

## ORIGINAL RESEARCH

**Evaluation of significance of adenoidectomy or adenotonsillectomy in improving Eustachian tube function and to determine how it affects middle ear pressure and hearing threshold****<sup>1</sup>Dr. Jaya Sahu, <sup>2</sup>Dr. Surjeet Singh, <sup>3</sup>Dr. Dinesh Kumar Patel**<sup>1</sup>Associate Professor, <sup>3</sup>Assistant Professor Department of ENT, Late Shri Lakhiram Agarwal Memorial Government Medical College, Raigarh, Chhattisgarh, India<sup>2</sup>Associate Professor, Department of ENT, Lt BRKM Medical College, Jagdalpur, Chhattisgarh, India**Corresponding author**

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**Abstract**

**Background:** The nasopharynx and middle ear are connected via the Eustachian tube. In infants and children, it is shorter, wider, and more horizontal, which explains why they have a higher risk of otitis media. The Eustachian tube controls pressure while ventilating, shielding, and draining the middle ear. The most crucial of these three tasks is pressure regulation. The tensor veli palatini muscle contracts during swallowing, jaw movements, and yawning, causing active intermittent openings of the Eustachian tube to allow the middle ear pressure (MEP) to acclimatize to air pressure. Inadequate tubal function causes the middle ear to experience negative pressure.

**Aim:** The goal of the current study is to highlight the significance of adenoidectomy or adenotonsillectomy in improving Eustachian tube function and to determine how it affects MEP and hearing threshold.

**Methods and Materials:** 50 patient attending ENT outpatient department of Late Shri Lakhiram Agarwal Memorial Government Medical College Raigarh, with symptoms and signs of chronic adenoiditis and/or adenotonsillitis, with or without features of chronic OME and undergoing adenoidectomy or adenotonsillectomy were included for the study. A prospective, experimental study was done after obtaining institutional ethical committee clearance. Relevant history was taken, and clinical examination was done to look for the presence of adenoid hypertrophy, tonsil hypertrophy, and also for the retraction or perforation of tympanic membrane (TM) and or presence of air-fluid level. X-ray Nasopharynx soft-tissue lateral view was done in all the cases to confirm the presence of adenoids.

**Results:** The normal otoscopic findings was observed in 59.4% of ears examined. The air fluid level was observed in 25.2% of examined ears. Dull and retracted findings were observed in 18.7% of ears examined. The mean values of preoperative hearing threshold were  $16.06 \pm 9.204$  dbHL. The mean values of 2nd postoperative hearing threshold were  $20.60 \pm 7.439$  dbHL. The difference was statistically significant with  $p < 0.001$ . The mean values of preoperative hearing threshold was  $16.06 \pm 9.204$  dbHL. The mean values of 6<sup>th</sup> week

postoperative hearing threshold was  $8.70 \pm 5.259$  dbHL. The difference was statistically significant with  $p < 0.001$ . The mean values of preoperative hearing threshold was  $20.61 \pm 7.439$  dbHL. The mean values of 6<sup>th</sup> week postoperative hearing threshold were  $8.70 \pm 5.259$  dbHL. The difference was statistically significant with  $p < 0.001$ .

**Conclusion:** Early adenoidectomy or adenotonsillectomy will aid in the enhancement of the MEP and hearing threshold, the restoration of Eustachian tube function, and the prevention of OME's aftereffects. It may be thought of as a last choice because myringotomy with grommet insertion carries risks such as otorrhea, irreversible perforation, scarring, and retraction..

**Keywords:** Adenoidectomy, Adenotonsillectomy, Eustachian tube, middle ear pressure and hearing threshold

## Introduction

The nasopharynx and middle ear are connected via the Eustachian tube. In infants and children, it is shorter, wider, and more horizontal, which explains why they have a higher risk of otitis media.<sup>1,2</sup> The Eustachian tube controls pressure while ventilating, shielding, and draining the middle ear. The most crucial of these three tasks is pressure regulation.<sup>3,4</sup> The tensor veli palatini muscle contracts during swallowing, jaw movements, and yawning, causing active intermittent openings of the Eustachian tube to allow the middle ear pressure (MEP) to acclimatize to air pressure. Inadequate tubal function causes the middle ear to experience negative pressure.

Poorer active tubal function in the children who are more prone to otitis suggests that recurring infections are brought on by functional obstruction of the Eustachian tube.<sup>5,6</sup>

Adenoids that are swollen can clog the Eustachian tube and restrict the nasopharynx, which prevents the middle ear and mastoid system from being ventilated. The biofilm that covers the adenoids may serve as a reservoir for the bacteria that cause middle ear illness. This could help to explain the clinical gains made following the mechanical removal of the adenoids.<sup>7,8</sup>

The goal of the current study is to highlight the significance of adenoidectomy or adenotonsillectomy in improving Eustachian tube function and to determine how it affects MEP and hearing threshold.

## Methods and Materials

50 patients attending ENT outpatient department Late Shri Lakhiram Agarwal Memorial Government Medical College Raigarh, with symptoms and signs of chronic adenoiditis and/or adenotonsillitis, with or without features of chronic OME and undergoing adenoidectomy or adenotonsillectomy were included for the study. A prospective, experimental study was done after obtaining institutional ethical committee clearance. Relevant history was taken, and clinical examination was done to look for the presence of adenoid hypertrophy, tonsil hypertrophy, and also for the retraction or perforation of tympanic membrane (TM) and or presence of air–fluid level. X-ray Nasopharynx soft-tissue lateral view was done in all the cases to confirm the presence of adenoids.

Then, pure tone audiometry (PTA) using ALPES AD2100 and Impedance Audiometry using RMS TYMPANICA were done in all the cases 1 day before surgery to assess the hearing threshold and MEP. Other preoperative investigations were also done. The patients then underwent either adenoidectomy or adenotonsillectomy. They were then followed up with PTA and impedance audiometry on 2nd postoperative day and also after 6 weeks to assess the changes in hearing threshold and MEP. Children aged  $< 4$  years and more than 12 years, having pre-existing craniofacial anomalies or neuromuscular disorders, previously treated with adenoidectomy, adenotonsillectomy, and/or ear surgery (including ventilation tube insertion for otitis media with effusion [OME]), refused postoperative examination or study enrollment, and those with hemorrhagic diathesis were excluded from the study.

## Results

The normal otoscopic findings were observed in 59.4% of ears examined. The air fluid level was observed in 25.2% of examined ears. Dull and retracted TM findings were observed in 18.7% of ears examined. (Table 1).

**Table 1: Otosopic findings (n=100)**

Otosopic findings (n=100)	Percentage of ears
Normal	59.4
Air-fluid level	25.2
Dull and retracted	18.7

The mean values of preoperative hearing threshold was  $16.06 \pm 9.204$  dbHL. The mean values of 2nd postoperative hearing threshold was  $20.60 \pm 7.439$  dbHL. The difference was statistically significant with  $p < 0.001$ . The mean values of preoperative hearing threshold was  $16.06 \pm 9.204$  dbHL. The mean values of 6<sup>th</sup> week postoperative hearing threshold was  $8.70 \pm 5.259$  dbHL. The difference was statistically significant with  $p < 0.001$ . The mean values of preoperative hearing threshold was  $20.61 \pm 7.439$  dbHL. The mean values of 6<sup>th</sup> week postoperative hearing threshold was  $8.70 \pm 5.259$  dbHL. The difference was statistically significant with  $p < 0.001$ . (table 2).

**Table 2: Comparison of preoperative and postoperative pure tone audiometry values**

	N	Mean	SD	P value
Pair 1				
Preoperative hearing threshold in dbHL	100	16.06	9.204	<0.001
2nd postoperative hearing threshold in dbHL	100	20.60	7.439	
Pair 2				
Preoperative hearing threshold in dbHL	100	16.06	9.204	<0.001
6th week hearing threshold in dbHL	100	8.70	5.259	
Pair 3				
2nd postoperative hearing threshold in dbHL	100	20.61	7.439	<0.001
6th week hearing threshold in dbHL	100	8.70	5.259	

The mean values of preoperative MEP was  $-64.70 \pm 89.027$ . The mean values of 2nd postoperative day MEP was  $-157.26 \pm 152.859$ . The difference was significant statistically with  $p < 0.001$ . The mean values of preoperative MEP was  $-64.70 \pm 89.027$ . The mean values of 6th week MEP was  $18.6 \pm 46.006$ . The difference was significant statistically with  $p < 0.001$ . The mean values of 2<sup>nd</sup> preoperative MEP was  $-157.26 \pm 142.960$ . The mean

values of 6<sup>th</sup> week MEP was 18.6±46.006. The difference was significant statistically with  $p < 0.001$ . (table 3).

**Table 3: Comparison of preoperative and postoperative middle ear pressure**

	N	Mean	SD	P value
Pair 1				
Preoperative MEP	100	-64.70	89.027	<0.001
2nd postoperative day MEP	100	-157.26	152.859	
Pair 2				
Preoperative MEP	100	-64.70	89.027	<0.001
6th week MEP	100	18.6	46.006	
Pair 3				
2nd postoperative day MEP	100	-157.26	142.960	<0.001
6th week MEP	100	18.6	46.006	

## Discussion

It is possible that repeated infections are caused by a functional obstruction of the Eustachian tube based on the fact that children who are more prone to otitis have poorer active tubal function.<sup>9,10</sup> Swollen adenoids can constrict the nasopharynx and obstruct the Eustachian tube, making it difficult to ventilate the mastoid system and middle ear. The germs that cause middle ear disease may be stored in the biofilm that covers the adenoids. This may contribute to the clinical improvements seen after the mechanical excision of the adenoids.<sup>11,12</sup>

The current study's objectives are to demonstrate the importance of adenoidectomy or adenotonsillectomy in enhancing Eustachian tube function and to ascertain how it impacts MEP and hearing threshold. The normal otoscopic findings was observed in 59.4% of ears examined. The air fluid level was observed in 25.2% of examined ears. Dull and retracted findings was observed in 18.7% of ears examined.

This finding was consistent with a study by Fujioka et al. that revealed that while adenoid size varies across children, its maximum was between the ages of 4 and 8 and that it gradually shrank by the time a child reached 15 years old.<sup>3</sup> The incidence of adenoid hypertrophy did not differ significantly according to gender.

The incidence of hearing loss was found to be 16% in a study by Kindermann et al. to determine whether the obstruction of the Eustachian tube opening caused by adenoid hyperplasia causes a change in the MEP (8 out of 50 children).<sup>4</sup> Sarafoleanu et al. calculated the incidence of hypoacusis to be 77.8% in order to demonstrate the relevance of adenoid tissue hypertrophy in the development of Eustachian tube dysfunction.<sup>5</sup> In a different study by Khayat and Dabbagh to determine the prevalence of OME in kids with adenoid hypertrophy, 22 (or 50%) of the 44 kids with OME experienced hearing loss, which was determined by parental and educational reports.<sup>6</sup> In their research of 119 children with OME, Enache et al. noted that every child had a history of deafness.<sup>7,8</sup>

In their study, Sarafoleanu et al. found that 49.2% of participants had middle ear effusion and 28.57% had retracted TM. Moreover, 98 instances with tympanogram data revealed pathologic curves (40.47% Type B curve and 37.30% Type C curve).<sup>5</sup> The otoscopic findings of a related study by Khayat and Dabbagh similarly varied with deformed light cones, TM retractions, and air bubbles.<sup>6</sup> In a study by Ajayan et al. to examine the effects of

tonsillectomy and adenoidectomy in paediatric patients with OME, it was shown that 78.5% of patients had dull and retracted TM, while only 11.42% had air-fluid.<sup>8</sup>

The mean values of preoperative hearing threshold was  $16.06 \pm 9.204$  dbHL. The mean values of 2nd postoperative hearing threshold was  $20.60 \pm 7.439$  dbHL. The difference was statistically significant with  $p < 0.001$ . The mean values of preoperative hearing threshold was  $16.06 \pm 9.204$  dbHL. The mean values of 6<sup>th</sup> week postoperative hearing threshold was  $8.70 \pm 5.259$  dbHL. The difference was statistically significant with  $p < 0.001$ . The mean values of preoperative hearing threshold was  $20.61 \pm 7.439$  dbHL. The mean values of 6<sup>th</sup> week postoperative hearing threshold was  $8.70 \pm 5.259$  dbHL. The difference was statistically significant with  $p < 0.001$ .

These findings were comparable to those made in the study by Choi et al. to determine how an adenotonsillectomy affected young patients with adenotonsillar hypertrophy's ability to function immediately after the procedure. He saw that the majority had a C-shaped curve. 76% (38/50) of the cases (CC and BB kinds) remained unresolved on postoperative day 2, compared to 24% (12/50) of normal (AA type) or resolved patients (CA type). Bilateral MEPs showed a statistically significant difference between preoperative and postoperative days (P 0.001).<sup>9</sup> In a study by Unlu et al. to examine the changes in the MEP in the early stage after adenoidectomy in children with adenoid hypertrophy without OME, similar outcomes were seen.

48 patients (or 75%) had a pathological drop in MEP 24 hours after the surgery in one ear, while 38 patients (or 59.3%) had bilateral Eustachian dysfunction. Additionally, no patients' postoperative Type B tympanogram was seen. By the seventh postoperative day, these changes in MEP had recovered to their preoperative value.<sup>10</sup> The transient dysfunction of the Eustachian tube caused by edema or blood clots at the surgical site, particularly around the Eustachian tube orifice, may be the cause of the increase in hearing threshold and decrease in MEP in the immediate time. Moreover, swallowing is decreased in the postoperative phase due to discomfort, which contributes to the cause of Eustachian tube dysfunction.

According to PTA and tympanometry results from the current investigation, there was a noticeable improvement in the MEP and hearing threshold six weeks after surgery. According to postoperative Type A tympanogram results, 15 out of 16 children had completely resolved OME. The findings of a study by Tuohimaa and Palva were comparable.<sup>11,13,14</sup> According to a related study by Zaman and Borah, the MEP significantly improved after adenoidectomy.<sup>12,15,16</sup> Sandooja et al. concluded that adenoidectomy improves the Eustachian tube function and MEP by removing the mechanical obstruction, edema of Eustachian tube orifice, in their study on the effect of adenotonsillectomy on hearing threshold and MEP. They also observed improvement in MEP and hearing threshold after surgery.<sup>15-18</sup>

The mean values of preoperative MEP was  $-64.70 \pm 89.027$ . The mean values of 2nd postoperative day MEP was  $-157.26 \pm 152.859$ . The difference was significant statistically with  $p < 0.001$ . The mean values of preoperative MEP was  $-64.70 \pm 89.027$ . The mean values of 6<sup>th</sup> week MEP was  $18.6 \pm 46.006$ . The difference was significant statistically with  $p < 0.001$ . The mean values of 2<sup>nd</sup> preoperative MEP was  $-157.26 \pm 142.960$ . The mean values of 6<sup>th</sup> week MEP was  $18.6 \pm 46.006$ . The difference was significant statistically with  $p < 0.001$ .

Enache et al retrospective investigation produced similar findings. At one month following surgery, 43.70% of the children had normal Eustachian tube function, and at three months following surgery, when a second evaluation was conducted, 109 children (91.60%) showed complete recovery of the middle ear function with normal Eustachian tube activity.<sup>7</sup> According to Ajayan et al., 6 weeks after surgery, 55.71% of Type B tympanograms converted to Type A and 15.7% to Type C, while Type B persisted in 28.57% of cases.

65.71% of tympanograms were Type A after three months, and 8.57% were Type C. Type B tympanograms persisted in 25.71% of the individuals. Also, it was noted that preoperative hearing loss in all of the participants with persistent Type B tympanograms was greater, measuring between 40 and 50 dB.<sup>8,19,20</sup>

### Conclusion

By removing mechanical obstructions and foci of infection that result in edema of the eustachian tube orifice and/or lymphatic obstruction of the eustachian tube, adenoidectomy or adenotonsillectomy do improve the Eustachian tube function, especially in OME. Early adenoidectomy or adenotonsillectomy will aid in the enhancement of the MEP and hearing threshold, the restoration of Eustachian tube function, and the prevention of OME's aftereffects. It may be thought of as a last choice because myringotomy with grommet insertion carries risks such as otorrhea, irreversible perforation, scarring, and retraction.

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