



Impact of Adenotonsillectomy on the Quality of Life of Children with Obstructive Sleep - Disordered Breathing

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Abstract

Background: This study aims to assess the impact of the adenotonsillectomy on quality of life of children with obstructive sleep-disordered breathing and compare the impact of obstructive sleep-disordered breathing and surgery on quality of life among children categorized in low weight/eutrophic and overweight/obese.

Materials and Methods: Interventional prospective study with 35 children (6.0 ± 2.0 years old) with obstructive sleep-disordered breathing and indication of adenotonsillectomy. Quality of life was assessed by the questionnaires PedsQL 4.0 and OSA-18, before and after 30 to 60 days of surgery.

Results: The total and domains scores of the PedsQL 4.0 (75.0 ± 15.1 vs. 83.7 ± 13.1, p<0.01) and the OSA-18 (69.6 ± 21.7 vs. 31.8 ± 0.6, p<0.01) significantly improved after adenotonsillectomy. The overweight/obese group's physical score of PedsQL 4.0 (70.6 ± 20.5) was significantly lower than the low weight/eutrophic group (85.8 ± 15.1, p=0.017). After adenotonsillectomy, the total and the domains scores of this questionnaire did not differ between groups. In the OSA-18, the overweight/obese group (19.7 ± 3.2) presented worse scores in the domain parent's concern compared to the low weight/eutrophic group (14.9 ± 7.7, p=0.031). After surgery, the low weight/eutrophic and overweight/obese groups' physical suffering scores were, respectively, 8.1 ± 3.3 and 5.5 ± 2.2, p=0.012.

Conclusion: This study confirms improvement on quality of life of patients with obstructive sleep-disordered breathing submitted to adenotonsillectomy, assessed by the PedsQL 4.0 and the OSA-18. It extends the areas of knowledge by revealing change in severity category in the OSA-18 from 93.3% moderate-severe to 100% mild in the overweight/obese group, and from 55% moderate-severe to 90% mild in the low weight/eutrophic group.

Keywords: Obstructive sleep apnea; Quality of life; Obesity; Tonsillectomy; Child

Introduction

Respiratory sleep disorders affect up to 11% of children and can cause serious consequences to children development [1]. They encompass primary snoring, ventilatory alterations and obstructive and central apneas. Obstructive Sleep-Disordered Breathing (oSDB) is the term used to describe events of an obstructive cause. Its diagnosis is clinical, characterized by snores, oral breathing, and episodes of respiratory pause. The most severe presentation is the Obstructive Sleep Apnea (OSA). Beyond the clinical condition of the oSDB, patients with OSA evolve with apnea during sleep, evidenced during the Polysomnography (PSG) and represented by an Apnea-Hypopnea Index (AHI) equal or higher than 1.2 OSA affects 1.2% to 5.7% of children, and its incidence increases every year due to the growing index of child obesity [3-5]. Between 61 to 80% of obese children and adolescents are affected by OSA [2,6].

Children with oSDB have higher risk of neurocognitive and behavioral impairment, cardiovascular diseases, metabolic syndrome, obesity and pulmonary sequelae. However, the damage caused, both physical and mental, tend to be resolved after efficient treatment [3,5]. Currently, treatment of choice for this disease is adenotonsillectomy (T&A), once hypertrophy of the palatine and pharyngeal tonsils is the main cause of oSDB [7]. After surgical procedure, these children present improvement of growth, school performance, and enuresis, behavior, and asthma exacerbations [2].

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Studies also demonstrate significant impact of the oSDB and adenotonsillar hypertrophy in children's Quality of Life (QoL) [8,9]. The gold standard for OSA diagnosis in children is PSG, but this is not a broadly available exam in underdeveloped countries. Therefore, authors propose usage of screening tools to predict risk of this disease, including QOL questionnaires, evaluate the impact of oSDB in children and to be a possible strategy to predict diagnosis [10,11].

The oSDB in infancy is associated with obesity, both in relation to prevalence and severity. Obese children tend to have a more severe disease, higher risk of the condition's persistence even after surgical treatment and worse QoL scores in the pre and postoperative [2,12,13]. Excess of body mass worsens neurocognitive performance in children with oSDB, which persists after T&A in long term follow-up [14].

Wide attention is being given to the study of oSDB in children during the last years. Studies establish association of this disease with impairment in QoL, as well as improvement after T&A [9]. Furthermore, the number of obese children has increased and obesity is closely associated with oSDB. Besides the fact that QoL has improved in this group of patients, the real influence of surgery in this parameter is not yet established [14]. In Brazil, until this date, we do not know about the existence of studies which have evaluated QoL in overweight/obese children with oSDB, before and after T&A.

The present study aims to evaluate QoL in children with oSDB and the impact of T&A on QoL. It also intends to evaluate the impact of oSDB and T&A in QoL among children categorized as low-weight/eutrophic and overweight/obese.

Materials and Methods

Sample calculation

A pilot study with 10 patients in the preoperative and postoperative period was considered for sample calculation and the parameters were calculated according to the general QoL score. Standard deviation of the difference between pairs, mean difference between pairs, 95% confidence interval and 80% power were considered as necessary parameters. Calculations were performed using software Open-epi version 3.01. Considering the parameters of the pilot study, a sample of at least 32 patients was needed at the end of the assessment.

Study population

This is a prospective interventional study performed in a tertiary hospital from June 2019 to February 2020. Studied population included children from 3 to 10 years old, with clinical diagnosis of oSDB and previous indication of T&A by an otolaryngologist. Diagnosis was based on the presence of symptoms, with at least six months of duration, including snoring, oral breathing, noisy breathing and pauses in breathing during sleep. PSG was not performed. Exclusion criteria were craniofacial dysmorphism, psychiatric disorders (except for attention deficit hyperactivity disorder), and neuromuscular diseases, congenital or acquired cardiac abnormalities, rheumatic diseases, acute or chronic liver diseases, kidney failure, arterial hypertension, arrhythmias, and diabetes mellitus.

Demographic and clinical data were collected through questionnaires and questions directed to parents or caregivers. All variables and measurements were registered in the preoperative period and again at some point between the 30th and 60th day after surgery. Forty-six patients were initially included in the study. However, there was a follow up loss of 11 children, who were excluded. Thus, the

analysis involved 35 participants (n=35). This study was approved by the local Research Ethics Committee, under the protocol number 08812019000005134, and informed consent form for parents and assent for minors were obtained in all cases.

Clinical assessment

Children were submitted to physical examination and nasal endoscopy for inspection of the nasal mucosa, adenoids, and tonsils. Tonsils' hypertrophy was classified according to Brodsky scale from 0 to 4[15]. Adenoids' hypertrophy was classified according to the percentage of occupation of the adenoid in the nasopharynx [16].

Body Mass Index (BMI) and its respective percentile, according to the World Health Organization (WHO), were measured and registered. Children were classified in low-weight (BMI \leq percentile 3), normal-weight (BMI between percentiles 3 and 85), overweight (BMI between the percentiles 85 and 97) and obese (BMI \geq percentile 97) [17].

Other variables such as symptoms' duration and presence of comorbidities were also collected. All children were assessed by the same examiner, who is the primarily responsible for the study.

Quality of life assessment

The questionnaires Obstructive Sleep Apnea-18 (OSA-18) and Pediatric Quality of Life Inventory, version 4.0 (PedsQL 4.0) was applied [18,19]. The first assess QoL specifically related to OSA, and the second is a generic questionnaire of QoL for children.

OSA-18 is simple and useful for clinic and academic purposes. It can be applied to children from 2 to 12 years and comprehends five domains: sleep disturbance, physical suffering, emotional distress, and daytime function and caregiver concerns. Each item punctuates in an ordinal scale of 7 points, being 1 for none of the time and 7 for all the time. Scoring varies from 18 to 126 and is classified in relation to their impact as mild (scores below 60), moderate (scores between 60 and 80) and severe (scores above 80) [20].

PedsQL 4.0 has 23 items and comprehends 4 domains: Physical functioning, emotional functioning, social functioning, and school functioning. It includes the self-assessment for children between 5 and 18 years old and questionnaires for parents of children and adolescents from 2 to 18 years old. Each item scores in a scale of 4 points, being 0 for never and 4 for almost always. Scores for calculation are physical and psychosocial health, which include the emotional functioning, social functioning and school functioning domains. Scoring of these items is registered inversely in a scale from 0 to 100 (0=100, 1=75, 2=50, 3=25, 4=0). Therefore, the higher the score is, the better the QoL is in this study, and only the parent's version of the questionnaire was used [19].

The same examiner was responsible for applying the questionnaires OSA-18 and PedsQL 4.0.

Surgical procedure

T&A is a procedure performed under general anesthesia. Adenoid tissue is resected with Beckmann's knives and tonsils are resected with scissors. Hemostasis is achieved with bipolar cauterization [12].

Data analysis

For the data analysis, techniques of exploratory statistic were used, which allowed a better visualization of the data's general characteristics. Data was presented in tables with absolute frequencies and their respective percentages, as well as descriptive measures

(mean and standard deviation) for the quantitative data.

Quantitative variables were tested according to their normality through the Kolmogorov-Smirnov test. Because they presented a normal distribution, parametrical tests were used. T paired test was used to compare QoL scores assessed by the PedsQL and OSA-18 questionnaires before and after surgery. To evaluate classification generated by the OSA-18 before and after surgery, the McNemar test was used.

QoL scores were also compared in relation to the anthropomorphic classification, based in the WHO recommendations for child obesity classification [17]. The comparison involved two groups: The first included patients with normal weight and low weight and the second included overweight and obese patients. To compare the QoL scores between these groups before and after surgery, T test was used. To compare OSA-18 classification between groups before surgery the Chi-square test was used, with the Monte Carlo adjustment (MMC). After surgery, Fisher Test was used.

In all tests, the significance level adopted was 5%. The software used for this analysis was the SPSS version 20.0.

Results

Clinical and demographic characteristics of the population are described in Table 1. Thirty-five patients submitted to surgery were assessed. Mean duration of symptoms before surgery was 16.7 months. Mean period of QoL assessment after surgery was 45.6 days. Forty-two per cent of patients were above normal weight, being 5 obese and 10 overweight. Of these, only one had comorbidity (vesicoureteral reflux). Sixteen patients were eutrophic and four were low-weight. Of these, two had comorbidities: A child with asthma and another one with history of partial nephrectomy without kidney sequelae.

QoL scores assessed by PedsQL 4.0 and OSA-18 are described in Table 2 and Table 3, respectively. Scores of the different domains of the questionnaires evidenced an improvement in general QoL after treatment (Figure 1, 2).

Table 1: Classification of VA occlusion site by cervical ultrasonography.

Variables	N (%)
Age (Years)	6.0 ± 2.0
Sex	
Female	16 (45.7%)
Male	19 (54.3%)
Duration of symptoms (months)	16.7 ± 7.4
BMI (kg/m ²)	
Low-weight and eutrophic	20 (57.1%)
Overweight and obese	15 (42.9%)
Adenoid (% of nasopharynx occupation [17])	
0 to 24%	1 (2.9%)
25 to 49%	1 (2.9%)
50 to 74%	11 (31.4%)
75 to 100%	22 (62.9%)
Tonsils (Degree, Brodsky [15])	
1 and 2	9 (25.7%)
3 and 4	26 (74.3%)

The data are presented as mean ± standard deviation and as percentage. BMI: Body Mass index

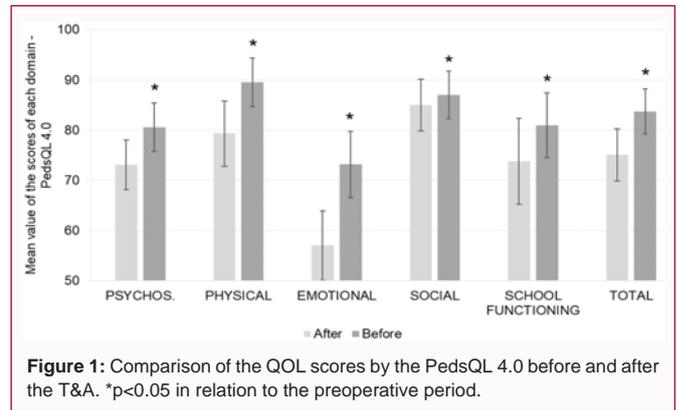


Figure 1: Comparison of the QoL scores by the PedsQL 4.0 before and after the T&A. *p<0.05 in relation to the preoperative period.

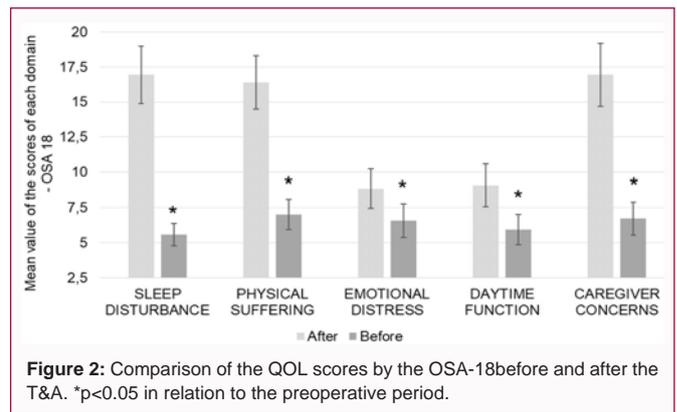


Figure 2: Comparison of the QoL scores by the OSA-18 before and after the T&A. *p<0.05 in relation to the preoperative period.

Table 2: Comparison of VA delineation and occlusion sites by cervical ultrasonography and MRA.

PedsQL 4.0 domains	Before	After	CI 95%	P value*
Psychological	73.1 ±14,4	80.6 ± 14.1	-10.6; -4.3	<0.001
Physical	79.3 ±19.0	89.5 ± 14.1	-14.6; -5.9	<0.001
Emotional	57.0 ± 20.2	73.1 ± 19.3	-20.8; -11.4	<0.001
Social	85.0 ± 14.9	87.7 ± 13.8	-5.1; -0.3	0.028
School	73.8 ± 24.9	80.9 ± 18.8	-12.6; -1.7	0.012
Total	75.1±15.1	83.7 ± 13.1	-11.9; -5.3	<0.001

The data are presented as mean ± standard deviation. *Paired T test

Regarding impact in QoL in OSA-18 categories, there was a significant improvement after T&A. Eleven patients, who were classified as severe before surgery, were classified as mild after the procedure. Fourteen patients classified as moderate (85.7%) became mild degree. Patients who were mild degree before surgery kept the same category.

After patients' stratification according to BMI percentiles in the groups low-weight/eutrophic and overweight/obese, it was observed that only the physical domain of the questionnaire PedsQL 4.0 was different between the groups (p=0.017) before surgery. Physical score of overweight/obese group (70.6 ± 20.5) was significantly lower than in the low-weight/eutrophic group (85.8 ± 15.1). This reveals worse QoL in overweight and obese children within the preoperative period. After surgery, there was no difference between groups in total scores or in different domains in the PedsQL 4.0 questionnaire (Table 2).

In the OSA-18 questionnaire, only the domain caregiver concern differed significantly between groups before surgery (p=0.031). The group overweight/obese (19.7 ± 3.2) presented worse QoL in this domain when compared to the low-weight/eutrophic group (14.9 ±

Table 3: Comparison of the QoL scores using the OSA-18 before and after T&A.

OSA-18 domains	Before	After	CI 95%	P value*
Sleep Disturbance	16.9 ± 6.0	5.6 ± 2.3	9.2;13.5	<0.001
Physical Suffering	16.4 ± 5.5	7.0 ± 3.1	7.1;11.6	<0.001
Emotional Distress	8.8 ± 4.0	6.6 ± 3.5	1.4;3.1	<0.001
Daytime Function	9.1 ± 4.4	5.9 ± 3.1	2.0;4.3	<0.001
Caregiver Concerns	16.9 ± 6.6	6.7 ± 3.4	7.6;12.8	<0.001
Total	69.6 ± 21.7	31.8 ± 12.6	29.5;46.0	<0.001

The data are presented as mean ± standard deviation. *Paired T test

Table 4: Comparison of the OSA-18 categories between groups, before and after T&A.

OSA-18 Categories	Groups			
	Overweight/Obese n (%)		Low-weight/Eutrophic n (%)	
	Before*	After**	Before*	After**
Mild	1 (6.7)	15 (100)	9 (45.0)	18 (90.0)
Moderate	10 (66.7)	0 (0)	4 (20.0)	2 (10.0)
Severe	4 (26.7)	0 (0)	7 (35.0)	0 (0)

*p value =0.008, Qui-squared test with MMC (comparison between groups before T&A)

**p value =0.496, Fisher test (comparison between groups after T&A)

7.7) (Table 4). After surgery, only the score of the physical suffering domain differed significantly between the groups ($p=0.012$). For this domain, the scores of the groups low-weight/eutrophic and overweight/obese were, respectively, 8.1 ± 3.3 and 5.5 ± 2.2 . This demonstrates worse QoL in the group low-weight/eutrophic. Both groups, however, had a good postoperative QoL. The remaining domains assessed and the total scores were similar in both groups in the OSA-18 (Table 4).

When the total score of OSA-18 was stratified according to severity categories, it was observed that the impact of surgery in QoL differed significantly between the groups overweight/obese and low-weight/eutrophic. Before surgery, the percentage of patients in the group low-weight/eutrophic that were classified as mild (45%) was significantly higher ($p=0.008$) than in the overweight/obese group (6.7%). After surgery, the percentage of patients in the mild category was similar in both groups, modifying from 45% to 90% in the low-weight/eutrophic groups, and from 6.7% to 100% in the overweight/obese group (Table 4).

Discussion

In the present study, it was observed that children with oSDB presented significant improvement in all domains of the generic QoL questionnaire PedsQL 4.0 and of the specific questionnaire OSA-18 after T&A. When patients were stratified according to the BMI percentiles, it was observed that PedsQL 4.0 physical score of the overweight/obese group was significantly lower than the low-weight/eutrophic group, which demonstrates worse QoL in overweight and obese children in the preoperative period. After surgery, scores of all the domains of the PedsQL 4.0 questionnaire did not differ significantly between groups. In OSA-18 questionnaire, before surgery, the group overweight/obese presented worse QoL when compared to the low-weight/eutrophic group, regarding caregiver concern score. After surgery, the score of physical domains of low-weight/eutrophic group was worse than the overweight/obese group. When OSA-18 severity categories were analyzed by low-weight/eutrophic and overweight/obese groups, there was a greater improvement on QoL on the second

group in the postoperative period.

Our results reveal that T&A improves QoL of children with oSDB. Similar to other studies, improvement of QoL was significant in all domains in both questionnaires used [8,21,22]. In OSA-18, all patients classified as severe and 85.7% classified as moderate degree became mild degree after surgery, which demonstrates important improvement in QoL. In the same questionnaire, the domains sleep disturbance, caregiver concerns, and physical suffering presented the highest reduction in score after surgery, which means a higher improvement in QoL. The magnitude of improvement in the emotional suffering and daytime function was lower in relation to the others. Sarmah et al. [23] found less impact in the domains daytime function and sleep disturbance. It is possible that these domains are influenced by other factors, such as the surgical recovery process itself, leading to a lower magnitude of the response to surgery.

Naiboğlu et al. [22] in a similar study observed that after T&A, children with oSDB presented significant improvement in all domains of the PedsQL 4.0. These authors observed significant difference in all scores of the preoperative assessment of the affected patients when compared to the control group, besides the abolition of this difference in the postoperative. The results exhibit that child with oSDB treated surgically have comparable QoL to healthy children, proving the relevance of the T&A in the improvement not only of the respiratory condition, but also QoL. Alike other studies, our results demonstrated significant improvement in all domains of the PedsQL-4.0 after surgery [8,21,22].

Mean interval assessment after surgery was 45.6 ± 9.4 days. Despite the short period between pre and postoperative assessments, there was significant improvement in QoL scores. Time of assessment of QoL after surgery varies indifferent studies, and they range from 38.7 ± 10.65 to 266.6 ± 76.3 days [7,24]. A meta-analysis which assessed studies that applied OSA-18 and PedsQL 4.0 with a short term follow up (<6 months) displayed a well-established improvement in QoL [25]. Randhawa et al. [26] described those benefits of surgery in QoL observed within 3 months post-surgery are persistent in patients after 4 years of follow-up.

Despite many publications that report QoL in patients with oSDB and its improvement after T&A, the number of studies that approach the differences of this impact in obese patients is minimal [14,27,28]. Moreira da Silva et al. [29] described in a Brazilian sample a higher negative impact on sleep disorders, physical suffering and parent's concern on obese children with oSDB using the OSA-18 questionnaire. Our study demonstrated worse pre-operative QoL scores in the physical domain of PedsQL 4.0 and in the caregiver concern of OSA-18 in overweight patients. Differently, Tripuraneni et al. [27] observed worse QoL in the domains emotional suffering and daytime function of OSA-18 in obese children. Although our study did not demonstrate significant difference between the total QoL preoperative scores in the groups overweight/obese and low-weight/eutrophic, worse scores in two domains can suggest something already demonstrated in previous reports, which is that obese with oSDB have worse QoL than non-obese [14,27].

Mitchell et al. [14] demonstrated worse QoL before and after surgery in obese patients, using the OSA-18, in total scores and in the majority of the domains. Differently from these authors, who did not find significant difference in the physical suffering domain in the postoperative, our study reported worse QoL in the low-weight/

eutrophic group in this domain and did not find significant difference between groups in total scores for both questionnaires. Despite that, when evaluating OSA-18 categories in the groups low-weight/eutrophic and overweight/obese, there was a higher improvement in QoL in the second group after surgery, since a higher percentage of overweight/obese children were classified as a less severe category, and all of them were classified as mild after surgery. This result suggests a more significant improvement of QoL in overweight/obese group after T&A. That could be explained by the worse preoperative QoL in the overweight/obese group, which has already been related by other publications [8,14,26,28]. It is known that obese patients have a higher risk of oSDB persistence after surgery [6,8,27,28]. Our study suggests that this tendency does not apply to the impairment in QoL, since both groups, overweight/obese and low-weight/eutrophic, were categorized as mild in a balanced way in the postoperative period. The small sample of obese children is a limitation of this study.

PSG is the gold standard for oSDB classification and diagnosis. However, clinical diagnosis has gained relevance, considering the high prevalence of the disease and the unavailability of children PSG in underdeveloped countries [10,11]. According to Raman et al. [10], the majority of children submitted to T&A do not have previous PSG and simpler strategies to evaluate the severity of oSDB, such as QoL questionnaires, need to be implemented. The absence of this diagnostic test to classify the severity of oSDB is a limitation of this study. Nevertheless, we believe that careful clinical investigation of respiratory symptoms is sufficient to diagnose oSDB, which is in accordance to the American Academy of Otolaryngology clinical guidelines [2].

Adenotonsillar hypertrophy is the main risk factor for oSDB [7,9]. Authors have reported tonsil's size influences QoL in children with oSDB and observed worse scores in patients with adenotonsillar hypertrophy [7,9,21]. Patient's age when submitted to T&A also may influence QoL. One can suppose that older patients might have worse QoL in school or emotional domains due to a wider social interaction. These aspects were not analyzed in this paper.

QoL assessment in children is a challenge, due to the complex nature of this variable and to child development. Children may not have the ability to answer correctly the questionnaires used in this assessment, making the QoL measurement from the parents' perspective easier [30]. There are studies that demonstrate variable correlation between data obtained in children and those obtained by their parents' point of view [31]. Thus, this is a limitation of this research, which used only questionnaires applied for parents. Despite that, many authors have similar practice in the assessment of QoL in children with oSDB [7-9,11,14,21,23,28].

This study confirms improvement on QoL in patients with oSDB submitted to T&A assessed by the PedsQL 4.0 and OSA-18. It extends the areas of knowledge by revealing postoperative modification in severity category of the OSA-18 from 93.3% moderate-severe to 100% mild in the overweight/obese group, and from 55% moderate-severe to 90% mild in the low-weight/eutrophic group.

There are some aspects that may influence QoL results, such as patient's age when submitted to T&A, which was not analyzed in this paper. The small sample of obese children and the absence of polysomnography results to diagnose the severity of oSDB are also limitations of the study.

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