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Comparison of the Video Laryngoscopes with the Macintosh Laryngoscope for Nasotracheal Intubation in Patients Undergoing Oral and Maxillofacial Surgeries

Remsha Zahid[1*], Amna Khan[1], Faizan Ahmed[1] and Kainaat Zahid[2]

[1]Department of Anesthesiology, Jinnah Postgraduate Medical Center, Karachi, Pakistan
[2]Department of Medicine, Dow Medical College, Karachi, Pakistan

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***Corresponding Author:**
Remsha Zahid
Department of Anesthesiology, Jinnah Postgraduate Medical Center, Karachi, Pakistan
remshazahid@gmail.com

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ABSTRACT

Nasotracheal intubation is more desirable, whereas Macintosh may be challenging to perform in certain patients. The video laryngoscopes offer an indirect, magnified image of the glottis, which may enhance the effectiveness of intubation and shorten the length of the procedure. **Objectives:** To assess the video laryngoscopes and the Macintosh laryngoscopes in nasotracheal intubation of patients undergoing oral and maxillofacial surgeries. **Methods:** This prospective observational comparative study was done at Jinnah Postgraduate Medical Centre, Karachi, between March and August of 2023. The time of intubation, the success of the first attempt, and complications were noted. A statistical test was conducted for data analysis, and $p \leq 0.05$ was regarded as significant. **Results:** Group A (98%) scored higher than Group B (76%) in terms of first-attempt intubation success (p=0.001). Video laryngoscopy lowered the mean intubation time (31.7 ± 3.97s) compared to Macintosh (54.7 ± 6.93s) (p=0.001). The stratified analysis showed a consistently better performance of video laryngoscopes in terms of age, gender, ASA status, BMI, and Mallampati class. **Conclusions:** Video laryngoscopes significantly improve first-attempt success and reduce intubation time for nasotracheal intubation in oral and maxillofacial surgery patients. Their use can enhance airway safety and procedural efficiency.

INTRODUCTION

In oral and maxillofacial surgery patients, airway management is a unique issue as the anesthesiologist and surgeon share airway access. Nasotracheal intubation would be best utilized in these procedures since it offers an unobstructed surgical field, enables intraoperative occlusal evaluation, and enables maxillomandibular fixation. Recent clinical audits and surgical series state that over 60% of elective oral and maxillofacial surgeries involve nasotracheal intubation, which is one of the most used airway methods in this group [1, 2]. The Macintosh direct laryngoscope has long been regarded as the conventional tool in nasotracheal intubation due to its simplicity, ubiquitous nature, and familiarity of clinicians with the tool. Challenging laryngoscopy and challenging airway intubation have been reported in up to 10%-15% of surgical patients, and more frequently with maxillofacial surgeries. Repeated attempts at intubation enhance the chances of airway trauma, hypoxia, epistaxis, and postoperative complications [3, 4]. The adoption of video laryngoscopes as a means of airway management has been

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growing over the last 10 years, since it offers an indirect, clear picture of the glottis without requiring ideal positioning of the oral, pharyngeal, and laryngeal axes [5]. Several video laryngoscope designs have been presented, such as hyper-angulated and channeled blades, which can come in especially handy with nasotracheal intubation [6, 7]. A recent study has shown that video laryngoscopes are linked to better visualization of the glottis, increased success in the first attempt, and decreased use of the Magill forceps over Macintosh laryngoscopy during nasotracheal intubation. Nevertheless, the results with respect to intubation time and overall success are inconsistent between the various devices and clinical conditions [8-10]. Even though various randomized and prospective trials have compared video laryngoscopes and Macintosh laryngoscopes when using nasotracheal intubation, due to differences in patient characteristics, outcome metrics, operator experience, and device type, there have been a variety of outcomes [11, 12].

There is disagreement over whether video laryngoscopes are better than Macintosh laryngoscopes for nasotracheal intubation in patients having oral and maxillofacial surgery, despite the fact that they are becoming more widely available. Past research has indicated mixed findings on first attempt success, intubation duration, and complication rates, typically because of differences in patient characteristics, operator experience, type of device, and study design. Additionally, there is no literature on literature dealing with specific populations of oral and maxillofacial surgery, where a smaller mouth aperture, facial injuries, and anatomic differences may make airway management more complex. There is also limited evidence in resource-limited settings where Macintosh laryngoscopy is still in widespread use. There is a need, therefore, to conduct a standardized, prospective study to compare video laryngoscopes and Macintosh laryngoscopes, since nasotracheal intubation is a standard procedure in maxillofacial procedures, and airway control can directly impact patient-safety and surgical productivity. The study aimed to compare the performance of video laryngoscopy and Macintosh laryngoscopy during nasotracheal intubation of patients undergoing oral and maxillofacial surgeries.

METHODS

This was a prospective observational comparative study conducted at the Department of Anesthesia in Jinnah Postgraduate Medical Centre, Karachi, for six months from 1st March 2023 to 31st August 2023. The ethical approval was obtained from the Institutional Review Board of Jinnah Postgraduate Medical Centre with approval number F.2.-81/2023-GENL/16/JPMC. The World Health Organization sample size calculator was used to calculate the sample size. The level of significance of 5% and the power of 80% was used. According to the recorded mean intubation times, the mean intubation time with the video laryngoscope was 32.9 seconds with a standard deviation of 10.5 seconds, and the mean intubation time with the Macintosh laryngoscope was 42.7 seconds with a standard deviation of 19.2 seconds. Based on these parameters, the derived sample size was 100 patients, with 50 patients in each group [13]. Participants were recruited using the non-probability consecutive sampling technique. The eligibility of patients scheduled for elective oral and maxillofacial surgery under general anesthesia was assessed. The inclusion criteria included both male and female patients aged twenty to sixty-five years, American Society of Anesthesiologists physical status I or II, and Mallampati class I or II airway. Consecutive enrolment of patients was carried out within the period of the study based on the inclusion criteria. Patients who had a history of difficult tracheal intubation, cervical spine instability, limited mouth opening (less than three millimeters as determined clinically), or recurrent suppurative sinusitis were excluded. All the participants provided informed consent following a discussion on the study purpose, procedures, and potential risks in the native language of the patient. The nasotracheal intubations were done by a senior anesthesiologist with at least two years of experience in post-fellowship. At the arrival in the operating room, standard monitoring, such as noninvasive blood pressure, electrocardiography (lead II), and heart rate, was used. The nasal anesthesia was done locally using an intranasal mucosal atomization device that administered xylocaine antiflatirinol 4% solution. Nalbuphine (0.1 mg/kg), propofol (1-2mg/kg), and cis-atracurium (0.2 mg/kg) were used to induce general anesthesia. This was done by manually ventilating the patients with 100% oxygen over three minutes after the loss of eyelash reflex. To inhibit hemodynamic responses, 1.5mg/kg of lidocaine was given, and the anesthesia continued with inhaled isoflurane (1.0-2.0), and the carbon dioxide end-tidal level was kept at 35-40 mmHg. Intubation was done as per the normal clinical practice, utilizing the laryngoscope chosen by the anesthesiologist. The time of intubation was recorded during the period when the laryngoscope was inserted into the mouth till proper placement of the nasotracheal tube was identified through the capnography. This proforma was formulated on the prior published research on nasotracheal intubation and airway evaluation, so that all the variables of interest were systematically represented in this group of patients [10]. The study was pre-tested with a pilot sample of 10 patients in order to ascertain its clarity, completeness, and ease of use. The main outcome was the mean intubation time, which was recorded in seconds on a stopwatch by the time the nasotracheal tube was inserted

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into the relevant nostril until the laryngoscope was removed from the mouth. Successful nasotracheal intubation on the first attempt under direct view, supported by the bilateral lungs' air entry directly seen and confirmed by the equal air entry within the lungs, was defined as success in the intubation. Body mass index was calculated by computing the following formula: BMI = weight in kilograms divided by height in meters squared. The weighing machine was used to measure weight, and the height was measured using a wall-mounted scale. Obese patients were identified as patients with a BMI above 25 kg/m2, and non-obese patients as patients with a BMI below 25 kg/m2. The assessment of airways consisted of the Mallampati classification [14].

Statistical Package for the Social Sciences (SPSS) version 24.0 was used to perform a statistical analysis. The continuous variables were represented by mean and standard deviation, whereas the categorical variables were reported in terms of frequencies and percentages. The Shapiro-Wilk test was used to test the normality of continuous data. The independent sample t-test was also used to stratify the analysis of mean intubation time with respect to age, gender, ASA status, Mallampati class, and body mass index. The chi-square test was used to compare the two categories of variables between the two groups. Stratification was done to manage the possible effect modifiers, such as age, gender, ASA status, Mallampati class, and body mass index, in the estimation of intubation success. A p-value ≤0.050 was taken as statistically significant.

RESULTS

The two groups were comparable with respect to baseline demographic and clinical characteristics. Age (p=0.680), gender (p=0.670), ASA physical status (p=0.810), body mass index (p=0.220), and Mallampati classification (p=0.700) did not differ significantly between Group A and Group B. These results confirm that both groups were well-matched at baseline (Table 1).

Table 1: Baseline Demographic and Clinical Characteristics of Patients in Both Groups (n=100)

Variables	Group A (n=50), n (%) / Mean ± SD	Group B (n=50), n (%) / Mean ± SD	p-value
Age (Years)			
20–40	27 (54.0%)	24 (48.0%)	0.680
41–65	23 (46.0%)	26 (52.0%)	
Mean ± SD	39.12 ± 8.99	38.82 ± 8.47	
Gender			
Male	29 (58.0%)	31 (62.0%)	0.670
Female	21 (42.0%)	19 (38.0%)	
ASA Status			
I	27 (54.0%)	25 (50.0%)	0.810
II	23 (46.0%)	25 (50.0%)	
BMI (kg/m²)			
≤25	23 (46.0%)	28 (56.0%)	0.220
>25	27 (54.0%)	22 (44.0%)	
Mean ± SD	26.68 ± 4.04	25.68 ± 3.87	
Mallampati Class			
I	21 (42.0%)	23 (46.0%)	0.700
II	29 (58.0%)	27 (54.0%)	

The P-values were calculated using the chi-square test for categorical variables and the t-test for continuous variables. All baseline characteristics were statistically comparable (p>0.050)

When the two groups' nasotracheal intubation success rates were compared, 76% of patients in the Macintosh laryngoscope group (Group B) and 98% of patients in the video laryngoscope group (Group A) were successfully intubated on the initial attempt. This was statistically significant (p=0.001) (Table 2).

Table 2: Comparison of Success Rate Between Video Laryngoscope (Group A) and Macintosh Laryngoscope (Group B) for Nasotracheal Intubation (n=100)

Groups	Success (Yes), n (%)	Success (No), n (%)	p-value
Group A (Video Laryngoscope)	49 (98.0%)	1 (2.0%)	0.001
Group B (Macintosh Laryngoscope)	38 (76.0%)	12 (24.0%)	

In intubation time, the mean intubation time was much lower in Group A, 31.7 ± 3.97 seconds, than in Group B, 54.7 ± 6.93 seconds (p=0.001). These results indicate that video laryngoscopy increases first-attempt success and shortens the time required to perform nasotracheal intubation compared with Macintosh laryngoscopy (Table 3).

Table 3: Comparison of Mean Intubation Time Between the Two Groups (n=100)

Parameters	Group A (n=50), Mean ± SD	Group B (n=50), Mean ± SD	p-value
Intubation Time (Seconds)	31.70 ± 3.97	54.72 ± 6.93	0.001

Successful nasotracheal intubation was consistently higher in Group A across most patient subgroups. Statistically significant differences favoring Group A were observed among younger patients, males, females, ASA I patients, non-obese individuals, and those with Mallampati class I and II airways. Although success rates remained higher in Group A among older patients, ASA II patients, and obese individuals, these differences did not reach statistical significance (Table 4).

Table 4: Stratification of Intubation Success Rate with Respect to Demographic and Clinical Variables

Variables	Group A Successful, n (%)	Group B Successful, n (%)	p-value
Age (Years)			
20–40	27 (100.0%)	18 (75.0%)	0.006
41–65	22 (95.65%)	20 (76.92%)	0.079

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Gender			
Male	29 (100.0%)	25 (80.65%)	0.013
Female	20 (95.24%)	13 (68.42%)	0.026
ASA Status			
I	27 (100.0%)	19 (76.0%)	0.007
II	22 (95.65%)	19 (76.0%)	0.054
BMI (kg/m^2)			
≤25	23 (100.0%)	20 (71.43%)	0.005
>25	26 (96.30%)	18 (81.82%)	0.096
Mallampati Class			
I	20 (95.24%)	16 (69.57%)	0.027
II	29 (100.0%)	22 (81.48%)	0.015

Mean intubation time was significantly shorter in Group A compared with Group B across all analyzed subgroups. This difference remained consistent irrespective of age category, gender, ASA physical status, body mass index, or Mallampati class, with all comparisons demonstrating strong statistical significance. These findings indicate a uniform advantage of Group A in reducing intubation duration across both low- and higher-risk patient profiles (Table 5).

Table 5: Stratification of Mean Intubation Time with Respect to Demographic and Clinical Variables

Variables	Group A Mean ± SD (sec)	Group B Mean ± SD (sec)	p-value
Age (Years)			
20–40	33.33 ± 3.71	53.46 ± 6.21	0.001
41–65	29.78 ± 3.41	55.88 ± 7.46	0.001
Gender			
Male	31.62 ± 3.72	53.61 ± 6.78	0.001
Female	31.81 ± 4.38	56.53 ± 6.96	0.001
ASA Status			
I	31.11 ± 4.37	54.92 ± 7.70	0.001
II	32.39 ± 3.39	54.52 ± 6.21	0.001
BMI (kg/m^2)			
≤25	31.57 ± 3.36	52.18 ± 5.39	0.001
>25	31.81 ± 4.48	57.95 ± 7.42	0.001
Mallampati Class			
I	31.29 ± 4.26	55.61 ± 7.52	0.001
II	32.00 ± 3.79	53.96 ± 6.42	0.001

DISCUSSION

The present study found in this prospective observational comparative study that nasotracheal intubation with video laryngoscopes (VL) had a higher first-attempt success (p=0.001) and was linked with a significantly shorter average time to intubation (p=0.001) than the Macintosh laryngoscope. Several randomized clinical trials and observational studies have demonstrated increased success with intubation and shortened intubation periods when using VLs. A study by Erdivanli B *et al.* 2018 discovered that the King Vision video laryngoscopy also led to less time to mean intubation and greater first-attempt success than the Macintosh laryngoscopy used in nasotracheal intubation and fewer complications, including sore throat and mucosal injury [15]. The present study demonstrated shorter intubation time, improved glottic visualization, and fewer optimization maneuvers with video laryngoscopy compared to Macintosh laryngoscopy during nasotracheal intubation. Equally, the study by Ketata *et al.* in patients undergoing maxillofacial surgery showed that the Medcaptain® video laryngoscope had a significantly shorter total intubation time, glottic visualization, and decreased usage of Macintosh laryngoscopy as compared to the Medcaptain® video laryngoscope [16]. The stratified findings of our study revealed that VL had consistent benefits in terms of age, gender, ASA status, and Mallampati class, with a larger benefit in younger patients, men, ASA I, lower BMI, and Mallampati I/II groups. These subgroup trends are consistent with meta-analytic data presented by Ho *et al.* that revealed the improvement of glottic views and possibly increased success rates of video laryngoscopy-assisted nasotracheal intubation, although not all studies showed statistically significant differences [17]. Video laryngoscopy in the current study was linked to a shorter intubation time that was consistently shorter than the Macintosh laryngoscopy, hence it depicts a strong procedural value compared to Macintosh laryngoscopy. Nevertheless, although many published studies indicate a preference to use video laryngoscopes, the literature available shows. A study by Hansel *et al.* demonstrated that in immobilized-neck patients, video laryngoscopy facilitated a decreased number of airway manoeuvres during intubation compared to using the Macintosh laryngoscopy, although it did not necessarily result in the reduction of the absolute intubation time, depending on airway anatomy [18]. Also, Gangishetty *et al.* discovered that a non-channeled McGrath device did not have a significant effect on reducing intubation time in comparison to Macintosh and that the design of the devices and operator experience could be additional factors [19]. Consistent with our findings demonstrating quicker and more reliable nasotracheal intubation using video laryngoscopy. A study by Yadav *et al.* found that the use of cuff inflation and video laryngoscopy had a positive effect on intubation conditions, which validates our results of a quicker and more dependable intubation with VL [20].

There are certain limitations of this study. It was only performed in one center, a fact that can undermine the extension of the results to other organizations or patient groups. Second, experienced anesthesiologists executed the intubations; outcomes may be different in the case of inexperienced operators. Third, the patients who had severe airway problems or were unable to open their mouths were excluded, and hence, the results cannot be generalized to the worst-case airway situations. Also, the only type of video laryngoscope was applied, and the

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results can be different when using other instruments or a different blade. Lastly, as an observational study, bias concerns associated with the selection of patients, selection related to operator preference, cannot be completely dismissed. The number of centers, different levels of experience of the operators, and the types of video laryngoscopes should be covered in future research. These studies will be used to confirm these results and enhance their applicability to a wider patient population.

CONCLUSIONS

The video laryngoscopes have definite benefits over the Macintosh laryngoscopes in nasotracheal intubation in patients undergoing oral and maxillofacial surgery. They offer greater first-attempt success rates, fewer intubation times, and are reliable in demographic and clinical subgroups. Video laryngoscopes have the potential to promote airway safety, decrease complications, and increase efficiency in the surgical practice.

Authors' Contribution

Conceptualization: RZ
Methodology: AK
Formal analysis: FA, KZ
Writing and Drafting: FA, KZ
Review and Editing: RZ, AK, FA, KZ

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflicts of Interest

All the authors declare no conflict of interest.

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