



# International Journal of Sleep Disorders

## Research Article

# Impact of Adenotonsillectomy Vs Conservative Treatment on the Behavioural Changes in Children with Sleep Related Breathing Disorder - A Randomized Trial -

Roshan K verma<sup>1\*</sup>, Vetri Kumar<sup>1</sup>, Manju Mohanty<sup>2</sup> and Naresh K Panda<sup>1</sup>

<sup>1</sup>Department of Otolaryngology, Head and Neck surgery, Institute of Medical Education and Research, Chandigarh, India

<sup>2</sup>Department of Neurosurgery, Institute of Medical Education and Research, Chandigarh, India

**\*Address for Correspondence:** Roshan K Verma, Department of Otolaryngology, Head and Neck surgery, Institute of Medical Education and Research, Chandigarh, India -160012. Fax +911-722-744-401; Tel: +919-914-209-761; E-mail: roshanverma@hotmail.com

**Submitted: 23 November 2020; Approved: 17 December 2020; Published: 18 December 2020**

**Cite this article:** Verma RK, Kumar V, Mohanty M, Panda NK. Impact of Adenotonsillectomy Vs Conservative Treatment on the Behavioural Changes in Children with Sleep Related Breathing Disorder - A Randomized Trial. Int J Sleep Disord. 2020 Dec;3(1): 017-023.

**Copyright:** © 2020 Verma RK, et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

**Introduction:** There is a strong relation between sleep related breathing disorder and behavioral issues seen in children. Adenotonsillar hypertrophy is one of the major causes of sleep related breathing disorder (SDB) in children. The aim of the present study was to see the impact of adenotonsillectomy vs conservative treatment on the behavioral problems seen in children with sleep related breathing disorder.

**Study design:** Prospective, randomized study

**Material and methods:** 40 children presenting with history of sleep related breathing disorder were assessed by Child's Sleep Habit Questionnaire (OSA-18) to assess the severity of SDB. These children were then assessed by child psychiatrist and caregivers were asked to fill child behaviour questionnaire - Parent Version Probit II study to look for behavioral issues.

Children's were randomly divided into two groups of 20 children.

Group I underwent adenotonsillectomy

Group II received conservative medical management

After 1 year these children were reassessed by the child psychologist and care givers were asked to fill child behaviour questionnaire - Parent Version Probit II

**Results:** Though improvement was seen in all the categories of child behaviour questionnaire post intervention in both the groups I and II but statistically significant improvement in hyperactivity and emotional scores was seen in adenotonsillectomy group I when compared to the medical management group II. ( $p < .05$ ).

**Conclusion:** Adenotonsillectomy in children with sleep related disorder breathing disorder and adenotonsillar hypertrophy had significant improvement in hyperactivity and emotional scores.

**Keywords:** Sleep related breathing disorder; Children; Adenotonsillectomy; Medical treatment; Behavioral issues

## INTRODUCTION

Pediatric Sleep-Disordered Breathing (SDB) is a spectrum of conditions that occur as a result of upper airway narrowing during sleep. The frequency and severity of upper airway narrowing may lead to gas exchange abnormalities and frequent arousals during sleep. Sleep related breathing disorder may range from primary snoring (mildest) to upper airway resistance syndrome to obstructive hypoventilation and obstructive sleep apnea (severe) [1].

The prevalence of SDB in children may approach 11% [2]. Adeno-tonsillar hypertrophy is the commonest causes of SDB in children. The three main symptoms of SDB in children are snoring, apnea with noisy resumption of breathing, and difficulty in breathing during sleep. Restless sleep, persistent body movements during sleep and abnormal sleeping positions (kneeling or upright) can also be seen in children with adenotonsillar hypertrophy presenting with SDB. Few children may complain of nocturnal enuresis. Some may have compromised somatic growth and cardiovascular complications and pulmonary hypertension at presentation [3].

Children with sleep disorder breathing disorder may also have multiple neurocognitive behavioral issues like hyperactivity, restlessness, inattention, alertness, aggressive behavior, learning difficulties and emotional issues like depression, anxiety, aggression, conduct problem at school, peer related issue and social withdrawal issues [4]. This may affect memory processes, lead to low IQ levels, language delays and are usually poor academic performers in the school.

Adeno tonsillectomy has been shown to be effective in reversing the ventilatory and sleep disturbances in children with SDB [5,6]. But does adenotonsillectomy reverse the neurocognitive and behavioral deficits seen in SDB? Medical management with intranasal corticosteroids, course of antibiotic therapy, antiallergic treatment have also been shown to effective in the management of SDB in children. How effective is medical treatment in comparison

to adenotonsillectomy in reversing the neurocognitive and sleep behavior in children presenting with sleep disorder breathing.

This study was designed to study the effect of adenotonsillectomy on the behavioral and cognitive deficits in children suffering from Sleep disorder breathing and to compare it with children receiving medical therapy.

## MATERIALS AND METHODS

This study was a randomized prospective observational control study and was approved by the institute review board. The study period was from July 2017 to December 2018. This study included 40 consecutive children who were having symptoms of sleep disordered breathing and had adeno-tonsillar hypertrophy on examination. They were divided randomly into 2 groups based on randomization table.

Group A: These children underwent Adenotonsillectomy.

Group B: These children were given medical management consisting of tab amoxiclav 15-20 mg/kg/day for 3 weeks, levocetirizine oral solution .5 mg/ml for 6 weeks, saline nasal drops three drops/ three times a day and mometasone nasal spray 2 puffs /day for 6 weeks.

Children with co-existing conditions that exacerbate OSAs (congenital disorder, allergy, poorly controlled asthma or cardiac disease), history of medication for ADHD, children diagnosed with mental Retardation, neurological disorder, history of head Injury or brain trauma, obese children with BMI > 25 and uneducated caregivers who couldn't fill the questionnaires were excluded from the study.

## STUDY METHODOLOGY

The tools of study - was

1. Child Behavior Questionnaire -Parent Version Probit 2 Study [7].

## 2. Children's Sleep Habits Questionnaire [8].

All the children attending the outpatient department of department of Otolaryngology, PGIMER, Chandigarh with complaints of adeno-tonsillar hypertrophy were screened and those with history of disturbed sleep behavior and frequent arousals were included in the study. A detailed general physical examination along with detailed otolaryngologic examination was done and findings recorded. An informed consent from parents was taken before inclusion of study. The parents and care takers were counselled and informed about the procedures and treatment and only those who were willing that their children be included in the study were enrolled for the study.

Caregivers of children were asked to fill questionnaire related with child's behavior during sleep using Child's sleep habit questionnaire and quality of life (with OSA-18) questionnaire to assess the severity of sleep related breathing disorder.

Child psychologist and parents and caregivers of children were asked to fill child behaviour questionnaire - Parent Version Probit II Study independently. The average scores of both scores were recorded

### Postoperative assessment:

The children were reassessed after three months and 1 year in both the groups. Detailed clinical examination was done and improvement in symptoms was recorded in both the groups. Care giving parents were again asked to fill questionnaire related with child's behavior during sleep using Child's sleep habit questionnaire and quality of life (with OSA-18) questionnaire. Child was referred to child psychologist for assessment of general behavior and mental functioning. Parents and caregivers and child psychologist were again asked to fill child behaviour questionnaire - Parent Version Probit II Study independently. The average of both scores were considered for evaluation.

The statistical analysis was done using the student t test. The comparison of Pre and Post intervention of both Group's variable was done using Mc Nemar Bowker test. Levene's test was used to test the equality of variance and obtain the  $p$  - values of the sub variant of CBQ & SHQ scores.

## RESULTS

A total of 40 children who fulfilled the inclusion and exclusion criteria were included in the study. The mean age of children's in group I was 6.1years (4-10 years) and the mean age in group II was 5.37 year (3-12years) ( $p > .05$ ). Out of 20 children in group I, 15 children (75%) were males and 5 children (25%) were female. In group II out of 20 children 16 children (80%) were males and 4 children (20%) were female. ( $p > .05$ ) Snoring at night was the most common symptom in both the groups. It was the presenting feature in 50% of children of group I and 58% of children in group II. Other presenting symptoms were recurrent respiratory infections (25%), altered sleep habits during sleep (15%), changes in mood and poor school performance (5%) and bedwetting (1%).

Adenoid and tonsillar status was recorded preoperatively and at 3 months and 1year after intervention in both the group I and group II using lateral x ray of neck and nasal endoscopy. Preoperatively in group I, 14 children (70%) had grade III, 3 (15%), grade IV, 1 (4%) grade II and 2 (9%) had grade I adenoid hypertrophy. While in group II, 15 children (75%) had grade III, 3 (15%) grade IV, 1 (5%) grade II and 1 (5%) grade I adenoid hypertrophy. Comparison of preoperative

adenoid status of Group I and group II was nonsignificant ( $p > .05$ ) At 3 months and 1 year after adenoidectomy adenoid hypertrophy was absent in all gr I children while at 3 months in group II, 7 children had grade I, 10 had grade II, 2 had Gr 3 and 1 had grade 4 hypertrophy and at 1 year 9 children had grade 1, 8 had grade 2 and 2 had grade 3 and 1 had grade 4 adenoid hypertrophy (Figure 1a).

The tonsillar status was also assessed at presentation and at 3 months and 1 year after intervention in both the groups. Preoperatively in Group I, 14 children (70%) had grade III tonsillar hypertrophy, 3 children (15%) had grade IV, 2 (10%) had grade II and 1 (5%) had grade I while in group II, 12 children (60%) had grade III, 4 (20%) grade IV, 3 (15%) had grade II, 1 (5%) had grade II and 1 (5%) had grade I tonsillar hypertrophy. ( $p > .05$ ). At 3 months in group I only 1 patient had small remnant of tonsillar tissue which was not operated, while at 1 year no tonsillar remnant was seen in any group I child. While at 3months in Group II, 7 children had grade I, 9 had grade II, 2 had grade 3 and 2 had grade 4 tonsillar hypertrophy. At 1 year after intervention in group II, 9 children had grade 1, 7 had grade 2 and 3 had grade 3 and 1 had grade 4 tonsillar hypertrophy (Figure 1b).

Sleep related breathing disorder was assessed by Child's sleep habit and quality of life (with OSA-18) questionnaire in both the groups. The mean preintervention score of sleep questionnaire in group I was 55.35 (35-80) while the mean score in group II was 54.65 (40-80). The difference between both groups was not significant. ( $p > .05$ )

Behavior issuers in children with sleep related breathing disorder was assessed using child behaviour questionnaire - Parent Version Probit II Study. The pretreatment scores were recorded in both the groups. The mean child behavior questionnaire score in group I was 35.15 (29-44), while the mean score in group II was 33.95 (20-43). There was no statistical difference between both the groups. ( $p > .05$ ). Both groups were found to be comparable in all parameters measured.

We compared the Sleep Habit Questionnaire scores both pre and post operatively in both Groups. In group I, the pre intervention mean SHQ score was 55.35 (35-68) and the mean post intervention SHQ score was 67.05 (46-65) at 3 months and 72.05 (34-80) at 1 year. This was found to be statistically significant. ( $p > 0.023$ ). While in group II children the mean pre intervention SHQ score was 54.65 (35-68) and the post intervention the mean SHQ score was 60.05 (46-65) at 3 months and 63.2 (38-76) at 1year. ( $p$  value .30). The mean post-operative SHQ score of both groups at the end of 1year was compared between both groups. The mean postoperative SHQ score in group I at 1 year was 70.05 (34-80) and Group II was 63.2 (38-76). ( $p$  value .023). Adenotonsillectomy was found to significantly improve the postoperative SHQ scores when compared to conservative treatment (Figure 2).

We also evaluated the sleep behavior in terms of sleep habits like bed time behavior, sleep behavior, waking during night and morning wake between both groups I and II. No significant difference in the sleep behavior was observed after 1 year of intervention in both the groups (table 1).

Child behavior questionnaire was assessed using child behaviour questionnaire - Parent Version Probit II in both the groups at different times. We compared mean difference between the preoperative-post operative CBQ score in both the groups.

The mean Preoperative CBQ score in group I was 35.15 and Postoperative CBQ score at 3 months was 39.1 and at 1year it was 41.1.

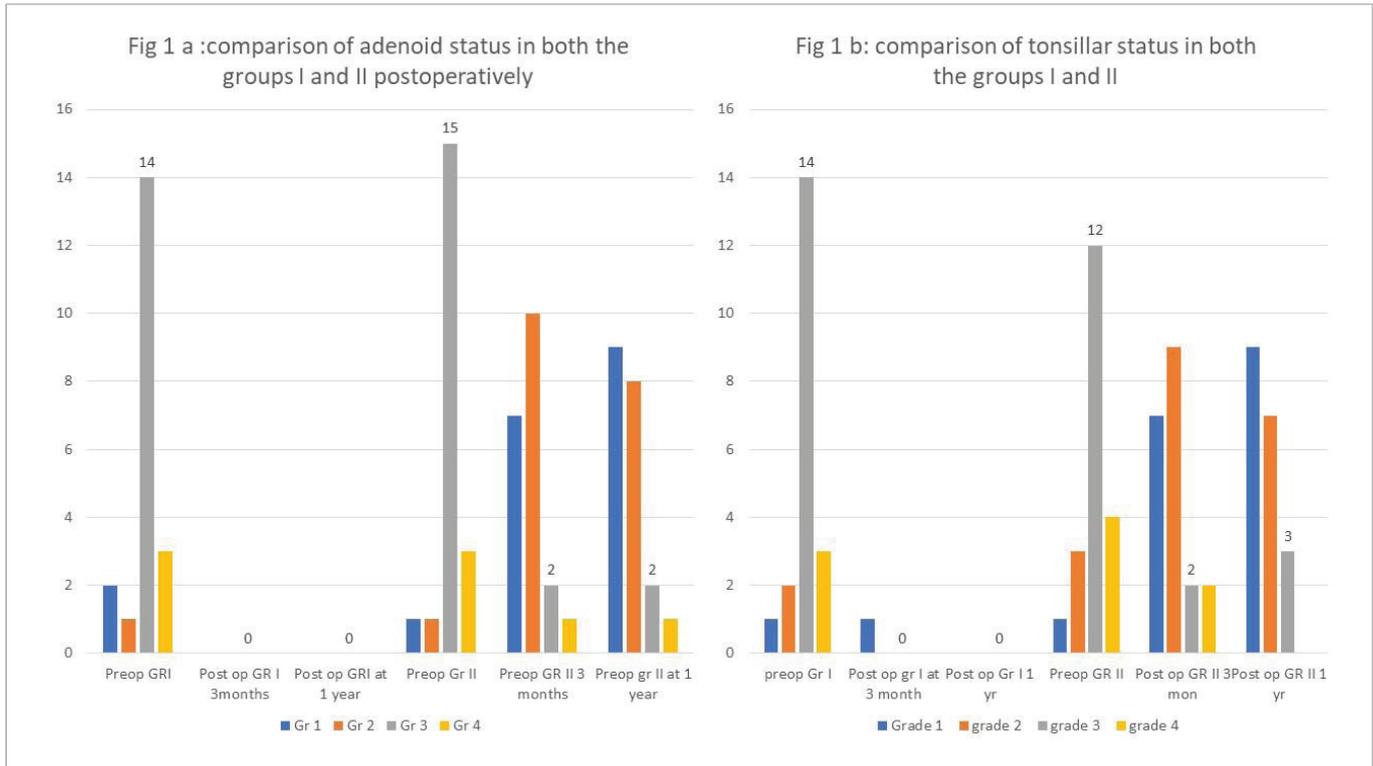


Figure 1a,b: Shows the status of adenoid and tonsils preoperatively and after 3 months and 1 year after surgery.

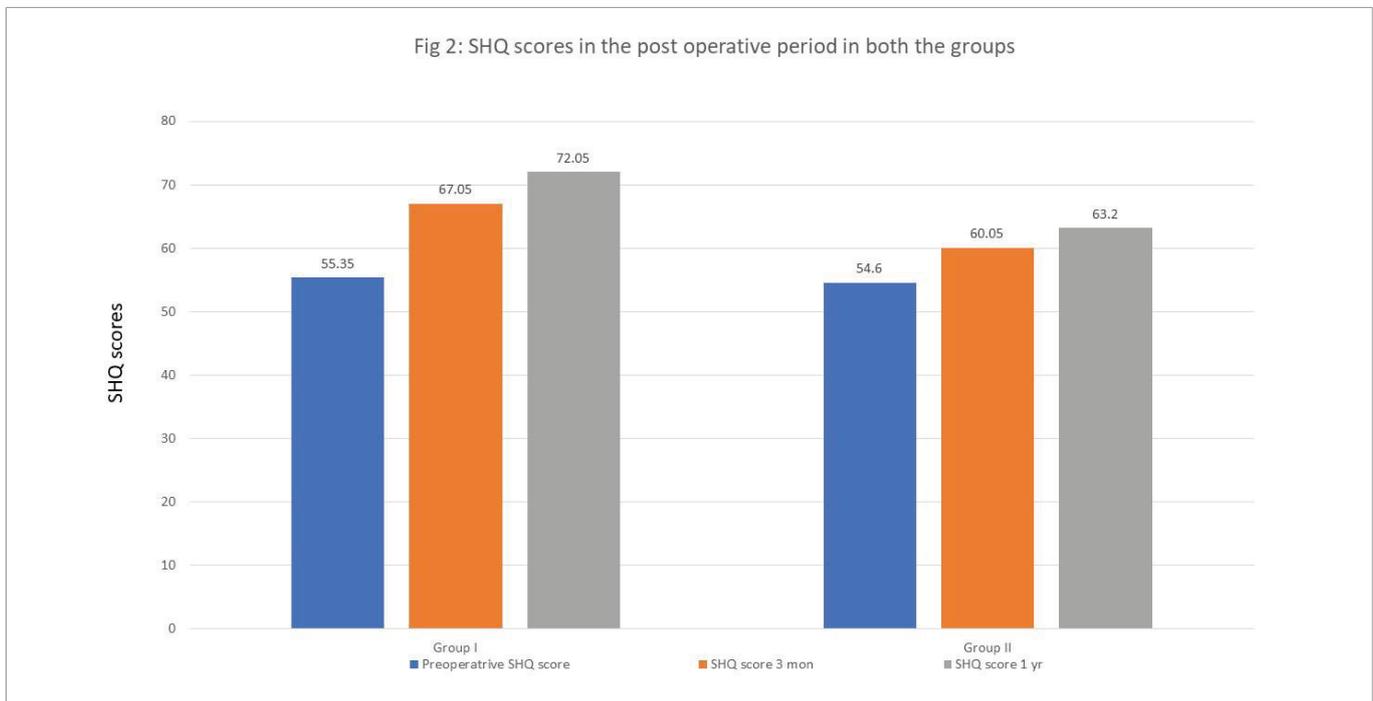


Figure 2: Sleep habit scores in both the groups pre and post intervention.

(*p* value .078) which was nonsignificant. While in group II the mean preintervention CBQ score was 33.95- and 3-month post intervention score was 38.5 (15-55) and at 1 yr the mean CBQ score was 39 (15-65). The difference was statistically non-significant (*p* value .075). We also compared the mean post-operative CBQ score between both

groups at 3 month and 1 year. The difference was also statistically not significant. (*p* value.625). Child behavior questionnaire scores were not significantly different between the adenotonsillectomy and the conservative management group (Figure 3).

We also evaluated the child behavior in terms of emotional

problem, conduct problem, hyperactivity, peer problem and Prosocial, between both groups I and II before and after intervention based on questionnaire components.

In group I, mean emotional problem behavior questionnaire score preoperatively was 7.25 and post-operative at 1 year it was 9.45. This was significant (*p* value .014). In group II, the emotional problem score pre intervention was 6.20 and post intervention score at 1yr it was 7.00 which was not statistically significant (*p* value 0.105). Emotional scores in children were found to be improved in the adenotonsillectomy group.

The mean conduct problem score in Group I preoperatively was 6.75 and postoperative conduct score at 1 yr was 7.8. This was not significant (*p* value 0.378). While the mean conduct problem score pre intervention was 6.40 in group II while post intervention at 1 year the score was 8.22 which also was found not significant. (*p* value 0.105). Both adenotonsillectomy and conservative management of SDB in children did not significantly improve the conduct problem scores in children after 1 year.

**Table1:** Comparison of pre and postintervention sleep behavior scores in both the groups.

	Group I	Group I		Group II	Group II	
	Mean preop	Mean post op at 1 yr	<i>p</i> values	Mean pre op	Mean post op at 1 yr	<i>p</i> values
SHQ	55.35	67.05	.001	54.65	60.05	0.32
Bedtime	22.55	25.65	.10	22.44	23.85	.12
Sleep Behaviour	21.20	24.60	0.15	21.65	22.65	.77
Waking During Night	7.55	6.50	0.16	3.70	5.25	.30
Morning Wake up	7.10	9.50	.081	7.65	7.80	.64

We also assessed the hyperactivity score. In Group I preoperative hyperactivity score was 6.45 (3-13) while postoperative at the end of 1 year the score was 7.5 (5-15) which was found to be significant. (*p* value 0.042) while in group II the mean hyperactivity questionnaire score pre intervention was 7.6 (5- 20) and post intervention score at 1 year was 7.8 (5 - 20). This was also found non-significant. (*p* value - 0.50).

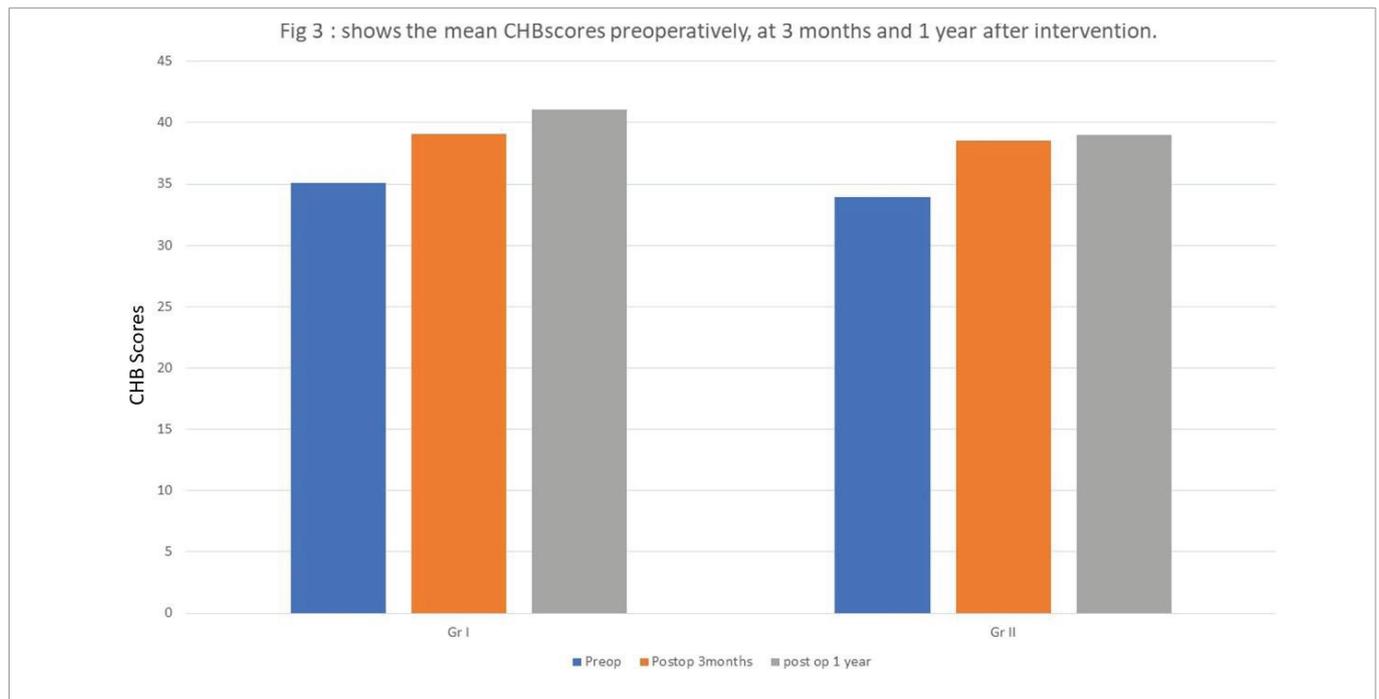
Peer problem issues in children were also assessed using questionnaire. In group I the peer problem score preoperatively was 7.0 (4-11) and postoperatively at 1 year was 7.25 (0 - 16) (*p* value 0.513) which was non-significant. In group II, peer problem score pre intervention score was 6.7 (0-15) and post intervention at 1 year was 7.6 (0-18) (*p* value .45) which was also found nonsignificant.

Social behavioral issues in children was assessed using prosocial questionnaire scores. In group I, the mean preoperative prosocial score was 7.5 (4-13) and post-operative pro social questionnaire scores at 1 year was 7.55 (3-15) (*p* value 0.783) nonsignificant. While in group II,

Peer problem score pre intervention was 6.7 (3-10) and post intervention at 1year it was 7.6 (4-12) (*p* value .440) which was also non-significant (Table 2).

## DISCUSSION

Adenotonsillectomy is considered to be the gold standard for the management of sleep disorder breathing disorder in children if children have significant adenotonsillar hypertrophy at presentation. Children who undergo adeno-tonsillectomy for adenotonsillar hypertrophy and sleep related breathing disorder may experience improved sleep and alleviation of upper airway obstruction. There are reports in the literature which prove that adenotonsillectomy improves many of the behavioral and neurocognitive functions in children occurring due to sleep related breathing disorder.<sup>5,6</sup> But is conservative medical



**Figure 3:** Child behavior scores in the both the groups pre and post intervention at 1 year.

**Table2:** Comparison of pre and postintervention CBQ in both the groups.\

	Group I	Group I		Group II	Group II	
	Mean preop	Mean post op at 1 yr	P values	Mean pre op	Mean post op at 1 yr	p values
<b>CBQ</b>	35.1	39.1	0.78	33.95	38.50	.786
<b>Emotional problems</b>	7.2	9.4	0.014	6.20	7.55	0.015
<b>Conduct prob-blems</b>	6.7	7.8	0.378	6.40	8.22	0.378
<b>Hyperactivity</b>	6.4	7.0	0.428	7.6	7.40	.428
<b>Peer problem</b>	7.0	7.2	0.513	6.7	7.60	0.513
<b>Prosocial</b>	7.5	7.5	0.783	6.9	7.70	.783

treatment equally effective in improving the sleep related breathing disorder and other behavioral issues in children? How does it compare with improvement seen after adeno-tonsillectomy? This study was done to compare the improvements in Sleep behavior and overall behavior in children after adenotonsillectomy in comparison to conservative medical treatment in children presenting with SDB.

In our study, the children presented most commonly with history of snoring (50%). Other common symptoms were history of recurrent upper respiratory tract infections, altered sleep habit, mood changes and poor school performance and bed wetting. Our study also highlights that children with sleep disorder breathing have emotional and behavioral changes which may include hyperactivity, inattention, and conduct problems, peer problem issues and social issues.

We found a statistically significant difference in the sleep behavior scores between pre and post adenotonsillectomy in group I. (*p* value 0.023) while in group II difference between the Pre intervention and the post intervention SHQ score was nonsignificant. (*p* value 0.30). So we conclude that adenotonsillectomy is better in controlling sleep related behavioral issues in children who have sleep related breathing disorder due to adenotonsillar hypertrophy in comparison to the conservative management.

Child behavioral issues in children with sleep related breathing disorder was assessed using child behaviour questionnaire - Parent Version Probit II preoperatively, at 3 month and 1 year after intervention in both the groups. Though we did find improvement in postoperative CBQ score in children post adenotonsillectomy in group I and post medical treatment in group II but the difference was found to be statistically insignificant. We also compared the mean postintervention scores of both groups at 1 year. Though the CBQ scores were slightly better in group I than group II but the difference was statistically found nonsignificant. (*p* value .625). This shows that adenotonsillectomy improved children overall behavior scores but was not superior to medical management. We conclude that though overall CBQ score improves after both adenotonsillectomy and medical treatment in children with SDB but the magnitude of improvement is more in the adenotonsillectomy group [9]. Even Carole et in her randomized trial concluded that strategy of watchful waiting and surgical treatment by adenotonsillectomy though did not improve the attention and executive function but they did significantly reduce the symptoms and improved the child’s behavior outcome and quality of life [10].

We also found statistically significant improvement of

postoperative emotional and hyperactivity scores in group I as compared II. This suggests that adenotonsillectomy is better in controlling hyperactivity and emotional problems in children presenting with SDB and adenotonsillar hypertrophy as compared to medical management. However, pre and post intervention conduct score, peer problem score and pro social score were found to be non- significant between both group I and II. (*p* >.05). This suggests that adenotonsillectomy is better in controlling hyperactivity and emotional problems in children as compared to medical management. Mitch El in their study reported significant improvement in the BASC scales of atypicality, depression, hyperactivity, and somatization after adenotonsillectomy [11].

We also correlated the severity of behavioral changes seen preoperatively with severity of sleep disorder breathing assessed by sleep breathing questionnaire. We did not find a positive correlation between the degree of behavioral impairment seen in children assessed by CBQ scores and the degree of sleep disorder breathing questionnaire and the grade of adeno-tonsillar hypertrophy. This finding is similar to study done by Owens et al, Friedman et al [12,13].

## CONCLUSION

Children with sleep disorder breathing disorder have multiple neurocognitive behavioral issues like hyperactivity, emotional issues like depression, anxiety, aggression, conduct problem at school, peer related issue and social withdrawal issues. Adenotonsillectomy improved overall child behavior scores though it was not found superior to medical management. Hyperactivity and emotional scores in children were found to improve significantly after adenotonsillectomy.

## COMPLIANCE WITH ETHICAL STANDARDS

Institutional Ethics board approval was taken. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

## REFERENCES

1. Bonuck KA, Chervin RD, Cole TJ, Emond A, Henderson J, Xu L, Freeman K. Prevalence and persistence of sleep disordered breathing symptoms in young children: a 6-year population-based cohort study. *Sleep*. 2011 Jul 1;34(7):875-84. doi: 10.5665/SLEEP.1118. PMID: 21731137; PMCID: PMC3119829.
2. Witmans M, Young R. Update on pediatric sleep-disordered breathing. *Pediatr Clin North Am*. 2011 Jun;58(3):571-89. doi: 10.1016/j.pcl.2011.03.013. PMID: 21600343.
3. Guilleminault C, Akhtar F. Pediatric sleep-disordered breathing: New evidence on its development. *Sleep Med Rev*. 2015 Dec;24:46-56. doi: 10.1016/j.smrv.2014.11.008. Epub 2014 Dec 4. PMID: 26500024.
4. Chervin RD, Dillon JE, Archbold KH, Ruzicka DL. Conduct problems and symptoms of sleep disorders in children. *J Am Acad Child Adolesc Psychiatry*. 2003 Feb;42(2):201-8. doi: 10.1097/00004583-200302000-00014. PMID: 12544180.
5. Garetz SL. Behavior, cognition, and quality of life after adenotonsillectomy for pediatric sleep-disordered breathing: summary of the literature. *Otolaryngol Head Neck Surg*. 2008 Jan;138(1 Suppl):S19-26. doi: 10.1016/j.otohns.2007.06.738. PMID: 18164375.

6. Kohler MJ, Lushington K, van den Heuvel CJ, Martin J, Pamula Y, Kennedy D. Adenotonsillectomy and neurocognitive deficits in children with Sleep Disordered Breathing. *PLoS One*. 2009 Oct 6;4(10):e7343. doi: 10.1371/journal.pone.0007343. PMID: 19806214; PMCID: PMC2752197.
7. Rothbart MK, Ahadi SA, Hershey KL, Fisher P. Investigations of temperament at three to seven years: the Children's Behavior Questionnaire. *Child Dev*. 2001 Sep-Oct;72(5):1394-408. doi: 10.1111/1467-8624.00355. PMID: 11699677.
8. Katz T, Shui AM, Johnson CR, Richdale AL, Reynolds AM, Scahill L, Malow BA. Modification of the Children's Sleep Habits Questionnaire for Children with Autism Spectrum Disorder. *J Autism Dev Disord*. 2018 Aug;48(8):2629-2641. doi: 10.1007/s10803-018-3520-2. PMID: 29500758.
9. Wei JL, Mayo MS, Smith HJ, Reese M, Weatherly RA. Improved behavior and sleep after adenotonsillectomy in children with sleep-disordered breathing. *Arch Otolaryngol Head Neck Surg*. 2007 Oct;133(10):974-9. doi: 10.1001/archotol.133.10.974. PMID: 17938319.
10. Marcus CL, Moore RH, Rosen CL, Giordani B, Garetz SL, Taylor HG, Mitchell RB, Amin R, Katz ES, Arens R, Paruthi S. A randomized trial of adenotonsillectomy for childhood sleep apnea. *New England Journal of Medicine*. 2013 Jun 20;368(25):2366-76. doi: 10.1056/NEJMoa1215881
11. Mitchell RB, Kelly J. Behavioral changes in children with mild sleep-disordered breathing or obstructive sleep apnea after adenotonsillectomy. *Laryngoscope*. 2007 Sep;117(9):1685-8. doi: 10.1097/MLG.0b013e318093edd7. PMID: 17667138.
12. Friedman BC, Hendeles-Amitai A, Kozminsky E, Leiberman A, Friger M, Tarasiuk A, Tal A. Adenotonsillectomy improves neurocognitive function in children with obstructive sleep apnea syndrome. *Sleep*. 2003 Dec 15;26(8):999-1005. doi: 10.1093/sleep/26.8.999. PMID: 14746381.
13. Owens JA. Neurocognitive and behavioral impact of sleep disordered breathing in children. *Pediatr Pulmonol*. 2009 May;44(5):417-22. doi: 10.1002/ppul.20981. PMID: 19382210.