The Relationship of Placement Accuracy and Insertion Times for the Laryngeal Mask Airway to the Training of Inexperienced Dental Students

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Any health care professional can be faced with a medical emergency in which the patient needs ventilatory support. Bag-valve-mask ventilation with the assistance of an oropharyngeal airway that uses 100% oxygen is currently the preferred method for artificial ventilation. This procedure is generally performed ineffectively by most dentists inexperienced in airway management. We examined whether a short and simple period of training by dental students inexperienced in airway management would increase the speed and accuracy of the placement of the laryngeal mask airway (LMA), which may be a superior airway device to the bag-valve-mask and oropharyngeal airway. Thirty-five dental students inexperienced in airway management were divided into 3 groups. The first group received only a demonstration on how to use the LMA. The second and third groups received the demonstration plus practiced inserting the LMA 5 and 10 times, respectively. A dental anesthesiologist graded the placement of the LMA with a tracheobroncho-fiberscope (fiberoptic bronchoscope). Those who practiced inserting the LMA 5 times faired better than those who received no training; however, those who practiced 10 times did not do any better than the second group. The LMA can be inserted rapidly and effectively by dentists inexperienced in airway management after a short period of simple training that may be critical when personnel experienced in intubation are not readily available.

Key Words: Laryngeal mask airway; Dental anesthesiology; Airway management.

Any health care professional can be faced with a medical emergency in which the patient may require ventilatory support. One of the most important considerations during resuscitation, as well as in the provision of general anesthesia, is the delivery of oxygen to the lungs. The most common indication for airway intervention is unconsciousness, during which the airway is frequently obstructed by the base of the tongue falling into the posterior oropharynx and hypopharynx. The main problems associated with difficult airway include brain injury, myocardial injury, airway trauma, and death. Maintaining ventilation with an oropharyngeal airway and bag-valve-mask device, while maintaining head tilt-chin lift and jaw thrust, is tiring and often ineffective when attempted by dentists inexperienced in airway management (Figure 1).[1-3]

Most commercially available nasopharyngeal airways have been shown to be shorter than the optimal length[4] and can cause severe bleeding when inserted. Endotracheal intubation is the gold standard for securing a patent airway. It is, however, a difficult skill to acquire and requires regular practice to maintain proficiency. Endotracheal intubation usually requires direct laryngoscopy, which may cause problems such as dental or laryngopharyngeal trauma, sore throat, and even loss of voice.[5] Endotracheal intubation requires not only an endotracheal tube, but also equipment such as a laryngoscope, pharyngeal suction, and a stethoscope (or some other means

Received October 20, 2000; accepted for publication September 4, 2001.

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Anesth Prog 49:9–13 2002

ISSN 0003-3006/02/$9.50
SSDI 0003-3006(02)

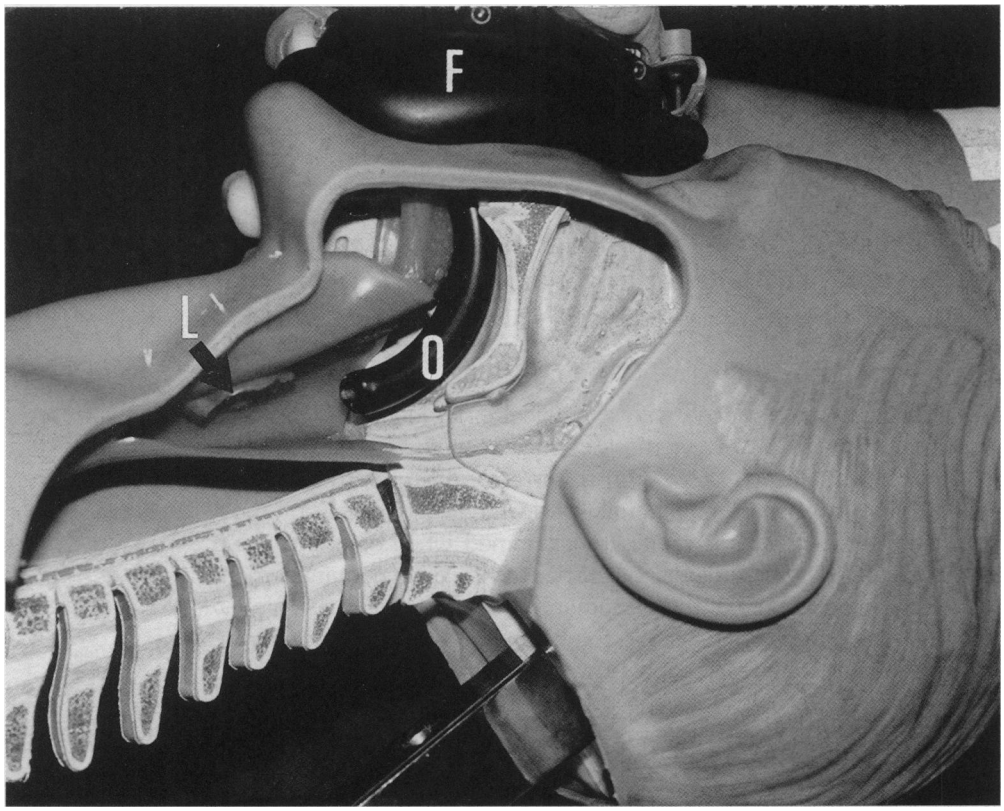

Figure 1. Intubating model with oropharyngeal airway and bag-valve-mask device. O indicates oropharyngeal airway; F, face mask; and L, laryngeal inlet.

of confirming intubation), which adds to the cost and amount of equipment required.

The laryngeal mask airway (LMA) (Laryngeal Mask Co, Nicòsia, Cyprus), shown in Figure 2, was developed in 1983 and is a device that frequently provides a patent airway for resuscitation or anesthetic delivery in both adults and children.[6] It is inserted blindly, with a low incidence of airway trauma, into the hypopharynx and forms a low-pressure seal around the laryngeal inlet. There are 2 main components to the device. The first is a shaft that varies in diameter according to the size of the LMA and is fitted at one end with a standard anesthesia connector device. Fused to the distal end of the shaft at a 30° angle is an elliptical, inflatable rim (cuff). The distal aperture that faces the laryngeal inlet has 2 bars that prevent the epiglottis from falling back and obstructing its lumen. The tip of the mask cannot pass beyond the esophageal sphincter, and hence esophageal intubation is not possible.

In the operating room, the LMA has been shown to prevent laryngotracheal airway soiling in dental procedures for adults[7] and children[8] and in other upper airway surgical procedures such as intranasal surgery.[9] In the emergency situation, once the LMA is inserted, the resuscitator is free to use both hands to squeeze the ventilation bag.

The purpose of this study was to determine whether a short and simple period of training would increase the speed and accuracy of placement of the LMA by dental students with little formal airway management experience.

MATERIALS AND METHODS

Thirty-five fifth-year dental students from a 6-year, undergraduate dental program who had never seen or used an LMA volunteered for the study. Ethical approval was granted before the study was performed by the University Ethic's Committee and the university's president. The participants were classified into 3 groups. The first group (n = 12) received only a demonstration on how to use the LMA (nil practice group). The second group (n = 11) received the demonstration and practiced inserting the LMA 5 times on the adult intubation model manikin (Laerdal, Stavanger, Norway; 5 times practice group). The third group (n = 12) received the demonstration and practiced inserting the LMA 10 times on the manikin (10 times practice group).

Following the demonstration and/or training, each participant inserted an adult-size No. 4 LMA in the same cadaver. Participants with varying degrees of train-

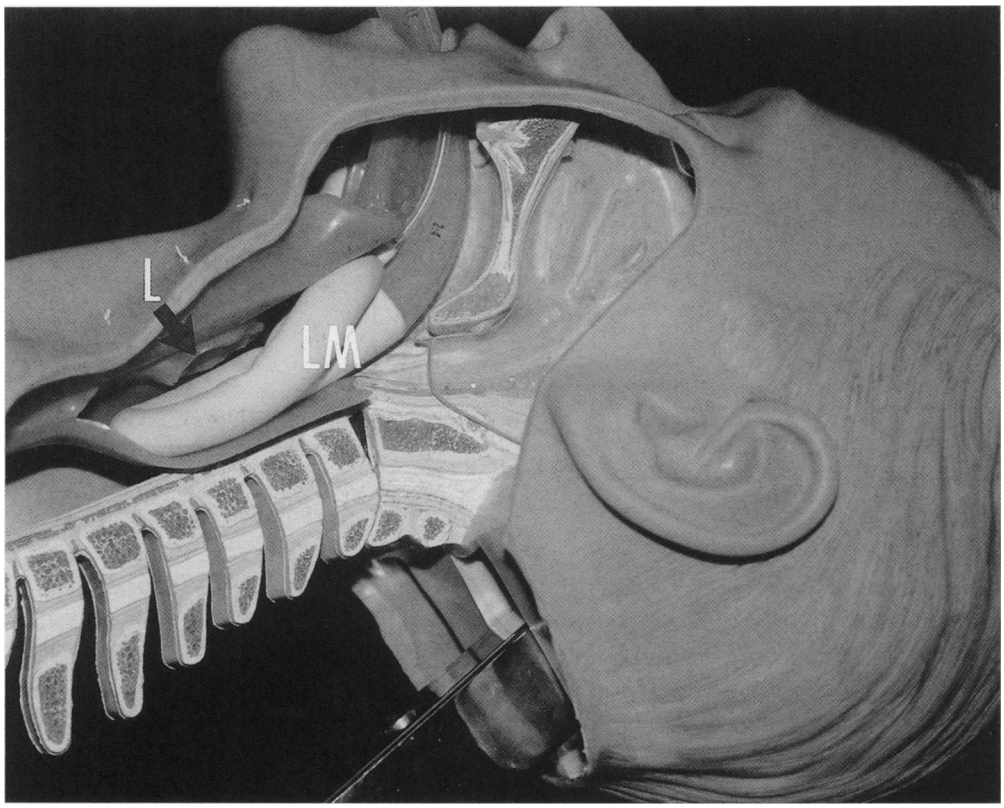

Figure 2. Laryngeal mask airway (LM) slightly retracted to show the laryngeal inlet (L).

ing were randomized and immediately followed one another to insert the LMA in the cadaver. Insertion time was recorded as being the time from first handling the LMA to its insertion and connection to a self-inflating ventilation bag. The cuff of the LMA was inflated with air according to the manufacturer's instructions before connecting the ventilation bag. A single dental anesthesiologist experienced in airway management, who did not observe the LMA placement or know the participant's training, graded the quality of placement using a 4-mm-diameter tracheobroncho-fiberscope (Olympus BF type 3C20). The position of the LMA was determined using the following 3-tiered grading system: A = 1 (all of the vocal cords can be seen), B = 2 (part of the vocal cords can be seen), and C = 3 (vocal cords cannot be seen). The technical index was used to describe the averaged sum of all insertion times in seconds multiplied by a placement grade for each group.

RESULTS

Average (SD) LMA insertion times per student for the nil practice group (group 1), 5 times practice group (group 2), and 10 times practice group (group 3) were 15.8 ± 3.0, 12.0 ± 2.7, and 9.1 ± 1.7 seconds, respectively.

Kruskal-Wallis tests were used to compare differences for all 3 groups, and Fisher exact tests were used to compare differences between 2 groups. $P < .05$ was regarded as significant. Insertion times for groups 2 and 3 were significantly faster than group 1, and group 3 was significantly faster than group 2 ($P < .05$) (Figure 3). Group 1 (average = 2.8) had poor placement grades (C = 10, B = 2, A = 0). Group 2 (average = 1.4) and group 3 (average = 1.3) had superior placement grades compared with group 1, but groups 2 (C = 1, B = 4, A = 7) and 3 (C = 0, B = 4, A = 7) were not significantly different ($P < .05$) (Figure 4). Technical indexes for groups 1, 2, and 3 were 44.4 ± 9.7, 16.5 ± 7.2, and 12.3 ± 5.3, respectively. Groups 2 and 3 varied significantly from group 1; however, groups 2 and 3 were not significantly different (Figure 5).

DISCUSSION

The purpose of this study was to determine whether a short and simple period of training would increase the speed and accuracy of LMA placement by dental stu-

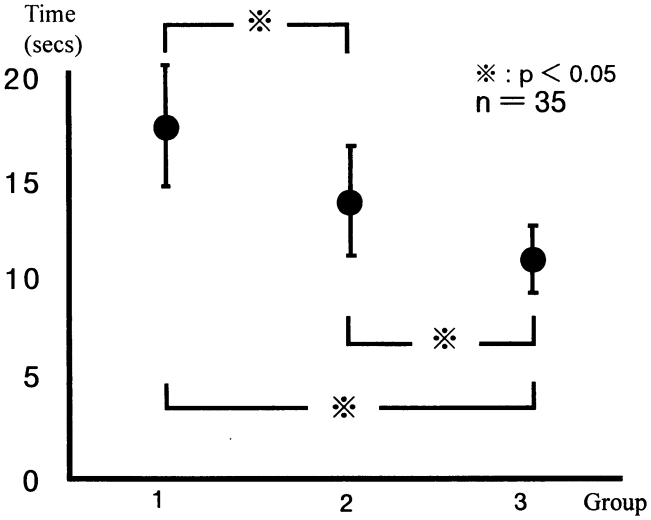

Figure 3. Average time to insert laryngeal mask.

dents unfamiliar with airway management. The participants who practiced at least 5 times had a shorter insertion time and superior placement grade. Those who practiced only 5 times had similar insertion grades to those who practiced 10 times.

During resuscitation, the LMA can be inserted to obtain a patent airway and ventilate the lungs until more experienced personnel arrive. It has been shown that once the LMA has secured a patent airway, a more secure endotracheal tube up to 6 mm in diameter can be passed blindly into the trachea in up to 90% of cases.[10] Although the cadaveric model we used was very useful, rigor mortis altered tissue dynamics and a living model may be superior. The cadaver was an elderly, edentulous man, which may have affected the placement of the LMA. This work has yet to be verified in dental patients in need of airway management.

In a study of 164 cases of cardiac arrest, 130 trained

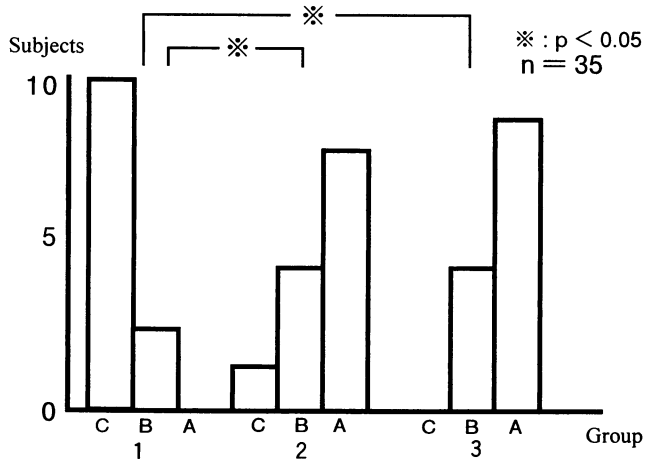

Figure 4. Grade placement of laryngeal mask.

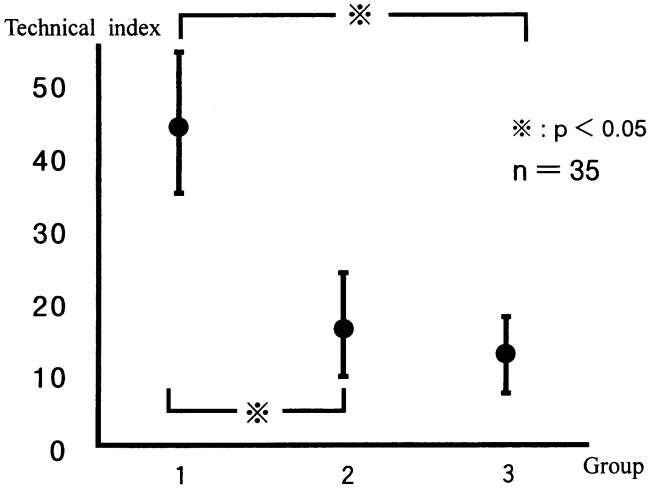

Figure 5. Technical index.

ward nurses were able to satisfactorily produce chest expansion 86% of the time with the use of the LMA.[11] We have demonstrated that, at least in cadavers, after a short and simple period of training, LMA placement becomes quicker and more accurate by dental students previously inexperienced in airway management. It has been shown that the LMA can be inserted far more rapidly and reliably than a tracheal tube[2,5] and that it provides better ventilation than a face mask.[3] Since its introduction, the LMA has been used millions of times worldwide by both anesthetists and others.[11] The LMA may well be the airway of choice, especially when bag-valve-mask ventilation is inadequate and personnel experienced in intubation are not readily available.[12–14] A disposable version of the LMA is less expensive than the reusable device and may be preferable in this setting. Face masks continue to be the most common method of airway management; however, the LMA is a good compromise when endotracheal intubation is not readily available.

The use of the LMA should be taught to dental staff and other health care workers who may have to manage respiratory resuscitation cases. The effect over time on the retention of skills gained in this study is currently unknown and requires further investigation.

Realizing its limitations, this study demonstrates the usefulness of learning clinical techniques in an unrushed manner on cadaveric models that resemble the living situation more closely than artificial models. Use of such models may be particularly important during the education of clinical procedures that have little latitude for errors.

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