

Hearing Loss, Otalgia and Neck Pain: A Case Report on Long-Term Chiropractic Care That Helped to Improve Quality of Life

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ABSTRACT: *Objective:* to describe symptom reports, multiple chiropractic assessments and adjustments over 7 years with a patient experiencing neck pain and complex ear symptoms consistent with Meniere's syndrome. *Clinical Features:* a 43-year-old female, injured years earlier in a motor vehicle collision, suffered recurrent exacerbations of otherwise continuous neck pain. Later she developed aural symptoms of severe otalgia, hearing difficulty, tinnitus and dizziness that increased and decreased in severity with her neck pain. *Intervention and Outcome:* The intervention was repeated application of chiropractic adjustments using a modified Pettibon adjusting device. Over 7 years of observation, the subject consistently reported reduction in symptom severity after adjustments, with relief lasting up to 2 months. Consistent with the natural history of Meniere's syndrome, an overall deterioration was noted during the observation period. Hearing fluctuated in approximate synchrony with changes in angular displacements of upper cervical vertebrae during the treatment period. *Conclusion:* Observation over an extended period assists in understanding the progression of chronic disorders. This patient experienced substantially reduced symptoms with chiropractic care during the 7-year observation period. Of note is the repeated exacerbation of neck pain that often precedes exacerbation in ear symptoms, along with the relief of both following adjustment and an association between improved hearing and improved cervical alignment.

INDEX TERMS: (MeSH): CHIROPRACTIC; NECK PAIN; TINNITUS; DEAFNESS; HEARING DISORDERS; WHIPLASH INJURIES; MENIERE'S DISEASE; DIZZINESS.

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INTRODUCTION

The association between mechanical musculoskeletal problems and visceral symptoms remains tenuous, particularly when assessed by the standards of science. Many in the chiropractic profession accept as a useful clinical premise that such an association exists. Clarifying the issue is important and can proceed only by documenting examples of such associations. In the first instance, this evidence is gathered by case reports and cross-sectional surveys. To date, cross-sectional surveys suggest that between 1% and 10% of persons seeking chiropractic care do so for a problem not directly associated with the spine.¹⁻³

Case reports serve to illustrate exceptional individual situations, often those that challenge the *status quo*. Together with other case reports or other evidence, newer and more complex theories can be developed to provide an explanation for such exceptions. The case presented here, linking the neck with ear symptoms, fits into this category. Generally, ear symptoms, such as hearing loss, tinnitus and dizziness, are seldom thought of as being associated with the spine.

The neck and ear are sources of many health complaints. Chronic or recurrent neck pain affects between 14% and 33% of the population.⁴ Eisenberg *et al.*⁵ found that neck problems are reported by 57% of persons seeking non-medical therapy and that chiropractic is the most used non-medical therapy. It has been estimated that between 24% and 35% of persons seeking chiropractic care do so for neck complaints.^{6,7} Up to 50% of neck pain sufferers relate their condition to prior injury, most commonly incurred in a motor vehicle collision.⁶

Hearing loss is reported to be “the most common physical impairment,” with a probable prevalence in Australia of 15% to 19%.⁸ Meniere’s disease is estimated by the Meniere’s Support Group in Victoria to affect 2% of the Australian population.⁹ Some of these people will receive care from a chiropractor, by chance or by intent.

Terret,¹⁰ in a review of tinnitus and the cervical spine, cites the earliest reference to this link in 1843. More recently, Kessinger and Boneva¹¹ cite six research publications linking the cervical spine with the vestibular system. Between these two dates (1843-2000) there have been a number of other reports important to chiropractors and their patients, such as the claimed recovery of hearing by Harvey Lillard in 1895 after a spinal adjustment;¹² the report on 1,029 patients seen between 1933 and 1948 that documented serial audiometric changes after upper cervical spinal adjustment;¹³ and a report of the sudden onset of deafness, vertigo and tinnitus, with no sign of vertebrobasilar artery compromise, following non-chiropractic manipulation of the neck,¹⁴ as well as two reviews of “vertebrogenic deafness,”^{15,16} In specialist journals, the neck-ear links are occasionally noted.¹⁷ In only one journal article identified by the authors is there an observation over time.¹⁸ In the case presented here, a 43-year-old female with neck and ear symptoms was assessed and treated using chiropractic care for seven years. Several influences preceded changes in the subject’s ear symptoms, with the most frequent being the chiropractic adjustment.

CASE REPORT

History

A 43-year-old schoolteacher visited the office of two chiropractors (the first author and his partner) in late October 1993 complaining of continuous hearing loss, tinnitus and otalgia (“aural fullness”) in the right ear, and of occasional unsteadiness and disorientation. These symptoms had begun 32 months earlier with several hours of “room-spinning” dizziness (vertigo) a week after a right-ear syringing, and two weeks after an ear infection in March 1991. During the following 12 months she was extensively investigated, while her symptoms fluctuated “erratically,” and she was diagnosed as having early endolymphatic hydrops (Meniere’s disease). One or two episodes of vertigo followed, and about 19 months before visiting our office, she said that hearing loss, tinnitus and otalgia had become continuous with severities that varied from 4 to 8 on a 0-10 scale where 10 represented maximum distress. Since the first visit to our office, several data collection strategies were used to collect information on this case. Table 1 summarises the information available for analysis and includes data gathered prior to commencing care as well as data gathered prospectively throughout the period of care.

The patient also complained of shoulder and neck pain, temporal headaches and jaw pain, all on the right side, as well as insomnia and concentration difficulties. The neck pain was continuously present and, like the ear symptoms, ranged from 4 to 8 in severity. Neck pain was first experienced after a motor vehicle collision 15 years earlier (October 1978). She had been the driver of a vehicle that was struck almost head-on by another vehicle; she was not wearing a seat belt. Her head, which had been turned slightly to the right, struck and dislodged the rear-view mirror and then continued forward to strike the windscreen. She was taken to a hospital casualty ward, where glass was removed from lacerations on her face, her wounds were bandaged, and she was discharged. Within 24 hours she developed severe, radiating, right-sided neck and head pain. Despite daily analgesic medication, the pain remained constant and severe for 6 months until she visited a chiropractor.

After the first adjustment to her neck, she said that the pain became milder for a day or two before again becoming severe and radiating. Similar remissions and relapses followed further adjustments, at a frequency of 1 to 3 per week over the first year. After 18 months, she reported, her remissions (“not-too-bad” times) were lasting longer, and she reduced the number of visits to “6 or 7 times a year.” Ten years after the injury she moved to another town and visited another chiropractor for the next five years, 6 or 7 times a year, during severe episodes of neck pain.

Severe episodes of neck pain usually began with a shift from the right lower neck and shoulder to the upper neck “two inches below the right ear” with pain radiating into the right temporal and frontal regions of the head. After the onset of ear symptoms in 1991, the neck pain was then often accompanied by an exacerbation of ear symptoms, and “the ear was at its worst when the neck (pain) was at its worst.” At these times, she said that she often experienced increased right-ear pain with loud television or playground noises (auditory recruitment). She could not locate where sounds were coming

from and had trouble following conversation, even in quiet environments. Tinnitus rose in pitch and volume from “an echoing hum” to a loud “screeching.” A feeling of “water fullness” in the ear became a painful pressure “like a knitting needle through the head.” She felt that she tended to “bump into things” and was disorientated, especially when driving at night.

As a consequence of these distressing symptoms, she suffered a loss of concentration and self-confidence because, as she stated, “Often you can’t think about anything except what’s going on in your head.” In the 32 months following the onset of ear symptoms, she complained of these symptoms at 36 visits to 10 health professionals, including a dentist and oral surgeon.

Daily diuretic medication (Moduretic: 50 mg hydrochlorothiazide and 5 mg amiloride hydrochloride) reduced her dizziness, and she felt she benefited from restricting intake of dietary salt. Naturopathic treatment and chiropractic adjustments also provided relief. She reported that on one occasion the tinnitus had abated for some hours immediately after a neck massage by a naturopath, and on another it had abated for several days immediately after a chiropractic neck adjustment.

Despite these temporary benefits, her condition continued to worsen during the 32 months preceding the case-study period. Till the onset of ear symptoms, she said that despite continuing neck pain, ear infections “Perhaps once a year,” dysmenorrhoea and occasional bouts of bronchitis, she regarded herself as “perfectly healthy” and enjoyed an active home, work and social life. By 1993, the severe episodes were becoming more frequent; she slept poorly and was always exhausted. She had therefore delegated and relegated household chores, discontinued playing squash and doing vigorous exercise, feared night driving, avoided social activities and reduced lesson-preparation times. She said, “At work it was horrific. I became very irritable and had little patience with the children because they wouldn’t speak up.” Because teaching in noisy classrooms had become so difficult, she enrolled in a course of sign language (Signed English) with a view to retraining as a teacher of the deaf. Then she first visited the first author’s partner in October 1993 with the thought that “there had to be some connection with the ear and the spine.”

Examination

The patient was lightly built, held her head tilted to the right, her left shoulder and right hip high, and there was a slightly reduced thoracic kyphosis. Jaw posture was that of clenching, and there was less than a 3 mm shift to the left of the lower incisors. On examination of the neck, active ranges of motion (ROM) were restricted on extension, left rotation and on both sides in lateral flexion. She reported pain on all these movements. Neck flexion was unrestricted. The transverse processes of atlas could not be palpated. Light palpation revealed firmness of the suboccipital muscles and mid-cervical region. On firmer palpation, tenderness was reported over the suprascapular regions bilaterally and the lower thoracic region on the right.

On the supine leg check, she had a functional leg length inequality (LLI) of approximately 6 mm, “short” on the right, as one indication of the “upper cervical subluxation complex.”^{19,20} There was no evidence of hip or pelvic problems, and lumbar movement was full and pain-free. Cervical spine X-rays showed that the atlas transverse processes lay partly cephalad to the inferior of the mastoid processes and were judged non-palpable and inaccessible to traditional hand or instrument tissue-compression adjustment.

Using modified Pettibon x-ray analysis protocols as outlined by Aldis and Hill,²¹ the relationships between occiput and atlas, atlas and axis, and third cervical vertebrae were assessed. These three vertebrae appeared shifted towards the right in the frontal plane, and atlas was angulated right anterior in the horizontal plane. Using the formula of Aldis and Hill,²¹ the total displacement from zero (TDZ) was calculated at 6°. This displacement was interpreted as indicating misalignments at C0-C1, C1-C2 and C2-C3 joint levels. Together with the neck ROM and LLI findings, this patient’s condition was described in chiropractic parlance as an *upper cervical spine disorder* (UCSD) and specifically as a right anterior “into-the-angles” upper cervical vertebral subluxation²² or “second basic type” upper cervical vertebral subluxation.²³

Such an “into-the-angles” subluxation complex refers to displacement of the atlas and vertebrae below atlas as being on the same side relative to the occiput. These subluxations are generally less common and more severe than others, according to Pettibon.²² Because of the apparent inaccessibility of the atlas

transverse processes, Pettibon instrument adjustment calculations were modified so that vectored percussions directed at the right atlas transverse process could be delivered through the right temporal bone.²²

Intervention

The chiropractic intervention (fixed-stylus, compression-wave adjustments) on the first visit and most subsequent visits were carried out in a similar fashion. The subject lay down on her left side on a movable adjusting table, with her head resting on a padded support. An electrically operated percussion cervical adjusting instrument²⁴¹ was set at a 3-pound (about 14 N) force setting. The stylus was then brought into contact with the skin over the subject's right temporal bone at a predetermined contact point and aimed at the right transverse process of atlas (Figure 1).

The instrument was set to deliver a rapid volley of about 30 mechanical percussions, conducted through the stationary stylus, over a period of about 15 seconds. At the end of each visit, the subject rested supine on a padded bench for 15 minutes with the back of the neck cushioned comfortably on a polyurethane semi-cylindrical support, of about 10 cm diameter ("Chinese pillow") with legs bent and thighs and calves supported on several pillows.

Assessments

A visual check of supine leg length was performed before and after each adjustment. Change from an apparent LLI to none was used to indicate a successful result. Usually, other indications were that the subject was able to move her head more freely on extension and left and right rotation. X-rays were retaken 10 minutes after the first adjustment.

Results and Ongoing Management

Measurements taken from the X-rays after the first adjustment indicated a reduction in TDZ of 2° (from 4° to 6°). After the first adjustment and lasting for 4 days until the following visit, the subject reported no tinnitus or otalgia. Further visits were recommended, and when 6 mm or greater LLI was found, an adjustment was given. At each visit the subject consulted her diary and reported on symptoms experienced since the previous visit. More often than not she would describe a reduction in severity, but also frequently noted residual neck pain on active right rotation. During the 5 months after the first adjustment, she made 23 visits at frequencies ranging from twice a week to twice a month, as recommended by the chiropractors. Thereafter, she made appointments whenever she thought she needed an adjustment, typically if right neck pain and other symptoms returned, or were not sufficiently relieved by home use of the "Chinese pillow." In the 7-year period the subject visited the office on 217 occasions, was X-rayed 7 times and took 7 hearing tests.

No adjustment was given at 37 visits, because no LLI was found on examination. At 180 visits (83% of visits) an adjustment was given. Intervals between these adjustments varied from 1 to 71 days (mode 14, average 14.2). There were 16 intervals longer than 28 days (range 29-71), averaging 45.9 days of relief after an adjustment.

When several visits were made within 2 to 3 weeks, this indicated that the adjustment had provided only temporary or no relief. The worst period of response to adjustment was towards the end of 2000 (final 6-month period) when the subject reported a cluster of home, work and study stresses and received 25 adjustments in 26 weeks. Figure 2 shows the spread of visits and adjustments on a 6-monthly basis from the time of the first visit.

Apart from providing relief, adjustments also were observed to provoke the symptoms. This happened on 17 June 1994, when the subject reported only mild neck pain and no other symptoms. Within hours of the adjustment, however, she wrote that "no amount of Disprin" could ease the severe neck pain, which "spread across the base of the skull" and was followed by a "blocked and painful" right ear and a

¹ * The adjusting head was supplied by Dr Jeffrey Blanchard, Del Mar, California, USA and the guidance apparatus (a modified milling machine) by Dr Burl Pettibon, Tacoma, Washington, USA.

“very sore” right jaw, as well as mid-thoracic pain, concentration difficulties and irritability. On another occasion, a rapid exacerbation of tinnitus was reported after adjustment.

SELF-REPORT OF SYMPTOM CHANGES

Diary and Other Self-Reports

For the first 3½ years, records of symptom frequency and severity were noted at visits and in the subject’s clinical diary. Usually, verbal rather than numerical descriptions were used. These records show that after the first adjustment, all neck and ear symptoms became and remained intermittent rather than continuous, and that symptoms were rarely as severe as prior to chiropractic care. Diary entries covering the first 215 days are summarised in Table 2. She reported being symptom-free for over 50% of the 215 days during this observation period.

After this period, jaw pain and headaches, which had been present “for years,” were rarely reported. Also, tinnitus reports were virtually absent (7 in 6½ years) up to the last six months of the study period, when this symptom was reported 18 times at a 1-2 severity rating.

During the 7 years, there were 11 intermittent self-reports on the use of diuretic medications (Moduretic 50 mg hydrochlorothiazide and 5 mg amiloride hydrochloride), which the subject reported experimenting with at varying frequencies (regularly; every second, third or fourth day; “when I remember,” and during exacerbations). In the third year, she reported that “it doesn’t seem to have any effect” on exacerbations. Some time after this report, she discontinued using it altogether and was still abstinent at the end of the study period. She maintained a reduced intake of dietary salt over the whole study period.

Structured Responses

For the period 17 March 1997 to 30 October 2000 a more structured data collection strategy was undertaken. During this time a further 108 visits were made, and on 99 of these visits structured response data were collected. The earlier diary notes were used to determine on which symptoms to collect data. Data on 10 symptom components were collected: neck pain, sleep disturbance, concentration disturbance, irritability, jaw pain, perceived hearing loss, otalgia, tinnitus, headache and dizziness. For each of these symptoms the subject rated the symptom severity using a numeric rating scale with a range of 0-10 where 0 represented no problem and 10 represented worst possible interference or severity.

Neck Symptoms

Figure 3 shows how musculoskeletal symptoms like neck pain, headaches and jaw pain varied over the observation period (March 1997 to October 2000). Right upper-neck pain was reported as the “most worrying” symptom, because “it was most often associated with the ear,” however lower-neck pain, usually arising from the right lower aspect, generally preceded and accompanied reports of upper-neck pain and ear symptoms, generally reported at severity ranging from 1-2 out of 10, and generally persisted for a day or so after the upper-neck and ear symptoms had abated.

The following excerpts are samples of the positive and negative symptomatic changes that the subject reported in the early months of care. The positive: “Am I imagining, or can I hear better in the right ear?” ... “Noises (tinnitus) only once, for an hour, since starting” ... “How good it feels when the neck is in place!” The negative: “Top right shoulder very tender” ... “Slept badly. Tense and anxious” ... “Click at back of neck seemed to cause slight pressure above left ear and some swelling in glands below right ear”... “When will I start to feel better?” After 14 adjustments and 124 days of care: “Can’t believe I’ve gone this long.” After 18 months of care, in a later diary entry (15 April 1995), she wrote: “Chiropractic care has reduced my Meniere’s disease symptoms to minimal.” Figure 4 shows how associated symptoms like sleep disturbance, irritability and concentration varied during this same time period.

Ear Symptom Reports

The duration of abatement of ear symptoms after an adjustment varied from 3 to 116 days (mean 38.7 days). Most commonly, a group of 2 or 3 adjustments were made over about a month. Figure 5 shows how ear symptoms varied throughout the study period. Ear symptoms that were recorded were dizziness, tinnitus, otalgia and hearing difficulty. Notwithstanding the variety and inconsistency of the reporting methods, otalgia was the most frequent of the ear symptoms.

Improved driving (“less disorientated in traffic” on leaving the clinic) was reported to follow 6 adjustments. Immediately after 14 other adjustments, the subject reported improved steadiness immediately after adjustment. On 27 occasions she reported an improvement in hearing, and on 5 she reported no change or exacerbation. Otalgia abated 58 times, was unchanged 7 times and increased twice. Altogether, tinnitus abated quickly after adjustment on 17 occasions, was unchanged 5 times and increased 3 times.

The episodes where ear symptoms were the worst, or rated by the subject using a numeric rating scale of 0-10 as being 4 or more are shown in Figure 6. This graph includes the subject’s estimate of the ear symptom severity during the 19 months prior to the first visit at this clinic and shows a recent increase in the number of visits associated with increased work and study commitments as well as with persisting influenza and bronchitis.

The ear and neck symptoms were frequently associated. The diary, structured reports and office reports contain 117 mentions of ear symptoms, and 105 of them (90%) mention preceding or accompanying neck symptoms. The onset of ear symptoms typically followed this sequence: “Neck stiffens, right ear blocks, right hearing decreases, right (side) pressure, right hum, (then) insomnia.” At 87 visits, when reports of both ear and neck symptoms were accompanied by LLI along with painfully restricted cervical ROM, an adjustment was given. Abatement of all symptoms followed 76 of these 87 adjustments (87%).

For 3 episodes of ear and neck symptoms, more than one adjustment was needed to achieve abatement of neck and ear symptoms. Neck symptoms were more likely to persist at mild severity for 1 to 3 days.

CLINICAL COURSE

Audiology

An audiologist reviewed all 10 of the available audiograms. In his first report (1995), he compared the last pre-care test with the first two available during-care audiograms and stated that thresholds had improved and were normal. In his fourth report (1999), he wrote that thresholds had remained normal and steady except for the test made in November 1998, which he regarded as an “aberration.” In April 2001 a further audiogram was done, which showed deterioration in hearing. These tests are summarised in Figure 7.

Radiology

The TDZ values on the 7 sets of X-rays varied throughout the study period (Figure 7), ranging from 6° at the beginning of the study period to 2° at the end. All TDZ values found after the first adjustment were smaller than the original TDZ value. There were 2 successive reductions of TDZ followed by 2 successive increases, and then a reduction. The second successive increase, 3.25°, was found on X-rays taken 2 weeks after the hearing “aberration” noted by the audiologist.

Ranges of Motion

CROM device assessments were undertaken on 24 occasions during the treatment period. Not all 6 cervical movements were assessed at every assessment because of discomfort. Figure 8 shows the variation in flexion and extension during the treatment period. The first 2 assessments show ranges closest to normal for both flexion and extension. Initially these ranges of movement were taken more frequently. The scale represents 3-monthly periods, and dates of assessment do not fall exactly on these dates. The normal values are shown in the legend box as reported by Youdas *et al.*²⁵ and Feipel *et al.*²⁶ On 11 occasions, pre- and post-adjustment readings were taken of lateral flexion. The mean increase post-adjustment in left lateral flexion was 1.2° (range -8 to +7), and in right lateral flexion, the mean increase was 4.3° (range -7 to +12). Figure 9 shows the variation in side-bending for those times it was

considered prudent to assess. The normal values are shown in the legend box as reported by Youdas *et al.*²⁵ and Feipel *et al.*²⁶.

Leg Length Inequality

LLI was present before adjustment and absent immediately after adjustment at 180 visits. The quick change from present to absent was interpreted as a positive effect of the adjustment. The repeated recurrence of LLI was interpreted as an inadequate adjustment by the chiropractors and/or a failure by the patient to hold the adjustment.

Subject Status at End of Study Period

The subject continued full-time teaching throughout the 7 years, resumed household chores and social life (which again included night-time driving, concerts), and completed 5 years of part-time study leading to a Master's degree in education. She discontinued the sign-language classes and diuretic medication.

DISCUSSION

This case illustrates, over a longer period than we have found in previous reports, that non-musculoskeletal symptoms such as those associated with Meniere's disease can change quickly following chiropractic adjustment. The case is notable for the amount of data available, the duration of time over which the data was collected, the association between spinal and ear symptoms, the repeated positive responses to adjustment that improved the patient's quality of life over a number of years, and finally the apparent inevitable deterioration in ear symptoms that commonly characterises Meniere's syndrome.

It needs to be strongly emphasised that this is a single case report and should be interpreted with all limitations that are inherent in this type of report. As is often the case with clinical work, the decision to monitor symptoms occurs after good results have been reported. In this case the quality and quantity of the data collected was progressively improved during the period of observation. Unfortunately, data prior to March 1997 are from diary reports and notes at visits, so the graphs (Figures 3-5) illustrating change after this time (drawn from the structured response sheets) are likely to underestimate the full extent of change shown if the diary reports and the reason for seeking chiropractic care are any indication of the initial severity of symptoms. Second, this syndrome being characterised by exacerbations and remissions, the more detailed formal assessments such as audiograms and X-rays often occur at times of exacerbation rather than at predetermined points. These assessments would then tend to understate the significance of the moderately long-term symptom changes reported by the patient, such as the virtual absence of tinnitus and jaw pain for most of the study period. The fact that the data were not collected at predetermined points makes them harder to interpret.

This case also shows how important it is to be fully conversant with the issues relating to the case at hand so that prospective and comprehensive data collection can proceed at the earliest opportunity. Another form of analysis could be performed to highlight the benefit reported by the subject—that is times of exacerbation followed by treatment-induced relief. In many respects this is how care has progressed, with some occasions with less than satisfactory results—often for differing reasons—such as a different type of adjustment or stress. Horner²⁷ suggests that patients with Meniere's syndrome are more likely to be middle-aged professionals in stressful jobs. This subject falls into this category, and apart from the initial presentation, there have been several periods where stressful circumstances in her life have resulted in an exacerbation of her symptoms. She has learnt to manage these stresses, and to adopt palliative measures at times when such stresses cannot be completely removed.

Readers unfamiliar with chiropractic may ask, "Why chiropractic care, and in particular, why has this form of chiropractic provided this individual with more relief than other forms of physical intervention?" This patient diligently attended yoga and Feldenkrais classes and undertook for periods of 6 months or longer courses of massage and acupuncture. She had also gained some relief from earlier chiropractic care, though not as consistently, and at a different phase of the condition. Apart from the yoga, which had aggravated the neck pain, each physical intervention had provided some small and brief relief.

This form of chiropractic was used for two reasons: 1) the region of spinal involvement and location of intervention is the neck, and 2) it is the preferred technique of the first author and his partner. The subject's description of her pain was similar to the pattern reported by 5 subjects in an experimental study that placed provocative injections into the lateral atlanto-occipital and atlanto-axial joints.²⁸ The upper cervical spine is a likely site of whiplash injury at higher-trauma accelerations,²⁹ and may result in displacements and/or dysfunction in the craniovertebral joints.^{30,31}

The emphasis of this technique is the careful determination of alignment of the atlas relative to surrounding tissues. For some types of injury or some patients, it may be more important that the "correct" vector is delivered rather than a less discriminating mobilising force that simply makes the joints easier to move. Manipulation has been reported to produce different outcomes when delivered from different sides.^{32,33} How important this is in different patients or conditions is beyond the scope of this paper. The technique employed here used vectors as a part of the procedure. This hypothesis is fundamental to chiropractic principles, but remains controversial in scientific circles; this case description cannot address this issue, but the assertion is repeated.

The need for a specific adjustment vector in this case is reinforced by:

1. Repeated symptomatic relief coinciding with clinical indicators of improved LLI and cervical ROM.
2. Times of apparent error and poor response to treatment. Wrongly directed adjustments appear to provoke symptoms.³⁴
3. Corresponding failure of the LLI to indicate holding of an adjustment, and with other findings and external stresses.

Using a mechanical adjustment device allows for more repeatable interventions than those done by hand.^{35,36} In 1971 the first author and Dr Kathleen Bras converted the adjusting-instrument method of Pettibon from vectored "toggle" of soft tissue near the atlas transverse process to vectored percussions of the temporal region of the head.²¹

Tapping the skull with vectored percussions has been reported to change craniovertebral angulations seen on X-rays,²¹ and tapping it with a reflex hammer has been reported to activate vestibular reflexes.³⁷ For reasons covered above in the discussion on vectors, the presumed effect on craniovertebral angulations is thought to be the primary one in this case. For an overview of upper-cervical adjusting instruments, see Kyneur and Bolton²⁴ and Grostic.³⁵ The TDZ x-ray analysis is based on the Pettibon analysis protocols for upper cervical spine X-rays,^{21,22,38} also referred to as upper cervical orthogonal (UCO) analysis. An early study of reliability in intra- and inter-observer reliability for UCO x-ray measurements found it to be very good for both atlas laterality and the lower angle and acceptable for atlas rotation. No studies have established the validity of UCO procedures, and they remain controversial.^{40,41} The leg-length analysis indication used to indicate the need for an intervention is used widely within the chiropractic profession.⁴²

The impact of these symptoms on this subject prior to the study period was substantial and appeared to be progressively increasing. The subject was planning a career change to try to cope with the impact of the disorder. Despite lack of a complete cure, the prolonged abatement of many hitherto intractable symptoms has been important to the patient. The psychological distress associated with Meniere's disease is generally accepted as an effect rather than a cause of the disorder⁴³ and may be severe. In one study of 19 sufferers whose symptoms, like this subject's, were resistant to dietary and medical therapies, depression scores were as high as for people with serious trauma and wellbeing scores were as low as for people with cancer.⁴⁴

It is important to remember that controversy exists within the medical world regarding the appropriate management for Meniere's sufferers/ Deafferentation surgery is usual in extreme cases,⁴⁵ yet even at this extreme end of the scale, where surgery is considered the only option left, significant numbers of subjects experience remissions within the 6-8 week period awaiting surgery. Like chronic neck pain, Meniere's disease continues to provide challenges because of its unclear definition, lack of definitive treatment and its multifactorial, intermittent and often extremely disabling nature. Because of this complexity, a global assessment of treatment results using both objective and subjective findings is

appropriate,⁴⁶ and a clinical diary as used in this case report makes an important contribution to overall assessment.¹⁸

The patient reports on consistent sequences of symptoms are reminiscent of the patients whom Prosper Meniere praised 140 years ago as “good historians.”⁴⁷ At that time, vertigo was thought to be a “cerebral trouble.” Meniere wrote that his patients’ reports of their vertigo being preceded by tinnitus had led him to believe that the inner ear was the site of their mysterious symptoms.⁴⁷ By comparison, this woman’s extensive record-keeping helps demonstrate a link between Meniere’s syndrome and the neck. Her experiences support the corollary also, that physical intervention to the neck by way of adjustment, can relieve symptoms of Meniere’s syndrome.

Reviewers since 1977 have lamented the lack of progress in understanding this syndrome,⁴⁸⁻⁵⁰ describing the situation as a “therapeutic imbroglio.”⁴⁹ In the past, reviewers made dismissive reference to using the spine as a focus for Meniere’s syndrome, either by traction,⁴⁸ or by manipulation,⁴⁹ however, the research community is not unanimous in its rejection of the musculoskeletal contribution to inner ear disorders such as Meniere’s disease.^{10,11}

The lack of anatomical connection has been one objection to the association between the neck and ear symptoms. Recent research supports a neurologic connection. Shore *et al.*⁵¹ note that the trigeminal nucleus is a major nucleus showing convergence of sensory input.⁵¹ They demonstrated, using anterograde and retrograde tract tracing methods, that the auditory brainstem nuclei are connected with the trigeminal nucleus. Thus it is plausible that trauma to the cervical spine affects hearing and/or balance in some patients. It is also plausible to hypothesise that physical intervention to this region alters the course of conditions like Meniere’s disease—even if temporarily. Weimama *et al.*⁵² postulated that pressure imbalance between the endolymphatic sac and intracranial space, aggravated when the cochlear aqueduct is blocked, may account for Meniere-like symptoms that were triggered by CSF leakage after spinal anaesthesia. The membranes in the cochlea and labyrinth have been demonstrated histologically at *post mortem*, but the amount of fluid necessary to produce the changes are minute—too little to measure *in vivo* (correspondence, R.M. Loane). This difficulty, along with the “exquisite sensitivity” to small changes that is said to be a feature of “dynamical diseases” such as Meniere’s,^{18,53} may explain why such a puzzling variety of interventions are useful, but to different degrees in different subjects.

The fact that undertaking a lumbar puncture⁵⁴ or spinal anaesthesia⁵² can both trigger Meniere’s syndrome-like symptoms supports the idea of a relationship between this syndrome and the spine. A more direct connection may exist in the discovery of the so-called “myodural bridge” in the form of the rectus capitis posterior minor muscle attaching to the posterior atlanto-occipital membrane,⁵⁵ with an influence upon CSF flow. The clinical implications are only now being explored.⁵⁶⁻⁵⁸ Clearly, anatomical evidence for a link between these structures is growing.

Watanabe *et al.*, using 20 subjects with confirmed Meniere’s disease, plotted the severity of symptoms over a 243-day period. They, as in our case, note the association of stiff neck or shoulder with the exacerbation of ear symptoms, albeit with a 2-14 day latent period.¹⁸ It appears that at least a subgroup of Meniere’s disease sufferers may experience modulation of symptoms because of the cervical spine. Similar findings were had by Franz *et al.*,⁵⁹ who found that 9 out of 45 subjects with vertigo and tinnitus also had upper cervical dysfunction, and of these one progressed to Meniere’s syndrome. They proposed that a syndrome called “cervicogenic oto-ocular syndrome” might exist as a forerunner to Meniere’s disease. Bjorne *et al.*¹⁷ also found that 75% of a group of 24 patients diagnosed with Meniere’s disease reported a strong association with neck problems and triggered vertigo. Examination of the cervical spine for dysfunctions (such as muscle and joint tenderness and/or restrictions in movement) was found to be more common in Meniere’s sufferers than in matched control subjects. At each exacerbation, our subject reported progression of symptoms from right lower neck pain to upper neck and then to the right ear. The history of neck trauma, most probably now associated with fibrosis, links these factors together. Other researchers have also noted this association as outlined above.

Filipo and Barbara⁶⁰ consider that over time Meniere’s disease is characterised by four stages. Though the duration of each is unclear, the first prodromal stage is that in which any one of the key symptoms is first experienced, but diagnosis remains unclear. Stage 2 is characterised by loss of balance and is the most disabling. Stage 3 develops as a stable period with less dizziness, and in Stage 4, the syndrome

becomes bilateral. The hearing loss is either progressive or staged, usually without remissions in the level of loss.

The subject in this report has been followed for 7 years. This may be long enough for the advanced stages to have developed, and it is possible, in view of the reduced severity and duration of exacerbations, that this subject's deterioration has been delayed because of the adjustments. Four observations suggest that deterioration has been delayed: 1) no episodes of vertigo were reported in the study period; 2) all four presenting ear symptoms were reported as briefer and milder than they had been in the pre-study period; 3) her worst audiometric indication of hearing loss in the study period, a pure tone average (PTA) of 25dB, was comparable with her pre-study losses and more than the Kinney *et al.* subjects' average baseline loss of 38.0 (± 22.1 SD) dB than their average long-term loss of 43.3 (± 22.0 SD) dB; and 4) her audiograms indicated continuing fluctuation, a common characteristic of the early stages of Meniere's disease. These findings suggest that chiropractic care may have retarded this subject's progression towards the more advanced stages of Meniere's disease.

Wilson *et al.*⁸ believe that hearing loss can be relied on in subjective reports, however in a long-term follow-up of Meniere's disease, Silverstein *et al.*⁶⁰ found only 50% correlation between subjective and objective hearing reports. Some credibility in reporting hearing loss seems appropriate for this subject, specifically because 7 of her reports were corroborated by roughly contemporaneous audiograms and, more generally, because subjective reports of hearing difficulties, elicited by questionnaires, were judged rough but reasonable substitutes for audiometry in recent South Australian and British surveys of hearing loss.⁸

Range of motion assessments were variable in pre- and post- assessments. Only lateral flexion data is illustrated, because it is considered the most stable, and an observed change would more likely to represent true change—more so than the other directions of movement. The measured changes were still quite variable, though the subject reported pre-adjustment a reduction in flexibility, and post-adjustment an increase in flexibility. The extent of this appears to be more one of perception—perhaps by way of when pain is produced. Looking at the graph, there seems to be far wider variation in the earlier period.

CONCLUSION

Notwithstanding the limitations inherent in case reports, this subject has been a good historian who, together with her clinicians, has provided the first long-term perspective of chiropractic care for ear symptoms. Four main observations are made in this report:

1. Ear symptoms developed repeatedly after neck symptoms.
2. Severe and mild episodes of ear and neck symptoms repeatedly and rapidly abated after neck adjustments.
3. Improved quality of life followed the beginning of care and was maintained throughout frequent symptom fluctuations during the 7 years of ongoing care.
4. Hearing fluctuated in approximate synchrony with changes in angular displacements of upper-cervical vertebrae.

The subject's condition appears to be following the "normal" progression for Meniere's syndrome, albeit with less distress and periods of relative normality assisted substantially by chiropractic adjustments. We look forward to further similar case reports and perhaps prospective group studies of chiropractic care for persons who suffer such non-life-threatening, but debilitating, non-musculoskeletal conditions.

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We would like to acknowledge the exceptional willingness of the subject to participate for such a long time, recording her symptoms before and after chiropractic adjustment. Her work has added strength to the more objective data, particularly in the contentious area of outcome assessment for treatments of Meniere's syndrome sufferers.

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Table 1

SOURCES OF INFORMATION: OPINIONS AND TESTS	
PRE-CARE for the 32 months prior to beginning care on 20 October 1993	<p>WRITTEN REPORTS (11) from chiropractor (1), general practitioner (1), ENT surgeons (4), university ear clinic (5)</p> <p>HEARING TESTS (5—available audiograms, 4) from 3 June 1991 to 4 March 1992</p>
DURING CARE for the 84 months from 20 October 1993 to 28 October 2000	<p>WRITTEN REPORTS (6) from ENT surgeon (22 August 1994), audiologist (17 February 1996, 21 July 1997, 18 November 1998, 27 July 1999, 18 April 2001)</p> <p>HEARING TESTS (7, available audiograms 6) from 31 March 1994 to 18 April 2001</p> <p>CROM device assessments of cervical movement (25, including pre- and post in lateral flexion)</p> <p>UPPER CERVICAL X-RAYS (7 sets) 27 October 1993 to 7 October 2000</p> <p>NOTES AT OFFICE VISITS (217) on symptom reports, LLI, cervical ROM</p>
WRITTEN SELF-REPORTS (18)	<p>CLINICAL DIARY (172 entries) 2 November 1993 to 19 June 1995</p> <p>STRUCTURED RESPONSE SHEETS (99) 17 March 1997 to 30 October 2000</p> <p>NATUROPATH VISITS (6-10) reported in September 1995</p> <p>DIURETIC MEDICATION (Moduretic) use, reported in March 1996</p> <p>DIZZINESS HISTORY: bumps, bruises and inability to drive a car, reported in April 1996</p> <p>EAR-INFECTION HISTORY, reported in June 1997</p> <p>HEARING BETTER THAN HUSBAND, e.g. telephones (14 January 1997); owls (April 1999)</p>

Table 2

SUMMARY OF SUBJECT'S CLINICAL DIARY Main topics covered in first 215 days, 2 November 1993-5 June 1994	
DAYS COVERED BY EARLY DIARY ENTRIES	215
ENTRIES (daily for the first 146 days, one for the next 69)	147
OFFICE VISITS (an adjustment was given at 19 visits and withheld on 4)	23
DAYS ENTIRELY FREE OF SYMPTOMS (54.8%)	118
DAYS OF MILD OR BRIEF SYMPTOMS ("not a worry") (15.8%)	34
DAYS OF MODERATE OR SEVERE SYMPTOMS ("worrying")(29.3%)	63
MENTIONS OF MAIN INDIVIDUAL SYMPTOMS (often more than one on a given day)	135
Neck pain (7 severe episodes, 56 mild)	33
Otagia, right ear 17, left ear 5	22
Tinnitus, right ear	6
Hearing loss, right ear	2
Disorientation	1
Other ear symptoms (unspecified)	2
Sleeping difficulties	17
Headaches, 4 severe, 9 mild	13
Jaw pain (right TMJ 2, both TMJs 2)	4
"Strange sensations" (brief, mild paraesthesias)	5
POST-ADJUSTMENT EFFECT REPORTS (extent of relief of symptoms)	19
LOSS-OF-ADJUST EFFECT REPORTS (extent of return of symptoms)	24
SELF-HELP EFFECT REPORTS (extent of control of symptoms): Chinese pillow (16), reducing stress (2), Feldenkrais exercise (2), varying work (1)	21
STRESS-EFFECT REPORTS (events tending to trigger or aggravate symptoms): windy days and noises (6), reading and writing (3), bus days, late nights (3), menses (3), tiredness and being too busy (2), long drives (1), tension and anxiety (1), job interview (1)	20
ENTRY #147 (SUMMARY): "Chiropractic care has reduced Meniere's disease symptoms to minimal."	

The summary above is based on a review by the subject and the first author of a clinical diary with few numbers and many words. Symptom severities, for example, were usually recorded in words rather than numbers. Other observations involved considerable detail ("I had a fear of the unknown in the beginning and I probably recorded everything"). The subject distinguished finely between similar events (e.g. "tingling in head," "numbness behind the right ear"), anatomical locations (e.g. cranial, upper, mid- and lower cervical regions) and types of discomfort, e.g. in the right neck (ache, pain, soreness, tightness, tiredness) and, e.g. in the right ear (fullness, pressure, block, ache, soreness, numbness). The table therefore presents an overview made approximate by the need to fit verbal accounts of severity into "mild," "moderate," or "severe" categories and the need to ignore some distinctions of place and pain.

Fig. 1.

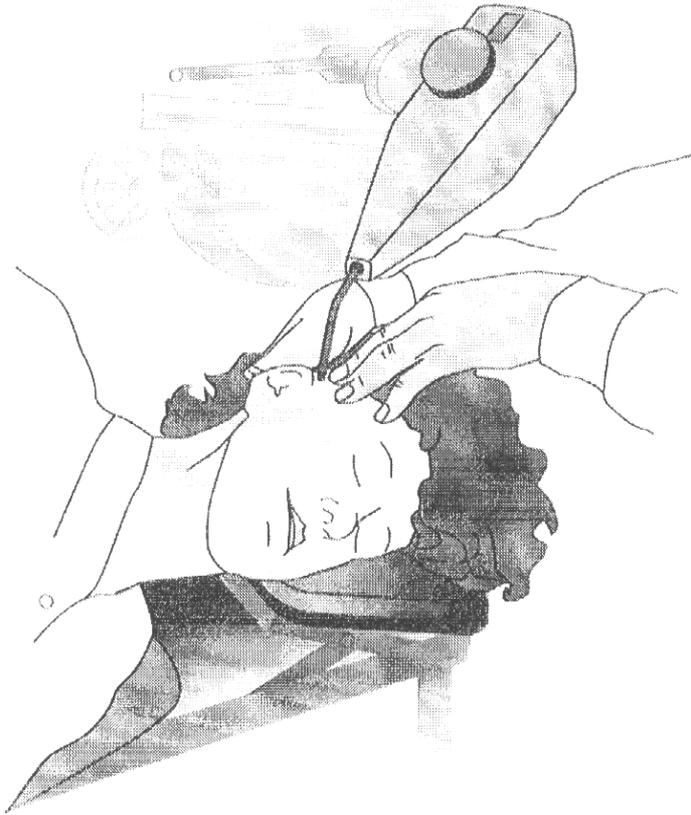


Fig. 2.

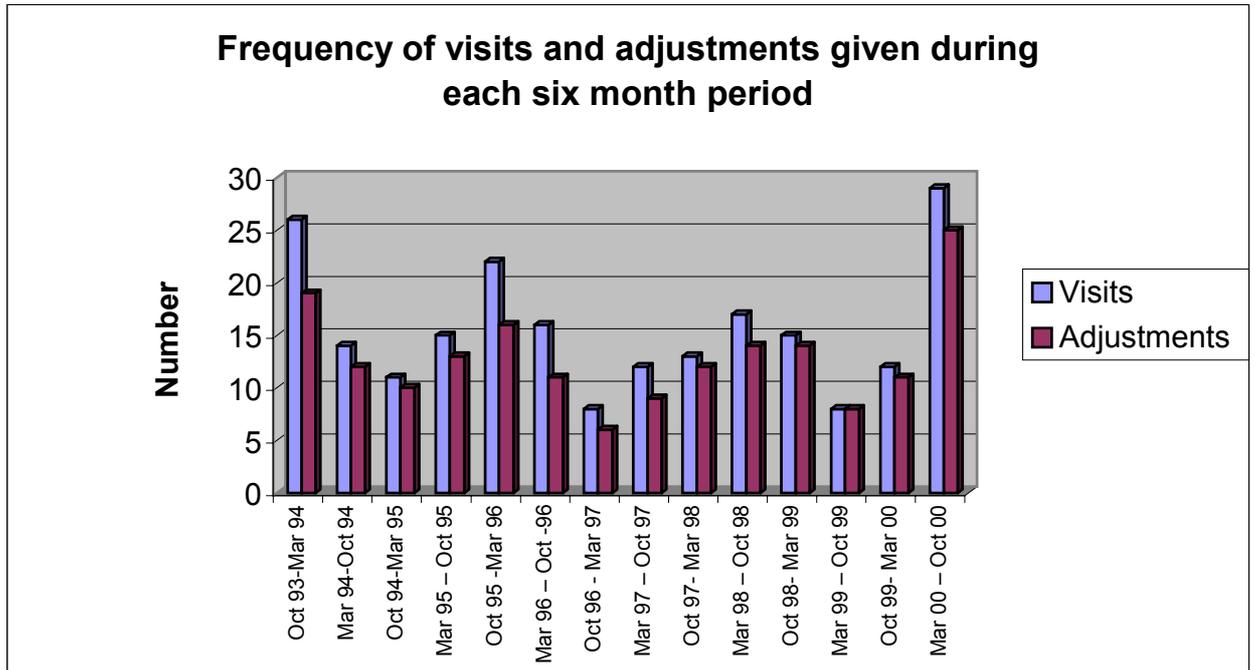


Fig. 3.

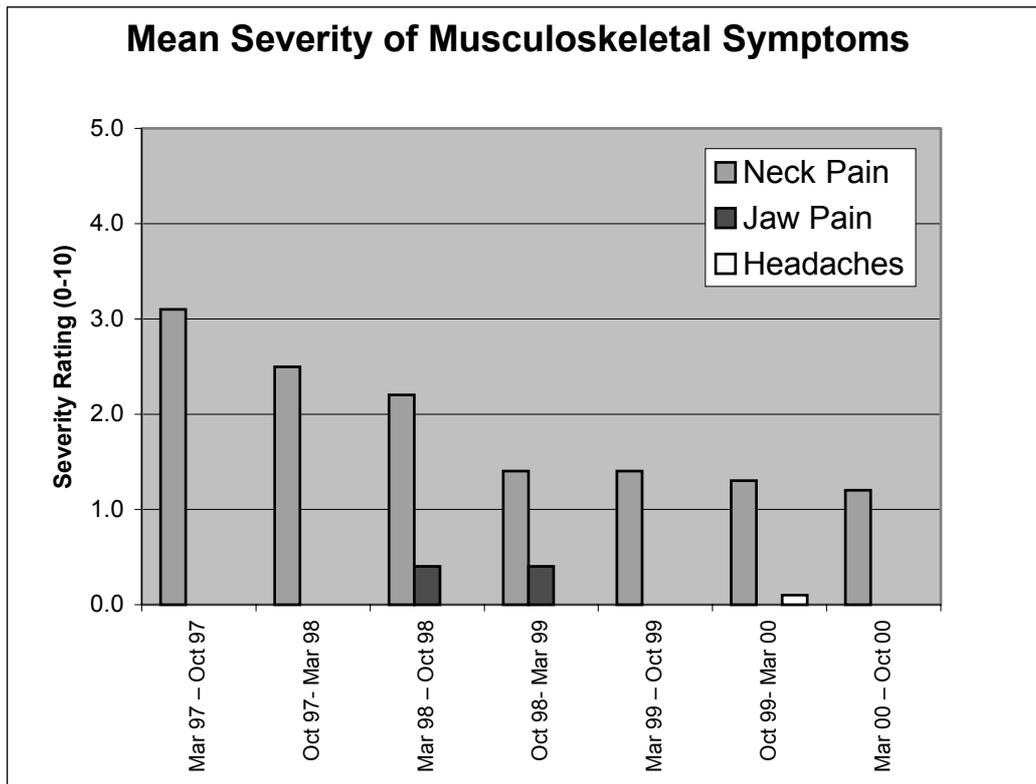


Fig. 4

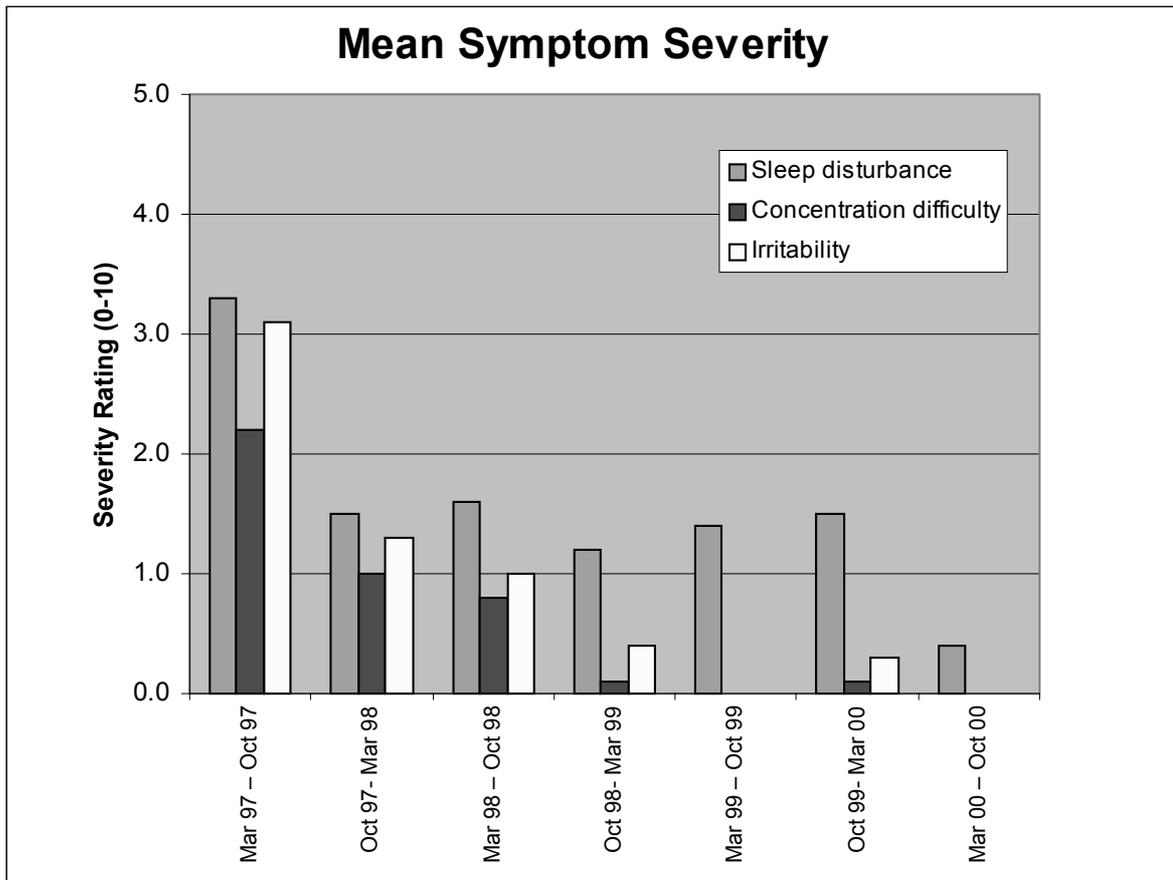


Fig. 5.

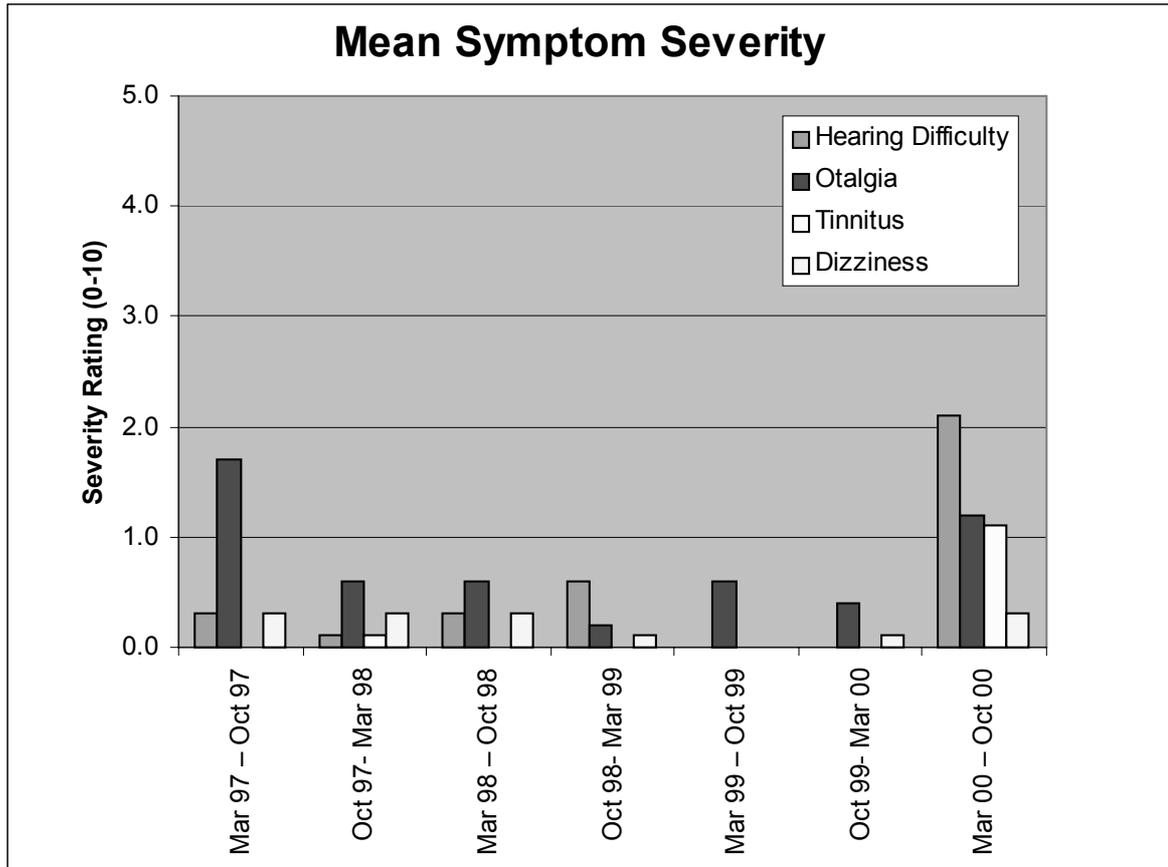


Fig. 7. Hearing loss and upper cervical joint displacement angles.

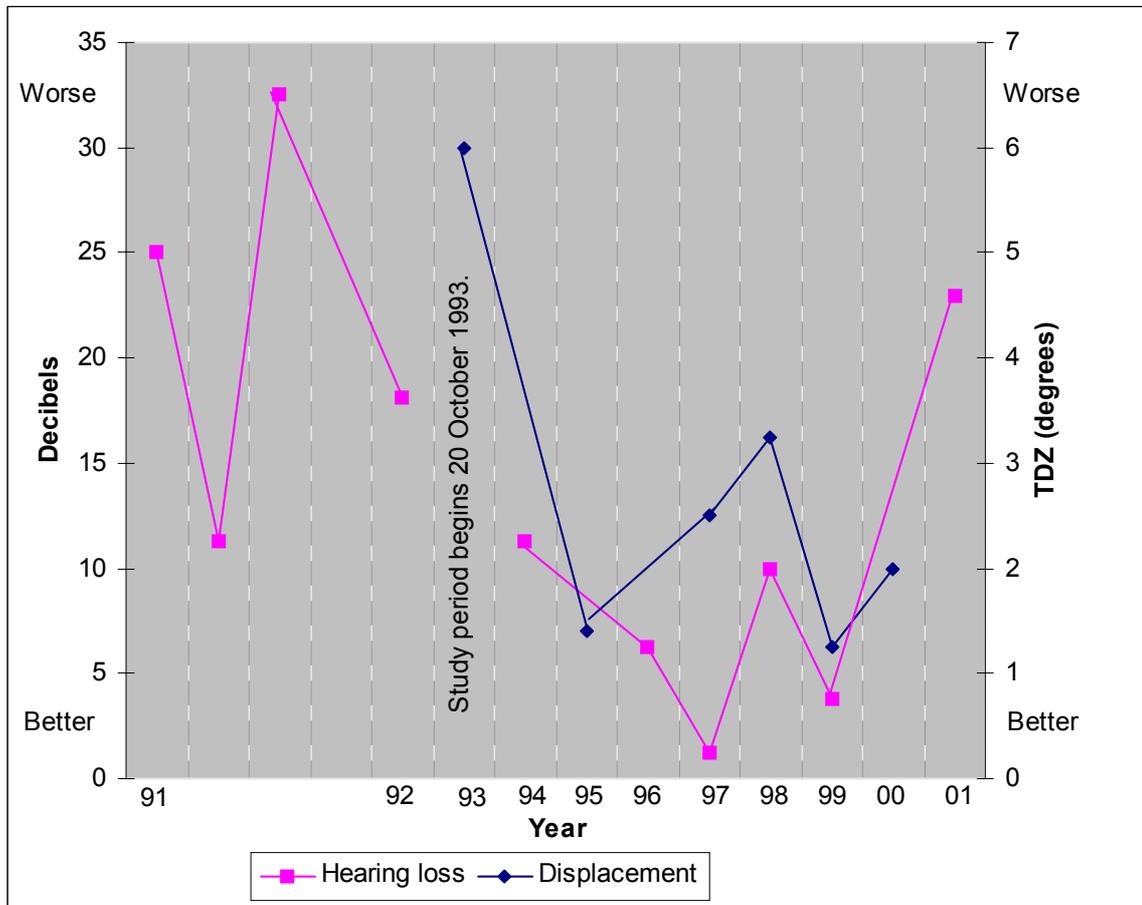


Fig. 8. Flexion and extension values during the treatment period (before each intervention).

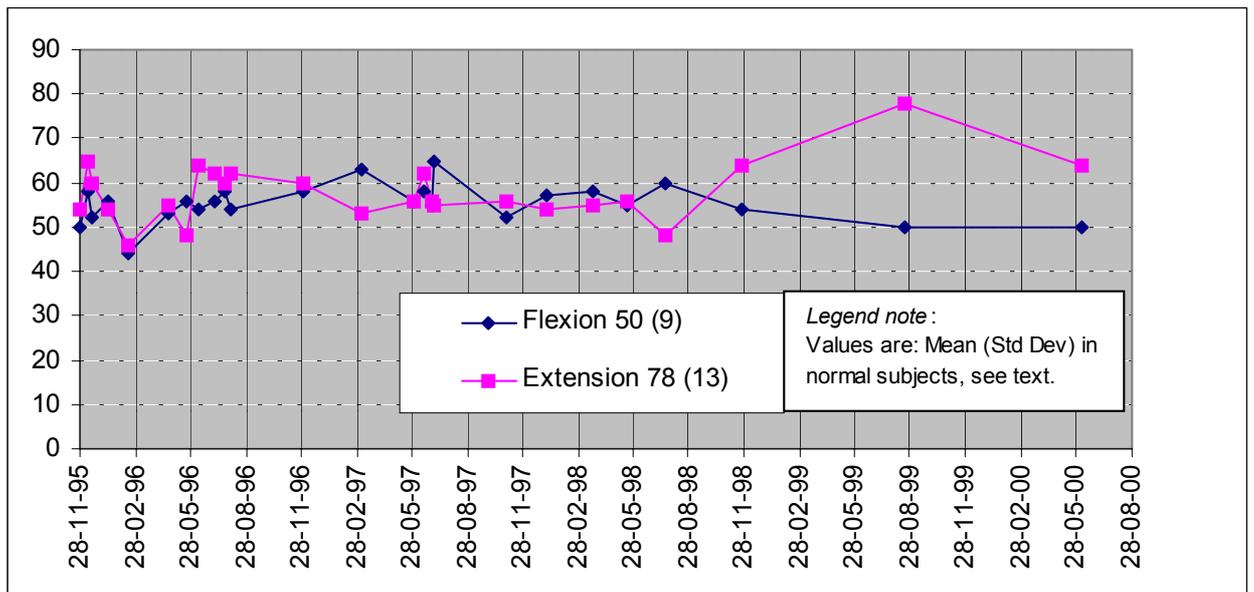


Fig. 9. Sidebending (ROM) values during the treatment period.

