Review Article

JRAD Journal of Research and Advancement in Dentistry

J Res Adv Dent 2021;12:2:195-202.

Intubation via Submental Route: A Review of Literature

Abhishek Bera[1*] MD Tipu Sultan[2] Rahul Sahoo[3] Chirantan Maity[4] Gourab Mandal[5]

[1]Clinical Tutor, Department of Dentistry, College of Medicine and Sagore Dutta Hospital, Kolkata, West Bengal, India.
[2]Clinical Tutor, Department of Dentistry, Murshidabad Medical College and Hospital, Berhampore, Murshidabad, West Bengal, India.
[3]Assistant Professor, Department of Periodontics, Awadh Dental College and Hospital, Jamshedpur, Jharkhand, India.
[4]Assistant Professor, Department of Oral & Maxillofacial Surgery, Haldia Institute of Dental Sciences and Research, Haldia, West Bengal, India.
[5]Assistant Professor, Department of Oral & Maxillofacial Surgery, Guru Nanak Institute of Dental Sciences and Research, Kolkata, West Bengal, India.

ABSTRACT

Background: Submental intubation, a less invasive alternative to tracheostomy, was first described for acute airway management of maxillofacial trauma patients, where nasoendotracheal intubation was contraindicated and oral intubation was not possible due to the desire to establish dental relationships peri-operatively. While submental intubation is used most commonly in trauma patients, the range of indications for its use has broadened to include many orthognathic and skull base surgical procedures. Submental intubation is a safe, effective technique for many maxillofacial procedures, requiring the cooperation of both anesthesiologists and maxillofacial surgeons.

Keywords: Submental Intubation, Airway techniques, Maxillofacial Trauma.

INTRODUCTION

Submental intubation was first described in 1986 [1] for acute airway management of maxillofacial trauma patients, in whom nasoendotracheal intubation was contraindicated and oral intubation was not ideal due to the desire to establish dental relationships perioperatively. The technique was a nice alternative to tracheostomy. Since that time, there have been case reports describing the technique and individual experience of many practitioners, but only a few articles have reviewed its use across specialties. Since the first report of the technique, the range of indications for submental intubation has broadened to include many orthognathic and skull base surgical procedures.

Technique

Hernández Altemir's original paper described a technique for submental intubation that begins with the standard oral intubation, followed by a 2 cm submental skin incision parallel to the mandible in a paramedian location approximately one finger breadth from the mandibular border [1]. Next, a 2 cm oral incision in the lateral sulcus is made. The last step is the creation of a paramandibular, subperiosteal, sublingual pathway through the floor of the mouth to open into the oral cavity. The geniohyoid and genioglossus muscles are not crossed, and insertion of the anterior belly of the digastric muscle is spared. The deflated pneumatic cuff is then brought inferiorly through the created opening, followed by the endotracheal tube (ETT). After reversing the previous two steps at the conclusion of the operation, loose approximation of tissue with sutures is performed to allow for moderate drainage. Technical modifications of the submental intubation technique include using ventilatory tubes other than ETTs so as to provide additional options that may be implemented for specific circumstances and specific patient populations [2,3]. The first modification described the use of a reinforced tube of a Laryngeal Mask Airway (LMA; The Laryngeal Mask Company, Henley-on-Thames, UK). In a set of three patients, use of a LMA

Received: Jan. 9, 2021**: Accepted**: Mar. 12, 2021
*Correspondence **Dr. Abhishek Bera.**
Department of Dentistry, College of Medicine and Sagore Dutta Hospital, Kolkata, West Bengal, India.
Email: drabhishekbera@gmail.com

pISSN 2278-0076
eISSN 2321-9270

was beneficial in avoiding the risk of damaging laryngo-tracheal structures, preventing any harm to the vocal cords of a voice professional, and ensuring no further harm in a patient with unstable cervical fractures and orofacial trauma. Ball et al [4] also reported the benefits of using the flexible tracheal tube supplied with the intubating LMA. The benefits include the easily removable universal connector and the specific shape and design of the tube tip, which aids in placement. The other modifications involve the use of a Combitube SA (Tyco-Healthcare-Kendall-Sheridan, Mansfield, MA, USA) [5] in severe oral and maxillofacial trauma. The Combitube SA is a double lumen tube with one blind end, which functions as an esophageal obturator airway, while the other lumen serves as a standard cuffed ETT. The combined effect is the successful sealing of the oral and nasal pharyngeal cavities, specifically useful in pharyngeal bleeding. The added benefit of the proximal balloon may serve to support maxillomandibular structures, acting as a reducer and buttress for displaced bone fragments when inflated. The original technique of exteriorizing an oral tube through a surgically created tunnel requires the use of a tube fitted with a universal connector that may be removed prior to bringing the tube into the submental area. Recognizing that this tube may not always be available, two modifications using a two-tube technique were published [6,7]. After a standard oral ETT is placed, the submental incision is made and dissection of the soft tissue is created, as in the standard technique. Once the tunnel is complete, artery forceps are introduced from an intraoral position into the submental space. A second ETT is then brought back through the tunnel into the mouth. The original tube is withdrawn and the second tube is used to reintubate the patient.

A few technical modifications have sought to minimize the trauma produced when making the submental incision and tunnel into the oral cavity. Bartkowski et al [8] described an intraoral incision performed laterally from the frenulum of the tongue, and Nwoku et al [9] described a 2 cm intraoral incision made parallel to the gingival margin. After unsatisfactory results with the lateral sulcus technique of Hernandez and minor modifications of others, MacInnis et al [10] implemented a midline intraoral incision. Desiring to avoid important anatomical structures and to take advantage of the dearth of vascularity in the midline, they reported that a midline approach would minimize bleeding and damage to structures such as the sublingual gland, Wharton's ducts, and lingual nerve. Their intraoral incision is a 2 cm midline incision that bisects the sagittal plane of the face and is made posterior to the openings of Wharton's ducts. Noting a risk of sublingual hematoma and edema formation, Mahood et al [11] used a 1 cm midline intraoral incision placed slightly more anteriorly. The incision is placed halfway between the reflection of mucosa from the mandible and the submandibular duct papillae. A final group of technical modifications sought to minimize damage to the ETT during the process of exteriorization and return of the tube to the intraoral position. In 2003, Lim et al [12] noted that the standard method of exteriorization often resulted in trauma to surrounding tissues.

Specifically, they noted that blood or soft tissue actually may inadvertently enter the hollow tube. Using the blue cap on the end of a thoracic catheter, a technique was developed that attempted to minimize the traumatic effects of the exteriorization process. After the ETT connector is removed and the pilot tube deflated, both are inserted into the blue cap of a 32-French (Fr) - sized thoracic catheter. With both capped, a careful process of pulling inferiorly with a hemostat through the surgically created tunnel, along with pushing from the intraoral side, minimized the traumatic exteriorization process. Nyarady et al [13] attempted to minimize the trauma of exteriorization using a sterile nylon tube. The nylon tube was first pulled through the submental tunnel with the aid of a hemostat. After disconnecting the ETT from the universal connector, the tube was inserted into the nylon tubing and both were brought through the submental tunnel into the extraoral position. This nylon guiding tube made the exteriorization process easier, decreasing trauma to the soft tissues. With the same goal of minimizing tissue damage, Biswas et al [14] used a percutaneous dilational tracheostomy kit in the exteriorization process. Instead of creating the submental tunnel using blunt dissection, the tunnel was made using a series of dilators (21-Fr - 36-Fr). After the tunnel was created, the ETT was exteriorized over one of the smaller dilators out to the submental area. Another technique for submental intubation begins with oral

intubation using a reinforced tube. The submental area is prepped in a sterile fashion and infiltrated with local anesthetic solution. A transverse incision, approximately 2 cm long, is made slightly posterior to the submental crease. A hemostat is then used to bluntly dissect through and through in a cranial direction into the anterior aspect of the floor of the mouth, anterior to Wharton's ducts. The orotracheal tube is briefly disconnected and brought through the floor of mouth tunnel into the submental area (Fig. 1). The inflation tube of the cuff is also pulled through this tunnel (Fig. 2); correct tube positioning is confirmed by the anesthesiologist. The tube is subsequently secured to the submental skin with silk sutures to minimize risk of displacement intraoperatively. Either immediately postoperatively or in a delayed fashion, depending on the need for continued intermaxillary fixation or airway protection, the tube is transferred back to the oral position before complete extubation. Closure of the submental incision is required, while intraoral closure is not necessary. The patient is then extubated in the usual manner. A submental scar revision may be performed if an aesthetic revision is appropriate.

Indications

Maxillofacial trauma is the overwhelming indication for implementation of the submental intubation technique [15–19]. It obviates the dilemma of whether to suffer the limitation of poor exposure and inability to determine dental relationships perioperatively using an orotracheal tube. The technique also eliminates the need for nasal tube placement when possibly contraindicated due to skull base or other maxillofacial fractures, and avoids tracheostomy when it is not required long-term.

Table 1: Submental intubation technique

1. Oral intubation with reinforced tube.
2. Transverse submental incision made.
3. Blunt dissection through floor of mouth in the midline with hemostat.
4. Oral tube disconnected, grasped with hemostat, and brought through submental incision. Inflation tube separately transferred.
5. At extubation, tube is brought back to oral position and submental scar revision performed.

The submental intubation technique has become popular in many elective facial osteotomies [20], and numerous situations have arisen for its use. Traditionally, in combined Le Fort III/ Le Fort I procedures, intraoperative conversion from an oral tube at the completion of Le Fort III osteotomy to a nasal tube at the start of the Le Fort I osteotomy is necessary to establish occlusal relationships. Submental intubation at the outset of the procedure avoids the need for oral-to-nasal tube conversion, a potentially hazardous proposition for the anesthesiologist (and patient) intraoperatively. In a similar way, our experience has shown that the technique is beneficial in orthognathic surgery with simultaneous rhinoplasty. In this case, a nasal-to-oral tube conversion is required after the maxillofacial osteotomies, prior to undertaking nasal surgery. The submental technique is also of benefit in those patients undergoing orthognathic surgery, who have a pharyngeal flap or other anatomic anomaly precluding nasal tube placement. Certain base of skull procedures, such as the transmaxillary access with the use of Le Fort I osteotomy, is another indication for the submental technique [21]. This approach allows for improved exposure because the maxilla is retracted a greater distance than if an oral tube were present. Cancrum oris is another possible indication for the technique [22].

Contraindications

The submental technique is contraindicated if prolonged intubation is necessary. Any patient with a significant head injury, as in many facial injuries, should not be considered a candidate for the submental technique. In this situation, tracheostomy should be considered the treatment of choice.

Advantages

The primary advantage of the submental intubation technique is the ability to avoid a tracheostomy and the resulting morbidity associated with it. The major complications of a tracheostomy include, but are not limited to, infection, hemorrhage, recurrent laryngeal nerve damage, tracheal stenosis, pneumothorax, pneumo-mediastinum, subcutaneous emphysema, and tracheoesophageal fistula. These complications are avoided with submental intubation. In addition, the more minor

risks and complications from submental intubation are less frequently present than those from tracheostomy. The time required to complete submental intubation is less than the time required for tracheostomy, and the resulting scar is more aesthetically acceptable. Minimal postoperative care and ease of reversibility also support the benefits of the submental technique over tracheostomy, when appropriate.

In those surgical cases in which submental intubation may be of benefit, there are three primary advantages that assist in the operative procedure. The ability to ensure dental occlusion throughout the procedure has already been discussed but is of great importance. Maxillofacial trauma often results in damage that alters the dental occlusal relationships. Being able to address this perioperatively is of great benefit. Any oral tube would prevent any analysis of whether preinjury occlusion has been restored. Removal of the ETT from the direct surgical field is also an important benefit. Rather than having to work around and manipulate the tube, the submental intubation technique allows for a larger and unobstructed operative field. Third, the submental approach to intubation allows for increased retraction in skull base procedures. Seeking to gain access to the skull base using a transmaxillary approach, after the osteotomy is completed, the maxilla is retracted inferiorly to open up the field of vision.

Potential drawbacks and complications

While only minor complications have been published in the literature, the primary disadvantage of submental intubation is the requisite submental scar. With an appropriate length of incision chosen and meticulous closure, this scar may be minimized with aesthetically acceptable results. Scar revision is always an option for cases in which the submental scar leaves a lasting, unacceptable appearance. Patients with previously documented poor scarring or tendency to form hypertrophic scars or keloids may not be appropriate candidates for the technique.

The most serious reported complication is accidental extubation. Two cases have been reported in the pediatric population [23, 24]. The most frequent complication has been superficial skin infections. Damage to the ETT is another potential problem that may occur during the process of converting the oral tube position to the submental position. It can also be damaged during maxillofacial procedures, either from a drill bit to place rigid fixation or a reciprocating saw blade during osteotomies, especially those of the chin.

Discussion

Interest in submental intubation has slowly risen over the past 25 years. Almost 10 years passed before a second article was published on submental intubation in 1995 [25]. The indications for submental intubation are specific and as such lend well to incorporation in an algorithm. First, submental intubation is indicated in patients with planned or traumatic jaw fractures necessitating the re-establishment of a functional occlusion in the presence of nasal fractures, nasal-orbital, ethmoidal fractures, skull base fractures and congenital deformities where nasotracheal, oral endotracheal intubation or tracheostomy is not indicated. Second, submental intubation is indicated in cases where increased surgical exposure is desired such as transmaxillary skull base surgeries or complicated infections. These indications provide a useful guide when determining airway selection in maxillofacial surgery patients. Additional factors to consider include the length of anticipated intubation. Despite several articles reporting prolonged submental intubation of 72 h without adverse effects and no reports to the contrary, prolonged submental intubation greater than 72 h is not routinely practiced due to increased risk of laryngeal damage and pneumonia [25, 26].

The maxillofacial airway algorithm (Table 1) begins with the decision to perform a craniofacial surgery. If ventilator support is anticipated for a period greater than 7 days and when combined with multiple anticipated surgeries, neurological deficits, compromised pulmonary status or severe polytrauma a tracheostomy should be considered. If the anticipated duration of mechanical ventilation is less than 7 days in patients who require isolated orbital, nasal, zygomatico-maxillary complex, sinus fractures or soft tissue repair then an oral endotracheal airway should be considered.

This time span reflects the potential for significant complications as reported in a prospective study of laryngotracheal sequelae associated with intubation

longer than 7 days [27, 28]. In those patients who sustain jaw fractures or undergo routine orthognathic or telegnathic surgery and anticipated mechanical ventilation is less than 7 days, a nasotracheal airway should be considered. Despite 100 reported cases of submental intubation in elective facial osteotomy patients, aesthetic tolerance of scarring is highly variable and in the authors' opinion limits the usefulness in this patient subset when nasotracheal intubation is possible. In patients with an anticipated mechanical ventilation period of less than 7 days who sustain jaw fractures that require the restoration of occlusion in the setting of nasal bone, naso-orbital, ethmoidal, skull base fractures or congenital deformity or in head and neck pathology or cosmetic cases where enhanced surgical exposure is necessary, submental intubation should be considered. This algorithm is expressed diagrammatically (Table 1).

In comparing submental intubation and tracheostomy, submental intubation has no significant reported major complications. Tracheostomy complications include hemorrhage, surgical emphysema, wound site infection, recurrent laryngeal nerve injury, tracheal stenosis, poor scar aesthetics, tracheoarterial fistula and death [27, 29, 30]. The mortality rate of tracheostomy has been reported to range from 0.5% to 2.7% [30, 31, 32]. In addition to fewer reported minor complications, submental intubation requires less time than a tracheostomy, costs less and results in an aesthetically well tolerated scar.

CONCLUSION

In conclusion, submental intubation is an underutilized, safe and effective technique for establishing an airway in patients requiring facial reconstructive surgery where traditional methods are contraindicated. Despite the low LOE in the literature, the cumulative results reported in this manuscript include the best available evidence. Additional research is necessary to compare tracheostomy to submental intubation and larger studies are required to validate new modifications reported in the literature (Table 2). The potential exists to significantly reduce morbidity by avoiding a tracheostomy in selected patients. Reported complications are minor and resolve with minimal intervention. Technique modifications aimed at reducing tube damage may serve to reduce complications with little added risk. In choosing a potential modification, the surgeon should inform the anesthesiologist of their intended sequence. Communication between the surgeon and anesthesiologist is paramount. Innovations based on the original technique, such as the percutaneous dilator method described by Biswas or enhanced pilot balloon tubing, may further decrease complications and should be explored in greater detail.

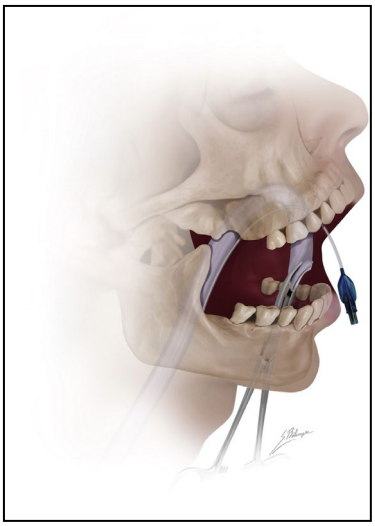

Fig. 1 Diagram showing a hemostat bringing the oral endotracheal tube through the midline submental soft tissues. The authors acknowledge the illustration by S. Bélanger.

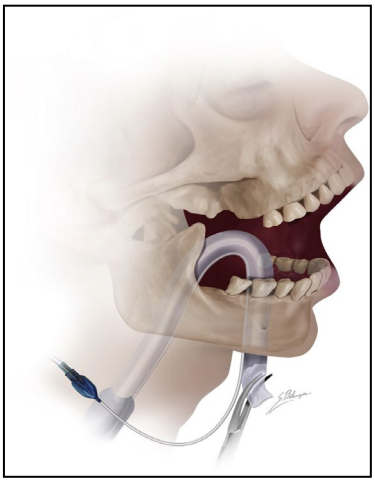

Fig. 2 Diagram of the inflation tube of the cuff transitioned separately. The authors acknowledge the illustration by S. Bélanger.

Table 1: Maxillofacial Airway Algorithm

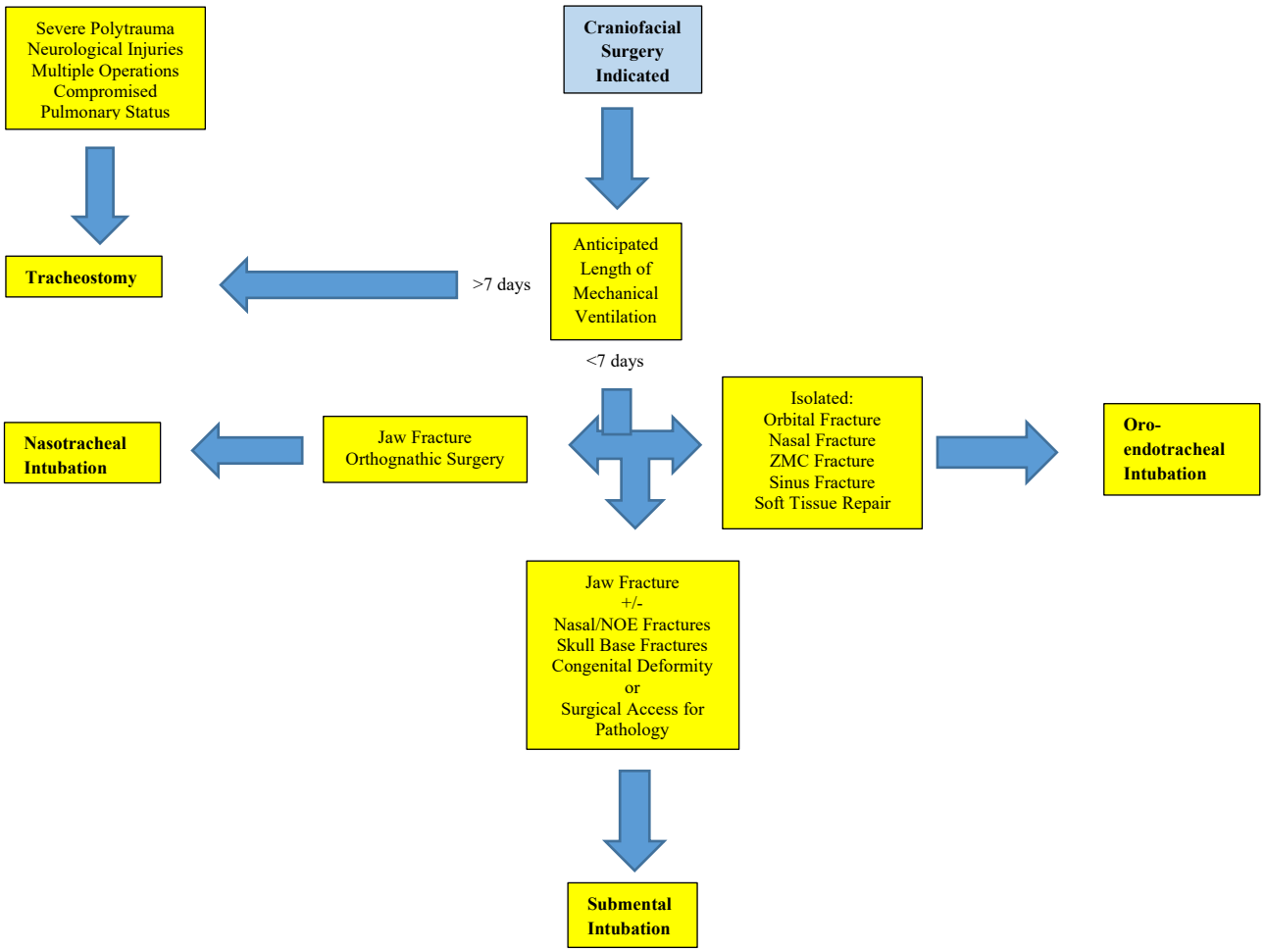

Table 2: Submental Intubation Modifications:

Author	Year	Modifications	Reason for modifications
Altemir et al.[1]	1986	2 cm paramedial incision in subperiosteal plane. Nasal speculum facilitates tube passage through submental region.	First report
Green & Moore[6]	1995	1st tube: oral intubation, 2nd tube: submental approach. Oral tube is substituted with submental endotracheal tube, patient is reintubated.	Allows use of endotracheal tubes with non-detachable universal connectors
Macinnis & Baig[10]	1999	2cm midline incision posterior to Warton's ducts between geniohyoid, genioglossus and anterior belly of the digastric muscles	Decreased bleeding
Altemir et al.[2]	2000	Utilized a reinforced laryngeal musk airway in submental approach	Allows use in severe laryngotracheal trauma, singers and patients with unstable cervical fractures
Nwokuet al.[9]	2001	2cm latero-submental incision	Attempts to avoid significant floor of the mouth structures

Mahmood & Lello [11]	2002	1 cm midline incision between Wartson's duct and the reflection of lingual gingiva and floor of the mouth	Decreased bleeding and avoidance of important structures
Altemir et al. [3]	2003	Utilized a reinforced combitube in submental approach	Assists in tamponade of pharyngeal haemorrhage
Ball et al. [4]	2003	Flexible tracheal tube with an intubating laryngeal musk	Connector easily removed and refitted and tube tip design eases intubation
Lim et al. [12]	2003	1.5 submental and paramedial incision. Blue cap size of 32Fr thoracic catheter is placed over the distal end of the tube incorporating the pilot balloon and tube	Reduction of tube damage complications
Nyarady et al. [13]	2006	A sterile nylon guiding tube is placed over the distal end of the tube incorporating the pilot balloon and tube	Reduction of tube damage complications
Biswas et al. [14]	2006	Percutaneous tracheostomy dilatational kit facilitates exteriorization of the endotracheal tube through the submental route	Reduction of tube damage complications

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interest regarding this article.

REFERENCES

1. Hernández Altemir F. The submental route for endotracheal intubation. A new technique. J Maxillofac Surg 1986;14:64-5.

2. Hernández Altemir F, Hernández Montero S. The submental route revisited using the laryngeal mask airway: a technical note. J Craniomaxillofac Surg 2000;28:343-4.

3. Hernández Altemir F, Hernández Montero S, Moros Peña M. Combitube S.A through submental route. A technical innovation. J Craniomaxillofac Surg 2003;31:257-9.

4. Ball DR, Clark M, Jefferson P, Stewart T. Improved submental intubation. Anaesthesia 2003;58:189.

5. Eisemann Bradley, Eisemann Michael, Rizvi Mort, Urata Mark M., Lypka Michael A.. Defining the role for submental intubation Journal of Clinical Anesthesia (2014)

6. Green JD, Moore UJ. A modification of submental intubation. Br J Anaesth 1996;77:789-91.

7. Drolet P, Girard M, Poirier J, Grenier Y. Facilitating submental endotracheal intubation with an endotracheal tube exchanger. Anesth Analg 2000;90:222-3.

8. Bartkowski SB, Zapała J, Szuta M, Podziorny H, Kuchta K. General anesthesia via tracheosubmental intubation from our own experience. Aesthetic Plast Surg 1999;23:292-5.

9. Nwoku AL, Al-Balawi SA, Al-Zahrani SA. A modified method of submental oroendotracheal intubation. Saudi Med J 2002;23:73-6.

10. MacInnis E, Baig M. A modified submental approach for oral endotracheal intubation. Int J Oral Maxillofac Surg 1999;28:344-6.

11. Mahmood S, Lello GE. Oral endotracheal intubation: median submental (retrogenial) approach. J Oral Maxillofac Surg 2002;60:473-4.

12. 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;44:919-22.

13. Nyárády Z, Sári F, Olasz L, Nyárády J. Submental endotracheal intubation in concurrent orthognathic surgery: a technical note. J Craniomaxillofac Surg 2006;34:362-5.

14. Biswas BK, Joshi S, Bhattacharyya P, Gupta PK, Baniwal S. Percutaneous dilational tracheostomy kit: an aid to submental intubation. Anesth Analg 2006;103:1055.

15. Jundt JS, Cattano D, Hagberg CA, Wilson JW. Submental intubation: a literature review. Int J Oral Maxillofac Surg 2012;41:46-54.

16. Das S, Das TP, Ghosh PS. Submental intubation: a journey over the last 25 years. J Anaesthesiol Clin Pharmacol 2012;28:291-303.

17. Gordon NC, Tolstunov L. Submental approach to oroendotracheal intubation in patients with midfacial fractures. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995;79:269-72.

18. Agrawal M, Kang LS. Midline submental orotracheal intubation in maxillofacial injuries: a substitute to tracheostomy where postoperative mechanical ventilation is not required. J Anaesthesiol Clin Pharmacol 2010;26:498-502.

19. Davis C. Submental intubation in complex craniomaxillofacial trauma. ANZ J Surg 2004;74:379-81.

20. Chandu A, Witherow H, Stewart A. Submental intubation in orthognathic surgery: initial experience. Br J Oral Maxillofac Surg 2008;46:561-3.

21. Biglioli F, Mortini P, Goisis M, Bardazzi A, Boari N. Submental orotracheal intubation: an alternative to tracheotomy in transfacial cranial base surgery. Skull Base 2003;13:189-95.

22. Eipe N, Neuhoefer ES, La Rosee G, Choudhrie R, Samman N, Kreusch T. Submental intubation for cancrum oris: a case report. Paediatr Anaesth 2005;15:1009-12.

23. Sharma RK, Tuli P, Cyriac C, Parashar A, Makkar S. Submental tracheal intubation in oromaxillofacial surgery. Indian J Plast Surg 2008;41:15-9.

24. Amin M, Dill-Russell P, Manisali M, Lee R, Sinton I. Facial fractures and submental tracheal intubation. Anaesthesia 2002;57:1195-9.

25. Gordon NC, Tolstunov L. Submental approach to oroendotracheal intubation in patients with midfacial fractures. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995;79:269–72.

26. MacInnis E, Baig M. A modified submental approach for oral endotracheal intubation. Int J Oral Maxillofac Surg 1999;28:344–6.

27. Pryor JP, Reilly PM, Shapiro MB. Surgical airway management in the intensive care unit. Crit Care Clin 2000;16:473–88.

28. Whited R. A prospective study of laryngotracheal sequelae in long-term intubation. Laryngoscope 1984;94:367–77.

29. Johnson TR. Submental intubation versus tracheostomy. Br J Anaesth 2002;89:344–5.

30. Zeitouni AG, Kost LM. Tracheostomy: a retrospective review of 281 cases. J Otolaryngol 1994;23:61–6.

31. Castling B, Telfer M, Avery BS. Complications of tracheostomy in major head and neck cancer surgery: a retrospective study of 60 consecutive cases. Br J Oral Maxillofac Surg 1994;32:61–6.

32. Zeitouni AG, Kost LM. Tracheostomy: a retrospective review of 281 cases. J Otolaryngol 1994;23:61–6.