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Effectiveness of Endodontic Management of Avulsed Immature Permanent Teeth

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Introduction

- Avulsion is one of the most severe traumatic injuries of immature permanent teeth that may adversely affect the pulp and the periodontium.
- For tooth survival, immediate treatment consisting of reimplantation, and splinting is critical.
- Following the initial treatment, pulp necrosis and root resorption are the main pathologies requiring endodontic treatment.
- According to the International Association of Dental Traumatology Guidelines, endodontic treatment should be avoided unless there is clinical or radiographic evidence of pulp necrosis and infection of the root canal system on follow-up examinations.
- In this study, we investigated the most appropriate time of follow up and initiation of endodontic treatment, by critically reviewing the literature and presenting two cases completed at the University of Pennsylvania School of Dental Medicine.

Cases

Case #1: Early endodontic treatment

- A 6-year-old female avulsed tooth #8 after a fall.
- Tooth #8 was kept in milk, reimplanted within 1 hour and splinted using a flexible wire.
- Pulp revascularization was initiated within 1 week, and completed in 2 weeks.
- In 6 and 18 month follow up (Fig 1) there was absence of clinical signs and symptoms, and radiographic examinations revealed the healing of apical periodontitis.

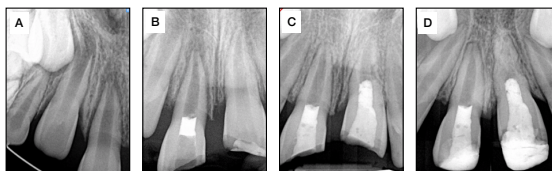


Fig 1. A) #8 Pre-Op. B) #8 Post-Op. C) 6-month follow up. D) 18-month follow up.

Case #2: Delayed endodontic treatment

- A 6-year-old male avulsed tooth #24.
- After 15 mins, #24 was placed in milk for 1 hour and then EMT tooth saver for 3 hours before reimplanted and splinted using a flexible wire.
- Pulp necrosis and external root resorption (ERR) were detected after 5 weeks.
- Revascularization was initiated and completed in 4 weeks.
- The patient was followed in 3, 6, and 17 months (Fig 2). Clinical and radiographic examinations showed resolution of the signs and symptoms and arrest of ERR.

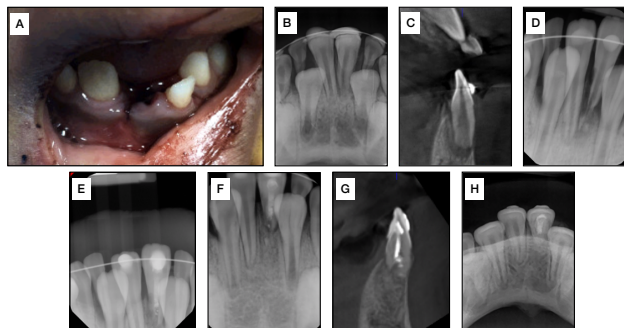


Fig 2. Clinical photos and radiographs. A) Initial exam immediately following a trauma. B) One-day after trauma. C) CBCT after 3 weeks. D) #24 Pre-Op. E) #24 Post-Op. F) 3-month follow up. G) 6 month follow up. H) 17-month follow up.

Materials and Methods

Database searched: PubMed, Ovid Medline, Embase, Cochrane
Search terms: (("Endodontics"[Mesh] OR endodontic therapy)) AND ("Tooth Avulsion"[Mesh] OR intrusion)
Publication dates: 1990 – 2022
Language: English
Age: Child: 6-12 years

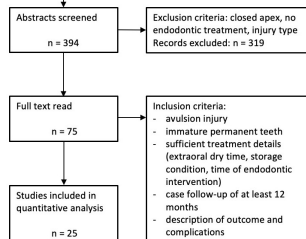


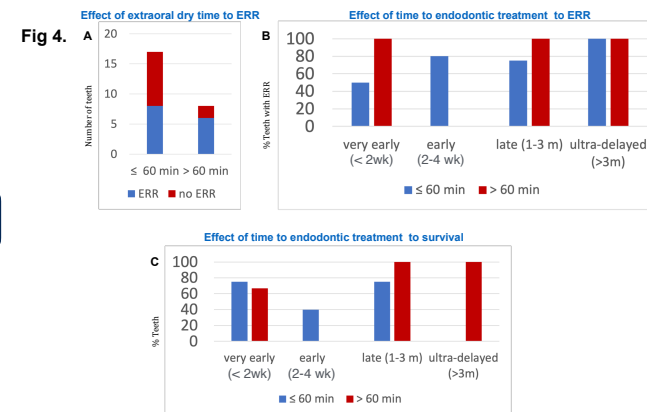
Fig 3. Literature search process and inclusion/exclusion criteria. A total of 394 papers were identified and 25 were accepted for final data analysis.

Table 1	very early		early		late		ultra-delayed	
	≤ 60	> 60	≤ 60	> 60	≤ 60	> 60	≤ 60	> 60
Total # of teeth	4	6	5	0	4	1	1	1
ERR	3	4	2	NA	3	1	0	1
no ERR	1	2	3	NA	1	0	1	0
ERR %	75	67	40	NA	75	100	0	100
survived	2	6	4	NA	3	1	1	1
extracted	2	0	1	NA	1	0	0	0
survival %	50	100	80	NA	75	100	100	NA

Table 1. Summary of avulsed immature permanent teeth included in the analysis showing extra-oral dry time, time of endodontic intervention, presence of ERR and survival.

Results

- 25 teeth included in the study, 17 teeth had ≤ 60 minutes and 8 had > 60 min of extra-oral dry time. There was a trend towards increased (but not statistically significant) ERR occurrence in the over 60 minute, (Fisher's exact test, $p = 0.23$) (Fig4A).
- To determine the impact of the time to endodontic intervention to ERR (Fig. 4B) and survival of the teeth (Fig. 4C), the data was stratified into four time segments and the extra-oral dry time; trends were not observed. A total of 4 teeth were eventually extracted due to vertical fracture following re-traumatization.



Conclusion

- To date, published studies on avulsed teeth do not include time to initial treatment, follow up frequency and time between initial treatment to endodontic intervention. Therefore, in our study we did have the statistical power to identify predictors of endodontic treatment success on the basis of these factors.
- As shown, in our second case, a delay in the endodontic management of avulsed immature permanent teeth may affect the treatment outcome.
- Future publications on the treatment of avulsed teeth should include time to initial treatment, follow up frequency and time between initial treatment to endodontic intervention information as these factors may be important in the outcomes.

References

1. Trope, Martin. Root resorption due to dental trauma. Endodontic Topics 2002.