

Dr John Laffey,
Department of Anaesthesia,
University College Hospital,
Galway,
Ireland

Title: Learning and performance of Tracheal intubation by novice personnel: A comparison of the Airtraq[®] and Macintosh laryngoscope.

AUTHORS: Maharaj, C.H.^{1,2}
Costello, J.^{1,2}
Higgins, B.D.²
Harte B.H.¹
Laffey J.G.^{1,2}

INSTITUTIONAL AFFILIATIONS

¹ Department of Anaesthesia, University College Hospital Galway, Ireland.

² Department of Anaesthesia, Clinical Sciences Institute, and National Centre for Biomedical Engineering Sciences, National University of Ireland, Galway, Ireland.

Address for Correspondence: Dr John Laffey, Department of Anaesthesia, Clinical Sciences Institute, National University of Ireland, Galway, Ireland.
john.laffey@nuigalway.ie

WORD COUNT (*body of manuscript only*): 2513

FINANCIAL SUPPORT: This study was funded from Departmental resources.

SUMMARY

Direct laryngoscopic tracheal intubation is taught to many healthcare professionals as it is a potentially lifesaving procedure. However, it is a difficult skill to acquire and maintain. Of concern, the consequences of poorly performed intubation attempts are potentially severe. The Airtraq[®] Laryngoscope is a novel intubation device which may possess advantages over conventional direct laryngoscopes for use by novice personnel. We conducted a prospective trial with 40 medical students who had no prior airway management experience. Following brief didactic instruction, each participant took turns performing laryngoscopy and intubation using the Macintosh and Airtraq[®] devices under direct supervision. Each student was allowed up to three attempts to intubate in three laryngoscopy scenarios in a Laerdal[®] Intubation Trainer and one scenario in a Laerdal[®] SimMan[®] Manikin. They then performed tracheal intubation of the normal airway a second time to characterise the learning curve for each device. The Airtraq[®] provided better intubating conditions, resulting in greater success of intubation, particularly in the difficult laryngoscopy scenarios. In both easy and simulated difficult laryngoscopy scenarios, the Airtraq[®] decreased the duration of intubation attempts, reduced the number of optimisation manoeuvres required, and reduced the potential for dental trauma. The Airtraq[®] exhibited a rapid learning curve and the students found it significantly easier to use. The Airtraq[®] appears to constitute a superior device for novice personnel to acquire the skills of tracheal intubation.

[226 Words]

Key Words: *Equipment:* Airtraq[®] Laryngoscope; Macintosh Laryngoscope; Manikin
Intubation: Tracheal; Difficult Intubation; Students, Medical

Direct laryngoscopic tracheal intubation is a potentially lifesaving procedure in diverse clinical situations characterized by respiratory failure and/or loss of patient control of the airway. Several studies have demonstrated improved outcome in critically ill and injured patients if the airway is secured early by endotracheal intubation (1-3). Accordingly, this skill is taught to many healthcare professionals, both medical and paramedical, many of whom may be infrequently required to perform this manoeuvre. However, conventional direct laryngoscopy is a difficult skill to acquire (4-6), and proficiency deteriorates over time if not practiced (7). This is compounded by the fact that the consequences of poorly performed intubation attempts are potentially severe. Difficult or failed tracheal intubation in this context constitutes an important cause of morbidity, arising from direct airway trauma and the systemic complications of hypoxia (8,9).

The Airtraq[®] is a new intubation device that is designed to provide a view of the glottis without alignment of the oral, pharyngeal and tracheal axes (**Figure 1**). The blade of the Airtraq consists of two side by side channels. One channel acts as the housing for the placement and insertion of the endotracheal tube (ETT), while the other channel terminates in a distal lens. A battery operated light is present at the tip of the blade. The image is transmitted to a proximal viewfinder using a combination of lenses and prisms, rather than fibre optics. The viewing lens allows visualization of the glottis and surrounding structures, and the tip of the tracheal tube. The Airtraq[®] is anatomically shaped and standard endotracheal tubes of all sizes can be used. The blade is inserted into the mouth in the midline, over the base of the tongue, and the tip positioned in the vallecula. Where necessary, the epiglottis can be lifted by elevating the blade. Once the view of the glottis has been optimized, the endotracheal tube is passed through the vocal cords, held in place, and the device removed. A clear view of the glottis and ETT is maintained throughout the intubation process and the ETT does not obstruct the view of the vocal cords (**Figure 2**).

The Airtraq[®] device may require less operator skill to use. Our group has recently demonstrated that Airtraq[®] device performs superiorly to the conventional Macintosh laryngoscope when used by experienced anaesthetists in simulated difficult laryngoscopy

(10). Notably, we observed a rapid learning curve for the device. Based on these findings we proposed that the Airtraq[®] may possess advantages over conventional laryngoscopes for use by novice personnel. The purpose of this study was to evaluate the usefulness of this new device for use by personnel with no prior experience of tracheal intubation in anatomically correct manikins. We hypothesised that, in the hands of novice laryngoscopists, the Airtraq[®] would prove equal or superior to the Macintosh laryngoscope in the normal and simulated difficult airway.

METHODS

Following ethical committee approval, and written informed consent, 40 medical students with no prior experience of performing tracheal intubation consented to participate. Each participant was given a standardised fifteen minute demonstration of both the Macintosh, and the Airtraq[®] devices by one of the investigators, which included a demonstration of the intubation technique with each device, and oral instructions regarding the correct use of each device. The use of optimisation manoeuvres, such as a bougie, to facilitate intubation with the Macintosh was also demonstrated. Each participant was then allowed five practice intubations with each device, at which stage all students could successfully perform tracheal intubation with both devices. All intubations were performed with a 7.5 gauge cuffed endotracheal tube. The sequence in which each participant used the devices was randomised, and each participant used the devices in the same sequence throughout the protocol.

The design of the study was a randomised crossover trial. Each medical student first performed tracheal intubation with each device in a Laerdal[®] Airway Management Trainer (Laerdal[®], Stavanger, Norway) in the following laryngoscopy scenarios: (1) normal airway in the supine position; (2) normal airway in the left lateral position; and (3) cervical immobilization. The participants then performed tracheal intubation in a SimMan[®] manikin (Laerdal[®], Kent, UK) in the (4) pharyngeal obstruction difficult laryngoscopy scenario. At the end of this protocol, each subject performed tracheal intubation of the normal airway a second time in the Laerdal[®] Airway Management Trainer with each device in order to characterise the learning curve.

The primary endpoints were the duration of tracheal intubation and the rate of successful placement of the endotracheal tube (ETT) in the trachea. The duration of each tracheal intubation attempt was defined as the time taken from insertion of the blade between the teeth until the ETT was deemed to be correctly positioned by each participant. Where the participant was unsure as to the position of the ETT, the time taken to connect the ETT to an Ambu[®] bag and inflate the lungs was also included in the duration of the attempt. In

any case, after each intubation attempt, the position of the ETT tip was verified by an investigator. A failed intubation attempt was defined as an attempt in which the trachea was not intubated, or where intubation of the trachea required greater than 120 seconds to perform.

Additional endpoints included the number of intubation attempts, the number of optimisation manoeuvres required (readjustment of head position, use of a bougie, second assistant) to aid tracheal intubation and the severity of dental trauma. The severity of dental trauma was calculated based on the number of audible teeth clicks (0, 1 or ≥ 2) with the Laerdal airway trainer, and based on a grading of pressure on the teeth (none =0, mild =1, moderate/severe ≥ 2) in the SimMan manikin. At the end of each scenario, each participant scored the ease of use of each device on a visual analogue scale (from 0 = Extremely Easy to 10 = Extremely Difficult).

Data for the success of tracheal intubation attempts was analysed using the chi square or Fishers exact test as appropriate. Data for duration of the first and the successful intubation attempt and the instrument difficulty score were analysed using the t test. The number of intubation attempts, number of optimisation manoeuvres, and severity of dental trauma was analysed using the Mann Whitney rank sum test. Continuous data are presented as means $\pm$ standard deviation (SD), and ordinal data and categorical data are presented as raw number and as frequencies. The α level for all analyses was set as $P < 0.05$.

RESULTS

Forty medical students consented to participate in the study. All students were in their final medical year, and no participant had previously performed tracheal intubation.

Scenario 1 – Normal Airway at start of Protocol

Thirty-nine (97.5%) students successfully intubated the trachea with both devices (**Table 1**). Seven students required more than one attempt to intubate the trachea with the Macintosh laryngoscope, while 2 students required more than one attempt with the Airtraq[®] laryngoscope. The duration of both the first and the successful tracheal intubation attempts were significantly shorter with the Airtraq[®] compared to the Macintosh Laryngoscope (**Table 1 and Figure 3**). The number of optimisation manoeuvres and the severity of dental trauma were significantly lower with the Airtraq[®] (**Table 1**). The participants found the Airtraq[®] significantly easier to use in this scenario (**Figure 4**).

Scenario 2 – Head in Left Lateral Position

The rate of successful intubation of the trachea with the Airtraq[®] device was significantly greater than that seen with the Macintosh laryngoscope (**Table 2**). The duration of both the first and the successful tracheal intubation attempts were significantly shorter with the Airtraq[®] compared to the Macintosh Laryngoscope (**Table 2 and Figure 3**). The number of intubation attempts, the number of optimisation manoeuvres and the severity of dental trauma were all significantly lower with the Airtraq[®] (**Table 2**). The participants found the Airtraq[®] significantly easier to use in this scenario (**Figure 4**).

Scenario 3 – Cervical Spine Immobilisation

The rate of successful intubation of the trachea with the Airtraq[®] device was similar to that seen with the Macintosh laryngoscope (**Table 3**). The duration of both the first and the successful tracheal intubation attempts were significantly shorter with the Airtraq[®] compared to the Macintosh Laryngoscope (**Table 3 and Figure 3**). The number of intubation attempts, the number of optimisation manoeuvres and the severity of dental

trauma were all significantly lower with the Airtraq[®] (**Table 2**). The participants found the Airtraq[®] significantly easier to use in this scenario (**Figure 4**).

Scenario 4 – Pharyngeal Obstruction

The rate of successful intubation of the trachea with the Airtraq[®] device was significantly greater than that seen with the Macintosh laryngoscope (**Table 4**). The duration of both the first and the successful tracheal intubation attempts were significantly shorter with the Airtraq[®] compared to the Macintosh Laryngoscope (**Table 4 and Figure 3**). The number of intubation attempts, the number of optimisation manoeuvres and the severity of dental trauma were all significantly lower with the Airtraq[®] (**Table 2**). The participants found the Airtraq[®] significantly easier to use in this scenario (**Figure 4**).

Scenario 5 – Normal Airway at end of Protocol

All students successfully intubated the trachea with both devices on the first attempt (**Table 5**). The duration of the intubation attempt with each device was significantly shorter than that required at the start of the protocol, illustrating rapid skill acquisition for both devices. However, the duration of the tracheal intubation attempts, and the severity of dental trauma was significantly shorter with the Airtraq[®] compared to the Macintosh Laryngoscope (**Table 5 and Figure 3**). The participants found the Airtraq[®] significantly easier to use than the Macintosh (**Figure 4**).

DISCUSSION

It is widely acknowledged that securing the airway by insertion of an ETT is the optimal method for assisting ventilation while protecting the airway from the risks of aspiration in unconscious patients. Several studies have demonstrated improved outcome in critically ill and/or injured patients if the airway is secured early by tracheal intubation (1-3). Medical and paramedical personnel may therefore be required to perform tracheal intubation as a lifesaving manoeuvre in the emergency room or in the prehospital arena. Accordingly, this skill is taught to many healthcare professionals, both medical and paramedical, many of whom may be infrequently required to perform this manoeuvre.

Part of the difficulty in acquiring the skill of tracheal intubation arises from the limitations of conventional approaches to direct laryngoscopic tracheal intubation. These approaches require the use of laryngoscopes, such as the Macintosh laryngoscope, which require the alignment of the oral, pharyngeal and tracheal axes in order to view the glottic opening. This is a difficult skill to successfully acquire (4-6), and to maintain (7), particularly if the opportunities to practice this skill are limited, such as in the case of non-anaesthetists required to perform tracheal intubation in emergency situations. A slow learning curve for intubation with the Macintosh blade has been well documented among paramedical personnel (4,7). This difficulty is further compounded by the fact that emergent tracheal intubation, e.g. in the pre-hospital setting, is more difficult to perform, with a lower success rate, particularly if performed by inexperienced personnel (11). The occurrence of difficulties and/or failure to successfully intubate the trachea in these situations constitutes an important cause of complications such as airway trauma, oesophageal intubation, hypoxia, pulmonary aspiration and adverse haemodynamic events (8,9,12).

The Airtraq[®] device appears to require less operator skill, and may therefore be a better device for teaching the skills of tracheal intubation compared to conventional direct laryngoscopes. It has an exaggerated curvature with enhanced optics that gives an excellent view of the glottis with minimal airway manipulation. The Macintosh laryngoscope (13) remains the most popular device used to facilitate orotracheal

intubation, notwithstanding recent developments in airway device technologies, it constitutes the gold standard. We therefore decided to compare the utility of the Airtraq[®] to the Macintosh laryngoscope for use by personnel with no airway management experience in anatomically correct manikins. We utilised medical students for this purpose in this study, and assessed the ease of laryngoscopy in two different manikins, in four scenarios simulating easy and difficult laryngoscopy.

Our study demonstrates that, in comparison to the Macintosh laryngoscope, the Airtraq[®] provides superior intubating conditions in the normal airway. All students successfully intubated the normal airway with both devices in the final scenario. Of interest, the duration required for the intubation attempt was reduced significantly at the end of the protocol for both devices, illustrating that skills in the use of both devices were rapidly acquired. The Airtraq[®] device significantly reduced the duration of intubation, the requirement for manoeuvres to optimise the laryngoscopic view obtained, and reduced the potential for dental trauma at the start and at the end of the protocol.

The Airtraq[®] also provides superior intubating conditions in the simulated difficult airway, a scenario not uncommon outside the operating room where intubating conditions and assistance may be suboptimal. In the simulated difficult airway scenarios, the Airtraq[®] resulted in a higher percentage of successful intubations, reduced the time required to perform tracheal intubation, required fewer airway optimisation manoeuvres, and caused less dental trauma than the Macintosh Laryngoscope. Of particular interest, the duration of intubation attempts with the Airtraq[®] compared well with that recorded by experienced anaesthetists in our recent study (10). This finding highlights the ease of use and the short learning curve associated with this device, for both experienced and inexperienced laryngoscopists. The medical students also found the Airtraq[®] easier to use than the Macintosh laryngoscope, as reflected in their lower Instrument Difficulty Score for the Airtraq[®] device.

The Airtraq[®] provides a high quality view of the glottis without a need to align the oral, pharyngeal and tracheal axes, and therefore requires less force to be applied during

laryngoscopy. Our present study attests to this, by the fact that, the dental trauma scores, were lower with the Airtraq[®] laryngoscope, particularly in the difficult airway scenarios. These findings confirm our contention that the Airtraq[®] requires less operator skill compared to the Macintosh laryngoscope, leading to more rapidly acquired proficiency in novice personnel. The Airtraq[®] may also have advantages for personnel who are infrequently required to perform tracheal intubation, such as emergency room staff. While this study does not directly examine this issue, the fact that the device exhibits a rapid learning curve, despite a deliberately brief instruction period, supports this contention.

The Airtraq[®], as a single-use device, removes the potential for transmission of prions, which are thought to be responsible for causing variant CJD (14,15). This complies with the guidelines of the Association of Anaesthetists of Great Britain and Ireland, which state that 'single use intubation aids' should be used where possible (16), due to difficulties in ensuring that all proteinaceous material has been removed during cleaning and sterilisation (14,17).

In conclusion, the Airtraq[®] laryngoscope appears to possess advantages over the conventional Macintosh laryngoscope when used by novice laryngoscopists. In this manikin study, the Airtraq[®] laryngoscope performed superiorly in both the normal and the difficult airway scenarios. Further clinical studies are necessary to confirm these initial positive findings.

ACKNOWLEDGEMENT

We would like to thank Prodol Ltd, for the provision of the Airtraq[®] device.

CONFLICT OF INTEREST

The authors have no conflict of interest in regard to the Airtraq[®] device.

REFERENCES:

1. Winchell RJ, Hoyt DB. Endotracheal intubation in the field improves survival in patients with severe head injury. Trauma Research and Education Foundation of San Diego. Arch Surg 1997;132:592-7.
2. Garner A, Rashford S, Lee A, Bartolacci R. Addition of physicians to paramedic helicopter services decreases blunt trauma mortality. Aust N Z J Surg 1999;69:697-701.
3. Sanson G, Di Bartolomeo S, Nardi G et al. Road traffic accidents with vehicular entrapment: incidence of major injuries and need for advanced life support. Eur J Emerg Med 1999;6:285-91.
4. Wang HE, Seitz SR, Hostler D, Yealy DM. Defining the learning curve for paramedic student endotracheal intubation. Prehosp Emerg Care 2005;9:156-62.
5. Gerbeaux P. Should emergency medical service rescuers be trained to practice endotracheal intubation? Crit Care Med 2005;33:1864-5.
6. Mulcaster JT, Mills J, Hung OR et al. Laryngoscopic intubation: learning and performance. Anesthesiology 2003;98:23-7.
7. Garza AG, Gratton MC, Coontz D et al. Effect of paramedic experience on orotracheal intubation success rates. J Emerg Med 2003;25:251-6.
8. Mort TC. Esophageal intubation with indirect clinical tests during emergency tracheal intubation: a report on patient morbidity. J Clin Anesth 2005;17:255-62.
9. Mort TC. Emergency tracheal intubation: complications associated with repeated laryngoscopic attempts. Anesth Analg 2004;99:607-13, table of contents.
10. Maharaj CH, Higgins B, Harte BH, Laffey JG. Evaluation of ease of intubation with the Airtraq® or Macintosh laryngoscope by anaesthetists in easy and simulated difficult laryngoscopy - A manikin study. Anaesthesia 2006;(in press).
11. Adnet F, Jouriles NJ, Le Toumelin P et al. Survey of out-of-hospital emergency intubations in the French prehospital medical system: a multicenter study. Ann Emerg Med 1998;32:454-60.
12. Schlossmacher P, Martinet O, Testud R et al. Emergency percutaneous tracheostomy in a severely burned patient with upper airway obstruction and circulatory arrest. Resuscitation 2005.
13. Macintosh RR. A new Laryngoscope. Lancet 1943;1:205.
14. Lowe PR, Engelhardt T. Prion-related diseases and anaesthesia. Anaesthesia 2001;56:485.
15. Will RG, Ironside JW, Zeidler M et al. A new variant of Creutzfeldt-Jakob disease in the UK. Lancet 1996;347:921-5.
16. Infection control in Anaesthesia. London: The Association of anaesthetists of Great Britain and Ireland, 2002.
17. Miller DM, Youkhana I, Karunaratne WU, Pearce A. Presence of protein deposits on 'cleaned' re-usable anaesthetic equipment. Anaesthesia 2001;56:1069-72.

TABLE LEGENDS

Table 1: Data from easy laryngoscopy scenario at the start of the protocol in Laerdal[®] Airway Trainer.

Table 2: Data from laryngoscopy in left lateral position scenario in Laerdal[®] Airway Trainer.

Table 3: Data from Cervical Immobilization scenario in Laerdal[®] Airway Trainer.

Table 4: Data from Pharyngeal Obstruction scenario in SimMan[®] Manikin.

Table 5: Data from easy laryngoscopy scenario at the end of the protocol in Laerdal[®] Airway Trainer.

FIGURE LEGENDS

Figure 1: Photograph of the Airtraq[®] laryngoscope with an endotracheal tube in place in the side channel. The device is held in the left hand and passed into the mouth over the tongue, and the tip placed in the vallecula or under the epiglottis

Figure 2: View of the glottis obtained during tracheal intubation with the Airtraq[®] laryngoscope. The view of the glottis can be optimised by lifting the epiglottis by means of elevating the blade into the vallecula (**Panel A**). Once the glottis is in the centre of the view seen from the viewfinder, the ETT is then passed from its position in the channel through the vocal cords (**Panel B**). The cuff of the ETT can be viewed passing through the cords, and the position of ETT confirmed at the level of the cords (**Panel C**).

Figure 3: Graph representing the duration required to successfully intubate the trachea with each device in each scenario tested. The data are given as mean $\pm$ SD.

* Indicates significantly different compared to the Macintosh Laryngoscope

Labels: Normal Airway – Start: Intubation of the normal airway at the start of the protocol; Left Lateral – intubation of the normal airway in the left lateral position; Cervical Immobilization– SimMan Cervical Spine Rigidity Scenario; Pharyngeal

Obstruction – SimMan Pharyngeal Obstruction Scenario; Normal Airway – End: Intubation of the normal airway at the end of the protocol.

Figure 4: Graph representing the user rated degree of difficulty of use of each instrument in each scenario tested. The data are given as mean $\pm$ SD.

* Indicates significantly different compared to the Macintosh Laryngoscope

Labels: Normal Airway – Start: Intubation of the normal airway at the start of the protocol; Left Lateral – intubation of the normal airway in the left lateral position; Cervical Immobilization– SimMan Cervical Spine Rigidity Scenario; Pharyngeal Obstruction – SimMan Pharyngeal Obstruction Scenario; Normal Airway – End: Intubation of the normal airway at the end of the protocol.

Table 1 – Data from easy laryngoscopy scenario in Laerdal® Airway Trainer.

Parameter Assessed	Macintosh	Airtraq®
Overall Success Rate (%)	39 (97.5)	39 (97.5)
Duration (1 st attempt)	40.8 ± 39.2	18.7 ± 24.9†
Number of Intubation Attempts (%)		
1	33 (82.5)	38 (95)
2	6 (15)	1 (2.5)
3	1 (2.5)	1 (2.5)
No of Optimisation Manoeuvres (%)		
0	24 (60)	39 (97.5)†
1	14 (35)	1 (2.5)
>1	2(5)	0
Dental Trauma [Teeth Clicks] (%)		
0	10 (25)	34 (85)†
1	12 (30)	6 (15)
>1	18 (45)	0

Notes: Data are reported as mean ± SD or as number (percentage).

* Significantly [P < 0.05] different compared to the Macintosh laryngoscope.

† Significantly [P < 0.01] different compared to the Macintosh laryngoscope.

Table 2 – Data from laryngoscopy in left lateral position scenario in Laerdal® Airway Trainer.

Parameter Assessed	Macintosh	Airtraq®
Overall Success Rate (%)	24 (60)	19 (95)†
Duration (1 st attempt)	74.4 ± 49.3	29.5 ± 35.8†
Number of Intubation Attempts (%)		
1	19 (47.5)	35 (87.5) †
2	4 (10)	3 (7.5)
3	17 (42.5)	2 (5)
No of Optimisation Manoeuvres (%)		
0	13 (32.5)	38 (95)†
1	18 (45)	2 (5)
>1	9 (22.5)	0
Dental Trauma [Teeth Clicks] (%)		
0	8 (20)	30 (75)†
1	6 (15)	9 (22.5)
>1	26 (65)	1 (2.5)

Notes: Data are reported as mean ± SD or as number (percentage).

* Significantly [P < 0.05] different compared to the Macintosh laryngoscope.

† Significantly [P < 0.01] different compared to the Macintosh laryngoscope.

Table 3 – Data from Cervical Spine Immobilisation scenario in Laerdal® Airway Trainer.

Parameter Assessed	Macintosh	Airtraq®
Overall Success Rate (%)	26 (90)	39 (97.5)
Duration (1 st attempt)	55.1 ± 42.8	20.3 ± 24.2†
Number of Intubation Attempts (%)		
1	28 (70)	39 (97.5)*
2	8 (20)	0
3	4 (10)	1 (2.5)
No of Optimisation Manoeuvres (%)		
0	19 (47.5)	40 (100)†
1	16 (40)	0
>1	5 (12.5)	0
Dental Trauma [Teeth Clicks] (%)		
0	5 (12.5)	33 (82.5)†
1	15 (37.5)	7 (17.5)
>1	20 (50)	0

Notes: Data are reported as mean ± SD or as number (percentage).

* Significantly [P < 0.05] different compared to the Macintosh laryngoscope.

† Significantly [P < 0.01] different compared to the Macintosh laryngoscope.

Table 4 – Data from Pharyngeal Obstruction scenario in SimMan[®] Manikin.

Parameter Assessed	Macintosh	Airtraq [®]
Overall Success Rate (%)	31 (77.5)	40 (100)†
Duration (1 st attempt)	51.1 ± 44.5	11.9 ± 8.0†
Number of Intubation Attempts (%)		
1	29 (72.5)	40 (100)*
2	2 (5)	0
3	9 (22.5)	0
No of Optimisation Manoeuvres (%)		
0	19 (47.6)	40 (100)†
1	11 (37.5)	0
>1	10 (35)	0
Dental Compression [Severity] (%)		
0	0	30 (75)†
Mild [+]	7 (17.5)	10 (25)
Severe [++]	33 (82.5)	0

Notes: Data are reported as mean ± SD or as number (percentage).

* Significantly [P < 0.05] different compared to the Macintosh laryngoscope.

† Significantly [P < 0.01] different compared to the Macintosh laryngoscope.

Table 5 – Data from easy laryngoscopy scenario at end of protocol in Laerdal® Airway Trainer.

Parameter Assessed	Macintosh	Airtraq®
Overall Success Rate (%)	40 (100)	40 (100)
Duration (1 st attempt)	15.4 ± 1.2	8.9 ± 5.1†
Number of Intubation Attempts (%)		
1	40 (100)	40 (100)
2	0	0
3	0	0
No of Optimisation Manoeuvres (%)		
0	36 (90)	40 (100)
1	4 (10)	0
>1	0	0
Dental Trauma [Teeth Clicks] (%)		
0	23 (57.5)	39 (97.5)†
1	12 (30)	1 (2.5)
>1	5 (12.5)	0

Notes: Data are reported as mean ± SD or as number (percentage).

* Significantly [P < 0.05] different compared to Macintosh group

† Significantly [P < 0.01] different compared to the Macintosh laryngoscope.

Figure 1



Figure 2

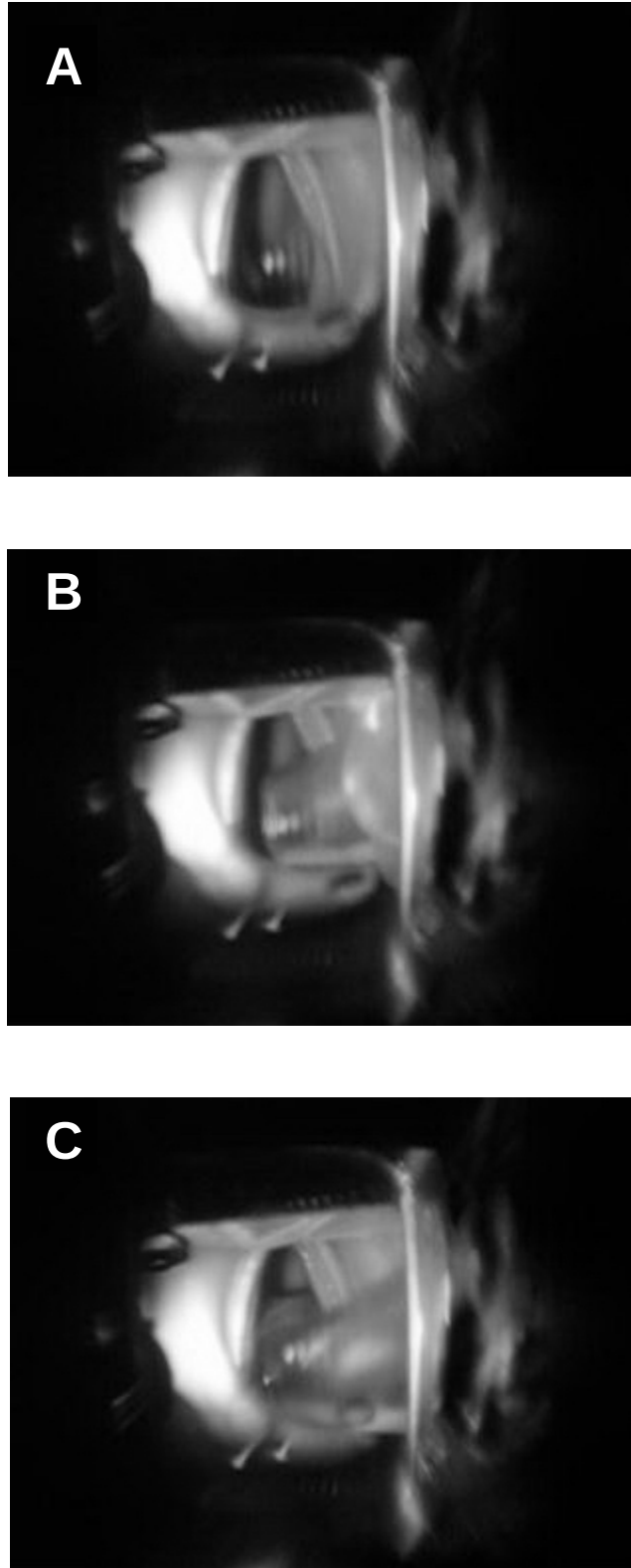


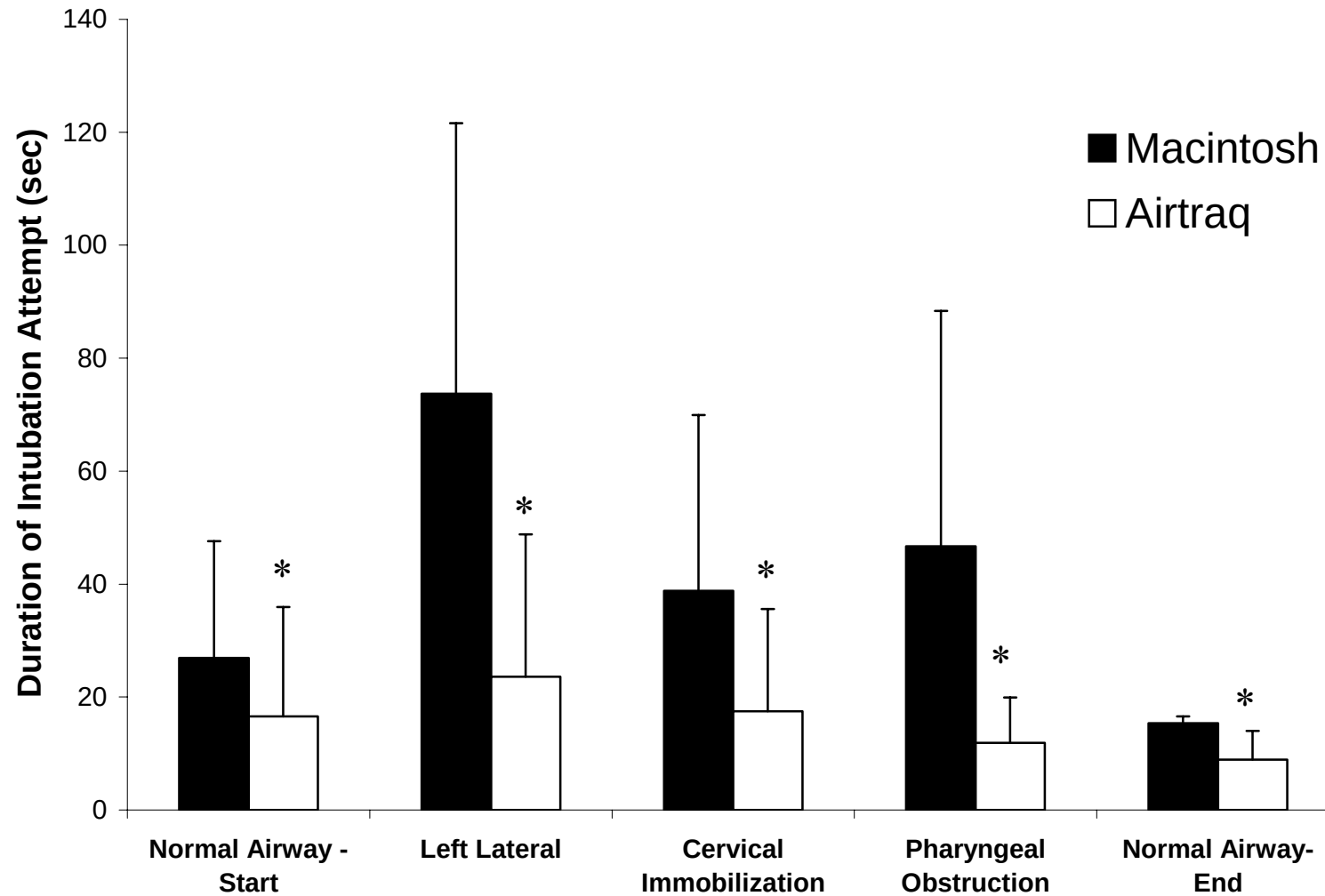
Figure 3

Figure 4