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Original Research Article

Use of sound therapy in management of tullio phenomenon associated with unilateral endolymphatic hydrops

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ABSTRACT

Background: The tullio phenomenon consists of the production of vestibular signs or symptoms by an acoustic stimulus. TP was found to be present in many inner ear pathologies such as superior semicircular canal dehiscence, perilymphatic fistula and endolymphatic hydrops. No previous study probed the value of tinnitus maskers in the alleviation of Tullio phenomenon associated with endolymphatic hydrops.
Methods: Twenty one patients who had a confirmed unilateral endolymphatic hydrops associated with Tullio phenomenon were selected for the study. Their age ranged from 20 to 52 years old. Tinnitus masker±amplification was used according to the audiological findings of each patient. The device was used in the affected ear for a minimum of 6 months.
Results: Ten patients reported marked improvement on a graded scale with a mean of 8.6±1.2 as regards the occurrence of tullio phenomenon. Six patients achieved an average amelioration (mean 5.9±0.12) while five patients reported failure of the device (mean 3.4±0.6).
Conclusions: Sound therapy using tinnitus masker±amplification is a good tool for alleviation of tullio phenomenon associated with unilateral endolymphatic hydrops.

Keywords: Tullio phenomenon, Endolymphatic hydrops, Tinnitus masker

INTRODUCTION

Tullio phenomenon (TP) is a form of disequilibrium and/or oscillopsia induced by sudden loud sounds. An Italian physiologist, Pietro Tullio, observed disequilibrium in animals. Engineers who were exposed to the noise of the early types of jet engines suffered from some sort of dizziness.[1-3] The presence of labyrinthine fistula was thus considered to be the pathologic finding responsible for the presence of TP. The phenomenon has, however, been reported to occur in other conditions such as congenital hearing loss, direct vestibular trauma, and endolymphatic hydrops.

TP could be one of the associated symptoms in cases of endolymphatic hydrops (EH). The effect of low frequency sound on postural stability was studied in 55 healthy volunteers and in 50 patients with EH. The sound levels ranged from 130 to 132 dB and were given at frequencies of 25, 50 and 63 Hz. The patients with EH displayed increased body sway during stimulation. In the individual response, 26% of the patients with EH experienced significant body sway. The results demonstrate that subjects with EH are sensitive to low frequency sound. The activation of vestibulo-spinal responses by low frequency sound seems to be a result of the tullio phenomenon, in which sound energy activates the vestibular end-organ.

The philosophy that lies behind sound therapy devices were introduced on the principle of distraction; that if a level of noise, usually 'white noise' is introduced it can reduce the contrast between the tinnitus signal and background activity in the auditory system, with a decrease in the patient's perception of their tinnitus.[5,6]

The use of tinnitus maskers with or without a hearing aid has not been studied before in the management of TP associated with unilateral EH or other pathologies.

Objective

The research was designed to address the value of tinnitus maskers in the alleviation of TP in cases of unilateral EH.

METHODS

Twenty one patients who had a confirmed unilateral endolymphatic hydrops associated with tullio phenomenon were selected for the study from the database of the audiovestibular medicine department at Qena faculty of medicine, south valley University, Egypt in the period from 2018 to 2020. These cases were diagnosed after a thorough medical history (typical history of EH and TP), full otorhinolaryngological evaluation, pure-tone and speech audiometry, videony-stagmography, caloric testing and electroco-chleography. An approval to join the study was obtained from all patients. Those who refused to participate were excluded.

Inclusion criteria were; age <60 years, confirmed unilateral EH with tullio phenomenon and absence of any associated otological or systemic disease.

The age of the selected patients ranged from 20 to 52 years old. Fourteen patients had unilateral sensorineural hearing loss in the affected ear while 7 patients had normal hearing at the affected ears. Tinnitus masker± amplification was used according to the audiological findings of each patient. The device was used in the affected ear for a minimum of 6 months. The tinnitus masker was adjusted according the patient's comfort level while the hearing aids with tinnitus treatment were adjusted according to the proper first fit proposed by the programming interface. If interference from the programmer was needed, it was fulfilled to meet the patient's comfort. A graded scale was used to assess the patient's satisfaction from 1 to 10 (Figure 1). If the average final score ranged from 7.1 to 10, it was considered good. A score from 5 to ≤7 was ranked as average and a score of less than 5 was considered as poor. The graded scale was obtained from patients twice, first after 3 months of continuous use of the device and then 6 month later.

Descriptive statistical analysis and paired t-test analysis were done using SPSS 16.

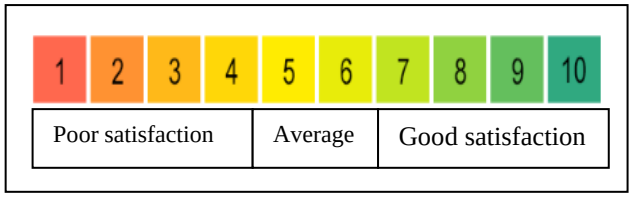

Figure 1: Grade scale to assess patient's satisfaction.

RESULTS

Ten patients reported marked improvement on a graded scale with a mean of 8.6±1.2 as regards the occurrence of tullio phenomenon. Six patients achieved an average amelioration (mean 5.9±0.12) while five patients reported failure of the device (mean 3.4±0.6).

Table 1: Patients demographics.

Variables	Females	Males	Total
Normal hearing	4	3	7
With hearing loss	6	8	14
Total	10	11	21

A paired t-test was performed for the grades of improvement after 3 and 6 month period of device use. A highly significant improvement of the response was found with the continuous use of the sound therapy device for the whole 6 months ($p<0.01$).

Table 2: The variability of the degrees of improvement among those who used tinnitus maskers only and those who used hearing aids±tinnitus treatment.

Variables	Tinnitus maskers only (normal hearing)	hearing aids± tinnitus treatment (sensorineural hearing loss)	Total
Good	6	4	10
Average	1	5	6
Poor	-	5	5
Total	7	14	21

Figure 2: Number of patients who achieved good, average, and poor responses to sound therapy.
X-axis shows patient response category and Y-axis shows number of patients.

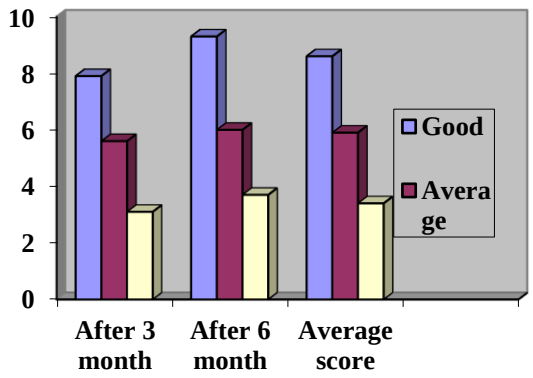

Figure 3: Mean of graded responses for each category after 3 months, 6 months and their average.
X-axis shows patient response categories after 3, 6 month and their average and Y-axis shows number of patients.

DISCUSSION

Menière's disease is a chronic condition characterized by a tetrad of unilateral fluctuating/increased sensorineural hearing loss, tinnitus, sense of fullness and vertigo. Its prevalence may reach a proportion of 500:100000. Prosper Menière was the first to recognize the inner ear as the site of lesion for this clinical syndrome. Seventy-five years ago, endolymphatic hydrops was discovered as a pathology of Menière's disease.[4,7] The use of sound therapy is a novel technique that has never been used before to alleviate Tullio phenomenon in cases of EH. One of the obstacles that faced the researchers was the fluctuations of hearing thresholds and the repeated programming of the hearing aids and/or the tinnitus maskers.[8]

In the current study, marked improvement was reported by 10 patients and average alleviation was reported by 6 other patients. The dynamic technology of hearing aids as well as the availability of control capabilities of the hearing aids on cellular phones increased the success rate of hearing devices in TP. Most of the reviewed studies support the use of hearing aids for tinnitus treatment.[9]

It is well known that external sounds can make tinnitus inaudible or tolerable. Sound therapy, either in the ear or behind the ear, can deliver white or narrow band noise according to the requirements of the patient. They may be combined with a hearing aid to augment a patient's hearing if tinnitus is associated with hearing loss. Considering TP as a form of hyperacusis and consequently a form of tinnitus, sound therapy was expected to be valuable in the alleviation of TP. Sequential sound therapy was 100% successful with high compliance of patients to the treatment protocol according to the results of Miguel and Rocio.[10]

Additionally, the duration of use of the digital sound therapy proved efficiency in the control of TP. A highly significant difference was found between the scores obtained after 3 month and 6 month of continuous use. This could be attributed to the more regularity added to the neural firing of the VIII cranial nerve with the continuity of sound therapy.

CONCLUSION

We concluded through the research findings that, sound therapy using tinnitus masker±amplification is a good tool for alleviation of tullio phenomenon associated with unilateral endolymphatic hydrops.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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