



# Development of Eustachian Tube Dysfunction Questionnaire – Child Edition (Etdq-Ce)

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## Review Article

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## Abstract

**Purpose:** Eustachian Tube Dysfunction (ETD) is a common condition seen in children is a common complaint in otolaryngology and audiology practices. The assessment measures of ETD include immittance and Eustachian Tube Dysfunction Tests which provide objective view but not the severity of the possible symptoms with the child. This paper focuses on developing a tool for children as well as the addition of parental perspectives of the child based on Eustachian Tube Dysfunction Questionnaire 7 (ETDQ-7)

**Methods:** 30 children (16 males and 14 females) with inclusion criteria were taken and was administered the Questionnaire as well as the original ETDQ as a comparison. The parents/caregivers were asked to rate the Part I of the questionnaire while the questions in Part II were asked to rate by the child.

**Results:** The results show significant amount of reliability with the child population as well as good internal reliability with each of the questions and a good correlation with the original questionnaire as well.

**Conclusion:** The ETDQ-CE is a valid and specific tool that can be used for children and can be administered in a clinical setting in a minimal time and can be used to know about the severity of the problem as well.

**Keywords:** Eustachian Tube Dysfunction; Children; Parental Perspectives

**Abbreviations:** ETD: Eustachian Tube Dysfunction; OME: Otitis Media with Effusion; ETDQ-7: Eustachian Tube Dysfunction Questionnaire 7; CHIP: Child Health and Illness Profile; SNOT-20: 20-Item Sino-Nasal Outcomes Test.

## Introduction

The hearing system contains three main parts: outer, middle, and inner ear. The middle ear also has anatomic and functional connections with the nasopharynx. Inflammation

of the nasal mucosa may lead to Eustachian tube dysfunction (ETD) and which can lead to impairment of the middle ear pressure. The presence of such a condition is often common in children with an incidence of 29.8% [1] in all the present ETD cases and a high percentage of cases with Otitis Media with Effusion (OME) of 62% [2]. The assessment of such disorder in adults has been well sought out and several advances have been made with respect to the diagnosis [3] even with the creation and validation of several questionnaires such as the Eustachian Tube Dysfunction Questionnaire 7 (ETDQ-7) [4],

Sino-Nasal Outcome Test (SNOT-20) [5].

But there exists a lack of tools to be used for the population with children. Out of all the validated questionnaires, the ETDQ-7 shows a high amount of responsiveness due to the closely and reviewed choice of questions that were present in them [6]. Some of the use of developing such a questionnaire is that a symptom score can provide a more precise estimate of disease burden and may yield information not readily identified by the clinician. Second, a symptom score produces formal and validated documentation of patient-reported history for the clinical record. Third, participation in reporting his or her own impressions may motivate patient compliance with prescribed treatment [4].

The major caveat of using questionnaires for children is the presence of false positive and false negative responses that accompany them and are common in such questionnaires [7]. One of the possible methods to avoid such errors and accompanying problems would be to include a parental perspective/view of the child. One such tool is the Child Health and Illness Profile (CHIP) for children 6 to 11 years old [8,9]. A study done on using this questionnaire and having the child's caregiver's perspectives as an integral value in the assessment information provided good correlation with the symptoms and which other symptoms explained or reported by the child [10]. Therefore, this would aid in providing a good correlation with the symptoms. Another possible modification is the change in the question format that can be used by or understood by the child who is being assessed with this being one of the main challenges in the many of the questionnaires developed for adults [11]. Therefore, this study focuses on developing a variation of the ETDQ-7 questionnaire to be used for children and look whether the addition of a parental perspective portion in the study would bring about significant changes or selections in them. The aim of this study is to look into whether the questionnaire assess the qualities associated with ETD, if there is a high reliability between the items included and whether the components of this tool compare or correlate with the components of original validated tool.

## Materials and Methods

### Materials

**Eustachian Tube Dysfunction Questionnaire (ETDQ-7):** This was developed by the Department of Otolaryngology-Head and Neck Surgery and Department of Public Health at Weill Cornell Medical College in New York, U.S.A. This tool was developed from widely used and validated otolaryngology tools such as the Otitis Media 6-Item Quality-of-Life Survey (OM-6) [12], the Nasal Obstruction Symptom Evaluation

[13] and the 20-Item Sino-Nasal Outcomes Test (SNOT-20) [5]. After making a pilot study regarding the questions and the validity of them, the questionnaire was validated with the aid of a total of 75 patients were enrolled for the validation portion of the study. Fifty subjects carried a diagnosis of ETD as defined, and 25 had complaints not related to ETD and served as a control group. The tool contains seven-item Likert scale, with a response of "1" indicating no problem and "7" indicating a severe problem. The overall layout was modelled on the layout of other popular questionnaires, notably the OM-6 and SNOT-20. The resulting instrument included nine items plus an inquiry of laterality. Scoring was possible in one of two ways. The total item score could be reported, with a range from 9 to 63, although this lacked the intuitive property of round numbers. Alternatively, the score could be reported as a mean item score, and expressed as a range from 1.0 to 7.0. The second method was preferred because of the easily understood score limits [4]. The reported Cronbach  $\alpha$  coefficient for the tool is .93 indicating good internal consistency of the instrument for all respondents.

**Eustachian Tube Dysfunction Questionnaire-Child Edition (ETDQ-CE):** This was prepared from the ETDQ-7 questionnaire and SNOT-20 questionnaire. The questionnaire was prepared from common questions and symptoms that were assessed in children that were available in both the questionnaire and the sentences were prepared with the help of Audiologist. It was then given and provided to English Teachers in the local school for review of grammar and spelling. The questionnaire has two parts: Part I contains questions to be asked to the caregiver or child and was inspired from Child Health and Illness Profile, Child Edition [14] and mostly contained questions about behaviours that the parents could observe in their everyday situation. Scoring for this was made using a 4-point Likert like Scale with lower scores reporting no concern and higher scores reporting more concern. Part II contains questions that are to be asked to the child or rated by the child. In addition to the original 7 questions, three more were added based on the common symptoms seen in children with Eustachian Tube Dysfunction [1]. The age range that was aimed for this questionnaire to be used ranges from 7-13 years since this age group was found to be more competent and reliable results can be obtained from the population [15]. The questionnaire was presented to children and was made to read, and feedback was received which revealed that the questions were simple and understandable to them.

**Subjects:** The study was conducted at MERF-Institute of Speech and Hearing (P) Ltd in Chennai, Tamil Nadu. Informed Consent from the subjects and their caregivers were received. 30 children within age range of 7-13 years were taken from the visit to the clinical unit. The subjects were tested using conventional immittance audiometry to verify the diagnosis and those with C type tympanogram or

with peak pressure more than -100 daPa were taken. Other inclusion criteria were that patients with at least 2 of the following symptoms such as: aural fullness or pressure, a sensation of clogged or muffled hearing, inability to rapidly self-equilibrate middle ear pressure following changes in ambient atmospheric pressure. Exclusion criteria included surgery of the head or neck within 3 months; a history of radiation therapy to the head and neck; sinonasal malignancy; evidence of acute upper respiratory infection, including sinusitis and acute otitis media; adenoid hypertrophy; nasal polyposis; cleft palate or history of cleft palate repair; craniofacial syndrome, including Down syndrome; cystic fibrosis; ciliary dysmotility syndrome; or other systemic immunodeficiency [4]. The parents/caregivers were asked to rate the Part I of the questionnaire while the questions in Part II were asked to rate by the child while any doubt was cleared and if the child was unable to do so, the clinician assisted in the administration. Some of the patients were called through telephone or through video conference call and was asked. English was mostly used but in cases, the individual's mother tongue was used to fill the questionnaire. The subjects were assessed in the same method using ETDQ-7 since there is a lack of questionnaires

that are aimed towards paediatric population and in the geographical location's population [4].

## Results

### Descriptive Statistics

In the group of 30 participants with a mean age (standard deviation) of 9.06 (2.11) were taken. In that, 16 (53.3%) participants were male with a mean age (standard deviation) of 8.62 (2.09) and 14 (46.7%) with a mean age (standard deviation) of 9.57 (2.10).

### Internal Consistency Reliability

The internal consistency reliability was assessed using the Cronbach  $\alpha$  on Part I yielded a result of 0.75 overall and for Part II yielded a result of 0.766 overall indicating good reliability of the questions. Individual reliability of the questions was also seen shown in Table 1.1 and 1.2. All showed good scores expect the fourth question on Part I of the questionnaire which enquires about the limitations in school and day with a score of 0.681.

Item	Cronbach's $\alpha$
Does your child have difficulties in perceiving sounds?	0.751
Does your child have difficulties in perceiving speech?	0.719
Does your child have emotional distress, frustration, sadness, restlessness for the past 4 weeks?	0.758
Does your child have limitations/difficulties in sleeping, playing, attending school or day care?	0.681
How tired has been your child since the problem started?	0.737

**Table 1.1:** Cronbach  $\alpha$  Scores of Part I.

Item	Cronbach's $\alpha$
Do you feel pressure in your ears?	0.747
Have you been hearing sounds quieter than you usually do?	0.753
Do you have ear pain?	0.728
Do you have nose block/having trouble breathing through nose?	0.74
Do you hear any popping sound in your ear?	0.797
Do you hear ringing sound in your ear?	0.695
Do you have running nose?	0.745
Do you breathe through your mouth?	0.819
Do you have difficulty understanding speech?	0.742
Have you been feeling any kind of spinning sensation?	0.755

**Table 1.2:** Cronbach  $\alpha$  Scores of Part II.

### Concurrent Reliability

Questions were taken from each of the two questionnaires (ETDQ-CE and ETD-7) that are similar and assessed. First, common symptoms and questions regarding them are taken

	Item	Cronbach's $\alpha$	
			ETDQ-7
		0.747	0.522
2	Ear Pain	0.728	0.436
3	Ringling	0.695	0.562
4	Muffled Speech	0.742	0.521

**Table 2.1:** Comparison of Cronbach A of ETDQ-CE and ETDQ-7 Questionnaires.

Secondly, the focus on the degree of correlation of the tool with the adult version was also checked for in the above four symptoms so that there a level of validity and structuring of the tool can be established which is displayed in (Table 2.2) where p-value of the questions are above 0.5 or equal to indicating moderate agreement except on ringing and tinnitus which shows poor agreement due to the issue discussed earlier.

	Item	ETDQ-CE	ETDQ-7	p-value
1	Pressure	5.8	4.7	0.003
2	Ear Pain	4.2	3.9	0.003
3	Ringling	2.6	5.2	0.004
4	Muffled Speech	4.9	3	0.005

**Table 2.2:** Pearson's Correlation between Each Questionnaire.

### Discussion

The current work describes the development of the ETDQ-CE questionnaire and its effectiveness in assessing dysfunction symptoms. One of the reasons for the development of such a questionnaire is that Eustachian Tube Dysfunction when seen for a prolonged period of time or as a chronic condition can result in more severe conditions such as otosclerosis or sensory loss [3] and the presence of such a disorder also causes significant developmental problems at an early age and may result in delay of milestones in development. The Rhinosinusitis Quality of Life Questionnaire is a self-administered instrument that describes symptoms in 7 domains: sleep, non-hay fever symptoms, practical problems, nasal symptoms, eye symptoms, activities, and emotional function. The instrument takes 5 to 10 minutes to complete and is intended to be used repeatedly over time for longitudinal assessment [17]. This tool is easier to administer and takes lesser amount of time and can be easily understood by the child as well as the caregiver. Assessment of concurrent reliability was limited

to look whether the child questionnaire assess them more correctly than the adult version as displayed in (Table 2.1) which clearly shows a good reliability and better agreement to the symptoms of the child than the adult questionnaire.

to the use of the original ETDQ 7 questionnaire since there are no validated dysfunction questionnaires developed for children. The tool also shows good reliability and is able to agree or even outperform the adult counterpart due to the addition of questions that are much in line with children's symptoms as well as the simplicity and the nature of the questionnaire. The internal consistency was observed to be good expect the fourth question on Part I of the questionnaire which enquires about the limitations in school and day with a score of 0.681. This deviance might be attributed to the parent/caregiver's lack of knowledge in a classroom/play school setting [16] and can be adequately assessed using the aid of the teacher. Part II of the questionnaire also had a score of 0.695 the question of which inquires whether there exists a ringing sensation in the ear which is in line with tinnitus being a minor complication in children [3].

There are some limitations in the tool. First, the statistical score for Part I question regarding school and day care are lower which reflects that teachers should also be involved, or the question can be removed. Second like its adult counterpart, the ETDQ-CE is not intended for the assessment of eustachian tube symptoms that arise in conjunction with acute upper respiratory infection or a neoplastic process [4].

Thirdly, a larger cohort study may be necessary to improve the precision of the Cronbach  $\alpha$  and the confidence interval of the tool. Additionally, the recall period of the questionnaire is not yet set and was chosen attributably although a different recall period may have resulted in different overall responses. The recall period inherently represents a compromise because a longer period improves the sensitivity for detecting positive symptoms but also increases the likelihood of recall bias.

Disease-specific instruments can serve as important outcome measures for clinical interventions. Useful attributes that contribute to validity for outcome measurement include responsiveness, sensitivity to clinical change, and criterion

validity. A prospective study of these aspects of the ETDQ-7 [4] as well as ETDQ-CE is warranted to determine its utility for outcome assessment after the medical or surgical treatment of ETD.

## Conclusion

The ETDQ-CE is a valid and specific tool that can be used for children and can be administered in a clinical setting in a minimal time. A standardized symptom score may enhance clinical care by highlighting the impact of ETD and guiding appropriate management. Further prospective testing of patients being treated for ETD may establish the utility of the ETDQ-7 in the assessment of treatment outcomes.

## References

1. Leo G, Piacentini E, Incorvaia C, Consonni D (2007) Sinusitis and Eustachian tube dysfunction in children. *Pediatr Allergy Immunol* 18(S18): 35-39.
2. Grote JJ, Kuijpers W (1980) Middle ear effusion and sinusitis. *J Laryngol Otol* 94(2): 177-183.
3. Bluestone CD, Bluestone MB, Coulter J (2005) Eustachian Tube: Structure, Function, Role in Otitis Media. BC Decker Inc., Hamilton, Ontario, Canada, pp: 1-219.
4. McCoul ED, Anand VK, Christos PJ (2012) Validating the Clinical Assessment of Eustachian Tube Dysfunction: The Eustachian Tube Dysfunction Questionnaire (ETDQ-7). *Laryngoscope* 122(5): 1137-1141.
5. Piccirillo JF, Merritt MG, Richards ML (2002) Psychometric and clinimetric validity of the 20-Item Sino-Nasal Outcome Test (SNOT-20). *Otolaryngol Head Neck Surg* 126(1): 41-47.
6. Roeyen SV, Heyning PV, Rompaey VV (2016) Responsiveness of the 7-item Eustachian Tube Dysfunction Questionnaire. *Journal of International Advances Otolaryngology* 12(1): 106-108.
7. Van Wijk RG (2005) Assessment of quality of life: advantages and pitfalls. *Clinical & Experimental Allergy Reviews* 5(1): 32-35.
8. Riley AW, Forrest CB, Rebok GW, Starfield B, Green BF, et al. (2004) The Child Report Form of the CHIP-Child Edition (CHIP-CE/CRF): reliability and validity. *Med Care* 42(3): 221-231.
9. Riley AW, Forrest CB, Starfield B, Rebok GW, Robertson JA, et al. (2004) The Parent Report Form of the CHIP-Child Edition (CHIP-CE/PRF): reliability and validity. *Med Care* 42(3): 210-220.
10. Forrest CB, Riley AW, Vivier PM, Gordon NP, Starfield B (2004) Predictors of Children's Healthcare Use: The Value of Child versus Parental Perspectives on Healthcare Needs. *Medical Care* 42(3): 232-238.
11. Gelberg L, Andersen RM, Leake BD (2000) The behavioral model for vulnerable populations: application to medical care use and outcomes for homeless people. *Health Serv Res* 34(6): 1273-1302.
12. Rosenfeld RM, Goldsmith AJ, Tetlus L, Balzano A (1997) Quality of life for children with otitis media. *Arch Otolaryngol Head Neck Surg* 123(10): 1049-1054.
13. Stewart MG, Witsell DL, Smith TL, Weaver EM, Yueh B, et al. (2004) Development and validation of the Nasal Obstruction Symptom Evaluation (NOSE) Scale. *Otolaryngol Head Neck Surg* 130(2): 157-163.
14. Riley AW, Forrest CB, Starfield B, Rebok GW, Robertson JA, et al. (2004) The Parent Report Form of the CHIP-Child Edition (CHIP-CE/PRF): reliability and validity. *Med Care* 42(3): 210-220.
15. Riley AW, Forrest CB, Rebok GW, Starfield B, Green BF, et al. (2004) The Child Report Form of the CHIP-Child Edition (CHIP-CE/CRF): reliability and validity. *Med Care* 42(3): 221-231.
16. Goodall J, Montgomery C (2014) Parental involvement to parental engagement: a continuum. *Institute of Education, University of Warwick, Coventry, UK. Educational Review* 66(4): 399-410.
17. Juniper EF, Guyatt GH (1991) Development and testing of a new measure of health status for clinical trials in rhinoconjunctivitis. *Clin Exp Allergy* 21(1): 77-83.
18. Comesso EA, Kaylie D, Risoli T, Peskoe SB, Witsell D, et al. (2022) Screening for Eustachian Tube Dysfunction in Clinical Practice Using the Eustachian Tube Dysfunction Questionnaire-7. *The Laryngoscope* 132(11): 2217-2223.

