OTONEUROLOGIC AND AUDILOGIC FINDINGS IN FIBROMYALGIA

UIF Rosenhall, GÖran Johansson and Gustav Öndahl

From the Departments of Audiology, Karolinska Hospital, Karolinska Institutet, Stockholm and Sahlgren's University Hospital, Department of Rehabilitation Medicine, Sahlgren's Hospital, and Department of Medicine, Östra Hospital, Göteborg, Sweden

ABSTRACT. Patients with fibromyalgia were studied with otoneurological and audiological tests. Altogether 168 patients (141 women) participated. Vertigo/dizziness was reported by 72% of the patients. Sensorineural hearing loss was found in 15% of the cases. Auditory brainstem responses (ABR) and oculomotor tests were applied, and statistical comparisons between patients and controls were performed. Significant differences were found for the absolute latency of wave V and for the I–V and III–V interpeak latencies, indicating brainstem dysfunction. Abnormal ABR recordings were found in 30% of the cases. In the oculomotor study the mean velocity gain for the smooth pursuits and the mean saccadic latency were significantly different between patients and controls. Abnormal saccades were seen in 28% and pathological smooth pursuit eye movements in 58% of the patients. Electronystagmography was pathological in 45% of the cases. The findings indicate that CNS dysfunction frequently occurs in patients with fibromyalgia, although proprioceptive disturbances might also explain some of the abnormalities observed.

Key words: auditory brainstem response, electronystagmography, fibromyalgia, hearing loss, oculomotor tests, saccade eye movements, smooth pursuit eye movements.

INTRODUCTION

Although fibromyalgia is a syndrome of unknown etiology and pathophysiology, diagnostic criteria have been formulated and the syndrome is looked upon as a fairly well-defined condition (27). Widespread and chronic musculoskeletal pain is a cardinal symptom, but fatigue and symptoms of autonomic dysfunction are also commonly reported (28).

In advanced cases, symptoms which can be indicative of cerebral dysfunction, e.g., sleep disturbances, headache disturbed memory and difficulties with concentration, may be present. Hallucinations, probably caused by cerebral irritation and not part of a functional mental disorder, has been reported (14). In a study of regional cerebral blood flow in patients with fibromyalgia with the 133 Xe inhalation technique, regional flow reductions were observed in a high percentage of cases (15). These studies could indicate that CNS dysfunction is likely in advanced cases of fibromyalgia.

Disturbances of the eye motor function have been reported in patients with fibromyalgia. Odvíst et al. (18) found abnormalities affecting smooth pursuits and electronystagmography. Rosenhall et al. (20) found disturbances of the saccades in 42% of cases and of the smooth pursuits in 89% of cases in patients with fibromyalgia and dysaesthesia. One explanation for oculomotor disturbances is CNS dysfunction involving the systems generating, executing or regulating the eye movements. However, erroneous proprioceptive signals may also cause disturbances of the oculomotor function (4). A further indication of a CNS-dysfunction is the abnormal auditory brainstem responses (ABR) observed in 30% of patients with fibromyalgia (21). However, these observations have been made in selected cases of non-consecutive patients who had fibromyalgia with dysaesthesia.

The present study, which includes the patients of the earlier studies cited above (20, 21), is a report of otoneurological and audiological test results of all patients, fulfilling the diagnostic criteria of fibromyalgia, referred to a rehabilitation clinic during 1983–93.

SUBJECTS

From a population of patients with pain problems, mainly chronic, idiopathic pain, referred to a rehabilitation clinic for pain treatment and/or vocational guidance, 168 patients fulfilling the criteria of fibromyalgia were selected for the present study.

Initially, the criteria proposed by Yunnus et al. in 1981 (28) were used. These criteria implicate generalized aches and pains or prominent stiffness, involving three or more anatomical sites for at least 3 months, with at least five
typical and consistent tender points, and with no secondary causes. After 1990 the criteria proposed by the American College of Rheumatology (ACR) were used. These include pain persisting for at least 4 quadrants of the body for at least 3 months, and having at least 11/18 tender points at specific anatomic sites.

Of the 101 patients, 141 were women (mean age 45.1 years, range 21–81 years) and 27 men (mean age 46.0 years, range 25–61 years). Almost all cases were on long-term sick leave or on an early pension because of the pain syndrome. They were, except from a few cases, blue-collar workers. Immigrants from rural districts in former Yugoslavia and Greece constituted 50% of the patients.

Exclusion criteria were earlier CNS infections, head trauma with unconsciousness, and abuse of alcohol and drugs. According to extensive files available, no cases of toxocariasis or other abuses seemed to be at hand. Specific rheumatologic disease was excluded by a thorough clinical examination carried out by a senior internist with special interest in neurology (GO). All patients were also examined by an orthopedic surgeon who excluded orthopedic disease as a cause of the pain. Rheumatologic or other inflammatory disease was excluded by laboratory test procedures and clinical examination.

The patients (and the controls) were instructed verbally and by letter to stay off all medication for 48 h prior to the test procedures. Measurements of metabolites of different drugs were not performed, however.

**METHODS**

The hearing of each patient was measured using pure tone and speech audiometry according to standard procedures. A history of dizziness/vertigo and disturbances of the equilibrium was taken. All tests were performed by trained audiologists.

**Auditory brainstem response (ABR)**

All patients were tested with ABR, an evoked response method which records the function of the cochlear nerve and the auditory pathway in the brainstem. In 157 cases, equipment based on a Nicolet 527 signal averager was used; 904 trials with alternating polarity were performed monosynaptically by TDT-36 electrophones. The intensity level was 80 dB peak, and the repetition rate 2.5 stimuli/s. The signals were bandpassed (150–250 Hz) and averaged. In 11 cases a Medel 2250 ERA was used. Randomization (100 half-second waves with an intensity level of 80 dB HL and a repeat rate of 20 stimuli/s) was used. The filter settings were 150–2000 Hz.

There are different patterns of ABR abnormalities indicating retrocochlear or brainstem pathology. The following parameters were measured in this investigation: (a) the absolute latencies of waves I, III and V; (b) interpeak latencies (IPLs) between waves I and V (I-V IPL), I and III (I-III IPL) and III-V (III- V IPL); (c) the interaural time differences (ITD) of wave V and the L-V IPL (ITD-V) and (d) the amplitude of wave V in relation to the amplitude of wave I (V/I ratio). Normative criteria for the latency parameters were established using a control group, see below. ITDs of >25 μs were regarded as pathological (25). Regarding the amplitude parameter the criterion adopted by Starr & Achor (24) was used. This implies that an amplitude ratio wave V/wave I of <0.5 is regarded as abnormal.

**Control group for ABR**

One-hundred-and-twenty-four apparently healthy subjects were enrolled as controls for ABR: 81 women (mean age 44.6 years, range 21–75 years) and 43 men (mean age 40.7 years, range 23–75 years). All controls were tested with the same Nicolet equipment as a majority of the patients. All had normal hearing (≤20 dB) in the frequency range 0.25–4 kHz and normal hearing or, at most, a slight hearing loss (≤40 dB) at frequencies 3–6 kHz.

**Oscillocotons tests**

All except two patients were given oscillocotons tests, which monitor the neuroacoustic systems responsible for the eye motor function. Voluntary horizontal smooth pursuit eye movements (slow, tracking eye movements) with gaze angles of 40° and target velocities of 10°/s, 20°/s and 30°/s were recorded. Smooth pursuits for each direction and target velocity were averaged. The velocity gain (ratio between the velocity of the eye movement and the velocity of the target) was calculated.

Voluntary horizontal saccades (rapid eye movements) with gaze angles of 30°, 40° and 60° were recorded. Seven to eight saccades for each of the gaze angles and for both directions were averaged. The maximal velocity and the accuracy of the saccades were calculated for all subjects tested. I latency (the reaction time from the change of the target to the initiation of the eye movement) was calculated for 91 of all patients.

**Control group for oscillocotons tests**

The control group for oscillocotons tests comprised 90 apparently healthy subjects with neither chronic nor recent vertigo. There were 38 women (mean age 43.1 years, range 21–76 years) and 42 men (mean age 40 years, range 21–76 years). The normal subjects were tested with the same methodology and the same equipment as the patients.

**Electroencephalography (EEG)**

ENG was performed on 85 of the patients. ENG measures the vestibular function, both the peripheral in the labyrinth, and the central in the vestibular nuclei, the vestibulocerebellum and other locations. Horizontal eye movements were recorded with a Siemens-Elema Mignotkop 34 ink-jet recorder. The presence of spontaneous nystagmus with and without gaze fixation, of nystagmus and of positional nystagmus was observed. A bithermal caloric test was performed with water temperatures of 30°C and 44°C. Unilateral weakness of the caloric response or the presence of directional preponderance was calculated. Inability of visual suppression of the caloric nystagmus was noted. The normative criteria suggested by Consensus (3) were used.

**Statistical evaluation**

Comparisons were made between the patients and the controls using the Mann-Whitney U test. Women and men were analyzed separately. As regards ABR comparisons were performed for the latency parameters (absolute latencies, IPLs and ITDs). A hearing loss induces a latency shift, which makes a neurophysiological evaluation of the ABR difficult in hearing-impaired subjects. For this reason only subjects with no or only minor hearing loss were included (≤20 dB HL in the frequency range 0.25–2 kHz and ≤40 dB at the frequencies 3–6 kHz). Since the latencies are also dependent on the equipment used, only patients tested with the Nicolet device were included; 128 women and 24 men fulfilled these criteria and were selected for the statistical Engelberg evaluation. The following ocular rotation test parameters were selected for statistical evaluation: the mean smooth pursuit gain for the target velocity 20°/s, and the saccades the mean velocity, accuracy and latency for the gaze angle 60°. Averaged values for right- and left-directed eye movements were used.

The results of ABR and oscillocotons tests for each patient were also compared with the normative standards used in our laboratory. These normative standards are based on healthy controls (including the control groups used in the present study) taking into account age, sex and hearing loss. Normal mean ±2SD was regarded as a normal test result, and individual deviations from the norms were registered.

**RESULTS**

**Dizziness and vertigo**

Seventy-two percent of the patients complained of dizziness or vertigo. Most of them (48% of all patients) had slight, diffuse dizziness causing no or only minor discomfort. Four percent of all patients complained of constant, severe dizziness. Eighteen percent complained of attacks of rotary or nystagmic vertigo. Disturbance of the gait without dizziness or vertigo was reported by 2% of the patients.

**Hearing loss**

Sensorineural hearing loss, not related to aging, exposure to occupational noise or middle ear disease, was found in 25 of the 168 patients (15%). Slight hearing loss was most common (10%, 16 cases), moderate hearing loss was found in 4% (6 cases) and severe hearing loss in 1% (2 cases).

**ABR**

There were no statistically significant differences for either women or men between the patients and the
typical and consistent tender points, and with no secondary causes. After 1990 the criteria proposed by the American College of Rheumatology were used. These include pain perceived in all four quadrants of the body for at least 3 months, and having at least 11/18 tender points at specific anatomic sites.

Of the 161 patients, 141 were women (mean age 45.7 years, range 21–73 years) and 20 men (mean age 46.0 years, range 24–61 years). All cases were on long-term sick leave or on an early pension because of the pain syndrome. They were, except from a few cases, blue-collar workers. Immigrants from central districts in former Yugoslavia and Greece constituted 50% of the patients.

Exclusion criteria were earlier CNS infections, head trauma with unconsciousness and abuse of alcohol and drugs. According to extensive file available, no cases of toxocariasis or other abuses seemed to be at hand. Specific neurologic disease was excluded by a thorough clinical examination carried out by a senior internist with special interest in neurology (G.D). All patients were also examined by an orthopedic surgeon who excluded orthopedic disease as a cause of the pain. Rheumatologic or other inflammatory disease was excluded by laboratory test procedures and clinical examination.

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The control group for oculomotor tests comprised 90 apparently healthy individuals with neither chronic pain nor vertigo. There were 40 women (mean age 43.1 years, range 21–76 years) and 42 men (mean age 40 years, range 21–76 years). The normal subjects were tested with the same methodology and the same equipment as the patients.

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The following oculomotor test parameters were selected for statistical evaluation: the mean smooth pursuit gain for the target velocity 20°, and (b) the accuracy for the gaze angle 60°. Average values for right- and left-directed eye movements were used. The results of ABR and oculomotor tests for each patient were also compared with the normative standards used in our laboratory. These normative standards are based on healthy controls (including the control groups used in the present study) taking into account age, sex and hearing loss. Normal mean ±2 SD was regarded as a normal test result, and individual deviations from the norms were registered.

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ABR

There were no statistically significant differences for either women or men between the patients and the

controls for waves I and III. Wave V was significantly lengthened in the patient group (p < 0.001; women and p < 0.01, men). The I-V IPL was also prolonged in the patient group (p < 0.01, women and men). The I-III IPL was similar in both patients and controls. The III-V IPL was significantly prolonged in the patient group (p < 0.001, women, and p < 0.05, men) (Figs 1 and 2). The interaural time differences were also significantly longer in the patient group (ITD V p < 0.01, women, and p < 0.001, men; ITD I-V IPL p < 0.001, women, and p < 0.05, men) (Fig. 3). Fifty-one of the 108 patients (47%) had abnormal ABR recordings. The I-V IPL/wave V latency was significantly prolonged in 19% of the cases and the ITD was abnormal in 10% of the cases.

**Smooth pursuit eye movements**

The mean velocity gain was significantly lower in the patient group than in the control group for both women and men (p < 0.001) (Fig. 5). Ninety-six of the 108 patients tested (88%) had pathological smooth pursuit eye movements. In all cases the mean velocity gain of the 20's smooth pursuit was significantly reduced. In 24% of all patients the smooth pursuit were severely abnormal with a mean velocity gain of ≤0.5.

**Saccadic eye movements**

The statistical evaluation showed a significant difference between the patient group and the control group for women and men for the mean saccadic latency (p < 0.001). For the other parameters studied, saccadic velocity and accuracy, there was no statistical difference between the groups were observed (Fig. 6). Forty-seven of the 108 patients tested (44%) had abnormal saccades. The saccadic velocity was disturbed in 185% of the cases. The velocity was reduced in 165% and increased in 2%.

**DISCUSSION**

A majority of the patients in the present study had vertigo/dizziness. This symptom was not very prominent in most of the patients, however, and was described as a vague, indistinct dizziness. The vertigo was generally not of the type present in peripheral vestibular disorders, e.g. Menière's disease (10, 3). Hearing loss, in most cases slight, was an infrequent finding in the present study group. Since other causes, e.g. presbyacusis, noise-induced hearing loss or middle-ear disease, were excluded as far as possible, the present study suggests a weak correlation between fibromyalgia and hearing loss, a relationship which has been reported earlier (9).

**Electroencephalographic abnormalities**

<table>
<thead>
<tr>
<th>Total</th>
<th>Positional nystagmus</th>
<th>Spontaneous nystagmus</th>
<th>Caloric hyporeactivity</th>
<th>Unilateral weakness</th>
<th>Directional preponderance</th>
<th>Decreased visual suppression</th>
</tr>
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<tbody>
<tr>
<td>38</td>
<td>16</td>
<td>16</td>
<td>16</td>
<td>5</td>
<td>4</td>
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</tr>
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**Table III. Numbers and percentages (within parenthesis) of patients with abnormal ENG. Data regarding different types of pathological patterns are reported.**
controls for waves I and III. Wave V was significantly lengthened in the patient group (p < 0.001; women and p < 0.01, men). The I-V IPL was also prolonged in the patient group (p < 0.01, women and men). The I-III IPL was similar in both patients and controls. The III-V IPL was significantly prolonged in the patient group (p < 0.001, women, and p < 0.05, men) (Figs 1 and 2). The interaural time differences were also significantly longer in the patient group (ITD N p < 0.01, women, and p < 0.001, men; ITD I-V IPL p < 0.001, women, and p < 0.05, men) (Fig. 3). Fifty-one of the 108 patients (47%) had abnormal ABR recordings. The I-V IPL/wave V latency was significantly prolonged in 19% of the cases and the ITD was abnormal in 10%.

The mean velocity gain was significantly lower in the patient group than in the control group for both women and men (p < 0.001) (Fig. 5). Ninety-six of the 108 patients tested (88%) had pathological smooth pursuit eye movements. In all these cases the mean velocity gain of the 20's smooth pursuit was significantly reduced. In 24% of all patients the smooth pursuit was severely abnormal with a mean velocity gain of < 0.5.

Saccadic eye movements

The statistical evaluation showed a significant difference between the patient group and the control group for women and men for the mean saccadic latency (p < 0.001). For the other parameters studied, saccadic velocity and accuracy, no statistical differences between the groups were observed (Fig. 6). Forty-seven of the 108 patients tested (43%) had abnormal saccades. The saccadic velocity was disturbed in 18% of the cases. The velocity was reduced in 16% and increased in 24% of patients.

DISCUSSION

A majority of the patients in the present study had vertigo/dizziness. This symptom was not very prominent in most of the patients, however, and was described as a vague, indistinct dizziness. The vertigo was generally not of the type present in peripheral vestibular disorders, e.g. Menière's disease (10, 3). Hearing loss, in most cases slight, was an infrequent finding in the present study group. Since other causes, e.g. presbyacusis, noise-induced hearing loss or middle-ear disease, were excluded as far as possible, the present study suggests a weak correlation between fibromyalgia and hearing loss, a relationship which has been reported earlier (9).

Saccadic Abnormalities

Electrophysiographic abnormalities

Table III. Numbers and percentages (within parenthesis) of patients with abnormal ENG. Data regarding different types of pathological patterns are reported.
The present study of consecutive patients with fibromyalgia indicated that most of them has osteome-
urological abnormalities. The symptoms interfered with social activity level and work performance, and most patients were on long-term sick leave and the pain was refractory to physiotherapy and ordinary pharma-
cological treatment. There were far more immigrants than expected from the general population. Inmigrants were more often affected but not more severely affected than Swedes.

Ödskott et al. (18) and Rosenhall et al. (20, 21) have shown similar results in studies of fibromyalgia patients.

In our earlier study the patients had severe fibro-
myalgia with focal neurological symptoms (hemi-
dysaesthesia). In the later part of the study most of the patients had less severe fibromyalgia, and neuro-
ological symptoms and signs were often absent. This latter group showed in this way similarities with the fibromyalgia group studied by Ödskott et al. (18).

The prevalence of ABR abnormalities was the same (6-30%) in this study as in the earlier one (21). Since the material has been extended considerably, a more detailed statistical analysis is possible now. Significant differences were found, for both women and men, between patients and controls for the absolute latency of wave V, for the I-V and III-V IPIs and for ITDs of both wave V and I-V IPI. The III-V IPI reflects the function of the auditory system in the brainstem, between the cochlear nuclei and the superior olivary complex (17). The consistent findings of ABR abnormalities affecting wave V, the III-V IPI and the ITDs, strongly indicate that dysfunction involving thepons is common in patients with fibromyalgia.

Oculomotor disturbances were more commonly seen in our earlier study of fibromyalgia with dysaesthes-
ia than in the present one (42% and 28% respectively for sacades and 95% and 58% respectively for smooth pursuits). The reason for this is probably that the former represents a group with very pro-
nounced symptoms, while the total group includes patients with somewhat less severe manifestations.

The mean velocity gain was significantly lower in the patient groups than in the control groups. The prevalence of smooth pursuit abnormalities is similar between the present study and that of Ödskott et al. (18).

Velocity disturbances of sacadic eye movements were seen in 18% of the cases tested. Reduced saca-
dic velocity was the most common abnormality and can be seen in pontine lesions (19). Increased sacadic

velocity, occasionally observed here, has been reported to occur in cases with acute meningo-encephal-
itis (11). In the present study, some were more often hypertonic than in our earlier study, in which the sacades commonly had reduced velocity. Sacadic

dystonic often reflects cerebellar dysfunction, but a supraspinal location of the lesion is also possible (26, 6, 19). Although sacadic abnormalities affecting velocity and accuracy occur frequently, there were no significant differences between patients and controls in the statistical analysis. One explanation is that abnormalities of velocity and accuracy deviate in both directions from normal values (sacades might be either reduced or increased velocity and they can be either hypertonic or hypotonic), resulting in increased variability and, consequently, no statistically significant differences between clinical and normative groups.

The only saccadic parameter with significant differ-
ences from norms was the latency, which deviated in one direction only from normative values (all patients with deviations had longer latencies than the con-
trols). The latency reflects the reaction time which elapses from the change of the target to the execution of the eye movement. It might measure a more generalized influence on the CNS than the other parameters.

Oculomotor dysfunction, affecting both sacadic and smooth pursuits, has been reported in connection with spine injuries (13). These abnormalities, which are similar to what has been reported in fibromyalgia, could be secondary to impaired proprioception of neck or could be caused by brainstem lesions.

The interpretation of the findings of abnormal sacades and smooth pursuits as well as abnormal ENG registrations is that of CNS dysfunction, most likely in the posterior fossa. However, disturbances of smooth pursuits, to some extent, of sacades, can be seen in patients with tension headache (TH) without neurological signs and symptoms (4). The explanation of this observation is that proprioceptive dysfunction in the neck might cause erroneous signals which could disturb the oculomotor regulations.

The prevalence of smooth pursuit abnormalities was about the same in the TH group (22) and in the group of fibromyalgia patients studied here (53% and 58% respectively). The prevalence of sacadic abnormal-
ities was also about the same in both groups; about 30%. Velocity disturbances were more commonly seen among fibromyalgia patients than among TH

patients (16% and 6% respectively). None of the patients with TH had abnormal ABR recordings (22), in contrast to what was found in the fibromyalgia group.

Ödskott et al. (18) reported that positional nystag-
mus, neck tension nystagmus, hyperactivity, and unsteadiness are also present in patients with fibromyalgia. This is in agreement with the findings of the present study. The ENG findings found here generally signal CNS involvement. Direc-
tional changing positional nystagmus, hyperactivity of the caloric nystagmus, directional preponderance and decreased visual suppression of the caloric nys-
tagmus indicate central vestibular dysfunction. Spon-
taneous nystagmus and reduced vestibular function in one ear can be seen in both peripheral and central unilatera vestibular lesions.

The present study suggests that CNS dysfunction often occurs in patients with fibromyalgia according to the results of ABR, the saccade test and ENG. Proprioceptive disturbances of CNS dysfunction are also plausible explanatory factors of the pathophysiological smooth pursuit findings observed here.

The cause of the observed CNS dysfunction is unknown, but some hypothetical mechanisms are possible. One is long-standing medication of drugs e.g. analgetics, antidepressants, tranquillizers and hypnotics. One important aim of the rehabilitation clinic is to render the patients as free as possible from all medication, including all ABR abnormalities. Relief of pain relief are encouraged. According to personal knowledge of the patients and the files available, none of the patients was judged to have any drug dependence, including abuse of analgetics, tranquill-
izers or alcohol. It can therefore be presumed that the observations described above were not caused by medication or abuse, or by withdrawal of medication during the test session. However, since metabolites of different analgetic compounds were not measured prior to testing, and since data concerning medicatio

earlier in life could not be reliably assessed, it cannot be ruled out that recent or earlier medication might have had an influence on the test results.

Chronic fatigue syndrome (or chronic fatigue immune dysfunction syndrome), which seems to be similar to fibromyalgia (8) has been suggested to be caused by infectious agents. Behan et al. (2) coined the term myalgic encephalo-myelitis, and pointed out enteroviruses as a possible agent. Herpes viruses and

retroviruses have also been discussed as aetiologi-
ical agents to fibromyalgia, but these suspicions have not been verified (25, 7).

Stress factors have been discussed as inducing CNS dysfunc-
tion (1, 12). Such a discussion is relevant concerning fibromyalgia, which shares some similarities to Post Traumatic Stress Disorder (PTSD), where stress mechanisms are known to be the aetiological factor. In animal experiments, glucocorticoid elevation induced by repeated stress causes neuronal degeneration and CNS atrophy (16). It can therefore be speculated that mental stress with its neurohormonal aspects may be both an aetiological and patho-physiological mecha-
nism explaining both the symptoms and signs as well as the oto-neurological findings, indicating CNS dys-
function in cases of fibromyalgia.

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dysesthesia). In the latter part of the study most of the patients had less severe fibromyalgia, and neuro-
ological symptoms and signs were often absent. This latter group showed in this way similarities with the fibromyalgia group studied by Ökvist et al. (18).

The prevalence of ABR abnormalities was the same (6-30%) in this study as in the earlier one (21). Since the material has been extended considerably, a more detailed statistical analysis is possible now. Significant differences were found, for both women and men, between patients and controls for the absolute latency of wave V, for the I-V and III-V IPIs and for ITDs of both wave V and I-V IPI. The III-V IPI reflects the function of the auditory system in the brainstem, between the cochlear nucleus and the superior olivary complex (17). The consistent findings of ABR abnormalities affecting wave V, the III-V IPI and the ITDs, strongly indicate that dysfunction involving thepons is common in patients with fibromyalgia.

Oculomotor disturbances were more commonly seen in our earlier study of fibromyalgia with dysaesthe-
ias than in the present one (42% and 28% respectively for sacades and 89% and 58% respectively for smooth pursuit). The reason for this is probably that the former represents a group with very pro-
nounced symptoms, while the total group includes patients with somewhat less severe manifestations.

The mean velocity gain was significantly lower in the patient groups than in the control groups. The prevalence of smooth pursuit abnormalities is similar between the present study and that of Ökvist et al. (18).

Velocity disturbances of sacadie eye movements were seen in 18% of the cases tested. Reduced sacadie velocity was the most common abnormality and can be seen in pontine lesions (19). Increased sacadie velocity, occasionally observed here, has been re-
ported to occur in cases with acute meningitis-encephal-
itis (11). In the present study the velocities were more often hypometric than in our earlier study, in which the sacades commonly had reduced velocity. Sacadic hypometric often reflects cerebellar dysfunction, but a supratenorial location of the lesion is also possible (26, 6, 19).

Although sacadie abnormalities affecting velocity and accuracy occur frequently, there were no significant differences between patients and controls in the statistical analysis. One explanation is that abnormalities of velocity and accuracy deviate in both directions from normal values (sacades might be either reduced or increased velocity and they can be either hypometric or hypermetric), resulting in increased variability and, consequently, no statistically significant differences between clinical and normative groups.

The only saccadic parameter with significant differ-
ences from norms was the latency, which deviated in one direction only from normative values (all patients with deviations had longer latencies than the con-
trols). The latency reflects the reaction time which elapses from the change of the target to the execution of the eye movement. It might measure a more generalized influence on the CNS than the other parameters.

Oculomotor dysfunction, affecting both sacadic and smooth pursuits, has been reported in connection with psychiatric disorders (13). These abnormalities, which are similar to what has been reported in fibromyalgia, could be secondary to impaired proprioception of neck or could be caused by brainstem lesions.

The interpretation of the findings of abnormal sacades and smooth pursuits as well as abnormal ENG registrations is that of CNS dysfunction, most likely in the posterior fossa. However, disturbances of smooth pursuits and also, to some extent, of sacades, can be seen in patients with tension headache (17) without neurological signs and symptoms (4). The explanation of this observation is that proprioceptive dysfunction in the neck might cause erroneous signals which could disturb the oculomotor regulation.

The prevalence of smooth pursuit abnormalities was about the same in the TH group (22) and in the group of fibromyalgia patients studied here (53% and 58% respectively). The prevalence of sacadic abnormal-
ities was also about the same in both groups; about 30%. Velocity disturbances were more commonly seen among fibromyalgia patients than among TH

patients (16% and 6% respectively). None of the patients with TH had abnormal ABR recordings (22), in contrast to what was found in the fibromyalgia group.

Ökvist et al. (18) reported that positional nystag-
umus, neck tension nystagmus, hyperactivity and abnormalities of spontaneous nystagmus often occurs in patients with fibromyalgia. This is in agreement with the findings of the present study. The ENG findings found here generally signal CNS involvement. Direc-
tional changing positional nystagmus, hyperactivity of the caloric nystagmus, directional preponderance and decreased visual suppression of the caloric nys-
tagmus indicate central vestibular dysfunction. Spontan-
eous nystagmus and reduced vestibular function in one ear can be seen in both peripheral and central unilateral vestibular lesions.

The present study suggests that CNS dysfunction often occurs in patients with fibromyalgia according to the results of ABR, the saccade test and ENG. Proprioceptive disturbances of CNS dysfunction are both plausible explanatory factors of the pathologiacal smooth pursuit findings observed here.

The cause of the observed CNS dysfunction is unknown, but some hypothetic mechanisms are possible. One is long-standing medication of drugs, e.g. analgetics, antidepressants, tranquillizers and hypnotics. One important aim of the rehabilitation clinic is to render the patients as free as possible from all drugs. In the group of ABR abnormalities, where smooth pursuit and saccadic eye movements are barely affected, pain relief are encouraged. According to personal knowledge of the patients and the files available, none of the patients was judged to have any drug dependence, including abuse of analgetics, tranquill-
izers or alcohol. It can therefore be presumed that the observations described above were not caused by medication or abuse, or by withdrawal of medication during the test session. However, since metabolites of different analgetic compounds were not measured prior to testing, and since data concerning medication earlier in life could not be reliably ascertained, it cannot be fully ruled out that recent or earlier medication might have had an influence on the test results.

Chronic fatigue syndrome (or chronic fatigue immune dysfunction syndrome), which seems to be similar to fibromyalgia (8) has been suggested to be caused by infectious agents. Behan et al. (2) coined the term myalgic encephalo-myelitis, and pointed out enteroviruses as a possible agent. Herpes viruses and retroviruses have also been discussed as zetiological agents to fibromyalgia, but these suspicions have not been verified (25, 7).

Stress factors have been discussed as inducing CNS dysfunction (1, 12). Such a discussion is relative to concerning fibromyalgia, which includes similarities to Post Traumatic Stress Disorder (PTSD), where stress mechanisms are known to be the zetiological factor. In animal experiments, glucocorticoid elevation induced by repeated stress causes neuroendocrine dysfunction and CNS atrophy (16). It can therefore be speculated that mental stress with its neurohormonal aspects may be both an zetiological and pathophysiological mecha-
nism explaining both the symptoms and signs as well as the oto-neurological findings, indicating CNS dys-
function in cases of fibromyalgia.

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IMPORTANCE AND ATTAINMENT OF LIFE VALUES AMONG DISABLED AND NON-DISABLED PEOPLE

Henry Montgomery, Lars-Olof Persson, and Anna Rydin

From the Department of Psychology, University of Stockholm, the Department of Nursing, Goteborg College of Health Sciences and the Department of Psychology, University of Goteborg, Sweden

ABSTRACT. How do disabled persons evaluate their life situation? To address this issue, importance and attainment ratings of 82 different life values as well as mood ratings were collected from 325 chronically ill and/or disabled persons and 504 non-disabled persons. Both groups largely agreed on what is important in life. The disabled persons, however, gave lower importance ratings on functions related to health and mobility. The attainment and mood ratings were in general slightly lower for the disabled persons. The attainment ratings for health and mobility were markedly lower. The concordance between rated importance and attainment across different life values was positive in both groups. This measure was also positively related to mood in both samples. It was suggested that disabled persons adjust to their life situation by de-emphasizing the importance of the physical functions affected by the disability and through habituation.

INTRODUCTION

Scores relating to quality of life are increasing concern for medicine, rehabilitation and health care to obtain a more global understanding of patients' satisfaction with life. Measures of quality of life consider people's subjective experiences of their life situation, in contrast to the more objective "bio-physical" outcome measures traditionally used in the medical disciplines.

Empirically, the research on quality of life most often has focused on the extent to which people experience their attainment of various states that are commonly regarded as desirable, like health or good social relations (5). However, since people have different views of what is important in life, a fair picture of how people evaluate their life situation is only obtained when both the subjective evaluations of importance and attainment of the different areas of life are considered (16). Thus, satisfaction with life could conceptually be viewed as a function of the distance between subjective importance of life values and perceived attainment. The smaller the gap, the greater is the satisfaction with life (13). According to this view, unrealistic strivings might be as much a threat to a high life quality as are bad conditions. However, most people tend to adjust their values and strivings to what is possible (14). Likewise, people seem to adapt over time to both good and bad conditions through a change of reference standards (3, 4).

Wright (20) in particular, has stressed that adjustment to disability is a matter of arriving at a value change, including a subordination of the physique and an enlargement of the scope of values. Although examples of such value changes are easy to find in interviews with disabled patients, e.g. "due to my disability I have learnt to appreciate the things in life that really matter" (20), there are few empirical studies that have tried to investigate these existential adjustment processes. One exception is a study by Stensman (19), who found that the functions severely mobility-disabled persons lacked most compared to non-disabled, were those that they also rated as relatively less important.

The purpose of the present study was twofold: first, to further investigate possible differences in life values between a chronically ill and/or disabled group and non-disabled group; and second to relate the congruence between attainment ratings and importance ratings of these values to subjective well-being. The aim is to shed further light on how disabled persons adjust to their losses by means of changing their value orientation.