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Special Article

A Comparison of Fiberoptic-Compatible Oral Airways

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Fiberoptic-compatible oral airways (FCOAs) combine the simplicity and benefits that traditional oral airways provide, with the advantage of mechanically guiding fiberoptic intubation. This review examines and compares the salient properties of these devices. Of note, the clinician should pay particular attention to the location and depth of the channel. FCOAs, with an anterior channel, may be advantageous for use with difficult intubations arising from an excessively anterior-oriented glottis, whereas a channel with excessive depth may hinder the localization of a glottis which is off-midline. In certain circumstances, channel size will limit tracheal tube size. The intubating Laryngeal Mask Airway (iLMA) is also included in this comparison. Although this device may have an advantage in performing blind intubations, its use, even with a fiberscope, may be limited. This limitation applies to intubations in which mouth opening is restricted, the glottis is off-midline, airway tumors are present, or with the presence of prior cervical radiotherapy. Furthermore, because of its size, the iLMA can potentially cause airway trauma, which could subsequently limit the utility of a fiberscope. In addition, the FCOA can generate greater positive-pressure ventilation, when used with a tight-fitting face mask, than the iLMA. FCOAs offer clinicians the ability to visualize airway anatomy while allowing straightforward access for tracheal intubation.

Keywords: Airway, fiberoptic-compatible; airway anatomy; intubation, intratracheal; Laryngeal Mask Airway

Introduction

Various commercially available oral airways are designed to assist in the process of fiberoptic intubation. The great value of these devices is that they allow for both mask ventilation and fiberoptic intubation.[1,2] Specifically, each has a "channel" that allows for passage of the fiberoptic cable and, in some designs, the tracheal tube. However, under close examination, it should be noted that this channel is structurally situated on either the anterior, or posterior, aspect of the oral airway. Furthermore, this channel may or may not extend for the entire length of the airway.

Fiberoptic-compatible oral airways (FCOAs) are particularly helpful for management of difficult awake oral intubations. They are also useful for "surprise" difficult intubations arising after the induction of general anesthesia and following unsuccessful traditional laryngoscopic attempts.

As shown in *Figure 1*, FCOAs with an anterior (lingual) channel may function better to facilitate in the localization of the glottic opening as compared with

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Received for publication June 13, 2002; revised manuscript accepted for publication April 10, 2003.

360 Park Avenue, South, New York, NY 10010

0952-8180/04/$–see front matter
doi:10.1016/j.jclinane.2003.04.003

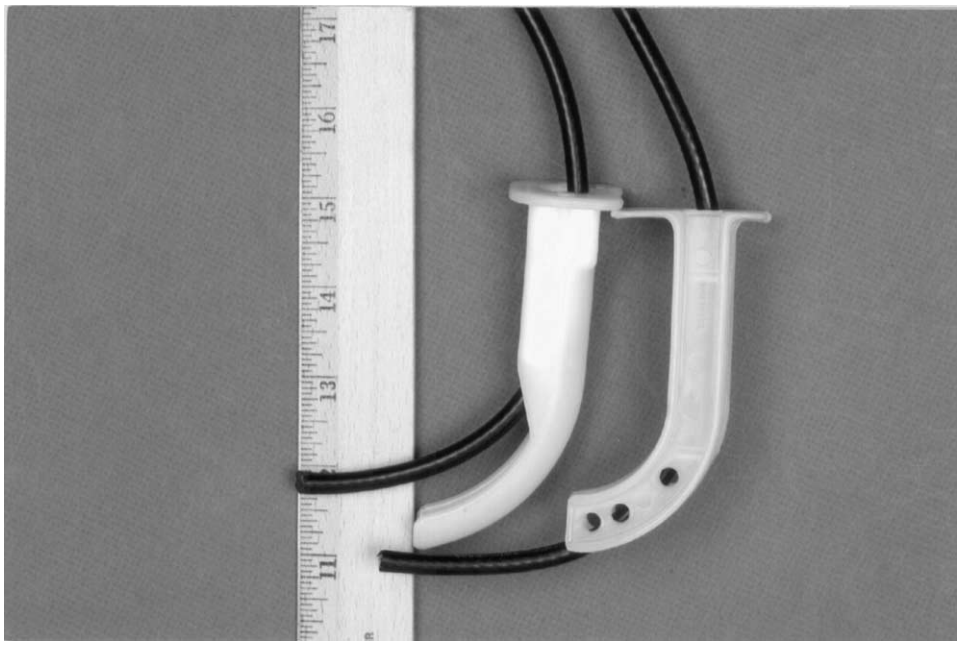

Figure 1. A comparison between fiberoptic-compatible oral airways (FCOAs) with anterior *versus* posterior channels. At left is a Williams airway intubator, with its anterior channel. On the right is a Luomanen FCOA, which has a posterior channel. Note how an anterior channel may offer a more immediate entry into an anterior-oriented glottis.

those containing a posterior channel. Thus, the anterior channel may be particularly helpful with difficult intubations arising from an excessively anterior-oriented glottis. This is a common situation in which fiberoptic intubation can be favorable as well as life saving.

Fiberoptic oral intubation techniques have been previously described.[2,3] Typically, the tracheal tube is placed over the fiberoptic cable. The fiberoptic cable is then placed through the FCOA, the glottis is located, and subsequently the trachea is intubated by advancing the tracheal tube over the fiberoptic cable.

Obviously, when fiberoptic intubation is implemented *via* the nasal route, these airways are unnecessary. However, an oral fiberoptic intubation usually allows for a larger tracheal tube. Furthermore, bleeding from the nasal mucosa, occurring from a nasal intubation attempt, may possibly hinder subsequent airway visibility. This can be especially troublesome during fiberoptic intubations in

Figure 2. Patil-Syracuse airway. This device has an anterior channel that is both shallow and narrow. It must be removed from the oropharynx before a tracheal tube can be advanced.

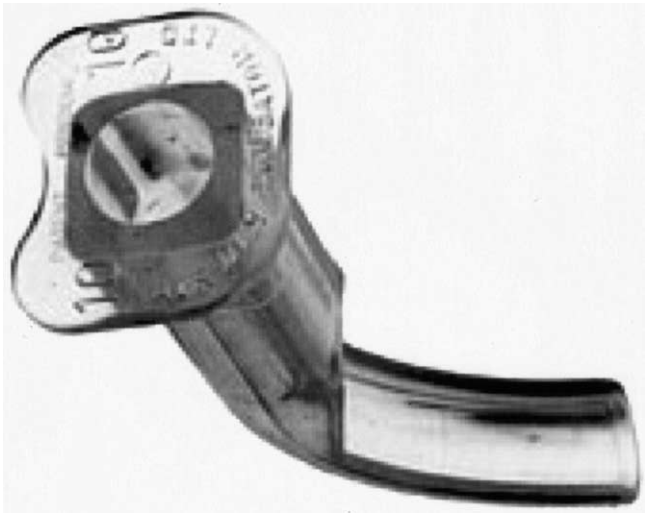

Figure 3. Williams airway intubator. This apparatus has a shallow anterior channel, as well as an orifice, to allow for the passage of a tracheal tube. It is also an effective "bite block."

which small amounts of blood, appearing on the tip of the fiberscope, may interfere with image transmission. Long-term nasotracheal intubation has also been associated with sinusitis and sepsis.[4]

It should be noted that these airways may not always be necessary when performing an oral fiberoptic intubation. One common technique is to grasp the patient's tongue, with gauze, then "follow" the base of the tongue, with the fiberscope, to the glottis. However, this method may then prove cumbersome if the patient requires urgent mask ventilation.

This "tongue traction" technique was shown to be comparable, in terms of intubation time and cardiovascular response, to that of a fiberscope with a FCOA. However, this study excluded patients with expected difficult intubations.[5]

Comparing Specific Airways

As shown in *Figure 2* and *Figure 3*, both the Patil-Syracuse and the Williams airway intubator have anterior channels. However, the Patil-Syracuse airway must be removed, from the oropharynx, before a tracheal tube can be advanced over the fiberoptic cable and into the glottis. The anterior channel of this airway is too small to permit the passage of a tracheal tube. Removal of the FCOA from the oropharynx creates an unnecessary extra step.

In contrast, the Williams airway intubator allows for a tracheal tube to be passed directly through its anterior channel into the glottis. It should be noted that the Williams airway intubator may be removed by slipping it over the tracheal tube.[6] However, to do so, the friction-fit conical circuit adapter must be detached from the tracheal tube.

If left in place, this airway will also function as an effective "bite block", thus preventing occlusion of the tracheal tube from a patient's clenched teeth. Interestingly, the Williams airway intubator was developed by modifying a standard Guedel airway. It has also been used for blind orotracheal intubations.

Oral airways with a posterior channel, such as the Ovassapian and Luomanen, also facilitate fiberoptic oro-

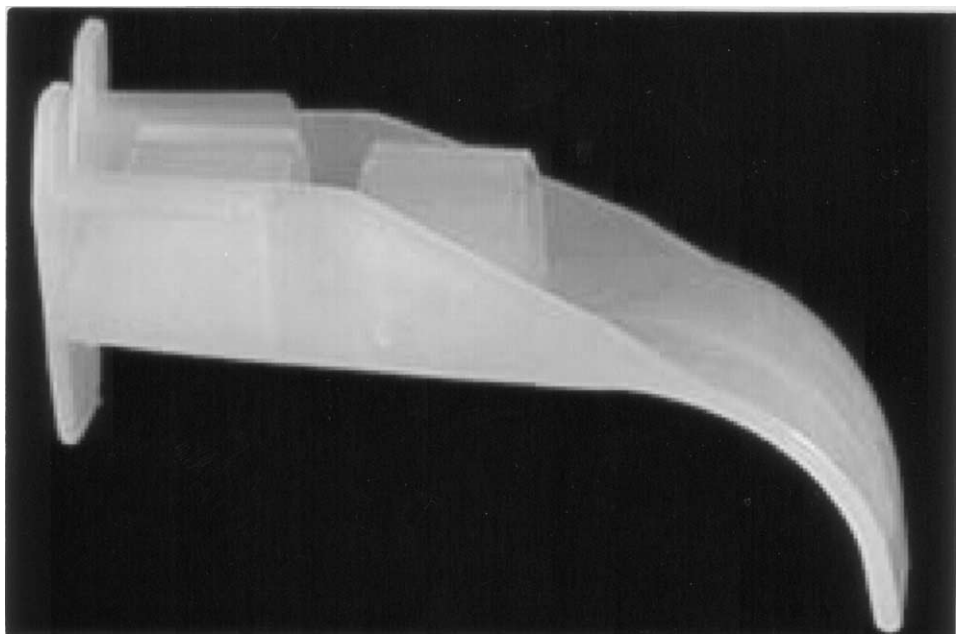

Figure 4. Ovassappian airway. Incomplete rings along the posterior aspect of this FCOA allow for the easy removal of this device from around a tracheal tube. The absence of the posterior channel, near the tip, may make it difficult to keep the fiberscope midline. However, the absence of the posterior channel may also facilitate in the localization of glottic openings that are off-midline. Furthermore, the posterior channel may not be optimal for localization of glottic openings that are excessively anterior.

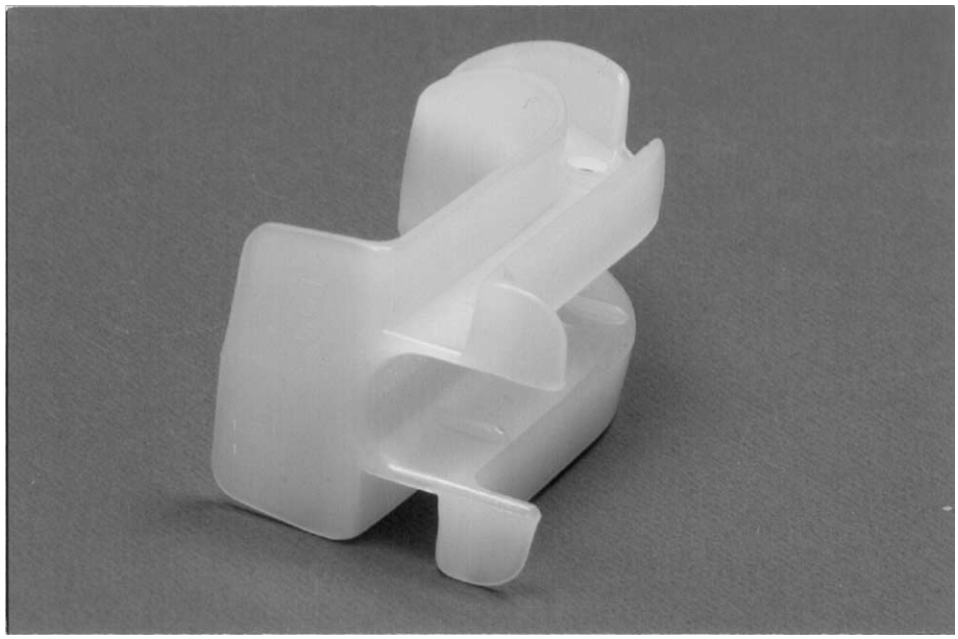

Figure 5. The Luomanen FCOA has a deep channel on its posterior surface. This channel continues until the tip of the airway. Fiberoptic localization, of a glottic opening that is off-midline, may be difficult because of this.

tracheal intubation. These devices are shown in *Figure 4* and *Figure 5*, respectively. Each is rapidly removed from around the tracheal tube. This is a potential benefit of the posterior channel. However, FCOAs with an anterior channel appear to offer a more "direct access" to an anterior glottis.

The depth of the channel may also limit access to glottic openings that are located laterally and thus off-midline. This situation may be especially significant in those patients with airway tumors. The Luomanen airway has a particularly prominent posterior channel that extends the entire length of the airway. Thus, it may not be

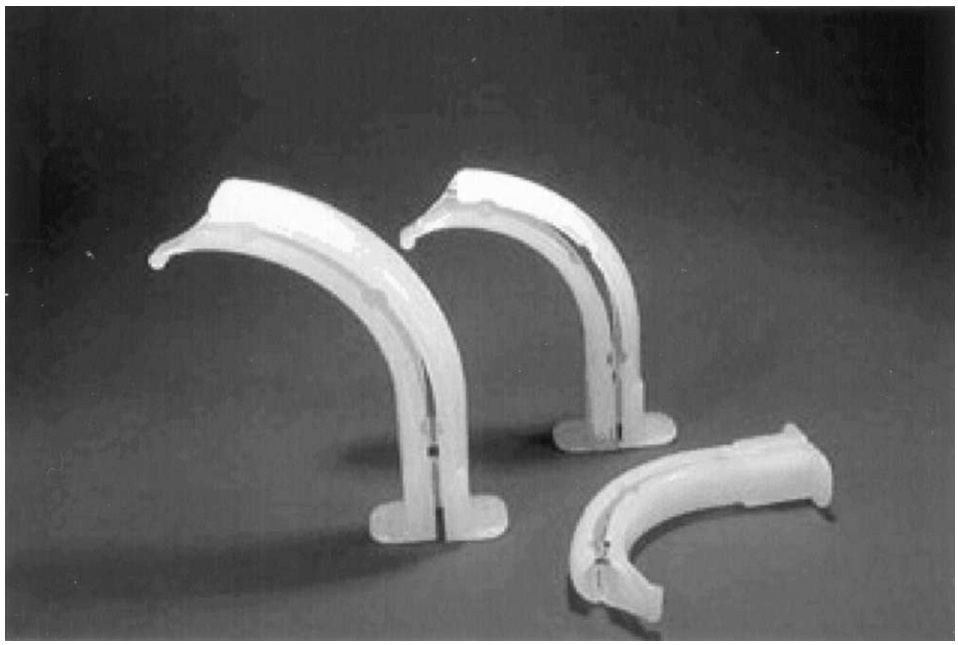

Figure 6. The Berman intubating/pharyngeal airway. A slit is located on the lateral aspect of this FCOA to allow it to be removed from around a tracheal tube. This airway has the potential disadvantages associated with posterior channels.

Table 1. Fiberoptic-Compatible Oral Airways

Airway	Figure	Channel Location	Comments
Patil-Syracuse	2	Anterior	Shallow anterior channel. Airway must be removed before insertion of the tracheal tube.
Williams airway intubator	3	Anterior	Tracheal tube is inserted directly through its orifice. Airway is removed by slipping it over the tracheal tube.
Ovassapian	4	Posterior	Posterior channel may limit access to "anterior" airways. Channel is absent near the tip. Localization of the midline may be difficult.
Luomanen	5	Posterior	Similar to Ovassapian but with a deep posterior channel that continues to the tip. Access to glottic openings that are off-midline may be difficult.
Berman intubating/pharyngeal airway	6	Posterior	Lateral slit allows for removal from around the tracheal tube. However, this may pose some difficulty.

Note: Each fiberoptic-compatible oral airway has significantly different structural characteristics that affect their clinical use.

the most appropriate FCOA when the glottis is known – or suspected to be – off-midline.

The Ovassapian airway has a flat posterior surface, near the tip, at the end of its posterior channel. However, localization of the midline may be difficult. It has been suggested that a line be drawn, on the posterior surface of this device, to identify the midline through the fiberscope.[7]

The Berman intubating/pharyngeal airway, shown in *Figure 6*, also has a posterior channel. A slit on the lateral aspect of this device allows for removal from around a tracheal tube. However, this "lateral removal" may be more cumbersome than removal of other FCOAs.

In a controlled trial, fiberoptic orotracheal intubations were found to be more difficult, with the Berman intubating/pharyngeal airway, than the Ovassapian airway. However, with the Berman airway, the ability to localize the glottis was easier.[8]

Table 1 summarizes the salient aspects of the five available oral airways that are designed for fiberoptic use.

Intubating Laryngeal Mask Airway

When used with a fiberscope, the intubating laryngeal mask airway (iLMA) can be thought of as another FCOA.

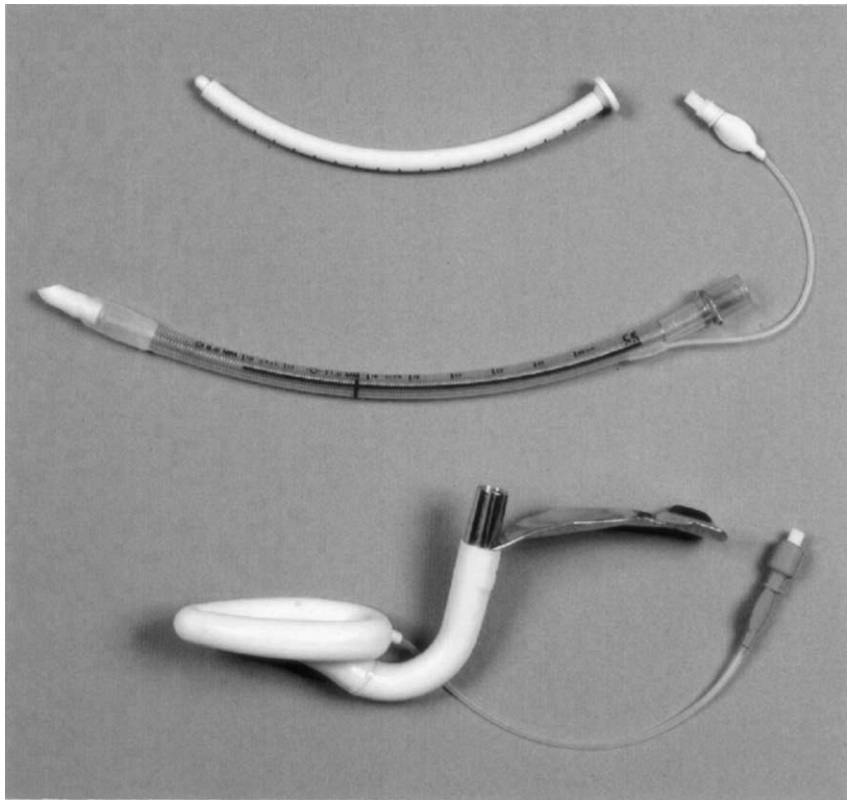

Figure 7. The intubating Laryngeal Mask Airway. This device requires the use of a pusher rod as well as a unique tracheal tube.

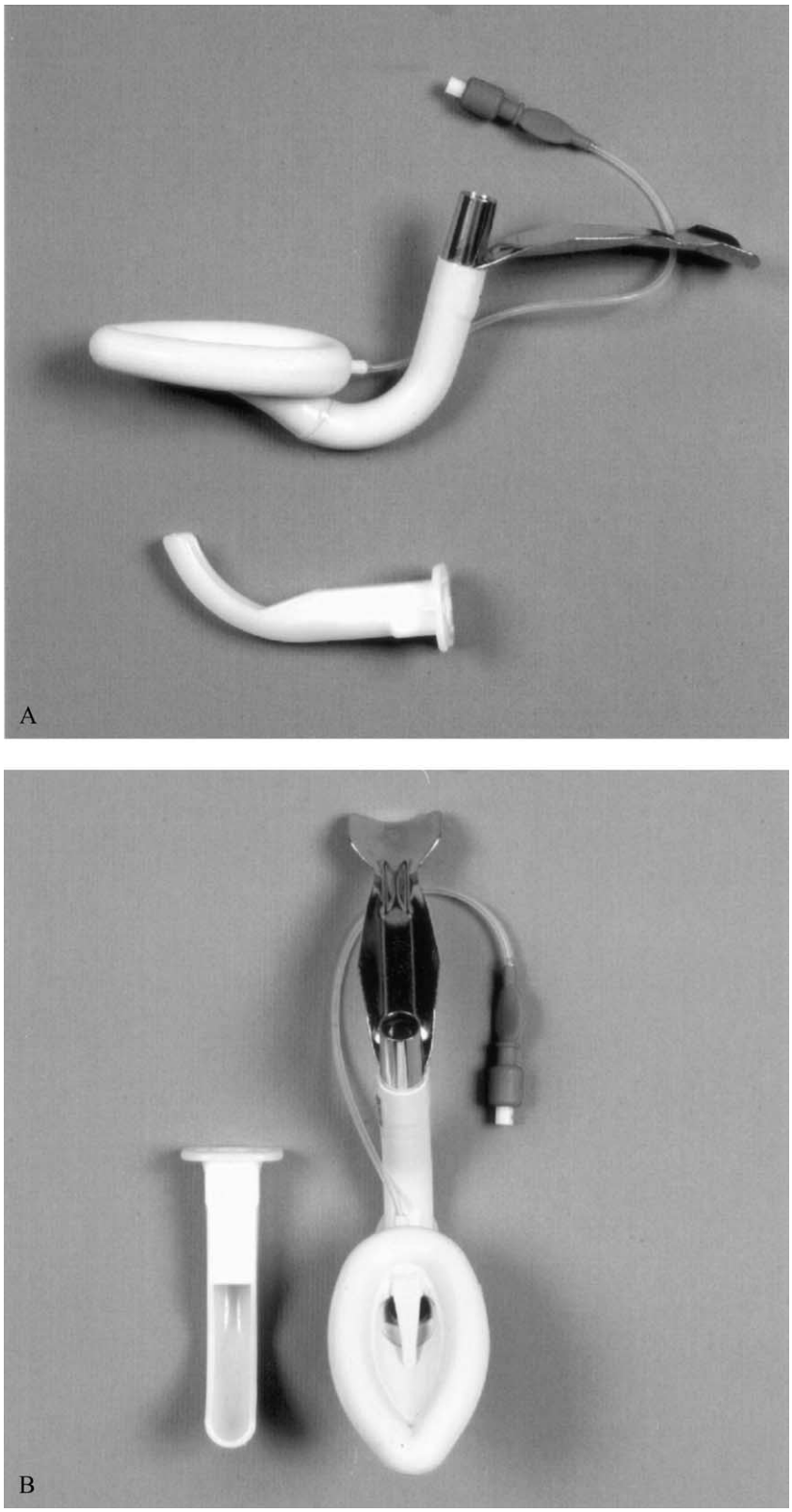

Figure 8. A size comparison between the intubating LMA (iLMA) and a Williams airway intubator. The presence of the right angle, or elbow, in the iLMA necessitates a greater degree of mouth opening for placement. The iLMA also has a greater lateral width.

Table 2. Comparison of The Intubating Laryngeal Mask Airway With The Fiberoptic-Compatible Oral Airways

	Intubating Laryngeal Mask Airway	Fiberoptic-Compatible Oral Airways
Blind intubation	Possible in some circumstances	Not possible in most circumstances*
Tracheal tube	Requires a unique tracheal tube	Appropriate size standard tracheal tube
Pusher rod	Necessary	Not necessary
Overall size	Large	Small
Potential for airway trauma	Significant	Minimal
Ability to visualize off-midline	Less reliable	Device-dependent
Ability to generate positive pressure ventilation	Less reliable	More reliable when used with a tight-fitting face mask

*The Williams airway intubator has been used for blind orotracheal intubations.

This device, along with its associated tracheal tube and pusher rod, is shown in *Figure 7*. It should be noted that similar airway anesthetic techniques can be used to achieve an awake intubation with either the iLMA or the FCOA.[9] Furthermore, the iLMA can also be used for blind orotracheal intubations.

In a comparison of fiberoptic intubations performed with an Ovassapian airway *versus* the iLMA used blindly, both techniques were shown to have similar overall intubation success rates and cardiovascular responses were the same.[10] Blind intubation with the iLMA was only slightly faster. However, this study did not include subjects with mouth openings less than 2.5 cm or those with significant upper airway pathology.[10] Furthermore, a history of prior cervical radiotherapy, for head and neck cancer, was shown to be associated with failure of the iLMA to secure tracheal intubations.[11]

In another comparison of the iLMA, when placed after induction of general anesthesia, with awake fiberoptic oral intubation without FCOAs, it was found that a more experienced anesthesiologist was required to achieve a successful intubation, with the iLMA, in 10% of patients. In this study of patients with known or expected difficult airways, intubation with the iLMA was initially done in a blind manner. Subsequent intubation attempts, if necessary, were then done with the iLMA using a fiberscope. This study found that overall intubation success was the same using either the iLMA, after induction of general anesthesia, or using awake fiberoptic intubation. Furthermore, when used blindly, the iLMA was successful only 50% of the time.[12]

Moreover, the iLMA is significantly larger than any of the FCOAs. This size increase occurs in both the anteroposterior direction as well as laterally (*Figure 8*). For orotracheal intubations, in which mouth opening is limited, this device may not be useable but a FCOA might function ideally. In addition, the iLMA may cause more airway trauma than a FCOA. If trauma happens, subsequent use of a fiberscope may be limited by blood and/or secretions. Furthermore, oral airways usually will allow for a greater generation of positive-pressure, with a tight-fitting mask, than an iLMA. However, when traditional mask ventilation is difficult or impossible, the iLMA may be ideal to use.

In situations in which mouth opening is limited, the glottis is off-midline, or in the presence of an airway tumor or prior cervical radiotherapy, the iLMA may not be as useful as a FCOA. In addition, the iLMA requires the use of a pusher rod to advance the tracheal tube as the LMA is removed. This extra step is not needed with a FCOA.

Table 2 summarizes the salient clinical differences between the iLMA and FCOAs.

Finally, battery-operated fiberscopes are readily available. These devices further increase the utility of FCOAs over that of blind intubation techniques. This fact is especially important during "off the floor" intubations, in which properly trained personnel, or other equipment, may not be available.

Summary

Clinicians should be aware of the subtle but significant differences between each of these devices. A working knowledge of FCOAs may facilitate the critical task of securing a difficult airway with a fiberscope. In particular, the use of a FCOA with an anterior channel may be particularly helpful with tracheal intubations in which the glottic opening is excessively anterior.

Furthermore, the iLMA may also be thought of as an FCOA. It must be remembered that the use of the iLMA may be limited in situations in which the glottis is off-midline or in the presence of an airway tumor. Limitations in mouth opening and prior cervical radiotherapy may also restrict the use of this device. In addition, a greater positive-pressure can be generated when using a tight-fitting face mask, with a FCOA, as compared with an iLMA.

Clearly, FCOAs allow the clinician to both optimally ascertain airway anatomy and to effectively ventilate, with positive pressure, by mask.

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