



Interdisciplinary management of dental avulsion: from emergency care to long-term prognosis

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Abstract

INTRODUCTION. Dental avulsion is a traumatic dental injury defined by the total displacement of a tooth from its alveolar socket. The most effective intervention in these cases is the reimplantation of the avulsed tooth. Additionally, a long-term follow-up plays a crucial role in managing potential complications.

AIM. To present and analyze two clinical cases of dental avulsion in children, emphasizing the importance of immediate reimplantation, appropriate storage media, and strict follow-up protocols in determining long-term prognosis.

MATERIAL AND METHODS. Two pediatric patients with dental avulsion were examined and treated: Case 1: A 12-year-old patient with avulsion of two mature upper central teeth stored in milk, presented 15 minutes post-trauma. Initial reimplantation and rigid contention were performed by a general practitioner. Root canal treatment was initiated 2 weeks later at the Pediatric Dentistry and Prevention Department, Monastir Dental Clinic, followed by interceptive treatment and a 24-month follow-up. Case 2: A 10-year-old patient with avulsion of two immature upper central teeth stored in milk for 24 hours. Reimplantation and rigid contention were carried out after the appearance of inflammatory signs, followed by further management.

RESULTS. In Case 1, the rapid intervention, appropriate storage medium, and timely endodontic treatment contributed to favorable healing and tooth retention over a 24-month follow-up. In Case 2, the delayed reimplantation and prolonged extraoral time negatively affected prognosis, with clinical signs of inflammation influencing the long-term stability of the teeth.

CONCLUSION. These cases highlight that immediate reimplantation, correct choice of storage medium, and strict adherence to follow-up protocols are critical for successful management of avulsed teeth. Prompt intervention and compliant follow-up care significantly influence the long-term prognosis and survival of reimplanted teeth.

Keywords: case report, tooth Avulsion, reimplantation, complication, follow-up

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Междисциплинарное ведение авульсии зубов: от неотложной помощи до долгосрочного прогноза

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Резюме

ВВЕДЕНИЕ. Авульсия зуба – это травматическое повреждение, характеризующееся полным смещением зуба из альвеолы. Наиболее эффективным методом лечения в таких случаях является реплантация авульсированного зуба. Дополнительно важную роль играет длительное наблюдение, позволяющее контролировать и корректировать возможные осложнения.

ЦЕЛЬ. Представить и проанализировать два клинических случая авульсии зубов у детей, подчеркнув значение немедленной реплантации, выбора адекватной среды хранения и строгого соблюдения протоколов наблюдения для определения долгосрочного прогноза.

МАТЕРИАЛЫ И МЕТОДЫ. Были обследованы и пролечены два педиатрических пациента с авульсией зубов: Случай 1: 12-летний пациент с авульсией двух зрелых верхних центральных резцов, хранившихся в молоке; обращение через 15 минут после травмы. Первичная реплантация и жесткая иммобилизация были выполнены врачом общей практики. Через 2 недели в отделении детской стоматологии

логии и профилактики Стоматологической клиники Монастира проведено эндодонтическое лечение, далее – перехватывающее лечение и наблюдение в течение 24 месяцев. Случай 2: 10-летний пациент с авульсией двух незрелых верхних центральных резцов, хранившихся в молоке в течение 24 часов. Реплантация и жесткая иммобилизация были проведены после появления воспалительных признаков, с последующим лечением.

РЕЗУЛЬТАТЫ. В случае 1 быстрая медицинская помощь, использование подходящей среды хранения и своевременное эндодонтическое лечение способствовали благоприятному заживлению и сохранению зубов в течение 24 месяцев наблюдения. В случае 2 отсроченная реплантация и длительное экстраоральное время негативно сказались на прогнозе; клинические признаки воспаления повлияли на долгосрочную стабильность зубов.

ЗАКЛЮЧЕНИЕ. Представленные клинические случаи демонстрируют, что немедленная реплантация, правильный выбор среды хранения и строгая приверженность протоколам наблюдения являются ключевыми факторами успешного ведения пациентов с авульсией зубов. Своевременное вмешательство и последовательное наблюдение оказывают значительное влияние на долгосрочный прогноз и сохранность реплантационных зубов.

Ключевые слова: случай из практики, авульсия зуба, реимплантация, осложнения, динамическое наблюдение

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INTRODUCTION

Avulsions represent a major traumatic injury commonly encountered in general dental practice and entail prompt definitive treatment along with appropriate follow-up care. It represents one of the most serious dental emergencies and accounts for 0.5 to 16% of dental-alveolar traumas (DAT) [1]. The maxillary central incisors are the most frequently affected teeth, accounting for 0.5% to 3% of traumatic injuries in the permanent dentition [2]. Several predisposing factors may increase the risk of avulsion, including increased overjet, inadequate lip coverage, and anterior open bite [3].

The management of avulsed permanent teeth remains challenging, necessitating immediate intervention to optimize outcomes, and is carried out according to the guidelines of the International Association of Dental Traumatology (IADT) published in 2020 [4]. This work suggests 2 contrasting cases broaching the protocol and procedures to abide by during an emergency consultation for the avulsion of a mature and immature permanent tooth and highlighting the clinical outcomes, and complications associated with different scenarios.

In a second phase the short-, medium-, and long-term consequences.

CASE 1

Patient history

A 12-year-old patient was referred to the Pediatric Dentistry and Prevention Department at Monastir Dental Clinic two days after experiencing a domestic accident that led to the avulsion of both maxillary central incisors. The patient's medical history was unremarkable, with no systemic diseases or allergies reported. His tetanus vaccination status was current.

The avulsed teeth had been stored in milk and were reimplanted by a general doctor within 15 minutes of the traumatic incident.

Clinical findings

Clinical examination revealed a wound, swelling, and a firm nodule on the lower lip (Fig. 1, A). Intraoral assessment showed a composite resin splint stabilizing the reimplanted central incisors (11 and 21), which exhibited an enamel-dentin crown fracture without pulp exposure and associated gingival bleeding (Fig. 1, B). Radiographic assessment confirmed proper positioning of the mature reimplanted teeth, as shown on periapical X-rays (Fig. 1, C). Additionally, an occlusal X-ray revealed radiopaque fragments in the lower lip, suggesting the presence of embedded dental fragments (Fig. 1, D).

Therapeutic intervention

It involved surgical removal of the embedded dental fragments (Fig. 2, A), followed by wound disinfection with povidone-iodine, and suturing. (Fig. 2, B).

In a second phase, the rigid composite splint was replaced with a flexible twisted orthodontic wire splint extending from canine to canine for two weeks (Fig. 2, C, D) to promote physiologic mobility and reduce the risk of ankylosis.

The prescribed medication included a 7-day course of amoxicillin, pain management with paracetamol for 5 days, and ibuprofen for 5 days to control inflammation. Oral hygiene care included an antiseptic mouthwash for 10 days, a soft diet for one week.

Two weeks post-trauma, root canal treatment was initiated with calcium hydroxide medication, followed by final obturation gutta-percha (Fig. 3, A, B) and composite restoration. (Fig. 3, E).

In the last phase, due to a thumb-sucking habit causing an anterior open bite, the patient was fitted with a removable anti-thumb-sucking appliance and tongue-strengthening exercises. (Fig. 4).

Follow-up and outcomes

Clinical and radiographic evaluations were conducted at regular intervals (1 week, 2 weeks, 1 month, 3 months, 6 months, 12 months, and 24 months).

At 6 months, a significant reduction in the anterior open bite was observed (Fig. 4, C). By 12 months, no clinical complications were noted, though but periapical radiographs revealed evidence of external root resorption in the apical third of both central incisors (Fig. 3, C). At the 24-month follow-up, the teeth remained stable without mobility or signs of inflammation, and radiographic findings confirmed that the external root resorption had ceased (Fig. 3, D).



Fig. 1. Clinical findings patient: *A* – exobuccal photograph showing facial trauma with swelling and nodule formation on the lower lip; *B* – intraoral photograph of reimplanted maxillary permanent central incisors with rigid composite splint in place. Note the enamel-dentin crown fractures without pulp exposure and associated gingival inflammation; *C* – preoperative periapical X-ray confirming proper positioning of the reimplanted mature central incisors; *D* – occlusal X-ray revealing multiple radiopaque dental fragments embedded in the lower lip

Рис. 1. Клинические данные пациента: *A* – внеоральная фотография, демонстрирующая лицевую травму с отеком и формированием узелка на нижней губе; *B* – интраоральная фотография реплантированных постоянных верхних центральных резцов с установленной жесткой композитной шиной. Отмечаются коронковые переломы эмаль-дентинного типа без вскрытия пульпы, сопровождающиеся воспалением десны; *C* – предоперационный прицельный рентгеновский снимок, подтверждающий правильное положение реплантированных зрелых центральных резцов; *D* – окклюзионный снимок, выявляющий множественные рентгеноконтрастные зубные фрагменты, внедренные в мягкие ткани нижней губы

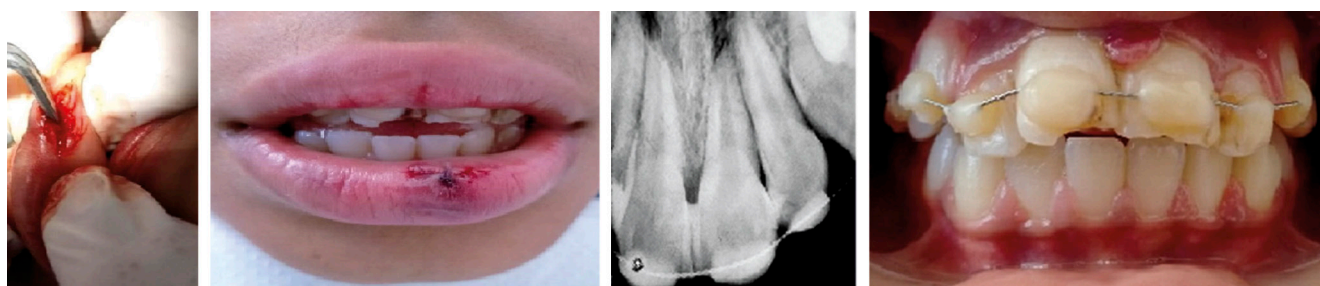


Fig. 2. Initial treatment including surgical management and suturing and splinting modification: *A* – horizontal incision to remove the tooth fragments; *B* – resorbable suture to close the wound; *C* – removal of the initial rigid composite and Application of the flexible twisted orthodontic wire splint (extending from canine to canine); *D* – postoperative periapical X-ray showing proper repositioning

Рис. 2. Первоначальное лечение, включающее хирургическую обработку, ушивание раны и модификацию шинирования: *A* – горизонтальный разрез для удаления зубных фрагментов; *B* – закрытие раны с использованием рассасывающегося шовного материала; *C* – снятие исходной жесткой композитной шины и наложение эластичной витой ортодонтической проволочной шины, фиксированной от клыка до клыка; *D* – послеоперационный прицельный рентгеновский снимок, демонстрирующий правильное репозиционирование

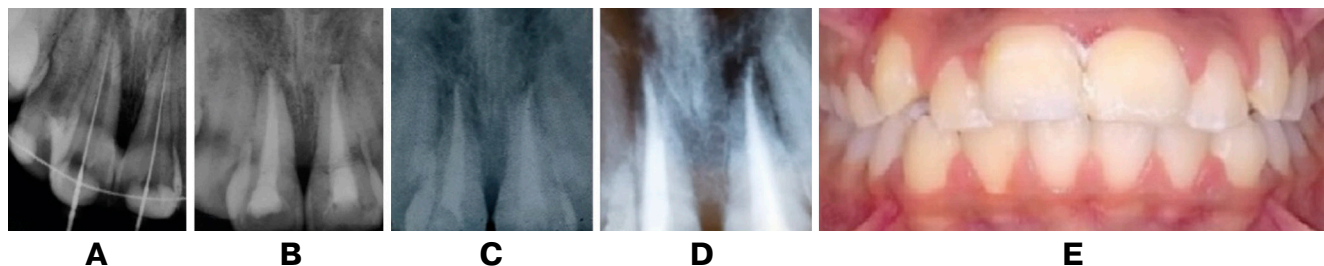


Fig. 3. Conservative treatment illustrating the endodontic treatment preceded by follow-up care at 12 months and 24 months and the coronal restoration: *A* – working length determination confirmed with periapical radiograph; *B* – radiograph confirming complete obturation of the root canals with gutta-percha and sealer; *C* – periapical X-ray at 12 months showing evidence of external root resorption in the apical third of both central incisors; *D* – periapical X-ray at 24 months demonstrating stabilization of the external root resorption process with no further progression. Note the intact periodontal ligament space and absence of periapical pathology; *E* – final composite resin restorations

Рис. 3. Консервативное лечение, включающее эндодонтическое вмешательство, последующее наблюдение через 12 и 24 месяца, а также коронковую реставрацию: *A* – определение рабочей длины, подтвержденное прицельным рентгеновским снимком; *B* – рентгенограмма, подтверждающая полную obturацию корневых каналов гуттаперчей и силером; *C* – прицельный рентгеновский снимок через 12 месяцев, демонстрирующий признаки внешней резорбции корня в апикальной трети обоих центральных резцов; *D* – прицельный рентгеновский снимок через 24 месяца, демонстрирующий стабилизацию процесса внешней резорбции без дальнейшего прогрессирования. Отмечается сохраненное пространство периодонтальной связки и отсутствие периапикальной патологии; *E* – окончательные реставрации композитной смолой

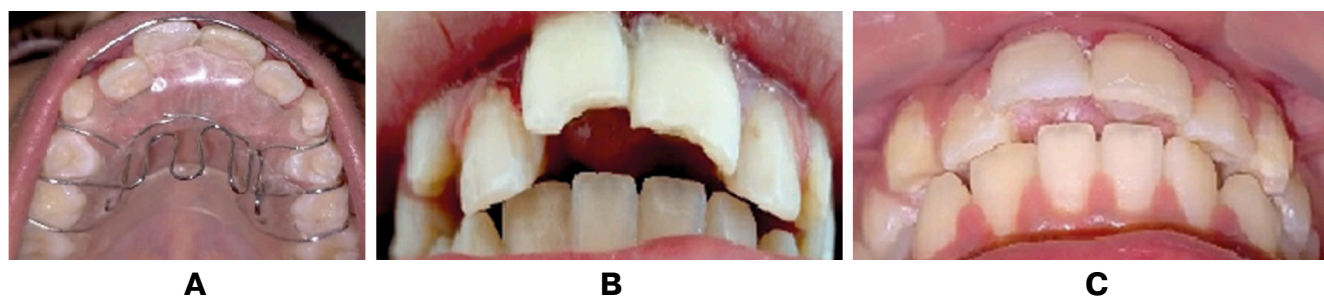


Fig. 4. Interceptive orthodontic treatment: *A* – intra-oral view of the appliance in place, positioned to prevent digit placement during thumb-sucking attempts; *B* – initial presentation of anterior open bite before interceptive treatment; *C* – day 180 with thumb guard showing a reduction in the open bite

Рис. 4. Перехватывающее ортодонтическое лечение: *A* – интраоральный вид установленного аппарата, препятствующего введению пальца в полость рта при попытках сосания; *B* – первичное состояние – передний открытый прикус до начала перехватывающего лечения; *C* – состояние на 180-й день с использованием защитного аппарата для большого пальца отмечается уменьшение открытого прикуса

CASE 2

Patient history

A 10-year-old patient consulted the Pediatric Dentistry and Prevention Department at Monastir Dental Clinic with his mother 24 hours after experiencing a traumatic incident, resulting in the complete avulsion of both maxillary central incisors.

The patient's medical history revealed no systemic diseases, and their health history was not contributory. The tetanus vaccination was up to date.

Clinical findings

Clinical examination revealed swelling of the upper and lower lips, lacerations and wounds on the nose, and scab formation on the lips (Fig. 5, A). Intraoral as-

essment showed empty alveolar sockets for teeth 11 and 21 with blood clot formation. Since the avulsed teeth had been adequately preserved in milk (Fig. 5, B), reimplantation was deemed appropriate.

Therapeutic intervention

The emergency treatment consisted in gentle alveolar curettage (Fig. 6, A), blood clot removal, followed by irrigation with sterile saline solution. The root surfaces were cleaned with sterile gauze soaked in saline to remove necrotic periodontal ligament tissue. Teeth 11 and 21 were then reimplanted into their respective sockets (Fig. 6, B), with clinical and radiographic verification ensuring proper positioning (Fig. 6, C).

Then, a flexible splint was placed from canine to canine for two weeks to stabilize the reimplanted teeth (Fig. 6, D, E).

The patient was prescribed a 7-day course of amoxicillin, paracetamol for 5 days for pain management, and ibuprofen (400 mg) for 5 days as an anti-inflammatory. Oral care guidelines emphasized using an antiseptic mouthwash for 10 days, adhering to a soft diet for one week.

Follow-up and outcomes

After missing the first follow-up, the patient returned after four weeks with signs of acute apical periodontitis,

necessitating immediate endodontic intervention with calcium hydroxide medication.

At the 8-week follow-up, inflammation had improved, but external root resorption was detected, requiring another round of medication (Fig. 7, A). The patient subsequently missed several follow-up appointments. At 4 months the patient returned, with accelerated resorption in tooth 21, while tooth 11 appeared relatively stable. Tooth 11 underwent apexification with a bioceramic plug (Fig. 7, B), followed by permanent root canal filling (Fig. 7, C). Despite the aggressive resorption observed in tooth 21, the stabilization allowed for apexification and final root canal obturation. (Fig. 7, D, E).



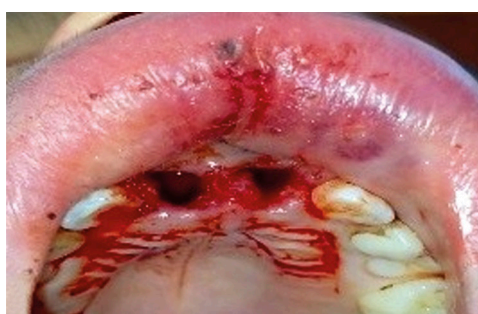
A



B

Fig. 5. Clinical findings patient: A – exobuccal photograph showing facial trauma with swelling of the upper and lower lips, lacerations and wounds on the nose, and scab formation on the lips; B – avulsed 11 and 21 stored in milk for 24 hours prior to reimplantation. Note the absence of visible root fractures

Рис. 5. Клинические данные пациента: А – внеоральная фотография, демонстрирующая лицевую травму с отеком верхней и нижней губ, наличием расщечений и ран в области носа, а также образованием корок на губах; В – авульсированные зубы 11 и 21, хранившиеся в молоке в течение 24 часов перед реплантацией. Отмечается отсутствие видимых переломов корней



A



B



C



D



E

Fig. 6. Emergency treatment involving gentle alveolar curettage, correct teeth reimplantation and x-ray verification then flexible splint application followed by x-ray confirmation: A – alveolar socket preparation showing gentle curettage to remove blood clots, followed by irrigation with sterile saline solution; B – clinical view immediately after reimplantation of teeth 11 and 21 into their respective sockets; C – post-reimplantation periapical radiograph confirming proper positioning; D – placement of flexible wire extending from primary canine to primary canine; E – post-splinting X-ray showing proper repositioning

Рис. 6. Экстренное лечение, включающее щадящий альвеолярный кюретаж, правильную реплантацию зубов и рентгенологическую верификацию, затем установку эластичной шины с последующим рентгенологическим контролем: А – подготовка альвеолярной лунки: щадящий кюретаж для удаления сгустков крови с последующим промыванием стерильным физиологическим раствором; В – клинический вид сразу после реплантации зубов 11 и 21 в их анатомические лунки; С – прицельный рентгеновский снимок после реплантации, подтверждающий правильное положение зубов; D – установка эластичной проволочной шины, фиксированной от временного клыка до временного клыка; E – рентгенограмма после шинирования, демонстрирующая корректное репозиционирование

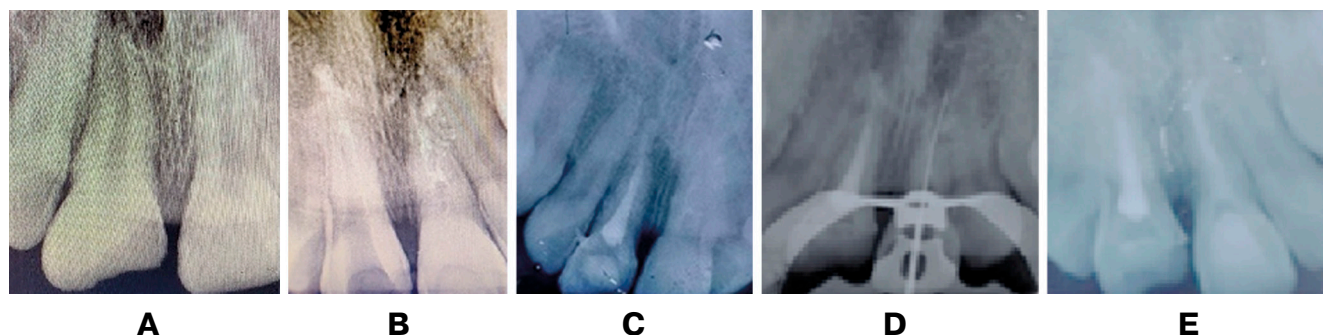


Fig. 7. Follow-up with periapical X-ray showing proof of root resorption and complication management involving root canal treatment with biodentine plug then final obturation on both incisor 11 and 21: *A* – eight-week follow-up radiograph showing early signs of external root resorption; *B* – apexification procedure for tooth 11 showing placement of biodentine apical plug (approximately 4 mm thickness) to establish an artificial barrier at the apex; *C* – final obturation of tooth 11 with gutta-percha and sealer; *D* – working length determination confirmed with periapical radiograph on tooth 21; *E* – apexification procedure for tooth 21 with biodentine apical plug placement and final obturation of tooth 21 with gutta-percha and sealer

Рис. 7. Динамическое наблюдение с прицельной рентгенографией, демонстрирующей признаки резорбции корня и проведение лечебных мероприятий, включающих эндодонтическое лечение с использованием апикальной пробки из Biodentine, а затем окончательную obturацию обоих резцов 11 и 21: *A* – рентгенограмма через 8 недель, показывающая ранние признаки внешней резорбции корня; *B* – процедура апексофикации зуба 11 с установкой апикальной пробки из Biodentine толщиной около 4 мм для формирования искусственного барьера в области верхушки; *C* – окончательная obturация зуба 11 гуттаперчей и силером; *D* – определение рабочей длины зуба 21, подтвержденное прицельной рентгенограммой; *E* – процедура апексофикации зуба 21 с установкой апикальной пробки из Biodentine и последующей окончательной obturацией гуттаперчей и силером

DISCUSSION

Traumatic dental injuries, particularly avulsion of maxillary central incisors, continue to present significant challenges in pediatric dentistry. The present cases underscore the critical role of expeditious intervention, appropriate storage media, and longitudinal follow-up in preserving tooth vitality and function.

Reimplantation and splinting protocols

The treatment approach in these cases was based on well-established principles of dental trauma management. Immediate reimplantation is the gold standard for avulsed teeth. In the first case, reimplantation was performed within 15 minutes of the traumatic incident, which is considered optimal for maintaining PDL cell viability. In the first case, reimplantation was performed within 15 minutes of the traumatic incident, which is considered optimal for maintaining PDL cell viability [5]. In contrast, the second case involved a 24-hour extra-alveolar period, which significantly compromises PDL cell survival and increases the risk of complications such as inflammatory root resorption and ankylosis [6]. The IADT guidelines recommend immediate reimplantation at the site of injury whenever possible, or otherwise, preservation in an appropriate storage medium such as milk, Hank's Balanced Salt Solution (HBSS), or saline, followed by prompt professional intervention [6].

Regarding splinting, both cases initially employed flexible wire-composite splints, which allow physio-

logical mobility of the reimplanted teeth and reduce the risk of ankylosis. Current evidence suggests that a short-term (2 weeks) flexible splint provides superior outcomes compared to rigid splinting, as it promotes functional healing of the periodontal ligament [7]. The first case initially had a rigid composite splint, which was replaced with a flexible wire splint to facilitate optimal healing. This approach aligns with evidence-based protocols advocating physiological functional fixation to mitigate the risk of ankylosis and reduce the likelihood of complications such as root resorption [8]

Endodontic management and external root resorption

Endodontic intervention is essential for reimplanted teeth, particularly when they are mature with closed apices, as observed in the first case. The timing of endodontic treatment is critical, with the IADT recommending initiation within 7–10 days post-reimplantation for mature teeth to prevent inflammatory root resorption [4]. In both cases, calcium hydroxide was used as an intracanal medicament due to its antimicrobial properties and ability to inhibit inflammatory root resorption [9].

The first case demonstrated stabilization of external root resorption by the 24-month follow-up, suggesting effective management through timely endodontic intervention and calcium hydroxide medication. In contrast, the second case exhibited progressive external root resorption, likely exacerbated by delayed follow-

up and the extended extra-alveolar period. This highlights the importance of strict adherence to follow-up protocols and the potential consequences of delayed intervention.

For immature teeth with open apices, as observed in the second case, apexification with biocompatible materials such as biodentine or mineral trioxide aggregate (MTA) is recommended to establish an apical barrier and facilitate obturation [10]. Biodentine was chosen for the second case due to its superior biocompatibility, sealing ability, and ability to promote dentinogenesis [11]. While the resorption process was aggressive, particularly in tooth 21, apexification and final obturation were successfully performed, emphasizing the resilience of immature teeth despite significant challenges.

Complications and Long-Term Prognosis: Complications, such as acute apical periodontitis observed in Case 2, underscore the necessity of timely endodontic intervention. Noncompliance with scheduled follow-ups contributed to progressive external resorption, necessitating apexification with a biodentine plug [11].

In cases of tooth avulsion followed by reimplantation, pulpal necrosis is the most common complication. This occurs in two-thirds of replanted immature teeth and systematically in mature teeth due to rupture of the neurovascular bundle during trauma, leading to pulp degeneration.

Clinical signs include negative pulp sensitivity tests, axial percussion sensitivity, greyish discoloration, and radiographic loss of the lamina dura with periapical radiolucency. Necrosis can manifest as early as three weeks post-trauma, exacerbating periodontal inflammation and worsening prognosis [12]. Endodontic treatment, including intra-canal medication, is typically needed; however, complications such as external root resorption may still occur.

Root resorption is a destructive process that can be external or internal, though trauma-related cases are mostly external. It's triggered by damage to the cementum layer and can be worsened by factors like prolonged extraoral time (over 2 hours), bacterial contamination, improper cleaning, or extended splinting [13].

Three types exist: surface resorption, inflammatory resorption, and replacement resorption (ankylosis). Inflammatory resorption is most common and results from bacterial invasion and pulpal necrosis, leading to progressive root loss. Replacement resorption (ankylosis) involves direct fusion of bone to root due to damage to periodontal ligament cells, ultimately leading to infraocclusion as the tooth becomes integrated into the bone [14].

While guidelines often emphasize immediate replantation, cases with extended dry periods (e.g., 13 hours) have shown limited success with revascularization in immature teeth, suggesting flexibility in certain scenarios.

The anterior open bite noted in Case 1 highlights the influence of parafunctional habits on occlusal development, necessitating interceptive orthodontic interventions.

Anterior open bite is a significant malocclusion that not only affects dental aesthetics and function but also

increases the susceptibility to traumatic dental injuries in children.

The increased overjet and protrusion often seen in these cases leave the upper incisors more exposed and less protected during incidents such as falls or impacts, making them more vulnerable to fractures, chipping, or even avulsion.

Additionally, the risk of dental injury in children with an anterior open bite is about twice as high as in those without this condition [15]. Even more, children with anterior open bite exhibited a 47% higher prevalence of severe dental trauma, and a 46% increase in injuries affecting multiple teeth, compared to their peers without this malocclusion [16].

Impact of Delayed Follow-Up: Patient adherence to follow-up appointments is crucial for successful long-term outcomes in dental trauma management. The second case illustrated the adverse consequences of delayed follow-up, with progressive external root resorption developing due to missed appointments and delayed endodontic treatment.

Regular follow-up evaluations, as recommended by the IADT guidelines, include clinical and radiographic assessments at 1 week, 2 weeks, 4 weeks, 3 months, 6 months, and annually for at least 5 years [4]. These evaluations allow for early detection of complications such as pulp necrosis, inflammatory root resorption, and ankylosis, facilitating timely intervention, such as intracanal medication with calcium hydroxide or mineral trioxide aggregate (MTA), which can halt the resorptive process and improve prognosis [9].

Missed follow-ups also delay adjustments to treatment plans, such as replacing splints or modifying medication regimens, which can directly impact healing outcomes. The first case demonstrated better adherence, leading to controlled resorption and a more favourable long-term prognosis. In contrast, the second case demonstrated the consequences of delayed follow-up, with accelerated external root resorption requiring more aggressive endodontic management.

This reinforces the necessity of patient education and caregiver involvement in ensuring compliance with follow-up care [17].

Prognostic Indicators and Future Considerations: These clinical cases corroborate the significance of appropriate emergency management protocols, adherence to structured follow-up evaluation, and interdisciplinary therapeutic approaches in the comprehensive management of avulsed permanent dentition. The extra-alveolar time, condition of the periodontal ligament cells, stage of root development, and patient age serve as critical prognostic indicators for reimplanted teeth. Future investigative efforts should be directed toward enhancement of regenerative endodontic methodologies and biocompatible materials to optimize long-term clinical and radiographic outcomes in traumatically avulsed permanent teeth [17].

Limitations and Clinical Implications: The primary limitation of this study is its retrospective nature, which precludes standardized assessment and intervention protocols. Additionally, the limited sample

size (two cases) restricts the generalizability of the findings. Nevertheless, these cases provide valuable insights into the management of avulsed teeth and the potential complications associated with different scenarios.

From a clinical perspective, these cases emphasize the importance of immediate reimplantation, appropriate storage media, and strict adherence to follow-up protocols in optimizing outcomes for avulsed teeth. Additionally, they highlight the need for comprehensive patient education regarding the urgency of seeking dental care following avulsion and the importance of compliance with follow-up appointments.

Notably, the first case underscores the crucial role of general medical doctors in dental trauma management. The successful outcome can be partially attributed to the general doctor's prompt intervention with reimplantation, demonstrating that non-dental healthcare providers can significantly impact prognosis when ade-

quately educated about emergency dental procedures. Since general doctors are often first responders to dental trauma, especially in remote areas or during off-hours, their training in emergency dental procedures is essential for better patient outcomes.

CONCLUSION

Dental avulsion cases emphasize the importance of quick and proper intervention for successful reimplantation, especially in children. Following established protocols, such as correct tooth storage and prompt reimplantation, helps prevent complications like infections and pulp necrosis. Post-operative follow-up is crucial for monitoring and managing potential issues. Despite improvements in treatment protocols, complications can still arise, often due to delays or improper handling of the tooth. Ongoing advancements in treatment are necessary to further improve patient outcomes and effectively manage complications.

REFERENCES / СПИСОК ЛИТЕРАТУРЫ

1. Fouad A.F., Abbott P.V., Tsilingaridis G., Cohenca N., Lauridsen E., Bourguignon C. 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. <https://doi.org/10.1111/edt.12573>
2. Ravi K.S., Pinky C., Kumar S., Vanka A. Delayed replantation of an avulsed maxillary premolar with open apex: a 24 months follow-up case report. *J Indian Soc Pedod Prev Dent.* 2013;31(3):201–204. <https://doi.org/10.4103/0970-4388.117971>
3. Glendor U. Epidemiology of traumatic dental injuries – a 12 year review of the literature. *Dent Traumatol.* 2008;24(6):603–611. <https://doi.org/10.1111/j.1600-9657.2008.00696.x>
4. Levin L., Day P.F., Hicks L., O'Connell A., Fouad A.F., Bourguignon C., Abbott P.V. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: General introduction. *Dent Traumatol.* 2020;36(4):309–313. <https://doi.org/10.1111/edt.12574>
5. Flores M.T., Andersson L., Andreasen J.O., Bakland L.K., Malmgren B., Barnett F. et al. Guidelines for the management of traumatic dental injuries. I. Fractures and luxations of permanent teeth. *Dent Traumatol.* 2007;23(2):66–71. <https://doi.org/10.1111/j.1600-9657.2007.00592.x>
6. Andreasen J.O., Borum M.K., Jacobsen H.L., Andreasen F.M. Replantation of 400 avulsed permanent incisors. 4. Factors related to periodontal ligament healing. *Endod Dent Traumatol.* 1995;11(2):76–89. <https://doi.org/10.1111/j.1600-9657.1995.tb00464.x>
7. Diangelis A.J., Andreasen J.O., Ebeleseder K.A., Kenny D.J., Trope M., Sigurdsson A. et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations of permanent teeth. *Dent Traumatol.* 2012;28(1):2–12. <https://doi.org/10.1111/j.1600-9657.2011.01103.x>
8. Kahler B., Heithersay G.S. An evidence-based appraisal of splinting luxated, avulsed and root-fractured teeth. *Dent Traumatol.* 2008;24(1):2–10. <https://doi.org/10.1111/j.1600-9657.2006.00480.x>
9. Trope M. Clinical management of the avulsed tooth: present strategies and future directions. *Dent Traumatol.* 2002;18(1):1–11. <https://doi.org/10.1046/j.1600-4469.2001.00001.x>
10. Kahler B., Rossi-Fedele G. A review of tooth discoloration after regenerative endodontic therapy. *J Endod.* 2016;42(4):563–569. <https://doi.org/10.1016/j.joen.2015.12.022>
11. Rajasekharan S., Martens L.C., Cauwels R.G., Verbeeck R.M. Biodentine™ material characteristics and clinical applications: a review of the literature. *Eur Arch Paediatr Dent.* 2014;15(3):147–158. <https://doi.org/10.1007/s40368-014-0114-3>
12. Müller D.D., Bissinger R., Reymus M., Bücher K., Hickel R., Kühnisch J. Survival and complication analyses of avulsed and replanted permanent teeth. *Sci Rep.* 2020;10(1):2841. <https://doi.org/10.1038/s41598-020-59843-1>
13. Zouiten Skhiri S., Abdelmoumen E., Jemaa M., Douki N., Oueslati A., Zokkar N., et al. Avulsions traumatiques des dents permanentes. *Actual. Odonto-Stomatol.* 2013;266:4–13. <https://doi.org/10.1051/aos/2013602>
14. Bayrak G.D. Traumatic avulsion and delayed replantation of maxillary incisors in an eleven-year-old child. *Edorium J Dent.* 2018;5:100032D01GB2018. <https://doi.org/10.5348/100032D01GB2018CR>
15. Norton E., O'Connell A.C. Traumatic dental injuries and their association with malocclusion in the primary dentition of Irish children. *Dent Traumatol.* 2012;28(1):81–86. <https://doi.org/10.1111/j.1600-9657.2011.01032.x>
16. da Silva R.M., Mathias F.B., da Costa C.T., da Costa V.P.P., Goettems M.L. Association between malocclusion and the severity of dental trauma in primary teeth. *Dent Traumatol.* 2021;37(2):275–281. <https://doi.org/10.1111/edt.12615>
17. Bastone E.B., Freer T.J., McNamara J.R. Epidemiology of dental trauma: a review of the literature. *Aust Dent J.* 2000;45(1):2–9. <https://doi.org/10.1111/j.1834-7819.2000.tb00234.x>

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