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Throat Packing in Pediatric Dental General Anesthesia: Effects on PONV and Postoperative Sore Throat in a Randomized Trial

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Abstract

Throat packs are frequently inserted during orofacial operations to reduce postoperative nausea and vomiting (PONV). However, available research offers conflicting results regarding their usefulness, and their application has been connected to complications, including throat discomfort after surgery and the risk of accidental retention. This investigation examined the ability of throat packs to prevent PONV and postoperative sore throat in children with special healthcare needs (SHCNs) receiving dental care under general anesthesia. 80 children diagnosed with SHCNs were randomly allocated into two arms: the throat pack group (Group TP, n = 41) and the group without a throat pack (Group n-TP, n = 39). A throat pack was inserted for participants in Group TP, and assessments of PONV, together with sore throat, were performed at 1, 2, and 4 hours following the procedure. All data were processed using the Statistical Package for the Social Sciences (SPSS) version 23.0. The trial was registered on ClinicalTrials.gov under the registration number NCT06169306 on 28 December 2023. Participants assigned to Group n-TP demonstrated considerably elevated PONV levels at both 1 hour and 2 hours after surgery ($P < 0.001$, $P = 0.019$, respectively). Scores on the Visual Analog Scale (VAS) for throat pain were also substantially greater in Group TP at these same intervals ($P < 0.001$, $P = 0.002$, respectively). Insertion of throat packs during dental procedures under general anesthesia in children with SHCNs reduced PONV frequency but increased the incidence of postoperative sore throat.

Keywords: Dental treatment, PONV, Children with special healthcare needs, Throat pack, Sore throat

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Introduction

Throat packs continue to serve as a standard measure intended to prevent the aspiration or inhalation of blood and surgical debris, especially in orofacial surgeries and dental interventions performed under general anesthesia [1]. Postoperative nausea and vomiting (PONV) ranks among the most common complaints following operations that involve general anesthesia [2], largely because blood and other fluids reaching the stomach act as a key trigger. Beyond lowering satisfaction with recovery, PONV can produce serious issues such as loss of fluids and disruptions in electrolyte balance. Children experience this problem more often than adults, with reported rates spanning 33% to 82% [3]. Scientific publications provide little solid evidence that throat packs actually curb PONV by reducing blood entry into the stomach, and no unified position exists among surgeons, anesthetists, or dental

specialists regarding the complications associated with their placement [4]. The gravest concerns include throat pain, swallowing difficulties, and the potentially lethal danger that the pack may be overlooked and left inside before the breathing tube is removed. Cases of death caused by retained throat packs have been documented. Moreover, these packs tend to intensify postoperative throat soreness and cause tissue damage, as well as swelling in the mouth and pharynx [5].

The American Academy of Pediatric Dentistry characterizes special healthcare needs (SHCNs) as any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or restriction that demands ongoing medical attention, healthcare services, or access to tailored support programs [6]. Young patients with SHCNs face an elevated risk of dental caries and related oral conditions, driven by challenges with daily oral hygiene, bite misalignment, consumption of sugary foods, and gaps in understanding oral hygiene practices. Providing reliable dental treatment for this population often requires general anesthesia, making it vital to identify and address potential adverse events [3] promptly. In addition, these children often struggle to describe or report the discomfort they feel, which means every element of their treatment—from surgical methods to anesthesia protocols—must be selected with the lowest possible risk of unwanted effects. Apart from throat packs, several other factors can contribute to PONV and a sore throat during general anesthesia, including endotracheal tube placement, excessive cuff pressure, the specific anesthetic medications used, and unintended gastric inflation with gas [7]. Consequently, achieving a smooth and safe discharge while keeping unpleasant symptoms to a minimum remains a priority after outpatient operations. Carefully standardized research with dependable findings is essential to establish the true balance between the benefits and drawbacks of throat pack use. To date, only a single published study has specifically tested the efficacy of throat packs in reducing postoperative complications in pediatric cases [8]. Current medical literature does not provide clear recommendations on routine throat packing for children with SHCNs, particularly when general anesthesia already carries added risks. For this reason, the current study explored the influence of throat packs on PONV and sore throat during dental procedures performed under general anesthesia in children with SHCNs. We proposed the hypothesis that throat pack application in such dental treatments under general anesthesia would show no meaningful effect on either PONV or postoperative sore throat.

Materials and Methods

Ethical approval

The study protocol was reviewed and approved by the Ethics Committee for Noninvasive Clinical Research at Çukurova University Faculty of Medicine, in line with the principles of the Declaration of Helsinki (approval number 2022/118-49). The trial adhered to CONSORT reporting standards and was prospectively registered on clinicaltrials.gov under identifier NCT06169306 on 28 December 2023.

Sample selection and randomization

This randomized controlled trial enrolled children aged 5–16 years with special healthcare needs (SHCNs) who were unable to cooperate for dental care and presented to the Pediatric Dentistry Clinic of Çukurova University Faculty of Dentistry between December 2023 and April 2024.

Sample size estimation was carried out using G Power software (version 3.1.9.2). A total of seventy-four participants (37 per group) were planned to provide 95% statistical power at a 5% significance level with an effect size of 0.8. The corresponding noncentrality parameter λ was calculated as 3.65, and the critical t-value was 1.98.

Inclusion criteria were as follows: (1) written parental consent and agreement to take part, (2) age ranging from 5 to 16 years, (3) American Society of Anesthesiologists (ASA) physical status classification of grade 1 or 2 [9], (4) planned need for at least one tooth extraction plus one restorative procedure (either amalgam or composite restoration), and (5) presence of a physical, developmental, sensory, or other limiting condition that requires medical supervision, excluding primary mental disorders, while the child retained the ability to communicate (for example: epilepsy, cerebral palsy, cystic fibrosis, congenital heart disease, developmental delay, or metabolic disorders).

Exclusion criteria comprised: (1) existing tracheostomy, (2) predicted difficult airway or intubation, (3) any comorbid conditions involving the esophagus, stomach, or intestines, (4) prior percutaneous endoscopic gastrostomy, (5) previous history of PONV, (6) morbid obesity, (7) elevated baseline airway pressures, (8) known hypersensitivity to any of the planned anesthetic or analgesic agents, (9) requirement for an anesthesia technique different from the standardized protocol, and (10) presence of intellectual disability.

Of 108 children with SHCNs initially screened preoperatively, 90 met all inclusion and exclusion criteria and were enrolled. To ensure balanced groups and reduce selection bias, an internet-based randomization tool (researchrandomizer.org) was utilized, along with a random number table for the final assignment that accounted for age and gender distribution. 10 enrolled patients were subsequently withdrawn after completing general anesthesia because they did not undergo at least 1 extraction and 1 restorative procedure, as stipulated in the inclusion criteria. Ultimately, the analysis included 41

children in the throat-packing arm (Group TP) and 39 in the non-throat-packing arm (Group n-TP) **(Figure 1)**.

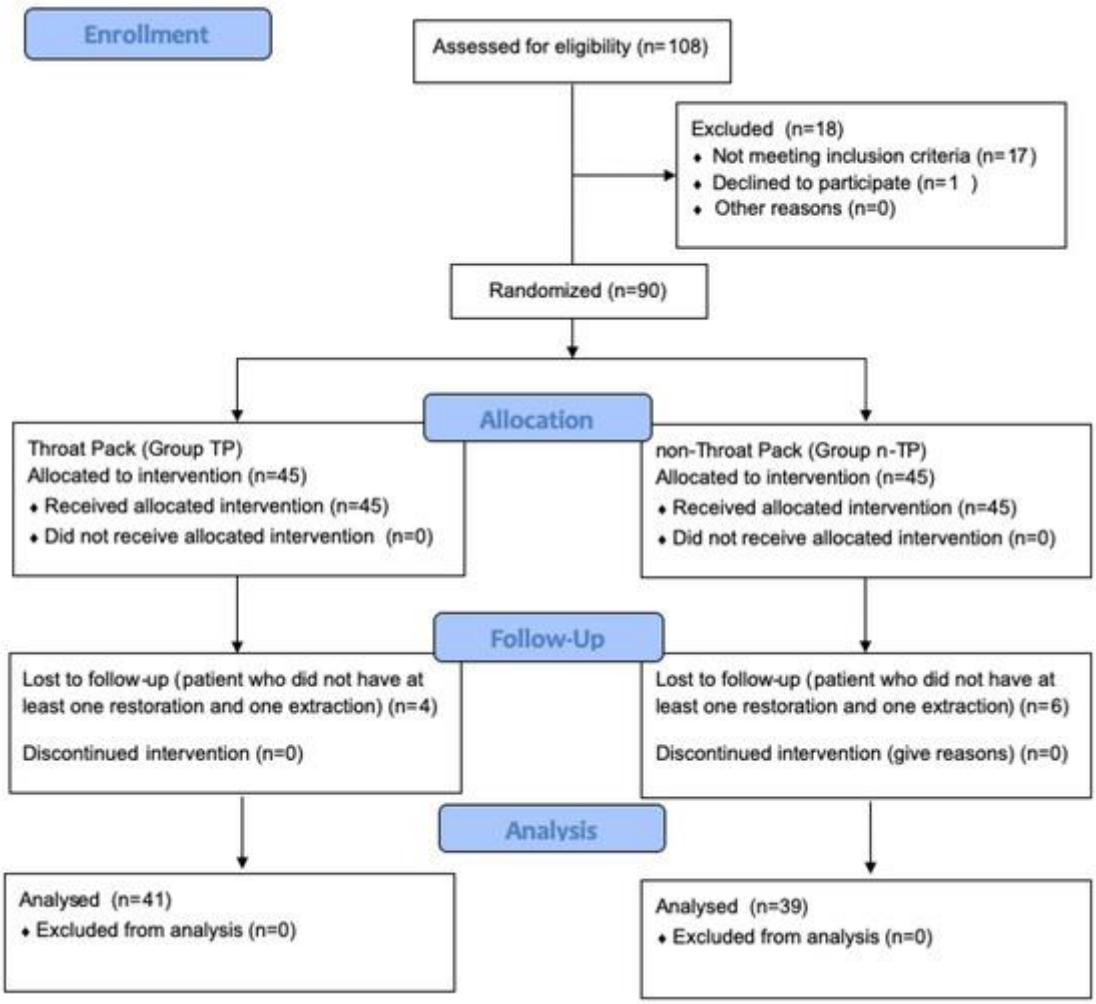

Figure 1. Participant flow diagram.

Procedures

Before surgery, every child received oral midazolam premedication in the holding area (0.5 mg/kg for those weighing less than 20 kg and 0.3 mg/kg for those weighing 20 kg or more). After premedication, patients were brought into the operating theatre together with a parent. A peripheral intravenous line was inserted using a 22–24 G cannula, and maintenance fluid consisting of 5% dextrose in 0.45% sodium chloride was infused at 4 mL/kg/h. Standard monitoring — electrocardiography (ECG), noninvasive blood pressure (NIBP), and oxygen saturation (SpO2) — was established for all cases.

Induction of general anesthesia was achieved with propofol at 2 mg/kg, immediately followed by the neuromuscular blocking agent rocuronium at 0.5 mg/kg. Controlled mechanical ventilation in volume-controlled mode (VCV) was applied using age-appropriate respiratory rates, a tidal volume of 8 mL/kg, and a maximum peak inspiratory pressure of 15 cmH2O. Intubation was performed by the same anesthesiologist in every case, employing a Macintosh blade and a cuffed endotracheal tube (Bıçakçılar, İstanbul, Turkey) sized according to the child's anthropometric data. Cuff pressure was standardized at 20 cmH2O and verified at 30-minute intervals with a dedicated manometer (Endotest, Teleflex Medical, Rush, Athlone, Ireland) to remain within the target range. Maintenance anesthesia consisted of 1–2% sevoflurane delivered in a 50:50 nitrous oxide/oxygen mixture. For patients in Group TP, the same pediatric dentist inserted a single sterile, radiopaque, saline-soaked gauze throat pack into the oropharynx using 35 × 35 mm forceps. The pack was anchored externally at the mouth corner using a sterile 1.0 silk suture to prevent accidental retention, and its presence was explicitly noted on the anesthesia safety checklist. No throat pack was placed in children assigned to Group n-TP.

The same pediatric dentist carried out all dental interventions. Initial periodontal scaling was performed in every patient, followed by restorative work, with extractions completed at the end. A local anesthetic containing 40 mg/mL lidocaine with 0.01 mg/mL epinephrine (Maxicaine Fort) was used throughout. The

same dental assistant supported the operator for all procedures. Extraction sites were closed with sutures, and hemostasis was secured using a hemostatic dressing.

Perioperative methylprednisolone was given at 1 mg/kg, and postoperative pain management began with paracetamol at 10 mg/kg. Once dental treatment was finished, the throat pack was carefully removed in Group TP patients. Anesthesia records were completed, and general anesthesia was discontinued. Neuromuscular blockade was reversed with sugammadex at a dose of 2 mg/kg. Before extubation, an orogastric tube was used to aspirate gastric contents and check for blood, with the results documented. Patients were extubated only after return of consciousness and adequate spontaneous respiration, then transferred to the recovery area. Once fully awake, they moved to the day-surgery observation unit for a 4-hour monitoring period [10]. An independent anesthesiologist, unaware of group allocation and not involved in the case, assessed PONV and sore throat scores for all children in both groups at 1, 2, and 4 hours after surgery. Discharge was permitted only when the Modified Aldrete score was 9 or above [11].

Sore throat intensity was quantified at 1, 2, and 4 hours post-extubation using the Visual Analog Scale (VAS) from 0 (no pain) to 10 (worst imaginable pain). PONV was evaluated at the same intervals using the Baxter Retching Faces (BARF) pictorial scale [12], which ranges from 0 (no nausea/vomiting) to 10 (most severe). After the fourth postoperative hour, rescue medication was administered as follows: paracetamol 10 mg/kg for any VAS score exceeding 5 and ondansetron 0.15 mg/kg for any BARF score exceeding 4.

Statistical analyses

Statistical analysis of the collected data was performed using the Statistical Package for the Social Sciences (SPSS) version 23.0. Counts and percentages were used to describe categorical variables. For continuous variables, results were expressed as mean ± standard deviation, with medians and ranges provided when appropriate. Normality of data distribution was examined through the Shapiro–Wilk test. The chi-square test is used for comparing categorical variables between groups. Variables that failed to meet normality assumptions were analyzed with the Mann–Whitney U test. Any result yielding a p-value below 0.05 was regarded as statistically significant.

Results and Discussion

This investigation examined 80 children aged 5–16 years with special healthcare needs (SHCNs). Among them, 49 were boys (61.3%), and 31 were girls (38.7%). The average age across all participants was 8.44 ± 2.90 years, and the mean body weight was 26.1 ± 11.4 kg. Further examination confirmed that the two study arms had comparable sex ratios, ages, and weights **(Table 1)**.

Table 1. Patient characteristics.

	P-value [a]	Group n-TP (n = 39) n (%)	Group TP (n = 41) n (%)
Sex			
Male	0.610	25 (64.1)	24 (58.5)
Female		14 (35.9)	17 (41.5)
	P-value [b]	**Mean ± SD**	**Mean ± SD**
Age	0.808	8.28 ± 2.8	8.59 ± 3.2
Weight	0.965	26.1 ± 12.0	26.2 ± 10.9

P-value < 0.05, a: Ki-kare, b: Mann–Whitney U, and SD: standard deviation.

The average surgical duration across procedures was 69.1 ± 26.9 minutes. Operation times showed no notable variation between the groups. In addition, the frequency and types of dental interventions — specifically restorative fillings and tooth extractions — remained balanced and exhibited no meaningful differences across the two groups **(Table 2)**.

Table 2. Distribution of operation time and dental procedures performed by groups.

Variable	P-value[b]	Group n-TP (n = 39) (Mean ± SD)	Group TP (n = 41) (Mean ± SD)
Duration of operation	0.843	69.6 ± 27.9	68.5 ± 26.4
Dental procedures			
Restorative procedures	0.984	6.75 ± 2.5	7.40 ± 4.7
Tooth extractions	0.306	5.17 ± 3.1	6.06 ± 3.8

P-value < 0.05, b: Mann–Whitney U test, SD: standard deviation.

Aspiration of stomach contents performed immediately before extubation at the end of surgery detected no blood in any child assigned to Group TP. By comparison, blood was present in the gastric aspirate of eight children in Group n-TP, and this difference reached statistical significance (P = 0.002) **(Table 3)**.

Table 3. Quality of gastric contents.

	p-Value [a]	Group n-TP (n = 39) n (%)	Group TP (n = 41) n (%)
Bloody	**0.002 ***	8 (20.5)	-
Not bloody		31 (79.5)	41 (100)

* P-value < 0.05, a: Ki-kare.

Assessment of postoperative throat discomfort revealed significantly elevated Visual Analog Scale (VAS) scores in the Group TP patients at the 1-hour and 2-hour marks

after surgery (P < 0.001 and P = 0.002, respectively) **(Table 4)**. In contrast, evaluation of postoperative nausea and vomiting (PONV) demonstrated markedly higher scores among children in Group n-TP at the same postoperative intervals (P < 0.001 and P = 0.019, respectively) **(Table 4)**.

Table 4. Postoperative data.

	P-value [b]	Group n-TP (n = 39) (Mean ± SD)	Group TP (n = 41) (Mean ± SD)
Sore throat, VAS at 1 h	**< 0.001 ****	0.21 ± 0.9	1.32 ± 1.7
Sore throat, VAS at 2 h	**0.002 ***	0.05 ± 0.3	0.61 ± 1.1
Sore throat, VAS at 4 h	0.087	0.0 ± 0.0	0.17 ± 0.6
PONV at 1 h	**< 0.001 ****	1.23 ± 1.7	0.0 ± 0.0
PONV at 2 h	**0.019 ***	0.26 ± 0.7	0.0 ± 0.0
PONV at 4 h	0.305	0.05 ± 0.3	0.0 ± 0.0

* P-value < 0.05, ** P-value < 0.001, b: Mann–Whitney U test, VAS: visual Analog Scale, PONV: postoperative nausea and vomiting, and SD: standard deviation.

During dental procedures such as periodontal cleaning, restorative work, and tooth extractions performed under general anesthesia, various substances, including water, blood, saliva, debris, calculus, fractured tooth fragments, root remnants, and leftover filling materials, accumulate in the oral cavity. Because blood possesses strong emetic effects once it enters the digestive tract, throat packs are commonly inserted to reduce the chance of inhaling or swallowing foreign material, surgical waste, blood, or other liquids — even when an endotracheal tube cuff is in place. Nevertheless, agreement on the actual benefit of throat packs remains elusive, and their use may lead to increased postoperative throat discomfort. The present investigation sought to clarify the influence of throat packs on both PONV and sore throat among children with special healthcare needs (SHCNs). Results indicated that PONV occurred at a markedly higher rate in the group without throat packs (Group n-TP) during the postoperative phase. In contrast, the sore throat was more pronounced in the group that received throat packs (Group TP). Consequently, the initial hypothesis stating that "throat pack placement during dental treatments performed under general anesthesia in children with SHCNs exerts no effect on PONV or postoperative sore throat" was not supported by the findings.

Advances in contemporary healthcare have led to longer survival among children with medical and developmental challenges, which in turn has raised the likelihood of dental decay and gum disease in this population. As a result, dental care for children with SHCNs is most often delivered under general anesthesia [3]. One key benefit of this approach is the ability to complete all necessary treatments in a single session without depending on the child's cooperation. PONV ranks among the most frequent complications observed after operations conducted under general anesthesia. Research focusing on young patients has documented a greater occurrence of PONV in those with SHCNs compared with otherwise healthy children [3]. The existing literature presents mixed conclusions: some reports indicate that throat packs fail to reduce PONV, while others maintain that these packs help prevent it [2, 5, 13-19]. In one investigation by Temel and colleagues, which assessed throat packs during nasal operations using ultrasound to measure gastric volume, the authors found that throat packs reduced gastric volume and functioned as a physical barrier, decreasing the frequency of PONV [20]. In the current trial, gastric aspiration performed just before extubation revealed blood in the stomach contents of eight children in Group n-TP, yet only one participant in the entire cohort required antiemetic medication afterward. The observation that PONV rates remained elevated during the first 2 postoperative hours among patients who did not receive a throat pack supports the idea that throat packs serve as an effective protective barrier.

That said, the entry of blood into the stomach is not the sole trigger for PONV. Multiple additional elements associated with general anesthesia — such as the nature and length of the procedure, the specific anesthetic drugs administered, and any factors promoting gastric distension — can influence how often PONV develops. Evidence has shown that nitrous oxide does not heighten the risk of PONV and can safely be employed in pediatric cases [21]. Moreover, antiemetic preventive measures can mitigate nausea and vomiting caused by inhaled anesthetics [22], and agents such as dexamethasone or methylprednisolone have demonstrated reliable protective effects against PONV [21]. In the present study, every participant received methylprednisolone, thereby providing uniform antiemetic coverage.

During anesthesia induction in children, manual ventilation controlled by the provider often prevents consistent standardization of airway pressure and tidal volume, raising the possibility of gastric inflation that may lead to nausea and vomiting [23]. For this reason, experts advise limiting peak airway pressure to 15 cmH2O during mechanical ventilation in young patients to minimize the risk of gastric distension. In this trial, all children underwent volume-controlled mechanical ventilation with age-adjusted respiratory rate and tidal volume settings before intubation, deliberately chosen to avoid gastric insufflation. This approach successfully eliminated variability linked to manual hand-ventilation and prevented uncontrolled high tidal volumes that could otherwise cause gastric distension.

The exact reason why a sore throat develops after procedures performed under general anesthesia remains unclear. However, it is widely believed to result from irritation and swelling in the trachea caused by the endotracheal tube. Factors such as the tube diameter, cuff pressure, and the overall duration of intubation can increase the likelihood of this irritation and inflammatory response. In particular, cuff pressures exceeding 30 cmH2O are known to interfere with blood flow to the tracheal lining, potentially causing tissue death. Current guidelines recommend maintaining cuff pressure at 20 cmH2O [24]. Across various operations conducted under general anesthesia, the rate of postoperative sore throat linked to endotracheal intubation ranges from roughly 14.4% to 62% [25]. Throat packs are suspected of worsening postoperative throat discomfort by causing mechanical injury and fluid accumulation in the mouth and throat [5, 26]. In one earlier investigation involving orthognathic surgery patients in which cuff pressure was carefully managed and throat packs were inserted, the postoperative sore throat rate was 34% [27]. In line with those observations, the present trial also found significantly higher postoperative sore throat levels among children in Group TP. Importantly, the intensity remained mild, with VAS scores staying at or below 5, so no additional pain relief was needed after surgery. To the authors' knowledge, no previous investigations have examined this specific patient group and setting, making direct comparison of the current outcomes with existing data difficult.

Postoperative throat pain appears to be linked to the dimensions of the throat pack, yet clear recommendations or standardized sizing protocols are lacking in the literature. Research conducted in adult populations has revealed considerable inconsistency in the sizes of throat packs employed. In several of those reports, the actual size of the pack was not even documented [14, 17, 19, 20, 26, 28]. Although some studies have addressed complications connected with throat pack use in pediatric patients, none have thoroughly explored how pack size relates to the development of sore throat or its possible influence on PONV [8].

Beyond sore throat, other frequent concerns with throat packs include difficulty swallowing, unintended shifting of the endotracheal tube, injury to the pharyngeal nerves, tongue swelling, and — most critically — the risk that the pack may be left behind before the patient is extubated [29]. Leaving a throat pack in place can have severe, even life-threatening, consequences. Multiple instances of retained throat packs have already been documented in medical publications [30, 31]. The likelihood of such an oversight increases in urgent situations in the operating room, such as when rapid emergency extubation is necessary or when handovers between staff are incomplete. To reduce this hazard, various safety measures are routinely applied.

Nevertheless, no foolproof system currently exists. A widely adopted practice involves documenting the presence of the throat pack verbally and in written records, under the oversight of both the anesthesiologist and the surgeon. In 2009, the UK National Patient Safety Agency introduced a helpful algorithm to reduce the risk of forgotten throat packs. The guidance suggested combining at least one visible reminder — for example, a label on the patient or breathing tube, attaching the pack to the tube, or leaving part of it visible outside the mouth — with at least one written confirmation in the surgical notes [32]. In keeping with this approach, the current study employed a visible portion of the throat pack extending from the mouth and ensured its presence was clearly noted both verbally and in the official records.

Because no prior research has specifically investigated the impact of throat pack placement on PONV and sore throat in children with SHCNs undergoing general anesthesia, the authors could not make direct comparisons with other findings. The present work was planned drawing on earlier related studies; however, confirming the observed effects with greater confidence may require larger participant numbers in future trials. Another area requiring attention in subsequent research is the consistent standardization of throat pack sizes across patients, given that available publications offer limited guidance on this matter.

Conclusion

Considering the constraints of this investigation, throat pack insertion during dental procedures under general anesthesia in children with SHCNs proved effective in reducing the risk of PONV by reducing gastric aspiration of blood and debris. At the same time, it resulted in a higher rate of postoperative sore throat. Given the elevated overall risks associated with general anesthesia in this vulnerable population, the use of throat packs can be recommended for dental treatment under general anesthesia in children with special healthcare needs.

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Conflict of interest: None

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Ethics statement: This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Çukurova University (2022/118-49; 7 January 2022).

Written informed consent was obtained from the participants' parents for the present study.

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