

Study on Eustachian Tube Dysfunction and Effect of Adenoidectomy on Hearing Threshold and Middle-Ear Pressures

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Abstract

Adenoiditis and Adenoid Hypertrophy are the most common health conditions afflicting the Paediatric population. Nasopharyngeal obstruction due to Adenoid Hypertrophy leads to Hyponasality, Mouth breathing, Snoring, and Sleep apnea. It also causes Eustachian Tube Dysfunction leading to increased negative middle ear pressure, which is an important etiological factor in the causation of hearing loss in children. This may result in serious consequences in the form of Speech impairment, Inattention, Poor performance in school, Behavioral problems and Impaired intellectual development. *Materials and Method:* In this study, one hundred children (200 ears) aged between 5 and 14 years who underwent Adenoidectomy were analyzed using Otoscopy, Pure Tone Audiometry and Impedance Audiometry pre-operatively and 6 weeks post-operatively. X-Ray Nasopharynx-Lateral view and Diagnostic Nasal Endoscopy was done to assess the grade of Adenoid Hypertrophy. *Results:* It was found that post-operative hearing threshold and middle ear pressures showed significant improvement following Adenoidectomy. The total percentage of ears with normal Type A impedance curve increased from a pre-operative 53.5% to a post-operative 91%. *Conclusion:* Our study concludes that Adenoidectomy has beneficial effects in children with Otitis Media with Effusion and Eustachian Tube Dysfunction.

Keywords: Adenoiditis, Adenoid Hypertrophy; Adenoidectomy; Hyponasality.

Introduction

Adenoiditis and Adenoid Hypertrophy are the most common health conditions afflicting the Paediatric population. Nasopharyngeal obstruction due to Adenoid Hypertrophy leads to Hyponasality, Mouth breathing, Snoring, Sleep apnea, Otitis Media with Effusion and Sinusitis.

Eustachian Tube Dysfunction can occur in Adenoiditis and Adenoid Hypertrophy. The functions of the Eustachian Tube include middle ear ventilation to Equalize the middle ear pressure with atmospheric pressure, Clearance of secretions produced within the middle ear into nasopharynx and Protection of middle ear from nasopharyngeal secretions. Hearing is optimal when pressure within the middle ear is relatively the same as that of the

atmosphere. Adenoid Hypertrophy can obstruct the pharyngeal ostia of the Eustachian Tube by mechanical pressure and produce pressure on the lymphatics causing mucosal swelling. It can also act as a carrier of pathogenic bacteria and viruses leading to increased oedema and Eustachian Tube dysfunction.

The presence of Eustachian Tube Dysfunction leads to increased negative middle ear pressure which is an important aetiological factor in the causation of hearing loss. This may result in serious consequences in the form of Speech impairment, Inattention, Poor performance in school, Behavioral problems and Impaired intellectual development.

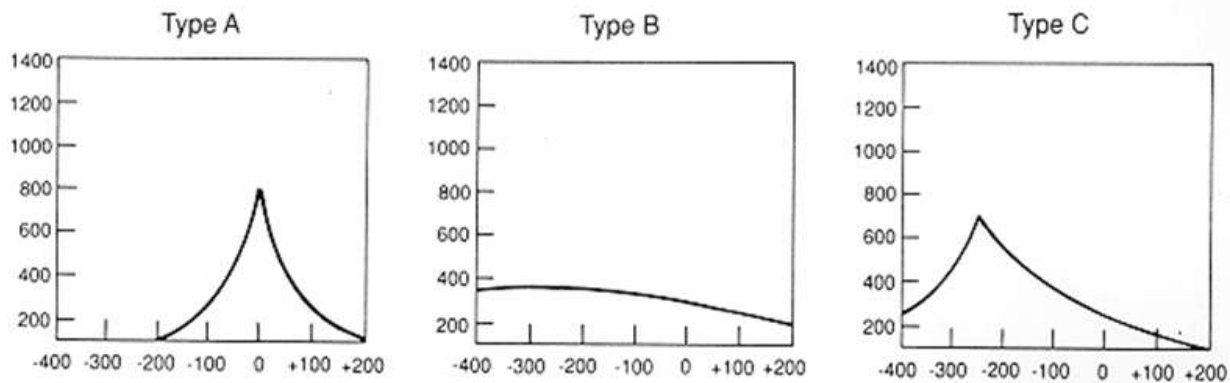
This study documented the presence of the Eustachian Tube dysfunction in children with Adenoiditis and Adenoid Hypertrophy and the

beneficial effect of Adenoidectomy on Hearing threshold and Middle ear pressures.

Materials and Method

Patients attending the Department of Otorhinolaryngology at Rajah Muthiah Medical College with symptomatic Adenoiditis and Adenoid Hypertrophy and undergoing Adenoidectomy between October 2015 to August 2017 were included in this study.

One hundred children, of either sex, in the age group between 5 and 14 years suffering from Adenoiditis and Adenoid Hypertrophy were included in the study. X-Ray Nasopharynx-Lateral view and Diagnostic Nasal Endoscopy was done to confirm presence of Adenoid Hypertrophy, to determine size of adenoids and to assess airway patency. Pure Tone Audiometry and Impedance Audiometry was done in all cases before surgery and 6 weeks after Adenoidectomy to assess the Hearing Threshold and Middle Ear Pressures and thereby Eustachian Tube Dysfunction.



Tympanometry was done in all patients pre-operatively and six weeks post-operatively and the results are noted as

Type A- Normal Compliance

Type B- Otitis Media with Effusion with reduced Compliance

Type C- Negative Middle Ear Pressure with normal Compliance

Endoscopic Grading of Adenoid Hypertrophy

GRADE	Percentage of Obstruction of Choana
I	< 25%
II	25 - 50%
III	50 - 75%
IV	>75 %

X-Ray Nasopharynx Lateral View Grading of Adenoid Hypertrophy

Grade	Soft Tissue Shadow in Nasopharynx (%)	Adenoid Hypertrophy
1	0-50	Mild
2	50-75	Moderate
3	75-100	Severe

Inclusion Criteria

1. Children between the ages of 5- 14 years
2. Children presenting with Adenoiditis and Adenoid Hypertrophy (Minimum three episodes/year)
3. Children presenting with complaints of Nasal

Obstruction not influenced by decongestants, Mouth breathing, Snoring, Difficulty in swallowing and Hypoacusis.

Exclusion Criteria

Children with Cranio-facial anomalies, Nasal septal deviation and Sinonasal infection

Results

Table 1: Gender Incidence

Male	54 %
Female	46 %

Table 2: Presenting Symptoms

Symptom	Incidence
Dysphagia	100%
Odynophagia	100%
Mouth Breathing	52%
Snoring	52%
Hearing Impairment	18%
Ear Block	18%
Recurrent URTI	100%

Table 3: Examination Findings

Clinical Sign	Incidence
Open Mouth Breathing	16%
High Arched Palate	8%
Pinched Nostrils	8%
Crowded Teeth	12%

Table 4: Diagnostic Endoscopic Grading of Adenoid Hypertrophy in the Present Study

Grade of Adenoid Hypertrophy	Total (Number of Children)
Grade 1	0
Grade 2	48
Grade 3	36
Grade 4	16

Table 5: Diagnostic Nasal Endoscopic Finding of Abutment of Adenoid on the Torus Tubaris

Presence of Abutment on the Torus Tubaris (Percentage)	Absence of Abutment on the Torus Tubaris (Percentage)
36%	64%

Table 6: X-Ray Nasopharynx Lateral View Grading of Adenoid Hypertrophy in the Present Study

Grade	Incidence (Percentage)
1	48%
2	36%
3	16%

Table 7: Comparison Between Grade of Adenoid Hypertrophy and Pre-Operative Type of Curve

Grade of Adenoid Hypertrophy	Pre Op Type A Impedance Curve (Number of Ears)	Pre Op Type B Impedance Curve (Number of Ears)	Pre Op Type C Impedance Curve (Number of Ears)	Total
Grade 1	0	0	0	0
Grade 2	89	6	1	96
Grade 3	16	39	17	72
Grade 4	2	9	21	32
Total	107	54	39	200

Table 8: Comparison of Pre-Operative and Post-Operative Hearing Threshold

Hearing Threshold	PRE-OP (n = 200)	PRE - OP (PERCENTAGE)	POST - OP (n = 200)	POST-OP (PERCENTAGE)
	No of Ears		No of Ears	
0 - 25	148	74%	180	90%
26 - 40	36	18%	14	7%
41 - 60	16	8%	0	0%
61 - 80	0	0%	0	0%
> 81	0	0%	0	0%
Lost for Follow up	-	-	6	3%
TOTAL	200	100	200	100

Table 9: Comparison of Pre-Operative and Post-Operative Middle Ear Pressure

Middle Ear Pressure (mm H20)	PRE -OP (n = 200) No of Ears	PRE-OP (Percentage)	POST -OP n= 200 No of Ears	POST - OP (Percentage)
-400 to -350	9	4.5 %	0	0 %
-349 to -300	7	3.5 %	1	0.5 %
-299 to -250	5	2.5 %	1	0.5 %
-249 to -200	20	10%	3	1.5 %
-199 to -150	14	7 %	0	0 %
-149 to -100	22	11 %	8	4 %
-99 to -50	23	11.5 %	2	1%
-49 to 0	88	44%	159	79.5%
1 to 50	10	5%	18	9%
51 to 100	2	1 %	2	1 %
Lost for Follow - up			6	3%
Total	200	100	200	100

Table 10: Comparison between Pre-Operative & Post Operative Type of Impedance Curve

Type of Curve	PRE-OP (n = 200)	PRE-OP (Percentage)	POST-OP (n = 200)	POST-OP (Percentage)
Type A	107	53.5 %	182	91 %
Type B	54	27 %	13	6.5 %
Type C	39	19.5 %	5	2.5 %
Total	200	100 %	200	100 %

Discussion

Secretory Otitis Media also known as Otitis Media with Effusion has been identified as a common middle ear condition causing deafness in children. It affects the child's learning ability through recurrent temporary hearing loss, permanent hearing impairment and language disorders. A Child with an episode of Otitis Media with Effusion often experiences a mild to moderate fluctuating hearing loss, thus appreciating only partial or inconsistent auditory cues which may make it difficult for the ear to filter it from background noise. It has been hypothesized that this may affect the input to the knowledge base or to the neural substrate on which language learning is built. It also has been proposed that any difficulties attributable to Otitis Media with Effusion associated hearing loss may become evident when a child reaches school age and faces the challenges of school environment. Academic skills particularly reading and other language based subjects may be affected when there is a high demand for attention to verbally presented information.

In my study following Adenoidectomy, Pure Tone Audiometry revealed that Hearing Threshold between 0 and 25 db increased from a pre-operative 74% to a post-operative 90%. Remarkable improvement in Middle Ear Pressure was also noted in the range of middle ear pressure between -99 to 99

mm H20, which increased from a pre-operative 61.5% to a post-operative 90.5%. The above findings substantiate the beneficial role of Adenoidectomy in improving Eustachian Tube Function and Middle Ear Pressure.

The main clinical problem in children with Adenoiditis and Adenoid Hypertrophy is that in some children the symptoms of Otitis Media with Effusion is occult. Some children may present with only poor expression and poor communication skills which parents may find to be trivial and hence neglected. Clinical examination is also difficult, especially in children with narrow ear canal, it is very difficult to examine the tympanic membrane. Children tend to be fearful of otoscopic examination, causing them to cry which in turn will cause tympanic membrane congestion resulting in a possible mis-diagnosis.

Thus diagnosing a child with Otitis Media with Effusion is a tricky task. Regardless of the difficulty in diagnosis, it is extremely important to subject a child with suspected Adenoiditis and Adenoid Hypertrophy to Otoscopic, Radiographic and Audiometric studies so that a diagnosis of Eustachian Tube Dysfunction and Otitis Media with Effusion is not missed. If a diagnosis of Otitis Media with Effusion is suspected, early diagnosis and prompt treatment will significantly improve the child's learning and cognitive abilities.

Conclusion

As Helen Keller once notably said, *“The problems of deafness are deeper and more complex, if not more important, than those of blindness. Deafness is a much worse misfortune, for it means the loss of the most vital stimulus- the sound of the voice that brings language, sets thoughts astir, and keeps us in the intellectual company of man.”* Middle ear effusion and Eustachian Tube Dysfunction caused by Adenoid Hypertrophy and Adenoiditis will adversely affect hearing and interfere with the Child’s Intellectual Development and Academic Performance.

Diagnosis of Otitis Media with Effusion in children is often delayed as they cannot complain of hearing loss. Most of the children with abnormal Tympanograms were regarded to have normal hearing by their parents. This may result in serious consequences in the form of Speech impairment, Inattention, Poor performance in school, Behavioral problems and Impaired intellectual development. Thus screening for hearing impairment should include Tympanometry, as Otitis Media with Effusion is one of the most preventable causes of Conductive Hearing Loss. As supported by the results seen in my study, Adenoidectomy has beneficial and constructive effects in children with Eustachian Tube Dysfunction and Otitis Media with Effusion.

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