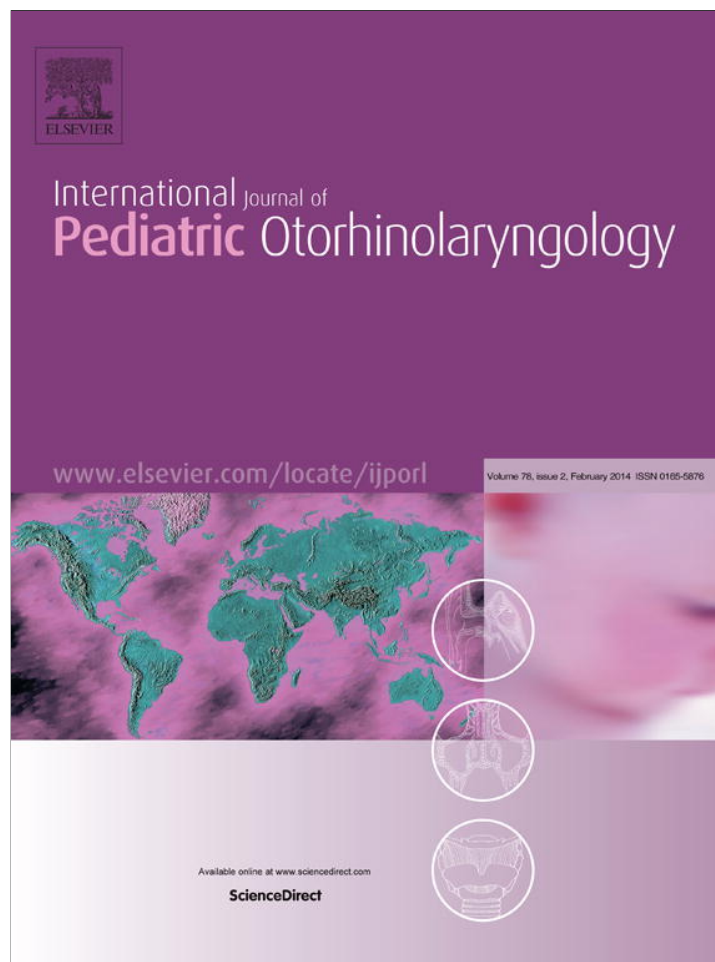


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# Sleep related quality of life before and after adenotonsillar surgery in pediatric population<sup>☆</sup>



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## ABSTRACT

**Objective:** To assess the quality of life in children with adenotonsillar problems before and after adenotonsillectomy in short term follow-up.

**Methods:** Quasi-experimental study (before and after study) of children with adenotonsillar problems at Tehran University of Medical Sciences, Amir'Alam hospital. Eighty six pediatric patients aged 3 through 13 years (58 boys and 28 girls) who underwent adenotonsillectomy, for treatment of sleep disordered breathing or recurrent throat infection, were recruited. Parents completed OSA-18 quality of life survey and Brouillette score questionnaire before and one month after surgery.

**Results:** Reliability of the Brouillette score and OSA-18 survey was established by evaluating the Cronbach  $\alpha$  value. Cronbach  $\alpha$  for Brouillette score was 0.70 and for OSA-18 survey it was 0.88. Preoperative values for the OSA-18 total and domain scores were high in children: mean  $\pm$  SD; 61.65  $\pm$  20.78. Preoperative values for the Brouillette score were: mean  $\pm$  SD; 0.41  $\pm$  2.34. The total OSA-18 survey score and the scores for all domains showed significant improvement after surgery: mean  $\pm$  SD; 28.01  $\pm$  9.09 ( $P < 0.001$ ). Post-operative Brouillette score had a significant improvement: mean  $\pm$  SD; -3.57  $\pm$  0.91 ( $P < 0.001$ ).

**Conclusion:** Considering the OSA-18 survey and Brouillette score results, surgical therapy with adenotonsillectomy is associated with marked improvement in quality of life in both obstructive and infective adenotonsillar disease.

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## 1. Introduction

Sleep disordered breathing (SDB) is a common entity in children [1–4] with a spectrum of upper airway disorders ranging in severity from primary snoring to obstructive sleep apnea (OSA) [5]. The etiology of SDB is multifactorial and its complex interplay among anatomical, neuromuscular and predisposing genetic factors into disease [6], most common cause of SDB in children is adenotonsillar hypertrophy. Tonsillectomy and adenoidectomy are curative in 85–95% cases [7–9]. Other causes of SDB include obesity, neuromuscular disorder and craniofacial anomalies [10].

Prevalence of snoring in children is reported between 3% and 12% [1–3,11] and prevalence of OSA is 1–3% [1–3,11,12].

The symptoms of SDB include oral breathing, sleep apnea, restless sleep, frequent awakening, hard to breath, abnormal bite and snoring. It can also lead to cor pulmonale or left ventricle hypertrophy, failure to thrive, systemic hypertension, and in severe cases of SDB decreasing cognitive skills, quality of life (QOL) and behavioral disturbance [2,5,13–26].

OSA 18 survey [27] is an 18-item questionnaire which has been tested and accepted for reliability and validity [28], also Brouillette score [29] is developed for screening healthy children with OSA caused by adenotonsillar hypertrophy [30].

Studies show that after tonsil surgery, significant improvement occurs in behavior, QOL and cognitive function [1,13,31,32].

The objective of the present study is to evaluate the quality of life in children with tonsillar problems, whether with obstructive or infectious surgical indications, before and after adenotonsillectomy using OSA-18 survey and Brouillette score.

## 2. Methods

This study was a quasi-experimental study (before–after trial). Parents of children aged 3–13 years who referred to Day Clinic of

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Amir'Alam hospital, Tehran, for adenotonsillectomy, enrolled in the study. The exclusion criteria included: children younger than 3 years or older than 13 years, previous history of tonsil surgery, neuromuscular diseases, craniofacial syndromes, any systemic disease, growth retardation, psychiatric disorders, having two illiterate parents, and parents' difficulty in communicating in Persian. This study was approved by the Otorhinolaryngology research committee of Tehran University of Medical Sciences.

The impact of adenotonsillectomy in relieving SDB symptoms were assessed by using OSA-18 survey [27] and Brouillette score [29]. The OSA-18 survey comprises 18 items in 5 domains of sleep disturbance, physical suffering, emotional distress, daytime problems, and caregiver concern. The domains of daytime problems and emotional distress consist of three items, while the other domains contain four. Each question is scored as follows: 1 (None of the time), 2 (Hardly any of the time), 3 (A little of the time), 4 (Some of the time), 5 (A good bit of the time), 6 (Most of the time), 7 (All of the time). The total score ranging from 18 to 126. The OSA-18 total scores were classified as mild (<60); moderate (>60, ≤80), or severe (>80) [27].

The Brouillette score consists of 3 questions. The first question deals with difficulty in breathing during sleep (*D*), and is scored 0 (never), 1 (occasionally), 2 (frequently) or 3 (always). The second question inquires about stopped breathing during sleep (*A*), and is scored 0 (no) or 1 (yes). The third question asks about snoring (*S*), and is scored 0 (never), 1 (occasionally), 2 (frequently), or 3 (always). Scores from these three questions are placed in the equation below to yield the final score:

$$\text{Brouillette score} = 1.42D + 1.41A + 0.71S - 3.83$$

Scores > 3.5 are diagnostic for OSA, between -1 and 3.5 suggestive for OSA, and < -1 absence of OSA.

The children's parents completed the OSA-18 survey and Brouillette score questionnaire before surgery and one month after it. Children underwent adenotonsillectomy.

Since these questionnaires had not been previously used in Iran, we used the forward-backward method to translate the questionnaires into Persian. For this purpose, the English version was first translated into Persian by two translators. The Persian versions were then translated back to English by two different translators, and finally a moderator prepared the final version using these English and Persian translations. We considered experts' comments for validity of the questionnaires in the final version. We applied the questionnaire to 30 patients to determine the sample size as well as the questionnaire's reliability. The selection was made using convenience sampling. According this sampling method. A sample size of 90 children was required in this study, at the 95% confidence level and 90% power. The calculated Cronbach's  $\alpha$  was 0.88 for OSA-18 survey and 0.70 for Brouillette questionnaire.

Parents were provided with sufficient information prior to the study. Attendance was elective and all participants were informed that responses would be anonymous and were blinded to the scope and purpose of the study.

Once the questionnaires were completed, the findings were analyzed on SPSS Version 16 (SPSS Inc., Chicago, IL, USA). Results were reported as mean  $\pm$  standard deviation (SD) for the quantitative variables and percentages for the categorical variables. The groups were compared using the dependent Student's *t*-test. 105 individuals (in addition to the primary 30) entered the study, 86 of whom completed the study and 19 patients were missed.

### 3. Results

The parents of 86 children completed preoperative and postoperative questionnaires. Surgical candidates were diagnosed

by clinical assessment and all of them underwent adenotonsillectomy. There were 58 boys (67.4%) and 28 girls (32.6%) with mean age of  $7.93 \pm 2.09$  years (range 3–13 years). 51 patients had obstructive surgical indication (sleep disordered breathing) and 35 patients had infectious surgical indication. The preoperative mean  $\pm$  SD for OSA-18 survey was  $61.65 \pm 20.78$  and postoperative mean  $\pm$  SD was  $28 \pm 9.09$  ( $P < 0.001$ ). The preoperative mean  $\pm$  SD for Brouillette score was  $0.41 \pm 2.34$  and postoperative mean  $\pm$  SD was  $-3.57 \pm 0.91$  ( $P < 0.001$ ). Results for total and all domains for OSA-18 survey scores and Brouillette score showed considerable improvement after surgery ( $P < 0.001$ ). Mean and standard deviation of both questionnaires before and after surgery in SDB and recurrent infection groups are given in Table 1. Results of both questionnaires showed significant improvement postoperatively in both SDB and recurrent infection patients ( $P < 0.001$ ). Although these questionnaires are designed for obstructive cases, but our study shows significant improvement in both SDB and recurrent infection groups, so for further generalization of results in non-obstructive cases we recommend more studies to evaluate their eligibility in all scenarios. In this study, preoperatively 20 (23.3%) children had high OSA-18 survey total score, 25 (29.1%) had a moderate score, and 41 (47.7%) had low score. Postoperatively no one had high score, one (1.2%) had moderate score and 85 (98.8%) had low scores.

The mean and standard deviation of the total and domain scores and their change scores with 95% confidence intervals (CI) before and after surgery for OSA-18 survey is given in Table 2. The domain with the greatest change in mean score was physical suffering, which improved by 10.58, then caregiver concern by 8.11, sleep disturbance by 7.99, emotional distress by 3.57 had the largest change, respectively. The day time problems domain had the smallest mean change by 3.56.

Preoperatively 24 children had Brouillette score that shows the absence of OSA, 50 patients had score suggestive for OSA and 12 patients had score diagnostic for OSA. Postoperatively 85 children had score that shows the absence of OSA, and one had score diagnostic for OSA. Figs. 1 and 2 compare the results before and after adenotonsillectomy for both questionnaires.

One case of velopharyngeal insufficiency without cleft palate occurred as a surgical complication and the child was referred for necessary rehabilitation.

### 4. Discussion

The findings of the present study indicated that children with SDB and recurrent infection have better quality of life after adenotonsillectomy.

The parents reported improvement in sleep disturbance, physical suffering, emotional distress, caregiver concern, daytime problems and Brouillette score following adenotonsillectomy. The total score of OSA-18 survey, as well as each domain's score, improved significantly after surgery ( $P < 0.001$ ). Physical suffering and daytime problems improved the most and the least, respectively. Brouillette score improved significantly after surgery, as well ( $P < 0.001$ ). Previous studies indicate an improvement in

**Table 1**

Preoperative and postoperative mean and standard deviation in sleep disordered breathing and recurrent infection ( $n=86$ ).

	Sleep disordered breathing patients Mean (SD)	Recurrent infection patients Mean (SD)
OSA Pr-Op.	67.39 (20.47)	53.28 (18.49)
OSA Post-Op.	29.66 (9.55)	25.60 (7.90)
Brouillette score Pre-Op.	1.48 (2.04)	-1.15 (1.81)
Brouillette score Post-Op.	-3.45 (1.15)	-3.74 (0.28)

**Table 2**  
Preoperative and postoperative mean survey scores and change scores for OSA-18 survey (n = 86).

	Preoperative score	Postoperative score	Change score
	Mean (SD)	Mean (SD)	Mean (95%CI)
Sleep disturbance	12.82 (5.89)	4.83 (1.47)	7.99 (6.72–9.24)
Physical suffering	17.30 (5.97)	6.72 (3.21)	10.58 (9.25–11.9)
Emotional distress	9.45 (4.81)	5.88 (3.07)	3.57 (2.65–4.48)
Daytime problems	8.03 (4.17)	4.47 (2.36)	3.56 (2.69–4.41)
Caregiver concern	14.17 (6.83)	6.06 (3.27)	8.11 (6.69–9.51)
Total score (all 18 items of OSA)	61.65 (20.78)	28.01 (9.09)	33.64 (29.35–37.92)

children's condition after tonsil surgery in patients with SDB and recurrent infection. For instance, a study conducted by Goldstein et al. [33] evaluated 64 children who underwent tonsillectomy and adenoidectomy for treatment of SDB or recurrent tonsillitis, using history and physical examination and not polysomnography. Parents completed the Children Behavior Check List (CBCL) and OSA-18 survey before and 3 months after surgery. The results indicated a significant improvement in OSA-18 survey scores after surgery. The greatest improvement was in sleep disturbance, followed by caregiver concern then physical symptoms and emotional distress. The smallest improvement pertained to daytime problems. As Goldstein's study we evaluated children with SDB and recurrent infection, using clinical assessment not polysomnography. Parents completed OSA-18 survey and Brouillette score before and 1 month after surgery. As Goldstein's results we found significant improvement in both questionnaires on all SDB and recurrent infection patients.

Mitchell et al. [34] compared the preoperative and postoperative conditions of 61 children (43 cases of OSA and 18 cases of mild SDB) using OSA-18 survey for evaluating the effectiveness of adenotonsillectomy. Both groups improved significantly after surgery, with the most and the least improvement pertaining to physical suffering and emotional distress, respectively. In our study we used OSA-18 survey and Brouillette score for evaluating children with SDB and recurrent infection before and after adenotonsillectomy, as Mitchell's results our study showed significant improvement after surgery.

In another study by Mitchell et al. [35], 29 children with OSA who underwent adenotonsillectomy were assessed by polysomnography before and after surgery. In addition, their parents completed the OSA-18 survey, indicating a significant improve-

ment in scores following surgery. As this study our findings showed significant improvement in OSA-18 survey score after adenotonsillectomy also we found significant improvement in Brouillette score, too.

In a cohort study by Sohn et al. [28], OSA-18 survey was used to evaluate the quality of life in 69 children with sleep apnea syndrome. The children's parents completed the questionnaire on referral and one month after tonsillectomy or adenoidectomy. The results indicated considerable improvement. Sleep disturbance, physical suffering, and caregivers concern had the greatest improvement. Our overall results and follow-up period is similar to those of Sohn's; however, the ranking of improvement in domains of OSA-18 survey differs between the two studies.

Fischer et al. [36] assessed the quality of life in 20 children who underwent tonsillectomy or adenoidectomy for obstructive sleep apnea. They used OSA-18 survey and Brouillette score, which were completed by caregivers before surgery, 7.5 ± 1.14 weeks and 14.8 ± 1.98 weeks after surgery. The results indicated considerable improvement in conditions of children suspicious of obstructive sleep apnea over both short term and long term follow up. Similar to the findings of Fischer et al., we used OSA-18 survey and Brouillette scores, but with a different follow-up period (1 month). In line with findings of Fischer et al., we found a significant improvement in both OSA-18 survey (P < 0.001) and Brouillette (P < 0.001) scores.

Hasukic [37] evaluated quality of life by OSA-18 survey on 60 children with symptoms of SDB. 30 patients underwent adenoidectomy and other 30 patients underwent adenotonsillectomy. Parents completed OSA-18 survey before surgery and 5 weeks postoperatively. The results indicated significant improvement on all patients (both adenoidectomy and adenotonsillectomy group). After adenotonsillectomy the domain with greatest change was physical symptoms and the domain with smallest change pertained to daytime problems. As Hasukic's study, we used OSA-18 survey and patients included by clinical assessment. Similar to Hausik we found significant improvement after adenotonsillectomy with similar improvement on domains.

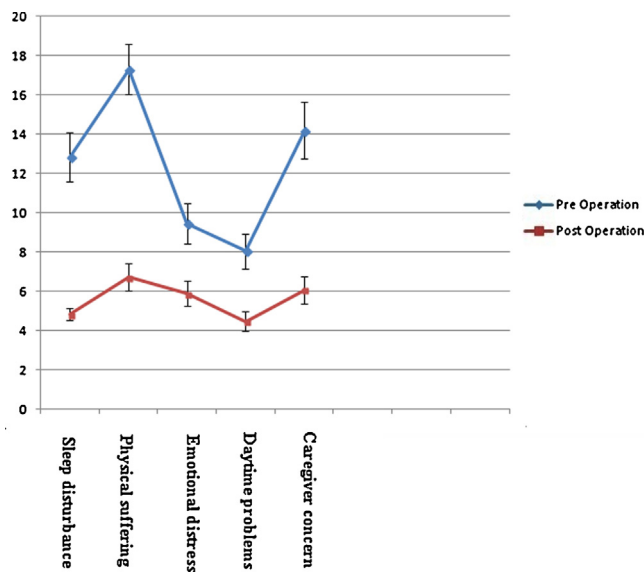


Fig. 1. Mean obstructive sleep apnea-18 domain scores.

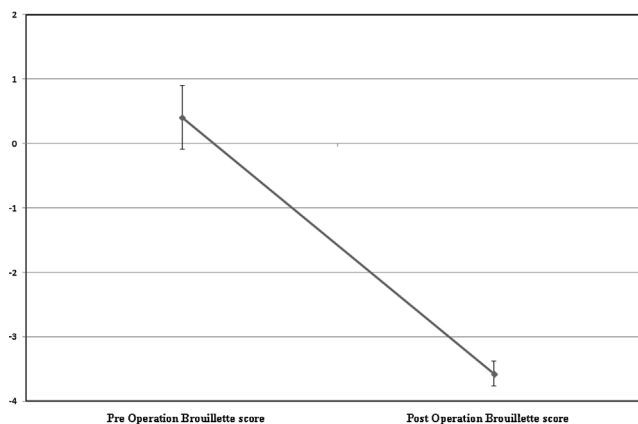


Fig. 2. Mean Brouillette scores.

Powell et al. [38] evaluated the quality of life of 22 children with sleep disordered breathing by using OSA-18 survey. 21 of them underwent adenotonsillectomy and one had tonsillectomy. Parents completed OSA-18 survey before surgery and postoperatively. They found significant improvement on total and each domain score of OSA-18 survey postoperatively. As Powell's study we evaluated patients with SDB by OSA-18 survey, also we used Brouillette score too. Similar to Powell et al. we found significant improvement postoperatively.

## 5. Conclusion

The findings of the present study indicated that adenotonsillectomy, improve the conditions of children with adenotonsillar problems, whether with obstructive or infectious surgical indications and enhance their sleep and quality of life. A more pronounced improvement in children with obstructive problems compared to those with infectious complains may be related to the larger tonsils or adenoid pad in the former, which the removal of them will substantially contribute to a more patent airway.

## Conflict of interest

There were no conflicts of interest and no financial relationships between authors, and also all authors contribute in the research process (e.g.: Study design, interpretation, revising, data analysis and final approval). This research funding was Tehran University of Medical Sciences.

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