are critical for preserving the viability, clonogenic capacity, and mitogenic potential of periodontal ligament cells.
- Milk is a preferred storage medium due to its satisfactory performance, widespread availability, and cost-effectiveness in emergency situations.

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Review Article

ISSN 0103-6440

Storage Media For Avulsed Teeth: A Literature Review

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Dental avulsion is the most severe type of traumatic tooth injuries because it causes damage to several structures and results in the complete displacement of the tooth from its socket in the alveolar bone. The ideal situation is to replant an exarticulated tooth immediately after avulsion because the extraoral time is a determinant factor for treatment success and for a good prognosis. However, it is not always possible. The success of replantation depends on a number of factors that may contribute to accelerate or minimize the occurrence of root resorption or ankylosis, among which is the type and characteristics of the medium used for temporary storage during the time elapsed between avulsion and replantation. Maintaining the tooth in an adequate wet medium that can preserve, as longer as possible, the vitality of the periodontal ligament cells that remain on root surface is the key to success of replantation. Recent research has led to the development of storage media that produce conditions that closely resemble the original socket environment, with adequate osmolality (cell pressure), pH, nutritional metabolites and glucose, and thus create the best possible conditions for storage. Although these storage media can now be purchased in the form of retail products, the most common scenario is that such a product will not be readily available at the moment of the accident This paper reviews the literature on the different storage

Storage of an avulsed tooth prior to replantation: A systematic review and meta-analysis

Niels De Brier[1] | Dorien O[1] | Vere Borra[1,2] | Eunice M. Singletary[3] | David A. Zideman[4] | Emmy De Buck[1,2,5] | On behalf of the International Liaison Committee on Resuscitation First Aid Task Force

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Abstract

Background/Aim: It is crucial to store an avulsed tooth appropriately to preserve the viability of the periodontal ligament cells prior to replantation. The aim of this systematic review was to identify the best available evidence for the effectiveness of any technique available to laypeople for storing an avulsed tooth compared with storage in milk or saliva.

De Brier N, O D, Borra V, Singletary EM, Zideman DA, De Buck E, International Liaison Committee on Resuscitation First Aid Task Force, Bendall JC, Berry DC, Carlson JN, Cassan P. Storage of an avulsed tooth prior to replantation: a systematic review and meta-analysis. Dental Traumatology. 2020 Oct;36(5):453-76.

Prognosis

Viability of the periodontal ligament cells remaining on root surface

Integrity of root cementum

Minimal bacterial contamination

Trope M. Avulsion of permanent teeth: theory to practice. Dent Traumatol. 2011 Aug;27(4):281-94.

In office treatment

Maturity of the root (open or closed apex)

Time elapsed after trauma

The PDL cells are most likely viable (i.e. the tooth has been replanted immediately or after a very short time at the place of accident)

The PDL cells may be viable but compromised. the total dry time has been less than 60 min.

The PDL cells are non-viable. total extra-oral dry time has been more than 60 min

SCENARIO 1: CLOSED APEX
The tooth has been replanted at the site of injury or before the patient's arrival at the dental clinic

Clean the injured area with water, saline, or chlorhexidine.

Verify the correct position of the replanted tooth both clinically and radiographically.

Administer local anesthesia, if necessary, and preferably with no vasoconstrictor.

If the tooth or teeth were replanted in the wrong socket or rotated, consider repositioning the tooth/teeth into the proper location up to 48 hours after the traumatic incident.

Stabilize the tooth for 2 weeks using a passive flexible splint Suture gingival lacerations, if present

Initiate root canal treatment within 2 weeks after replantation

Administer systemic antibiotics.

Check tetanus status.

Provide post-operative instructions

Follow up

SCENARIO 2 : CLOSED APEX
extra-oral dry time less than 60 minutes

Remove loose debris and visible contamination Administer local anesthesia, preferably without vasoconstrictor.

Irrigate the socket with sterile saline.

Examine the alveolar socket. Remove coagulum if necessary. If there is a fracture of the socket wall, reposition the fractured fragment with a suitable instrument.

Replant the tooth slowly with slight digital pressure. The tooth should not be forced back to place.

Verify the correct position of the replanted tooth both clinically and radiographically.

Stabilize the tooth for 2 weeks .

Root canal treatment should be carried out within 2 weeks.

Administer systemic antibiotics. Check tetanus status.

Provide post-operative instructions.

Follow up. clinical and radiographic

SCENARIO 3 : CLOSED APEX
extra-oral dry time more than 60 minutes

Remove loose debris and visible contamination Administer local anesthesia, preferably without vasoconstrictor.

Irrigate the socket with sterile saline. Examine the alveolar socket. Remove coagulum if necessary. If there is a fracture of the socket wall, reposition the fractured fragment with a suitable instrument.

Replant the tooth slowly with slight digital pressure. The tooth should not be forced back to place.

Verify the correct position of the replanted tooth both clinically and radiographically.

Stabilize the tooth for 2 weeks .

Root canal treatment should be carried out within 2 weeks.

Administer systemic antibiotics. Check tetanus status. Provide post-operative instructions.

Follow up. **Ankylosis is unavoidable. Replacement resorption**

Decoronation may be necessary when infra occlusion (>1mm) is seen

SCENARIO 4: OPEN APEX
The tooth has been replanted at the site of injury or before the patient's arrival at the dental clinic

Clean the area with water, saline, or chlorhexidine.

Verify the correct position of the replanted tooth both clinically and radiographically.

Administer local anesthesia, if necessary

Stabilize the tooth for 2 weeks using a passive and flexible splint

Suture gingival lacerations, if present.

Root canal treatment/ Pulp therapy should NOT be initiated; wait for revascularization to occur

Administer systemic antibiotics.

Check tetanus status.

Provide post-operative instructions

SCENARIO 5 : OPEN APEX
extra-oral dry time less than 60 minutes

Check the avulsed tooth and remove debris from its surface by gently agitating it in the storage medium.

. Administer local anesthesia

. Irrigate the socket with sterile saline

Examine the alveolar socket. Remove coagulumVerify the correct position of the replanted tooth both clinically and radiographically.

. Stabilize the tooth for 2 weeks using a passive splint

No revascularization procedure is done unless the signs and symptoms of pulp necrosis is seen later

Administer systemic antibiotics. Check tetanus status

. Provide post-operative instructions.

Follow up.

SCENARIO 6 : OPEN APEX
extra-oral dry time is more than 60 minutes

Check the avulsed tooth and remove debris from its surface by gently agitating it in the storage medium.

. Administer local anesthesia

. Irrigate the socket with sterile saline

Examine the alveolar socket. Remove coagulum,. Replant the tooth slowly with slight digital pressure. Verify the correct position of the replanted tooth both clinically and radiographically.

. Stabilize the tooth for 2 weeks using a passive splint

No revascularization procedure is done unless the signs and symptoms of pulp necrosis is seen later

Administer systemic antibiotics. Check tetanus status

Provide post-operative instructions.

Follow up.

Expected outcome : Ankylosis, Replacement resorption, Loss of teeth

Key points IADT 2020

Teeth with EADT >60 mins

No longer endo out of mouth

No longer treat root surface (previously based on animal studies)

No longer remove all PDL,

For all mature teeth endo advised within 2 weeks with EITHER

Non-setting CaOH for 1 month OR •Corticosteroid/AB paste for 6 weeks

Immature teeth prolonged EADT

Easily retrieved/resorbed intracanal medicament

Non-setting CaOH for 1 month OR •Corticosteroid/AB paste for 6 weeks

INTRA CANAL MEDICAMENTS

Non-setting CaOH for 1 month OR •Corticosteroid/AB paste for 6 weeks

Ledermix (triamcinolone acetonide , tetracycline) (Day et al 2012)

Odontopaste (triamcinolone acetonide , clindamycin) (Dettwiler et al 2016)

Root Surface Treatment

Tetracycline	Corticosteroids	Alendronate	Emdogain	Fluorides	calcitonin (i/c)	ledermix (i/c)
Anti resorptive action enhances regeneration of tissue	**Reduce osteoclastic activity, enhances favourable healing**	**Inhibitory effect on osteoclasts, reduces radicular resorption**	**Inductive for acellular cementum formation**	**Absence of inflammatory resorption**	**Slows down resorption**	**Slows down resorption**
Andreasen JO 1995	Sae-Lim V 1998	Lustosa-Pereira A 2008	Iqbal & barmaas 2001	Selvig KA 1992	Pierce A et al 1998	Bryson EC, et al 2002

IADT 2020 GUIDELINES – DOESN'T ADVISE USE OF ROOT SURFACE TREATMENT

PRIMARY TOOTH

Should not be reimplanted (IADT GUIDELINE 2020)

INTERNATIONAL JOURNAL OF PAEDIATRIC DENTISTRY

Review

Replantation of avulsed primary teeth: a systematic review

Paulo Antônio Martins-Júnior ✉, Felipe Augusto da Silva Franco, Ramon Valério de Barcelos, Leandro Silva Marques, Maria Letícia Ramos-Jorge

First published: 11 November 2013 | https://doi.org/10.1111/ipd.12075 | Citations: 7

All authors have made substantive contribution to this study and/or manuscript, and all have reviewed the final paper prior to its submission.

No specific protocol(Only one protocol by UFSC Brazil)

Reimplantation of primary teeth- Critical review

AGAINST	FOR
Children have no esthetic demands	Esthetic reasons
Financial costs, time consumption, and lack of children's cooperation	Space loss
Risk of pulp necrosis and external root resorption	Delayed eruption of the permanent successor and its malposition following eruption
Replantation may inflict damage to the permanent successor	Faulty speech development
Lack of scientific evidence	Difficulties in chewing and mastication
Ankylosis	
Risk of aspiration	

Holan G. Replantation of avulsed primary incisors: a critical review of a controversial treatment. Dent Traumatol. 2013 Jun;29(3):178-84. doi: 10.1111/edt.12038.

SPLINTING

Rigid splints:

- Arch bar splints
- Acrylic splints (Pfeifer splints)
- Composite splints

Semirigid splints:

- Orthodontic brackets and arches
- Wire and composite splints
- Fiber splints
- Composite with fishing net
- Titanium trauma splints

IDEAL REQUIREMENTS

Allow periodontal ligament reattachment and prevent the risk of further trauma

Be easily applied and removed without additional trauma or damage to the teeth and surrounding soft tissues

Stabilize the injured tooth/teeth in its correct position

Allow physiologic tooth mobility to aid in periodontal ligament healing

Not irritate soft tissues

Allow pulp sensibility testing and endodontic access

Allow adequate oral hygiene

Not interfere with occlusal movements

Preferably fulfil aesthetic appearance

Provide patient comfort

Andreasen JO. *Traumatic injuries of the teeth*. Copenhagen: Munksgaard, 1972:154.

RIGID SPLINTS

TYPE OF SPLINTS	INDICATIONS	CONTRA INDICATIONS	ADVANTAGES	DISADVANTAGES
WIRE LIGATURE SPLINTS	Mixed dentition	Generally avoided in cases of availability of other methods	Useful for oral surgeons when other splinting methods are not available	Gingival irritation and inflammation
SURGICAL SUTURES	No neighbouring tooth to which splint may be fixed	When other splinting methods would be better choice	Useful for oral surgeons as an alternative splint	Early suture loosening
ARCHBAR SPLINTS	Jaw fractures	Dento alveolar trauma when repair of PDL is expected	None	Gingival irritation and inflammation
ACRYLIC SPLINTS	Luxation of tooth in combination with fracture of alveolar bone	Isolated dental trauma	Individual splint that can be made with direct and indirect technique	Direct method creates warm reactions
COMPOSITE SPLINT	When neighbouring teeth are intact	Artificial crowns/ large fillings	Every dental office have it Easy to apply	Tendency to split due to occlusal forces

SEMI RIGID/FLEXIBLE SPLINTS

TYPE OF SPLINTS		INDICATIONS	CONTRA INDICATIONS	ADVANTAGES	DISADVANTAGES
ORTHODONTIC BRACKETS AND ARCHES		When injured tooth is intruded and must be repositioned later by orthodontic forces	When there is a doubt that orthodontic forces will disturb the healing process of injured tooth	Possibility of synchronizing movement of teeth	possible irritation of the lips Should be done bya specialist only
WIRE COMPOSITE SPLINTS (0.016" or 0.4 mm.)		All cases of traumatic injuries except for alveolar fractures	Artificial crowns/ large fillings	Easy to apply, most commonly available dentoalveolar splint	Problem with removing the splint
FIBRE SPLINTS	FISHING LINE		Alveolar fracture	Easy to manipulate/apply Favourable healing outcomes	None
	GLASS IONOMER FIBER				
	RIBBOND SPLINTS				More expensive in comparison with a wire composite splints
	KEVLAR FIBRE				
TITANIUM TRAUMA SPLINTS0(.2 mm thick and 2.8 mm wide)				Reduce the quantity of composite material.easy to apply and remove	High cost

Temporary splints

Patient's mouthguards

Orthodontic retainers

Aluminum foil adapted to the dental arch and covered with thermoplastic acrylic

Suturing of avulsed and/or luxated teeth as part of emergency treatment

Stomahesive® (ConvaTec Inc.), a skin barrier adhesive material

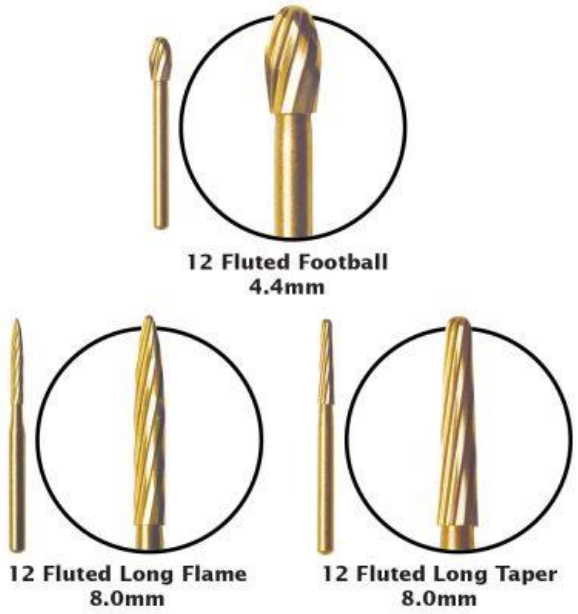
Composite Splint removal

Avoid iatrogenic injury to enamel

Tungsten carbide burs

Softflex discs

Recent advance - Use of GC Fuji Ortho LC



Avulsion Splints-

IADT GUIDELINES 2020

Splint for 2 weeks

Associated alveolar fracture (4 weeks)

Emphasis on passive and flexible wire (up to 0.4mm or 0.016”)

Composite with wire, Fishing line also suggested

IADT GUIDELINES 2020

Anaesthetics: Without Vasoconstrictor Regional anaesthesia is advised

Systemic Antibiotics

No Root surface treatment of Antibiotics

Tetanus Vaccination

Follow up

CLOSED APEX

2 weeks (when the splint is removed), 4 weeks, 3 months, 6 months, one year, and yearly thereafter for at least five years

OPEN APEX

2 weeks (when the splint is removed), 1, 2, 3, 6 months, one year, and yearly thereafter for at least five years

HEALING & PATHOL0GY

PULPAL REACTIONS

PERIODONTAL REACTIONS

HEALING WITH NORMAL PDL

Histologically , it is characterized by complete regeneration of pdl – takes about 4 weeks

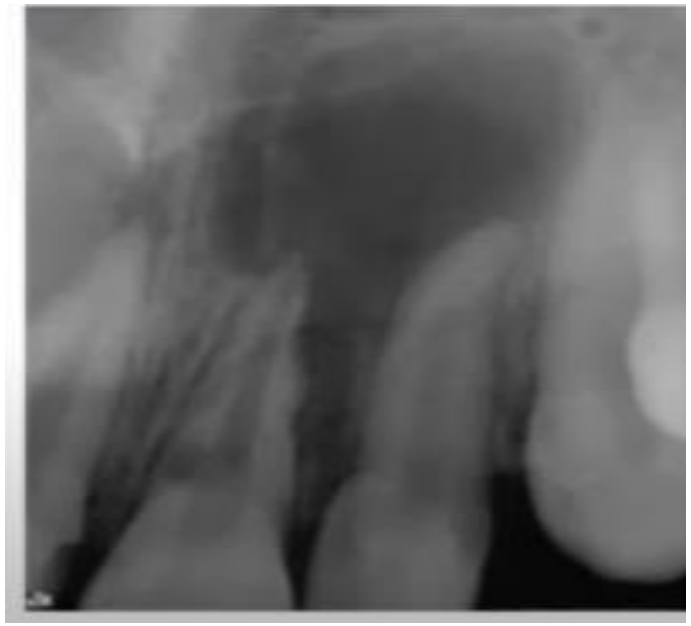
Radiographically , normal pdl space

This type of healing is rare

INFLAMMATORY ROOT RESORPTION

'Infection related IRR (IADT 2020)

- Characterized by bowl shaped resorption
- Active resorption
- Tooth extruded
- Sensitive on percussion
- Percussion -dull



PV Abbott. Prevention and management of external inflammatory resorption following trauma to teeth. Australian Dental Journal 2016; 61:(1 Suppl): 82–94

Healing with ankylosis, Replacement root resorption

Ankylosis related Replacement Root Resorption' (IADT 2020)

Can be seen 2 weeks after reimplantation

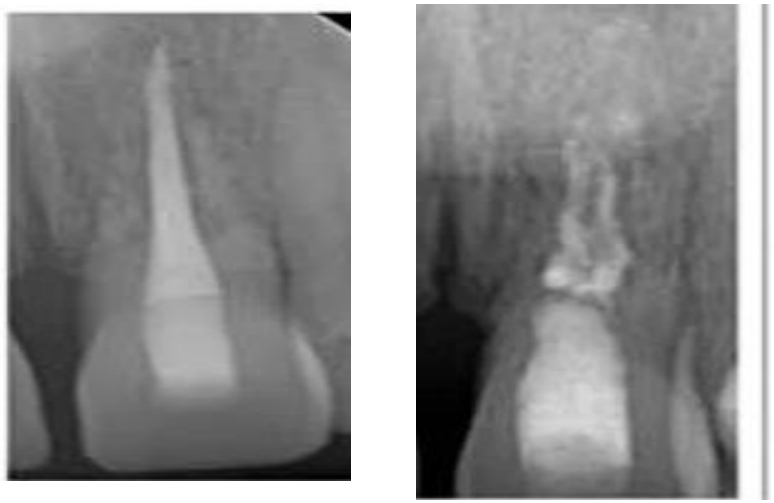
Progresssive –

Dull sound on percussion

Loss of lamina Dura

Dentin merging with bone

Obliteration of pulp canal



Contra Indications

Severe caries or periodontal disease

Uncooperative patient

Severe cognitive impairment

Severe medical conditions

Fouad AF, Abbott PV, Tsilingaridis G, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. Dent Traumatol 2020;36:331-342

FAVOURABLE CLINICAL OUTCOMES

CLOSED APEX

Asymptomatic, functional,

Normal mobility, no sensitivity to percussion,and normal percussion sound.

No radiolucencies and no radiographic evidence of root resorption. The lamina dura appears normal.

OPEN APEX

Radiographic evidence of continued root formation and tooth eruption

Obliteration of pulp canal spaces

Summary

Dental trauma often leads to complications

Emergency management and a treatment plan are important for a good prognosis

Clinicians should be aware of the protocols and guidelines

Learn, Relearn, Revise, Re Revise

Best Wishes

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