



University of Miami
Miller School of Medicine
Department of Surgery
Division of OMFS & General Dentistry

*Delayed Replantation of an Avulsed Maxillary
Lateral Incisor – Case Report*

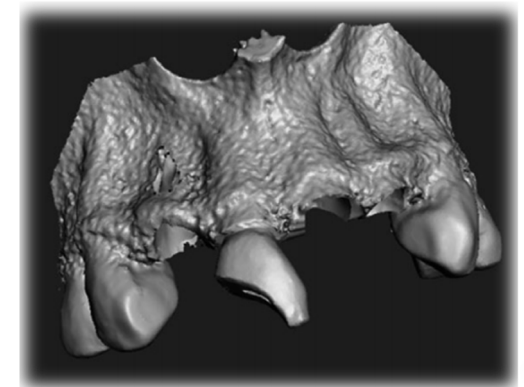
Ninoska Perez Enez, DMD



Disclosure

I have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation

1. Introduction – Traumatic Dental Injuries
2. Definition –Avulsion
3. Epidemiology
4. Clinical and Radiographic Findings
5. Treatment
6. Prognosis
7. Pulp and Periodontal Healing Complications
8. Case Report/Delayed Replantation
9. Conclusions



INTRODUCTION

Traumatic Dental Injuries (TDI's)

**Preschool, School-age children,
Young adults**

**Incidence - 25% Children and
33% Adults**



***“TDI'S Present a
challenge to clinicians worldwide”***



**International Association
of Dental Traumatology**



DENTAL TRAUMA GUIDE
- evidence based treatment guide -

Guidelines

Diangelis AJ, Andreasen JO, Ebeleseder KA, et. Al. International Association of **Dental** Traumatology **guidelines** for the **management** of **traumatic dental injuries**: Fractures, luxation and avulsion of permanent teeth. International Association of **Dental** Traumatology. Dent Traumatol. 2012 Feb;28(1):2-12.

INTRODUCTION



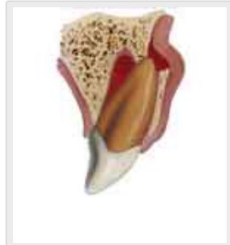
Concussion



Subluxation



Extrusion



Lateral luxation



Intrusion



Avulsion

3 -16 %



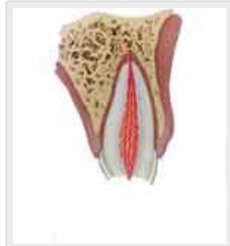
Infraction



Enamel fracture



Enamel-dentin fracture



Enamel-dentin-pulp fracture



Crown-root fracture without pulp involvement



Crown-root fracture with pulp involvement



Root fracture



Alveolar fracture

Traumatic Dental Injuries (TDI)

DEFINITION

Avulsion

Injury to the tooth-supporting structures



**Displacement
of the tooth out
from its socket**



**Total separation of
the PDL**

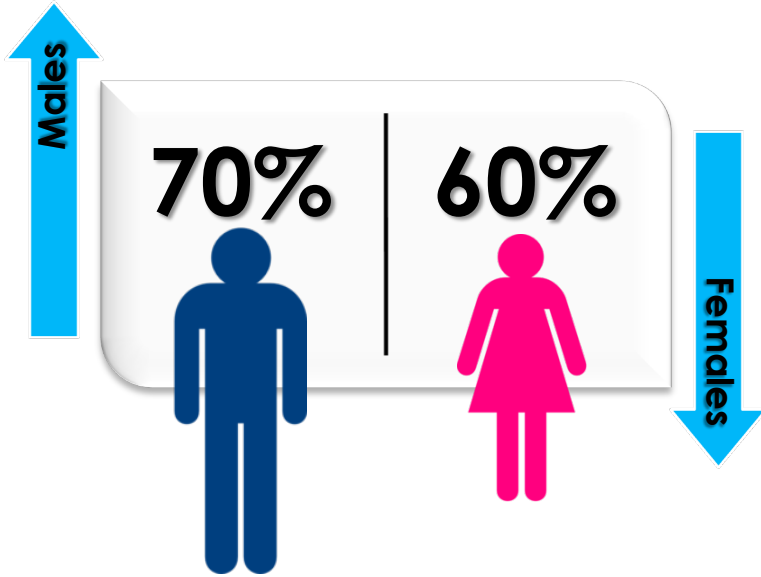
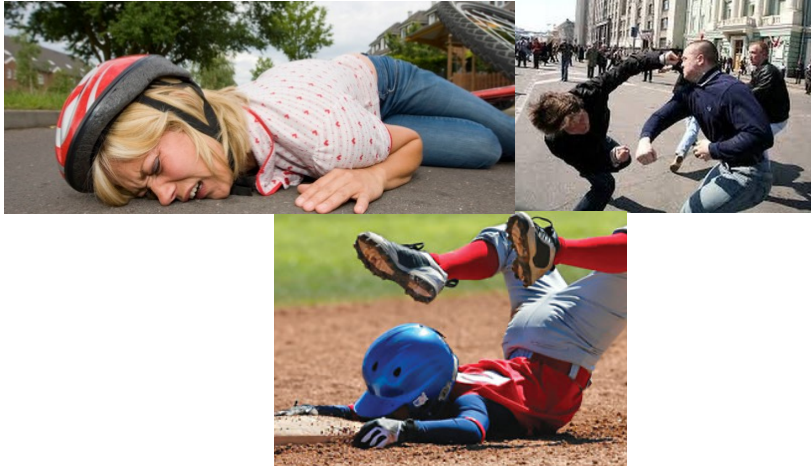


**Alveolar Fracture
may occur**



**Complicated or
Uncomplicated Crown
Fracture**

A sudden collision against a hard object



Males are more likely to be involved – 7 to 14 y/o



Central maxillary incisor is the most frequently tooth involved

42%

Avulsion

Clinical findings:

The tooth is displaced out from its socket



Radiographic findings



DENTAL TRAUMA GUIDE

- evidence based treatment guide -

The logo consists of a central blue circle containing a white silhouette of a tooth with a jagged crack at its base. This circle is superimposed on a light blue globe showing the continents. The words 'DENTAL TRAUMA' are written in white, bold, uppercase letters along the top arc of the circle, and 'GUIDE' is written along the right arc. Below the circle, the text '- evidence based treatment guide -' is written in white, lowercase letters, following the curve of the bottom arc.

TREATMENT

Avulsion

CONTRAINDICATIONS



~~Immediate replantation is the best option~~

Severe caries or periodontal disease

Primary teeth should not be replanted
Non-cooperating patients

Severe medical conditions

Subsequent **damage** of the developing permanent tooth
Primary teeth



TREATMENT

Avulsion

Avulsed Permanent Teeth



Immediate **Replantation**



If not possible, the use of a **storage medium solution** is indicated to preserve the vitality of the PDL cells


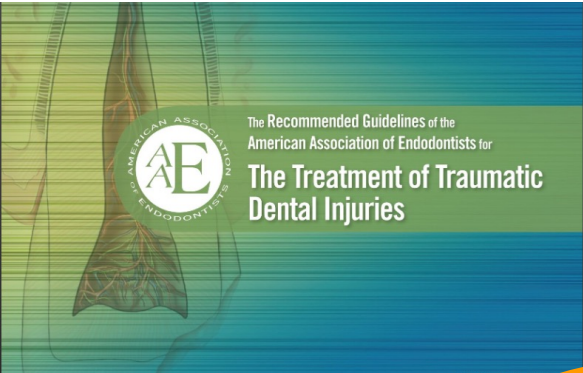
Protects, as long as possible **the viability of the periodontal ligament cells** that remain on root surface, which are the **key to success**



Hanks Balanced Salt Solution (HBSS) or Save a tooth solution, Viaspan, Emdogain, Gatorade, Saline, Milk, Saliva, Propoleo, Coconut Water, Eggs

TREATMENT

Avulsion

The Recommended Guidelines of the American Association of Endodontists for
The Treatment of Traumatic Dental Injuries

DIAGNOSIS & CLINICAL SITUATION	TOOTH HAS ALREADY BEEN REPLANTED	TOOTH HAS BEEN KEPT IN PHYSIOLOGIC STORAGE MEDIUM OR OSMOLALITY BALANCED MEDIUM (HBSS, SALINE, AND MILK) AND/OR STORED DRY FOR UP TO 60 MINUTES	EXTRA-ORAL DRY TIME > 60 MINUTES
ANTIBIOTICS	Prescribe systemic antibiotics: In patients <12 years old: amoxicillin for 7 days at appropriate dose for patient's age and weight. In patients >12 years old: doxycycline for 7 days, at appropriate dose for patient's age and weight. If the avulsed tooth has been in contact with soil, and if tetanus coverage is uncertain, refer to physician for a tetanus booster.		

PH Neutro range of **7.2 to 7.4** (PDL cells can **alive**)
 Osmolarity **230 a 400mOsm/Kg** (PDL cells can **reproduce**)
 Esteril solution (bacteriae are related with **resorption**, IRR)
 Components to **cells nutrition** (PDL cells **stable**)
~~Available in the place of the accident~~



Dent Traumatol. 2018 Apr;34(2):59-70. doi: 10.1111/edt.12382. Epub 2018 Feb 6.

Which is the most recommended medium for the storage and transport of avulsed teeth? A systematic review.

Adnan S¹, Lone MM¹, Khan FR², Hussain SM², Nagi SE².

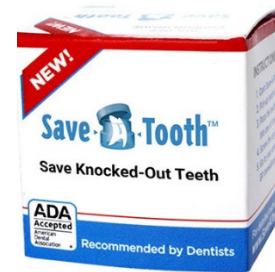
RESULTS: The initial search yielded 978 articles, but only 67 were selected. Milk was the most recommended individual medium followed by Hank's balanced salt solution. Among natural products other than milk, propolis and coconut water were most frequently recommended.

Recommendations were based on maintenance of PDL cell viability followed by ease of availability, low cost, and long shelf life.

Milk is considered as the most convenient storage medium solution in most situations

CONCLUSIONS: Natural products are more effective in maintaining the PDL cell viability compared to synthetic products. Some storage media recommendations were also based upon practical aspects. Although natural products other than milk have more recommendations as a group, milk is the most recommended storage medium individually, based not only on PDL cell viability, but also practical considerations.

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Which is the most recommended storage medium solution. A sistematic review : Milk . Based not only on the PDL cells viability, but also practical considerations. Dental Traumatology. 2018. April. 34. 59-70.

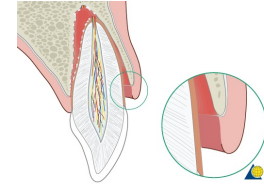
TREATMENT

Avulsion

Maturity of the root



Condition of the PDL cells



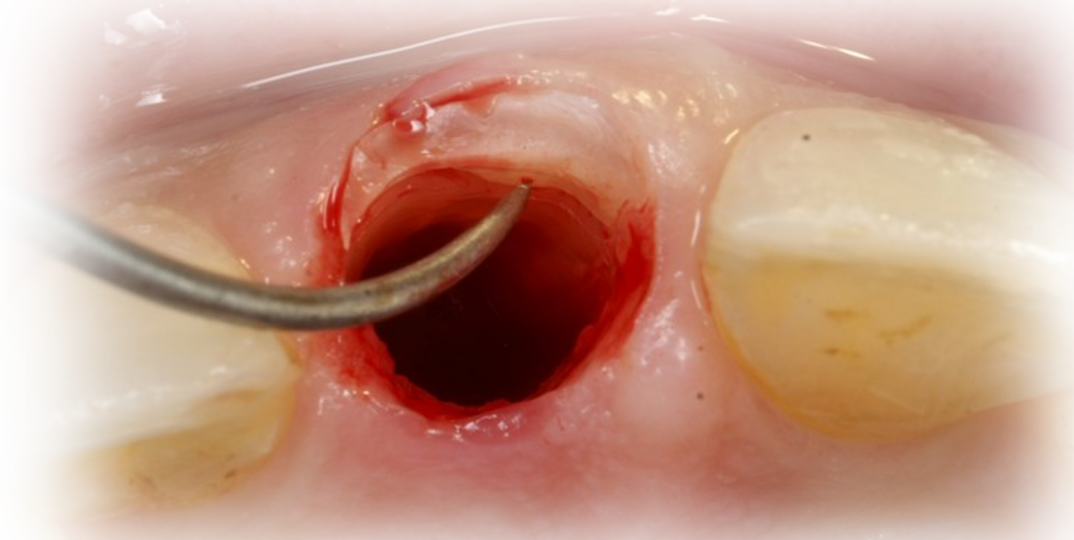
1. The PDL cells are **viable**
The tooth has been replanted **immediately**

2. The PDL cells **may be viable** but **compromised**
The tooth has been kept in storage medium and the total extra-oral dry time has been **< 60 min**

3. The PDL cells are **non-viable**
The total extra-oral dry time has been **> 60 min**

Clinical Situations

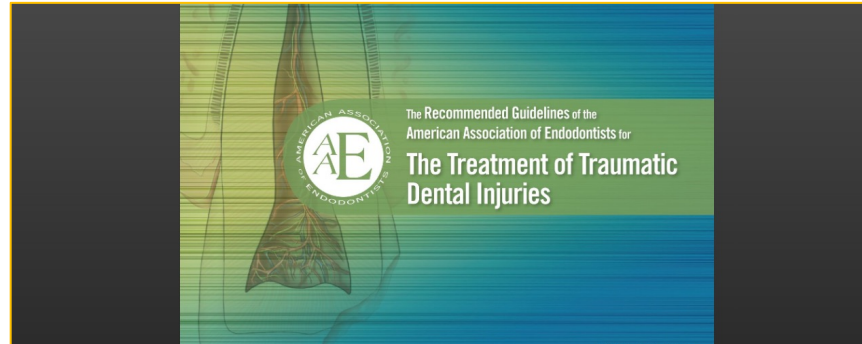
1. The tooth has been replanted immediately
2. The tooth has been replanted before 60 min
3. The tooth has been replanted after 60 min
DELAYED REPLANTATION



TREATMENT

Avulsion

Protocol Closed Apex



1. Immediately replanted

2. Biological storage medium or extraoral dry time <60 min

DELAYED REPLANTATION

3. Dry time >60 min

Splint for 2-4 weeks (Before remove it, RCT Initiation)

(CaOH 1 month, antiresorptive medicament)

Endodontic Treatment

2% Sodium Fluoride Gel

Extra oral RCT initiation

RCT=CaOH

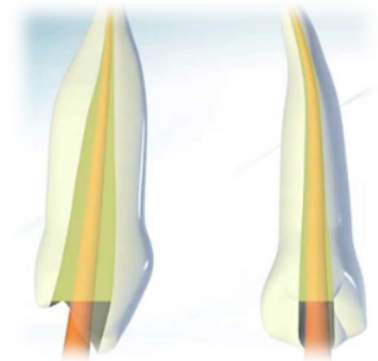
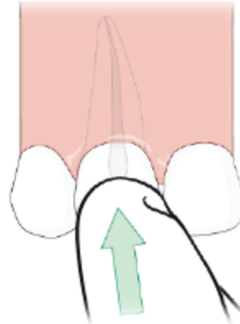
CASE REPORT

Year : 2014 | Volume : 4 | Issue : 2 | Page : 91-94

Delayed replantation after prolonged dry storage

Anita Rao, Apoorva Kommula, Muralidhar Tummala

Department of Conservative Dentistry and Endodontics, Mamata Dental College and Hospital, Giriprasad Nagar, Khammam, Andhra Pradesh, India



Delayed replantation has a poor long-term prognosis

The goal in delayed replantation is, in addition to restoring the tooth for **aesthetic, functional and psychological reasons**, to maintain **alveolar bone contour**

TREATMENT

Avulsion

Protocol Open Apex

CLEAN OPEN APEX THOROUGHLY



CLEAN SOCKET WITH SALINE



REPLANT TOOTH



CURE RESIN SPLINT WITH LIGHT



The goal for replanting still-developing teeth in children is to allow for possible **revascularization** of the pulp space

TREATMENT

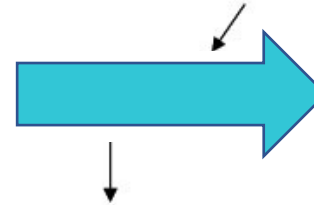
Avulsion

Protocol Open Apex



MANAGEMENT OF AN AVULSED PERMANENT TOOTH WITH AN OPEN APEX⁸

Extraoral storage time



Extraoral RCT
Initiation



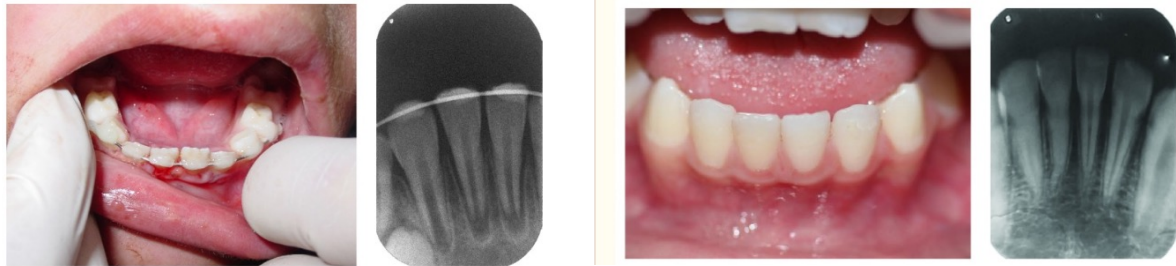
Splint for approximately 4 weeks for dry time >60 minutes

Antibiotics for 7 days ; Follow up in 7 to 10 days.



DELAYED REPLANTATION

The incidence of **Revascularization** after replantation of avulsed teeth is **34%** associated with **Open Apices**



Endod Dent Traumatol. 1995 Apr;11(2):51-8.

Replantation of 400 avulsed permanent incisors. 1. Diagnosis of healing complications.

Andreasen JO¹, Borum MK, Jacobsen HL, Andreasen FM.

⊕ Author information

- **1 week : RCT Initiation. < 1 h. Closed Apex.**
- **2 weeks:** Clinical and radiographic examination. *Splint removal*
- **1 month RCT Finish**
- 3 months *
- 6 months *
- 9 months *
- 1 year *
- Yearly for 5 years *



Splint: 4 weeks Delayed replantation

Extraoral dry time > 1h.

Clinical evaluation

1. Inspection: Tooth color
2. Tooth mobility
3. Palpation
4. Percussion: Tenderness and percussion tone
5. Pulp sensibility testing: Using carbon dioxide snow
(False negative possible up to 3 months) Open Apex
6. Presence or absence of sinus tracts, gingivitis, gingival dehiscence, and periodontal pocket depths

* *Clinical and radiographic examination*



HEALING COMPLICATIONS

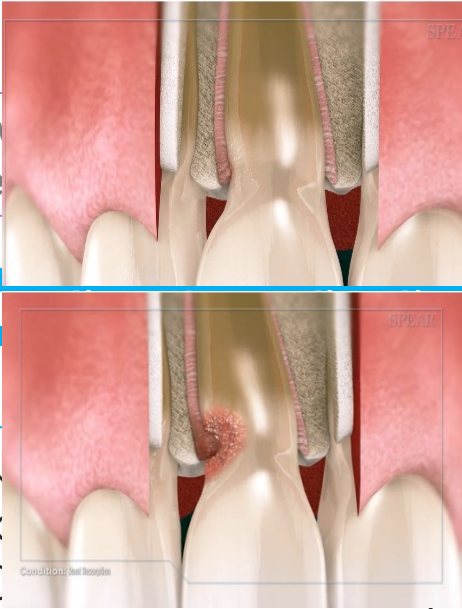
Avulsion

In cases w
tissue

Delayed Replantation a severe damage to supporting
negative consequence, **The External Root Resorption**

Pulp Hea

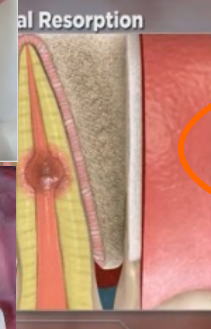
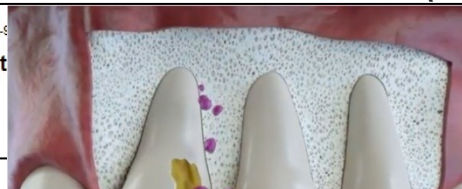
- Pulp N
- Intern
- Pulp C



(CO)

Dent Traumatol. 2005 Apr;21(2):80-8
Results after replant
Pohl Y¹, Filippi A, Kirschner H.
⊕ Author information

tic considerations.



Periodontal Healing Complications

- **External Surface Root Resorption (ESRR)**
- **External Invasive Cervical Resorption (EICR)**
- **Infection Related Resorption (IRR)**
- **Ankylosis & Replacement Root Resorption (RRR)**

Beijing Da Xue Xue Bao Yi Xue Ban. 2015 Apr 18;47(2):312-6.

[Retrospective study about periodontal ligament healing of replanted permanent teeth in children].

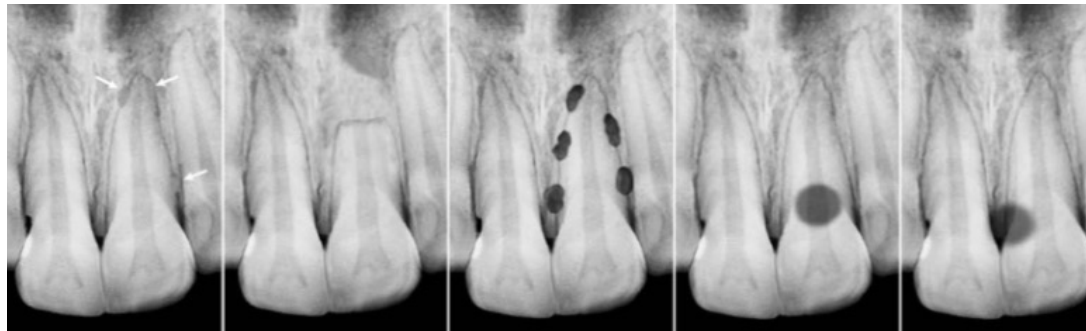
[Article in Chinese]
Bai J¹, Zhao YM², Qin M².

⊕ Author information

HEALING COMPLICATIONS

Avulsion

Replacement Root Resorption 51% > Inflammatory Root Resorption 23.3%
> Surface Root Resorption 13.3% > Internal Root Resorption 1.2%
> 1.1% Invasive Cervical Resorption




Journal of Endodontics
Volume 44, Issue 8, August 2018, Pages 1216-1227



Review Article

Incidence of Root Resorption after the Replantation of Avulsed Teeth: A Meta-analysis

Beatriz Dulcineia Mendes Souza DDS, MSc, PhD * , Kamile Leonardi Dutra DDS, MSc *, Morgane Marion Kuntze DDS, MSc *, Eduardo Antunes Bortoluzzi DDS, MSc, PhD *, Carlos Flores-Mir DDS, MSc, PhD †, Jessie Reyes-Carmona DDS, MSc, PhD ‡, Wilson Tadeu Felipe DDS, MSc, PhD *, André Luís Porporatti DDS, MSc, PhD §, Graziela De Luca Canto DDS, MSc, PhD †, §

Avulsion

Replacement Root Resorption

Complex process that results in **tooth fusion to the alveolar bone**- Ankylosis - RRR

Clinically:

Tooth is immobile, high percussive tone

Radiographically, the periodontal ligament space is absent. Bone apposition

Infra-occlusion relative to adjacent teeth

Treatment:

Can not be arrested or repaired

In children, replacement resorption leads to loss of ankylosed teeth usually in **3-7years**

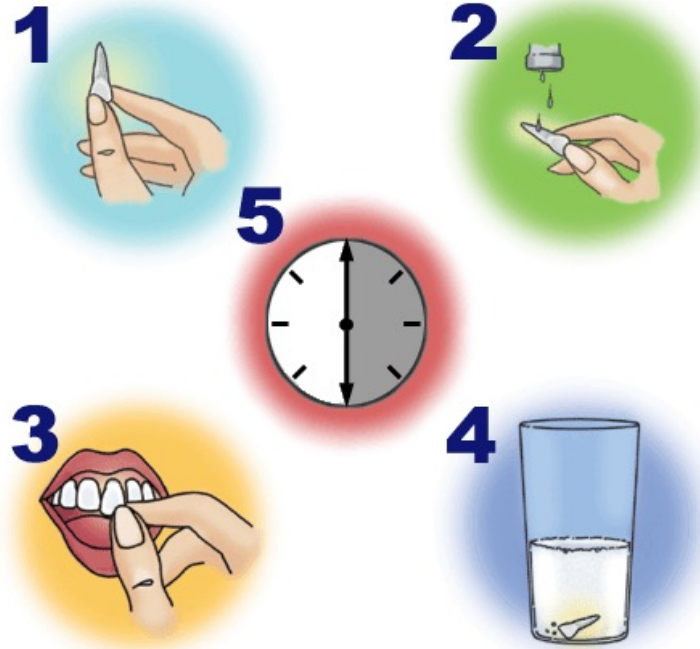
In adults: takes between 10 to 20 years



TREATMENT

Avulsion

The Shorter Time = The Better Prognosis



Andreasen JO, Andreasen FM, et Al; Rate of **73% PDL cells healing** when the tooth is replanted immediately

Case Report

Avulsion



Gender: **Female**
Age: **54 years old**

Admitted at **Deering Medical Plaza (Jackson South Medical Center)**, for treatment of traumatized and avulsed right maxillary lateral incisor after a home accident occurred 12 hours before. (Patient “fell on the floor”) **September, 2018**

Past Medical Hx: **ASA I**

Avulsion

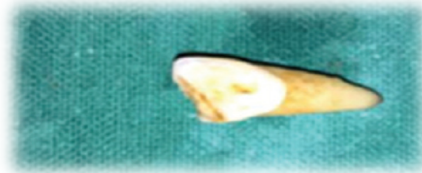
Clinical findings

Extraoral:

- Facial abrasion and hematomas
- Laceration upper lip

Intraoral:

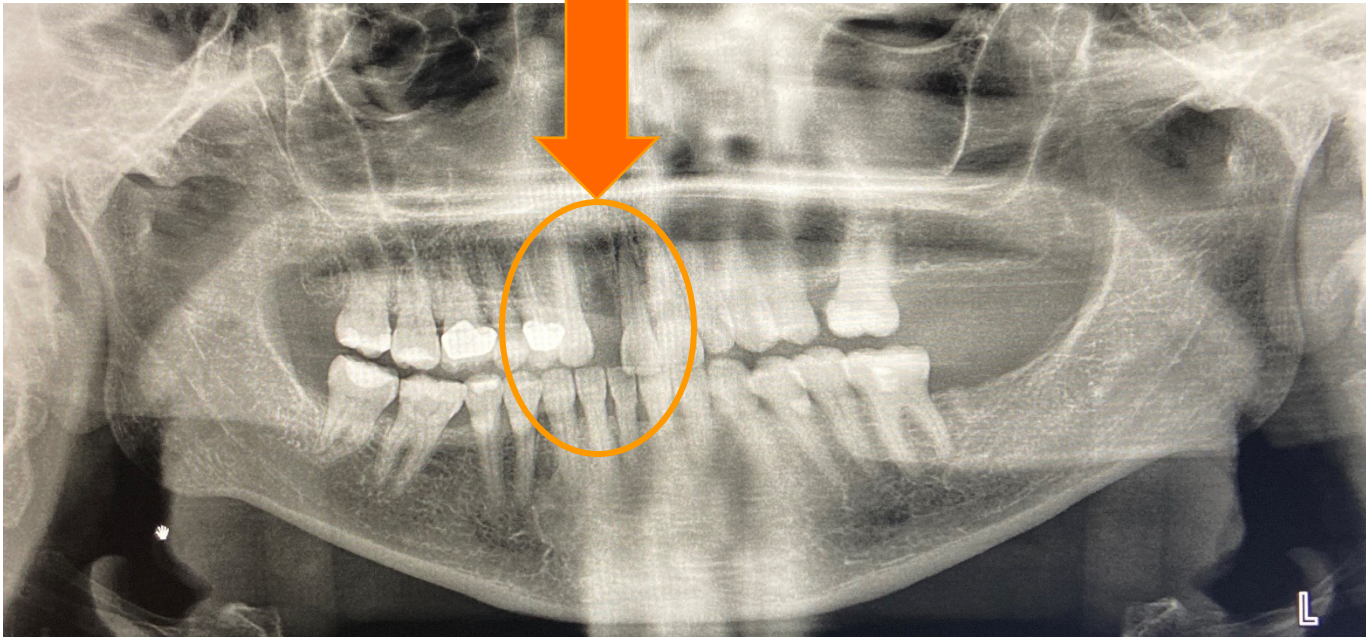
Avulsed maxillary right lateral incisor with complicated crown fracture



Avulsion

Radiographic findings

Panoramic X-ray indicated No alveolar maxillary bone fracture, No teeth fracture, No mandibular fracture, TMJ WNL, **Avulsion of maxillary right lateral incisor**



Avulsion

Treatment: In this case, the avulsed tooth was kept in a dry environment for 10 hours

- Cleaning non-viable PDL tissue with saline solution
- Irrigation with Chlorhexidine 0.12% for 5 min
- Sodium Fluoride Gel 20 minutes
- **Extra Orally RCT Initiation - CaOH Placement**
- L.A.
- Cleaning socket with saline solution
- **Replantation tooth #7**
- Verification normal position and Occlusion
- Flexible splint



Case Report

Avulsion

Teeth stabilization 4 weeks with flexible splint from #5 to #12



Patient Instructions:

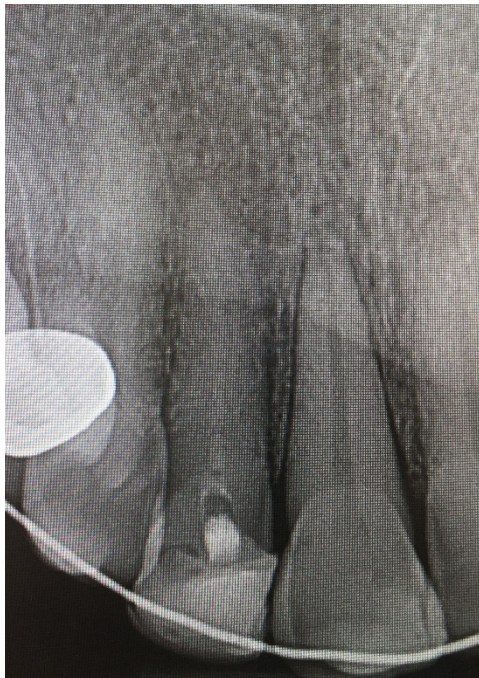


- 1.- Anti-inflammatory therapy
- 2.- Antibiotic therapy
- 3.- Chlorhexidine gluconate 0.12% for 2 week
- 4.- Soft Diet
- 5.- Meticulous and good oral hygiene. Brush with soft bristle
- 6.- Avoid participation in any sport contact
- 7.- Patient compliance with follow up visits
- 8.- Next visit splint removal in 4 weeks**

Case Report

Avulsion

4 weeks follow up/ Splint removal



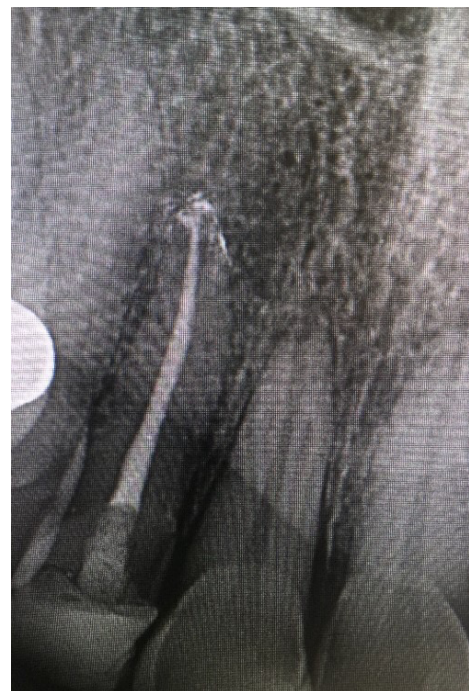
Case Report

Avulsion

6 weeks after accident



RCT Finished



Case Report

Avulsion

September 2018



October 2018



November 2018



March 2019



July 2019



December 2019



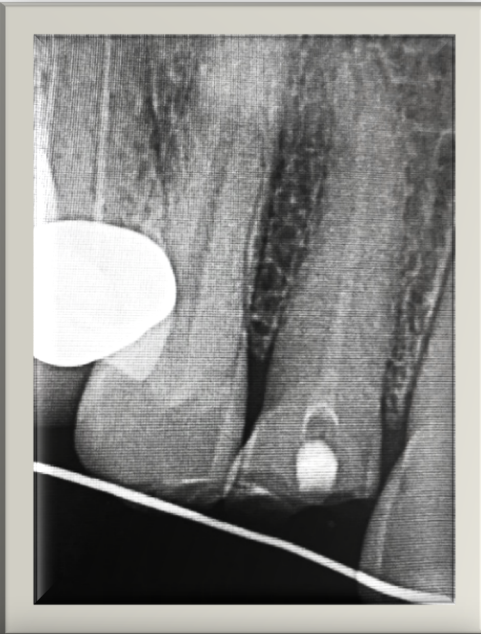
January 2020



February 2020



Endo
Evaluation
(+) #6
(-) #8 + percuss
(+) #9
(+) #10
(+) #11



Before



After



Delayed Replantation
of Maxillary Lateral Incisor



Avulsion

1. **Tooth avulsion** represents up to 16% of all TDI in permanent dentition

2. The main factors that **affect the outcome of periodontal healing** are the stage of the root development, conditions of the PDL cells, **extra oral dry time** and storage medium solution

3. Complications of avulsed teeth include **pulp necrosis, ankylotic root resorption, inflammatory root resorption, and pulp canal obliteration**. In consequence, long term follow-up is essential

Avulsion

4. According with IADT and AAE, **Delayed Replantation** has the lowest healing rate and the highest loss rate

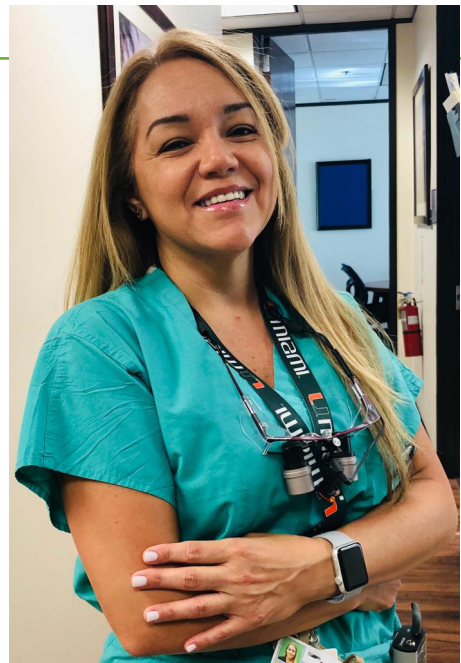
5. The success of Av
periodic clinical and

m follow up and



THANK
YOU





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