

Different Tonsillectomy Techniques: Our Experience

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Abstract

Aim of the study: This study investigates how different tonsillectomy techniques, including the cold steel method, coblation technique, and a device using ultrasonic energy, affect patients' recovery, specifically pain management. Each technique was compared postoperatively using the visual analogue scale, and the study assessed whether the different techniques increased the risk of revision surgery during the short and long postoperative periods.

Methods: Sixty patients were assigned to three groups, with 20 patients in each group (cold steel, coblation, and harmonic ultrasonic scalpel). Patients underwent adenotonsillectomy under general anesthesia using these techniques from November 2024 to July 2025. On the seventh postoperative day, a regular check-up was performed to evaluate pain management using the visual analogue scale. Before surgery, parents of minor children completed the T-14 questionnaire (Throat Disorder Outcome Test), a parent-reported tool used to assess the primary indication for tonsillectomy and adenoidectomy in children.

Results: The study included 60 patients, comprising 26 males (43%) and 34 females (57%). Most patients who experienced postoperative hemorrhage had been operated on with the cold steel method, while there was no statistically significant difference in complications between the ultrasound knife and coblation technique. Visual Analogue Scale (VAS) scores were statistically significantly higher among patients operated on with the cold steel method compared to those who underwent coblation or ultrasound knife procedures.

Conclusion: Both the harmonic scalpel and coblation techniques for tonsillectomy result in better pain management within the first postoperative week, allowing for an earlier return to everyday activities.

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Introduction

Tonsillar tissue consists of pharyngeal lymphatic tissue, known as the "inner Waldeyer's ring," and includes two palatine tonsils, one pharyngeal tonsil (also called the adenoid), one lingual tonsil, and two tonsils located near the pharyngeal opening of the Eustachian tube. These six tonsils are interconnected with lymph nodes in the neck, referred to as the "outer Waldeyer's ring," which connects the tonsils to the lymphatic system of the entire body (1). Tonsillar tissue serves as the first line of defense against bacteria and viruses, and most disorders are seen in children. The term "tonsillar problem" is well known among otorhinolaryngologists and refers to a set of questions used to make an adequate and precise primary indication for tonsillectomy. According to the American Academy of Otorhinolaryngology–Head and Neck Surgery, tonsillectomy is the most common surgical procedure performed in the United States, with more than 500,000 cases annually in children under fifteen years of age (2). The classic definition describes tonsillectomy as a surgical procedure in which the palatine tonsils are removed, with or without the adenoid tissue and its capsule, with special care taken during dissection in the peritonsillar region to completely remove the tonsillar tissue from the muscular pharyngeal wall, which forms the lateral margin of the surgical field. Several surgical techniques are used to perform tonsillectomy. Although we live in an era of technological innovation, the most common technique used today is the cold steel method, which involves scissors and bipolar cauterization, especially in smaller centers. However, tonsillectomy can also be performed using various techniques, including the coblation technique, CO₂ or diode lasers, monopolar cautery, devices utilizing ultrasound energy, and others. Since the classic tonsillectomy technique using scissors and bipolar cauterization is commonly associated with higher postoperative morbidity, particularly regarding postoperative bleeding and pain, we believe that newer, modern techniques such as the coblation method and devices using ultrasound energy have a positive impact on

these issues, leading to a lower rate of hospital readmission requiring secondary surgery for hemostasis. In both the United States and the United Kingdom, tonsillectomy is the most frequently performed surgical procedure by otorhinolaryngologists, either alone or combined with adenoidectomy, with more than 30,000 procedures performed annually in England (3). The two main indications for tonsillectomy, in both children and adults, remain sleep-disordered breathing and recurrent infectious tonsillitis.

The surgical procedure of tonsillectomy using the coblation method differs from the traditional cold steel method in several ways. The main principle of the coblation technique, marketed by Smith & Nephew® (London, UK), is based on radiofrequency current delivered by electrodes at the tip of the probe, or wand, which excites electrolytes in the saline irrigation fluid also delivered to the tip by a suction irrigation channel. This process creates a focused plasma gas that ablates tissue and breaks down molecular bonds. The fragmented debris is aspirated through an aspiration channel. Another key difference between the coblation and cold steel techniques is the temperature generated during ablation, which refers to the precise removal of tissue. The coblation method operates at low temperatures, ranging from 40 to 60 °C, while coagulation mode is achieved at 50 to 70 °C, significantly lower than the bipolar diathermy in the cold steel method, which ranges from 170 to 200 °C (4). Therefore, much lower temperatures are generated when dissecting tonsillar tissue and performing hemostasis with the coblation method, creating favorable conditions for postoperative healing. Besides the coblation method, another option for tonsillectomy is a device that uses ultrasound energy, or harmonic scalpel, a method introduced in 1992. However, to this day, not many otorhinolaryngologists are familiar with it, and this technique is probably the least used for tonsillectomies (5). With this method, surgery is performed using a harmonic scalpel, an instrument that, with ultrasonic waves at a frequency of 55,500 Hz, applies strong molecular vibrations to the tissue, heating the

surrounding surgical area and denaturing proteins. This is achieved by maintaining a temperature range of 40 to 100 °C (6). The advantage of this method is that the surgical instrument simultaneously cuts and cauterizes the tissue, as the ultrasonic energy delivered with the scalpel to the tissue is converted into mechanical energy. Moreover, the harmonic scalpel provides very precise dissection, less thermal damage, and more thorough hemostasis than any other method (7). Similar to the ablation mode in the coblation technique, the amount of heat produced at the tip of the blade at a distance of 1 mm from the surgical area ranges from at least 40 °C to a maximum of 100 °C. More importantly, the amount of heat generated at a distance of 2 mm is only 6 °C (8). Modern, technologically advanced tonsillectomy techniques, such as the coblation method or the use of a harmonic scalpel, positively impact patients' postoperative recovery, facilitate pain management, and reduce the risk of early postoperative hemorrhage. The goal of this study is to compare postoperative pain management using the visual analogue scale among three groups of

patients (cold-steel, coblation method, and harmonic scalpel ultrascission), investigate the main indication for primary surgery, determine whether different tonsillectomy techniques lead to a higher or lower risk of early or delayed postoperative hemorrhage, and assess whether age is an important factor.

Materials and methods

The study was conducted at the Department of Otorhinolaryngology and Head and Neck Surgery, University Hospital Centre Osijek, Croatia. We included 60 patients, both children and adults, diagnosed with either recurrent infective tonsillitis or sleep-disordered breathing as the primary indication for surgery. All patients underwent adenotonsillectomy between November 2024 and July 2025 under general anesthesia, during which the palatine tonsils were removed using one of the three methods investigated. Adenoidectomy was performed in all patients using the classical curettage technique with a Beckmann curette.

Table 1. T-14 Paediatric Throat Disorders Outcome Measure

This is a list of the following symptoms and problems that can be a cause of throatache in your child. We would like to know more about the mentioned problems and would be grateful for information you can give us. There are no right or wrong answers. Please try not to miss any of the following questions.						
1. Snoring loudly during sleep	0	1	2	3	4	5
2. Irregular or stopped breathing during sleep	0	1	2	3	4	5
3. Daytime sleepiness	0	1	2	3	4	5
4. Noisy breathing during the day	0	1	2	3	4	5
5. Breathing through the mouth during the day	0	1	2	3	4	5
6. Problem with poor appetite or poor eating habits (choking with food, etc.)	0	1	2	3	4	5
7. Frequent earache or frequent ear infections	0	1	2	3	4	5
8. Repeated short-term throat infection that lasts less than 2 weeks	0	1	2	3	4	5
9. Constant or chronic throat infections that last more than 2 weeks	0	1	2	3	4	5
10. Many phone calls to the doctor of primary healthcare	0	1	2	3	4	5
11. Many visits to the ENT department	0	1	2	3	4	5
12. Taking antibiotics over and over for less than 2 weeks at a time	0	1	2	3	4	5
13. Taking antibiotics for more than 2 weeks straight	0	1	2	3	4	5
14. Missing school/work days due to sore throats	0	1	2	3	4	5

0 – no problem; 1 – insignificant problem; 2 – insignificant or slight problem; 3 – moderate problem; 4 – severe problem
5 – as bad as it can get

Patients were divided into three groups according to the operative technique used. Each patient underwent a simple randomization process by picking an envelope containing the assigned surgical method. Adults selected envelopes themselves, while parents of minor children did so on their behalf. The first group was treated with the classic tonsillectomy technique, also known as the cold-steel method. The second group underwent surgery using the coblation method, and the third group was treated with the harmonic ultrasonic scalpel. Before surgery, parents were asked to complete the validated T-14 questionnaire (Throat Disorder Outcome Test – Table 1), a parent-reported tool used to assess the primary indication for tonsillectomy and adenoidectomy. Adult patients also completed the questionnaire. The T-14 questionnaire consists of 14 statements about sleep-disordered breathing and issues related to recurrent tonsillitis, including nighttime loud snoring, irregular or stopped breathing during the night, daytime sleepiness, noisy breathing during the day, and the

frequency of visits to a primary practitioner for antibiotics, among others. The first six questions address obstructive symptoms and indications, while the remaining eight address infectious problems and indications for surgery. Each statement is answered on a scale from 0 to 5, where "0" means no problem at all and "5" means the situation is as bad as it could be. The T-14 questionnaire was first designed in 2010 by Claire Hopkins, an otorhinolaryngologist from the UK, who provided written consent for its use in our research. All parents and adult patients signed informed consent.

All patients remained in the hospital for up to 24 hours after surgery for observation and were discharged the following morning. A regular check-up was scheduled on the 7th postoperative day, when patients were asked to rate their pain on a visual analogue scale (Visual Analogue Scale – Figure 2) from 1 to 10, where 0 and 1 indicate no pain, 2 and 3 indicate mild pain, 4, 5, and 6 indicate moderate pain, 7 and 8 indicate severe pain, and 9 and 10 indicate the worst possible pain.

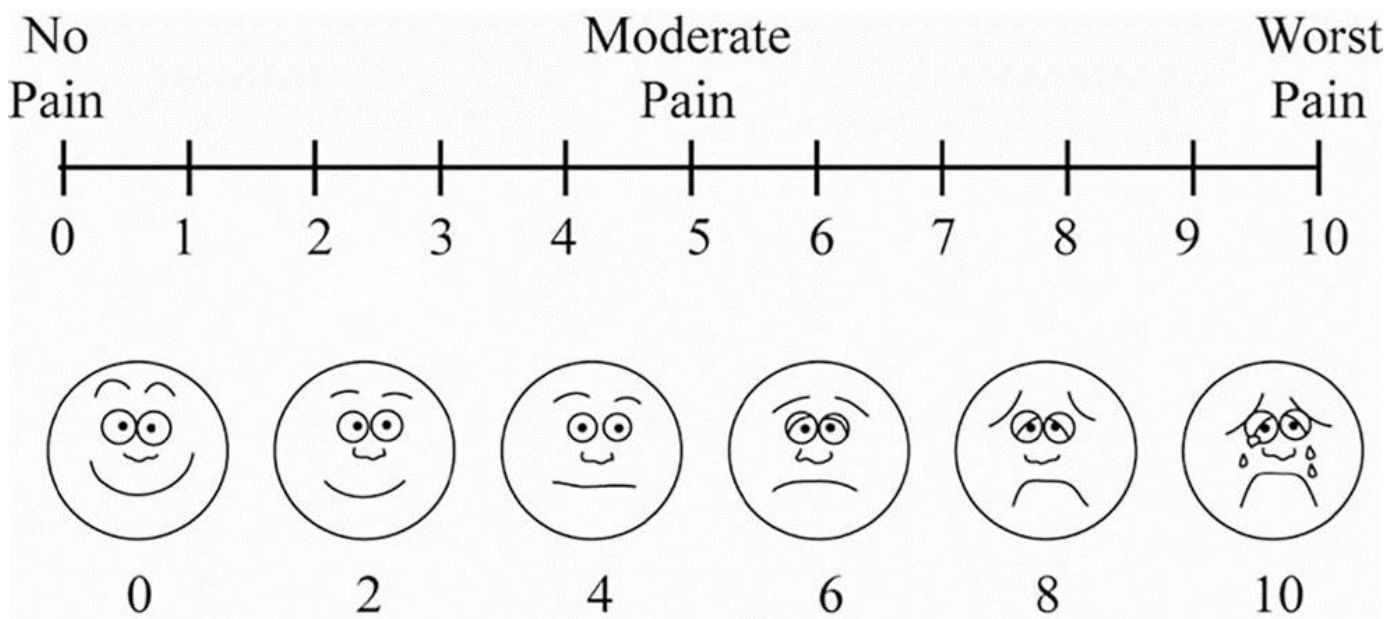


Figure 1. Visual analogue scale (VAS scale)

Inclusion criteria were age between 3 and 30 years, recurrent tonsillitis with five or more infections per year, sleep-disordered breathing, and complications of tonsillitis such as peritonsillar abscess. Exclusion criteria included

patients older than 30 years, those operated on for indications other than tonsillectomy (such as malignant neoplasm of the tonsil or any other relative indication), and patients with family

members diagnosed with severe coagulation disorders, including parents and close relatives. The coblation system used in our practice is the EVAC^o PLASMA WAND Device with Integrated Cable, indicated for ablation, resection, and coagulation of soft tissue and hemostasis of blood vessels in otorhinolaryngology surgery, including adenotonsillectomy, sinus surgery, ablation of cysts of the head and neck, and reduction of hypertrophic nasal turbinates in nasal airway obstruction. The system was developed and designed by Smith & Nephew[®]. Tonsillectomy using ultrasonic energy is performed with the HARMONIC FOCUS[®]+ Shears instrument, a sterile, single-use device consisting of a soft-grip scissor handle housing assembly with two hand controls: 'MIN' for minimum power and 'MAX' for maximum power. The instrument has a curved blade at the tip and is used for cutting and coagulating vessels up to and including 5 mm in diameter.

Statistical analysis

Categorical data are represented with absolute and relative frequencies. The Shapiro-Wilk test was used to determine the normality of the distribution of numerical variables. Numerical

data are described with the median and with interquartile range limits. Differences of categorical variables are tested with the χ^2 test. Differences in numerical variables between three independent groups are tested using the Kruskal-Wallis test (followed by the Conover post hoc test). All P values are two-sided. The level of significance is set to Alpha = 0.05. For statistical analysis, the following program was used: MedCalc Statistical Software (version 19.1.7, MedCalc Software Ltd, Ostend, Belgium; <https://www.medcalc.org>; 2020) and IBM SPSS Statistics 23 (version 23.0, IBM Corp., Armonk, NY, USA).

Results

The research included 60 patients, of whom 26 were male (43%) and 34 were female (57%). There was no statistically significant difference in age between any of the groups studied (Table 2).

There were significantly more female patients in the group operated on with classic tonsillectomy using the cold steel method, while there were significantly more male patients in the group operated on with the ultrasound harmonic knife (Table 3).

Table 2. Distribution of participants according to age and the group of patients

AGE	Number (%) according to the group of patients				P*
	Cold steel	Ultrasound knife	Coblation	Total	
< 18 years	13 (65)	9 (45)	10 (50)	32 (54)	0.40
≥ 18 years	7 (35)	11 (55)	10 (50)	28 (46)	
Total	20 (100)	20 (100)	20 (100)	60 (100)	

* χ^2 test

Table 3. Distribution of participants according to gender and the group of patients

GENDER	Number (%) according to the group of patients				P*
	Cold steel	Ultrasound knife	Coblation	Total	
Male	5 (25)	13 (65)	8 (40)	26 (43)	0.03
Female	15 (75)	7 (35)	12 (60)	34 (57)	
Total	20 (100)	20 (100)	20 (100)	60 (100)	

* χ^2 test

Most patients who experienced postoperative hemorrhage complications were operated on with the cold steel method, while there was no

statistically significant difference among the other two methods, the ultrasound knife and the coblation technique (Table 4).

Table 4. Distribution of participants according to postoperative haemorrhage and the group of patients

HAEMORRHAGE	Number (%) according to the group of patients				P*
	Cold steel	Ultrasound knife	Coblation	Total	
YES	8 (40)	4 (20)	3 (15)	15 (75)	0.10
NO	12 (60)	16 (80)	17 (85)	45 (25)	
Total	20 (100)	20 (100)	20 (100)	60 (100)	

* χ^2 test

Patients operated on with the cold steel method had statistically significantly higher Visual Analogue Scale (VAS) scores (Figure 1). There

was no significant difference in responses to any of the T-14 questionnaire items among the patient groups (Table 5).

Table 5. VAS scale score according to type of surgical technique

	Median (interquartile range) according to type of surgical technique				P*
	Cold knife	UZV knife	Coblation	Total	
VAS scale score	7.7 (6 - 9)	3.25 (2 - 5)	3.9 (2 - 5)	4.95 (2 - 7)	<0.001

*Kruskal Wallis test (Post Hoc Conover)

Primary hemorrhage was defined as bleeding that occurred intraoperatively or within 24 hours postoperatively. Secondary hemorrhage was defined as bleeding that occurred within 7 days after the operation. In the cold steel group, there were eight hemorrhages. Of these eight patients, only one had a primary hemorrhage intraoperatively. The other seven had secondary hemorrhages, of which four required revision surgery with hemostasis in the operating room, and the other three were observed in the clinic without needing revision surgery. In the coblation group, three hemorrhages occurred – one primary and two secondary. The primary hemorrhage occurred within a few hours after the operation due to bleeding from both tonsillar lobes. The first secondary hemorrhage occurred on the sixth postoperative day and required revision surgery. The third hemorrhage occurred on the 15th postoperative day, but the patient required only observation in the clinic without revision surgery. In the group operated on with the ultrasound knife, there were four secondary

hemorrhages; only one required revision surgery, while the others were observed in the clinic. Revision surgery in a patient operated on with the ultrasound knife occurred on the 15th postoperative day.

In the cold steel group, major preoperative issues were infectious in nature, with an average score for infectious questions of 3.14, while obstructive issues were reported in only two cases, which was insignificant according to the T-14 questionnaire. In the coblation group, there was a slight predominance of infectious problems before the operation, with an average score of 2.5, while obstructive issues were rated at 1.93. Similarly, patients operated on with the ultrasound knife had higher infectious issue scores before the operation (average 3.01) compared to obstructive issues (average 2.01). (Table 6.)

Table 6. Answers to the T-14 questionnaire questions according to the group of patients

	The median (interquartile range) according to the group of patients				P*
	Cold steel	Ultrasound knife	Coblation	Total	
Snoring loudly during sleeping	3 (3-4)	3 (1-4)	4 (1-4)	3 (1,25 - 4)	0,35
Irregular or stopped breathing during sleeping	1,5 (0-3)	1 (0-3)	1,5 (0-2,75)	1 (0 - 3)	0,92
Daytime sleepines	1,5 (0-2,75)	2 (1-3)	3 (0,25-3)	2 (0,25 -3)	0,26
Noisy breathing during the day	3 (0,5-4)	2 (1-3)	2 (0,25-3)	2 (1-3)	0,44
Breathing through the mouth during day	3 (2-4,75)	3 (2-4,75)	2,5 (1,25-4)	3 (2-4)	0,46
Problem with poor appetite or poor eating habits (choking with food, etc.)	0 (0-1,75)	0 (0-1,75)	0 (0-1,75)	0 (0,1,75)	0,97
Frequent earache or frequent ear infections	2,5 (1-4,75)	2 (0-3,75)	2 (0-3,75)	2 (0-4)	0,43
Repeated short-term throat infection that lasts less than 2 weeks	3 (2,25-5)	3,5 (2-4)	2 (1-4)	3 (2-4)	0,21
Constant or chronic throat infections that last more than 2 weeks	3,5 (1,25-4,75)	4 (1,5-4)	3 (2-4)	3 (1-4)	0,08
Many phone calls to the doctor of primary healthcare	3,5 (3-4)	4 (2,25-4)	3 (2-4)	4 (2,25-4)	0,42
Many visits to the ENT department	3,5 (1,25-4)	4 (2-4)	3 (1-3)	3 (1,25-4)	0,29
Taking antibiotics over and over for less than 2 weeks at a time	3 (2,25-4)	3,5 (1,25-4)	3 (1,25-4)	3 (2-4)	0,51
Taking antibiotics for more than 2 weeks straight	3 (2,25-4)	3 (1,5-4)	2,5 (1-3)	3 (2-4)	0,2
Missing school/work days due to sore throats	3 (3-4)	4 (3-4)	3 (1,25-4)	3 (3-4)	0,44

*Kruskal-Wallis test (Post Hoc Conover)

Discussion

Numerous studies in the literature have compared tonsillectomy techniques and their effects on postoperative bleeding and the time to return to regular activity. However, only a few

reports address how different tonsillectomy techniques and the level of heat generated by various instruments affect the postoperative period and the incidence of bleeding. Kandemir et al. compared three tonsillectomy techniques – cold steel, monopolar electrocautery, and coblation – and found that cold steel
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tonsillectomy is associated with less postoperative pain and shorter recovery times than monopolar electrocautery, while coblation provides better pain management during short-term recovery. The postoperative bleeding rate was similar in all three groups (9). Varadharajan et al. demonstrated a significant improvement in infectious and sleep-disordered breathing measurements on the T-14 questionnaire with coblation intracapsular tonsillectomy, with no reported complications related to hemorrhage, readmissions, or regrowth of tonsillar tissue (10). Wong and Paddle conducted a systematic literature review and meta-analysis comparing tonsillectomy using the ultrasound harmonic scalpel with other techniques, including cold steel, monopolar electrocautery, lasers, and bipolar diathermy. They found that the harmonic scalpel is associated with less postoperative pain compared to other techniques, although the difference is minimal. According to their findings, the harmonic scalpel is superior to blunt dissection, with a 56% reduction in delayed hemorrhage (11). Gill et al. compared tonsillectomy using a harmonic scalpel with

bipolar diathermy in 70 patients in 2023 and found a statistically significant difference in postoperative pain management, but no difference in intraoperative blood loss or surgery duration. Their research indicates that the harmonic scalpel offers an advantage in early healing, which helps reduce postoperative morbidity related to hemorrhage (12). Limitations of this study include the relatively small number of participants and the lack of prolonged postoperative follow-up. In conclusion, both harmonic scalpel and coblation techniques for tonsillectomy provide better pain management within the first postoperative week, resulting in a quicker return to normal daily activities. Regarding morbidity, postoperative and delayed hemorrhage, these two techniques showed a slight advantage over blunt dissection and the cold steel method. However, the small sample size remains a limitation, as tonsillectomy is the most common surgery performed in otorhinolaryngology and in the pediatric population in general. Therefore, further research is needed to address this issue more clearly.

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Analysis and interpretation of data: RM

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Različite metode tonzilektomije: naše iskustvo

Sažetak

Cilj studije: Istražiti kako različite metode tonzilektomije uključujući klasični oblik ili hladni nož, koblacijsku metoda i tehniku ultrazvučnim nožem utječe na pacijentov oporavak s naglaskom na postoperativnu bol uz usporedbu pojedinih grupa koristeći se vizualnom analognom skalom te ima li određena kirurška metoda povišeni rizik za revizijsku operaciju tijekom kratkog i odgođenog postoperativnog perioda.

Metode: Šezdeset pacijenata podijeljeno je u tri grupe od kojih svaka ima 20 ispitanika (hladni nož, koblacija, tehnika ultrazvučnim nožem). Svim je pacijentima u općoj endotrahealnoj anesteziji učinjena adenotonzilektomija u periodu od studenog 2024. do srpnja 2025. godine. Sedmi postoperativan dan učinjena je kontrola radi analize postoperativne boli koristeći se VAS skalom. Prije operacije roditelji maloljetnih ispitanika ispunili su T-14 upitnik.

Rezultati: Istraživanje je provedeno na 60 ispitanika od kojih je 26 muških, a 34 ženskih ispitanika. Najviše komplikacija postoperativno u smislu krvarenja bilo je u grupi ispitanika operiranih hladnim nožem dok u ostale dvije grupe nije bilo značajne razlike. Statistički je značajno veća vrijednost postoperativne bolnosti na temelju VAS skale u grupi ispitanika operiranih hladnim nožem u usporedbi s koblacijskom tehnikom te ultrazvučnim nožem.

Zaključak: Ultrazvučni nož i koblacijska tehnika dovode do manje postoperativne boli unutar prvog tjedna postoperativno u usporedbi s klasičnom tonzilektomijom što omogućava brži povratak svakodnevnim aktivnostima.

Ključne riječi: tonzilektomije, adenoidektomija, tonsilitis, OSA, bol