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Research Paper: The Prevalence of intubation induced dental complications among hospitalized patients

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ABSTRACT

Introduction: Intraoral manipulation is performed during endotracheal intubation for general anesthesia, which can traumatize the soft and hard tissue in the oral cavity and cause postoperative pain and discomfort. Dental trauma is the most common complication of intubation. This study aimed to assess the prevalence of dental complications due to intubation in patients hospitalized in Imam Khomeini Hospital during 2018-2019.

Materials and Methods: A total of 805 patients presenting to the Cancer Institute of Imam Khomeini Hospital for preoperative anesthesia consultation were randomly enrolled. A dentist interviewed the patients and performed a comprehensive clinical oral examination, preoperatively. The patients underwent clinical oral examination by another dentist, postoperatively.

Results: No significant correlation was found between dental trauma (tooth fracture, tooth mobility or soft tissue injury) after intubation with age or gender of patients. According to the Wilcoxon test and McNemar-Bowker Test, the rate of mobility before the intubation was significantly different from that after the intubation (P=0.000). Maxillary central incisors, maxillary left canine and mandibular right and left central incisors had the highest rate of fracture.

Conclusion: Mobile teeth before the intubation are at higher risk of avulsion and aspiration during the procedure. Patients with primary temporomandibular joint disorders are more susceptible to post-intubation trismus.

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Introduction

Intraoral manipulation is performed during endotracheal intubation for general anesthesia. Although laryngoscopy is a safe procedure and complications rarely occur, it can traumatize the soft and hard tissue and cause postoperative pain and discomfort (1). Airway injury is also common in both laryngoscopy and intubation. The most common airway injuries involve the larynx (33%), pharynx (19%), esophagus (18%) and temporomandibular joints (TMJs) (10%) based on the reported patient complaints (2). Gaudio et al. reported the prevalence of dental trauma during intubation to be 1 per 1000 population (3).

The prevalence of difficult intubation ranges from 1.5% to 13% (4,5). Also, failure in intubation has been reported in 0.05% to 0.35% (6,7). In order to prevent difficult endotracheal intubation, airways should be precisely inspected prior to anesthesia induction. Several studies attempted to predict difficult laryngoscopy and intubation, which led to introduction of new techniques for detection of complicated cases. The Mallampati test (8,9), palm print test, Cormack-Lehane classification system (10), upper lip bite test (4), measurement of sternomental distance (4), measurement of thyromental distance (8,11), the distance of upper teeth (4) and some other parameters related to the head and neck anatomy are used for this purpose in the clinical setting. However, there is no consensus on a preferred method for use prior to anesthesia induction (12).

Dental trauma refers to dental complications that occur within 7 days following general anesthesia, which require interventions such as restoration, splinting, or extraction of teeth and/or management of the supporting structures (13). It is the most prevalent complication during intubation with a prevalence rate of 0.06% to 12% (1, 14,15). Dental trauma is a common cause of complaints against anesthesiologists (10). As secondary indirect complications, there are reports regarding tooth avulsion or fracture of parts of the tooth structure and their aspiration into the airways or ear, nose and throat lumens, which are extracted after obtaining a radiograph, or are radiographically followed for months or years (16,17).

Dentition has a prominent role in facial esthetics and psychosocial well-being. The high cost of dental treatments and replacement of the lost teeth, high prevalence of dental trauma following intubation, the need for emergency treatment of traumatized teeth, secondary complications of dental trauma during and after intubation and the legal complaints filed against anesthesiologists in this regard highlight the need for prevention of dental trauma during intubation, and early detection of injury by physicians and patients. Use of intraoral protectors, clinical and periodontal examination, assessment of patient history with regard to periodontal disease, and adequate knowledge and expertise of the anesthesiologists are all important to prevent such injuries (17).

This study aimed to assess the prevalence of dental complications due to intubation in patients hospitalized in Imam Khomeini Hospital during 2018-2019.

Materials and Methods

Study design and participants: This descriptive, analytical, prospective study evaluated patients presenting to the Cancer Institute of Imam Khomeini Hospital for preoperative anesthesia consultation for surgical procedures requiring endotracheal intubation.

The inclusion criteria were patients' willingness for participation in the study, requiring a surgical procedure under general anesthesia, and age over 16 years. The exclusion criteria were edentulism and presence of oral pathologies.

Ethical approvals, registrations and patient consents: The study was approved by the ethics committee (IR.TUMS.DENTISTRY.REC.1397.051). Prior to the study onset, the study objectives were thoroughly explained

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to patients, and written informed consent was obtained from them. They were also informed about the need for any dental treatments in case of preoperative oral examinations.

Assessment: A dentist interviewed the patients and performed a canine-canine clinical oral examination. Each patient was examined using a sterile disposable examination set and an explorer under a spotlight. Carious lesions and restorations were identified using a dental explorer. A periodontal probe was used to measure the pocket depth at the mesiobuccal , midbuccal, distobuccal, and palatal surfaces of the teeth. The mobility of the teeth at the respective site was evaluated using a dental mirror and forceps. The age, gender, marital status, smoking status, blood group, number of present teeth, number of carious lesions, number of restorations, number of mobile teeth, presence/absence of periodontal disease, class of occlusion (according to the Angle's classification) and the status of the TMJ (normal, clicking and deviation, trismus) of patients were all recorded prior to surgery. Another dentist performed a clinical examination after intubation to ensure blind assessment. Tooth mobility, soft tissue injury (laceration, erosion, perforation, inflammation and wound), tooth fracture, TMJ status, and number of present teeth were all evaluated after the intubation. The changes were recorded.

Statistical analysis: Data were collected and analyzed using SPSS version 16 via descriptive statistics. The Wilcoxon Signed Ranks Test and McNemar-Bowker Test were used to assess the relationship between mobility and TMJ status before and after the procedure. Level of significance was set at $P<0.05$.

Results

Of 805 patients, 355 (44.9%) were males and 436 (55.1%) were females. Also, 181 (22.9%) were single and 610 (77.1%) were married. Of all, 599 (75.7%) were non-smokers and 192 (24.3%) were smokers.

In terms of blood group, 155 (20.2%) were A+, 103 (13.4%) were A-, 101 (13.2%) were B+, 67 (8.7%) were B-, 62 (8.1%) were AB+, 61 (7.9%) were AB-, 144 (18.8%) were O+ and 75 were O-.

In terms of occlusion, 338 (42.7%) were class I, 202 (25.5%) were class II, 65 (8.2%) were class III, 171 (21.6%) had off occlusion, 3 (0.4%) had distal step, 10 (1.3%) had flash terminal, and 2 (0.3%) had mesial step.

Pre-intubation examinations showed that 428 (53.2%) patients did not have any restoration while 377 (46.8%) had filled teeth before intubation. Carious teeth were not present in 373 (46.3%) while 432 (53.7%) had carious teeth before the intubation. Tooth mobility was absent in 695 (86.4%) and present in 109 (13.6%) before the intubation. 104 (12.9%) patients suffered from periodontal diseases. The TMJ status was normal in 664 (83.9%). The TMJ showed clicking and deviation in 123 (15.6%) and trismus in 4 (0.5%).

Post-intubation examinations showed that tooth fracture was absent in 748 (92.92%) and present in 57 (7.08%). Avulsion was observed in 36 (4.01%) after the intubation. Dental trauma was absent in 712 (88.91%) and present in 93 (11.09%) after the intubation. Soft tissue injury was absent in 694 (86.2%) and present in 111 (13.8%). Tooth mobility was absent in 733 (91.1%) and present in 72 (8.9%) after the intubation. the TMJ status was normal in 649 (82.0%). It had clicking and deviation in 3 (0.4%) and trismus in 139 (17.6%). Table 1 shows dental status of patients before and after the intubation.

According to the Wilcoxon test, the rate of mobility before the intubation was significantly different from that after the intubation ($P<0.001$).

The results of the present study showed that there was no significant relationship between dental injury (fracture, mobility, avulsion, soft tissue injury) after the intubation with age, gender, blood type, dental occlusion, marital status or smoking.

According to the McNemar Test, the primary mobility (before the intubation) was significantly different from the secondary mobility (after the intubation) in teeth # 31, 41, 42 and 43.

Table 1. Dental status of patients the intubation

		n (%)
Filled teeth intubation	Absent	428 (53.2)
	Present	377 (46.8)
	Mean ± SD	2.45 ± 3.60
Carious teeth intubation	Absent	373 (46.3)
	Present	432 (53.7)
	Mean ± SD	2.07 ± 2.69
Periodontal disease intubation	Absent	700 (87.1)
	Present	104 (12.9)
	Mean ± SD	0.92 ± 2.93
Fracture intubation	Absent	748 (92.92)
	Present	57 (7.08)
Avulsion intubation	Absent	769 (95.99)
	Present	36 (4.01)
Dental trauma intubation	Absent	712 (88.91)
	Present	93 (11.09)
Soft tissue injury intubation	Absent	694 (86.2)
	Present	111 (13.8)

Table 2. Mobility status of patients before and after the intubation

	Count	time		P (value[a])
		Before n (%)	After n (%)	
Mobility	0	696 (86.5)	733 (91.1)	
	1	50 (6.2)	60 (7.5)	
	2	35 (4.3)	10 (1.2)	
	3	15 (1.9)	2 (0.2)	
	4	8 (1)	0 (0)	
	6	1 (0.1)	0 (0)	
Mean ± SD		0.25 ± 0.74	0.11 ± 0.37	<0.001 (4.82)

a. Wilcoxon Signed Ranks Test

Table 3. TMJ status of patients before and after the intubation

		TMJ status after intubation			P (value[a])
		Normal n (%)	click ing & deviation n (%)	Trismus n (%)	
TMJ status before intubation	Normal	594 (91.5)	0 (0)	70 (50.4)	<0.001 (190)
	clicking & deviation	55 (8.5)	3 (100)	65 (46.8)	
	Trismus	0 (0)	0 (0)	4 (2.9)	

a.McNemar-Bowker Test

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Discussion

This study evaluated 805 patients and showed dental trauma in 11.09% of them, including avulsion in 4.01% and tooth fracture in 7.08%. This finding was similar to that of Chen et al, (1991) who assessed the prevalence of dental trauma before and after endotracheal intubation. They reported the prevalence of dental trauma to be 1.12%(19). Fung et al. (2001) reported that the prevalence of dental trauma following endotracheal intubation was 6.9%(20). Higher prevalence of dental trauma in our study may be due to higher DMFT in the Iranian population (21). It may also be due to racial differences (22).

Maxillary central incisors, maxillary left canine and mandibular right and left central incisors had the highest prevalence of tooth fracture in our study, which was similar to the findings of Chen et al, (1991) who reported that maxillary incisors, especially in the left side, had the highest rate of trauma (19). Warner et al. (1999) reported that the injured teeth were mainly maxillary incisors (13).

Givol et al, (2014) in their retrospective study reported that 86% of the injured teeth were maxillary incisors (23). Newland et al. (2017) reported that maxillary incisors were the most commonly injured teeth (24). Vogel et al, (2009) in a retrospective study showed that maxillary incisors, especially maxillary central incisors were traumatized in over three-fourths of the cases (25). Mourao et al. (2011) demonstrated that enamel fracture in maxillary incisors was the most commonly reported type of injury (26). Yaghmaie et al. (2013) reported that maxillary central incisors had the highest frequency of initiation of new cracks (27). Darawade et al. (2015) reported that maxillary left incisors had the highest rate of injury (28).

Manka-Malara et al. (2015) indicated that tooth loss was the most common type of dental trauma with a prevalence rate of 51%. The prevalence of soft tissue injury was 13.8% in our study which included injury to the palate, buccal mucosa, tongue, floor of the mouth and vestibules. Of these patients, 12.9% had dental conditions or periodontal disease before intubation (29). Mourao et al. (2015) evaluated the prevalence of oral soft tissue trauma during direct laryngoscopy for endotracheal intubation and the related risk factors. Soft tissue trauma was noted in 278 patients (1.52%). Soft tissue trauma occurred once in 214 (38.2%), twice in 64 (38.2%), and three times in 11 (1.9%) patients. The most common type of soft tissue trauma was trauma to the tongue (36.3%), lower lip (3.22%), upper lip (7.1%) and oral mucosa (2.1%) (2). Vogel et al, (2009) in their retrospective study evaluated dental trauma due to intubation and reported periodontal injury and lateral dislocation in the elderly (25).

In our study, the frequency of tooth mobility was 13.6% before and 8.9% after the intubation. Considering the number of avulsed teeth and the significant correlation between the primary and secondary tooth mobility, it was found that mobile teeth prior to intubation have a higher risk of avulsion and aspiration during intubation. Such a comparison showed the significance of full mouth examination, preoperatively.

Assessment of the TMJ before the intubation revealed that 15.6% of patients had clicking, deviation and deflection while 0.5% had trismus. After the intubation, 0.4% had clicking, deviation and deflection and 17.6% had trismus. These values indicated that patients with primary TMJ problems are more susceptible to trismus after the intubation. It indicates that these unknown cases may suffer more preventable problems.

In general, the current results showed no significant correlation between dental trauma (fracture, mobility, trauma, soft tissue injury) after the intubation with gender and class of occlusion of patients, which was in agreement with the findings of Yaghmaie et al, (2012), who assessed dental trauma following endotracheal and nasal intubation and the related risk factors. They found no significant correlation between gender, ASA, BMI, class of occlusion, and experience of the operator with increased number of cracks in the two groups (27). Also, no significant relationship was found between the marital

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status, blood type, drug use and age of patients, which have not been evaluated in similar studies.

The obvious difference between this study and other studies in this field is that patients were examined twice before and after intubation, and thus each patient was compared with him/herself. Our study had some limitations; the questionnaires were based on self-reports of patients without any validity checking. Second, despite the fact that some patients did not have good vital conditions, they could not remain in the study.

Conclusion

Considering the current results and findings of previous studies, preoperative clinical examination of the oropharynx by the anesthesiologists for patients suspected for difficult intubation can prevent trauma to the oral cavity and increase the accuracy of intubation. Knowledge about the available tests and indexes for this purpose and their application can greatly help in prevention of dental trauma.

The role of dentists in assessment of patients undergoing endotracheal intubation cannot be denied. Thus, a protocol should be designed for patients undergoing general anesthesia to undergo comprehensive oral and dental examination by dentists to prevent postoperative oral and dental complications.

Conflict of interest:

The authors declare no conflict of interests.

Ethics:

The study protocol was reviewed and approved by the Ethics Committee of Tehran University of Medical Sciences (ID IR.TUMS.DENTISTRY.REC.1397.051) and written informed consent was obtained from patients after briefing them about the study.

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