

The Incidence and Risk Factors for Dental Injury in Patients Undergoing General Anesthesia: A Case-Control Study

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Purpose: Dental injury is a known complication of endotracheal intubation during general anesthesia (GA), yet data on its incidence and associated risk factors remain limited. This study aimed to evaluate the incidence, risk factors, and outcomes of dental injury in patients undergoing GA.

Patients and Methods: This retrospective case-control study was conducted between January 2021 and June 2024. A total of 42,826 patients underwent GA during the study period; 72 cases of dental injury were identified from the departmental database. Controls were time-matched patients who underwent surgery in the same anatomical region, using a case-to-control ratio of 1:4. Univariable and multivariable logistic regression analyses were performed to identify independent risk factors for dental injury.

Results: The incidence of dental injury was 0.17%. Univariate analysis identified the following factors as associated with dental injury: age ≥ 60 years, pre-existing dental pathology, Mallampati classification ≥ 3 , anticipated difficult intubation, and difficult airway. In the multivariable logistic regression analysis, pre-existing dental pathology (adjusted OR 3.87, 95% CI: 1.92–7.81, $p < 0.001$), anticipated difficult intubation (adjusted OR 4.99, 95% CI: 1.84–13.50, $p = 0.002$), and difficult intubation (laryngoscopic view grade ≥ 3) (adjusted OR 10.56, 95% CI: 4.24–26.29, $p < 0.001$) remained significant independent predictors of dental injury during GA. The most common complication was bleeding.

Conclusion: Dental injury during GA is uncommon, with an incidence of 0.17%. Pre-existing dental pathology, anticipated difficult intubation, and poor laryngoscopic view (grade ≥ 3) were identified as independent risk factors. Awareness and thorough preoperative assessment of these factors may help reduce the risk of dental injury and related complications.

Keywords: incidence, risk factor, dental injury, dental trauma, general anesthesia, complication

Introduction

Dental injury is a recognized complication associated with general anesthesia (GA), particularly during airway management procedures such as endotracheal intubation. The incidence has been reported to range from 0.02% to 12%, depending on the patient population, type of surgery, and airway management techniques employed.^{1–3} Dental injuries associated with GA range from minor dislocation or avulsion of a tooth to more severe trauma, including fractures of the enamel, dentin, crown, or root, as well as damage to existing dental restorations such as crowns, bridges, or veneers.⁴ Although often considered minor, dental injuries can lead to significant patient dissatisfaction, increased healthcare costs, and medicolegal consequences.^{5,6} Some injuries, such as avulsions or crown-root fractures, may require complex dental treatment.^{1,7,8} Additional complications may include bleeding, aspiration of blood, or displacement of teeth into the digestive or respiratory tract.^{8,9}

Most dental injuries occur during tracheal intubation, particularly when airway visualization or manipulation is challenging. Patients with pre-existing dental vulnerabilities—such as poor dentition, periodontal disease, prosthetic devices, or loose teeth—are at increased risk.^{10–12} Additional risk factors include predictors of a difficult airway and limited operator experience.^{10–12}

Despite recommendations for routine preoperative dental assessment and documentation, such evaluations are frequently overlooked in daily practice.^{2,3,13} Moreover, in many institutions, the true incidence and contributing factors of dental injury remain underreported, often due to a lack of systematic data collection or inconsistent follow-up.²

Understanding the true incidence and associated risk factors in specific clinical settings is crucial for developing effective prevention strategies, improving patient safety, and guiding institutional policies. Reducing the incidence of dental injuries is an important goal and a key indicator of anesthesia care quality. Despite previous reviews, including a meta-analysis by Neto et al,¹⁴ significant gaps remain regarding dental injuries during GA. Data from Southeast Asia are particularly scarce, as most studies originate from Western or East Asian countries, despite potential differences in patient populations and practices. Additionally, many prior single-center studies lacked rigorous multivariable analyses to identify independent risk factors.^{10,11} Our study addresses these gaps by providing contemporary data from a major tertiary center in Thailand, using a robust case-control design and multivariable regression to provide updated evidence on incidence and predictors in this under-represented region. Therefore, this study aimed to determine the incidence of dental injury in patients undergoing GA at our institution and to identify modifiable and non-modifiable risk factors.

Materials and Methods

Design and Setting

This retrospective case-control study was conducted at Srinagarind Hospital, Khon Kaen University, a tertiary care and referral center in Northeastern Thailand. The study was approved by the Khon Kaen University Ethics Committee for Human Research (Reference No. HE671316). This study was conducted in accordance with the Declaration of Helsinki and adhered to institutional and international guidelines for retrospective observational research. This included ensuring all data were fully anonymized prior to analysis to protect patient confidentiality, waiving the requirement for informed consent as approved by the ethics committee due to the retrospective nature of the study, and maintaining strict data privacy and security throughout the research process.

Participants

This study included all patients who underwent GA between January 2021 and June 2024, with no age restrictions. During this period, a total of 42,826 patients received GA (22,630 males and 22,196 females). From this population, incident reports of dental injury were identified through the Department of Anesthesiology database. Additionally, consultations with the Department of Dentistry for post-GA dental injury repair during the study period were screened to ensure data completeness. Dental injury was defined as any change in dental status requiring dental consultation or a patient-reported complaint of dental damage within 24 hours after tracheal intubation.¹¹ To confirm that the injury was related to the anesthetic procedure, the anesthetic records of all potential cases were independently reviewed by two anesthesiologists from the departmental risk committee. A third anesthesiologist served as the final adjudicator in cases of disagreement.

At our institution, the preoperative dental assessment was conducted by the anesthesiologist during the routine pre-anesthetic evaluation and documented in a standardized preanesthetic record form. Dental injuries were typically reported either by the anesthesia care team immediately post-procedure or by the patient to nursing staff within 24 hours of surgery. Subsequently, for any suspected injury, a mandatory consultation with a dentist was initiated for evaluation, definitive diagnosis, and management with the final characterization of the injury type was based on this specialist's assessment. The dental injury identification relied on a passive surveillance system based on incident reports and dental consultations. There was no routine, active postoperative dental screening for all patients undergoing GA.

For each index case of dental injury, four control patients were randomly selected from the remaining pool of anesthetized patients without dental injury who underwent surgery in the same anatomical region and during the same

month as the respective case. This matching approach aimed to minimize confounding effects related to surgical type and anesthetist experience. The anesthetic and medical records of both cases and controls were reviewed. Cases with incomplete data were excluded from the analysis.

Data Collection

The following data were collected for each patient: demographic information, American Society of Anesthesiologists Physical Status (ASA PS) classification, presence of coexisting diseases, and anatomical area of surgery. Preoperative dental assessments included documentation of loose, missing, or carious teeth, as well as the presence of fixed dental prostheses (such as crowns or bridges). A history of difficult intubation (defined as a Cormack-Lehane laryngoscopic view $\geq$ grade 3) in previous anesthetic records was recorded. Preoperative airway evaluations included assessment of protruding teeth, receding chin, mouth opening, thyromental distance, neck extension/flexion, and Mallampati classification. Patients were considered to have predictors of difficult intubation if they exhibited any of the following: protruding teeth or receding chin, mouth opening < 3 cm, thyromental distance < 6 cm, limited neck extension/flexion, or Mallampati classification ≥ 3 .

Data related to the intubation procedure were also collected, including the type of airway device used, laryngoscopy technique, Cormack-Lehane laryngoscopic view, presence of difficult intubation, identity of the first-attempt intubator, number of intubation attempts, and intubator experience. For patients who experienced dental injury, additional data included the type of injury, the specific tooth affected, and any complications arising from the injury, such as bleeding, tooth loss, aspiration, or ingestion.

Sample Size Calculation

The sample size for this case-control study was calculated to detect an odds ratio (OR) of 3.5 with 90% power and a 5% significance level. Based on a previous study, the expected prevalence of the risk factor in the control group was 55%.¹ The minimum required sample size was 57 cases and 228 controls, maintaining a 1:4 case-to-control ratio.

Statistical Analysis

For continuous variables, results are presented as either the mean with standard deviation (SD) or the median with interquartile range (IQR), depending on data distribution. Categorical variables are reported as frequencies and percentages. Numerical variables were compared using the independent samples *t*-test or Mann–Whitney *U*-test, and categorical variables were analyzed using the chi-square test or Fisher's exact test. Logistic regression analysis was performed to identify factors associated with dental injury. Odds ratios (OR) and 95% confidence intervals (CI) were estimated. Variables with a *p*-value < 0.1 in univariate analysis were considered for inclusion in the multivariable logistic regression model. Prior to modeling, assumptions were assessed, including multicollinearity (variance inflation factor, VIF < 2) and an adequate number of events per variable (> 10). Backward stepwise selection was used to identify independent predictors. All statistical tests were two-tailed, with significance defined as $p < 0.05$. Data analysis was conducted using STATA software (Version 18.0; StataCorp LLC, College Station, TX).

Results

Between January 2021 and June 2024, 72 of 42,826 patients experienced a dental injury while undergoing GA, resulting in an incidence of 0.17%. The baseline characteristics of the dental injury group and the 288 time- and surgical site-matched control group are presented in Table 1. There were no significant differences between the groups in terms of sex, age, BMI, ASA PS classification, emergency surgery, coexisting diseases, or surgical area. The mean age of patients with dental injury was 53 years (6 to 92 years). The highest incidence was observed in patients classified as ASA PS 2 (54.2%). The most common coexisting conditions were hypertension (41.7%) and diabetes (22.2%). The most frequent surgical sites in patients with dental injury were the head and neck (31.9%) and abdomen (31.9%).

The comparison of baseline dental and airway characteristics between groups is shown in Table 2. The dental injury group had significantly more patients with pre-existing dental pathology compared to the control group (70.8% vs 35.8%, $p < 0.001$). The most common pre-existing dental conditions in the dental injury group were loosened teeth (56.9%) and

Table 1 Baseline Characteristics of Patients Who Received General Anesthesia Categorized by with and without Dental Injury

Variables	Control (n = 288)	Dental Injury (n = 72)	p-Value
Male	157 (54.5)	36 (50.0)	0.492
Age (years); mean (SD)	52.8 (19.2)	53.7 (21.5)	0.428
Weight (kg); mean (SD)	60.4 (18.1)	60.8 (24.9)	0.736
BMI (kg/m ²); mean (SD)	23.4 (5.2)	23.7 (7.9)	0.816
ASA PS classification			0.469
I	46 (16.0)	13 (18.1)	
II	180 (62.5)	39 (54.2)	
III	52 (18.1)	19 (26.4)	
IV	9 (3.1)	1 (1.4)	
Emergency surgery	35 (12.2)	9 (12.5)	0.936
Coexisting disease			
Hypertension	113 (39.2)	30 (41.7)	0.706
Diabetes	58 (20.1)	16 (22.2)	0.696
CKD	29 (10.1)	6 (8.3)	0.657
Heart disease	24 (8.3)	7 (9.7)	0.707
Liver disease	18 (6.3)	3 (4.2)	0.778
Asthma/COPD	10 (3.5)	1 (1.4)	0.701
Neurological disease	7 (2.4)	1 (1.4)	>0.999
Surgical location			>0.999
Head and neck	92 (31.9)	23 (31.9)	
Abdominal	92 (31.9)	23 (31.9)	
Extremities	64 (22.2)	16 (22.2)	
Thoracic	32 (11.1)	8 (11.1)	
Intracranial	8 (2.8)	2 (2.8)	

Notes: Data presented as number (%) unless indicated otherwise.

Abbreviations: BMI, Body Mass Index; ASA PS, American Society of Anesthesiologists physical status; CKD, chronic kidney disease; COPD, Chronic obstructive pulmonary disease.

missing teeth (29.2%). There was no significant difference between groups regarding a history of difficult intubation. In terms of baseline airway evaluation, dental injury occurred more frequently in patients with protruding teeth, receding chin, and thyromental distance less than 6 cm. Mallampati scores were similar between groups. The predicted difficult intubation rate was 30.6% in the dental injury group, significantly higher than 10.4% in the control group ($p < 0.001$).

Table 3 shows the comparison of intubation procedures between groups. Statistically significant differences were observed between groups in terms of airway device used, laryngoscopy technique, laryngoscopic view, presence of difficult intubation, first-attempt intubator, and number of intubation attempts. The dental injury group had a higher incidence of difficult airway (26.4%) compared to the control group (3.5%) ($p < 0.001$). Intubation by an anesthesiology trainee on the first attempt was more frequently associated with dental injury. In the dental injury group, 7.1% of patients

Table 2 Preoperative Dental and Airway Characteristics in Patients Who Received General Anesthesia Categorized by with and without Dental Injury

Variables	Control (n = 288)	Dental Injury (n = 72)	p-Value
Pre-Existing dental pathology	103 (35.8)	51 (70.8)	<0.001*
Loose	15 (5.2)	41 (56.9)	
Missing	78 (27.1)	21 (29.2)	
Fixed dental prostheses	13 (4.5)	3 (4.2)	
Caries	4 (1.4)	1 (1.4)	
History of difficult airway	6 (2.1)	4 (5.6)	0.118
Protruding teeth	2 (0.7)	4 (5.6)	0.016*
Receding chin	5 (1.7)	5 (7.0)	0.031*
Reduced mouth opening (< 3 cm)	5 (1.7)	2 (2.8)	0.631
Reduced thyromental distance (< 6 cm)	6 (2.1)	5 (6.9)	0.048*
Abnormal neck extension/flexion	2 (0.7)	0 (0)	>0.999
Mallampati classification			0.061
1	117 (40.6)	20 (27.8)	
2	148 (51.4)	41 (56.9)	
3	22 (7.6)	11 (15.3)	
4	1 (0.4)	0 (0)	
Expected difficult intubation	30 (10.4)	22 (30.6)	<0.001*

Notes: Data are presented as number (%) unless indicated otherwise. *p < 0.05 was considered statistically significant.

Table 3 Intubation Procedures in Patients Who Received General Anesthesia Categorized by with and without Dental Injury

Variables	Control (n = 288)	Dental Injury (n = 72)	p-Value
Airway device			0.002*
Oral endotracheal tube	285 (99.1)	67 (93.1)	
Nasal endotracheal tube	1 (0.3)	0 (0)	
Double-lumen endotracheal tube	1 (0.3)	0 (0)	
Laryngeal mask airway	1 (0.3)	5 (6.9)	
Laryngoscope technique			0.002*
Direct laryngoscopy	270 (94.1)	55 (82.1)	
Video-assisted laryngoscopy	17 (5.9)	11 (16.4)	
Fiberoptic bronchoscopy	0 (0)	1 (1.5)	

(Continued)

Table 3 (Continued).

Variables	Control (n = 288)	Dental Injury (n = 72)	p-Value
Laryngoscope view			<0.001*
1	189 (65.6)	26 (36.1)	
2	88 (30.6)	21 (29.2)	
3	10 (3.5)	18 (25.0)	
4	0 (0)	1 (1.4)	
Difficult intubation	10 (3.5)	19 (26.4)	<0.001*
First attempt intubation person			0.035*
Anesthesiologist trainee	122 (42.4)	35 (48.6)	
Nurse anesthetist trainee	103 (35.8)	16 (22.2)	
Anesthesiologist	47 (16.3)	11 (15.3)	
Nurse anesthetist	13 (4.5)	7 (9.7)	
Medical student	3 (1.0)	3 (4.2)	
Intubation > 3 attempts	0 (0)	5 (7.1)	<0.001*
Intubator experience < 5 years	229 (80.1)	57 (79.2)	0.864

Notes: Data are presented as number (%) unless indicated otherwise. *p < 0.05 was considered statistically significant.

required more than three intubation attempts, whereas no such cases were observed in the control group. The incidence of dental injury did not significantly differ based on whether the first-attempt intubator had less than five years of experience.

The logistic regression analysis for predictors of dental injury is presented in [Table 4](#). In the univariate analysis, significant risk factors associated with dental injury included age > 60 years (crude OR 1.99; 95% CI, 1.02–3.89; p = 0.044), pre-existing dental pathology (crude OR 4.36; 95% CI, 2.49–7.65; p < 0.001), Mallampati score ≥ 3 (crude OR 2.93; 95% CI, 1.23–6.95; p = 0.015), anticipated difficult intubation (crude OR 3.78; 95% CI, 2.02–7.09; p < 0.001), and

Table 4 Univariable and Multivariable Logistic Regression Analysis for Predictors of Dental Injury in Patients Who Received General Anesthesia

Variables	Crude OR (95% CI)	p-Value	Adjusted OR (95% CI)	p-Value
Male	1.20 (0.71, 2.01)	0.492		
Age ≥ 60 years	1.99 (1.02, 3.89)	0.044*	1.13 (0.56, 2.26)	0.740
ASA PS ≥ 3	1.42 (0.79, 2.57)	0.238		
BMI > 30 kg/m ²	2.16 (0.96, 4.85)	0.061	2.46 (0.94, 6.44)	0.066
Diabetes	1.13 (0.61, 2.12)	0.696		
Hypertension	1.11 (0.65, 1.87)	0.706		
Surgery at the head and neck area	1.00 (0.52, 1.91)	>0.999		
History of difficult airway	2.76 (0.76, 10.07)	0.123		

(Continued)

Table 4 (Continued).

Variables	Crude OR (95% CI)	p-Value	Adjusted OR (95% CI)	p-Value
Pre-existing dental pathology	4.36 (2.49, 7.65)	<0.001*	3.87 (1.92, 7.81)	<0.001*
Mallampati classification ≥ 3	2.93 (1.23, 6.95)	0.015*	0.48 (0.15, 1.54)	0.216
Expected difficult intubation	3.78 (2.02, 7.09)	<0.001*	4.99 (1.84, 13.50)	0.002*
Difficult intubation	11.20 (4.90, 25.57)	<0.001*	10.56 (4.24, 26.29)	<0.001*
Intubator experience < 5 years	0.95 (0.50, 1.79)	0.864		

Notes: *p < 0.05 was considered statistically significant.

Abbreviations: ASA PS, American Society of Anesthesiologists physical status; BMI, Body Mass Index.

Table 5 Type of Dental Injury and Affected Tooth in Patients with Dental Injury After General Anesthesia (75 Teeth from 72 Patients)

Tooth	Avulsion	Dislocation	Fracture	Damage to Fixed Dental Prostheses
Incisor	23 (0.3)	19 (25.3)	8 (10.7)	3 (4.0)
Canine	8 (10.7)	5 (6.7)	1 (1.3)	0 (0)
Premolar	4 (5.3)	1 (1.3)	1 (1.3)	0 (0)
Molar	1 (1.3)	1 (1.3)	0 (0)	0 (0)

Notes: Data are presented as number (%).

laryngoscopic view grade ≥ 3 (crude OR 11.20; 95% CI, 4.90–25.57; $p < 0.001$). Multivariable logistic regression analysis identified pre-existing dental pathology (adjusted OR 3.87; 95% CI, 1.92–7.81; $p < 0.001$), anticipated difficult intubation (adjusted OR 4.99; 95% CI, 1.84–13.50; $p = 0.002$), and laryngoscopic view grade ≥ 3 (adjusted OR 10.56; 95% CI, 4.24–26.29; $p < 0.001$) as independent predictors of dental injury in patients undergoing GA.

The type of dental injury and the affected teeth are summarized in Table 5. A total of 75 teeth were injured among 72 patients. The most commonly affected teeth were incisors (53 of 75), followed by canines (14 of 75). The predominant types of injury were avulsion (36 of 75) and dislocation (26 of 75). Additionally, damage to three fixed dental prostheses involving incisors was noted.

Regarding complications, the most common was bleeding, observed in 23.6% of cases. In one patient, an avulsed tooth could not be located. In another, a tooth was swallowed and passed through the gastrointestinal tract. No cases of dental aspiration into the airway were reported.

Discussion

This retrospective case-control study provides a comprehensive analysis of the incidence and risk factors for dental injury among patients undergoing GA at a tertiary care center in Southeast Asia. The overall incidence of dental injury in our cohort was 0.17% (1 in 599 patients). This finding aligns with recent retrospective studies from similar tertiary and teaching hospitals, which have reported incidence rates ranging from 0.03% to 0.92%.^{10,11} However, our rate exceeds those observed in broader population-based studies, where the reported incidence ranges from 0.02% to 0.07%.^{1,3,15} The higher incidence observed in our study may reflect a greater proportion of patients with pre-existing dental risk factors and more frequent use of advanced airway management techniques. Additionally, dental injury rates tend to be higher in teaching hospitals, possibly due to increased case complexity and the involvement of residents in training.¹⁵ In contrast, prospective studies have reported higher dental injury rates during GA. For example, Al-Shiekh et al¹⁶ found that 16% of hospitalized children experienced traumatic dental injuries during GA. Similarly, Chen et al¹⁷ and Mourão et al¹⁸

reported dental injury rates of 12% and 36%, respectively, in adult patients. Prospective designs likely capture a greater number of minor injuries that might otherwise go unnoticed or unreported in retrospective reviews. These variations may reflect differences in patient populations, case complexity, airway difficulty, and documentation practices.

Our study offers unique contributions, despite numerous studies, including a systematic review by Neto et al¹⁴ having investigated dental injuries during GA. It fills a significant geographical gap by providing robust data from Southeast Asia, a largely underrepresented region, and uses multivariable logistic regression to identify independent predictors. Our findings confirm that pre-existing dental pathology, anticipated difficult intubation, and poor laryngoscope view are significant, independent risk factors, reinforcing prior meta-analyses while adding specific regional context.

Our results demonstrated that the presence of any dental pathology increased the odds of dental injury nearly fourfold. Patients with pre-existing conditions such as loose teeth, advanced periodontal disease, extensive caries, or dental prostheses were at significantly higher risk of dental trauma during GA. This finding aligns with previous literature. For example, Ham et al¹¹ identified compromised dentition as a major predisposing factor, reporting an adjusted OR of 8.8 (95% CI, 3.9–20.0). Vogel et al⁴ similarly found that 63.5% of perioperative dental injuries occurred in patients with pre-existing dental abnormalities. Other studies, including those by Newland et al¹ and Tan et al,¹⁰ have also described poor pre-procedural dental status as one of the most consistent and significant risk factors for peri-anesthetic dental injury. The underlying mechanisms are well understood; weakened periodontal structures, prosthetic components, or carious teeth are less capable of tolerating mechanical forces applied during airway manipulation.³ Consequently, even routine intubation procedures can result in substantial dental trauma in these at-risk individuals.

Darawade et al² reported that only a small proportion of anesthesiologists (5%) use mouth guards to prevent direct impact on teeth, and that 65% do not refer patients with poor dentition for preoperative dental consultation. Similarly, Mullick et al¹⁹ found that only 14% of anesthesiologists consistently recommended dental consultations for patients with loose or diseased teeth. Furthermore, our institution did not have a protocol for routine preoperative dental consultation during the study period; dental assessment relied solely on anesthesiologist evaluation. The strong association between pre-existing dental pathology and injury highlights a potential gap in this approach. Our findings support previous studies emphasizing the importance of thorough preoperative dental assessment and suggest that implementing structured preoperative dental referral for high-risk patients could be a valuable preventive strategy to identify those at higher risk of dental injury during anesthesia.⁴ A pre-anesthetic dental examination should be conducted and clearly documented.^{19,20} During the preoperative visit, patients should be informed of the potential for dental injury.³ Proactive measures, such as dental stabilization or extraction of severely compromised teeth, can significantly reduce the risk of intraoperative dental trauma.^{3,13} Strengthening collaboration with dental professionals prior to elective procedures involving GA and intubation is recommended.¹⁸

Our study identified both anticipated difficult airway and difficult intubation as significant risk factors for dental injury during GA. This finding is consistent with prior literature, which has consistently shown that challenging airway management increases the risk of perioperative dental trauma.^{4,10,11,14,21} Several studies have demonstrated that pre-operative predictors of a difficult airway—such as limited mouth opening, restricted neck mobility, and poor oropharyngeal visualization (eg, high Mallampati or Cormack-Lehane grades)—are associated with a higher incidence of dental injury during anesthesia.^{10,14,22} Forces exerted during laryngoscopy and intubation, especially under poor visualization or with multiple attempts, increase the likelihood of inadvertent contact with dental structures.^{9,14,17} This highlights the importance of thorough airway assessment and cautious airway management in patients with predicted airway difficulties. In such cases, modifying techniques—such as minimizing intubation attempts, using protective tooth guards, careful laryngoscope placement, or employing alternatives like video laryngoscopy (VDL) or fiberoptic techniques—may help reduce dental injury.^{2,19,23} Protective dental guards may offer additional benefit.^{24,25} While custom-made guards provide optimal protection, soft roll gauze and boil-and-bite guards are cost-effective alternatives suitable for resource-limited settings.^{26,27} However, their routine use remains controversial, and further research is warranted to determine their efficacy and establish standardized guidelines for use.

VDL improves glottic visualization and requires less force.²⁸ In our study, VDL was used in 16.4% of cases in the dental injury group, compared to 5.9% in the control group. The higher use of VDL in the dental injury group may reflect

the greater number of patients with predicted difficult intubation, for which clinical guidelines recommend routine use of video laryngoscopy on the first attempt.²⁹

Univariate analysis showed that patients aged over 60 years had a higher incidence of dental injury. This is consistent with findings from Vogel et al,⁴ who reported that over half of dental trauma cases occurred in patients aged 50–80 years, with most between 60–70 years. Similarly, Givol et al²¹ found the majority of dental injuries occurred in the 50–70 age group. The increased risk in older adults is likely due to age-related periodontal attachment loss, as chronic marginal periodontitis commonly develops later in life.^{30,31}

Consistent with previous research, the majority of dental injuries in our cohort involved the upper incisors and canines, with avulsion and dislocation being the most common types.^{2,4} Anatomically, these teeth are particularly vulnerable due to their prominent position and proximity to the laryngoscope blade, especially during difficult tracheal intubation.

The clinical relevance of these findings underscores the importance of preventive strategies for patients with pre-existing dental conditions or anticipated difficult airways. Preoperative dental assessment, stabilization of loose teeth, use of protective dental guards, and alternative airway techniques such as VDL should be considered to minimize the risk of dental trauma.^{19,20} In high-risk cases, involving experienced providers and preparing contingency plans are also recommended. Additionally, structured documentation and reporting of peri-anesthetic dental injuries can contribute to improved patient safety and overall care quality.

Limitations

Our study has several notable strengths. It employed a robust case-control design with time- and procedure-matched controls, systematic case verification by an expert panel, and multivariable analysis to adjust for potential confounders. However, several limitations should be acknowledged. The retrospective design may have led to the underreporting of minor dental injuries, particularly if they were unrecognized or not actively assessed postoperatively. Additionally, our study focused exclusively on dental injuries and did not systematically collect data on associated soft tissue trauma which are often more subtle and difficult to capture retrospectively. Furthermore, data regarding the use of specific protective measures, such as dental guards or gauze rolls, were not systematically documented in the anesthetic records and therefore could not be included in our analysis. Future prospective studies are warranted to provide more accurate incidence estimates by using systematic post-procedure oral examinations to capture the full spectrum of hard and soft tissue injuries, and to evaluate the effectiveness of protective measures. Additionally, as this was a single-center study, the findings may not be generalizable to other institutions with different clinical practices. Despite our matching methods, unmeasured confounding—such as surgical complexity or patient comorbidities—cannot be entirely excluded.

Future studies should evaluate the effectiveness of interventions such as atraumatic airway techniques in reducing dental injuries across diverse healthcare settings. Additionally, implementing systematic surveillance and standardized reporting of perioperative dental injuries is recommended to support quality improvement initiatives.

Conclusion

Dental injury remains a notable complication of general anesthesia, particularly among patients with pre-existing dental pathology, anticipated difficult airway, and poor laryngoscopic view. Thorough preoperative assessment, meticulous airway management, and appropriate preventive dental strategies are essential to reduce the risk of injury and its associated complications.

Data Sharing Statement

The datasets generated and analyzed in this study are available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

The study was approved by the Khon Kaen University Ethics Committee for Human Research (Reference No. HE671316). The requirement for written informed consent was waived due to the retrospective nature of the study, and all data were anonymized prior to analysis.

Consent for Publication

No published individual participant data were reported that would require consent from the participants.

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Disclosure

The authors declare no conflict of interest in this work.

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