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A prospective non-randomised study to compare oral trauma from laryngoscope versus laryngeal mask insertion

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Abstract – *Background*: Prospective studies evaluating the incidence of dental injuries in anaesthesia are scarce or absent. The aim of this study was to compare the incidence of oral trauma in patients submitted to laryngoscopy and orotracheal intubation with those anaesthetized with a laryngeal mask. *Material and methods*: This observational study was performed in the University Hospital, with blind evaluation. We evaluated 121 patients older than 18 years old who were submitted to elective surgery under general anaesthesia. Patients were excluded if they were pregnant, underwent surgery of the mouth or required nasal intubation. Laryngoscopy and orotracheal tube were used in 70 patients and laryngeal mask in 51. Twelve to 24 h before anaesthesia and after surgery, all patients underwent a detailed oral examination performed by an anaesthesiology and a senior dentist, both blind to anaesthetic management details. Injuries of the teeth were diagnosed based on WHO's classification system modified by Andreasen. *Results*: Oral injuries were found in 84.1% of the patients after laryngoscopy and 19.6% after laryngeal mask insertion ($P < 0.001$). Corresponding values for teeth injuries were, respectively, 38.6% and 2.0% ($P < 0.001$). The great majority were enamel fractures of the maxillary incisors. This means that patients submitted to laryngoscopy had a significantly higher incidence of oral injuries compared with those having laryngeal mask insertion (unadjusted OR 21, 99; CI 0.95: 8.55–56.55). *Conclusion*: Minor oral trauma is significantly more frequent after endotracheal intubation than after use of the laryngeal mask. This is true for injuries of the teeth, inferior lip and tongue. Further studies are needed to evaluate on a long-term basis the clinical relevance of the dental injuries we found.

Endotracheal intubation and laryngeal mask airway (LMA) insertion are safe procedures, and major complications rarely occur (1, 2). Unintended damage of teeth, lips, gingiva and oral tissues are usually considered as minor complications but they can produce considerable discomfort or postoperative pain (3, 4). They can also be a source of litigation against anaesthesiologists (5–10).

Airway management is one of the most important skills in anaesthesiologists. Before 1990, only the face mask and the endotracheal tube were the available airway devices. Since then several supraglottic airway devices have been developed, of which the LMA is the most popular one. The common indications for endotracheal intubation in the operating room include the need to deliver positive pressure ventilation, protection of the respiratory tract from aspiration of gastric contents, surgical procedures involving the head and neck or in non-supine positions, surgical procedures involving the cranium, thorax or abdomen. Indications for laryngeal mask insertion are elective short surgical procedures under general anaesthesia excluding head and neck surgery.

Although anaesthesia textbooks refer to dental injury as a complication of intubation and a common anaesthetic event (1), few clinical studies have examined the incidence of this complication (8, 11, 12). Typically, the magnitude of the problem has been based on the number of legal claims, data from insurance companies and studies of complications in anaesthesia wherein oral injuries are only a secondary outcome (13). As far we know, the extent of oral damage done by the technique used to maintain the airway of a general anaesthesia patient has never been evaluated by a prospective study designed exclusively to investigate this aspect.

The primary aim of this study was to compare the incidence of oral trauma between surgical patients submitted to laryngoscopy and those submitted to LMA insertion. The secondary aim was to evaluate the effect of factors that might predispose to the occurrence of oral trauma. The risk factors explored were sex, age, body mass index and duration of surgery.

Materials and methods

With approval from the hospital ethics committee and written informed consent from all patient, we performed this study on all patients over 18 years of age submitted to elective interventions in general Surgery, gynaecology, orthopaedics, plastic Surgery and urology under general anaesthesia, during a 2-month period. Exclusion criteria were pregnancy, mental deficiency, surgery of the mouth or nose and any cause of maxillary airway surgical manipulation.

A pilot study with 30 patients was carried out to assess diagnostic criteria and methodology. During the pilot study, we carried out intraexaminer calibration; the intrareliability score was $<10\%$.

Twelve to 24 h before and after surgery, all patients underwent a detailed oral examination performed by an anaesthesiologist and a senior dentist, both blind to anaesthetic management details.

The first oral examination included registration of the decayed, missing and filled teeth (DMFT); tooth fractures; and injuries of oral mucosa, lips and tongue. This analysis allowed calculation of the DMFT index (14), a general indicator of the dental health status of a population. The second oral observation (after the procedure) included notation of tooth injuries based on WHO's classification modified by Andreasen (15–17) and injuries to the soft tissues, gingivae, tongue and lips. Subluxation and concussions were not classified as injuries nor were crown-root or root fractures because for those radiographs would have been needed.

After completion of the second oral examination, the anaesthesia records were consulted and the following items were registered: technique used to maintain the airway, number of attempts to insert airway device, and type and duration of surgery. According to the anaesthesia department protocol, all are obligatory items to record for all anaesthesias.

Statistical analysis was performed using the SPSS® 17.0 SOFTWARE PACKAGE (SPSS Inc., Chicago, IL, USA). Numerical data are presented as the mean and standard deviation. Chi-square, Fisher and two-sample Student *t* test were used to group comparisons of the appropriate variables. Risk of different injuries was evaluated by a multivariate logistic regression model. Odds ratios are presented with a 95% confidence interval.

Results

A total of 121 patients were submitted to a surgery; 70 of the patients underwent orotracheal tube insertion by laryngoscope (Group I) while the remaining 51 had LMA insertion (Group II). The patients were between 18 and 77 years old, with a mean of 48 years and a standard deviation of 14 years.

Group I consisted of 23 men (32.9%) and 47 women (67.1%), with a mean of 47 ± 14 years and a DMTF of 13.11 ± 7.996. Group II included 23 men (45.1%) and 28 women (54.9%) subjects, aged 49 ± 14 of age and a DMTF of 12.2 ± 8.8. No significant differences in age ($P = 0.432$, *t* test) and DMTF ($P = 0.501$, *t* test) were observed between the groups.

Distributions of sex, age, body mass index, DMFT, duration of surgery, tooth injuries, maxillary upper lip injuries, mandibular lip injuries, tongue injuries, oral cavity injuries and overall injuries in each group can be observed in Table 1. There was no record of any difficult airway management in the study. There was no significant difference in sex ($P = 0.189$), body mass index ($P = 0.855$), or presence of maxillary lip ($P = 0.137$) or soft tissue injuries ($P = 0.234$) between the groups (Table 1).

Table 1. Sex, age, decayed, missing and filled teeth (DMFT) index and number of injuries (absolute and percentage) observed in patients with laryngoscopy (Group I) and patients managed with laryngeal mask airway (Group II) without laringoscopy

	Group I (n = 70) (%)	Group II (n = 51) (%)
Sex (P = 0.189, chi-squared test)		
M	23 (32.9)	23 (45.1)
F	47 (67.1)	28 (54.9)
Age (P = 0.432, t-test)		
18–40	26 (37.1)	11 (21.6)
40–65	36 (51.4)	33 (64.7)
65–78	8 (11.4)	7 (13.7)
Body mass index (P = 0.855, chi-squared test)		
Obese and overweight	34 (48.6)	26 (51.0)
Normal and underweight	36 (51.4)	25 (49.0)
DMFT (P = 0.501, t-test)		
0–10	30 (42.9)	27 (52.9)
11–20	27 (38.6)	14 (27.5)
20–29	13 (18.6)	10 (19.6)
Duration of surgery (P = 0.000, chi-square test)		
30 min–4 h	55 (78.6)	51 (100.0)
4–8 h	15 (21.4)	0 (0.0)
Teeth injuries (P = 0, chi-square test)		
No injuries	43 (61.4)	50 (98.0)
Total injuries	27 (38.6)	1 (2.0)
Fracture	24 (34.3)	1 (2.0)
Avulsion	2 (2.9)	0 (0.0)
Luxation	1 (1.4)	0 (0.0)
Maxillary lip injuries (P = 0.137, Fisher test)		
No injuries	66 (94.3)	51 (100)
Total injuries	4 (5.7)	0 (0)
Laceration	3 (4.3)	0 (0.0)
Contusion	1 (1.4)	0 (0.0)
Mandibular lip injuries (P = 0, chi-square test)		
No injuries	31 (44.3)	46 (90.2)
Total injuries	39 (55.7)	5 (9.8)
Laceration	22 (31.4)	4 (7.8)
Contusion	17 (24.3)	1 (2.0)
Tongue injuries (P = 0.014, chi-square test)		
No injuries	58 (82.9)	50 (98.0)
Total injuries	12 (17.1)	1 (2.0)
Laceration	1 (1.4)	0 (0.0)
Contusion	11 (15.7)	1 (2.0)
Oral cavity injuries (P = 0.234, chi-square test)		
No injuries	60 (85.7)	48 (94.1)
Total injuries	10 (14.3)	3 (0.9)
Laceration	3 (4.3)	0 (0.0)
Contusion	5 (7.1)	3 (5.9)
Other injuries	2 (2.9)	0 (0.0)
Total injuries (P = 0, chi-square test)		
No injuries	11 (15.7)	41 (84.4)
Injuries	59 (84.3)	10 (19.6)

Table 2. Odds ratio (0.95 CI) to the influence of studied factors on the overall incidence of injuries observed. *P* determined by multivariate logistic regression

	Odds ratio					
	OR	CI 0.95	*P*	No injuries (n = 52), (%)	Injuries (n = 69), (%)	*P* (chi-square test)
Sex						
Male	0.478	0.159–1.433	0.187	25 (48.1)	21 (30.4)	0.059
Female				27 (51.9)	48 (69.6)	
Age						
18–40	0.264	0.046–1.508	0.134	16 (30.8)	21 (30.4)	1
40–65	0.628	0.127–3.116	0.570	30 (57.7)	39 (56.5)	
65–78	–	–	–	6 (11.5)	9 (13.0)	
Body index mass						
Obese or overweight	0.641	0.230–1.786	0.395	27 (51.9)	33 (47.8)	0.715
Normal or underweight	–	–	–	25 (48.1)	36 (52.2)	
DMFT						
0–11	1.001	0.240–4.173	0.999	28 (53.8)	29 (42.0)	0.211
11–21	1.930	0.416–8.954	0.401	13 (25)	28 (40.6)	
21–29	–	–	–	11 (21.2)	12 (17.4)	
Intubation						
Laryngeal mask	0.027	0.008–0.091	0.00	41 (78.8)	10 (14.5)	0
Laryngoscope	–	–	–	11 (21.2)	59 (85.5)	
Duration of surgery						
30 min–4 h	2.769	0.620–12.367	0.182	48 (92.3)	58 (84.1)	0.265
4–8 h	–	–	–	4 (7.7)	11 (15.9)	

DMFT, decayed, missing and filled teeth

All surgeries performed with LMA lasted between 30 min and 4 h, while most of the surgeries (78.6%) where laryngoscopy was used had the same duration. Some form of injury (teeth or soft tissue) was found in 84.3% of the patients in group I, but only 19.6% of patients in group II (P = 0.001).

Injuries of teeth were found in 38.6% of Group I and 2.0% of Group II. The vast majority of tooth injuries were fractures of the maxillary incisors and expressed by enamel fracture (P < 0.001). Tongue injuries were present in 17.1% of patients of group I and only 2% of patients of groups II (P = 0.014) (Table 1).

In our study, there was no significant difference in sex (P = 0.059), age group (P = 1), body index mass (P = 0.715), DMFT (P = 0.211) and duration surgery (P = 0.265) between those who presented some kind of lesion and those who did not. We did not found significant differences in the values of DMFT (P = 0.910) between patients with oral trauma and no oral trauma.

Discussion

In our study, we found that orotracheal intubation by laryngoscopy produced an incidence of oral injuries six times higher than with the laryngeal mask. This incidence is significantly higher than that described in medical literature (3, 9, 18–23). Fung et al. (9) found 6.9% of patients to have subjective or objective oral tissue trauma, Konedgen et al. (18) found 75% to have minor mucosal injuries in patients submitted to suspension laryngoscopy, and Chen et al. (12) found an 18% incidence of oral injuries in patients submitted to endotracheal general anaesthesia. In view of the prospective design and our careful blind postoperative examination 12–24 h postsurgery, we believe our estimate to reflect the true rate of oral injury. Also this large difference found in our study may be explained by the total injuries reported in our study that were not recorded in the Chen and the Fung studies. They only reported the soft tissue laceration and dental trauma.

Our study reported a total of 38.6% of dental injuries in group I and only 2% in group II. Had we calculated only the injuries that led to loose teeth, we would have found 2.9% in group I and 0% in group II. Fung reported 2.7% of injuries that led to loose teeth, which is very similar to our study. This emphasises that these blind evaluators with professional expertise can detect minor injuries that currently cannot be perceived by anaesthesiologists, surgical staff, or even by the patient.

The teeth most often affected in our study were the maxillary incisors, which is in concordance with the Bucx et al. study. They found that most anaesthesiologists used the maxillary incisors as a fulcrum of leverage and few attempted to avoid doing so (24). The presence and magnitude of *the forces exerted on the maxillary incisor teeth* are somewhat surprising (24).

Our analyses did not reveal any significant relation between a high DMFT index and oral or dental trauma

(t-test; P = 0.910, P = 0.518, respectively; Table 2). This is different from what Fung et al. that found: 'missing tooth', 'crown' and 'residual root' were some significant factors for these complications; nevertheless, they did not explain what classification they used for this diagnosis (9).

Concerning the clinical relevance of the larger number of injuries we found, it is important to stress that these injuries do not constitute serious sequelae or pain; they healed spontaneously without further treatment.

As in the study of Konedgen et al. (18), our results showed more injuries of the lower lip compared to upper lip. We postulate that these injuries occured during insertion of the laryngoscope, when the lower lip becomes trapped between the teeth and the instrument.

The clinical relevance of the high frequency of fractures we observed deserves further study. Such a study should evaluate the long-term consequences of the injuries we found resulting from the laryngoscopy and use of the orotracheal tube. Although these injuries were temporary, we recommend that when selecting an anaesthetic, the anaesthesiologist should be aware of the risks of oral injury inherent in laryngoscopy use.

Conclusion

Oral trauma is not an uncommon complication in general anaesthesia. Minor oral trauma is significantly more frequent after endotracheal intubation than after using the laryngeal mask. This is true for injuries of the teeth as well for injuries of the lower lip and tongue. Further studies are needed to evaluate on a long-term basis the clinical relevance of the high incidence of minor dental injuries we found with after laryngoscopy and to seek some other factors that might be linked with it.

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