Original Article

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# Comparison of Intubating Conditions using King Vision™ Video Laryngoscope versus I-view™ Video Laryngoscope: A Randomised Clinical Study

Anaesthesia Section

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## ABSTRACT

**Introduction:** Video Laryngoscopes (VLs) offer better glottic visualisation than direct laryngoscopy, thereby minimising the risk of hypoxia and trauma associated with Difficult Intubation (DI). The King Vision™ VL is a portable device with disposable hyperangulated channelled and non channelled blades. The I-view™ Intersurgical™ VL is a novel, fully disposable single-use device with a Macintosh-type blade that offers a familiar and intuitive intubation technique.

**Aim:** To compare the intubating conditions using the non channelled King Vision™ VL and the I-view™ VL in adult patients receiving general anaesthesia for elective surgical procedures.

**Materials and Methods:** This randomised single-blind clinical was conducted at the Department of Anaesthesiology, Guru Teg Bahadur Hospital, Delhi, India. A total of 40 adult patients (American Society of Anaesthesiologists (ASA) I-II) were randomly assigned to Group KV (King Vision VL, non channelled, size 3 blade; n=20) or Group I (I-view VL; n=20). Time to successful intubation (TTI) was the primary outcome. Secondary outcomes included the Intubation Difficulty Score (IDS), Percentage of Glottic Opening (POGO) score, Fremantle score (FS), first-attempt success rate, need for additional manoeuvres, haemodynamic responses and complications, were compared between groups. Normally distributed quantitative variables were evaluated using unpaired t-tests and qualitative variables were assessed using Chi-square or Fisher's-exact test, as appropriate. Statistical analyses were all performed using Statistical Package for the Social Sciences (SPSS) version 20.0, with a significance level of p-value <0.05.

**Results:** Baseline demographics and airway parameters, including age, weight, Body Mass Index (BMI), ASA class and airway assessment scores, were comparable (p-value >0.05). Mean TTI was similar between Group I and Group KV (49.5±10.7 seconds vs. 52.7±9.3 seconds, p-value =0.312). First-attempt success was higher in Group I (85% vs 70%, p-value =0.250), with fewer additional manoeuvres (30% vs. 45%, p-value =0.439). POGO scores, IDS and Fremantle scores were comparable (p-value >0.05). Both groups achieved a 100% overall success rate. Haemodynamic responses (Heart Rate (HR) and blood pressure) were significantly lower in Group I following intubation (p-value <0.05). No complications occurred in either group.

**Conclusion:** Both King Vision™ and I-view™ VLs provided comparable intubation conditions regarding time to intubation, glottic visualisation and difficulty in adult elective surgical patients. The I-view™ demonstrated advantages, including higher first-attempt success, fewer additional manoeuvres and attenuated haemodynamic responses.

**Keywords:** Glottis, Haemodynamics, Intubation, Laryngoscopy

## INTRODUCTION

The Difficult Intubation (DI) occurs in 0.5- 10% of general anaesthesia cases, increasing the risk of hypoxia, airway trauma and haemodynamic instability [1,2]. Technological advancements have facilitated airway management, including innovations such as intubation through laryngeal mask airways and specialised laryngoscope blades [3]. Direct laryngoscopy, introduced in the 1940s, provides a direct view of the glottis and has long been considered the standard method for intubation [4]. However, it has limitations: the view can be restricted by patient positioning, oropharyngeal anatomy, cervical immobilisation, or limited mouth opening (Mallampati scores 3 and 4) [5].

To address these challenges, Video Laryngoscopes (VLs) were developed in the late 1990s and a plethora of devices are now available [6]. VLs consist of a handle and a blade equipped with a camera that transmits images to a display screen, allowing indirect visualisation of the larynx. Different VLs vary in blade shape, geometry, user interface and tube insertion strategy [7]. VLs offer several advantages over direct laryngoscopy. They provide a wider viewing angle without requiring alignment of the oral, pharyngeal and tracheal axes, improve glottic visualisation, reduce neck manipulation and minimise force on the tongue, thereby decreasing the pressor response [7-12].

The King Vision™ VL is a portable device with two types of disposable blades channeled and non channeled, both featuring an antifogging coating. The blade dimensions differ slightly (height 13 mm vs 18 mm; width 26 mm vs 29 mm). An Organic Light-Emitting Diode (OLED) display is attached to the blade handle, while a Complementary Metal-Oxide-Semiconductor (CMOS) camera and LED light at the blade tip enable glottic visualisation [13,14]. The hyperangulated blade design of the King Vision™ VL minimises soft-tissue lifting and head extension, thereby reducing airway trauma; however, its thickness can make oral insertion challenging, which is a notable limitation of this video laryngoscope [15].

The I-view™ Intersurgical™ VL is a novel, fully disposable, single-use device with a fixed proximal screen and a camera/light source at the distal blade tip. It features a video-enhanced Macintosh size 4 blade. Like other video enhanced VLs, it allows unobstructed visualisation of the glottis and facilitates smooth tracheal tube placement. Its traditional Macintosh geometry also allows the option of direct laryngoscopy in the same attempt if needed [16].

Although several studies have evaluated the King Vision™ VL [13-15,17-19], data on the I-view™ are limited [19-21] and no studies have directly compared these two devices clinically. This randomised clinical study compared the King Vision™ and I-view™ video laryngoscopes clinically in patients undergoing elective surgery under general anaesthesia, with the hypothesis that the I-view™ VL, with its familiar Macintosh-type blade, may allow easier and more intuitive intubation than the hyperangulated non channeled King Vision™ VL. The study aimed to compare intubating conditions between the two devices, with the primary objective being the time to intubate the trachea and secondary objectives including IDS, POGO score, Fremantle score, number of attempts, haemodynamic response, trauma during intubation and any other complications.

## MATERIALS AND METHODS

This randomised, single-blinded clinical trial was conducted at the University College of Medical Sciences and Guru Teg Bahadur Hospital, Delhi, India from January 2021 to April 2022. Ethical approval was obtained from the Institutional Ethics Committee (Approval No. IECHR/2020/PG/47/13-R1, dated 22/12/2020) consistent with the Declaration of Helsinki guidelines. The trial was registered with the Clinical Trials Registry-India (www.ctri.nic.in; registration number: CTRI/2021/01/030868, registered on 29/01/2021) before enrolling participants. Written and informed consent was explained and obtained from all participants.

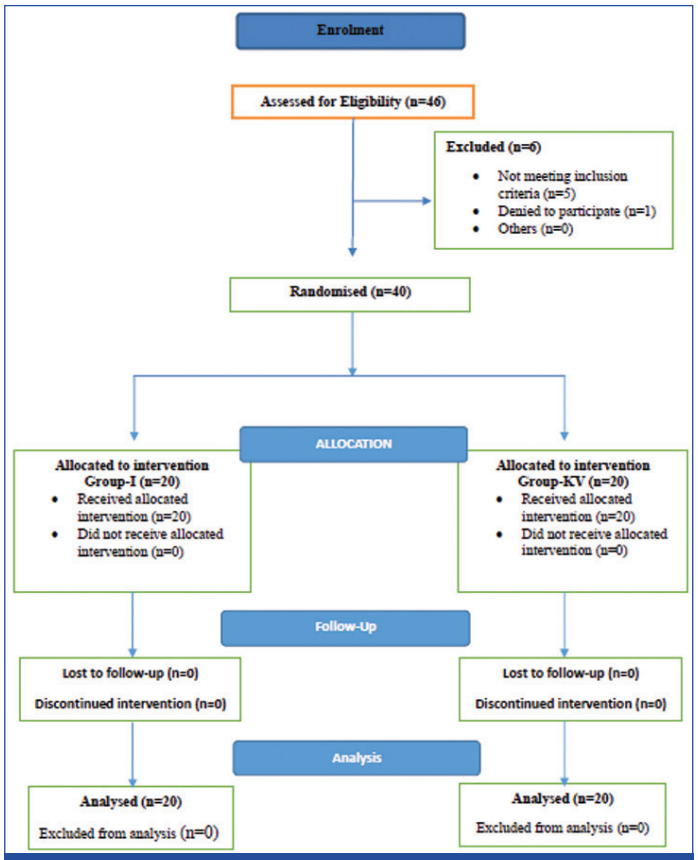
**Inclusion criteria:** Adult patients aged 18-60 years, weighing 40-70 kg, with Mallampati scores of 1, 2, or 3 and ASA grades I and II, scheduled for elective surgery under general anaesthesia requiring endotracheal intubation were included in the study.

**Exclusion criteria:** Patients with pre-existing cardiovascular, neurological, or psychological conditions, obesity (BMI > 30 kg $m^2$), increased aspiration risk (including pregnant females, patients with abdominal trauma, intestinal obstruction, hiatus hernia, gastro-oesophageal reflux disease, or a known history of delayed gastric emptying), visible neck swelling, mouth opening < 18 mm; or restricted neck movements were excluded from the study.

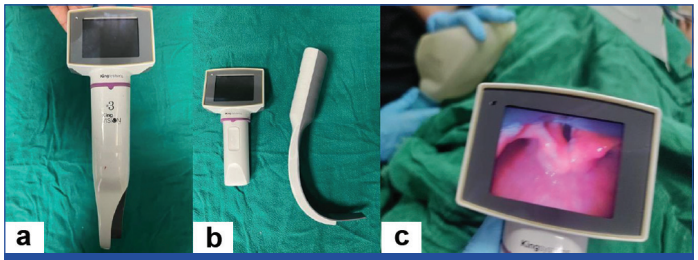
**Sample size calculation:** A comprehensive literature review revealed no prior studies directly comparing the King Vision video laryngoscope (non channelled, size 3 blade) with the I-view™ Intersurgical VL in adult patients. An estimated sample size including 20 patients per group was determined, based on median intubation times observed in manikin studies: 18 seconds (IQR 13.8–25.2 seconds) for King Vision and 28.4 seconds (IQR 23.9-37.8 seconds) for I-view™ [19]. This calculation was designed to detect a statistically significant difference between the two devices, assuming a 5% significance level ($\alpha$=0.05) and 80% power. Consequently, 20 patients were enlisted in each group.

### Study Procedure

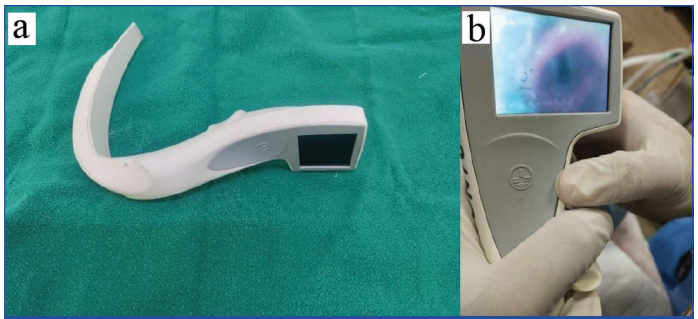
Forty-six patients were screened for study inclusion, with six exclusions: five did not meet eligibility criteria and one declined participation. The remaining 40 patients were randomised equally into Group I (n=20) and Group KV (n=20) [Table/Fig-1]. Randomisation was performed using a computer-generated random number table prepared by a statistician who was not involved in patient recruitment or interventions. Participants were enrolled by the principal investigator, while group allocation was revealed using consecutively numbered and sealed opaque envelopes. These envelopes were opened in the operating room before induction by an anaesthesiologist not involved in the study, who then provided the allocated device to the intubating anaesthesiologist. Group KV was intubated using the King Vision VL (non channelled, size 3 blade) [Table/Fig-2] and Group I was intubated using the I-view™ VL [Table/Fig-3]. This was a single-blinded study and patients were unaware of the device used, whereas the anaesthesiologist performing intubation and recording outcomes could not be masked because the intervention inherently required it.




**[Table/Fig-1]:** CONSORT flow diagram of participant progress through the study.




**[Table/Fig 2]:** King Vision™ Video Laryngoscope (VL) with a non channeled size 3 Blade (Ambu A/S, Ballerup, Denmark): (a) Monitor attached to the blade; (b) Monitor and blade detached; (c) Laryngoscopic view captured through the King Vision™ VL.




**[Table/Fig-3]:** I-View™ Video Laryngoscope (VL) (Intersurgical Ltd., Wokingham, Berkshire, UK) (a) I-View™ Video Laryngoscope; (b) Laryngoscopic view obtained using the I-View™ VL.

All participants underwent a thorough preanaesthetic evaluation, and maintained Nil Per Os (NPO) status for at least eight hours preoperatively. Patients received oral alprazolam (0.25 mg) [22] and ranitidine (150 mg) [23] as premedication the evening before and the morning of the surgical procedure. After arriving in the operating room, standard monitors like Non Invasive Blood Pressure (NIBP), Electrocardiography (ECG) for HR and pulse oximetry ($SpO_2$) were attached. Intravenous access was established using an 18G

cannula. General anaesthesia was induced through intravenous administration of fentanyl at a dose of 1-2 µg/kg, propofol at a dose of 1.5-2 mg/kg and vecuronium bromide at a dose of 0.1 mg/kg. Following three minutes of neuromuscular blockade, a senior resident with at least one year of post-MD anaesthesiology experience performed all endotracheal intubations using the assigned videolaryngoscope, having completed at least 20 prior intubations with each device.

**Outcomes:** The main outcome was the time required for successful intubation, assessed as the interval from device insertion to the visualisation of a capnograph waveform, which was noted. Secondary outcomes included IDS, glottic visualisation (POGO and Fremantle scores), number of intubation attempts, haemodynamic responses, procedure-related trauma, any additional manoeuvres required and other complications.

The POGO score was recorded, with 100% indicating complete glottic visualisation and 0% signifying no visualisation of the interarytenoid notch [24]. The Fremantle score was assessed in three components, recorded once after intubation: the "view" component (F for full view, P for partial view, N for no view), the "ease" of intubation (1 for easy, 2 for modified, 3 for unachievable, defined as when the operator is unable to pass the endotracheal tube or the technique is abandoned) and the name of the specific device and blade used [25]. A seven-point IDS evaluated factors such as attempts, additional operators, alternative techniques, Cormack-Lehane score, lifting force, laryngeal manipulation and cord position. Intubation was categorised as easy (IDS=0), mildly difficult (IDS 1–5), or moderate to severely difficult (IDS >5) [26]. The number of intubation attempts required to achieve successful intubation was recorded once after intubation; if intubation was unsuccessful on the first attempt, a second attempt was made after one minute of oxygenation and if the second attempt also failed, the procedure was classified as a "failed intubation" for that device, with direct laryngoscopy subsequently performed. Haemodynamic variables, such as SBP, DBP, MAP, HR and $SpO_2$, were measured and recorded at baseline (T0), post-induction (T1), preintubation (T2), immediately after intubation (T3) and at 3, 5, 10 and 15 minutes postintubation (T4-T7). Any additional manoeuvres used to facilitate intubation, such as neck extension, head tilt, chin lift, jaw thrust, or Backward Upward Rightward Pressure (BURP) and were noted once after intubation. Any trauma or complications during device insertion, removal and the intraoperative period were documented.

## STATISTICAL ANALYSIS

Data were analysed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA). Normally distributed quantitative variables were evaluated using unpaired t-tests and qualitative variables were assessed using Chi-square or Fisher's-exact test, as appropriate, with a significance level of $p<0.05$.

## RESULTS

**Demographics and airway assessment:** Both groups showed comparable results in baseline characteristics and preoperative airway parameters, indicating balanced randomisation (all p-value >0.05) [Table/Fig-4].

**Intubation characteristics:** Time to successful intubation and overall success rates were similar between groups (p-value =0.312). First-attempt success was higher in Group I, while Group KV required more second attempts; however, these differences were not statistically significant (p-value=0.250). POGO scores were high and without any statistical difference between groups (p-value=0.623). Fremantle view scores (p-value=1.000) and ease scores (p-value=0.749) were comparable between the two groups. The need for additional manoeuvres was somewhat higher in Group KV but did not differ significantly (p-value=0.439) [Table/Fig-5].

| Variable | Group I (n=20) | Group KV (n=20) | p-value |
|---|---|---|---|
| Age (years) | 38.2±15.3 | 37.0±13.1 | 0.790 |
| Weight (kg) | 60.9±7.6 | 63.6±7.4 | 0.240 |
| Gender (M: F) | 7:13 | 6:14 | 0.736 |
| ASA Class (I: II) | 14:6 | 10:10 | 0.197 |
| Height (cm) | 161.6±4.7 | 163.1±5.7 | 0.369 |
| BMI (kg/m²) (<25:25–30:>30) | 8:7:5 | 6:6:8 | 0.314 |
| Thyromental distance (cm) | 6.60±0.30 | 6.40±0.41 | 0.244 |
| Interincisor gap (cm) | 4.64±0.38 | 4.47±0.39 | 0.110 |
| Neck movements (Normal: Restricted) | 20:0 | 20:0 | - |
| Mallampati class (1:2:3) | 11:9:0 | 6:14:0 | 0.110 |

**[Table/Fig-4]:** Demographics and preoperative airway assessment.
Data are presented as mean ± SD (Unpaired t-test) or frequency ratios (Chi-square test); $p < 0.05$ considered significant. M: Male; F: Female; BMI: Body Mass Index; ASA: American Society of Anesthesiologists.

| Parameter | Group I (n=20) | Group KV (n=20) | p-value |
|---|---|---|---|
| Time to intubation (seconds) | 49.45±10.71 | 52.70±9.27 | 0.312 |
| Total success rate (%) | 100 | 100 | |
| First attempt success (n (%) | 17 (85) | 14 (70) | 0.250 |
| Number of attempts (1:2:3) | 17:3:0 (85%:15%:0%) | 14:6:0 (70.0%:30%:0%) | |
| Intubation Difficulty Score (IDS) (0:1–5:>5) | 11:9:0 (55%:45%:0%) | 11:9:0 (55%:45%:0%) | 1.000 |
| POGO Score (%) | 95.50±6.53 | 96.50±5.59 | 0.623 |
| Fremantle score -View (F: P: N) | 19:1:0 (95%:5%:0%) | 20:0:0 (100%:0%:0%) | 1.000 |
| Fremantle score -Ease (1:2:3) | 12:8:0 (60%:40%:0%) | 11:9:0 (55%:45%:0%) | 0.749 |
| Maneuvers used (None: Neck Extension: BURP) | 14:6:0 (70%:30%:0%) | 11:8:1 (55%:40%:5%) | 0.439 |
| Complications (Present/ Absent) | 0/20 | 0/20 | - |

**[Table/Fig 5]:** Comparison of intubation performance and complications.
Data are mean ± SD (Unpaired t-test) or n (%) (Chi-square test); $p < 0.05$ considered significant. POGO: Percentage of glottic opening; BURP: Backward, Upward, Rightward Pressure.

**Intubation difficulty:** IDS values were similar, indicating minimal difficulty in both groups (p-value=1.000). [Table/Fig-5].

**Haemodynamic response:** Group KV exhibited greater increases in blood pressure and HR immediately after intubation and at three minutes post-intubation compared to Group I, reflecting a more pronounced haemodynamic response [Table/Fig-6].

**Complications:** No adverse events, such as desaturation, mucosal injury, dental trauma, or laryngospasm, were observed in either group.

## DISCUSSION

This study compared the King Vision™ and I-view™ in 40 patients undergoing elective surgery, focusing on intubation conditions. Both devices provided comparable intubation times (p-value=0.312), glottic visualisation (POGO and Fremantle scores) and intubation difficulty (IDS). However, the I-view™ VL demonstrated a significantly reduced haemodynamic response, a higher first-attempt success rate (85% vs 70%) and required fewer additional manoeuvres (30% vs 45%) compared to the King Vision™ VL. These findings suggest that, despite similar overall effectiveness, the I-view™ VL may provide advantages in terms of haemodynamic stability and user-friendliness.

The VLs have become essential in airway management since the 2000s, offering improved glottic visualisation via an indirect camera view. ASA and DAS guidelines recommend their use in both

| Parameter | Group | T1-T0 | T2-T0 | T3-T0 | T4-T0 | T5-T0 | T6-T0 | T7-T0 |
|---|---|---|---|---|---|---|---|---|
| SBP (mmHg) | I | -3.60±4.10 | -2.65±3.72 | 2.05±7.65 | 0.60±4.97 | -0.45±2.76 | 0.00±3.48 | 0.50±5.30 |
| | KV | -4.10±5.59 | -0.90±4.09 | 8.65±9.49 | 3.40±10.12 | 0.35±6.20 | -0.45±4.11 | -0.25±6.87 |
| | p-value | 0.749 | 0.165 | 0.021* | 0.274 | 0.601 | 0.711 | 0.701 |
| DBP (mmHg) | I | -2.80±2.78 | -0.70±6.94 | 2.80±9.00 | 2.00±5.41 | 1.10±2.02 | 1.45±3.20 | 3.35±4.26 |
| | KV | -2.95±3.32 | -0.20±3.83 | 9.75±10.37 | 6.70±7.75 | 2.90±4.82 | 1.35±3.07 | -0.40±4.62 |
| | p-value | 0.878 | 0.780 | 0.029* | 0.033* | 0.132 | 0.920 | 0.011* |
| MAP (mmHg) | I | -2.95±2.74 | -1.20±5.14 | 2.65±8.23 | 1.75±4.78 | 0.60±1.88 | 1.00±2.47 | 2.60±3.56 |
| | KV | -3.35±3.51 | -0.40±3.10 | 9.45±9.58 | 5.65±8.06 | 2.10±4.75 | 0.85±2.68 | -0.15±4.56 |
| | p-value | 0.690 | 0.555 | 0.021* | 0.072 | 0.196 | 0.855 | 0.040* |
| HR (bpm) | I | -1.15±3.79 | -0.95±4.73 | 3.30±8.47 | -1.20±7.87 | -1.75±9.61 | -1.95±8.92 | -0.80±10.32 |
| | KV | -0.45±4.07 | 1.25±5.57 | 12.85±9.64 | 4.65±8.96 | 1.10±8.42 | -4.00±4.87 | -2.95±5.63 |
| | p-value | 0.577 | 0.186 | 0.002* | 0.034* | 0.325 | 0.374 | 0.420 |

**[Table/Fig 6]:** Mean differences (± SD) in hemodynamic parameters from baseline (T0).
Time points: T1 (post-induction), T2 (pre-intubation), T3 (immediate post-intubation), T4–T7 (3, 5, 10, 15 min post-intubation). Unpaired t-test; $p < 0.05$ considered significant SBP:Systolic blood pressure;DBP:Diastolic blood pressure;MAP:Mean arterial pressure; HR:Heart rate.

routine and difficult airways [27,28]. Compared to conventional laryngoscopy, VLs have a shorter learning curve, allowing even less experienced practitioners to intubate successfully and improving patient wellbeing. This study provides a clinical comparison between the King Vision™ and I-view™ devices.

Time to successful intubation (TTI) did not differ significantly between the I-view™ and King Vision™ VLs (p-value =0.312). In contrast, Moritz A et al., reported a longer TTI with I-view™ (28.4 s) compared to King Vision™ (18 seconds) among experienced anaesthesiologists in a manikin study, although no difference was observed when used by paramedics (24 seconds vs 24.2 seconds, p-value > 0.05) [19]. These differences are likely due to variations in study design, including clinical versus manikin settings, the lack of physiological factors in manikins, heightened anxiety in real-patient intubations and the broader TTI definition used in this study, which extends to capnography confirmation.

The I-view™ VL achieved a higher first-attempt success rate (85% vs 70%) and required fewer additional manoeuvres (30% vs 45%) compared with the King Vision™. Although the difference was not statistically significant, these findings suggest procedural ease with I-view™. Verma A et al., similarly reported variable first-attempt success with King Vision™, showing 55.4% with channelled blades versus 81.6% with non channelled blades, recommending the latter for emergency use [18]. Meanwhile, Ratajczyk P et al., demonstrated a 100% success rate with I-view™ compared to the Macintosh laryngoscope in a simulated out-of-hospital setting, highlighting its reliability even for less experienced users [20].

Glottic visualisation was excellent, with POGO scores of 95.5% for King Vision™ and 96.5% for I-view™ and Fremantle scores were comparable between the devices. This finding was consistent with Rendeki S et al., who reported excellent glottic views with the King Vision VL in manikins [17]. Similarly, Ratajczyk P et al., reported superior glottic visualisation with the I-view™ VL (Cormack-Lehane Grade I in most cases) compared to the Macintosh in simulated settings, reinforcing its effectiveness [20] Gaszynski T, however, reported lower POGO scores (81.6±22.8%) in super-obese patients compared with the present study population of normal BMI patients (95.5±6.5%), underscoring the role of patient factors [21]. IDS were consistently low (<5), with no failed intubations, confirming both devices as effective in routine clinical airways.

Haemodynamic responses postintubation (T3-T0) were significantly higher with the King Vision VL, suggesting a more pronounced stress response, possibly linked to increased manoeuvres or attempts. Oxygen saturation remained stable and no major complications (e.g., bronchospasm, laryngospasm, or oropharyngeal injury) occurred, reinforcing the safety of both devices.

Device design likely influenced performance differences. The non channelled King Vision™ blade, with its thicker profile, longer handle and acute blade angle, may necessitate greater soft-tissue manipulation during insertion. In contrast, the I-view™ employs a disposable Macintosh-style blade with an integrated camera and light source, preserving familiar curvature and enabling smoother tube placement with minimal force or neck extension. These features may explain the reduced need for manoeuvres, lower haemodynamic impact and higher success rates observed with the I-view™.

From a cost-effectiveness perspective, King Vision™ requires a higher upfront cost but uses disposable blades with a reusable monitor, lowering per-use expenses over time. In contrast, the fully disposable I-view™ eliminates reprocessing and lowers infection risk but incurs a higher cost per intubation. Although no formal cost analysis was performed, these factors are relevant for institutional decision-making.

### Limitation(s)

This study was conducted at a single centre, which may have limited the generalisability of the findings. Patients were blinded to the device used, whereas the anaesthesiologist who performed intubation and recorded outcomes could not be blinded due to the visible differences between the two devices. Although inter-operator variation could not be fully excluded, all providers had more than one year of anaesthesia experience and at least 20 prior intubations with both devices, which may have reduced its impact. Larger, multicentre studies, including a broader spectrum of airway scenarios, are needed to validate and generalise these findings.

## CONCLUSION(S)

In the present study, it was found that both the King Vision™ and I-view™ video laryngoscopes provided comparable intubation conditions in terms of time to intubation, glottic visualisation and intubation difficulty in adult patients undergoing elective surgery. The I-view™, however, demonstrated certain advantages, including a higher first-attempt success rate, fewer additional manoeuvres and attenuated haemodynamic responses during intubation. Further, larger, multicentre studies are warranted to confirm these findings, particularly in patients with difficult airways.

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