Original Article

Effectiveness of Mouth Guard with Video Laryngoscope to Prevent Dental Injury during Anesthesia at Pathumthani Hospital

Kantanabat C, MD[1]

[1] Division of Anesthesiology, Pathumthani Hospital, Pathum Thani, Thailand

Objective: To evaluate the effectiveness of mouth guard with video laryngoscope to prevent dental and lip injuries during general anesthesia.

Materials and Methods: A prospective randomized double-blind study involving 200 patients with pre-existing dental problem at anterior of mouth undergoing surgery during general anesthesia was conducted. Patients were divided into two groups, according to randomly allocated by block of 4 to use Macintosh laryngoscope (group C, n=100), or use mouth guard with video laryngoscope (group I, n=100) for intubation. Vital signs, $ETCO_2$ were record every five minutes during surgery until the end of operation. Side effect such as dental injuries and lip injuries were also recorded. Data were analyze using t-test, and a p-value lower than 0.05 was taken as significant.

Results: There was no incidence of post-operative dental injuries and intubation that required two or more attempt in group I (p=0.01 and 0.02) compared with group C. There was no incidence of lip and tongue injuries in either groups. Every periodontal damage patient was emergency case and only one tooth was affected. The left upper central incisor teeth were the most common sites for injury.

Conclusion: Mouth guard with video laryngoscope can prevent dental injury from intubation without any complication in patients with pre-existing dental problem at the anterior of the mouth who are undergoing surgery at Pathumthani Hospital. No incidence of lip and tongue injuries were found.

Keywords: Dental injury, Mouth guard, Video laryngoscope

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General anesthesia is a common choice of anesthesia for surgery. Dental injury has been associated with general anesthesia, especially for endotracheal intubation using classic laryngoscopy[1-16]. This is the most common complication. The overall incidence of dental injury is estimated to be between 0.06% and 12%[1-10,15]. This has an aesthetic and functional consequence. The social impact is an important factor. Dental injuries occur mainly during laryngoscopy[1]. Risk factors making teeth more vulnerable to injury are divided between patients' factors and iatrogenic factors[1,2,9-11]. The patient's factors include limited mouth opening, limited mandibular mobility, poor visibility in the hypopharynx, narrow thyromental distance, and low mobility of the neck. In addition, oral and dental health related risk factors are prominent such as large sized teeth, anterior crowding, isolated teeth, difficult mask ventilation, periodontal diseases, presence of prostheses, previous history of difficult intubation, previous neck surgery, prior radiotherapy to the oral cavity, tongue neoplasm, and oral trauma. The iatrogenic factors include several anesthetic equipment, particularly rigid equipment if used inappropriately. The lack of experience anesthesiologist is an important causative factor. Many strategies are used to minimize the incidence of dental injuries such as pre-anesthetic dentist consultation[2], positioning of head and neck[2], intraoperative equipment such as mouth guard[2,7,9,15],

Correspondence to:

Kantanabat C.

Division of Anesthesiology, Pathumthani Hospital, Pathum Thani 12000, Thailand.

Phone: +66-2-5988997

Email: kwang_krab@hotmail.com

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video laryngoscope[1,2,5,6,12-14], soft roll gauze[1], and adhesive surgical tape[1]. However, there is no strategies to make zero incidence. The use of isolated mouth guard can prevent dental injury but because of the poor laryngeal view on the conventional laryngoscopy, the mouth guard covers up the view of the vocal cord. Only video laryngoscope can improve laryngeal view in difficult airway but direct force on tooth increase the risk of dental injury. Therefore, a combination of mouth guard and video laryngoscope might improve laryngeal view and decrease dental injury. The present study aimed to evaluate the effectiveness of mouth guard with video laryngoscope to prevent dental and lip injuries during general anesthesia.

Materials and Methods

After obtaining approval from the Hospital Ethics Committee, a prospective randomized double-blind study involving 200 patients undergoing surgery during general anesthesia at Pathumthani Hospital between November 2018 and April 2019 was conducted. The patients who refused to enroll were excluded. After informed written consent was done, the patients with pre-existing dental problem at anterior of the mouth undergoing surgery requiring tracheal intubation were included in the study. All study patients underwent detailed oral examination performed by an anesthetist. Before anesthesia, the author recorded each patient's sex, age, height, weight, body mass index (BMI), dental condition, mallampati class, thyromental distance, and mouth opening. Degree of tooth mobility was defined as 1=tooth mobility of 1 millimeter or less in bucco-lingual alignment, 2=tooth mobility of more than 1 millimeter in bucco-lingual alignment, 3=tooth mobility in bucco-lingual alignment and occluso-gingival alignment. Mallampati class and mouth opening measured with the mouth fully open. The thyromental distance was measured with the patient in the sitting position. Patients were divided into two groups, according to randomly allocated by block of 4 to use Macintosh laryngoscope or to use mouth guard with video laryngoscope for intubation. Baseline blood pressure, heart rate, and oxygen saturation were obtained using standard monitors. All patients were induced with propofol 1 to 2 mg per kg intravenous, then intubation with succinylcholine 1 to 2 mg per kg intravenous. Intubation with cuffed endotracheal tube was done with appropriate size for each patient. Group C were intubated by Macintosh laryngoscope, and group I were intubated by mouth guard (Figure 1A) with C-MAC video laryngoscope

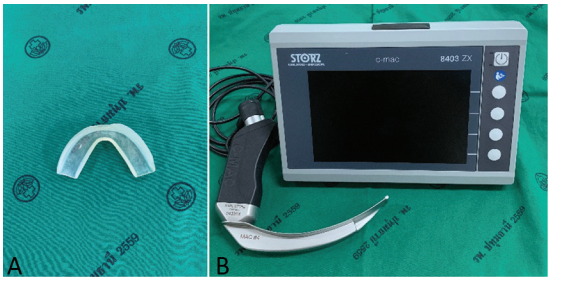

Figure 1. (A) Mouth guard and (B) video laryngoscope.

8403ZX series (Figure 1B). Intubation attempts and laryngeal view were also recorded. Experience of all anesthetists who intubated were more than five years.

After intubation, anesthesia was maintained with 50% to 60% N_2O/O_2 combination with sevoflurane 1% to 3% adjusted to ensure proper anesthetic level and using standard monitoring. Vital signs, $ETCO_2$ were recorded every five minutes during surgery until the end of the operation. Fentanyl 1 to 2 mcg per kg and cisatracurium were adjusted to proper anesthetic level and vital signs. After extubation, all patients were observed in the post-anesthesia care unit (PACU) until good recovery from anesthesia was established and returned to the ward. In the PACU, a second oral examination was performed by the same anesthetist who were blinded to airway management. Any tooth injuries were recorded, as was degree of tooth mobility, in a similar way as in the pre-operative period. Sites of tooth injuries, numbers of tooth injuries, lip injuries, tongue injuries were also recorded. Sample size was determined by power analysis (desired power 0.8, alpha 0.05). Primary outcome was the incidence of dental injury. Secondary outcomes were lip and tongue injuries. All data were entered into a database using Microsoft Excel with statistical analysis performed with the SPSS 14.0 statistical software package (SPSS Inc., Chicago, IL, USA). Data were analyze using t-test. All p-value less than 0.05 were considered statistically significant. Categorical data were presented as number and percentage, and continuous data were presented as mean ± standard deviation.

Results

Two hundred patients who fulfilled the entry criteria were enrolled in the present study. All patients were able to complete the entire study and their data were included in the final analysis. The two groups (C and I) were comparable with respect to age, sex, body weight, height, BMI, ASA physical status, and

Table 1. Demographic and clinical feature of the patients

Variables	Group C (n=100)	Group I (n=100)	p-value
Age (years), Mean±SD	68±5.4	68.5±5.2	0.717
Sex: male (%)	40	45	0.531
Weight (kg), Mean±SD	69.9±2.1	70.2±2.2	0.826
Height (cm), Mean±SD	158.8±5.2	156.7±5.1	0.761
BMI ($kg.m^{-2}$), Mean±SD	25±2.1	25.9±2.3	0.275
ASA I/II/III	40/45/15	38/47/15	
Emergency case	32	33	0.625

SD=standard deviation; BMI=body mass index; ASA=American Society of Anesthesiologists

Table 2. Preanesthetic dental condition

Variables	Group C (n=100)	Group I (n=100)	p-value
Site of tooth mobility			
Left upper central incisor	39	36	0.653
Right upper central incisor	22	24	0.784
Left lower central incisor	10	13	0.746
Right lower central incisor	8	10	0.356
Left upper lateral central incisor	15	13	0.239
Right upper lateral central incisor	17	15	0.454
Site of missing tooth			
Left upper central incisor	29	30	0.364
Right upper central incisor	34	35	0.712
Left lower central incisor	7	10	0.314
Right lower central incisor	8	6	0.462
Left upper lateral central incisor	16	13	0.698
Right upper lateral central incisor	18	14	0.414

Table 3. Preanesthetic airway evaluation

Variables	Group C (n=100)	Group I (n=100)	p-value
Mallampati			
Class 1	18	19	0.523
Class 2	79	78	0.726
Class 3	2	1	0.212
Class 4	1	2	0.245
Thyromental distance (cm), Mean±SD	7.5±0.5	6±0.5	0.484
Mouth opening (cm), Mean±SD	4±0.4	4.5±0.4	0.584

SD=standard deviation

Table 4. Postanesthetic dental injuries and complication

Variables	Group C (n=100)	Group I (n=100)	p-value
Dental avulsion	5	0	0.01*
Increase dental dislocation	10	0	0.01*
Crown fracture	0	0	
Lip and tongue injuries	0	0	
Intubation attempt >1 time	7	0	0.02*

* Significant ($p<0.05$)

Table 5. Patients with dental injuries by tooth

Tooth	Injuries n (%)
Left upper central incisor	7 (46.7)
Right upper central incisor	6 (40.0)
Left lower central incisor	0 (0.0)
Right lower central incisor	0 (0.0)
Left upper lateral central incisor	2 (13.3)
Right upper lateral central incisor	0 (0.0)

emergency case (Table 1).

The pre-anesthetic dental condition and airway evaluation are described in Table 2 and 3. There was no differences between both groups in site of tooth mobility and site of missing tooth before surgery. Left upper central incisor was the most common site of tooth mobility in both groups and right upper central incisor was the most common site of missing tooth in both groups. Pre-anesthetic airway evaluation was not significant different between both groups in mallampati class, thyromental distance, and mouth opening.

Periodontal damage (avulsion and dislocation) and intubation requiring two or more attempt were significantly lower in group I compared with group C, ($p<0.05$). There was no incidence of crown fracture or lip and tongue injury in either groups as shown in Table 4. In all periodontal damage patients, only one tooth was affected. The distribution of the incidence of dental damage by teeth is shown in Table 5.

The left upper central incisor teeth were the most common site for injury. There were no lesions in the left lower central incisor teeth, right lower central incisor teeth, and right upper lateral central incisor teeth. All periodontal damage patients were emergency case.

Discussion

The present study was a prospective randomized double-blind study. It showed no incidence of periodontal damage (avulsion and dislocation) when using mouth guard with video laryngoscope for intubation. In addition, the mouth guard with video laryngoscope does assist the intubation as they were successful within one attempt. This can be explained as mouth guard can fix and protect the mouth from the great force that laryngoscopy can apply on tooth. Additionally, the video laryngoscope makes it easier to see the vocal cord that could be obscured by the mouth guard. In the periodontal damage patients who were intubated by the Macintosh laryngoscope, only one tooth was affected. There was no incidence of crown fracture or lip and tongue injury. This may be due to known pre-existing dental problem of the patients and careful airway manipulation. All the periodontal damage patients were emergency cases. This is because the elective case almost always had enough time for good airway preparation, including airway evaluation, patient positioning, and drugs and equipment preparation. Vogel et al found that emergency intubation was not a risk factor for tooth injury[4]. In the present study, the left upper central incisor teeth were the most common sites for injury, similar to the studies of Bucx et al[11], Lee et al[14], and Vogel et al[4]. The reason that maxillary incisors were the most affected is well explained by Bucx et al. It is because routine laryngoscopy exerts great forces on the maxillary teeth from the prominent flange of the Macintosh blade[11]. However, Nivatpumin et al[9] found that the right upper central incisor had more incidence than the left upper central incisor.

Dental injury after anesthesia has an aesthetic and functional effect and the social impact can lead to unsatisfied patients and medical prosecution. Therefore, evaluation of dental status prior to intubation, dentist consultation, discussion about the risk and complication with the patient, and good airway preparation could contribute to risk minimization. Because of the high rate of reported injury with conventional laryngoscopy, it would be important to evaluate the present study methodology by using other intubation devices such as video laryngoscope and assess if the rate of injury is different.

Conclusion

Mouth guard with video laryngoscope can prevent dental injuries from intubation without any complication in patients with pre-existing dental problem who undergo surgery at Pathumthani Hospital. No incidence of lip and tongue injuries were found.

What is already known on this topic?

Use of mouth guard could decrease incidence of dental injury, but when it is used with a conventional laryngoscope, it may cause difficulty to see vocal cord during intubation. Video laryngoscope make it easier to see the vocal cord in difficult airway patients, but dental injury may happen.

What this study adds?

Using a mouth guard with a video laryngoscope to decrease limitation of each equipment resulted in reducing the incidence of dental injury in general anesthesia.

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Conflicts of interest

The author declares no conflict of interest.

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