Available online at http://www.ijims.com
ISSN - (Print): 2519 – 7908 ; ISSN - (Electronic): 2348 – 0343
IF:4.335; Index Copernicus (IC) Value: 60.59; Peer-reviewed Journal

Laryngeal Mark Airway in Oral and Dental Surgeries- A Review

Md Irfanul Haque
Associate Professor of Anesthesia
Faculty of Dentistry
Jamia Millia Islamia, New Delhi, India.
Corresponding Author: Md Irfanul Haque

Abstract

Oral and dental surgery requires a stable airway that is unobstructed, protects lung from aspiration, low interference with the surgical field and few complications. The laryngeal mask airway (LMA), is an alternative to nasal mask and endotracheal intubation, provides advantages of intubation while avoiding some of its complications. LMA is easy to insert and can be used for both spontaneous and controlled ventilations. Operation theater pollution is very less with scavenging of gases. Many other variants of LMA have been developed over the years on same principle, providing additional features and benefits. The LMA flexible, a wire reinforced LMA, is specifically designed for head and neck surgeries. In the intervening years, LMA has been extensively used in oral and dental surgeries despite some being skeptical about it. The purpose of this article is to review the laryngeal mask airway with especial emphasis on its use in oral and dental surgery.
Key words: Anesthesia, Laryngeal mask airway, LMA flexible, oral surgery, dental surgery

Introduction

General Anesthesia in dental practice is targeted to achieve condition for day care surgery by reducing the post-operative complications of nausea, pain, sore throat and other side effects of anaesthetic agents. The airway is shared with dental surgeons necessitating for endotracheal intubation and throat pack insertion, to prevent airway aspiration with blood and tissues. Ideal airway requirement for dental oral procedure can be achieved by providing an unobstructed airway, prevention of aspiration and minimal surgical field interference along with low anesthetic complications.

Sore throat and side effects of muscle relaxants are major concern, when endotracheal tube is inserted for airway maintenance. Nasal mask anesthesia is an alternative avoiding intubation but carries risk of pack displacement, aspiration along with theater pollution due to wasted anesthetic gases. Post-operative pain can occur due to Suxamethonium in dental patients and sometime leads to readmission.[1] Onset of action of newer non-depolarizing muscle relaxants is quick with high doses, however effect may be prolonged. Furthers, it requires intermittent positive pressure ventilation and reversal. There may be potential risk of awareness, allergy and post-operative respiratory insufficiency. Intubation by nasal route may be difficult to achieve and carries risk morbidity due to nasal trauma.

The laryngeal mask airway (LMA), a supraglottic device, invented by Brain in 1981 was considered as alternative option in oral surgery. It can be inserted easily without laryngoscope, and in general takes less time than endotracheal intubation. The LMA lies in hypopharynx and provides end to end seal with glottis. As glottis is not crossed by LMA, its insertion can be achieved without muscle relaxant.The LMA can be used for both spontaneous and controlled ventilation and it provides an airtight seal around laryngeal inlet. As compared to face mask, it frees the anesthetists hand along with providing better airway control as well as scavenging the waste gases. Recovery is smooth as patient tolerance of it is better.

LMA has been extensively used in oral and dental practices. Despite its advantages many anesthetists are still reluctant to use it in oral and dental procedures.[2] Multiple shortcomings, disadvantages and potential complications have been pointed out against its use.[3] Proper selection of patients and a good teamwork between anesthetist and surgeon, as airway is shared, may makes it excellent choice. The purpose of this article is to review the laryngeal mask airway with especial emphasis on its use in oral and dental surgeries.

History

Dr. Archie I.J. Brain began to develop the laryngeal mask airway in 1981. First commercial LMA was made available for clinical use in United Kingdom in 1988, before that Dr. Brain researched numerous combinations of materials, shapes, sizes and techniques and made hundreds of prototypes.[4]

The LMA (later renamed LMA classic) is made of medical grade of silicon consisting of elliptical mask with inflatable outer rim attached with gently curved tube. A pilot tube is attached with pilot balloon to inflate the cuff. LMA classic comes in 8 sizes and used in patients ranging from neonates to large adults.

LMA Flexible (Reinforced laryngeal mask airway) was first described by Alexander from Royal east Sussex hospital in 1990. It was a specially designed modified LMA for use in ENT and dental patients.[5] The modified LMA (subsequently named LMA flexible) was made with size 3 or 4 laryngeal mask sealed attached to an armored tube narrower than endotrached tube. Flexometallic (armored) tube is crush proof and easily movable in oral cavity, provides better surgical access and prevents displacement of cuffed mask while manipulation during surgery.

LMA Fastrach was developed in 1997 for anticipated and unanticipated difficult airway situations.[6] The device has a rigid handle attached to a wide bore tube, that facilitates one hand insertion. Smaller size endotracheal tube can be passed through it, while manipulating the device with handle. While LMA Fastrach has major use during difficult airway, its use is highly limited in oral surgery due to bulky size.

LMA Unique (1997), which has similar design as that of LMA classic, is intended for single use and made of polyvinyl chloride.[7] Another variant of LMA unique is available with silicon cuff and manometer attached to pilot balloon.[8]

LMA proseal (PLMA) (2000) had added built in drain tube lateral to airway tube; it allows regurgitated fluid to pass without soiling the glottis.[9] It also achieves high seal pressure (60 cmH_2O). Nasogastric tube (upto18 FG) can be inserted blindly in drain tube.

I-Gel (Intersurgical Ltd, Wokingham, UK) is a supraglottic device developed by Dr. Nasir. It consists of a tube with noninflatable cuff and also has gastric drain tube with orifice in the cuff. I-Gel, is non LMA family supraglottic device, that provides very high seal pressure.[10] The use of this device has been limited in dental and oral surgery due to thickness of its shaft. A modified I-Gel has been proposed, to be used in oral and dental surgery, based on its comparison with LMA flexible on airway manikin. The part of the shaft of the I-Gel removed and replaced with flexible endotracheal tube.[11] Currently no flexible I-Gel is available commercially.

Anatomy and physiology

When compared to endotracheal intubation, the LMA is relatively noninvasive and causes fewer disturbances to cardiac and respiratory systems.[12-13] Increased heart rate and blood pressure decreases more rapidly to baseline with LMA as compared to intubation. Spontaneous respiration can be maintained on normal classic LMA, however the LMA flexible having narrower tubing can produce higher resistance. Prolonged spontaneous ventilation should be avoided with LMA flexible. The LMA leaks at higher airway pressure of 15 to 25 cmH_2O, while it is disadvantage at one end as non-compliant lungs cannot be ventilated however it may be advantageous as it protects lungs from barotrauma. High airway pressure during ventilation (above 25 cmH_2O) causes gastric dilatation and gas leak causing theater pollution.

Incidence of sore throat is less with the LMA as compared to intubation and it further can be reduced with limitation of cuff pressure during deep anesthesia.[14-15] Cases of pulmonary aspirations have been reported with the LMA, patient selection should be proper to avoid this situation.[16] Spontaneous ventilation with the LMA during spontaneous ventilation may decrease lower esophageal sphincter tone and increases risk of aspiration.[17] A throat pack is generally inserted during oral surgery, however the LMA itself makes airtight seal and throat pack may not be needed routinely.[18]

Indications and contraindications

The LMA is primarily used for minor and short duration surgery. It can be used as an alternative to bag mask ventilation and reduces gastric inflation and risk of aspiration.It is utilized as rescue device when intubation has failed and bag mask ventilation is difficult. Lately, due to ease of insertion, its use has been advocated in emergency setting, prehospital care and cardiac arrest.[19] The LMAs can be used in all sets of patients irrespective of age, gender and weight.

Distorted oral and spinal anatomy is relative contraindication for LMA insertion; the placement may become difficult. LMA use is contraindicated in full stomach patients, as it can cause gastric insufflation and aspiration. Increased airway pressure requirement in patients of reduced lung compliance and high airway resistance, would limit its use. Despite increased risk of aspiration and increased elastance and resistance of the respiratory system in obese patients, LMA with nasogastric tube has been successfully used.

Literature review- use for oral & dental surgeries

Numerous studies have been conducted to look at usefulness of LMA of oral and dental surgeries. Quinn et al has compared nasotracheal tube with reinforced LMA in 100 patients undergoing dento-alveolar surgery.[20] Reinforced LMA insertion was found to be technically difficult due to associated

learning curve. While reinforced LMA provided good access for surgery, repositioning of it midway of surgery was challenging. Higher incidence of epistaxis was noted with nasotracheal tube and incidence of partial obstruction and sore throat was more in reinforced LMA, due to less experience with its use.

George and Sanders Compared reinforced LMA with the standard LMA and nasal mask in 120 children for outpatient dental tooth extraction.[21] Significantly less episodes of airway obstruction, tachycardia, arrhythmias, and desaturation were noted with both LMAs as compared to nasal mask. Flexible LMA provided surgical access but insertion was difficult as compared to standard LMA. Zhao et al has compared the Classic LMA with endotracheal tube in 171 children for day case surgery.[22] Insertion and recovery time was better with the Classic LMA with only sevoflurane, whereas endotracheal tube was inserted along with muscle relaxants. Higher incidence of dislodgement and obstruction was recorded in LMA group that would have been due to size of LMA and positioning of the patient during surgery. Elkhadem et al, in their study with fifty children for full mouth rehabilitation, have concluded that accessibility and workability with naso-tracheal intubation is better leading to significant decrease in operation time. However, use of LMA resulted in less postoperative laryngeal pain and dysphonia.[23]

Proseal LMA (PLMA) has wide tube containing gastric drain tube along with large cuff size, that provides better seal and prevents aspiration.Kim et al used PLMA to manage airway in 19 children undergoing dental procedure.[24] Dental procedures were performed easily despite larger size tube and cuff of PLMA. PLMA has been suggested to be used potentially in difficult airway and dental surgery with longer duration.

The nasal flexible LMA was first mentioned in 5 patients by Marchionni et al in 1997.[25] The LMA flexible was first initially placed orally with standard technique, and then its proximal end without connector was taken out through nasal route with the help of Foley's catheter. This procedure provided perfect access to oral cavity without hindrance of tube. Arisaka et al, in 2006, further confirmed the Marchionni's technique with successful placement and completion of procedure in 15 dental patients.[26] Currently there is no commercially available nasal flexible LMA and LMA used in these studies were flexible LMA for nasal purpose.

Excess mouth opening (over 4 cm) during dental procedures may significantly increase oropharyngeal leak pressure and intra-cuff pressure of the LMA, that in turn may lead to sore throat, gastric insufflation and ventilation difficulties.[27] Opening the mouth leads to posterior displacement of mandible and compression of the pharyngeal lumen along with reduction in retroglossal air space. Keeping 45° head and neck extension with mouth open achieves acceptable airway condition.[28]

The flexible LMA is generally fixed in midline, however it can be fixed laterally, and if required, moved across intraoperatively then refixed.[2] Mouth prop or gag, to reduced distortion of the mouth, can usually be placed behind the tube usually. Modified LMA-PROP has been developed to fit in tube of the LMA, allowing oral surgeon to manipulate the LMA intraoperatively.[29] In dental procedures, removal of the LMA in awake state is more prudent as compared to deep stage, to prevent desaturation, coughing and laryngospasm.[30]

In general, perioperative complication associated with airway management may be technique failure, hypoxia, obstruction, aspiration, sore throat and perioperative nausea and vomiting. The sharing of airway in dental procedure have higher propensity for airway soiling and contamination. Prince et al in

a meta-analysis concluded that risk of post operative hypoxia is significantly less with the LMA when compared to intubation.[31] Partial laryngospasm, in form of reduced airentry and strider has been reported in some cases with the LMA.[32] It did not progressed to full laryngospasm and resolved with deeping of anesthesia or abandonment of general anesthesia.

Emergence delirium, in forms of inconsolable crying, disorientation, thrashing, kicking, hallucination and memory loss, is usual occurrence in pediatric patients. It may be multifactorial, and causes includes anesthetic agents, postoperative pain, rapid emergence, preschool children and preoperative anxiety. General anesthesia with the LMA in children for full mouth rehabilitation resulted in less emergence delirium than nasotracheal intubation.[33]

The airway anatomy may be altered in patients with some genetic abnormalities (e.g. Downs syndrome, cri-du-chat syndrome etc.); nasal endotracheal intubation may become challenging in these conditions.[34,35] Post intubation pain and discomfort associated with nasal tube may further aggravate the anxiety and emergence delirium of mentally challenged patients. [V]Use of the flexible LMA in mentally and developmentally challenged patients for dental treatment, produces less complications postoperatively and faster recovery.[36]

Practical considerations

Oral and dental surgery with laryngeal mask airway requires high level of cooperation between anesthetists and surgeon to obtain maximum benefits and minimize risk. The placement of the flexible LMA may be difficult as compared to classic LMA and have a learning curve associated with it. Once the LMA is placed and its functioning verified with detection of leak, it is led out on the side opposite to planned surgical site. The fixing of the flexible LMA can be in midline or laterally depending upon surgery; if required, it can be moved intraoperatively and then retaped. A mouth prop, placed in front of tube, prevents its retraction towards the operating site. A throat pack is usually not required as the LMA itself provides adequate seal and prevents laryngeal soiling. The LMA usually causes protrusion of tongue especially in children; throat pack can further aggravate the condition. A minimal throat pack can be placed, if required, while taking care of the seal to prevent its compromise.

The LMA can be dislodged or displaced readily during intraoperative manipulations by surgeons. A traction on tube, excessive pressure on neck, flexion of neck, large bite block and excessive mouth opening may lead to leak, obstruction or displacement of the LMA. Extension of the head, protrusion of the mandible, LMA repositioning and unkinking of the LMA tubing are some of the manoeuvers to relieve airway obstruction. Removing and reinserting the LMA would resolve the issue of leak or malpositioning in some cases.

During recovery, leaving the LMA in place protects the respiratory tract and provides a clear airway. Inserting a bite guard before patient wakes, prevents chewing on the tube. Awake removal of the LMA would be less complicating than deep removal.

Conclusions

The LMA has evolved into an acceptable third alternative to nasal mask or intubation in dental and oral surgeries. The flexible LMA has added benefits of improved surgical access and minimum

airway obstruction.While LMA has different sets of post-operative complications, it may be less severe as compared to intubation. For ambulatory oral surgical procedure, it provides quick recovery while avoiding the risks of intubation. The LMA has also been suggested to be used in pediatric patients especially with anatomical defect of airway and in mentally challenged. LMA should be avoided in case where perfect oral access is required and in long and complex cases.

Conflict of Interest: None

References

1. Goodwin AP, Ogg TW, Lamb WT, Adlam DM. The reinforced laryngeal mask in dental day surgery. Ambulatory Surgery. 1993 Mar 1;1(1):31-5.
2. Malden NJ. The use of the laryngeal mask in minor oral surgery. British Journal of Oral and Maxillofacial Surgery. 2003 Oct 1;41(5):343-5.
3. Rollert MK. The case against the laryngeal mask airway for anesthesia in oral and maxillofacial surgery. Journal of oral and maxillofacial surgery. 2004 Jun 1;62(6):739-41.
4. https://www.woodlibrarymuseum.org/museum/laryngeal-mask-airway/
5. Alexander CA. A modified Intavent laryngeal mask for ENT and dental anaesthesia. Anaesthesia. 1990 Oct;45(10):892-3.
6. Ferson DZ, Rosenblatt WH, Johansen MJ, Osborn I, Ovassapian A. Use of the intubating LMA-Fastrach™ in 254 patients with difficult-to-manage airways. The Journal of the American Society of Anesthesiologists. 2001 Nov 1;95(5):1175-81.
7. Verghese C, Berlet J, Kapila A, Pollard R. Clinical assessment of the single use laryngeal mask airway—the LMA-Unique. British Journal of Anaesthesia. 1998 May 1;80(5):677-9.
8. https://www.teleflex.com/usa/en/product-areas/anesthesia/airway-management/lma-airways/index.html#
9. Brain AI, Verghese C, Strube PJ. The LMA 'ProSeal'—a laryngeal mask with an oesophageal vent. British Journal of Anaesthesia. 2000 May 1;84(5):650-4.
10. Michalek P, Donaldson W, Graham C, Hinds JD. A comparison of the I-gel supraglottic airway as a conduit for tracheal intubation with the intubating laryngeal mask airway: a manikin study. Resuscitation. 2010 Jan 1;81(1):74-7.
11. Sanuki T, Sugioka S, Komasawa N, Ueki R, Kaminoh Y, Kotani J. Comparison of insertion of the modified i-gel airway for oral surgery with the LMA flexible: a manikin study. Anesthesia Progress. 2014;61(4):145-9.
12. Wood ML, Forrest ET. The haemodynamic response to the insertion of the laryngeal mask airway: a comparison with laryngoscopy and tracheal intubation. Acta anaesthesiologica scandinavica. 1994 Jul;38(5):510-3.
13. Wilson IG, Fell D, Robinson SL, Smith G. Cardiovascular responses to insertion of the laryngeal mask. Anaesthesia. 1992 Apr;47(4):300-2.
14. Burgard G, Möllhoff T, Prien T. The effect of laryngeal mask cuff pressure on postoperative sore throat incidence. Journal of Clinical Anesthesia. 1996 May 1;8(3):198-201.

15. Nott MR, Noble PD, Parmar M. Reducing the incidence of sore throat with the laryngeal mask airway. European Journal of Anaesthesiology. 1998 Mar;15(2):153-7.
16. Keller C, Brimacombe J, Bittersohl J, Lirk P, Von Goedecke A. Aspiration and the laryngeal mask airway: three cases and a review of the literature. British journal of anaesthesia. 2004 Oct 1;93(4):579-82.
17. Rabey PG, Murphy PJ, Langton JA, Barker P, Rowbotham DJ. Effect of the laryngeal mask airway on lower oesophageal sphincter pressure in patients during general anaesthesia. BJA: British Journal of Anaesthesia. 1992 Oct 1;69(4):346-8.
18. Brimacombe J, Berry A. The laryngeal mask airway for dental surgery—a review. Australian Dental Journal. 1995 Feb;40(1):10-4.
19. White L, Melhuish T, Holyoak R, Ryan T, Kempton H, Vlok R. Advanced airway management in out of hospital cardiac arrest: A systematic review and meta-analysis. The American journal of emergency medicine. 2018 Dec 1;36(12):2298-306.
20. Quinn AC, Samaan A, McAteer EM, Moss E, Vucevic M. The reinforced laryngeal mask airway for dento-alveolar surgery. British journal of anaesthesia. 1996 Aug 1;77(2):185-8.
21. George JM, Sanders GM. The reinforced laryngeal mask in paediatric outpatient dental surgery. Anaesthesia. 1999 Jun;54(6):546-51.
22. Zhao N, Deng F, Yu C. Anesthesia for pediatric day-case dental surgery: a study comparing the classic laryngeal mask airway with nasal trachea intubation. Journal of Craniofacial Surgery. 2014 May 1;25(3):e245-8.
23. Elkhadem A, Nagi P, Abdel-Ghany M. Pediatric dentist accessibility and post-operative complications of laryngeal mask airway versus nasotracheal intubation in full mouth rehabilitation under general anaesthesia: a randomised controlled trial. Egyptian Dental Journal. 2020 Jan 1;66(1-January (Orthodontics, Pediatric & Preventive Dentistry)):17-25.
24. Kim YJ, Hyun HK, Kim JW, Jang KT, Lee SH, Kim CC, Shin TJ, Koo YS. Clinical usefulness of ProSeal laryngeal mask airway for anesthesia during dental procedures in children. Journal of Clinical Pediatric Dentistry. 2015 Jan 1;39(2):179-82.
25. Marchionni L, Agro F, Favaro R, Verghese C, Brimacombe J. The flexible laryngeal mask as a nasal airway. Anesthesia & Analgesia. 1997 Nov 1;85(5):1179.
26. Arisaka H, Matsumoto M, Furuya M, Sakuraba S, Yoshida KI. Application of nasal flexible laryngeal mask airway in anesthesia for oral surgery. Journal of anesthesia. 2007 Feb;21:99-101.
27. Sanuki T, Sugioka S, Hirokane M, Son H, Uda R, Akatsuka M, Kotani J. Optimal degree of mouth opening for laryngeal mask airway function during oral surgery. Journal of Oral and Maxillofacial Surgery. 2011 Apr 1;69(4):1018-22.
28. Sanuki T, Sugioka S, Son H, Uda R, Akatsuka M, Kotani J. Effects of head-neck extension on abnormality of laryngeal mask airway function resulting from opening the mouth. Journal of oral and maxillofacial surgery. 2011 May 1;69(5):1311-5.
29. Mireles R, Devgun R, Tucker B, Votta T, Chahal P, Ramsdell R, Heard C. A novel way to secure the laryngeal mask airway during oral surgery procedures. Anesthesia & Analgesia. 2017 Jun 1;124(6):1836-8.

30. Dolling S, Anders NR, Rolfe SE. A comparison of deep vs. awake removal of the laryngeal mask airway in paediatric dental daycase surgery. A randomised controlled trial. Anaesthesia. 2003 Dec;58(12):1224-8.
31. Prince J, Goertzen C, Zanjir M, Wong M, Azarpazhooh A. Airway Complications in Intubated Versus Laryngeal Mask Airway–Managed Dentistry: A Meta-Analysis. Anesthesia Progress. 2021;68(4):193-205.
32. Jinzenji A, Maeda S, Higuchi H, Yoshida K, Mori T, Egusa M, Miyawaki T. Partial laryngospasms during general anesthesia with a laryngeal mask airway for dental treatment: a report of 5 cases. Journal of oral and maxillofacial surgery. 2010 Oct 1;68(10):2554-7.
33. Keles S, Kocaturk O. Postoperative discomfort and emergence delirium in children undergoing dental rehabilitation under general anesthesia: comparison of nasal tracheal intubation and laryngeal mask airway. Journal of pain research. 2018 Jan 4:103-10.
34. Haque MI. Anesthesia for patients with down syndrome. Int J Health Sci Res. 2019;9(5):381-5.
35. BRISLIN RP, STAYER SA, SCHWARTZ RE. Anaesthetic considerations for the patient with cri du chat syndrome. Pediatric Anesthesia. 1995 Mar;5(2):139-41.
36. Hung WT, Hsu SC, Kao CT. General anesthesia for developmentally disabled dental care patients: a comparison of reinforced laryngeal mask airway and endotracheal intubation anesthesia. Special Care in Dentistry. 2003 Jul;23(4):135-8.