

ORIGINAL ARTICLE

Perception of a Modified General Anaesthesia Intubation Technique in Paediatric Dentistry: A Cross-sectional Study

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ABSTRACT

Introduction: Endotracheal airway is essential in children undergoing dental general anaesthesia (DGA). Paediatric dentists' (PD) work with anaesthetists who use both nasal and oral intubation routes. Thus the study aimed to assess Gulf Cooperation Council (GCC) PDs' preference of oral or nasal endotracheal intubation and their perception regarding a modified oral intubation technique that avoids occlusal interference using a Ring, Adair and Elwyn "RAE" tube. **Materials and Method:** PDs in GCC were surveyed about their preference of endotracheal intubation and the modified RAE oral intubation method via a web-based questionnaire. Responses were analyzed by χ^2 and Exact Fischer's test. Statistical significance was set as $p < 0.05$. **Results:** A total of 73 PDs who perform DGA responded, a majority of whom (79.5%) preferred the nasal route. Male PDs were more familiar with RAE ($p = 0.031$). More PDs within the ages 36-45 years agreed on using the proposed modified technique ($p = 0.027$). Considering the reported complications associated with nasotracheal and traditional oral intubation, 49 PD (67.1%) believed that the modified technique was worth consideration. **Conclusion:** Most PDs preferred the nasal route, but more than half would consider utilizing the RAE-modified oral intubation technique. Further research and hands-on workshops of the modified RAE oral tube for DGA are suggested.

Malaysian Journal of Medicine and Health Sciences (2025) 21(6): 1-13. doi:10.47836/mjmh.v21.i6.1386

Keywords: Modified technique, Oral intubation, Nasal intubation, Paediatric dental general anaesthesia, Ring, Adair, Elwyn "RAE" tube

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INTRODUCTION

The management of paediatric patients with behavior management techniques in paediatric dentistry emphasizes the importance of providing a safe and painless experience for patients (1). Pharmacological and non-pharmacological techniques ranging from simple in-office behavior-management to full tracheal intubation dental general anaesthesia (DGA) in a hospital setting, are discussed in the literature (2). For the vast majority of paediatric patients, successful in-

office behavior management can be accomplished via communicative behavior management (e.g., positive reinforcement, tell show do, modeling), conscious sedation and DGA (3). Paediatric patients would benefit from deep sedation and DGA if the former techniques were unsuccessful. DGA may be considered taking into account patients' medical disability, physical and cognitive ability, perceived anxiety, procedure complexity, and patient cooperative ability (1).

According to the American Academy of Paediatric Dentistry (AAPD) DGA is indicated for patients (3): "who cannot cooperate due to a lack of psychological or emotional maturity and/or mental, physical, or medical disability; for whom local anesthesia is ineffective because of acute infection, anatomic variations, or allergy; who are extremely uncooperative, fearful, or anxious; who

are pre-communicative or non-communicative child or adolescent; requiring significant surgical procedures that can be combined with dental procedures to reduce the number of anesthetic exposures; for whom the use of general anesthesia may protect the developing psyche and/or reduce medical risk; and requiring immediate, comprehensive oral/dental care (e.g., due to dental trauma, severe infection/cellulitis, acute pain)".

The choice of intubation method is usually related to post-operative morbidity complications following paediatric DGA (4). The frequency and severity of complications were reported to be more on the first day compared to the third day postoperatively. For example, the inability to eat was reported by 85.5% on the first day and by 12.2% on the third day. Similarly, sore throat, a common complication of oral intubation, was reported by 34.4% and 7.8%, respectively (4). Therefore, various methods have been used to reduce such complications (5). However, there is a widely held view that paediatric dentists prefer a nasotracheal intubation (NTI) airway management technique over the oral route (OTI) due to logistical factors. Several factors are associated with this view: the clearance of the surgical field, lower chance of tube displacement, along with the ease of evaluation of dental occlusion (6). Despite its preference by paediatric dentists (7), nasotracheal intubation includes a major drawback associated with its blind traumatizing approach (8). Epistaxis is among the most common problems associated with nasotracheal intubation (6,8). In contrast, orotracheal intubation is characterized by the easiness of use, fewer provider attempts, and a less traumatic nature (6). In addition, some anesthetists prefer in general, the use of oral methods without endotracheal intubation, such as the Laryngeal Mask Airway (LMA) in their airway management algorithm (9).

When American Academy of Paediatric Dentistry (AAPD) members were asked, there was a preference for general endotracheal intubation (whether oral or nasal) as opposed to non-endotracheal methods, such as LMA. However, the preferred route of intubation

among paediatric dentists is still under intense debate. Furthermore, there is a lack of supporting literature regarding the perception of paediatric dentists in this issue (6). Therefore, any solution that addresses the issue with potential for improvement is viewed with optimism. Endotracheal tubes are catheters that are placed in the trachea to maintain a patent airway. They vary in size, shape, and composition depending on their use (10). Several types are recognized in the literature. One particular type is the Ring Adair Elwyn (RAE) tube that is named after its inventors Ring, Adair, and Elwyn in 1970 (11). The RAE tube is a preformed bent tube designed to reduce the probability of kinking and to clear tubing from the surgical field. They are south-facing tubes usually placed in the midline of the oral cavity, which bends downward under the chin, allowing an unobstructed view for the upper face, otolaryngology, and other facial surgeries (11). Knowing the anatomy of paediatric patients and proper selection of endotracheal tube were reported factors to minimize DGA post-operative complications (12,13).

Modifications were made to accomplish several tasks, such as the clear surgical field for dental treatment. It came to the attention of the authors of this paper that a consultant anesthesiologist in Dubai Healthcare City (DHCC) in Dubai, the United Arab Emirates (UAE) and a co-author of this paper, was employing a modified oral intubation technique using an RAE tube in a way where it was:

1. endotracheal placed,
2. positioned into the mouth by occupying the retromolar area, and
3. firmly secured at the corner of the mouth using adhesive tape

thus, maintaining a clear surgical field for restorative dental treatment with or without the rubber dam (See Figure 1). The figure highlights the RAE tube in situ and how the tubes are secured to the corner of the mouth, with no interference with the occlusion nor the rubber dam).

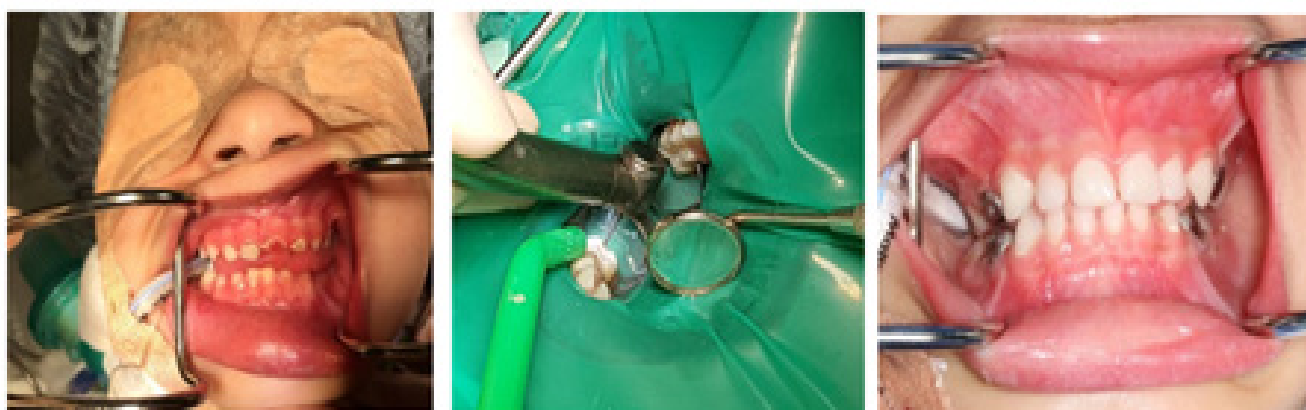


Figure 1: The modified RAE technique. Note the adhesive tape used to secure the RAE tube on the corner of the mouth; notice the lack of interference with the occlusion and rubber dam placement

Anecdotally, it was found out during the DGA that this technique 1) did not require moving the tube from one side to the other during DGA; 2) did not cause any occlusal interference. and 3) no complications had been documented since the consultant anaesthetist (one of the authors of this paper) started employing this technique in 2012. The data we have covers 600 cases conducted over a period of 10 years and no reported side effects (internal audit). Interestingly, this method was found to be highly acceptable upon conferring with the many paediatric dentists who worked with him in that period. However, no formal research had been carried out in that regard. Therefore, the current study aimed to assess the Gulf Cooperation Council (GCC) countries, of which the UAE is part of, paediatric dentists' preference of endotracheal intubation and their perception regarding a modified technique of oral intubation using an RAE tube during dental treatment under GA.

MATERIAL AND METHODS

Study design

A cross-sectional survey-based study was conducted to assess the GCC paediatric dentists' preference of endotracheal intubation technique and their perception regarding a modified oral intubation technique using an RAE tube during dental treatment under GA.

Step by step process (Figures 1) of placing the RAE tube is as follows:

1. Induction of anaesthesia as for any other GA. Choice depends on the patient characteristics and anaesthetist's and operator's preference.
2. Laryngoscope choice also like for any other GA intubation.
3. Tube is a south facing RAE tube. One size less than that for a tonsillectomy as we have to fix it at the angle of the mouth. A longer tube may cause endobronchial migration of the tip.
4. The tube is moved to the angle of the mouth and taped as shown in the picture. The tube is pushed to the buccal fold to place mouth gag on the same side. The tube passes lateral to the mouth gag, not encroaching the surgical field.
5. Change of tube to the other side if needed for exposure of the ipsilateral side. Very unlikely once the surgical team gets used to this technique.

A carefully structured questionnaire was developed by the principal investigator coupled with being edited by a panel of four faculty in the paediatric dentistry department at Hamdan Bin Mohammed College of Dental Medicine, Mohammed Bin Rashid University of Medicine, and Health Sciences (MBRU) in Dubai, UAE. The questionnaire was piloted amongst ten paediatric dentists to assess its usability, reliability, and ease of completion. Minor adjustments were made according to the feedback. These pilot surveys were not included in the results.

Population

A convenience sample of licensed GCC paediatric dentists who provide dental treatment under GA were invited to participate. The emails of the paediatric dentists in the UAE were obtained from the Emirates Paediatric Dentistry Club (EPDC), while other GCC paediatric dentists were contacted through their respective paediatric dentistry societies and through social networking applications such as Instagram, Twitter, Facebook, and WhatsApp.

Data collection

Data were collected over a 3-month duration from November 1, 2020, to February 1, 2021. Two reminders were sent for the completion of the survey at approximately 4-week intervals. Completion of the survey was voluntary and confidential (i.e., anonymous), and hence, no identifying personal details were obtained. Prior to answering the questionnaire, a standard script involving a brief about the modified oral intubation technique utilizing an RAE tube and illustrative photographs (Figure 1) was provided to further clarify the research study. The questionnaire was conducted through Microsoft Forms® and consisted of three sections. The first section asked about participants' demographics (6 questions). The second section explored the paediatric dentists' preferred technique of dental GA endotracheal intubation and their familiarity with the modified RAE technique (6 questions) along with an image for further clarification. Firstly, the participants were asked about their preferred route of intubation and the reason behind their preference. Secondly, they were asked about their knowledge with respect to the intubation route associated with more complications. Thirdly, in order to identify difficulties faced by the operators when oral intubation is the only available choice, participants were asked to select any applicable choice related to the difficulties when operating with oral intubation and to specify if there are any other limitations. Respondents were then asked to indicate whether they were familiar with the RAE tube and if they had used it to treat patients. In the cases where the RAE tube was used, respondents were asked to specify the RAE tube's location. Furthermore, they were asked if they had faced any problems due to the presence of the tube orally. The last set of four questions aimed to assess participants' perception toward the proposed modified intubation technique using an oral RAE tube through a Likert scale to evaluate their level of agreement. In some of the open-ended questions space for comments was made to add a qualitative component to the study.

For the purposes of analysis, the questions were further categorized into three main categories, set out to assess paediatric dentists' knowledge, practice, and perception regarding their preference, familiarity, and insight in a modified oral intubation technique using RAE oral tube.

Statistical analysis

Analysis of data was carried out using IBM-SPSS for Windows Version 25.0 (SPSS Inc., Chicago, IL). Categorical variables were described using frequencies with corresponding proportions. Cross tabulation was utilized to examine the independency between categorical variables. The χ^2 -square test and Exact Fischer's test were considered as appropriate to test association. P-value of less than 0.05 was considered significant in all statistical analysis.

Ethical considerations

The study was conducted in full conformance with principles of the "Declaration of Helsinki", Good Clinical Practice (GCP), and within the laws and regulations of the UAE. The ethical approval was obtained from the Research Ethics Review Committee at Mohammed Bin Rashid University of Medicine and Health Sciences (RE: MBRU-IRB-2020-012).

RESULTS

Demographics

This survey presented the findings of a web-based questionnaire conducted via Microsoft Forms® with a sample size of 75 participants. Seventy-three out of the seventy-five respondents agreed to participate, while two disagreed. Among those who responded to the survey, 25 out of 73 (34.2%) were consultants, and 48 (65.8%) were specialists in paediatric dentistry. The participants worked in two main practice settings: 20 in private practice (27.4%), 37 in governmental (50.7%), whereas 12 participants (16.4%) reported both settings, and 4 (5.5%) responded as other. Table 1 shows an overview of the participants' demographic tabulation, including gender, age range, total years of practice as a specialist, GCC country of practice, and the country whereby the paediatric specialist degree was granted.

Table 1: Study respondents' demographics

	Gender	n (%) *
	Male	27 (37)
	Female	46 (63)
Age		
	25 – 35	19 (26)
	36 – 45	28 (38.4)
	46 – 55	18 (24.6)
	>55	8 (11)
Total years of professional practice as a specialist		
	< 10	34 (47)
	10 – 20	21 (29)
	21 – 30	14 (19)
	31 – 40	4 (5)
Title		
	Consultant	25 (34)
	Specialist	48 (66)

CONTINUE

Table 1: Study respondents' demographics (CONT.)

	Gender	n (%) *
GCC country of practicing		
	United Arab Emirates	36 (49.3)
	Saudi Arabia	19 (26)
	Kuwait	9 (12.3)
	Qatar	1 (1.4)
	Bahrain	4 (5.5)
	Oman	4 (5.5)
Country of specialization		
	Arab Countries	42 (58)
	Asian Countries	6 (8)
	Western	25 (34)

* Percentages between parentheses are rounded and included only for comparison

Knowledge of paediatric dentists – descriptive results

The first set of analyses examined the participants' knowledge and expertise with respect to complications associated with each intubation route which demonstrated a range of diverse opinions, with the majority leaning towards the complications linked to nasal intubation. Fifty-three participants (72.6%) believed that nasal intubation is associated with more complications. In contrast, oral was chosen by three (4.1%), six (8.2%) reported that none of them produced complications, and the remaining eleven (15.1%) had no idea which one was associated with more complications.

Sixty percent of the respondents were unfamiliar with the RAE tube accounting for 44 out of the 73 participants, compared to 29 (39.7%) who reported familiarity. A total of 27 out of these 29 familiars had experience with the use of the RAE tube while treating children under GA.

When the participants were asked about the area of the mouth where the RAE tube was placed, among the 27 participants who reported that they had treated a patient under GA using an RAE tube 25 (92.6%) reported that it was in the corner of the mouth. In contrast, the remaining 2 out of 27 (7.4%) reported that it was in the midline.

Participants reported endotracheal intubation complications

The second set of analysis aimed at assessing the respondent's endotracheal intubation difficulties and complications (Table 2). On occasions where oral intubation was the only available choice, the challenges that the paediatric dentists encountered were as follows: obstructed surgical view and difficulties in taking impressions were reported by 45 (61.6%) and 44 (60.3%) participants, respectively. At the same time, tube

displacement and limitations of other procedures were reported by 36 (49.5%) and 28 (38.4%) participants, respectively. Participants were asked to elaborate more and specify other limitations encountered due to oral intubation. Qualitative explanatory comments were reported like “Mainly checking the occlusion specially for recent specialists” or “Rubber dam, impression, anaesthesia and any procedure at that site”.

Table II: Complications and problems of RAE oral intubation

Practice Questions	n (%)
Have you treated a patient under general anaesthesia intubated using an RAE endotracheal tube?	
Yes	27 (93.1)
No	2 (6.9)
Have you faced any problems due to the presence of the RAE tube orally?	
Yes	6 (22.2)
No	21 (77.8)
When oral intubation is the only choice, do you face any of these difficulties?	
Obstructed surgical view	
Yes	45 (61.6)
No	28 (38.4)
Difficulties in taking impressions	
Yes	44 (60.3)
No	29 (39.7)
Tube displacement	
Yes	36 (49)
No	37 (51)
Limitation of some procedures	
Yes	28 (38.4)
No	45 (61.6)

Twenty-seven out of 29 (93.1%) who were familiar with RAE tube have treated patients under GA using RAE endotracheal tube. Respondents were asked if they have faced any problems due to the presence of an RAE tube orally; 21 (77.8%) have not faced any problem, while 6 (22.2%) reported that they did. Challenges were conveyed as comments such as: “It is not placed exactly at the corner of the mouth, so still it was obstructing some view and work and needed to shift it to the other side” or “limitation of space for intraoral procedures”.

Perception of paediatric dentists about the preferred intubation route

This section analyzed the question related to the respondent's perception of the preferred endotracheal intubation route. Nasal intubation was the preferred choice among 58 (79.5%) respondents, while 8 (11%) considered oral intubation as the route of choice, and 7 (9.5%) respondents reported no preference.

Half of the respondents showed a level of agreement in using the RAE modified technique where the results varied among three main realms as (agree and completely agree) were collapsed: 37 (50.7%) agreed, 31 (42.5%) had a neutral response, and 5 (6.8%) disagreed. The majority of the respondents 49 (67.1%), indicated that this modified technique is worth considering in light of the reported NTI complications in the literature. Whereas 22 (30.1%) of the responses were neutral and the remaining minority of participants 2 (2.7%) disagreed.

Fifty-two percent of the participants believed that this modified oral intubation technique would make it more challenging to perform the procedure than nasal intubation. In comparison, almost forty-eight percent disagreed (Table 3).

Table III: Paediatric dentists' perception of endotracheal intubation techniques

Perception Questions	n (%)
Which route of intubation do you prefer?	
Nasal	58 (79.5)
Oral	8 (11)
No preference	7 (9.5)
What is the level of your agreement in using this modified technique of oral intubation with an RAE tube placed in the corner of the mouth?	
Disagree	5 (6.8)
Neutral	31 (42.5)
Agree	37 (50.7)
The literature has reported that nasal intubation might lead to some complications such as epistaxis. In light of this, do you think this technique is worth consideration?	
Disagree	2 (2.7)
Neutral	22 (30.1)
Agree	49 (67.1)
Do you think using this modified oral technique will make it more difficult for you to perform the procedure compared to nasal intubation?	
Yes	38 (52.1)
No	35 (47.9)

Demographic data cross-tabulated against knowledge, practice, and perception**Gender cross-tabulated against knowledge/practice/perception**

The association between respondents' knowledge/practice/perception and gender (Table 4) revealed

no statistically significant differences, except for the question "Have you heard about the Ring Adair Elwyn (RAE) tube?". Sixty-nine percent of female paediatric dentists (n=32) were not familiar with the RAE tube, compared to 44.4% of male paediatric dentists (n=12, $p = 0.031$).

Table IV: Association between gender and knowledge/practice/perception

Knowledge	Male	Female	p-value
Have you heard about Ring Adair Elwyn (RAE) tube?			
Yes	15 (55.6)	14 (30.4)	0.031
No	12 (44.4)	32 (69.6)	
In which area of the mouth was the oral RAE tube placed?			
Corner of the mouth	12 (92.3)	13 (92.9)	0.957
In the midline	1 (7.7)	1 (7.1)	
Practice			
Have you treated a patient under general anaesthesia intubated using Ring Adair Elwyn (RAE) endotracheal tube?			
Yes	13 (86.7)	14 (100)	0.157
No	2 (13.3)	0 (0)	
Have you faced any problems due to the presence of the RAE tube orally?			
Yes	4 (30.8)	2 (14.3)	0.303
No	9 (69.2)	12 (85.7)	
When oral intubation is the only choice, do you face any of these difficulties?			
Obstructed surgical view			
Yes	18 (66.7)	27 (58.7)	0.337
No	9 (33.3)	19 (41.3)	
Difficulties in taking impressions			
Yes	20 (74.1)	24 (52.2)	0.052
No	7 (25.9)	22 (47.8)	
Tube displacement			
Yes	16 (59.3)	20 (43.5)	0.145
No	11 (40.7)	26 (56.5)	
Limitation of some Procedures			
Yes	11 (40.7)	17 (37)	0.469
No	16 (59.3)	29 (63)	
Perception			
Which route of intubation do you prefer?			
Nasal	22 (81.5)	36 (78.3)	0.341
Oral	4 (14.8)	4 (8.7)	
No preference	1 (3.7)	6 (13)	
What is the level of your agreement in using this modified technique of oral intubation with RAE tube placed in the corner of the mouth?			
Disagree	2 (7.4)	3 (6.5)	0.317
Neutral	9 (33.3)	22 (47.8)	
Agree	16 (59.2)	21 (45.6)	
The literature has reported that nasal intubation might lead to some complications such as epistaxis. In light of this, do you think this technique worth consideration?			
Disagree	1 (3.7)	1 (2.2)	0.452
Neutral	6 (22.2)	16 (34.8)	
Agree	20 (74)	29 (63)	
Do you think using this modified oral technique will make it more difficult for you to perform the procedure compared to nasal intubation?			
Yes	15 (55.6)	23 (50)	0.415
No	12 (44.4)	23 (50)	

Age cross-tabulated against knowledge/practice/perception

The results shown in Table 5 indicate an association between knowledge/perception/practice questions and age. There was a clear significant correlation between practice questions in relation to some of the difficulties encountered with oral intubation by paediatric dentists and their age. Respondents were asked to select whatever was applicable to the difficulties encountered with orotracheal intubation in general. A total of 18 (64.3%) respondents who reported tube displacement as one of the encountered difficulties were from the 36-45 age group, whereas 4 (21.1%) among the 25-35 age group and 14 (53.8%) in the ≥ 46 age group ($p = 0.012$).

In addition, 15 (57.7%) of the ≥ 46 age group faced other limitations, compared to 4 (21.1%) in the 25-35 age group and 9 (32.1%) in the 36-45 age group ($p = 0.013$). Another statistically significant result was found ($p = 0.027$) when paediatric dentists were asked, "What is the level of your agreement in using this modified technique of oral intubation with the RAE tube placed in the corner of the mouth?", 18 (64.3%) of the respondents within the 36-45 age group answered "agree," while the figures in the age groups 25-35 and ≥ 46 were 10 (52.7%) and 9 (34.6%), respectively. The chi-square test did not reveal any significant differences between knowledge and age.

Table V: Association between age & knowledge/practice/perception

	Age of participants in years			p-value
	25-35	36-45	≥ 46	
Knowledge				
Have you heard about Ring Adair Elwyn (RAE) tube?				
Yes	6 (31.6)	9 (32.1)	14 (53.8)	
No	13 (68.4)	19 (67.9)	12 (46.2)	0.186
In which area of the mouth was the oral RAE tube placed?				
Corner of the mouth	5 (100)	7 (87.5)	13 (92.9)	
In the midline	0 (0)	1 (12.5)	1 (7.1)	0.703
Practice				
Have you treated a patient under general anaesthesia intubated using Ring Adair Elwyn (RAE) endotracheal tube?				
Yes	5 (83.3)	8 (88.9)	14 (100)	
No	1 (16.7)	1 (11.1)	0 (0)	0.337
Have you faced any problems due to the presence of the RAE tube orally?				
Yes	0 (0)	1 (12.5)	5 (35.7)	
No	5 (100)	7 (87.5)	9 (64.3)	0.188
When oral intubation is the only choice, do you face any of these difficulties?				
Obstructed surgical view				
Yes	11 (57.9)	18 (64.3)	16 (61.5)	
No	8 (42.1)	10 (35.7)	10 (38.5)	0.907
Difficulties in taking impressions				
Yes	10 (52.6)	16 (57.1)	18 (69.2)	
No	9 (47.4)	12 (42.9)	8 (30.8)	0.485
Tube displacement				
Yes	4 (21.1)	18 (64.3)	14 (53.8)	
No	15 (78.9)	10 (35.7)	12 (46.2)	0.012
Limitation of some Procedures				
Yes	4 (21.1)	9 (32.1)	15 (57.7)	
No	15 (78.9)	19 (67.9)	11 (42.3)	0.013
Perception				
Which route of intubation do you prefer?				
Nasal	16 (84.2)	20 (71.4)	22 (84.6)	
Oral	2 (10.5)	3 (10.7)	3 (11.5)	
No preference	1 (5.3)	5 (17.9)	1 (3.8)	0.457

CONTINUE

Table V: Association between age & knowledge/practice/perception (CONT.)

Knowledge	Age of participants in years			p-value
	25-35	36-45	≥46	
What is the level of your agreement in using this modified technique of oral intubation with RAE tube placed in the corner of the mouth?				
Disagree	0	0	5 (19.2)	
Neutral	9 (47.4)	10 (35.7)	12 (46.2)	
Agree	10 (52.7)	18 (64.3)	9 (34.6)	0.027
The literature has reported that nasal intubation might lead to some complications such as epistaxis. In light of this, do you think this technique worth consideration?				
Disagree	0	1 (3.6)	1 (3.6)	
Neutral	5 (26.3)	69 (21.4)	11 (42.3)	
Agree	14 (73.7)	21 (75)	14 (53.5)	0.539
Do you think using this modified oral technique will make it more difficult for you to perform the procedure compared to nasal intubation?				
Yes	9 (47.4)	12 (42.9)	17 (65.4)	
No	10 (52.6)	16 (57.1)	9 (34.6)	0.227

Experience cross-tabulated against knowledge/practice/perception

Upon analyzing the association between knowledge/perception/practice and experience (Table 6), none of the parameters were found to be significant except for the question related to paediatric dentists' perception: "Do you think using this modified oral intubation technique

will make it more difficult for you to perform the procedure compared to nasal intubation?" Surprisingly, 15 (83.3%) who answered "Yes" were more experienced (≥ 21 years of experience) compared to specialists with less than ten years of experience 14 (41.2%), and those with 10-20 years of experience 9 (42.9%) (p=0.009).

Table VI: Association between experience & knowledge/practice/perception

Knowledge	Experience			p-value
	<10 yrs	10-20 yrs	≥21 yrs	
Have you heard about Ring Adair Elwyn (RAE) tube?				
Yes	12 (35.3)	7 (33.3)	10 (55.6)	
No	22 (64.7)	14 (66.7)	8 (44.4)	0.284
In which area of the mouth was the oral RAE tube placed?				
Corner of the mouth	10 (90.9)	5 (83.3)	10 (100)	
In the midline	1 (9.1)	1 (16.7)	0 (0)	0.450
Practice				
Have you treated a patient under general anaesthesia intubated using Ring Adair Elwyn (RAE) endotracheal tube?				
Yes	11 (91.7)	6 (85.7)	10 (100)	
No	1 (8.3)	1 (14.3)	0 (0)	0.503
Have you faced any problems due to the presence of the RAE tube orally?				
Yes	0 (0)	2 (33.3)	4 (40)	
No	11 (100)	4 (66.7)	6 (60)	0.67
When oral intubation is the only choice, do you face any of these difficulties?				
Obstructed surgical view				
Yes	19 (55.9)	16 (76.2)	10 (55.6)	
No	15 (44.6)	5 (23.8)	8 (44.4)	0.267
Difficulties in taking impressions				
Yes	17 (50)	14 (66.7)	13 (72.2)	
No	17 (50)	7 (33.3)	5 (27.8)	0.231
Tube displacement				
Yes	16 (47.1)	12 (57.1)	8 (44.4)	
No	18 (52.9)	9 (42.9)	10 (55.6)	0.686

CONTINUE

Table VI: Association between experience & knowledge/practice/perception (CONT.)

Knowledge	Experience			p-value
	<10 yrs	10-20 yrs	≥21 yrs	
Limitation of some Procedures				
Yes	9 (26.5)	11 (52.4)	8 (44.4)	0.131
No	25 (73.5)	10 (47.6)	10 (55.6)	
Perception				
Which route of intubation do you prefer?				
Nasal	25 (73.5)	18 (85.7)	15 (83.3)	0.719
Oral	4 (11.8)	2 (9.5)	2 (11.1)	
No preference				
What is the level of your agreement in using this modified technique of oral intubation with RAE tube placed in the corner of the mouth?				
Disagree	0 (0)	1 (4.8)	4 (22.2)	0.055
Neutral	14 (41.2)	10 (47.6)	7 (38.9)	
Agree	20 (58.8)	8 (47.6)	7 (38.9)	
The literature has reported that nasal intubation might lead to some complications such as epistaxis. In light of this, do you think this technique worth consideration?				
Disagree	0 (0)	1 (4.8)	1 (5.6)	0.303
Neutral	7 (20.6)	8 (38.1)	7 (38.9)	
Agree	27 (79.4)	12 (57.1)	10 (55.5)	
Do you think using this modified oral technique will make it more difficult for you to perform the procedure compared to nasal intubation?				
Yes	14 (41.2)	9 (42.9)	15 (83.3)	0.009
No	20 (58.8)	12 (57.1)	3 (16.7)	

DISCUSSION

This study aimed to assess paediatric dentists' preferences regarding the route of endotracheal intubation and their perceptions of a modified oral intubation technique using an RAE tube during dental general anaesthesia.

DGA is a core service in paediatric dentistry, and the surgical procedures conducted as part of DGA are in the mouth (14). Thus, the type of intubation may directly impact the quality of treatment provided, especially if there is interference with the surgical site. This study showed that NTI was the preferred choice among 79.5% of participants and that they lacked familiarity with the RAE tube but were willing to consider it in their practice. The procedure for introducing the modified RAE is not different from established oral intubation techniques. The technique is different in terms of tube fixation. Fixation of this tube in the buccal fold and securing it at the angle of the mouth with adhesive tapes is the new technique here, which has been well illustrated in the figure 1 above. The advantage of this special tube and fixation technique over other oral is the lack of the need to change the tube side and no interference with the occlusion. This technique has been used by one of the author in over 600 cases over a period of 10 years (unpublished data from an internal audit process, and is

continued to be used till today). The size of the RAE tube is calculated by the formula; a) Children under 6 years of age: $3 + (\text{age} / 3)$ while children from 6 to 12 years of age: $4 + (\text{age}/4)$. One size smaller tubes are used in apparently smaller children to prevent endo-bronchial advancement.

In line with previous studies, it was assumed that paediatric dentists prefer the NTI technique because it provides an uninterrupted surgical field.⁶ Nevertheless, the complications associated with NTI are considered one of the many causes of general anaesthesia-related morbidity and mortality. Epistaxis is the most common complication of NTI due to nasal mucosal trauma. The use of esophageal stethoscope-obtured ETTs was reported to be effective and comparable to thermos-softening, in preventing epistaxis associated with nasotracheal intubation (15). NTI is performed through a relatively narrow nasal cavity; hence, additional care is needed. The technique has developed over the years with accumulated clinical experience and improved equipment to enable safe intubation and minimize complications (16). This aligned with the findings of the present study, where 53 participants (72.6%) expressed that nasal intubation is associated with more complications. Nevertheless, our results indicated that nasal intubation was the preferred technique for most of

the respondents, despite their belief that it is associated with more complications. Thus, any advancement in intubation techniques to address the issue with potential improvement to reduce these complications is viewed with optimism.

To the authors' knowledge, this study is the first to investigate the preference of the intubation route among GCC paediatric dentists and to explore their familiarity with and perceptions of a modified oral intubation technique using an RAE oral tube.

In the present study, 60.3% of the respondents (44 out of 73) were unfamiliar with the RAE tube. Reasons for this may include a lack of knowledge of PD about anaesthesia armamentarium or little interest in knowledge development in that field. Another reason could be that the anaesthetists are not familiar with this modified technique or feel uncomfortable utilizing it. Therefore, it is important to establish communication between paediatric dentists and anaesthetists and to mutually agree on the best endotracheal intubation to use. Among the remaining 29 respondents, 27 (93.1%) treated patients under GA using an RAE tube, and 25 (92.6%) out of those 27 respondents reported the tube was positioned in the corner of the mouth. The remaining 2 (6.9%) reported that the tube was placed in the midline. This might be attributed to the anaesthetist's skill or comfort and the operator's request. In other words, this might be based on an agreement between the dentist and the anaesthetists in line with performed procedure.

Most participants were aware that NTI is associated with more complications, which agrees with the literature. For example, Holzapfel (2003) reported that NTI was associated with more inconvenience and complications than OTI (17). These results were consistent with those of Erle et al. (2017), who reported that NTI posed more challenges than standard orotracheal intubation (18). The current survey shows that 61.6% of respondents have encountered obstructed surgical view when oral intubation was the only choice, while 61.3%, 49.5%, and 38.4% participants, respectively, reported obstructions while taking impressions, tube displacement, and the limitation of some procedures. Possible causes of tube displacement as reported by Weiss et al. (2006), who stated that head and neck manipulation and flexion during dental and ENT surgeries and while turning and lifting children lead to the inadvertent extubation of the tracheal tube (19). No challenges related to dental procedures under GA have been documented in the literature to the authors' knowledge. Therefore, the authors believe the reported complications might be attributed to several human- and procedure-related factors. Human-related factors may include the operator's skills and experience in managing dental procedures under GA and the anaesthetist's experience in securing the oral tube. Procedure-related factors may

consist of the sizeable orotracheal tube and its connector obstructing the surgical view.

Our study found a significant reporting of displacement as a difficulty in (64.3%) of the respondents in the 36–45 age group compared to other age groups. This might be because most of the respondents were from this age range (38.4%). In addition, this age group might have performed more DGA cases, have higher years of experience, and have worked with different anaesthetists with different skills compared to the younger age group with limited experience. Moreover, 57.7% of the ≥ 46 age group faced other limitations, compared to the 25–35 and 36–45 age groups ($p = 0.013$). The same age group (≥ 46 age group) showed the least level of agreement in utilizing the proposed modified intubation technique compared to the younger age groups ($p=0.027$), which may be attributed to the fact that older paediatric dentists might be more resistant to changing the way they practice. Another possible explanation might be the fact that older anaesthetists have tried many techniques and know which techniques make them the most efficient. In addition, the answers to the open-ended questions showed most of the respondents believed that it is still orotracheal intubation with its associated interruptions. Another possible reason for not using RAE tubes may be that some clinics and hospital units do not have them available. This was also reflected in the level of significance found between dentists' years of experience and their belief that this modified technique will make it more challenging to perform dental treatment when compared to nasal intubation. Whereas (83.3%) of respondents with ≥ 21 years of experience believed it would make it difficult compared to those with less than ten years of experience (41.2%), and those with 10–20 years of experience (42.9%).

The current study found that most respondents leaned toward nasal intubation as the route of choice. These results align with Adewale (20), who reported that NTI is the route of choice in dental GA among clinicians due to improved accessibility. In the same vein, Piepho et al. (21) reported that NTI remains the preferred intubation route for oral and maxillofacial procedures.

The literature does not provide evidence of agreement regarding the use of the modified oral intubation technique using an RAE tube placed in the corner of the mouth. In light of the perceived complications associated with NTI and traditional oral intubation reported in the present study, two-thirds of respondents believed it was worth consideration. This might be attributed to the fact that paediatric dentists are reconsidering patient safety, in addition to their willingness to provide dental treatment under GA in a safe manner without any interruptions. It is surprising that although most of the respondents reported that this modified technique is worth considering, almost half the respondents, still believe that this technique would make it difficult to

perform procedures compared to NTI. According to their comments, most of the respondents believed that it is still oral intubation and that they would continue to face the challenges mentioned previously. Thus, they felt it would still hinder performance. Others noted that they were not certain that the modified technique provided a clear intra-oral surgical view.

The participants' answers to the two open questions—"Can you please specify the problems associated with the RAE tube being placed orally?" and "What are the reasons that make you feel that the RAE intubation technique will make it more difficult for you to perform procedures compared to nasal intubation?"—were grouped into two themes: the difficulty of performing dental procedures compared to NTI and complications faced when using RAE. Most respondents answered the first question with "rubber dam insertion and restoration," "impression is not easy to obtain," or "some reported limitation of space intraorally." The answer to the second question was "having a tube in the mouth still obstructs the field even if it is at the corner" or "I have never seen it implemented, but I think it may interfere with occlusal assessment." A reasonable approach to addressing the issues arising from the comments of the participants revolving around the two themes could be to create a video demonstrating how the tube is secured in such a way that it does not interfere with the surgical field and that it offers the possibility to place the rubber dam and showing the ease of performing procedures without any interruptions.

In some cases where the mouth is small, it may be difficult to tuck the RAE tube behind the last tooth and the tube has to be moved to the other side of the operator and anesthetist may use nasal intubation. However, in most cases, it is possible to use the RAE tube in mixed dentitions as it can be placed and secured far posteriorly in the retromolar area as shown in figure 1.

The primary strength of this study lies in its novelty, as it is the first to investigate pediatric dentists' preferences regarding the use of a GA-modified oral RAE tube in child dental patients. The use of an RAE tube has the potential to address several previously reported disadvantages and complications associated with nasal and traditional intubation routes. A recent narrative review by Kim and Jeon (2024) concluded that NTI is a valuable airway management technique for pediatric patients, providing specific advantages in certain situations. However, healthcare providers must ensure safe and effective airway management, understand its indications, potential complications, and the latest advancements in airway management.

To facilitate the adoption and implementation of the modified RAE technique in real-world clinical settings, several challenges must be addressed. These include:

1. Training and Skill Acquisition: Successful adoption

of the modified RAE technique may necessitate additional training for pediatric dentists and anesthetists. This could be achieved through hands-on workshops, simulation-based training, and integration into continuing education programs to ensure competency and confidence in its use.

2. **Cost Considerations:** The large-scale implementation of this technique may be influenced by financial factors, including the cost of specialized equipment and potential modifications to existing intubation protocols. Economic feasibility studies and cost-benefit analyses may be necessary to support its adoption.
3. **Regulatory and Institutional Approval:** Introducing new intubation methods requires rigorous validation, including institutional approvals, clinical trials, and adherence to regulatory guidelines. Establishing standardized protocols and obtaining endorsements from relevant professional bodies could facilitate this process.
4. **Feasibility of Large-Scale Implementation:** Variations in clinical settings, resource availability, and institutional policies may impact the widespread adoption of the modified RAE technique. Addressing these disparities through tailored implementation strategies is essential.

To overcome these barriers, future efforts should focus on conducting multi-center studies, fostering collaborations with professional organizations, and developing clear guidelines for integration into clinical practice. These strategies could enhance acceptance and ensure the safe and effective implementation of the modified RAE technique in pediatric dental care.

Several methodological considerations in our study warrant discussion. First, the survey was distributed via e-mail and social networking applications. Having an open population, the authors could not predict the participants' response rate. Moreover, with the use of a relatively small sample size, caution must be applied, as the findings might not be conclusive and can be generalized to all GCC and worldwide population. This may be attributed to the limited number of paediatric dentists in GCC countries who treat patients under GA. In addition, some paediatric dentists may not have access to the aforementioned social media applications. Another limitation of this study is the uneven distribution of sample size among GCC countries included in this study. Thus, we were not able to compare the results among GCC countries individually. Nevertheless, the current study forms a base for future studies in which the sample size could be expanded.

Conclusions

The majority of the respondents believed that nasotracheal intubation is associated with more complications compared to orotracheal intubation.

Despite that, nasotracheal intubation was considered the route of intubation of choice. Less than half of the participants were familiar with the RAE tube and reported that it was placed at the corner of the mouth in almost all situations. The most common perceived complications with oral intubation were obstruction of surgical view, followed by tube displacement. The modified oral intubation technique using the RAE tube should be further investigated as to its appropriateness and limitations.

We recommend e-Education programs for paediatric dentists with videos demonstrating how the RAE tube could be secured in such a way that it does not interfere with the surgical field and that it allows the possibility to place the rubber dam showing the ease of performing procedures without any interruptions. In addition, hands-on simulation workshops are also recommended to familiarize paediatric dentists with the feasibility of RAE tube in paediatric DGA. Further research studies including randomized clinical trials are needed to evaluate PDs and anesthetists' knowledge, perception, and practice of DGA intubation techniques and their familiarity with the modified RAE tube technique.

ACKNOWLEDGEMENTS

We applied the 'first-last-author-emphasis' norm (FLAE) for the sequence and credit of authors' contributions. Author no. 1 conceived the idea, conducted the data collection, and wrote the initial drafts of the paper. Authors no. 2, 3, 4 contributed to the design, supervision and write up of the paper. Author 5 conducted the statistical analysis. Author 6 conceived the idea. Author 7 conceived the idea and design, supervision of the project, data collection, analysis, write up and corresponding author.

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