Stomatologija. Baltic Dental and Maxillofacial Journal, 28: 53-8, 2026

The management dilemma of alveolar bone fracture: Case report and narrative review

Oumayma El Yacoubi[*], *Akram Belmehdi*[*], *Bassima Chami*[*]

SUMMARY

Introduction. Alveolar process fracture is a common injury in dental practice that has a significant impact on patient's aesthetics and functionality, necessitating prompt and appropriate management.

The purpose of this article is to present a clinical case of a comminuted alveolar fracture managed through open reduction and fixation using a wire composite splint. Additionally, it will provide a narrative review of the different treatment options for alveolar bone fractures, discussing the controversies and challenges in their management. This comparative analysis of therapeutic approaches aims to identify best practices to optimize clinical outcomes for patients with this injury.

Case report. The clinical case involves a 25-year-old patient with a dentoalveolar fracture extending from the 33 to 44, caused by a workplace accident and treated with open reduction and wire splint placement.

*Discussion.*The initial management of bone fracture based on reduction and fixation of the fractured segment plays a critical role in determining the ultimate outcome. Various techniques have been documented in current literature, and selecting the right technique is determined by a clinical assessment and a comprehensive evaluation of the unique aspects of each clinical case.

Conclusion. It is essential for healthcare professionals to closely monitor the evolution of clinical guidelines and research studies in this field in order to provide patients with adapted treatment.

Keywords: alveolar fracture, dentoalveolar trauma, splinting, management.

INTRODUCTION

The terms "alveolar fracture," "alveolar process fracture," or "alveolar ridge fracture" all describe a type of fracture involving the upper bone structure of the mandibular or maxillary arch, which surrounds and supports the teeth. (1)

This injury is frequently observed in dental practice, representing about 1 to 15% of all craniofacial injuries. However, determining their exact frequency is challenging due to their common occurrence alongside other dental and facial traumas. (2, 4)

These fractures are more common in children and young adult males, often caused by falls, sports accidents, physical assaults, violence, and altercations. They primarily impact the anterior teeth of the maxilla followed by the anterior mandible. Factors such as increased overjet, proclination of upper incisors, and inadequate lip support can further increase the likelihood of these fractures. (2, 3, 4)

The aim of this paper is to discuss a case a comminuted alveolar fracture managed through open reduction and fixation using a wire composite splint, outlining the different treatment approaches for alveolar process fractures and highlighting the controversies and challenges encountered in their management.

CASE REPORT

A 25-year-old man presented to the emergency department following an accident at a construction site. Physical examination revealed injuries in his hands and legs, as well as a laceration under his chin that required suturing. The physician's assessment did not reveal any head trauma or vision impairments. Subsequently, he was referred to the

[*]*Mohammed V University, Rabat, Marocco*

Address correspondence to Oumayma El Yacoubi, Mohammed V University in Rabat, Oulad Helal, residence Nassim 2, building 1, apartment 9, Sala Al Jadida, Rabat, Morocco.
E-mail address: oumayma_elyacoubi@um5.ac.ma

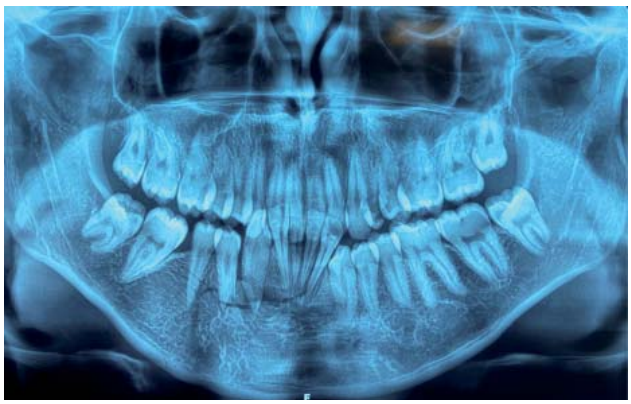

Fig. 1. Preoperative panoramic radiograph showing the alveolar fracture

Fig. 2. Immediate post-operative view after reduction and fixation

oral surgery department for management of his dentoalveolar injuries.

The general examination revealed no notable medical history or general pathology and no use of alcohol, tobacco, or illicit substances.

During intraoral examination, the patient exhibited lingually and vertically displaced dentoalveolar segment involving teeth 33 to 43 (lower left canine to lower right canine) with significant mobility (grade 3 of miller's classification) of the entire block.

Panoramic radiograph confirms the diagnosis of comminuted alveolar fracture in the lower incisor-canine region extending from 33 to 45 (Fig. 1).

The treatment plan included performing an open reduction under local anesthesia, followed by placement of a wire composite splint for 6 weeks (Fig. 2).

The patient received a prescription of amoxicillin, 2 g per day for 7 days, along with analgesics and a 0.12% chlorhexidine mouthwash, with instructions to follow a soft diet.

A follow-up visit was scheduled for one week later to remove the sutures, and no signs of infection or complication were observed at the site during that visit.

A panoramic radiograph conducted 4 weeks later revealed union at the fracture site (Fig. 3). The wires were subsequently removed at 7 weeks (Fig. 4) and examination confirmed excellent stability of the segment.

The patient's pulp sensitivity tests during the initial follow-up and at 4, 6, and 8 weeks indicated preserved vitality in the incisor-canine region, except for tooth 32. Consequently, the patient was referred for endodontic treatment and instructed to follow up as required.

DISCUSSION

According to Andreasen's classification, alveolar fractures are divided into two types: Alveolar wall fractures that affect the vestibular or lingual wall of the alveolar socket and are often associated with luxation and avulsion injuries, and alveolar process fractures, which may involve the alveolar sockets or not (9, 10).

Clinically, alveolar fractures may present with a mobile and displaced dentoalveolar segment, occlusal disturbances, hematoma in the adjacent oral mucosa, or exposure of the underlying bone.

Panoramic and periapical radiographs are beneficial for identifying alveolar bone fractures, while occlusal radiographs provide a distinct vertical view, particularly useful for detecting root fractures associated with alveolar fractures (4, 7).

Cone-beam volumetric tomography (CBCT) is also valuable and can provide detailed information in specific cases, facilitating localization, assessment of extent, and determination of fracture direction (4, 5).

The main objective of the treatment of alveolar fractures is to preserve the affected teeth and maintain bone support and soft tissue integrity. This treatment encompasses two closely interrelated procedures: reduction (the correct repositioning of bone fragments) and fixation (stabilization of fragments to promote healing) (7, 8).

It is essential to recognize that alveolar fractures frequently occur with other soft tissue and dental injuries, such as luxations, avulsions, and root fractures. These combinations complicate patient examination due to significant bleeding and discomfort and could contribute to a poorer prognosis through a negative synergistic effect (2, 3, 10).

Reduction

This process involves repositioning the fractured segments and displaced teeth to their original positions. The closed technique is preferred to open technique due to its ability to preserve proper blood circulation at the fracture site, reducing the risk of

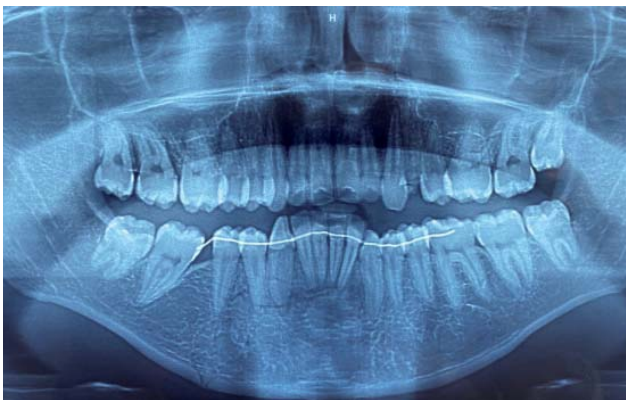

Fig. 3. Follow-up radiograph after 4 weeks

compromising blood supply to the teeth, bone, and soft tissues, while also minimizing postoperative discomfort and promoting healing (6).

The method entails exerting downward pressure on the fractured segment by placing one finger on the apical region of the teeth or bone unit, with another finger positioned on the occlusal surface of the teeth. It is then crucial to check the occlusion to verify proper alignment of the fragments (6, 8).

The open technique is generally reserved for severe cases involving bone fragmentation or exposure, significant displacement of the fractured segment, or delayed treatment resulting in fibrous callus formation. Incisions may be either intrasulcular or paramarginal (envelope). The paramarginal method offers the benefit of preserving soft tissue vascularity from the buccal mucoperiosteal pedicle, reducing gingival trauma, and promoting enhanced wound healing (7).

In our case, the presence of multiple fracture lines and significant displacement of the segment necessitated the use of the open technique.

It is crucial to recognize that in situations where fractured teeth associated to alveolar fracture have a poor prognosis necessitating extraction, it is advisable to delay the extraction until bone healing to avoid additional displacement or damage to the alveolar fracture (12).

Fixation

After achieving adequate reduction, it is imperative to stabilize or immobilize the bone. Various techniques are described in the literature, and the selection of the optimal fixation method depends on the type of alveolar fracture and the number of teeth in the affected dental arch. This decision must be carefully considered, as inadequate fixation can significantly compromise both bone and dental health (11, 13, 14).

Fig. 4. Views after removal of splint at 7 weeks

Splinting

A splint is considered as the preferred treatment method for alveolar fractures. This device is designed to protect, stabilize, and immobilize injured teeth while maintaining their proper alignment, thus ensuring the patient's functionality and comfort (13, 14).

Rigidity and duration

Rigid splinting with immobilization for several months has been associated with an increased incidence of pulpal necrosis, ankylosis, and pulpal canal obliteration. In contrast, flexible splints maintain a certain physiological mobility of traumatized teeth, allowing for normal masticatory stimulus, preventing root resorption and promoting pulpal healing (13, 14).

International Association for Dental Traumatology (IADT) 2020 recommend the use of short-term (4 weeks) passive and flexible retention techniques for managing this type of injury, However, some authors recommend an extended fixation duration (6 weeks) for complete bone union (10, 13).

Various historical and contemporary splinting methods can be categorized according to the materials used. The most commonly used devices are summarized in Tables 1 and 2.

Transgingival lag-screw osteosynthesis

Compression screw osteosynthesis is the process of achieving secure bone fragment union

by applying pressure with screws inserted in an overlapping manner. This technique was initially introduced in maxillofacial surgery by Brons and Boering in 1970, targeting symphyseal fractures, mandibular angle fractures, and condylar fractures. The utilization of transgingival compression screws for alveolar process fractures was first detailed by Nyarady et al. in 2010.

An observational non-randomized study conducted by Sharma et al. in 2019 on 20 patients with alveolar process fractures treated with transgingival screw fixation (following the protocol described previously by Nyarady et al. in 2010) has shown good results, with perfect bone healing in all cases and no complications or bone loss observed.

Ardary and colleagues emphasize that the success of compression screw fixation relies on the number of screws used, the method of screw placement, the inclusion of screws penetrating both cortices, and the thickness of the cortical bone. This technique is recommended in cases where conventional fixation is not possible, such as limited dental support, characteristics of the fracture line that could compromise blood flow to the injured bone (16).

Circummandibular wiring

Circummandibular wires have been employed in oral and maxillofacial surgery for over a century, although their use in alveolar process fractures is rare. They are still occasionally used in pediatric cases where the adjacent teeth cannot adequately stabilize the fracture.

In such situations, modern fixation techniques using miniplates and screws are typically avoided due to the risk of damaging developing tooth germs and the fragility of the bone walls.

This method involves the circumferential placement of 16- or 18-gauge silver wires around the mandible, sometimes combined with the use of splints (17, 18).

Vacuum-formed splint

The technique using a thermoformed plate was initially described in 2001.This plate is made from a 1 mm transparent thermoplastic sheet, shaped using vacuum thermoforming based on a model created after reducing the fracture and taking an alginate impression.

It is customized to fit the individual's dentition, with margins situated 2 mm below the free gingival margin. Once adapted, the plate is fixed to the teeth using glass ionomer cement for a period of three weeks.

This approach is recommended for cases where there is a significant gap between adjacent teeth, limited anchorage due to teeth affected by periodontal disease, and reliance mainly on temporary and immature permanent teeth (with incomplete root development) during the mixed dentition phase (19).

Titanium micromesh plate

This technique, proposed by Yonezawa and al in 2013, involves the use of a titanium mesh plate and self-tapping screws for the fixation of a fractured fragment over a period of 3 to 5 months (20).

Table 1. Summary table of the most commonly used splints in dentoalveolar trauma (13-15)

Resin Based Splints	Wire Splints	Metal Based Splints
Fiber splints • Broad spectrum of fiber types: glass fibers, vectran fibers, kevlar fibers, carbon fibers, and polyethylene fibers.	**Wire composite Splint** • Conventional technique. • Stainless-steel wire up to 0.4 mm in diameter. (flexible) • Easy and quick to apply, affordable cost. • Metal visible through the cemented material, compromising aesthetics.	**Titanium trauma splints** • Composed of a semi-rigid titanium structure. • Relatively elevated cost.
Ribbond • Introduced in 1992 (polyethylene fibers). • Smooth, thin, and non-irritating to the injured lip. • No shape memory and susceptible to fracture.	**Composite and fishing line** • Similar to the previously mentioned splints (metal wire replaced with fishing line). • Aesthetic.	
Power chain composite splint • Affordable, flexible, and aesthetic.	**Orthodontic brackets and wire** • Orthodontic brackets bonded to the tooth surface with adhesive, with a flexible 0.14 mm NiTi wire.	
Composite splints • Composite resin applied to the facial and interproximal surfaces of the affected teeth. • According to IADT guidelines, it is a non-functional splint.		

Medication prescription and postoperative instructions

According to the 2020 (IADT) recommendations, the use of systemic antibiotics is supported by limited evidence, and the decision of prescription is left to the discretion of the clinician based on the specific clinical situation and the patient's overall health (10).

Some authors recommend prescribing antibiotics for contaminated wounds to prevent infections. Amoxicillin is generally the preferred

first-line option, while clindamycin is an alternative for patients allergic to penicillin. In cases of skin lacerations, it is advisable to choose a broad-spectrum antibiotic such as a cephalosporin to effectively cover potential staphylococcal infections (2).

Antibiotic prescription is commonly complemented with analgesics, varying from level 1 to 2 based on the procedure's complexity, along with an antiseptic solution containing chlorhexidine (1).

Instructions will be provided on a soft diet, maintain strict oral hygiene and avoid contact sports to prevent further injuries (8, 10).

Postoperative follow-up

Follow-up visits after a traumatic injury, are essential and should be scheduled at 4 weeks, 6/8 weeks, 4 months, 6 months, 1 year, and then yearly for 5 years. Each follow-up session should involve a questionnaire about any symptoms, a clinical and radiographic examination, and a pulp sensitivity assessment.

It's crucial to note that sensitivity tests may not always be reliable due to temporary nerve response loss or undifferentiated a-delta nerve fibers in immature teeth. Therefore, a lack of response in pulp sensitivity testing is not definitive for diagnosing pulp necrosis in traumatized teeth. Despite this challenge, conducting pulp sensitivity tests initially and during follow-up visits is recommended to track any changes over time.

Patients should be informed about the importance of long-term clinical and radiographic follow-up, as well as potential long-term complications. These complications may include tooth loss, ankylosis, pulp space obliteration, root resorption, as well as loss of marginal gum and bone. Early detection and proactive management of this complications are crucial for improving the prognosis (3, 10).

CONCLUSION

It is essential for healthcare professionals to closely monitor the evolution of clinical guidelines and research studies in this field in order to provide patients with individualized treatment based on the best available practices.

STATEMENT OF CONFLICTS OF INTEREST

The authors state no conflict of interest.”

Table 2. Summary table of advantages, disadvantages, and indications of the main fixation techniques

Technique	Fixation device, duration	Advantages	Disadvantages	Indications
Splinting (13, 14)	• Wire, resin or metalbased splints. • 4/ 6 weeks	• Gold standard technique • Medical setback • Easy to apply	• Plaque accumulation • Risk of fracture	• Firstline treatment • Presence of sufficient dental support.
Transgingival lagscrew osteosynthesis (16)	• 2 to 3 Titanium screws. (2.0 mm for the mandible and 1.5 mm for the maxilla). • Placed through the gum. • 3 months	• Easy and quick technique • Less implant material • Reduced cost • Limited surgical exposure (decreased operation and healing time) • Maintained oral hygiene	• Risk of screw fracture • Risk of damage to teeth (germs, roots) • Risk of bone table fracture (thin table) • Potential growth restriction.	• Compromised blood supply and lack of dental support. • Adulte
Circummandibular Wiring (17, 18)	• 16 or 18gauge silver wires • 2 months	• Low cost • No damage to roots of adjacent teeth • No subperiosteal reflection of a buccal flap, providing better blood supply.	• Postoperative discomfort of threads in the vestibule. • Risk of submental scar formation and damage to the floor of the mouth. • Second operation to remove threads under anesthesia.	• Limited to the mandible • Absence of adjacent teeth at the fracture line.
Vacuum-formed splint (19)	• 1 mm transparent thermoplastic sheet formed. • 3 Weeks.	• Inexpensive and easy. • Visualize underlying dentition to check fit and occlusion. • Smooth surface (without any risk of injury to periodontal tissues and maintains proper oral hygiene). • Excellent threedimensional stability at the fracture site and allows physiological tooth mobility. • Preservation of orofacial functions.	• Initial investment for a thermoforming unit.	• Significant gap between adjacent teeth • Limited anchorage due to teeth affected by periodontal disease, or temporary and immature permanent teeth.
Titanium micromesh plate (20)	• Titanium mesh plate and selftapping screws • 35 months.	• Stable threedimensional reconstruction. • Precise anatomical reduction and fixation under direct vision. • Promotes primary bone healing.	• Potential growth restriction. • Damage to primary teeth and permanent tooth germs. • Creation of artifacts on CT or MRI scans. • Need for removal of fixation materials after complete healing.	• Severe alveolar wall fracture with dental displacement.

REFERENCES

1. Cornelius CP, Audigé L, Kunz C, Rudderman R, Buitrago-Téllez CH, Frodel J, Prein J. The Comprehensive AOCMF Classification System: Mandible Fractures-Level 3 Tutorial. Craniomaxillofac Trauma Reconstr. 2014 Dec;7(Suppl 1):S031-43. doi: 10.1055/s-0034-1389558. PMID: 25489389; PMCID: PMC4251719
2. Gutmacher Z, Peled E, Norman D, Lin S. Alveolar Bone Fracture: Pathognomonic Sign for Clinical Diagnosis. Open Dent J. 2017 Jan 31;11:8-14. doi: 10.2174/1874210601711010008. PMID: 28400864; PMCID: PMC5362980.
3. Lim L, Sirichai P. Bone fractures: assessment and management. Aust Dent J. 2016 Mar;61 Suppl 1:74-81. doi: 10.1111/adj.12399. PMID: 26923449.
4. Alimohammadi R. Imaging of Dentoalveolar and Jaw Trauma. Radiol Clin North Am. 2018 Jan;56(1):105-124. doi: 10.1016/j.rcl.2017.08.008. Epub 2017 Oct 6. PMID: 29157541.
5. Li F, Li J, Zhang D, Wu F. Role of Computed Tomography Scan in Dental Trauma: A Cross-Sectional Study. Dose Response. 2018 Aug 23;16(3):1559325818789837. doi: 10.1177/1559325818789837. PMID: 30150907; PMCID: PMC6108019.
6. Li Z, Hu TQ, Li ZB. Open reduction by vestibular approach in the treatment of segmental alveolar fracture. Dent Traumatol. 2012 Dec;28(6):470-3. doi: 10.1111/j.1600-9657.2012.01118.x. Epub 2012 Feb 13. PMID: 22325045.
7. Bourguignon C, Cohenca N, Lauridsen E, Flores MT, O'Connell AC, Day PF, Tsilingaridis G, Abbott PV, Fouad AF, Hicks L, Andreasen JO, Cehreli ZC, Harlamb S, Kahler B, Oginni A, Semper M, Levin L. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 1. Fractures and luxations. Dent Traumatol. 2020 Aug;36(4):314-330. doi: 10.1111/edt.12578. Epub 2020 Jul 17. PMID: 32475015.
8. Andreasen JO, Andreasen FM, Andersson L. Textbook and color atlas of traumatic injuries to the teeth. 4th ed. Oxford, UK: Wiley-Blackwell; 2007.
9. Purohit, J., Kumar, G. J., Datta, A., Maiti, S., Hinge, A., Kapoor, S., & Tiwari, R. V. C. (2020). Recent advances & historical management in dentoalveolar fracture-A review. Journal of Advanced Medical and Dental Sciences Research, 8(1), 129-136.
10. Shetye, Omkar Anand. "Dentoalveolar injuries and wiring techniques." Oral and Maxillofacial Surgery for the Clinician (2021): 1013-1037.
11. Alvino L, Ha WN, Chan WC, Rossi-Fedele G. What is new in the 2020 International Association of Dental Traumatology emergency treatment guidelines? Dent Traumatol. 2021 Jun;37(3):510-520. doi: 10.1111/edt.12671. Epub 2021 Mar 13. PMID: 33713538.
12. Levin L, Day PF, Hicks L, O'Connell A, Fouad AF, Bourguignon C, Abbott PV. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: General introduction. Dent Traumatol. 2020 Aug;36(4):309-313. doi: 10.1111/edt.12574. Epub 2020 Jun 22. PMID: 32472740.
13. Jamal S, Motiwala MA, Ghafoor R. Conventional and contemporary approaches of splinting traumatized teeth: A review article. J Pak Med Assoc. 2020 Feb;70(Suppl 1)(2):S53-S59. PMID: 31981337.
14. Sobczak-Zagalska H, Emerich K. Best Splinting Methods in Case of Dental Injury-A Literature Review. J Clin Pediatr Dent. 2020;44(2):71-78. doi: 10.17796/1053-4625-44.2.1. PMID: 32271668.
15. Ben Hassan MW, Andersson L, Lucas PW. Stiffness characteristics of splints for fixation of traumatized teeth. Dent Traumatol 2016;32:140-5. doi: 10.1111/edt.12234.
16. Kahler B, Hu JY, Marriot-Smith CS, Heithersay GS. Splinting of teeth following trauma: a review and a new splinting recommendation. Aust Dent J. 2016 Mar;61 Suppl 1:59-73. doi: 10.1111/adj.12398. PMID: 26923448.
17. von Arx T, Filippi A, Lussi A. Comparison of a new dental trauma splint device (TTS) with three commonly used splinting techniques. Dent Traumatol. 2001 Dec;17(6):266-74. doi: 10.1034/j.1600-9657.2001.170605.x. PMID: 11766094.
18. Paz JLC, Soares CJ, Rodrigues JF, de Araújo Almeida G, Soares PBF. Fractured alveolar process displacement evaluation-Effect of the rigidity of wire-composite splints. Dent Traumatol. 2021 Apr;37(2):247-255. doi: 10.1111/edt.12616. Epub 2020 Dec 4. PMID: 33185332.
19. Berthold C, Auer FJ, Potapov S, Petschelt A. Influence of wire extension and type on splint rigidity--evaluation by a dynamic and a static measuring method. Dent Traumatol. 2011 Dec;27(6):422-31. doi: 10.1111/j.1600-9657.2011.01033.x. Epub 2011 Jul 26. PMID: 21790987.
20. Nyárády Z, Orsi E, Nagy K, Olasz L, Nyárády J. Transgingival lag-screw osteosynthesis of alveolar process fracture. Int J Oral Maxillofac Surg. 2010 Aug;39(8):779-82. doi: 10.1016/j.ijom.2010.01.022. Epub 2010 May 8. PMID: 20452745.
21. Sharma A, Rastogi S, Shukla M, Choudhury R, Tripathi S, Iqbal J. Use of Transgingival Lag Screw Osteosynthesis in the Management of Alveolar Process Fracture. Craniomaxillofac Trauma Reconstr. 2019 Mar;12(1):27-33. doi: 10.1055/s-0038-1629906. Epub 2018 Feb 15. PMID: 30815212; PMCID: PMC6391255.
22. Maloney K. Circummandibular Wires for Treatment of Dentoalveolar Fractures Adjacent to Edentulous Areas: A Report of Two Cases. Craniomaxillofac Trauma Reconstr. 2015 Sep;8(3):246-50. doi: 10.1055/s-0034-1399801. Epub 2015 Jan 13. PMID: 26269735; PMCID: PMC4532572.
23. Quinto JHS, Bachesk AB, Nogueira LC, Filho LI. An Alternative Approach Using Circummandibular Wiring for Treatment of Dentoalveolar Fractures in Children: A Case Report. Craniomaxillofac Trauma Reconstr. 2022 Jun;15(2):169-174. doi: 10.1177/1943387521990283. Epub 2021 Mar 1. PMID: 35633772; PMCID: PMC9133519.
24. Nilesh K, Mahamuni A, Taur S, Vande AV. A simple novel technique for the management of a dentoalveolar fracture in a pediatric patient using a vacuum-formed splint. J Dent Res Dent Clin Dent Prospects. 2020 Winter;14(1):68-72. doi: 10.34172/joddd.2020.010. PMID: 32454961; PMCID: PMC7235701.
25. Choubey S, Shigli A, Banda N, Vyawahare S. Vacuum formed splints: Novel method for managing orofacial trauma. J Indian Soc Pedod Prev Dent. 2014 Oct-Dec;32(4):353-6. doi: 10.4103/0970-4388.140975. PMID: 25231048.
26. Yonezawa H, Yanamoto S, Hoshino T, Yamada S, Fujiwara T, Umeda M. Management of maxillary alveolar bone fracture and severely intruded maxillary central incisor: report of a case. Dent Traumatol. 2013 Oct;29(5):416-9. doi: 10.1111/j.1600-9657.2011.01111.x. Epub 2012 Jan 11. PMID: 22233224.

Received: 13 01 2025
Accepted for publishing: 22 06 2026