

Nasotracheal intubation for dental surgery: A comparison of direct laryngoscopy with McGrath MAC videolaryngoscopy

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Abstract

Aim: The purpose of our study was to compare the McGrath MAC videolaryngoscope (VL) with the Macintosh direct laryngoscope (DL) for the efficacy during nasotracheal intubation (NTI) in patients undergoing dental surgery.

Material and Methods: In total, 70 American Society of Anesthesiologist physical status (ASA) I-II patients who underwent elective dental surgery requiring NTI were included in this study. The patients were divided to two groups based on intubation using McGrath MAC VL (n=35) and Macintosh DL (n=35). The patients were monitored via electrocardiography (ECG), noninvasive arterial pressure, and peripheral oxygen saturation (SpO₂) after they were taken to the operating room. Preoxygenation was performed with face mask for at least 3 minutes with 100 % O₂. In addition, 2 mg/kg propofol and 1 µg/kg fentanyl were administered for anesthesia induction, and 0,6 mg/kg rocuronium was administered for muscular relaxation. NTI was performed 3 minutes after rocuronium injection with a nasotracheal tube. Anesthesia was maintained with sevoflurane and 50% air in oxygen. Mean arterial pressure (MAP), heart rate (HR), SpO₂ and end tidal-carbon dioxide (EtCO₂) were recorded at baseline; after anesthesia induction; and 1st, 2nd, 3th and 5th minutes after intubation. Cormack-Lehane and Mallampati Scores (MPS), laryngeal compression, duration of intubation, using Magill forceps, ease of intubation, and the incidence of complications due to intubation were recorded.

Results: The demographic characteristics of the groups were similar. Regarding the success of the intubation, no significant difference was detected between the McGrath MAC VL group and the Macintosh DL group (p >0,05). However, when intubation times were compared, a significant difference was noted between groups (p<0,05). The intubation time was reduced in the McGrath MAC VL group. No statistically significant difference was observed regarding MAP and HR values. Intubation using McGrath MAC VL was significantly easier than direct laryngoscopy (p<0,05). No difference in complications was observed (p>0,05).

Conclusion: We compared the McGrath MAC VL with the Macintosh DL for NTI and found that intubation was applied in less time using McGrath MAC VL than Macintosh DL. Intubation was more easy with McGrath MAC VL than Macintosh DL. We believe that McGrath MAC VL can be preferred to DL for NTI.

Keywords: Direct laryngoscopy; hemodynamics; nasotracheal intubation; videolaryngoscopy

INTRODUCTION

Airway management is a fundamental component of anesthesia practice. Problems related to airway management are important in terms of morbidity and mortality. The establishment and maintenance of a patent airway is one of the main responsibilities of every anesthesiologist. Intubation in anesthesia practice secures airway patency and enables management of airway and breathing (1).

An anesthesiologist should be able to directly see the glottis to successfully perform intubation with direct laryngoscopy. Therefore, the axis of patient's mouth

and pharyngeal axis should be aligned by pushing the patient's mandible, tongue and other soft tissues forward and placing the patient in a suitable position. Maneuvers applied during direct laryngoscopy may cause trauma to the mouth, soft tissues and teeth or hemodynamic instability in patients. Laryngoscopy and endotracheal intubation may cause tachycardia, hypertension and arrhythmia due to mechanical stimulation of the larynx and trachea. A poor laryngeal view in patients with difficult intubation, limited cervical motion or limited mouth opening may cause intubation to become difficult or impossible. On the other hand, videolaryngoscopes (VLs) display the larynx with the aid of a camera located

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distal to the blade, so the anesthetist does not have to view the glottis directly. The alignment of the mouth/oral and pharyngeal axes is not necessary during the use of a videolaryngoscope for intubation. Videolaryngoscopy requires less manipulation than direct laryngoscopy. This feature reduces the complications of direct laryngoscopy (2,3). Tracheal intubation can be performed via the oral or nasal route. Nasotracheal intubation (NTI) is a good alternative, especially in oral surgeries.

This study aimed to compare the effects of direct laryngoscopic NTI with videolaryngoscopic NTI in patients undergoing dental surgery in terms of hemodynamic changes, complications, intubation characteristics.

MATERIALS and METHODS

This study was performed at our university hospital with the approval of Local Clinical Research Ethics Committee (No:2015/207). Patients were informed before the study, and written informed consent was obtained from all patients.

A total of 70 patients who planned to undergo elective dental surgery between 18-65 years of age with American Society of Anesthesiologist physical status (ASA) I-II classification and an Mallampati score (MPS) of 1-2-3 were included in the study. Patients with diabetes mellitus, cardiovascular and pulmonary diseases, BMI (body mass index) greater than 35 kg/m², suspected difficult intubation, and planned oral intubation were excluded from the study. Patients who required rapid serial induction and those with contraindications for nasal intubation and videolaryngoscopy or propofol, fentanyl, or rocuronium were excluded from the study.

This study was planned as a randomized single-blind prospective trial. Randomization was performed with the MedCalc for Windows (medcalc.com.tr.), version 16 statistical software. An observer who was blinded to the patient group continuously watched a monitor to measure the time to intubation and hemodynamic values. The patients were examined, and age, height, weight, gender, ASA, BMI and MPS were recorded preoperatively. Standard anesthesia monitoring was applied after taking the patients into the operating room without receiving premedication. The patients were randomly divided into 2 groups. The first group was intubated with Macintosh direct laryngoscope (DL), and the second group was intubated with McGrath MAC Videolaryngoscope (VL). NTI with DL and VL was performed by the same clinically experienced anesthesiologist who had a success rate greater than 90% at the first attempt and performed at least 50 successful videolaryngoscopy interventions. After the establishment of vascular access, the patients were preoxygenated for 3 minutes with 100% O₂, and 2 mg/kg propofol, 1 µg/kg fentanyl, and 0.6 mg/kg rocuronium was administered to both groups intravenously. The female patients were intubated with a 6- to 6.5-mm nasotracheal tube, and male patients were intubated with a 6.5- to 7-mm nasotracheal tube (Portex® Ivory PVC, North Facing, Nasal, Profile Soft Seal Cuff, Polar Preformed Endotracheal Tube) after

three minutes of mask ventilation. Three spray puffs with the 0.1% xylometazolin hydrochloride nasal spray was administered to create vasoconstriction before the tube was placed. The size of the tube and nostril selection were decided by the anesthesiologist. Magill forceps were used in patients when considered necessary during intubation. In addition, 1-2% sevoflurane and 50% O₂ + 50% air (2 L/min) were administered for maintenance of anesthesia in both groups.

Mean Arterial Pressure (MAP) and Heart Rate (HR) values of patients were recorded before anesthesia induction (baseline); after anesthesia induction; and 1, 2, 3 and 5 min after intubation. In the cases exhibiting 20% reduction in MAP and HR compared with baseline values, 10 mg ephedrine was administered intravenously, and 0.5 mg atropine was administered intravenously when the HR was less than 40 beats/min. The selection of the nostril, using Magill forceps, classification of glottic grade, occurrence of cuff blast during cuff inflation, external laryngeal compression and change in head position were recorded during intubation. The presence of laryngospasm, bradycardia, hypoxia, epistaxis, intraoral bleeding, and hoarseness were recorded as complications. The anesthesiologist who performed the intubation scored the ease of intubation between 0-100 (easy intubation was scored 0, difficult intubation scored 100 points). Whether intubation was successful at first attempt was also recorded. The time from insertion of nasal intubation tube into the nostril after the termination of mask ventilation to the time of detection of Et-CO₂ trace was accepted as intubation time. Measurements were terminated after 5 min from intubation.

Statistical Analysis

Data on quantitative variables in the study were expressed as the mean ± SD (standard deviation), and data on qualitative variables were expressed as number (n) and percentage (%). Test for normality of variables was performed using the Shapiro-Wilk test. The statistical data analysis was performed using the Chi-square, Student T-test, Mann-Whitney U test, Pearson and Spearman correlation analysis. A p-value was considered statistically significant when <0,05. IBM SPSS Statistics 22.0 program (Statistical Package for Social Sciences; SPSS, Chicago, IL, USA) was used in the analysis.

RESULTS

The distribution of demographic features is presented in Table 1. No statistically significant differences were noted between the groups in terms of gender, weight, age, height, BMI, MPS, and ASA distribution (p >0.05). No statistically significant difference was noted between the number of complications that occurred in both groups (p >0.05). Cuff blast or hoarseness did not occur in either group, so these parameters were not evaluated statistically (Table 2). No significant differences in the values of using Magill forceps, laryngeal compression, changing head position, glottic grade, failed intubation and intubation at first attempt were noted between the groups.

Table 1. Demographic data (mean±SD)

	Macintosh DL (n=35)	McGRATH MAC VL (n=35)	p
Gender (M/F)	14(40%)/21(60%)	17(48.6%)/18(51.4%)	0.470
Age (year)	26.3 ± 9.7	24.3 ± 7.7	0.456
Weight (kg)	65.1 ± 11.7	63.8 ± 13.1	0.660
Height (cm)	167,3 ± 8.5	165.3 ± 9.1	0.350
BMI (kg/m ²)	23.1 ± 2.7	23.1 ± 3.9	0.567
MPS 1/2/3	24(68.6%)/10(28.6%)/1(2.9%)	18(51.4%)/16(45.7%)/1(2.9%)	0.326
ASA 1/2	20(57.1%)/15(42.9%)	17(48.6%)/18(51.4%)	0.516

DL: Direct Laryngoscopy, VL: Videolaryngoscopy, BMI: Body Mass Index, MPS: Mallampati Score, ASA: American Society of Anesthesiology, F:Female, M:Male, n:number of patients

Table 2. Characteristics of intubation

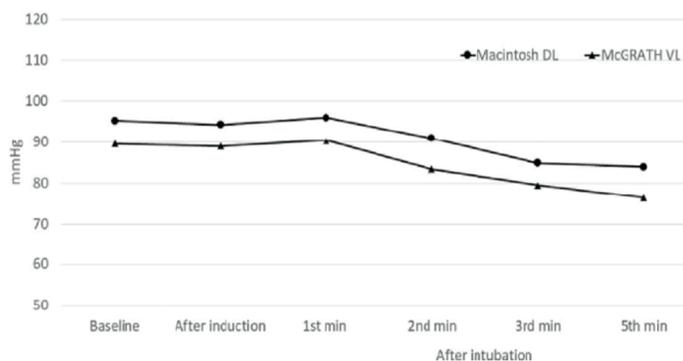
	Macintosh DL (n=35)	McGRATH MAC VL (n=35)	p
Using magill forceps	10(28.6%)	2(5.7%)	0.11
Laryngeal compression	9(25.7%)	4(11.4%)	0.124
Changing head position	8(22.9%)	1(2.9%)	0.12
Glottic grade (1/2/3)	26(74.3%) / 5(14.3%) / 4(11.4%)	28(80%) / 6(17.1%) / 1(2.9%)	0.374
Failed intubation	0(0%)	0(0%)	
Single attempt	35(100%)	34(97.1%)	0.314
Duration of intubation (sec)	35.7 ± 24.2 (11-120)*	25.9 ± 31.4 (8-150)*	<0.001
Ease of intubation (0-100)	44.29 ± 19.5 (10-90)**	31.71 ± 18.22 (10-70)**	0.002

Sec: second, *:range of duration of intubation, **:Range of ease of intubation, n:number of patients

Table 3. Complications

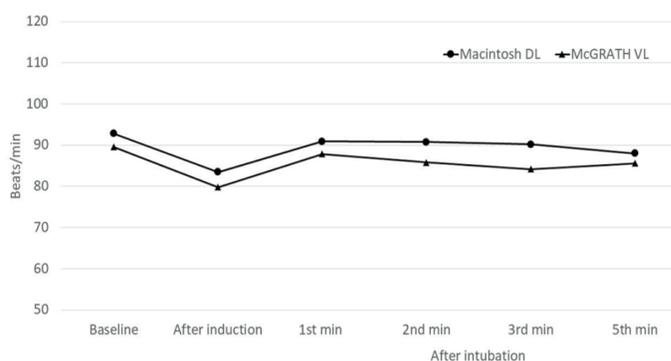
	Macintosh DL (n=35)	McGRATH MAC VL (n=35)	p
Nasal bleeding none/moderate/severe	32(91.4%)/2(5.7%)/1(2.9%)	34(97.1%)/1(2.9%)/0(0%)	0.498
Intraoral bleeding	2(5.7%)	0(0%)	0.493
Hoarseness	0(0%)	0(0%)	

DL: direct Laryngoscopy, VL: Videolaryngoscopy, n:number of patients



MAP: Mean Arterial Pressure, DL: Direct Laryngoscopy, VL: Videolaryngoscopy

Figure 1. MAP



HR: Heart Rate, DL: Direct Laryngoscopy, VL: Videolaryngoscopy

Figure 2. HR

The mean time to intubation was 35.7 ± 24.2 sec in the DL group. The mean time was reduced by 9.8 seconds (25.9 ± 31.4 sec) in the VL group. The time to intubation was found to be shorter in the VL group as statistically significant ($p < 0.05$). Intubation characteristics are presented in Table 3. Cuff blast and hoarseness were not observed in both groups.

No statistically significant differences between the groups were noted in terms of MAP and HR at baseline; after anesthesia induction; and 1, 2, 3 and 5 min after intubation ($p > 0.05$). The comparisons of MAP and HR values between groups are presented Figures 1 and 2, respectively.

DISCUSSION

Stimulation of the upper airway during laryngoscopy leads to activation of the sympathoadrenal system under general anesthesia. It has also been suggested that the time to intubation and the number of intubation attempts increase the sympathetic response (4,5).

Studies have demonstrated that videolaryngoscopes reduce the lifting force required to view glottis without alignment of the oral, pharynx and larynx axes during laryngoscopy to ensure that vocal cords could be seen more clearly. It has been hypothesized that intubation with videolaryngoscopy could reduce airway stimulation and subsequently reduce the hemodynamic response. However, conflicting results were noted in the hemodynamic response (6-9).

Numerous studies in the literature have compared various videolaryngoscopes with direct laryngoscopy. A limited number of studies were performed on NTI patients. The majority of these studies were performed with orotracheal intubation. This study aimed to compare McGrath MAC VL and Macintosh DL in patients who underwent NTI. Thirty-five patients were included in the direct laryngoscopy and video laryngoscopy groups, separately, in the study. No significant differences were noted in terms of gender, age, height, weight, MPS and ASA score between the groups in the study.

In their retrospective study, Yokose et al. (3) demonstrated that the incidence of hypertension after tracheal intubation was reduced when a McGrath MAC VL compared with a Macintosh DL was used. Xue et al. (6) reported that the Glidescope VL did not result in a difference in hemodynamic response compared with the Macintosh DL. This result has been attributed to the broad structure of the blade of Glidescope VL and the use of an endotracheal tube stylet. The use of the stylet caused more stimulation in the larynx and trachea, and the width of the blade of the VL used exerted more pressure on the tongue root. In a study with inexperienced anesthesiologists, Liu et al. (9) demonstrated that direct laryngoscopy increased the systolic arterial pressure (SAP) value after intubation compared with the McGrath MAC VL.

In a study comparing Glidescope, Pentax VL, and DL, Tsenk et al. (10) reported no difference between VL and DL in hemodynamic response compared with NTI. In a study

comparing McGrath MAC videolaryngoscopy with direct laryngoscopy in patients undergoing NTI, Kwak et al. (11) reported that the MAP value after intubation was reduced in the McGrath MAC VL group. However, this difference was not statistically significant. No difference in HR was noted between the two groups in the same study.

No significant differences in MAP and HR were noted between the videolaryngoscopy and direct laryngoscopy groups. Studies comparing the hemodynamic responses of VL and DL to orotracheal intubation have demonstrated that McGrath MAC videolaryngoscopy reduced the hemodynamic response, and no hemodynamic differences were noted with other VL (3,6). Studies comparing the hemodynamic effects of NTI concluded that the result of the hemodynamic response of videolaryngoscopy to intubation was similar to that noted for direct laryngoscopy (10,11).

In contrast to other studies, in our study, a reduced hemodynamic response was observed in SAP values after intubation. This result may be related to the experience of practitioners and intubation success rates. Because we know that hemodynamic fluctuations are higher in intubation performed by inexperienced practitioners. Intubations were performed by the same experienced anesthesiologist who had at least 50 successful interventions with the use of McGrath MAC VL and NTI and a success rate greater than 90% for the first attempt in our study. In addition, no differences in MAP and HR values between the two groups is consistent with other studies (10,11).

Some studies have reported that the use of videolaryngoscopy in orotracheal intubation significantly prolonged the time to intubation compared with direct laryngoscopy (12-15). In contrast, numerous studies have reported that the use of videolaryngoscope for NTI reduced the time to intubation compared with direct laryngoscopy (16-18).

Studies comparing direct laryngoscopy with a Glidescope videolaryngoscope for NTI demonstrated that videolaryngoscopy reduces the time to intubation compared with direct laryngoscopy (10,16). Gómez-Ríos et al. (18) reported that the time to intubation was reduced with the McGrath MAC VL compared with the DL in their study of nasal intubation that simulated difficult and easy airways in manikin. Similarly, Kwak et al. (11) found that the time to NTI using McGrath MAC videolaryngoscopy and direct laryngoscopy was 34.4 sec and 44.9 sec, respectively. In addition, videolaryngoscopy was 10.5 seconds shorter than direct laryngoscopy, and the difference was significant. In our study, the time NTI with videolaryngoscopy and direct laryngoscopy was 25.9 sec and 35.7 sec, respectively. Videolaryngoscopy was 9.8 sec. reduced compared with direct laryngoscopy. Similar to other studies for NTI, we found that the time to videolaryngoscopy was significantly reduced compared with that for direct laryngoscopy.

The use of McGrath MAC VL for NTI has several advantages that can explain the faster time to intubation. Videolaryngoscopy reveals the target for faster guiding by the nasotracheal tube during anesthesia. During NTI with McGrath MAC VL, Magill forceps may not be necessary to direct the tube and its not being used may prevent the loss of time removing the Magill forceps. We do not have to hang the laryngoscope to align the laryngeal, pharyngeal, and oral axes during McGrath videolaryngoscopy. This condition disturbs the airway anatomy less than direct laryngoscopy, allows the tube to be more easily directed into the nasopharyngeal trachea and reduces the time to intubation.

In a study comparing Glidescope videolaryngoscopy and direct laryngoscopy for nasal intubation, Jones et al. (16) reported that videolaryngoscopy provided a better glottic view and easier intubation compared with Glidescope videolaryngoscope. In the same study, they also stated that the use of Magill forceps was not required for nasal intubations performed using the Glidescope. In a study comparing Glidescope videolaryngoscope, Pentax VL and DL for NTI, Tseng et al. (11) reported that intubation with both videolaryngoscopy was easier than direct laryngoscopy and that the change required in the position of head and laryngeal compression during intubation was increased in the direct laryngoscopy group. Gómez-Ríos et al. (18) reported that McGrath MAC VL provided increased glottic visualization. Kwak et al. (11) found that the use of Magill forceps was significantly reduced for McGrath videolaryngoscopy, and no significant difference in the ease of intubation was noted for direct laryngoscopy and videolaryngoscopy.

In this study, no significant differences were noted between direct laryngoscopy and videolaryngoscopy in terms of glottic image, laryngeal compression and change in head position. The use of Magill forceps was required in 10 patients in the direct laryngoscopy group and 2 patients in the videolaryngoscopy group. This difference was not statistically significant, although Magill forceps were used in fewer patients in the videolaryngoscopy group. However, our study found that videolaryngoscopy was easier than direct laryngoscopy in terms of ease of intubation, and this finding was similar to other studies.

Although Magill forceps are used less often in the McGrath MAC VL group, the anesthesiologist may attempt to direct the nasotracheal tube towards the vocal cords by rotation between the fingertips during both direct and videolaryngoscopy. When the tip of the nasotracheal tube reaches the vocal cords, hanging the laryngoscope again by lowering the laryngoscope slightly and directing the tube toward the trachea allows for completion of the intubation without the use of Magill forceps. This maneuver provides more convenience to the anesthesiologist in terms of no vision loss during videolaryngoscopy.

Consequently, MAP, and HR did not differ significantly in NTI when compared McGrath MAC VL and Macintosh

DL. The time to intubation was reduced with McGrath MAC VL. The McGrath MAC VL increased the ease of intubation. No differences in complications related to intubation were noted. We suggest that McGrath MAC VL can be used safely for NTI.

LIMITATIONS

There are few limitations to this study. Firstly, this study was designed as a single blind study. Researchers who applied intubation could not be blinded. Only the observer who recorded the measurements was blinded. Secondly, it does not provide predictions about the results that may occur in patients with comorbidity and expected difficult intubation.

CONCLUSION

We compared the McGrath MAC VL with the Macintosh DL for NTI and found that intubation was applied in less time using McGrath MAC VL than Macintosh DL. Intubation was more easy with McGrath MAC VL than Macintosh DL. We believe that McGrath MAC VL can be preferred to DL for NTI.

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Competing Interests: The authors declare that they have no competing interest.

Financial Disclosure: There are no financial supports.

Ethical Approval: This study was performed at our university hospital with the approval of Local Clinical Research Ethics Committee (No: 2015/207).

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