

Traumatic Dental Injuries During Emergency Endotracheal Intubation

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Abstract

Objectives. The objectives of the study were to find out the reasons why dental injuries occur during endotracheal intubation as well as to clarify what tooth trauma occurs most often.

Result. The most dental injuries occurred in the middle-aged or older patients. The front teeth, especially maxillary incisors have the greatest risk of injury. The main cause of dental injury during endotracheal intubation is 'difficult airway'.

Conclusion. Pre-operative dental examination may help to assess the situation or prevent dental trauma through the evaluation of endotracheal intubation, possibly requiring dental protective devices. The use of excessive force in intubation and front teeth as a support for the instruments leads to an inevitable maxillary incisors injury. The most common injuries are tooth fractures, avulsion, exfoliation. damage to crowns and bridgeworks

Keywords: dental trauma, endotracheal intubation, tooth avulsion, tooth fracture.

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INTRODUCTION

Emergency airway management is one of the crucial aspects in critically ill patients. Endotracheal intubation is a medical procedure in which a tube is placed into the windpipe through the mouth or nose - in most emergency situations it is placed through the mouth. In emergency medicine, the most common indications for the need of tracheal intubation are acute respiratory failure, inadequate oxygenation or ventilation, and airway protection in a patient with depressed mental status. In the perioperative setting, endotracheal tubes may be placed in many clinical circumstances, including patients receiving general anaesthesia, surgery involving or adjacent to the airway, unconscious patients requiring airway protection, or surgery involving unusual positioning^[1]. However, not always endotracheal intubation is successful. If the intubation is performed in operating room by experienced anaesthesiologist, the rate of complications is relatively low.^[2-4] Yet if the emergency endotracheal intubation is performed outside the operating room, it is more likely that certain complications will occur, such as hypoxemia, soft tissue damage to the oesophagus and pharynx and dental damage. One of the most commonly reported complication associated to anaesthesia is dental injury. Lockhart et al^[5] have found that approximately one dental trauma occurs in every 1,000 endotracheal intubations. Of course, relative risk factors must be taken into account. Patients who are at risk of dental trauma are with pre-existing poor dentition and increased difficulty of intubation due to a difficult airway.^[6]

Dental injuries are often associated with tracheal intubation. According to a review of anaesthesia-related claims in England, the USA, and South Australia, dental injuries were the most common incidents reported, which accounted for up to a third of the claims^[7]. Patients with pathological changes, especially if involving pathosis of the incisors, are considered to be at the greatest risk of oral tissue trauma following laryngoscopy and endotracheal intubation^[8,9]. One of the simplest is the WHO classification, which forms the basis for several other, more detailed, classifications^[10]. The WHO classification divides dental trauma into ten categories:

1. Fracture of enamel.
2. Crown fracture without pulp involvement—the fracture involves the enamel and the dentin layer.
3. Crown fracture with pulp involvement.
4. Root fracture—the fracture can be seen only on X-ray. The treatment and prognosis depend on the fracture run and location.
5. Crown and root fracture— most such fractures need tooth extraction.
6. Fracture of tooth unspecified.
7. Luxation of tooth—increased mobility of a tooth following trauma.
8. Intrusion or extrusion of tooth—tooth presents decreased mobility and resembles ankylosis. Extruded tooth is partially displaced from the socket along the long axis. Such teeth have greatly increased mobility, and radiographs show displacement.
9. Avulsion of tooth—complete extraction of the tooth (crown and root).
10. Other injuries including laceration of oral soft tissues.

The aim of this study was to analyze the scientific literature data on the occurrence of dental injuries during emergency endotracheal intubation.

The objectives of the study were to find out the reasons why dental injuries occur during endotracheal intubation also clarify what tooth trauma occur most often.

METHODS AND MATERIALS

The review of scientific literature followed the methodological guidelines of the PRISMA Statement (The PRISMA Statement). The electronic databases search accomplished in PubMed (MEDLINE) database. Data collection protocol was prepared before two investigators started collecting the data and analyzing literature. The search for publications was based on keywords and word combinations. Keywords used and their combinations: *dental trauma, endotracheal intubation, tooth avulsion, tooth fracture*. In case of disagreement, two authors resolved it during the discussion. In the

electronic search MEDLINE (by PubMed) database 358 articles were found. Subsequently, after reading all the abstracts and discarding duplicates, 307 articles were excluded because their abstracts failed to conform to the aims of the study. Thus, 22 full-text articles were evaluated; 17 articles were excluded. Additional search was conducted using Google Scholar search engine and yielded one relevant article. Six suitable studies were included in the study (Fig.1).

The following inclusion criteria were applied: full text, articles in English, retrospective or prospective studies. Exclusion criteria: no full text, articles written in other languages than English, other purposes of the study, single case reports.

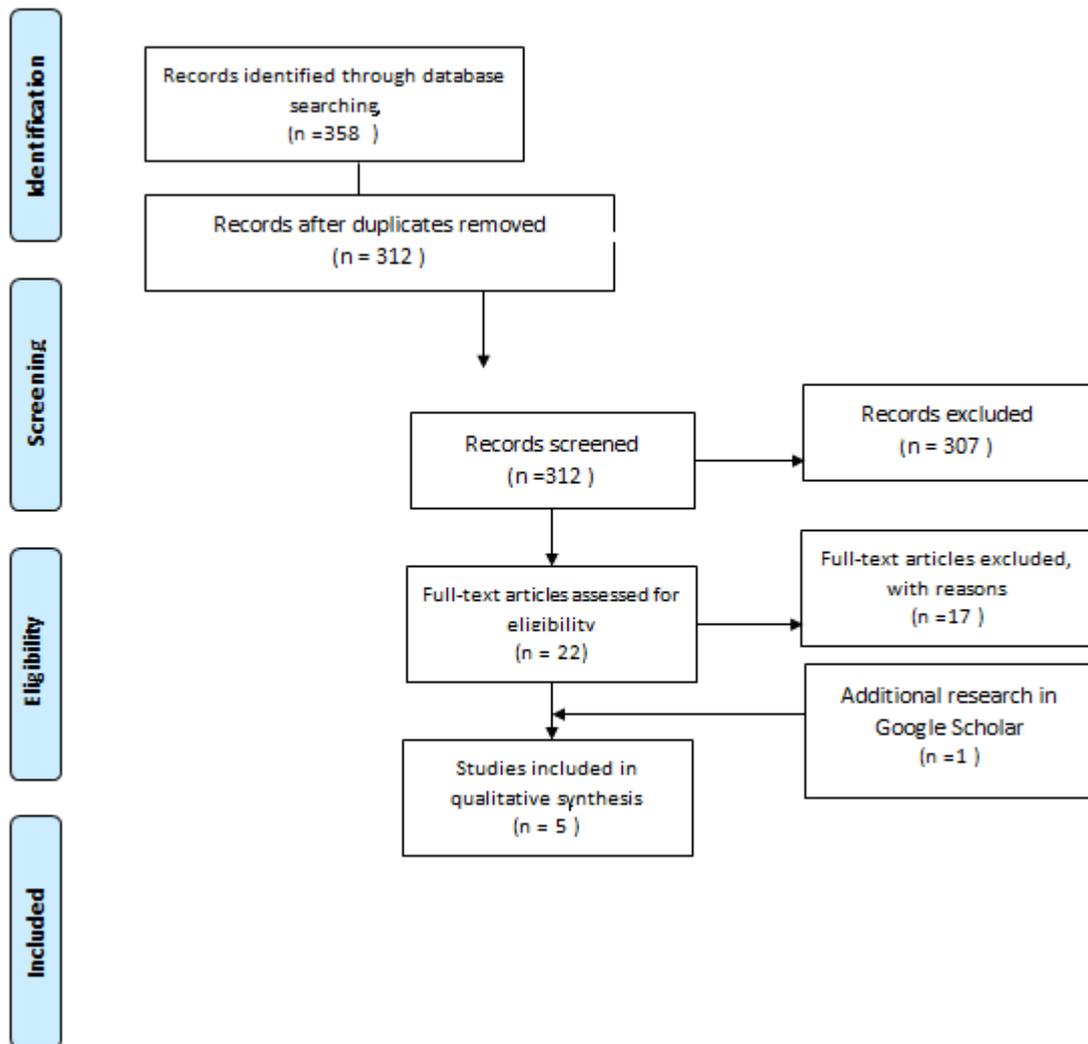


Figure 1. Prisma flow chart.

RESULTS

Out of 358 articles found on the PubMed database, only 6 articles reached our criteria [6,11-15]. Four of them were retrospective researches, one case control study and one prospective observational study.

Studies have shown [12-14] that the most dental injuries occurred in the middle-aged or older than middle-aged patients. Givol N. et al in their study have discovered that the most of the patients (72%) were in the 5th to 7th decade of life [11], Vogel J. et al agreed that more than half of the patients were between 50 and 80 years of age [12], Almost 60% of damage occurred in patients between 45 and 60 years

of age shown Rosa Maria G et al study ^[13] and Mourão J. et al ^[14] have calculated that the mean age were 58 years.

Four studies have pointed out that the main cause of dental injury during endotracheal intubation is ‘difficult airway’. All of them use the ASA Task force definition, which states that intubation is difficult due to an non-visible portion of the vocal cords or more than three attempts to intubate. ^[6,13-15] One study calculated, that patients who are moderate difficult or difficult to intubate are at a much higher risk (approximately 20.8-fold) of dental injury. Although, Jobst Vogel et al and Gaudio Rosa Maria et al have found that the type of injury depends on intubation difficulty. ^[12,13] And two of the studies noted that injuries were determined by the laryngoscope blade. ^[6,13] Gaudio Rosa Maria et al in one of their studies did not use dental protection device and in the other one discovered that it does not make any significant difference to the results - the number and rate of dental injuries stayed the same. ^[13,15] Four out of six studies have calculated, that dental injuries happen only in about 10-15% of emergency cases and does not have a huge impact to most of the cases. ^[11-13,15]

Maurao et al and Gaudio Rosa Maria et al in their studies mentioned one of the possible risk factors for difficult intubation that could lead to dental injury. They claim that neck circumference or previous neck surgeries are associated with odontological complications. ^[14,15]

The results of the most common dental injuries are shown in Table 1. Studies indicate that upper incisors are most vulnerable. ^[6,11,12,14]

Table 1. Frequency of dental injuries during endotracheal intubation

Author, year, country	Study type, period	Study population	Number of cases	Accident during emergency circumstances	Results
Gaudio MR. et al., 2011, Italy ^[15]	Retrospective study (2000-2009)	110 females and 125 males. (Age ranged between 6–88 years).	235	Emergency surgery 36 (15.3%)	Subluxation/luxation 42.1%, Tooth avulsion (0.93%) Teeth fracture (0.85%) Crown and root fracture (0.4%) Bridge dislocation(1.2%) Exfoliation of teeth (8.9%) Enamel fracture (2.1%) Oral soft tissues trauma (7.2%) Other injury (0.85%)
Navot Givol. et al. 2004, Israel ^[11]	Retrospective study (1992 - 1998)	98 females and 105 males. (Age ranged between 8 to 90 years (mean 53 years)).	203	Emergency intubations 25	Exfoliation (48%), crown fracture (22%), root fracture (19%), damage to crown, and bridgework (18%), and extensive tooth mobility (12%).

Vogel J. et al., 2009, Switzerland ^[12]	Retrospective study (1995-2005)	74 males, 56 and females. (57.6 years).	130 (170 teeth)	18 cases of 108	Crown fractures (32.5%) and dislocations (29.3%). Avulsions (17.1%)
Myrna C. Newland MD et al. 2007, USA ^[6]	Case-control study (1989-2003)	Men 29 Women 49.	78 (85 teeth) and 152 controls	Emergency surgery (9.0%)	Enamel fracture (32.1%) Loosening/subluxation (23.1%) Luxation (3.8%) Avulsion (9.0%) Crown fracture (7.7%) Crown and root fracture (1.3%) Missing tooth/teeth (10.3%) Other injury (21.8%)
Mourao J., 2013, Portugal ^[14]	Prospective observational study (2011)	345 women and 191 men. (Age between 20.0–91.0)	134 (162 teeth)		The enamel fracture occurred in tooth number 11 (13.0%), 12 (0.3%), 21 (8.8%), 22 (0.8%), 31 (0.2%) and 41 (0.9%). Avulsions occurred in tooth number 21 (0.5%), number 22 (0.3%), number 31 (0.5%), number 41 (0.2%), number 42 (0.2%), and number 43 (0.2%).
Gaudio MR. et al., 2010, Italy ^[13]	Retrospective study (2000-2008)	44 women (mean age 49.5) men 39 (mean age 47.5).	Eighty-three patients of a total of 60.000 surgical (0.13%)		Avulsion (50 %) Damage to crowns and bridgeworks (14%) Luxation (3.8%) Teeth fractures (12%)

DISCUSSION

Ritesh et al. suggest in order to reduce dental injuries during laryngoscopy^[16], patients' dental status should be examined before operations under general anesthesia¹⁷. The right choice of equipment can reduce number of casesaccidental for the accident.^[16,17] Certainly, dental status cannot be checked under emergency circumstances that is why dental complications can still occur.

Itoman et al. suggested that plastic laryngoscope blades had a lower dental fracture potential. This can help in supervision of endotracheal intubation by less experienced trainees. If the blade are used as a fulcrum to patient's teeth it would be a lower change to cause a dental trauma. This would permit the supervising physician to focus more attention on securing the airway^[18].

Fucuda et al. study researched if dental injuries during intubation would occur more frequently when performed by inexperienced beginners. The study showed that the experience levels of the laryngoscopists are not a major determinant of dental injuries in patients with healthy dentition. The maximum force applied by the inexperienced group was 40.2 N, which is substantially lower than the maximum bite force of normal incisors (150-200 N).^[19]

In Vogel et al study, we have noticed that older people may experience dental trauma more often than younger patients. This can be caused by dental and periodontal condition being better in younger patients. The affected periodontium may not be able to compensate for shear forces possibly arising during intubation. In contrast, younger patients primarily suffered from crown fractures^[11]. Givol et al. study showed that the major risk factor for dental trauma are preexisting poor dentition and the second risk factor was difficult intubation .^[11]

In other studies that we analyzed, it was pointed out that the front teeth, especially maxillary incisors have the greatest risk of injury. The reason for that is that a greater number of anaesthetists use the maxillary incisors as a fulcrum.^[14,20]

CONCLUSIONS

In conclusion, pre-operative dental examination may help to assess the situation or prevent dental trauma through the evaluation of endotracheal intubation, possibly requiring dental protective devices. The use of excessive force in intubation and front teeth as a support for the instrument, leads to an inevitable maxillary incisors injury. The most common injuries are tooth fractures, avulsions, exfoliations, damage to crowns and bridgeworks.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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