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Open reduction by vestibular approach in the treatment of segmental alveolar fracture

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Abstract – Fracture of the alveolar process is a common injury; the majority of alveolar fractures may be managed by closed reduction. However, some cases with severe segmental alveolar fracture cannot be reduced by close reduction, usually resulting in occlusion disturbance. This article describes open reduction by vestibular approach in the treatment of severe segmental alveolar fractures, with the aim of evaluating the prognosis. Fifteen patients with severe segmental alveolar fractures that could not be reduced by closed method were included in our case series. Open reduction by vestibular approach was performed on these patients, and the fractures were stabilized with dental arch bars or dental wires. Postoperatively, all patients achieved uneventful healing; consolidation of the fracture was confirmed clinically after 4 weeks. The technique presented is an effective treatment approach proposed for cases of severe segmental alveolar fracture that cannot be managed by closed reduction.

Fracture of the alveolar process is a common injury, constituting about 1–15% of all cranio-facial injuries (1–3). Segmental alveolar fracture involves multiple teeth and the supporting alveolar bone (4); the typical clinical presentation is a segment containing two or more teeth being displaced axially or laterally. The majority of alveolar fractures may be treated by closed reduction (5, 6). For alveolar fractures, closed reduction and immobilization for 4–6 weeks are often adequate (7). Cases where there is a tenuous blood supply to the alveolar segments may also require closed treatment. However, some cases with severe segmental alveolar fracture cannot be treated by closed reduction, usually resulting in occlusion disturbance. These severe cases require open treatment to ensure reduction of the displaced alveolar segment. By open treatment, the fracture is usually exposed through a marginal (envelope) incision, the fragment retaining its vascular supply from the lingual or palatal side. Obviously, open treatment through a marginal (envelope) incision may jeopardize the vascular supply of the fractured alveolar segment, subsequently resulting in tenuous blood supply after extensive exposure. In addition, open treatment through a marginal (envelope) incision necessitates separation of the gingival and alveolar mucosa from alveolar process, which may affect the appearance and postoperative healing of the gums. This article describes open reduction by vestibular approach in the treatment of severe segmental alveolar fractures, with the aim of evaluating the prognosis.

Patients and methods

Fifteen patients with severe segmental alveolar fracture were included in the case series. Eight were boys and seven were girls, and the mean age was 15.67 years (Table 1).

All patients had a history of dentoalveolar injuries. Ten patients visited our department within 3 h immediately after the dental trauma. In these patients, closed reduction was tried first; however, the fractures could not be reduced. Open reduction by vestibular approach was then performed. The other five patients were referred to our department more than 1 week after dental trauma. Open reduction by vestibular approach was performed right away on these five patients, because they had malunion of the alveolar fracture.

The surgical procedures were performed under local anesthesia ($n = 13$) and general anesthesia ($n = 2$). The fractures were exposed through a minimal vestibular incision; the soft tissues attached to the fractured alveolar fragment were maintained (Fig. 1a and b), with the aim of ensuring adequate vascular supply to the fractured alveolar fragment. With the fracture line under clear visualization, reduction was then achieved by

Table 1. The summarizing of the 15 cases suffering from segmental alveolar fracture

Cases	Sex	Age	Fracture characteristics	Associated dental injuries	Associated soft tissue injuries	Teeth involved in the segmental fractures	Splint type	Postoperative findings
1	M	8	Malunion	Luxation	Gingival laceration	31,41,42	Orthodontic wire	Satisfactory
2	M	13	Fresh	Luxation	Gingival laceration	11,12,21	Orthodontic wire	Satisfactory
3	F	15	Fresh	Root fracture	Gingival laceration, lip laceration	11,21	Arch bar	Satisfactory
4	M	11	Fresh	Dentin exposure	Gingival laceration, tongue laceration	32,41,42	Orthodontic wire	Satisfactory
5	F	8	Malunion	Root fracture	Gingival laceration	31,32,41,42	Orthodontic wire	Satisfactory
6	M	11	Fresh	Dentin exposure	Gingival laceration	11,12,21	Orthodontic wire	Satisfactory
7	M	15	Malunion	Luxation	Gingival laceration	11,12	Arch bar	Satisfactory
8	F	14	Fresh	Root fracture	Gingival laceration	11,12,21,22	Orthodontic wire	Satisfactory
9	M	12	Fresh	Luxation	Gingival laceration, tongue laceration	12,21,22	Orthodontic wire	Satisfactory
10	M	41	Malunion	Root fracture, luxation	Gingival laceration, lip laceration	11,12,21,22	Arch bar	Satisfactory
11	F	22	Fresh	Luxation	Gingival laceration, lip laceration	21,22, 23, 24	Arch bar	Satisfactory
12	F	12	Fresh	Luxation	Gingival laceration	31,41,42,43	Orthodontic wire	Satisfactory
13	F	13	Malunion	Root fracture	Gingival laceration	13,12,11	Orthodontic wire	Satisfactory
14	M	29	Fresh	Luxation	Gingival laceration	31,32,41	Arch bar	Satisfactory, but refused the follow up
15	F	11	Fresh	Dentin exposure	Gingival laceration	13,12,11,21	Orthodontic wire	Satisfactory, but refused the follow up

Fig. 1. (a) A minimal vestibular incision was made, (b) The fracture was exposed through the vestibular incision, (c) Small bone fragments or fibrous callus inside the fracture lines or root sockets were removed.

repositioning of the fractured segment. Prior to the repositioning of the segment, small bone fragments or fibrous callus inside the fracture lines or root sockets were removed (Fig. 1c). After the normal position of fractured segment had been re-established, indicated by alignment of the dental arch in premorbid occlusion (Fig. 2a), the fractures were stabilized with dental arch bars or orthodontic wire splint (Fig. 2b, Table 1). At the same time, associated soft tissue lacerations were sutured.

For all the cases, oral hygiene measures including toothbrushing using soft toothbrush and mouth rinsing with 0.1% chlorhexidine twice a day were emphasized during the postoperative phase, until complete gingival healing was achieved. Patients were encouraged to restrict themselves to soft diet and avoid clenching and any other traumatic overload to the alveolar segment for a period of up to 4 weeks postoperative. To prevent infection after the operation, antibiotics were provided to the patients.

3-Dimensional CT Scan was used in some severe cases to assess the state of reduction after the operation (Fig. 3 and 4). All the alveolar fractures were fixed for 4 weeks, and endodontic treatment was performed on teeth that developed pulp necrosis. Following the removal of arch bars or wires, a careful examination of the teeth and the fractured fragment was performed.

Results

Postoperatively, all patients achieved uneventful healing, without occlusion disturbance. The appearance of the gums was normal. The consolidation of the fracture was confirmed clinically at the end of 4 weeks, and the arch bars or wires were then removed. The premorbid occlusion restoration and wound healing were achieved in all the patients. In 13 patients with a follow-up period of longer than 6 months, the best possible condition of the alveolar fractured segment was maintained. The

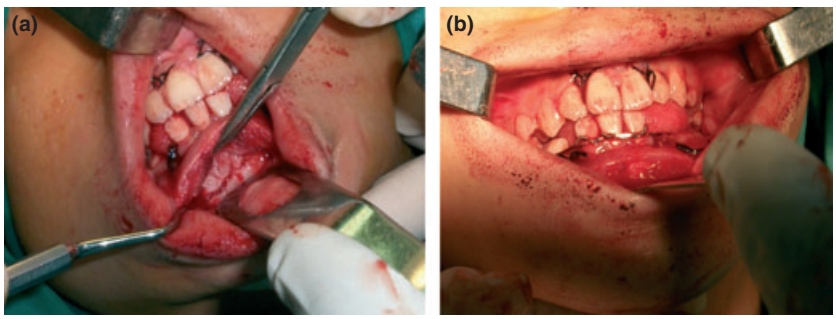

Fig. 2. (a) The fracture was reduced, and the dental arch was in proper occlusion, (b) The fracture was stabilized with dental wire splint.

Fig. 3. The preoperative malunion of alveolar fracture in one case was shown by 3-dimensional CT scan (front & lateral view).

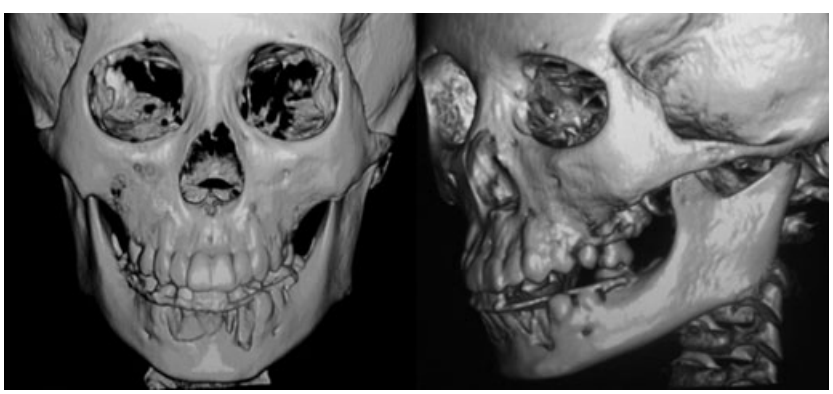

Fig. 4. Satisfactory reduction in the same case was shown by 3-dimensional CT scan (front & lateral view).

other 2 patients declined follow up after dental arch bar removal (Table 1).

Discussion

Fracture of the alveolar process is the result of an inflection or shift in the place of application of force. Teeth associated with alveolar fractures are characterized by mobility of the alveolar process; several teeth will typically move as a unit when mobility is checked. Dentoalveolar trauma commonly presents in clinic, but may prove difficult to manage for severe cases (8, 9). Segmental alveolar fractures present as a whole displaced alveolar segment containing two or more teeth, usually associated with dental injuries or soft tissue lacerations, which is their typical clinical appearance. In our case series, the number of teeth involved in the segmental fractures was 2–4, with a mean of 3.27. Associated dental injuries and soft tissue injuries were also present (Table 1), in which luxation, root fracture, dentin exposure, and gingival laceration

were the most common. Furthermore, for severe segmental alveolar fractures, small bone fragments or fibrous callus are often embedded in the fracture lines or root sockets, or malunion may also occur, thus making the situation more difficult to manage.

In common practice, treatment of fractures of the alveolar process involves reduction and immobilization of the involved segment and stabilization for at least 2 to 4 weeks (10). The majority of cases may be treated by closed reduction. Open reduction through marginal (envelope) incision is usually used in dentoalveolar fractures that cannot be treated by closed reduction. To the best of our knowledge, open reduction through vestibular approach used in our case series has not been previously published or reported by other authors in the English literature.

As for open reduction through marginal (envelope) incision, it may damage the mucous membrane pedicle and its vascular supply to the dentoalveolar fragment. The unique healing capacity of dentoalveolar injuries is because of the vascularity of tissues. Therefore, the soft tissues have to be inspected to ensure that there will be adequate soft tissue attached to the alveolar fragment to maintain the vascular supply if open reduction method is used. Compared with marginal (envelope) incision, the vestibular incision and flap elevation used in our case series were minimal, and the soft tissues attached to the fractured alveolar fragment were maintained as much as possible. By this vestibular approach, there was still vascular supply from the buccal mucoperiosteal pedicle and did not interfere with the already compromised vascular supply of the alveolar process. Moreover, as the vestibular incision was minimal, there was no significant trauma to the gums and mucoperiosteum of the alveolar process. This facilitated quick wound healing, as proved by the results in our case series. From the perspective of minimal tissue invasion emphasized in the open reduction of fractures, vestibular approach is undoubtedly a better choice and superior to the open reduction through marginal (envelope) incision.

In addition, two other important aspects of dental trauma healing should be considered: the effect of repositioning and the splinting (11). Open reduction by vestibular approach can provide a clear surgical field to expose the fracture, in which small bone fragments or fibrous callus inside the fracture lines and root sockets can be directly removed. In our case series, all the patients achieved good reduction during the operation under good visualization of the fracture site by this method. Therefore, the reduction of these alveolar fractures by this method was reliable. Dentoalveolar fractures are usually immobilized by various wiring techniques (12–15). For the cases in whom open reduction has been performed, a semi-rigid splint is necessary for the immobilization of the dentoalveolar fractures. According to our experience, immobilization by use of dental arch bars or orthodontic wire splint enables fracture healing after open reduction, and orthodontic wire splint is suitable for pediatric cases. The outcome of immobilization using dental arch bars or orthodontic wire splint was satisfactory in all the 15 cases.

General anesthesia is most convenient for reduction of major alveolar fractures. However, because of its high cost compared with local anesthesia, most of our patients had the procedure performed under local anesthesia ($n = 13$); only two cases were performed under general anesthesia. The two cases were too young to cooperate under local anesthesia. However, because of the minimal trauma during this procedure; the procedure itself being relatively simple, we believe local anesthesia is the method of choice.

In conclusion, the technique of open reduction by vestibular approach reported by us is an effective treatment method for severe segmental alveolar fractures. The technique is recommended for segmental alveolar fractures when the fractures cannot be treated by closed reduction.

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References

1. Ansari MH. Maxillofacial fractures in Hamedan province, Iran: a retrospective study (1987–2001). J Craniomaxillofac Surg 2004;32:28–34.
2. Bataineh AB. Etiology and incidence of maxillofacial fractures in the north of Jordan. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1998;86:31–5.
3. Nyárády Z, Orsi E, Nagy K, Olasz L, Nyárády J. Transgingival lag-screw osteosynthesis of alveolar process fracture. Int J Oral Maxillofac Surg 2010;39:779–82.
4. Ceallaigh PO, Ekanaykaee K, Beirne CJ, Patton DW. Diagnosis and management of common maxillofacial injuries in the emergency department. Part 5: Dentoalveolar injuries. Emerg Med J 2007;24:429–30.
5. Iatrou I, Theologie-Lygidakis N, Tzerbos F. Surgical protocols and outcome for the treatment of maxillofacial fractures in children: 9 years' experience. J Craniomaxillofac Surg 2010;38:511–6.
6. Olson RA, Fonseca RJ, Zeitler DL, Osbon DB. Fractures of the mandible: a review of 580 cases. J Oral Maxillofac Surg 1982;40:23–8.
7. Flint L, Meredith JW, Schwab CW, Trunkey DD, Rue L. Trauma: contemporary principles and therapy. Philadelphia: Lippincott Williams & Wilins; 2007.
8. Auld DN, Wright GB. The initial management of dentoalveolar trauma in general dental practice. Dent Update 2010;37:286–8.
9. Shinohara EH, Vieira EH, Júnior IR, Pires-Soubhia AM, Martini MZ. Atypical dento-alveolar fracture fixed with screws: a technical note. Dent Traumatol 2010;26:351–2.
10. Prabhakar AR, Tauro DP, Shubha AB. Management of an unusual maxillary dentoalveolar fracture: a case report. J Dent Child (Chic) 2006;73:112–5.
11. Koyuturk AE, Kusgoz A. Multiple dentoalveolar traumatic injury: a case report (3 years follow up). Dent Traumatol 2008;24:16–9.
12. Akin A, Uysal S, Cehreli ZC. Segmental alveolar process fracture involving primary incisors: treatment and 24-month follow up. Dent Traumatol 2011;27:63–6.
13. Baliga M, Shenoy V, Krishna L. Quick technique for immobilisation of dentoalveolar fracture. Br J Oral Maxillofac Surg 2003;41:417.
14. Oikarinen K. Tooth splinting: a review of the literature and consideration of the versatility of a wire-composite splint. End Dent Traumato 1990;6:237–50.
15. Dehen M, Mrzilek M, Paling T. Modified acrylic cap splint for dento-alveolar fractures. Int J Oral Maxillofac Surg 1989;18:85–6.