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Assessment of the ear and otoacoustic emission findings in fibromyalgia syndrome

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ABSTRACT

Objective. *We aimed to assess oto-acoustic emission (OAE) findings in fibromyalgia (FM) syndrome.*

Methods. *Thirty-two ears of 16 female patients with FM syndrome and 30 ears of 15 healthy female controls were also included in the study. Pure tone audiometry, speech discrimination testing, tympanometry and otoacoustic emission testing (both transiently evoked and distortion product) were performed.*

Results. *There was no significant difference between the pure tone hearing results of the patients and controls ($p > 0.05$). There was no significant difference between the distortion-product-otoacoustic emission results of the patients and controls. Audiologic findings of the patients with and without otologic symptoms were not significantly different than controls ($p > 0.05$).*

Conclusion. *Although FM patients generally have subjective symptoms related to ear, clinical or laboratory assessments usually fail to find out any objective finding related to these subjective symptoms. The otologic functions seem spared in FM syndrome.*

Introduction

Fibromyalgia (FM) syndrome causes chronic and disabling pain (1). This is a syndrome of unknown etiology, and is characterized by chronic widespread pain, increased tenderness on palpation, and some additional symptoms like disrupted sleep, stiffness, fatigue, psychological disease and cold intolerance. This syndrome is mostly seen in females. There may be neuroendocrine dysfunctions in FM syndrome (2).

Otoacoustic emissions (OAE) are acoustical signals, which occur spontaneously as narrow band tonal signals or after stimulation of the ear. Both TEOAEs (transiently evoked OAE) and DPOAEs (distortion product OAE) are produced by active micromechanisms of the outer hair cells (OHCs) of the organ of Corti. The DPOAE, which is a consequence of normal nonlinear processes in the cochlea, has gained popularity as a clinical test for hearing screening, research and diagnostic purposes (3-5).

The OAE findings of the patients with FM syndrome have remained unclear to date. The objective of this study was to address this issue and assess OAE findings in FM syndrome.

Materials and methods

Thirty-two ears of 16 female patients who were diagnosed as having FM syndrome were included in the study after informed consent was obtained. The ages of patients ranged from 22 to 45 years (31.5 years). Thirty ears of 15 healthy females were also included in the study and comprised of the control group. Their ages ranged from 21 to 42 years (mean 33.2 years).

The diagnosis of FM syndrome was made on the basis of the criteria of the American College of Rheumatology, 1990 (6). Briefly, the criteria were diffuse aches and stiffness in the muscle and tendon insertions on digital palpation with an approximate force of 4 kg (the amount of pressure required to blanch a thumbnail) lasting for at least 3 months. To meet the diagnostic criteria, pain must be in 11 or more out of the 18 specified tender point sites. The FM impact questionnaire was applied to all patients (7) (Table I). The patients had no symptoms other than pain, and those with the objective sign of articular or periarticular disease, erythrocyte sedimentation rate more than 10 mm/h (Westergren), positive latex fixation test, elevated creatine phosphokinase values, and obvious underlying disease such as diabetes mellitus, chronic renal insufficiency, epilepsy, chronic psychiatric disorder, multiple sclerosis, or hypothyroidism were not admitted to the study.

Otolaryngologic assessment included patient's history, and otolaryngologic and audiologic investigations. In the patient's history, questions were asked for the presence or absence of hearing loss, tinnitus, aural fullness and vertigo.

Audiometric evaluation: Pure tone audiometry results and speech discrimination scores were obtained (AC 40, Denmark). Tympanometry (Audiomet Sat 30, Germany), and TEOAE and DPOAE testing (ILO, England) were

performed. The pure tones were obtained at the frequencies of 250, 500, 1000, 2000, 4000 and 6000 Hz, and pure tone averages were calculated at the frequencies of 500, 1000 and 2000 Hz.

The TEOAEs and DPOAEs were recorded consecutively and analyzed utilizing the ILO-96 cochlear emission analyzer (Otodynamics, London). The TEOAEs were obtained with stimuli consisting of clicks of 80 μs duration. The stimulus level in the outer ear was set at 80 ± 3 dB per SPL. The click rate was 50 per second, and post-stimulus analysis was in the range of 2 to 20 ms. A total of 260 sweeps was averaged above the noise rejection level of 47 dB. Stimuli were presented in the non-linear mode, in which every fourth click stimulus was inverted and three times greater in amplitude than the three preceding clicks. A TEOAE was defined as a response if its amplitude was ≥ 3 dB above the level of the noise floor. Reproducibility percentages ≥ 60 percent were taken into account as acceptable for analysis at four successive frequency bands.

DPOAEs were measured where the intensity levels of the primary tones held constant. DPOAE data were recorded for different frequency regions from 1 to 6.3 kHz and plotted as a function of f2. The frequency ratio of the two primary tones (f2/f1) was fixed at 1.22. Stimulus levels were kept at 65 dB for f1 and 55 dB for f2 frequencies. DPOAE measurement at 2f1-f2 was considered significantly different from the background noise if it exceeded it by at least 3 dB.

Table I. Body sites and rates of the tenderness points.

Body site	Tenderness point No. Patients (%)
Occiput	8 (50)
Low cervical	11 (68.8)
Trapezius	11 (68.8)
Supraspinatus	13 (81.3)
Second rib	14 (87.5)
Lateral epicondyl	15 (93.8)
Gluteal	10 (62.5)
Trochanter	13 (81.3)
Knee	14 (87.5)

Table II. Frequency specific pure tone audiometry results.

Group	Frequencies on audiometry Pure tone results (dB ± Standard deviation)					
	250	500	1000	2000	4000	6000
FM	20 ± 5	13 ± 5	11 ± 5	8 ± 5	9 ± 6	15 ± 8
Control	17 ± 9	12 ± 8	9 ± 6	9 ± 8	12 ±13	21 ±15

Table III. Amplitudes recorded on DPOAE testing.

Group	f2 frequencies on DPOAE testing Amplitudes (dB ± Standard deviation)					
	1	2	3	4	5	6
FM	8.1± 6.8	7.2 ±7.2	4.8 ± 7.9	7.5 ± 7.4	11.3± 8.1	0.4± 8.6
Control	6.2± 5.5	7.5 ±5.1	5.4 ± 5.1	9.4 ±14.9	7.7± 6.7	2.9± 4.5

Statistics

The results of patients and controls were compared using the Kruskal Wallis test, and confirmation of the results were made using the Chi-square test.

Results

Of 16 FM patients, 11 (68.7%), 9 (56.2%), 7 (43.7%) and 6 (37.5%) complained of tinnitus, vertigo, hearing loss and aural fullness, respectively. There was no significant difference between the pure tone hearing results of the patients and controls ($p > 0.05$) (Table II). The TEOAEs could be obtained in all patients and controls. There was no significant difference between the DPOAE results of the patients and controls ($p > 0.05$) (Table III). Audiologic findings of the patients with and without otologic symptoms were not significantly different than controls ($p > 0.05$).

Discussion

Otolaryngologic disturbances may be seen in a variety of autoimmune or rheumatoid diseases like systemic lupus erythematosus, Wegener's granulomatosis, relapsing polychondritis, polyarteritis nodosa, cogan's syndrome, Sjögren's syndrome, Churg-Strauss syndrome and Behçet's disease (8, 9). It was also reported that there is a cochlear impairment in rheumatoid arthritis that can be confirmed by TEOAE testing and that inner ear injury depends on chronic damage to the cochlea due to impairment of the inner ear microcirculation rather than on an acute inflammatory reactivation of the disease (10). Although FM syndrome is mainly characterized by widespread pain, there may also be some other symptoms suggesting involvement of the other systems in the body. A number of otologic manifestations can be seen in FM syndrome, which can bring the patient to otolaryngologist initially. Almost 50% of the patients have some sort of otoneurologic symptoms despite the fact that the majority of them have normal audiovestibular test results (11). These findings are in parallel with the results in this study.

Audiologic findings of the patients and controls were similar. In other words, external ear canal and tympanic membrane were normal on otoscopic examination. Middle ear was normal on pure tone audiometry and tympanometry. Finally, cochlear functions were normal as far as the results of audiometry and OAE testing are concerned.

Some of the patients in this study had subjective cochleovestibular symptoms, but their otolaryngologic and audiologic assessments were normal. There was no difference between the results of patients with and without neurotologic symptoms. This condition may suggest that cochleovestibular symptoms are not associated with an organic ear disorder in FM syndrome. In addition to that, patients with FM syndrome may have an altered perception of normal and disease states. This contention could be supported by the

previous study that showed a generalized disturbance of perceptual thresholds in patients with FM, which was not restricted to the perception of pain (12). The patients may have reduction of cognitive functions, unprotected psychological functioning, and increased mental load, and somatic symptoms (13).

It was reported that there is an increase in regional cerebral blood flow in the caudate nuclei as well as a reduction in the pons and cerebral cortex in FM (14). That alteration in the cerebral blood flow may lead to changes in perception in the patients with FM. The blood circulation in the cochlea seems spared in FM as far as audiologic results of the patients are concerned. The otologic symptoms described by the patients may be attributed to perceptual changes rather than an ear disorder.

In conclusion, although FM patients generally have subjective symptoms related to ear, clinical or laboratory assessments usually fail to find out any objective finding related to these subjective symptoms. The otologic functions seem spared in FM syndrome.

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