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A Simple and Reliable Submental Intubation Technique for Maxillofacial Fractures

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Abstract: In 1986, Altemir first reported the use of submental intubation to avoid tracheotomy in patients with panfacial and midfacial fractures for whom intermaxillary fixation is necessary, but orotracheal and nasotracheal intubations are not recommended. This novel technique allowed intraoperative access to perform dental occlusion and reconstruction of the nasal pyramid in patients with skull base fractures. Herein, we describe a refined technique based on Altemir's original procedure. Seven male patients with panfacial fractures underwent submental intubation using our refined technique. The technique was developed after encountering a technical error with Altemir's original procedure. In this new technique, we employed a 2-0 silk suture guide to allow the passage of both the endotracheal and cuff-inflation tubes through the same tunnel created from the oral cavity to the submental area. The success rate of the refined technique was 100%, and there were no intraoperative or postoperative complications. There was 20 seconds of ventilation outage time in total. Endotracheal and cuff-inflation tubes were easily and quickly passed through the same submental tunnel. Our refined technique is simple, easy, safe, fast, inexpensive, and does not require specific materials. Submental scars were smaller and relatively inconspicuous in this study, compared to those reportedly associated with other modified techniques.

Key Words: Intubation, nasal, panfacial fracture, submental, tracheotomy

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In patients with panmaxillary and/or mandibular fractures, nasotracheal intubation is usually required to allow intraoperative access for maxillo-mandibular fixation to establish correct dental occlusion. However, nasotracheal intubation is not recommended in cases with nasal and/or basal skull fractures.[1] Tracheotomy is usually employed in such cases, but it often leaves a noticeable scar on the neck and is associated with iatrogenic complications, such as tracheal stenosis, laryngeal nerve damage, and long-standing tracheal fistula.[2,3]

In 1986, Hernandez Altemir first reported submental intubation as a procedure to avoid tracheotomy in cases with open reduction of facial fractures to obtain intraoperative access to dental occlusions when either nasotracheal or orotracheal intubation is impossible.[4] The technique is relatively easy to perform and reliable but is sometimes associated with complications, including those related to the wound and endotracheal/cuff-inflation tubes (Table 1).[5–10]

Importantly, the endotracheal and cuff-inflation tubes sometimes require different passageways through the submental tissue, which creates a loop in the inflation tube in the submental tunnel and results in cuff inflation difficulty. Several techniques have recently been reported to reduce the complications associated with the passage of both tubes from the oral cavity to the submental area.[11] Herein, we report a refined submental intubation technique based on Altemir's original method, designed to avoid the aforementioned complications.

METHODS

Seven patients underwent submental intubation using our refined technique at our institution between May 2016 and April 2017, and the technique was performed by 5 different plastic surgeons. All patients had panfacial fractures, and neither oral nor nasal intubation was applicable due to their maxillary and/or mandibular fractures in conjunction with nasal or basal skull fractures. All patients were male and were 16 to 75 years of age (mean 42.5 years). Written informed consent to undergo the procedure was provided

TABLE 1. The 2 Types of Complications During Submental Intubation

Group	Complication
Wound	Hypertrophic scar
	Infection
	Bleeding
	Orocutaneous fistula
	Transient lingual nerve paresthesia
	Mucocele
Endotracheal/cuff-inflation tube	Tube damage
	Right mainstem intubation
	Endotracheal tube obstruction
	Accidental extubation
	Erroneous passage of the tubes

TABLE 2. Clinical Profile of Patients who Underwent Submental Intubation

No	Sex	Age	Injury	Treatment	Technique	Complication	Time (min)
1	M	49	Le Fort I, II, III fracture, skull base fracture	ORIF + IMF	Original → refined	Erroneous passage	22
2	M	23	Le Fort I fracture, naso-ethmoid fracture	ORIF + IMF	Refined	None	6
3	M	72	Le Fort I fracture, mandibular fracture, nasal fracture	ORIF + IMF	Refined	None	6
4	M	75	Le Fort I fracture, right zygomatic fracture, mandibular fracture, nasal fracture	ORIF + IMF	Refined	None	9
5	M	16	Le Fort I, II, III fracture, naso-ethmoid fracture	ORIF + IMF	Refined	None	5
6	M	19	Le Fort I fracture, left zygomatic fracture, naso-ethmoid fracture, skull base fracture	ORIF + IMF	Refined	None	7
7	M	45	Le Fort I fracture, nasal fracture	ORIF + IMF	Refined	None	3

IMF, intermaxillary fixation; M, male; ORIF, open reduction internal fixation.

prior to undergoing open reduction and internal fixation simultaneously with intermaxillary fixation (Table 2). An anesthesiologist induced general anesthesia for basic oral intubation and extubation in all cases. The vital functions of all patients were monitored and the patients' breathing was managed during surgery.

Refined Submental Intubation Technique

After basic oral intubation, temporary draping of the mid and lower face was performed. A skin incision of approximately 2 cm was made centrally approximately 3 cm caudal to the inferior border of the mandible in the submental region down to the platysma. Using a pair of curved artery forceps (Medical U&A, Japan), the submental tunnel was bluntly made from the platysma to the mylohyoid muscle, and then to the mucosa of the oral floor. After the forceps reached the oral floor, the mucosa was incised from the oral cavity. The submental tunnel was then bluntly enlarged to the width of the endotracheal tube using the same forceps, and a 2-0 silk suture (Alfresa Pharma, Osaka, Japan) was grasped by the forceps and passed caudally through the tunnel. Next, the caudal part of the same suture was grasped by 2 pairs of curved artery forceps, with a distance of approximately 10 cm between the 2 pairs of forceps (Fig. 1A-B). After pulling the suture from the oral cavity, the first pair of forceps was passed through the tunnel. The cuff-inflation tube was grasped by the same pair of forceps and pulled out through the tunnel (Fig. 1C). The suture was pulled again, and the second pair of forceps was passed through the tunnel until the oral floor was reached. The endotracheal tube was then detached from the part connected to the ventilator and was grasped by the second pair of forceps and pulled out through the same tunnel (Fig. 1D) (rendering of our refined technique, which was described in Fig. 1A-D, is in Supplemental Digital Content, Video, http://links.lww.com/SCS/A357). The endotracheal tube was immediately attached to the connector and the ventilator and was fixed to the submental skin via a 2-0 silk suture (Fig. 1E). After repositioning and fixation of the fractures and subsequent intermaxillary fixation, the tubes were repositioned to the intraoral intubation position to re-establish ventilation. The submental incision was closed in 2 layers using 5-0 polydioxanone and 6-0 nylon sutures (Ethicon, Bridgewater, NJ), and the mucosa incision was closed in 1 layer using a 4-0 polyglactin 910 suture (Ethicon).

RESULTS

In the first case, we pulled out the inflation tube and then pulled out the endotracheal tube using curved artery forceps in accordance with the original submental intubation technique. However, we could not fully inflate the cuff to achieve sufficient ventilation because of a technical error, wherein the endotracheal and cuff-inflation tubes went through different passages in the submental tissue, which created a loop in the inflation tube within the incision (Fig. 2A-B).

We then modified the original method using a 2-0 silk suture, as described earlier, and successfully pulled out the 2 tubes easily through the same route. This technique was successfully utilized in 6 subsequent cases by 5 different plastic surgeons, thereby facilitating submental intubation. There were no intraoperative or postoperative complications associated with the procedure. The mean duration of the procedures, excluding the initial case, was approximately 6 minutes (minimum 3 minutes, maximum 9 minutes). The average outage time of ventilation was approximately 20 seconds.

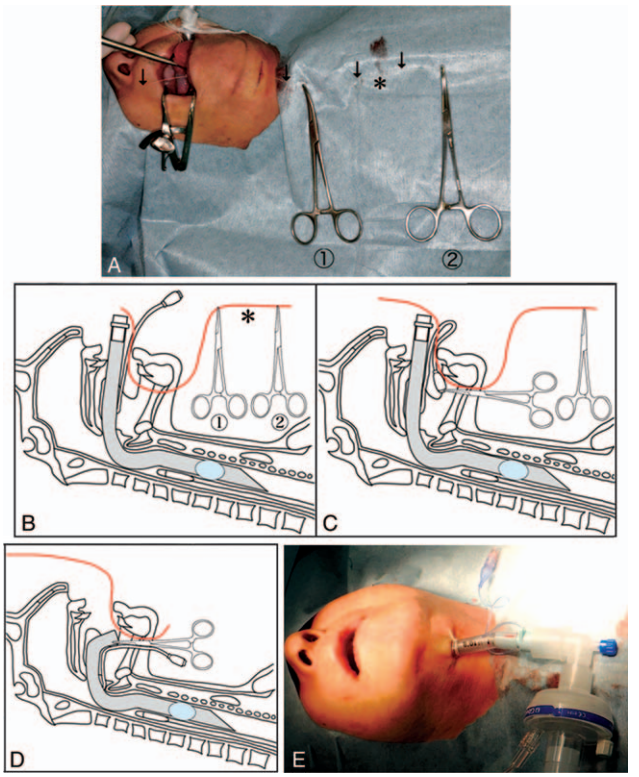

FIGURE 1. (A) A 2-0 silk suture (* and arrows) was passed through the submental tunnel. Two pairs of forceps were then attached to the suture with a distance of approximately 10 cm between them, on the submental side. (B) Schematic diagram of the photograph shown in (A). (C) The cuff-inflation tube was grasped with a pair of forceps and pulled through the tunnel. (D) The endotracheal tube was grasped by a second pair of forceps and pulled out through the same tunnel. (E) The endotracheal tube was fixed to the submental skin via a 2-0 silk suture.

TABLE 3. Previously Reported Modification Materials

Authors	Year	Material	Aim
Meyer et al	2003	Nasal speculum with long flanges	Passing the 2 tubes through the same tunnel and preventing tube and submental soft tissue damage
Nyárády et al	2006	Nylon tube	Passing the 2 tubes through the same tunnel and preventing tube and submental soft tissue damage
Biswas et al	2006	Dilator from a percutaneous tracheostomy kit	Passing the 2 tubes through the same tunnel and preventing tube and submental soft tissue damage
Hanamoto et al	2011	Polypropylene cylinder from a disposable 10-cc syringe	Passing the 2 tubes through the same tunnel and preventing tube and submental soft tissue damage
Kita et al	2016	Silicone tube	Passing the 2 tubes through the same tunnel and preventing tube and submental soft tissue damage
Lim et al	2003	Blue cap from a thoracic catheter	Covering the tips of both tubes and preventing submental soft tissue damage
Lima et al	2011	Surgical glove finger	Covering the tips of both tubes and preventing submental soft tissue damage
Haggerty and Vogel	2015	Surgical glove finger	Covering the tips of both tubes and preventing submental soft tissue damage

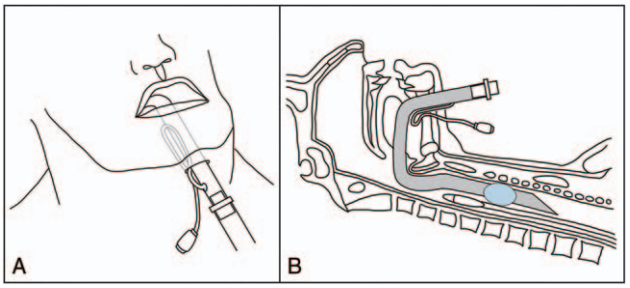

FIGURE 2. (A) The loop of the cuff-inflation tube within the incision. (B) A cross-sectional depiction of the intubation shown in (A).

DISCUSSION

Tracheotomy sometimes causes intraoperative and postoperative complications, and complication rates of 14% to 45% have been reported.[12] Submental intubation is generally not associated with major complications; however, minor complications can occur, and a minor complication rate of 7% was reported in one study.[13] In previous reports, the mean duration of tracheotomy was 42 minutes,[14] and the mean duration of submental intubation was 10 minutes.[15]

Various technical studies have described ways to avoid the complications associated with the passage of the endotracheal/cuff-inflation tube from the oral cavity to the submental area. To ensure that these 2 tubes pass through the same submental tunnel without damaging either tube, specialized equipment to guide the tubes through the submental tunnel is needed, such as a nasal speculum with long flanges,[16] nylon tubes,[17] silicone tubes,[18] a percutaneous dilational tracheostomy kit,[19] or a polypropylene cylinder from a disposable 10-cc syringe.[20] It has also been reported that covering the tips of both tubes with the blue cap from a thoracic catheter[21] or a surgical glove finger[22,23] can reduce the risk of tube damage (Table 3).

Notably, previously reported techniques to achieve this outcome have limitations, including requiring specific materials and use of larger submental skin incisions since the size of the equipment is often larger than that of the endotracheal tube diameter. Conversely, our refined technique only requires a silk suture which is generally in the hospital for surgery, and an incision size of <2 cm because the tunnel diameter required is almost the same as the endotracheal tube diameter. The mean duration of the procedure was 6 minutes, which is shorter than previously reported times in the literature.[24] A silk suture is soft, has a high level of flexibility, and a small diameter. Passing the hard and/or large equipment as a guide through the submental tunnel might risk damaging the submental soft tissue. Our technique reduces this risk and allows for passage of the 2 tubes through the same tunnel.

Submental intubation requires a learning curve for the plastic surgeon. For this reason, we cannot directly compare the outcomes reported herein with those derived from other institutions and plastic surgeons. Notably, 5 different plastic surgeons used our refined technique in the current study, and, in all cases, only a few minutes were required to achieve submental intubation.

CONCLUSION

Submental intubation requires superior technical skills, particularly when passing the endotracheal and cuff-inflation tubes from the oral cavity to the submental area. Our refined technique reduces the likelihood of complications associated with submental intubation. As well as being safe, it is simpler, easier, and faster than other techniques, it does not require any specialized equipment, and it is not costly. Submental scarring associated with the technique is lower than that associated with other techniques.

REFERENCES

1. Caubi AF, Vasconcelos BC, Vasconcellos RJ, et al. Submental intubation in oral maxillofacial surgery. Review of the literature and analysis of 13 cases. *Med Oral Patol Oral Cir Bucal* 2008;13:197–200
2. Straetmans J, Schlöndorff G, Herzhoff G, et al. Complications of midline-open tracheotomy in adults. *Laryngoscope* 2010;120:84–92
3. Halum SL, Ting JY, Plowman EK, et al. A multi-institutional analysis of tracheotomy complications. *Laryngoscope* 2012;122:38–45
4. Altemir FH. The submental route for endotracheal intubation. A new technique. *J Maxillofac Surg* 1986;14:64–65
5. Chandu A, Witherow H, Stewart A. Submental intubation in orthognathic surgery. Initial experience. *Br J Oral Maxillofac Surg* 2008;46:561–563
6. O'Connell JE, Kearns GJ. Submental intubation. a retrospective review of 45 cases. *Ir J Med Sci* 2013;182:309–313
7. Eisemann B, Eisemann M, Rizvi M, et al. Defining the role for submental intubation. *J Clin Anesth* 2014;26:238–242
8. Amin M, Dill-Russell P, Manisali M, et al. Facial fractures and submental tracheal intubation. *Anaesthesia* 2002;57:1195–1199
9. Langford R. Complication of submental intubation. *Anaesth Intensive Care* 2009;37:325–326
10. Navaneetham A, Thangaswamy VS, Rao N. Submental intubation. Our experience. *J Maxillofac Oral Surg* 2010;9:64–67
11. de Toledo GL, Bueno SC, Mesquita RA, et al. Complications from submental endotracheal intubation. A prospective study and literature review. *Dent Traumatol* 2013;29:197–202
12. Schütz P, Hamed HH. Submental intubation versus tracheostomy in maxillofacial trauma patients. *J Oral Maxillofac Surg* 2008;66:1404–1409
13. Jundt JS, Cattano D, Hagberg CA, et al. Submental intubation. A literature review. *Int J Oral Maxillofac Surg* 2012;41:46–54
14. Freeman BD, Isabella K, Cobb JP, et al. A prospective, randomized study comparing percutaneous with surgical tracheostomy in critically ill patients. *Crit Care Med* 2001;29:926–930

15. Scafati CT, Maio G, Aliberti F, et al. Submento-submandibular intubation. is the subperiosteal passage essential? Experience in 107 consecutive cases. *Br J Oral Maxillofac Surg* 2006;44:12–14
16. Meyer C, Valfrey J, Kjartansdottir T, et al. Indication for and technical refinements of submental intubation in oral and maxillofacial surgery. *J Craniomaxillofac Surg* 2003;31:383–388
17. Nyárády Z, Sári F, Olasz L, et al. Submental intubation in concurrent orthognathic surgery. A technical note. *J Craniomaxillofac Surg* 2006;34:362–365
18. Kita R, Kikuta T, Takahashi M, et al. Efficacy and complications of submental tracheal intubation compared with tracheostomy in maxillofacial trauma patients. *J Oral Sci* 2016;58:23–28
19. Biswas BK, Joshi S, Bhattacharyya P, et al. Percutaneous dilational tracheostomy kit. An aid to submental intubation. *Anesth Analg* 2006;103:1005
20. Hanamoto H, Morimoto Y, Niwa H, et al. A new modification for safer submental orotracheal intubation. *J Anesth* 2011;25: 781–783
21. Lim HK, Kim IK, Han JU, et al. Modified submental orotracheal intubation using the blue cap on the end of the thoracic catheter. *Yonsei Med J* 2003;44:919–922
22. Lima SM Jr, Asprino L, Moreira RW, et al. A retrospective analysis of submental intubation in maxillofacial trauma patients. *J Oral Maxillofac Surg* 2011;69:2001–2005
23. Haggerty CJ, Vogel CT. Submental orotracheal intubation: an alternative to open tracheotomy in maxillofacial surgery patients. *Jacobs J Otolaryngol* 2015;1:016
24. Gadre KS, Waknis PP. Transmylohyoid/submental intubation: review, analysis, and refinements. *J Craniofac Surg* 2010;21: 516–519

