

Successful Replantation of Avulsed Teeth with Arch Bar Fixation and Extraoral Root Canal Treatment: A Case Report

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ABSTRACT

Background: Tooth avulsion is the detachment of a tooth from its socket due to mechanical trauma. It was reported that a 26-year-old male patient was referred from the RSND Emergency Department to the dental clinic with complaints of loose front teeth of the upper jaw due to a traffic accident. From the intraoral examination, tooth 11 was partially detached from its socket, tooth 12 had an Ellis class II fracture, and a torn wound on the labial mucosa of the lower lip. Treatment of choice in this case is replantation and fixation of avulsed teeth, which aim to restore the physiological function of the teeth.

Case: Treatments include extraoral root canal treatment and replantation and fixation of the arch bar. Clinical and radiographic examinations during post-treatment control showed periodontal tissue healing and bone formation.

Conclusion: It was concluded that the success rate of tooth replantation, in this case, was good, and using the right arch bar provided stability to the avulsed tooth, thereby accelerating the healing of the periodontal ligament.

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INTRODUCTION

Tooth avulsion: detachment of a tooth from its socket due to mechanical trauma. Avulsion of permanent teeth generally occurs due to falls, fights injuries, sports injuries, and car accidents. The degree of damage to the periodontium during avulsion and the maintenance of the viability of periodontal ligament cells on the root surface of vital teeth determine the success of replantation of an avulsed tooth.^{1,2}

Replantation is the treatment of choice for treating avulsed teeth, which aims to restore the physiological function of the tooth. The term tooth avulsion is used to indicate a situation where a natural tooth is released from its socket due to trauma. Avulsion events in natural teeth can break the periodontal ligament fibers and neurovascular bundles, and can also injure the alveolar bone and surrounding teeth. When a tooth is released from its socket, the pulp cells and periodontal ligament begin to experience damage due to lack of blood supply.^{1,3}

The use of an Arch Bar in cases of avulsion is able to stabilize tooth mobility and help the periodontal ligament healing process by providing support for periodontal tissue in distributing chewing loads. Arch Bars provide little space for tooth movement and allow the periodontal ligament to receive light-intensity chewing loads.^{4,5}

This case report article describes the management and results of treatments for a central incisor tooth that experienced avulsion due to trauma from an accident.

CASE REPORT

A 26 years old male patient was referred from the RSND emergency room to the dental clinic on October 19 2022, with complaints of loose upper jaw front teeth due to a traffic accident in the morning around 10 AM. The results of the clinical examination showed that his general condition looked mildly ill, blood pressure was 120 /75mmHg, pulse 80x/minute. On extraoral examination, the patient's lower lip and chin appeared to be injured and swollen. From the intraoral examination, it was found that tooth 11 was partially separated from its socket, tooth 12 had an Ellis class II fracture, and the labial mucosa of the lower lip had a torn wound. Based on the data obtained, this patient was diagnosed with Dentoalveolar Fracture and replantation was planned.



Figure 1. Extrusion of the right anterior front tooth.

The first visit treatment involved extraction of tooth 11 with local anesthesia. The tooth that has been removed is placed in a saline solution. After the tooth is cleaned with saline, root canal treatment is performed in the tooth extraorally. Root canal preparation, extirpation, filling with gutta percha point and sealer, then closing with composite resin as the base and Glass Ionomer Cement (GIC) as the filling. After the root canal treatment is completed, the tooth socket is cleaned with saline solution. Followed by the insertion of tooth 11 into the socket, then fixed with an Archbar. After the teeth are well fixed, the patient is given prescribed medication to treat infection and pain: 500mg mefenamic acid, 0.5% chlorhexidine acetate gauze, and Minosep™ mouthwash. Patient is instructed to eat soft foods for three days, not consume hot drinks, brush the teeth slowly, and checkup one week later.

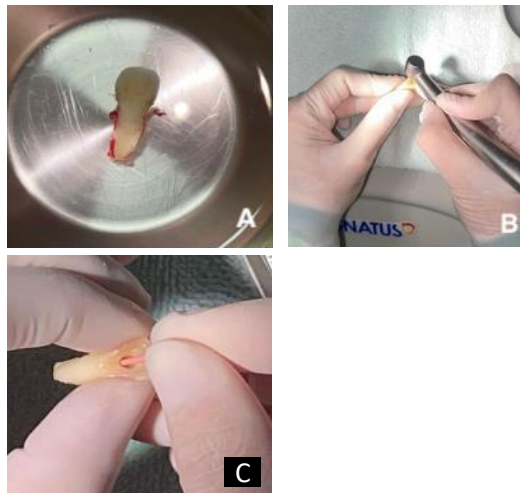


Figure 2. Stages of Root Canal Treatment (A) The extracted tooth is soaked in saline solution; (B) Open Access; (C) Root canal filling with Gutta-Percha.



Figure 3. Arch Bar Installation.

RESULTS

On the 7th day of control, October 26 2022, the patient was controlled and had irrigation performed. The patient did not complain of pain. Clinical examination shows that the soft tissue is in the process of healing, pain in the



upper teeth has decreased, pain when percussed, there is no mobility. On the 44th day of control, November 30 2022, the patient came back for control. The Arch Bar was removed because the patient's teeth did not show mobility and periodontal tissues abnormalities.

Figure 4. After using the Arch Bar for six weeks (A), control two weeks after removing the Arch Bar (B).

The next visit was carried on January 6, 2023, the patient brought the radiology results. The results of the radiological examination showed that on the x-ray there were no periapical abnormalities and bone formation was visible around the root of tooth 11.

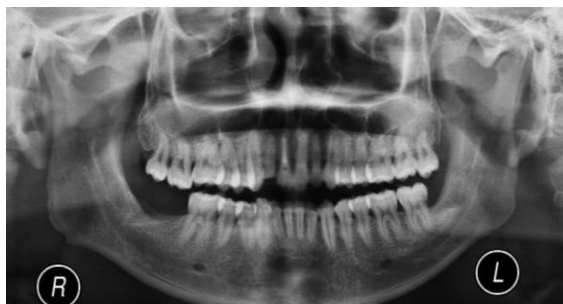


Figure 5. X-ray photo 2.5 months after replantation.

DISCUSSION

Tooth avulsion is the detachment of a tooth from its socket due to mechanical trauma.^{1,2,6} Avulsions of permanent teeth generally occur due to falls, fights, sports injuries, and car accidents. Tooth avulsion is considered a dental emergency.¹ The degree of damage to the periodontal tissue during avulsion and the maintenance of the viability of periodontal ligament cells on the surface of the surviving tooth root determine the success of replantation of an avulsed tooth. The length of time the tooth is outside the socket and the storage conditions greatly influence the periodontal ligament cells to remain vital. Necrotic periodontal ligament cells result in progressive resorption of the tooth root.^{1,7}

In this case, the patient experienced an avulsion of his maxillary teeth caused by a traffic accident in front of the Diponegoro National Hospital so treatment could be carried out immediately. Avulsed permanent teeth have a 60 minutes window. The step taken is to put it in storage media. In the treatment of avulsed teeth, storage media are useful as physiological solutions that closely replicate oral conditions to help adapt the periodontal ligament to teeth that have been avulsed.^{2,8,9} The storage media used can be saline, milk, saliva, etc. Saline has a pH of 7 and is compatible with periodontal ligament cells.^{2,3} Meanwhile, saliva can only be used for a limited time because it can cause damage to periodontal cells if used for more than one hour.^{6,7,10} Storage of saliva for 2 - 3 hours can cause swelling and damage to ligament cells periodontal.³ Milk is an ideal storage medium used to treat avulsion cases. Soaking in milk must be done in the first 20 minutes after avulsion for more effective result.^{6,10} Milk is able to maintain the viability of periodontal ligament cells, free of bacteria, and has a physiological pH of 6.5 – 7.2.^{3,11} Milk contains nutritional components such as amino acids, vitamins, and carbohydrate. Research by Khademi, et al states that periodontal ligament cells have been proven to survive for 2 – 6 hours when soaked in milk. Sour milk should not be used because it is harmful to periodontal ligament cells.¹⁰

The ideal requirements for an avulsed tooth storage medium must have antimicrobial characteristics, maintain the viability of the periodontal ligament, support the proliferative capacity of cells, have the same osmolarity as body fluids (290-300 mosmol/kg) and a balanced pH (7.2 – 7.4), be non-reactive with body fluids, does not produce antigen-antibody reactions, reduces the risk of post-replantation root resorption or ankylosis,

has a good shelf life, is effective in different conditions, and is clean from foreign materials and toxic products with the use of appropriate storage media.² In this case, the avulsed tooth is soaked in saline before root canal treatment is carried out. This is done to reduce the risk of root resorption or ankylosis during replantation.^{8,12,13} External periodontal ligament resorption was caused by the patient's motorbike accident. The accident caused trauma to the anterior teeth which resulted in damage to the cervical periodontal ligament and loss of the root pre cementum layer. The choice of root canal treatment before or after replantation can be considered based on the length of time the tooth is avulsed outside the mouth until it is replanted.^{6,7,11} Avulsed teeth can be replanted without root canal treatment if the periodontal ligament is still vital as long as the tooth is still outside the socket.⁷

In this case, the avulsed tooth is in an inadequate environment, so the option of root canal treatment outside the socket is carried out before the tooth is replanted. During root canal treatment outside the socket, the part of the tooth that can be held is the crown, this is because the root still contains periodontal fibers which can help the fixation process in the socket.^{11,13} Root canal treatment begins with pulp extirpation, filling the root canal with guttapercha point and endomethasone, then root ending or root tip using glass ionomer (Fuji 9™). Some root end filling materials that can be used are amalgam, zinc oxide eugenol cement, polycarboxylate cement, glass ionomer cement, and mineral trioxide aggregate (MTA). MTA is the best material for root end filling.^{14,15,16}

Replantation is an action in the field of dentistry which refers to the installation or insertion and temporary fixation of an avulsed tooth. Immediate replantation, before 30 minutes of the tooth being out of the socket, promises healing and periodontal ligament reformation of up to 90%.^{7,11} Determining the success of replantation requires paying attention to several things, namely the avulsed tooth must be healthy without caries, the crown or root is not fractured, there are no periodontal abnormalities, the socket of the avulsed tooth remains intact, the time the tooth is outside the mouth is no more than 60 minutes, and the storage media must remain intact.²

Fixation of the avulsed tooth in this case was carried out with an arch bar for 6 weeks. Arch bars provide less space for tooth movement and allow the periodontal ligament to continue to receive light intensity chewing loads. Chewing load can stimulate nitric oxide (NO), and increase fibroblast growth factor. NO induces osteoblast apoptosis and suppresses the bone healing process, so that the periodontal ligament can carry out a repair process before the reinforcement process, this can reduce the risk of ankylosis during healing.^{4,5} The bone healing process includes an inflammatory phase, cellular proliferation, callus formation and a remodeling phase. Systemic regulation of bone remodeling is influenced by vascular factors. Vascularization is very important in bone development, supplying blood cells, oxygen, minerals, ions, glucose. Vascularization is part of the first phase of ossification. In the intramembranous ossification process which usually occurs in flat bones such as the maxilla, direct mineralization of the connective tissue which is rich in blood vessels will occur, starting from several points called the center of ossification. At this central point, mesenchymal cells (osteoprogenitor cells) proliferate and unite around the capillary network. Between the cells and around the blood vessels there is an amorphous substance with a collagen fiber structure. Osteoprogenitor cells differentiate into osteoblasts, osteoblasts progress, the trabeculae slowly thicken, and intervene in the vascular space (spongiosa layer) and narrow slowly. whereas the endochondral ossification process which occurs in

short bones such as the mandible, begins with the formation of hyaline cartilage initials which continue to grow and develop into the primary ossification center.¹⁷

Trauma occurring near the root membrane (such as laceration of periodontal ligament cells) can cause temporary hyperactivity of the root membrane which can initiate rapid production of both dentin and cementum in the apical area. During the replantation process, the root membrane may be damaged either by avulsion, during the extra-oral period, or from a tooth repositioning procedure. Rupture of periodontal ligament cells usually occurs between the alveolar bone and the root surface, but periodontal ligament cell rupture can also occur either on the alveolar bone wall or the root surface. There was revascularization in the cervical and apical parts of the periodontal ligament cells after 4 days. After 1 week, the gaps in the periodontal ligament cells are filled by proliferation of fibroblasts and blood vessels. Within 2 weeks, a number of major fibers have healed and the damaged periodontal ligament cells have healed by 50-60%. After 8 weeks the periodontal ligament cells have healed completely. The patient's x-ray results after 2.5 months showed bone formation around the root of tooth 11.^{18,19}

After the replantation is complete, the patient is instructed to avoid strenuous exercise, go on a soft diet for 2 weeks, continue brushing his teeth with a soft-bristled toothbrush, and use 0.12% chlorhexidine mouthwash twice a day for 2 weeks. Replanted teeth should be monitored clinically and radiographically at 2 weeks, 4 weeks, 3 months, 6 months, 1 year and annually thereafter for at least 5 years. Clinical examination and radiography will provide information to determine the final results.^{13,19,20}

CONCLUSION

Proper and immediate treatment of avulsed teeth can influence the success of treatment. The maximum time an avulsed tooth is outside the oral cavity is 60 minutes. In this case, the success rate for tooth replantation is high, because treatment is carried out immediately after the accident. The use of an arch bar is considered appropriate to provide stability to avulsed teeth and can speed up periodontal ligament recovery.

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REFERENCES

1. Inayah Y, Herdiyati Y. Penanganan Avulsi dua gigi permanen pada anak usia 12 tahun. *J Indones Dent Assoc.* 2018;1(1):86-91.
2. Abdalla Eltahir M, Fath Elrahman Ibrahim R, Alharbi H. Perspective Chapter: Teeth Avulsion. 2023;(July).
3. Venugopal M. Recent Advances in Transport Medium for Avulsed Tooth. *Amrita J Med.* 2022;18(2):37-44.
4. Marantson N. Penggunaan Arch Bar pada Fraktur Dentoalveolar. *Maj Biomorfologi.* 2019;29(1):19-26.
5. Qureshi A, Reddy U, Warad N, Badal S, Jamadar A, Qurishi N. Intermaxillary fixation screws versus Erich arch bars in mandibular fractures: A comparative study and review of literature. *Ann Maxillofac Surg.* 2016;6(1):25.
6. Ameli S, Jafari K, Zadfatah F, Blurian M, Hekmatfar S. Delayed Replantation of Avulsed Teeth: A Case Report. *Zahedan J Res Med Sci.* 2021;23(2).
7. Kadulkar N, Katak R, Deka A, Thonai S. Replantation of an Avulsed Tooth: A Case Report. *Cureus.* 2023;15(5):1-6.
8. Suresh D, Sangappa K, Kumar AP, Srivastava P. Extra-Alveolar Storage Media for teeth: A Literature

- review. *Int J Adv Res.* 2014;2(7):963-972.
9. Pogrel, MA, Kahnberg, K AL. Essentials of Oral and Maxillofacial Surgery. Published online 2014:268-267.
 10. Kaur N, Srivastava N, Rana V, Kaushik N, Pruthi T. Storage Medium for Avulsed Teeth: a Literature Review. *Int J Adv Res.* 2021;9(08):874-886.
 11. Marampa WR, Marari SZ, Kende SY, et al. Replantation and non-surgical treatment of an avulsion teeth due to physical trauma in remote area: a case report. Published online 2023:3664-3671.
 12. Siddiqui F, Karkare S. Storage Media for An Avulsed Tooth: Nature to the Rescue. *Br J Med Heal Res.* 2014;1(3):1-10.
 13. Hupp, JR, Ellis III, E TM. *Contemporary Oral and Maxillofacial Surgery 7th Ed.*; 2019.
 14. Park N, Song J. Outcome of Regenerative Endodontic Treatment for an Avulsed Immature Permanent Tooth: A Case Report. *J Korean Acad Pediatr Dent.* 2018;45(2):250-256.
 15. Qualtrough, AJE, Satterthwaite, JD, Morrow, LA, Brunton P. *Principles of Operative Dentistry.*; 2005. d
 16. Garg N, Garg A. *Textbook of Endodontics Fourth Edition.*; 2019.
 17. Street J, Bao M, DeGuzman L, et al. Vascular endothelial growth factor stimulates bone repair by promoting angiogenesis and bone turnover. *Proc Natl Acad Sci U S A.* 2002;99(15):9656-9661.
 18. Andreasen J. *Textbook and Color Atlas of Traumatic Injuries to the Teeth.* John wiley & Sons; 2018.
 19. Rai A, Koirala B, Dali M, Shrestha S. Delayed replantation of avulsed permanent maxillary central incisor: Case report with 6-year follow-up. *Clin Case Reports.* 2024;12(2):1-7.
 20. Fouad AF, Abbott P V., 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(4):331-342.