OTOSPONGIOSIS AND SODIUM FLUORIDE

A Clinical Double-Blind, Placebo-Controlled Study on Sodium Fluoride Treatment in Otospongiosis

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ABSTRACT

The effect of sodium fluoride treatment in patients with otospongiosis has been evaluated in a prospective clinical double-blind, placebo-controlled study of 95 patients. The results showed a statistically significant greater deterioration of hearing loss in the placebo group than in the group actively treated with 40 mg of sodium fluoride daily. These results support the view that sodium fluoride can change otospongiotic, active lesions to more dense, inactive otosclerotic lesions.

Recalcification of an otospongiotic focus was proposed by Shambaugh and Scott in 1964.[1] Since that time medical treatment in otospongiosis has been debated, and several clinical reports[2-5] with a large number of patients show that this treatment can be helpful in most cases of progressive sensorineural hearing loss in otospongiosis. However, all these studies have been retrospective and lacked the necessary, matched controls to verify their statistic efficacy. Recent publications[6-8] include such controls in prospective studies, and some of the details of our study are presented here.

MATERIAL AND METHODS

A prospective study of 142 patients with clinical otospongiosis was carried out. The diagnosis was based on audiometry, stapedial reflex tests, and x-ray examinations, and no patient underwent surgery during the observation period. Most of the patients had a mixed perceptive and conductive hearing loss; the remaining patients had a pure conductive or a pure perceptive hearing loss.

All patients agreed to participate in a double-blind, placebo-controlled trial testing the efficacy of medical treatment with sodium fluoride. They were assigned to a treatment group according to their odd or even birthdays. The active treatment consisted of 20 mg of sodium fluoride as enteric coated tablets twice a day, 500 mg of calcium gluconate, and 400 units of vitamin D. The placebo treatment consisted of similar tablets without sodium fluoride but containing the same dose of calcium gluconate and vitamin D. Of the 142 patients, 47 were excluded before or during the investigation period, mostly as a result of different diseases or complications. Seven patients moved away from the area and could not be reached, 10 patients refused to join the investigation after the introduction, and nine patients were treated only 3 to 6 months and therefore were excluded (Table 1).

Ninety-five patients entered, went through the trial, and were controlled every third month in a 12- to 24-month period. At each control the patients filled out a questionnaire in which they were asked about the daily intake of the medicine and whether they had

Table 1. Survey of the Patient Group and Reasons for Exclusion*

Reason for Exclusion	*Number*
Kidney bladder stones	4
Arthritis	2
Leukemia and other metabolic disorders	3
Dyspepsia	4
Eczema	6
Psychosis	1
Pregnancy	1
No follow-up, moved	7
Refused to participate	10
Treated < 3 months	6
Treated < 6 months	3
Total	47

* 142 patients originally: 95 treated 12–24 months, 47 excluded.

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Table 2. Patient Population Data

Patient	*Active*	*Placebo*	*Total*
Total	43	52	95
Female	28	32	60
Male	15	20	35
Age range (years)	21–64	20–69	
Average age (years)	39.9	39.0	

taken the medicine regularly. Subjective symptoms of change in hearing or vertigo and tinnitus were reported, as well as side effects like dyspepsia, nausea, eczema, obstipation, and diarrhea. A complete audiologic examination was performed, including pure tone audiogram, speech reception threshold (SRT), and discrimination and stapedial reflex examinations. A polytomographic x-ray examination of the temporal bones, together with a side view of the calcaneus bone, was taken before treatment started. Kidney function was tested by serum and urine analyses. The code was broken 24 months after the last patient had entered the trial. The patient population data are shown in Table 2.

RESULTS

Subjectively, three patients (two in the active group and one in the placebo group) experienced improved hearing during the trial and 11 reported reduced hearing (six in the active and five in the placebo group), but the majority of the patients (35 active and 46 placebo) could not state any change in hearing (Table 3). Most of the patients indicated unchanged tinnitus or no tinnitus at all (41 active, 42 placebo), but six patients said that the tinnitus was improved and six found it worse. Five of these six in both situations were in the placebo group, but the difference was not significant (Table 4). Sixteen patients complained of vertigo, five in the active and 11 in the placebo group. This difference is not significant. The rest of the patients (38 active, 41 placebo) had no complaints of vertigo (Table 5).

In the audiometric evaluation, a changed hearing was noted if the average threshold of 500 to 1,000 to 2,000 Hz improved 10 dB or more or deteriorated 10 dB or more at the end of the trial. Hearing improved in four patients (one in the active group and three in the placebo group), but hearing loss was noted in 16 patients (three in the active group and 13 in the placebo group) (Table 6). This difference is significant ($p < 0.025$) using the χ^2 test. According to the SRT, hearing loss deteriorated more in the placebo group, but this difference was not significant ($p < 0.15$).

With regard to side effects, the majority of the patients (40 active, 48 placebo) tolerated the medicine without any complications, but seven patients (6.6%) noted minor disturbances (three active and four placebo) that were not severe enough to exclude them from the trial (Table 7).

Table 3. Results of the Patients' Subjective Symptoms—Hearing

Symptoms	*Actively Treated Patients**	*Patients Who Received Placebo*
Improved	2	1
Unchanged	35	46
Worse	6	5
Total	43	52

* 40 mg sodium fluoride daily

Table 4. Results of the Patients' Subjective Symptoms—Tinnitus

Symptoms	*Actively Treated Patients**	*Patients Who Received Placebo*
Improved	1	5†
Unchanged/none	41	42
Worse	1	5†
Total	43	52

* 40 mg sodium fluoride daily
† Not statistically significant

Table 5. Results of the Patients' Subjective Symptoms—Vertigo

Symptoms	*Actively Treated Patients**	*Patients Who Received Placebo*
Absent	38	41
Present	5	11†
Total	43	52

* 40 mg sodium fluoride daily
† Not statistically significant

Table 6. Results of Audiometric and Speech Reception Threshold Tests

Symptoms	*Audiometry (500–1000–2000 Hz)*		*SRT*	
	*A**	*P†*	*A*	*P*
Improved	1	3	1	1
Unchanged	39	36	37	36
Worse	3	13‡	5	15§
Total	43	52	43	52

* A, actively treated patients (40 mg sodium fluoride daily)
† P, patients who received placebo
‡ $p < 0.025$
§ $p < 0.15$

Table 7. Side Effects of Treatment

Symptoms	*Actively Treated Patients**	*Patients Who Received Placebo*
Absent	40	48
Present	3	4
Total	43	52

* 40 mg sodium fluoride daily

DISCUSSION

Experimental investigations, including animal cultures, organ cultures, and histologic, enzymatic, and biochemical examinations, have shown the effect of sodium fluoride.[3,9] Clinical data after sodium fluoride treatment in otospongiosis are much more difficult to evaluate, and only a few of the previously published studies have been carried out prospectively and blindly before analyzing the results.[6-8]

If otospongiotic bone presents an early phase of immature bone, sodium fluoride might stabilize otospongiotic lesions. But if the ground substance is abnormal, the chance for fluoride to help in the calcification becomes more problematic. Our x-ray analytical study[10] using the calcium phosphorus ratio as an indication for bone maturity after sodium fluoride treatment indicates that this treatment might stabilize otosclerotic lesions, particularly the spongiotic type with unstable mineralization, in retaining calcium relative to phosphorus.

The present clinical investigation has shown that, after 12 to 24 months of treatment with 40 mg of sodium fluoride daily, some spongiotic patients can benefit from the treatment because their hearing did not deteriorate as much as in the placebo group. As shown in Table 6, in about 100 untreated patients, roughly 25% can expect a worsening of the audiometric data in 1 to 2 years. After our treatment with sodium fluoride, less than 7% will show deterioration in hearing. Therefore we can conclude that approximately 20% of the patients will show a positive response to the treatment with sodium fluoride. The patients' own subjective hearing evaluation showed no difference between the two groups, and the medication seems safe (i.e., no severe complication was registered).

In well designed prospective clinical studies, Fisch[6] and Colleti and Fiorini[8] have shown a stabilizing effect of sodium fluoride on otospongiosis; these studies, together with ours, confirm the view that sodium fluoride promotes recalcification and reduces the activity of otospongiotic bone. The value of this treatment in the prevention of otospongiotic disease in its initial stage, and also in preventing progressive sensorineural hearing loss associated with otospongiosis, is more substantiated now.

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