Does Yoga help with Multiple Sclerosis?

An individual case study

Foto: Viktor Peschel
http://www.1a-photoshop.de/news/eingefrorenes-fahrrad

By **Anna Maria Mora**
Yoga Teacher / Yoga Therapist
www.yoga-leben-licht.de
In the context of a Yoga-Therapy Training with KHYF
Chennai, 2007 – 2011
www.khyf.com

Contents

1 Introduction

More and more people worldwide are practicing yoga. A survey of "Yoga Journal" indicates that in 2008 6.9% of American adults, or 15.8 million people are practicing. In addition to the improvements in physical fitness and flexibility, many people turn to yoga to combat health issues such as sleeplessness, back pain, migranes, and other chronic and non-curable diseases. (This is without statistical evidence out of interviews with yoga teachers).

This survey was started to investigate the influence of yoga on one non curable disease – Multiple Sclerosis (M.S.). M.S. is the most common debilitating neurological illness to afflict young adults. The average prevalence across the UK is approximately 130 per100,000, with an annual incidence of 0.2%.(11)

Articles published in scientific magazines like "Medical Tribune", "Lancet" and "Science" report predominantly about the effects of medication (1,4, 6) and in some cases about reasons for MS, like preceding virus infections (2), genetic disposition (3, 5) or the influence of climate, all of which cannot be altered by yoga. Even studies with promising titles like "Quality of life and its assessment in multiple sclerosis" (7) ended up in investigating which medication was helpful.

There was one research published by Mitchell et al. 2005 (7) examined its results with emphasize on Health Related Quality of Life, or HRQoL. They state that HRQoL is a broad multidimensional concept that usually includes self-reported measures of physical and mental health. This research indicated that physical exercise might be useful: "Two studies have shown that exercise training and physical rehabilitation improve patients' HRQoL. A recent study has shown that longterm exercise improves functional impairment in MS."

This article confirmed the doubts that useful research results for this special survey might not be found in the above mentioned media: "Studies of HRQoL show that clinicians are more concerned than patients about the physical manifestation of the disease, whereas patients consider vitality, role imitations, emotional problems, and mental health to be the critical determinants of overall burden."

Mitchell et al. 2005 also encouraged yoga´s holistic approach: "Predictors of HRQoL reveal that both physical and psychological concerns are important and interact with each other. Psychological concerns and psychiatric complaints have long been overlooked and undertreated in M.S."

The article also looked at family members and care-givers, who should be viewed at with an extra research project, perhaps not only for care-givers of M.S. patients: "The burden of living with MS affects not only a patient´s physical and mental health; it also has a similar effect on carers".

The aspect of self-empowering – one of the key aspects in yoga Therapy – was also mentioned: "Treatment of physical, psychological, and social needs of patients improves HRQoL in most cases, particularly where the interventions are sustained or incremental. Simple interventions such as providing adequate disease-related information or support are likely to be beneficial and should be provided for most patients."

A survey published in Neurology 2004 (9) was investigating the effects of yoga and other aerobic exercise on fatigue, mood and cognitive function. The result is, that yoga as well as other physical exercise can have a positive influence on fatigue. In this survey 2 tools of yoga - body postures and relaxation - were successfully applied. Students received one group class per week and were encouraged to practice at home.

Another survey investigated the effects of sports climbing and yoga (10). No significant reduction of spasticity was achieved in either of the groups, but the climbing group achieved a significant reduction of fatigue and the yoga group was able to improve selection attention. As this study was intended to be entirely client centered, there was also a search for information from MS patients themselves who achieved some improvements of their condition.

In addition, a number of books by M.S patients have been published supporting these results. One book is written by a German woman who overcame her symptoms of numbness in the feet and disability in walking by taking up running. Starting with short distances and gradually increasing her training, she found that over time all symptoms vanished and did not reappear for several years.(13)

Another example is the story of Eric Small, who worked his way out of a wheelchair with the help of yoga after being disabled by M.S. He was free of symptoms until very late in his life and provides advice on how a yoga practice for patients with M.S. could be designed. His story can be read on his web site, Yogams.com.

2. Multiple Sclerosis

2.1 What is Multiple Sclerosis

Multiple Sclerosis is the most common progressive and disabling neurological condition affecting young adults in the world. The cause is still unknown and could affect anybody at any age. But most commonly it affects between the age of 18 – 40 years, rarely before adolescence and quite seldom after the age of 60.

MS is a chronic, progressive, degenerative disorder that affects nerve fibers in the brain and spinal cord characterized by intermittent damage to the myelin sheath, - a fatty substance that surrounds and insulates nerve fibers and facilitates the conduction of nerve impulse transmissions. This is caused by the destruction of specialized cells (oligodendrocytes in the central nervous system) that form causes scarring and hardening (sclerosis) of nerve fibers usually in the spinal cord, brain stem, and optic nerves, which slows nerve impulses and can result in weakness, numbness, pain, and vision loss. Because different nerves are affected at different times, MS symptoms often worsen (exacerbate), improve, and develop in different areas of the body. Early symptoms of the disorder may include vision changes (e.g., blurred vision, blind spots) and muscle weakness.

According to DMSG (Deutsche Multiple Sklerose Gesellschaft) there are about 2,5 patients worldwide suffering from MS while the rate is increasing. Incidence of Multiple Sclerosis is five times more prevalent in temperate climates than in tropical climates (Tab.1) and women are affected twice as much as men.

Tab.1 MS Cases in different countries (from www.dmsg.de)	
Country	**MS-Cases per 100.000 Inhabitants:**
Northern Europe and USA	ca. 80 to 100
Europe	ca. 100 to 140
Südeuropa	ca. 50
Scottland	ca. 200
Orkney-Islands	ca. 300
Malta	ca. 4 cases

In the United States alone MS cases have risen from 146,892 people in 1996 to approx. 500,000 cases in 2004 (according to Wikipedia)

Fig.1 Basic neuron design (from Wikipedia)

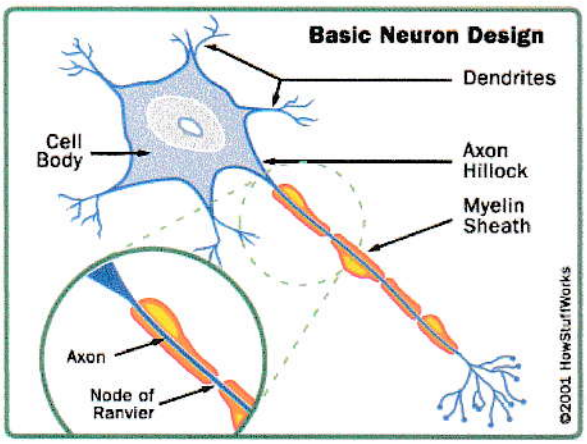
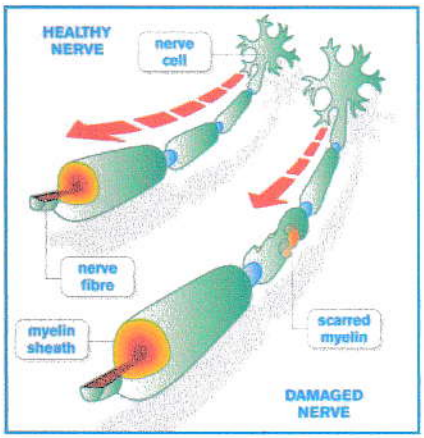


Fig. 2 Scarred myelin impedes action potentials (from Wikipedia)



2.2 Types of Multiple Sclerosis

MS can progress steadily or cause acute attacks (exacerbations) followed by partial or complete reduction in symptoms (remission). Multiple sclerosis is classified according to frequency and severity of neurological symptoms, the ability of the Central Nervous System to recover, and the accumulation of damage.

Primary progressive MS causes steady progression of symptoms with few periods of remission.
Relapsing-Remitting MS causes worsening of symptoms (exacerbations) that occur with increasing frequency, along with periods of reduced symptoms (remission).
Secondary progressive MS is initially similar to relapsing-remitting MS and eventually progresses to MS with no remission.
Relapsing-Progressive MS causes accumulative damage during exacerbations and remissions.

2.3 Symptoms

A person with MS can suffer almost any neurological symptom or sign, including changes in sensation such as loss of sensitivity or tingling, pricking or numbness (hypoesthesia and paresthesia), muscle weakness, clonus, muscle spasms, or difficulty in moving; difficulties with coordination and balance (ataxia); problems in speech (dysarthria) or swallowing (dysphagia), visual problems (nystagmus, optic neuritis including phosphenes, or diplopia), fatigue, acute or chronic pain, and bladder and bowel difficulties. Cognitive impairment of varying degrees and emotional symptoms of depression or unstable mood are also common. Uhthoff's phenomenon, an exacerbation of extant symptoms due to an exposure to higher than usual ambient temperatures, and Lhermitte's sign, an electrical sensation that runs down the back when bending the neck, are particularly characteristic of MS although not specific. The main clinical measure of disability progression and symptom severity is the Expanded Disability Status Scale or EDSS.

Multiple sclerosis relapses are often unpredictable, occurring without warning and without obvious inciting factors with a rate rarely above one and a half per year. Some attacks, however, are preceded by common triggers. Relapses occur more frequently during spring and summer. Viral infections such as the common cold, influenza, or gastroenteritis increase the risk of relapse Stress may also trigger an attack. Pregnancy affects the susceptibility to relapse, with a lower relapse rate at each trimester of gestation. During the first few months after delivery, however, the risk of relapse is increased. Overall, pregnancy does not seem to influence long-term disability. Many potential triggers have been examined and found not to influence MS relapse rates. There is no evidence that vaccination and breast feeding, physical trauma, or Uhthoff's phenomenon are relapse triggers.

To give an idea about the complexity of the disease and the great variety of symptoms see Tab.2

Tab.2 The variety of multiple sclerosis symptoms (taken from http://www.mold-survivor.com/MSsymptoms.html)

Visual Symptoms	
Symptom	**Description**
Optic Neuritis	Blurred vision, eye pain, loss of colour vision, blindness
Diplopia	Double Vision
Nystagmus	Jerky Eye Movements
Ocular Dysmetria	Constant under- or overshooting eye movements
Internuclear Ophthalmoplegia	Lack of coordination between the two eyes, nystagmus, diplopia
Movement and sound phosphenes	Flashing lights when moving eyes or in response to a sudden noise
Afferent Pupillary Defect	Abnormal pupil responses
Motor Symptoms	
Symptom	**Description**
Paresis, Monoparesis, Paraparesis, Hemiparesis, Quadraparesis	Muscle weakness - partial or mild paralysis
Plegia, Paraplegia, Hemiplegia, Tetraplegia, Quadraplegia	Paralysis - Total or near total loss of muscle strength
Spasticity	Loss of muscle tone causing stiffness, pain and restricting free movement of affected limbs
Dysarthria	Slurred speech and related speech problems
Muscle Atrophy	Wasting of muscles due to lack of use
Spasms, Cramps	Involuntary contraction of muscles
Hypotonia, Clonus	Problems with posture
Myoclonus, Myokymia	Jerking and twitching muscles, Tics
Restless Leg Syndrome	Involuntary Leg Movements, especially bothersome at night
Footdrop	Foot drags along floor during walking
Dysfunctional Reflexes	MSRs, Babinski's, Hoffman's, Chaddock's
Sensory Symptoms	
Symptom	**Description**
Paraesthesia	Partial numbness, tingling, buzzing and vibration sensations
Anaesthesia	Complete numbness/loss of sensation
Neuralgia, Neuropathic and Neurogenic pain	Pain without apparent cause, burning, itching and electrical shock sensations
L'Hermitte's	Electric shocks and buzzing sensations when moving head
Proprioceptive Dysfunction	Loss of awareness of location of body parts
Trigeminal Neuralgia	Facial pain

Coordination and Balance Symptoms	
Symptom	**Description**
Ataxia	Loss of coordination.
Intention tremor	Shaking when performing fine movements
Dysmetria	Constant under- or overshooting limb movements
Vestibular Ataxia	Abnormal balance function in the inner ear
Vertigo	Nausea/vomitting/sensitivity to travel sickness from vestibular ataxia
Speech Ataxia	Problems coordinating speech, stuttering
Dystonia	Slow limb position feedback
Dysdiadochokinesia	Loss of ability to produce rapidly alternating movements, for example to move to a rhythm
Bowel, Bladder and Sexual Symptoms	
Symptom	**Description**
Frequent Micturation, Bladder Spasticity	Urinary urgency and incontinence
Flaccid Bladder, Detrusor-Sphincter Dyssynergia	Urinary hesitancy and retention
Erectile Dysfunction	Male and female impotence
Anorgasmy	Inability to achieve orgasm
Retrograde ejaculation	Ejaculating into the bladder
Frigidity	Inability to become sexually aroused
Constipation	Infrequent or irregular bowel movements
Fecal Urgency	Bowel urgency
Fecal Incontinence	Bowel incontinence
Cognitive Symptoms	
Symptom	**Description**
Depression	
Cognitive dysfunction	Short-term and long-term memory problems, forgetfulness, slow word recall
Dementia	
Mood swings, emotional lability, euphoria	
Bipolar syndrome	
Anxiety	
Aphasia, Dysphasia	Impairments to speech comprehension and production

Other Symptoms	
Symptom	**Description**
Fatigue	
Uhthoff's Symptom	Increase in severity of symptoms with heat
Gastroesophageal Reflux	Acid reflux
	Impaired sense of taste and smell
	Epileptic seizures
	Swallowing problems
	Respiratory problems
Sleeping Disorders	
	Inappropriately cold body parts
	Autonomic nervous system problems

2.4 Treatment

There is no curative treatment available for MS. However, a number of medications are used to treat the disease symptomatically. Corticosteroids are medications for treating exacerbations. Interferonß-1B (Betaseron) as well as Interferonß-1a (Avonex.) are used to reduce the frequency and severity of relapses. Copolymer 1 appear to decrease the disease activity. (8)

Some members of the self aid group whom I worked with did rely on various forms of naturopathy like homeopathy, special diet, oil treatments or even Ayurveda. Each person was convinced that the disease increases more slowly than predicted because of their way of treatment. One group member said "if there is lots of different medicine for one disease it means that nothing really helps". She was without any medication, followed a special diet and did Qi Gong and meditation and was also sure that the disease did progress more slowly than estimated. At least oil treatment in Ayurvedic Clinics seemed to improve mobility and relax spastic muscles with a positive effect on coordination.

In addition the group went to cold chamber treatments where the person is exposed to temperatures of minus 110 degrees. This was beneficial for most of the group. The pain was less afterwards for several weeks and mobility was increased. Some persons, however could not undergo the cold chamber treatment because it drained them of energy and worsened the fatigue symptoms without showing a beneficial effect. In general patients seemed very well informed on *their disease.*

One patient tried to describe, how she feels since M. S. is progressively restraining her from doing what she wants to do:

Rainer Maria Rilke

Der Panther

Sein Blick ist vom Vorübergehn der Stäbe
so müd geworden, daß er nichts mehr hält.
Ihm ist, als ob es tausend Stäbe gäbe
und hinter tausend Stäben keine Welt.

Der weiche Gang geschmeidig starker Schritte,
der sich im allerkleinsten Kreise dreht,
ist wie ein Tanz von Kraft um eine Mitte,
in der betäubt ein großer Wille steht.

Nur manchmal schiebt der Vorhang der Pupille
sich lautlos auf -. Dann geht ein Bild hinein,
geht durch der Glieder angespannte Stille -
und hört im Herzen auf zu sein.

The Panther

His vision, from the constantly passing bars,
has grown so weary that it cannot hold
anything else. It seems to him there are
a thousand bars; and behind the bars, no world.

As he paces in cramped circles, over and over,
the movement of his powerful soft strides
is like a ritual dance around a center
in which a mighty will stands paralyzed.

Only at times, the curtain of the pupils
lifts, quietly--. An image enters in
rushes down through the tensed, arrested muscles,
plunges into the heart and is gone.
PoemHunter.Com

weitere Übersetzungen:
http://www.thebeckoning.com/poetry/rilke/rilke3.html

3 Yoga

3.1 General definition

Yoga is one of the six orthodox (āstika) schools of Indian philosophy. Yoga in this sense is based on the Yoga Sutras of Patanjali. Patanjali's system is discussed and elaborated upon in many classical Indian texts and has also been influential in Buddhism and Jainism. The goals of people practicing Yoga are varied and rage from improving health to achieving moksha (freedom). In the case of this survey Yoga will be applied as a way to improve health.

Yoga is a physical and mental discipline aiming at the individuals mind. As the mind can rest undisturbed when disturbing influences are diminished, there is a wide range of tools to keep the body healthy (Asana/ body postures), to relax the mind (Pranayama/ breathing exercise, sound, visualisation and meditation). Discipline and exercise lead to more clarity, may improve the physical as well as the mental condition of an individual and - provided the exercise is tailor-made to the person –may have a healing effect.

When reality is known, where is the delusion? When mind is pure, where is disease? When prana is under control, where is the question of death? Therefore surrender to yoga to support yourself." Yogacarya T Krishnamacharya in Yoganjalisaram.

3.2 Key aspects of yoga Therapy

Self – empowering: The students will learn how to improve their condition exclusively by means inherent to him or herself. Even if the teacher designs the practice, it is the students own power of practicing faithfully and regularly that shall result in a change. There is no use in yoga Therapy if the student is not able or willing to practice.

Non-invasive: In yoga Therapy there is no pill and no surgery. No foreign matter enters the body. The body will not be touched from outside, not even by massage. The individual is encouraged to seek additional help in these fields whenever useful or necessary. The effects of yoga will not be disturbed by any additional treatments as the individual practice can be adapted.

The yoga therapists should never ask the student to reduce or drop any medication given by the doctor in charge. The teacher gives a practice, the student practices and then the doctor may reduce medication, if they feel it is no longer necessary.

Student-teacher relationship: The process of yoga Therapy can only be successful if there is a relationship and if the student feels understood and cared for. If there is faith in the teacher the student will find it possible to practice regularly and overcome obstacles in the way. A good relationship facilitates the flow of information between both parts and the fine-tuning of the practice.

Curing and healing:

We might not be able to **cure** the disease but we may be able to **heal** the person.

Tab.3 The difference between curing and healing in Yoga Therapy (according to Dr. Kausthub Desikachar)

Curing	**Healing**
Curing is a more technical process	Healing is a process of care
Curing works on the symptoms	Healing is associated with how a person feels toward his disease
Curing relates to the disease	Healing relates to the person
Cure may take place quickly	Healing usually takes some time
Cure removes the result of an illness	Healing is changing patterns (Samskara)

3.3 Tools:

Yoga works with
- Lifestyle choices (food habits, regularity of lifestyle ...) This was not used here as the students were very well informed and had changed already what they found was necessary
- Physical exercise (Asana).
- Breathing exercise (Pranayama)
- Sound
- Relaxation
- Concentration (Pratyahara)
- Visualisation (Dharanam)
- Meditation (Dhyanam).

Strictly spoken relaxation is no specific tool but a goal of as well as a pre-condition for the whole process. (see more 4.5)
The tools will be adapted according to the needs and the abilities of a person.

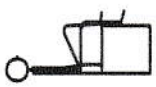
For example:
Asana:
There is an infinite number of variations to each Body Posture:

Fig. 3 Body posture variations

Not possible

Alternatively: use a stool

Or: move backwards as far as possible without pain



Or: move single legs
With and without arms movement

3. 4 The Pancha Maya Model

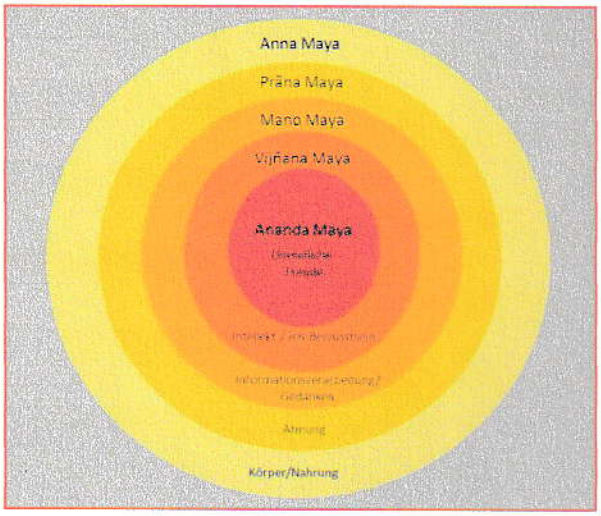


Fig. 4 The Pancha Maya Model

Since the Greek philosopher Platon (427-347 b.c.) divided the human being into body and mind this dualistic approach has spread into western minds and also into western medicine. The Indian Yoga developed independently from western philosophies and developed different models to explain the structure of man. Yoga views the human system as composed of several dimensions, including the physical body (Anna Maya), breath(Prāna Maya), mind (Mano Maya), personality (Vijñāna Maya), and emotions (Ānanda Maya). These dimensions are interconnected and, therefore, are interdependent. This holistic approach to the human system is the source of yoga's healing potential. In yoga therapy there is this ancient model of the human being which helps to identify which kind of tool may be useful for the person in question.

Keeping in mind that these "layers" are interconnected and thus a change in one part may result in changes in other parts of the human system, is an important aspect in yoga therapy. For example: a patient suffering from asthma may not be able to do anything with the breath, as breath as such is felt to be a problem. To help the person to produce a longer exhalation certain movements may be used (preferably forward bends), or a sound might help or concentration on a spoken sentence may be suggested.

This holistic approach provides a wide range of tools to apply and leads to the fact that two persons suffering from the same disease or the same symptoms might do not the same but different exercise in their daily yoga therapy practice. What helps one person with backache might harm another one whose physical or mental structure is different.

Once the right tool is found, the pancha maya model may be abandoned to allow a genuine contact to the individual seeking help.

4 Methods:

4.1 Participants:

Participants were found in a self help group at Abensberg, Germany (www.multiple-sklerose-abensberg.de). At the first regularly scheduled meeting yoga was explained to the members. This was followed by a short seated practice for the group members to experience what was explained to them before. After all yoga is more an experiential than an intellectual process. After this introduction ten patients agreed to participate in the survey. They suffered from various symptoms and were affected by the disease in various degrees, from almost no symptoms to being confined to a wheelchair.

During the survey two persons dropped out, due to personal and scheduling conflicts.

4.2 Questionnaire

A questionnaire was designed to evaluate the patient's state of health, to describe their problems and to find out what disturbed them most. As yoga Therapy is dependent entirely on the patient's cooperation, it is important to assess the most disturbing features of a disease according to the individual's feelings. These may be addressed in one of the first stages to increase the motivation to practice right from the start. This might result in an early success (even if it is a minor one) and motivate the patient to continue and even intensify the practice.

Students where asked
- how long they had been suffering from MS
- what form of MS they are suffering from
- what symptoms are there
- what medication is given
- what is done in addition to medication (like hypotherapy, acupuncture etc.)

Students were also asked about the quality of their sleep, their digestion and their energy level.

To go along with the study, there was a calendar in which every student recorded when and how long they practiced and whether they noticed any changes in their condition .

4.3 Consultation

Each participant had a personal consultation and was taught individually. The student´s abilities and limitations were tested, the student´s personal situation was discussed and first, short term goals were defined. A first session plan for this particular person was designed. It was important to build up trust in the process, to

motivate the participant and to establish a good teacher/student relationship in the first meeting. Besides assessing the abilities of each single person, as it is usually done in yoga Therapy, it was important to find out what each particular patient felt disturbed them most by M.S. These symptoms, rather than those that are most visible, should be addressed first, in order to keep the person motivated to practice.

4.4 Practice sequence

In yoga Therapy it is important to take into account that every person has his or her special abilities and restrictions regarding performing physical, mental or breathing exercises. Since the variety of symptoms suggests that this aspect has to be considered even more when working with people suffering from M.S., each of the participants had individual and customized lessons created for them.
At the end of the consultation a first personalized practice sequence was developed, practiced, sketched and discussed again. The participants were asked to follow the given order, to practice each pose and its corresponding counter-pose mindfully and not to add anything by themselves. These first sequences, which were to be practiced daily, were revised after one week. Most of the students were provided with a morning and an evening practice.

Every meeting began with feedback as to how easy or difficult it had been for the person to practice, how they felt afterwards and how they could cope with the technique and the exercises. The daily practice time and the design of the sequence design varied according to personal circumstances.

Exercise was changed with every meeting depending on the progress and on the feedback of the student. For example two students (numbers 4 and 6) said they felt tired after doing the exercise (tired is different from relaxed). As a result, the exercise was changed. Another student had surgery on her right knee, which resulted in more lying postures and breathing exercises given than standing ones. When the student improved, more demanding exercise was given and/or additional aspects where added. All exercises began with short durations, around 10 minutes, and increased over time to up to 30 minutes.

In the first sessions it was important to attempt to improve the quality of sleep, as the achievements of the practice might be diminished by disturbed sleep and disturbed digestion. In addition to physical exercise the quality of breath was closely monitored and improved by several methods like sound (see 5.3, tools) , counting the length of the breath or the use of techniques from classical pranayama. A short break between inhaling and exhaling was suggested. The classes were structured by a phase of concentration in the beginning, physical rest in the middle and visualization/meditation at the end.

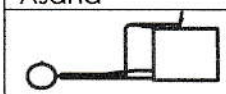
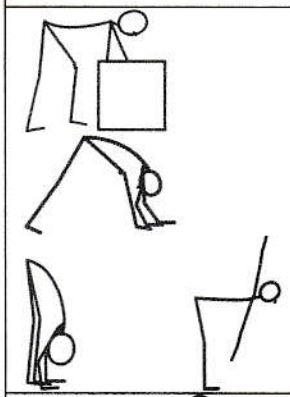
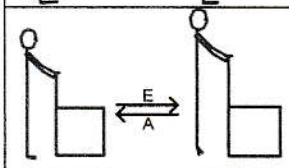
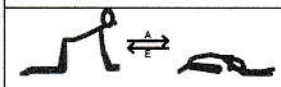
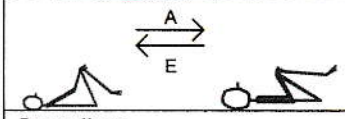
Individual lessons were scheduled once a month over a period of six months. The exception to this was the second lesson, which was scheduled one week after the first. This was to allow the yoga instructor to assess whether the instructions were being followed correctly. This is also done in regular yoga Therapy lessons. Sometimes the instructions might not be completely clear or the patient follows their own patterns unknowingly, thus diminishing the success of the exercise.

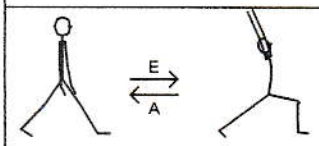
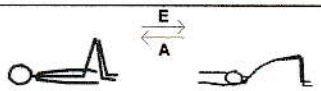
4.5 Tools

4.5.1 Asana

Simple Asanas where given to enhance coordination and concentration, to stretch muscles, to enhance muscular power, and to increase lung capacity in order to prolong the duration of breath.

Tab.4 A sample of the applied Asanas in this study

Asana	movement	effect
	move legs towards the body alternately on exhale chant: la le li lu	endurance of legs without straint chant -to make sure the movement is on exhale - to divert the mind from the idea this might be tyring
	with or without chair go down on exhale legs like picture or parallel + variations like lift upper back on inhale (to erect upper back) inhale spred arms, to strengthen muscles of upper back and erect body posture	for flexibility of legs and back
	With or without chair raise on toes on inhale, come down on exhale	Sensitivity of feet + strength
	Come forward on inhale, go back on exhale, stay in adverted V for one or more breaths only if possible	opening chest, erecting upper back and stretch legs and back to facilitate good breathing, to diminish fatigue
	come up on inhale go down on exhale easy even with little strength or difficulties with balance	to stretch back, erect upper back, - coordinate breath and movement, - prolong exhale - enhance concentration
	Knees to the body on exhale, knees away from the body on inhale	to stretch back to prolonge exhale enhance concentration
Bandhas	on exhale and hold after exhale: - work on pelvis floor, - on diaphragm	for energy and urination problems

	- and stretching neck´+ erecting upper back	
	- with or without wall - different variations according to patient inhale raise arms, bend front knee, maybe stay one or more breaths.	Erect upper spine, lengthen stride facilitate breathing for balance for strength
	Inhale move hips up, move arms, exhale come down. Maybe stay one or more breaths with hips up	Erect upper spine to improve breathing to help with fatigue

Depending on the abilities and needs of the person twists or more demanding or easier asanas where taught (an example for variation see **Fig. 3** Body posture variations)

4.5.2 Pranayama

Various forms of breathing with long inhalation and hold after inhalation were ato overcome fatigue. Equal rates (like 4 seconds in, 4 seconds out) where given as well as relaxing rates (4 seconds in, 8 seconds out) and refreshing rates (like 4 seconds in, 4 seconds hold, 4 seconds out) in various forms according to the needs and capacity of the person. Several classical techniques where used like *ujjayi* breathing (make a sound in the throat), or *sitali* breathing (inhale via rolled tongue),all of them aimed to make the breath longer and as smooth as possible and to help to focus the attention to the breath.

4.5.3 Concentration

Concentration in this context means to detach the mind from whatever it was busy with before starting the practice sequence and direct it to an object of choice where it stays as long as desired. Methods to achieve this may be counting the breath (like 4 seconds in, 4 seconds out), coordinate breath and movement, to count movements (like 4 times, 5 times....), to monitor signs of the flight-and-fight response (see 4.5.6) and react to the changes. i. e. as soon as the jaw is set the current Asana or Pranayama has to be finished.

4.5.4 Visualisation/Meditation

While concentration often is still be aided by movement or breath, visualization is often – not always – done with the mind alone. Sometimes certain, ritualized movements or gestures as well as the aid of a picture or of sound may help the mind to find its goal. In this case students mostly visualized the sun (for healing, clarity and strength) or water (for flexibility, cooling, fearless change into different physical conditions). By this the emotional level of the student was aimed at with the hope to achieve some positive changes there.

4.5.5 Sound

Sound in this study was used mostly to support concentration. If a sound is produced on exhalation it is easier for the student to concentrate on the breath. In one case a word (*soham*= I am who/what I am) was given to enhance self esteem

4.5.6 Relaxation

Relaxation is part of the whole practice. To calm down the fight-and-fight-response students start with a relaxed face (smooth forehead, relaxed muscles around the eyes, relaxed jaw and tongue) and try to keep this relaxed face throughout the practice. In the field of Asana (body postures) people tend to feel relaxed when the back gets stretched and the muscles, especially in the lower back, are allowed to relax, in Pranayama (breathing exercise) long exhalation leads to a relaxed feeling. Visualization and Meditation do what is aimed at from the beginning: detach the student´s feelings and thoughts from every day (and possibly stressful) topics and create positive and peaceful thoughts and a peaceful mind. Even if the Asana (physical) part of the exercise was demanding, (i.e. to build up strength) the meditation and visualization part will calm the student down again and allow for some peace.

5. Results

5.1 Symptoms at the beginning

From ten participants the symptoms were as follows:

problems with walking	numbness/ spasticity /	balance/ coordination	frequent urination/ urination hesitancy	lack of concentration	fear/ depression	lack of energy	disturbed sleep
9	9	9	6	5	3	10	5

If sleep was reported as sleep onset "good" and quality "changing" this was not classified as disturbed sleep.

Several symptoms showed only later and where not registered in this chart.

5.2. Results after 3 months

As some symptoms changed during the first weeks and regressed whereas others did not change in the beginning but only during the end, an intermediate result after 3 months is given:

+ means improved
- means has become worse

problems with walking	numbness/ spasticity /	balance coordination	frequent urination/ urination hesitancy	lack of concentration	fear/ depression	lack of energy	disturbed sleep
+5	+2	+ 4	+2	+ 1	+1	+4	+5

Nine patients felt refreshed after practicing. This was classified as an improvement in fatigue only when the patient felt this effect lasting for longer than one hour. As one of the patients said, "it is not possible to practice every hour to stay fit"

5.3 Results after 6 months:

+ = better than at the beginning
/ = no change
- = worse than at the beginning

problems with walking	numbness/ spasticity /	balance coordination	frequent urination/ urination hesitancy	lack of concentration	fear/ depression	lack of energy	disturbed sleep
-1 /2 +6	-1 /4 +5	-1 /3 +6	-1 /3 +2	/5	+2	/4 +6	+5

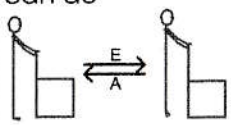
The problems which could be addressed by physical exercise (Asana) were easier to address than the ones which required more concentration (Pelvis floor training for urination problems). As all the participants reacted extremely well to relaxation and meditation, issues with sleep improved in all the cases quite soon. In two cases sleeping problems were related to frequent urination during the night. Here both symptoms changed and the quality of sleep was improved. Of course this was also influencing the fatigue-problem, which improved due to breathing techniques and a more erect spine.

The patients from the self-aid group were suffering to a surprisingly small degree from depression or fear. This may have been caused by the good social connections in the group and the activities the group was offering to their members. Lots of information was exchanged there, which probably helped the patients feel less helpless against their disease. Only one person participating in the survey was not in the group. She was quite desperate, a fact that unfortunately could not be changed during the survey.

One result that remains without an explanation is that two of the participants experienced relief of their urologic problems which became "normal" after 4 months. The patients surmised that the colder weather might have had an influence.

5.4 Results in Detail

Tab.5 Results for Patient 1

Patient	Start	Symptoms		MS	Practised	change after 3 months	Practised	change after 5 ½ months
male *1967	03.11.2007	**Physical:** - Problems to walk, - numbness of legs below the knee and feet, spasticity in the backside of legs, and lower back, - balance: disturbed - Urinary urgency, others: sight disorder, **Mental:** poor concentration **Emotional:** patient feels good, is optimistic, talks freely, seems happy **feels mostly disturbed** by disability to walk and urinary problems. He is still leading his company, is full of plans and wants to be able to do Surya Namaskar (Sun salutation) by end of this survey.	**Sleep:** o.k. **Digestion:** o.k. **Energy level:** not so good	since 1994, **Secondary progressive MS** mildly diseased until 2006. Had to use crutches early 2006, dependent on wheelchair by Sept. 2007. Worked his way out with the help of a physiotherapist. Comes with a walking stick	**Oct:** every day **Nov:** 3 days without **Dec:** 10 days without **Jan:** 10 days without	Banlance and gait improved walks most of the time without stick can do  without chair, is doing Surya Namaskar, (enclosed with literature-List), a bit unstable but nevertheless successful. Urinary problems not noticeabely improved Notes: try to stay more relaxed not only in the end but also while practicing	**Febr:** 5 days without 7 days group class in Ayurvedic ressort + individual practice **March:** 17 days group classes and individual classes no day without	Balance and gait improved, has abandoned stick completely Energy level improved, less frequent urination Due to breathing technicque more relaxed during exercise and in every day life

Tab.6 Results for Patient 2

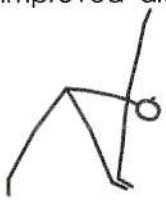
Patient	Start	Symptoms		MS	Practised	change after 3 months	Practised	change after 5 ½ months
female *1968	17.10.2007	**Physical:** - problems to walk able to walk 650 m max, footdrop left side, - spasticity in both legs, slight numbness and burning sensation in the soles of both feet , slight numbness in fingers of the left hand - problems with balance - Urinary hesitancy and retention (uses catheter), fatigue – enough energy until midday then exhausted, gets a bit better in the evening **Mental:** poor memory and concentration, **Emotional:** optimistic, otherwise no information given **mostly disturbed by** urological problems, fatigue and gait	**Sleep:** onset: changing quality: disturbed (frequent urination) **Digestion:** disturbed **Energy level:** good in the morning, poor in the afternoon, o.k. in the evening fatique	since 1955 **Primary progressive MS** first symptoms vanished after taking cortisone, meanwhile more and more disabilities stay	quite regular **Oct** one day without **Nov** 2 days without **Dec** 14 days without, 6 days in clinic for treatment chistmas	Gait improved does not stumble so often urination still the same sleeps better	irregular no practice on Saturday and Sunday no practice when consultation with medical doctor is scheduled, or yoga or meeting of the self aid group **Jan** 10 days without practice **Feb** 9 days without practice **March** 6 days without practice	Gait improved has not stumbled for weeks urination better, about one quarter less slight hunchback is better, fatique is less sleeps much better better

Tab.7 Results for Patient 3

Patient	Start	Symptoms		MS course	Practised	change after 3 months	Practised	change after 5 ½ months
Female *1964	17.10.2007	**Physical:** - problems to walk able to walk about 1 Km. all of a sudden the right leg stops working r, gets numb - numbness in right leg sometimes - problems with balance - strong urological problems **Mental:** o.k. **Emotional:** quite positive personality, fear the leg might stop working any time she walks unaided keeps her from walking far, lonely as husband is often away and they have moved just lately. Keeps herself busy by painting and organizing exhibitions. **feels mostly disturbed by** the urinal problems and the problems with balance	**Sleep:** onset: good quality: changing **Digestion:** disturbed **Energy level:** changing, easily exhausted after physical exercise	since 1992 **Secondary progressive MS**	**Oct:** 4 days without mostly only evening practice practices with music and incent sticks **Nov** 6 days without Rest only morning practice done mostly in the afternoon **Dec** operation at knee did lying, chanting and breathing part as well as hands and finger movements	Feels more relaxed all in all In Oct. and Nov. legs where more flexible after practicing, gait more coordinated, balance improved quite a lot feels refreshed after practicing practice helps to regain strength in operated knee still no change in urination	irregular **Jan** 7 days without practice lying postures where given to felax knee breathing, chanting and finger movements gentle flexing of the legs **Febr** 5 days without mostly chanting and meditation **March** 16 days without practice (vacation) breathing, chanting, meditation	feels more relaxed and optimistic, gait and balance not improved but, despite of operation balance and strength have only slightly decreased urination problem not improved

Tab.8 Results for Patient 4								
Patient	Start	Symptoms		MS	Practised	change after 3 months	Practised	change after 6 months
Male *1966	17.10.2007	**Physical:** - no problems to walk - hands very cold hands, tingling sensation in right foot - no problems with balance - no urological problems **Mental:** none **Emotional:** worried about future, afraid of disease to become worse **wants to exercise to keep status quo**	**Sleep:** onset: good quality: changing **Digestion:** good **Energy level** more and easier exhausted than before MS	Since 2006 **Relapsing-Remitting MS**	**Oct** 1 day without **Nov** no day without **Dec** 3 days without	Hands not so cold any longer calmer, not so much frightened sleeps a bit better, Fatique sometimes better (depending also on sleep)	**Jan** 2 days without **Febr** no day without **March** no day without	Hands warm, sleeps better, is not so easily exhausted any longer Still earlier exhausted then before disease but much better compared to the beginning of the survery less frightened than at the beginning

Tab.9 Results for Patient 5

Patient	Start	Symptoms		MS course	Practised	change after 3 months	Practised	change after 6 months
male *1962	03.11.2007	**Physical:** - problems to walk , sudden loss of muscle strength in legs - spasticity in legs - problems with balance, dizziness with movement of head - problems with coordination of hands, was unable to hold things in his hands, improved greatly after he started to hand-knot carpets and play accordion. **others:** burning sensation in head, dizziness, also when lying down walks a lot, likes to cycle **Mental:** lack of memory and concentration **Emotional:** optimistic, takes care for his mother **feels mostly disturbed** by the fact that he cannot do his job any longer	**Sleep:** onset: changing quality: disturbed **Digestion:** good **Energy level:** poor fatique	since 1999/2000 **Primary progressive MS**	**Oct:** 1 day without **Nov** every day **Dec** every day	Meditation helps to fall asleep easily after waking up Urination better, only once per night instead of 3 – 4 times Balance improved did  first on the wall, now with aid of chairs	**Jan** every day **Feb** every day **March** every day	Sleeps well Urination got worse again, is like at the beginning (cold weather?) fatigue better Dizziness better, can do head movement without getting disoriented burning sensation better legs more flexible, less spasm

Tab.10 Results for Patient 6

Patient	Start	Symptoms		MS	Practised	change after 3 months	Practised	change after 6 months
Female *1960	17.10. 2007	**Physical:** - problems to walk, uses crutches for distances longer then 300 m, - numbness in toes and sometimes also in other places - problems with balance - Urinary hesitancy and retention (uses catheter), walking restricted – distance, balance, uses crutches for distances longer then 300 m, fatigue, partial numbness, toes and sometimes other places **Mental:** no symptoms given, **Emotional:** positive, optimistic, enjoys life more and more nervous and sometimes short tempered due to exhaustion **feels mostly disturbed** by lack of energy and inability to walk the way she would like to	**Sleep:** onset: good quality: disturbed (due to frequent urination) **Digestion:** good **Energy level:** poor fatique energy in the morning meeting friends in the evening is only possible if she rests all afternoon long	since 1994 **Secondary progressive MS**	**Oct:** every day **Nov** every day **Dec** 3 days without	sleeps better, fatigue less less frequent urination, almost 4 hours in between (before round 3) sometimes no interruption of sleep at night legs more flexible, easier to walk	**Jan** every day , is doing Qi gong in the evening, too (used to teach Qi Gong) **Feb** 3 days without **March** 3 days without	sleeps still good Urination again more frequent very active, but often exhausted walks a longer distance without crutches

Tab.10 Results for Patient 6

Patient	Start	Symptoms		MS	Practised	change after 3 months	Practised	change after 6 months
Female *1960	17.10. 2007	**Physical:** - problems to walk, uses crutches for distances longer then 300 m, - numbness in toes and sometimes also in other places - problems with balance - Urinary hesitancy and retention (uses catheter), walking restricted – distance, balance, uses crutches for distances longer then 300 m, fatigue, partial numbness, toes and sometimes other places **Mental:** no symptoms given, **Emotional:** positive, optimistic, enjoys life more and more nervous and sometimes short tempered due to exhaustion **feels mostly disturbed** by lack of energy and inability to walk the way she would like to	**Sleep:** onset: good quality: disturbed (due to frequent urination) **Digestion:** good **Energy level:** poor fatique energy in the morning meeting friends in the evening is only possible if she rests all afternoon long	since 1994 **Secondary progressive MS**	**Oct:** every day **Nov** every day **Dec** 3 days without	sleeps better, fatigue less less frequent urination, almost 4 hours in between (before round 3) sometimes no interruption of sleep at night legs more flexible, easier to walk	**Jan** every day , is doing Qi gong in the evening, too (used to teach Qi Gong) **Feb** 3 days without **March** 3 days without	sleeps still good Urination again more frequent very active, but often exhausted walks a longer distance without crutches

Tab.12 Results for Patient 8

Patient	Start	Symptoms		MS course	Practised	change after 3 months	Practised	change after 6 months
female *1972	17.10.2007 dropped out after Lesson 8 (February) Marriage, relapse, exhausted	**Physical:** - problems to walk, especially climbing stairs, legs are very heavy - problems with balance, - no urological problems others: dizziness **Mental:** lack of concentration, does not drive very far because of this **Emotional:** stable, optimistic, still working (energy is enough until midday), new partner, going to marry **feels mostly disturbed** by fatigue. Wants to be fit in the afternoon, too, wants to be able to meet friends in the evening	**Sleep:** onset: good quality: good **Digestion:** good **Energy level:** poor fatigue fit until midday, sometimes again in the evening	since 2006 **Relapsing-Progressive MS** 3 relapses since 2006	**Oct** 4 days without **Nov** 10 days without, reapse **Dec** only evening practice, but this one every day	Sleeps better, more and more undisturbed nights, by end of dec. sleeps almost every night fatigue improved a bit, climbing of stairs slightly easier, relapse in November, Could not come for class came again in January different gait, problems with balance, Focus changed from fatigue to balance	**Jan** every day until accident dropped out	different gait, problems with balance, Focus changed from fatigue to balance Accident, fell, got hurt, ould not practice for a while, dropped out

Tab.13 Results for Patient 9

Patient	Start	Symptoms		MS	Practised	change after 3 months	Practised	change after 4 months
female *1958	started end of November, droped out, in February, was no longer able to come to lessons	**Physical:** - problems to walk, paralysis of legs, wheelchair, - disturbed function of bladder, fatigue, - weaknes in Hands and Fingers, sometimes disturbed function **Mental:** no symptoms given **Emotional:** stable, brave, optimistic with occasional depressive periods **feels mostly disturbed** by EVERYTHING that does not work any longer with this body	**Sleep:** onset: changing quality disturbed **Digestion:** good **Energy level:** poor fatigue	since 1979 **Relapsing-Progressive MS** relapsing remitting until 1986, progressive since then with occasional relapses	**Nov** every day **Dec** 5 days without	coordination problems with hands slightly better sleeps a bit better Rest still the same feels refreshed after practicing is doing practice in a hurry like everything else stress on break after inhale and exhale	**January** 2 days without **February** every day until dropout	haste slightly better, coordination problems with hands better, urination problems still the same sleep slightly better than at the beginning but still not good

6 Discussion

Pros and cons of the methods

In an individual case study each participant is the source and controller of his or her own statistics. On one hand, this highly individualized approach leads to an effective and tailor-made treatment. On the other hand it makes the results difficult to compare. Even if proved and tested scales are used to standardize the results the outcome will depend on the person´s own assessment. This is a flaw from the scientific point of view as the results are not fully repeatable. Due to the setting of the survey no blinding was possible. This might have eliminated the fact that students who try to please their teacher by producing good results might present their results more positive than they were. Also, a control group without treatment was not monitored, for several reasons. The first is ethical; it is not fair to deny a person the treatment he or she wants. The second reason was the small number of participants. Lastly, the fact that there are a great variety of symptoms which are changing over time, made the establishing of a control group not useful. On the positive side, each student´s needs could be met at his or her field of concern (physical or emotional) and that the relationship between student and teacher made the students reveal more and more problems which they had "forgotten" at the initial interview. Some of these new problems could be taken care of. As the student´s opinion and statements were considered and their input was important, they were motivated to a high degree to work at home and to comply with the settings of the survey. It was not easy for the students to come to each of the individual lessons as they had to drive quite a distance every time. Nevertheless, they faced this challenge bravely and only two of the students dropped out during the end of the survey. For this all the participants have earned respect and thanks.

The results

The problems which could be addressed by physical exercise (Asana) were easier to attend to than the ones which required more concentration (Bandha). As all the participants reacted extremely well to relaxation and meditation, sleeping problems were improved early in all of the cases. In two cases sleeping problems were related to frequent urination during the night. Here the students managed to solve this problem by following the advice of the Yoga Therapist and so the quality of sleep was improved. Sleeping better also influenced the fatigue-problem. The application of breathing techniques along with some change in the body´s posture (more erected spine, especially in the upper back) helped further to ease the symptoms of fatigue. Coordination can be trained in every person, even in people suffering with MS, which helped some students to cope with their daily routines a bit better. Stretching the muscles regularly was successfully applied to ease the effects of spastics. Together with some training of the muscles may have had a positive influence in some of the participants' ability to walk. The before described effects and their reasons could have been clarified and explained better than it was done here by a team of scientists examining the students professionally instead of just writing down what was reported by the students.

The students from the self aid group were suffering to a surprisingly small degree from depression or fear, which might be due to the good social connections in the self aid group and the activities this group was offering to their members. A lot of

information was exchanged there, which probably helped the students feel less helpless against their disease. Only student 10 was not in the group. She was quite desperate, a fact that unfortunately could not be changed during the survey.

Without explanation remains the fact that two of the participants experienced relief of their urologic problems after some weeks, but came back to "normal" after 4 months. The students assumed that the colder weather might have had an influence. As a whole, results in the urological problems took at least two month´s practicing to be achieved.

In truth, it can be said that the single tools of yoga are not entirely unique. The physical change might have been achieved by other ways of gymnastic or physical training (see reference 9 and 10). To enhance coordination and concentration other methods might work – and hopefully will be tested - as well. There are many methods of relaxation a person can choose from, according to their preference. What is more, but also not entirely, unique, is the application of meditation. Research on this field is done by several persons and institutions like Jon Kabat-Zinn (Professor of Medicine Emeritus and founding director of the Stress Reduction Clinic and the Center for Mindfulness in Medicine, Health Care, and Society at the University of Massachusetts Medical School), Tanja Singer at the Max-Planck-Institute, Leipzig or by the Psychologist Emil Ott at Giessen University. Not even the self-empowering attitude of yoga is exclusive, as with all the above mentioned methods the patient´s own effort is necessary and beneficial. What is unique about yoga is the holistic approach. yoga offers these different tools in one package. Thus combinations are possible i.e. use movement for concentration and, if necessary to start or facilitate meditation. In this special case of students suffering from fatigue it saves the exhausted patient from visiting too many different places and different therapists to receive the help they need. Even if the priorities of the MS patient may change over time yoga is able to adapt to the current need of the person in many ways. The students in the study seemed to enjoy the fact that their whole personality with all their healthy and diseased components, was part of the process. This is what makes yoga a useful method in helping not only people with MS but people with various disturbances and diseases. It is not necessary to present a disease as an entrance ticket for yoga therapy. The improvement in the quality of sleep for instance, could have happened also with people without MS who where just having difficulties to sleep well.

7 Conclusion

Yoga therapy tailored to the person´s specific needs achieved improvement in mobility and fatigue, even with a disease where no improvement is said to be possible. Not all of the needs of the students could be addressed and not all of the symptoms were eased. This might depend on the individual intensity of practice and of the teacher´s skilled specification of the exercise to the needs of the person. Also the short time of the survey, limited to 6 months, left quite some ailments unattended. As most of the students have limited energy and many commitments to fulfill (children to care for, jobs, etc)the time and energy to practice had to be confined according to the personal circumstances given.

More success may have been achieved if the students practiced at least three times a day. However, this would not have been possible for most of the students in their domestic environment.

It might be useful to run another study with students out of their home - for example in a health resort where the students are cared for and have time to relax. As students reported oil massages to ease their problems in mobility, it might be good to test this in combination. In a protected surrounding three practice sessions per day could be achieved and students and teacher could meet more often than once a month. Thus quicker results might occur. This could encourage the students to go on with their exercises despite of fatigue even when they return to their everyday life afterwards.

Comparing this survey to the one done by B.S. Oken et al (9) the author has to admit that she might be a sufficiently well trained yoga therapist but is not very skilled in executing a scientific survey. With more expertise in the scientific fields the results could have been made more comparable. It is the author's hope that any errors made in this field not overshadow the fact that real improvements were achieved during the six months of this survey. A survey held at a university will always be of different quality than one that is done privately without extra financial means and when the survey has to be done not within but in addition to the time spared for professional occupation.

8 References

1. **TNF-R1 Signaling: A Beautiful Pathway** by Guoqing Chen and David V. Goeddel
Science 31 May 2002: Vol. 296 no. 5573 pp. 1634-1635 DOI: 10.1126/science.1071924

2. **Human herpes virus 6 and multiple sclerosis: a Finnish twin study** by
H. Kuusisto, H. Hyöty, S. Kares, E. Kinnunen, I. Elovaara
Multiple Sclerosis Journal, January 2008 vol. 14 no. 1 54-58. doi: 10.1177/1352458507080063

3. **A Gender Gap in Autoimmunity**
by Caroline C. Whitacre, Stephen C. Reingold, Patricia A. O'Looney, Elizabeth Blankenhorn, Floyd Brinley, Elaine Collier, Pierre Duquette, Howard Fox, Barbara Giesser, Wendy Gilmore, Robert Lahita, J. Lee Nelson, Carol Reiss, Peter Riskind, Rhonda Voskuhl
Science 26 February 1999: Vol. 283 no. 5406 pp. 1277-1278 DOI: 10.1126/science.283.5406.1277

4. **The curious incident of disability in multiple sclerosis trials** by Alasdair Coles
The Lancet Neurology, Vol. 5, No. 11, Nov 2006, pp 899-900

5. **Autoimmune disease in families with multiple sclerosis: a population-based study** by Sreeram Varadharajan Ramagopalan, David Alexandre Dyment, William Valdar, Blanca Marcela Herrera, Maria Criscuoli, Irene Mei Ling Yee,Adele Dessa Sadovnick, George Cornell Ebers
The Lancet Neurology, Vol. 6, No. 7, July 2007, pp 604-610

6. **Multiple sclerosis: new insights and therapeutic progress**
by David Miller
The Lancet Neurology, Vol. 6, No. 1, Jan 2007, pp 5-6

7. **Quality of life and its assessment in multiple sclerosis: integrating physical and psychological components of wellbeing**
by Alex J Mitchell, Julián Benito-León, José-Manuel Morales González, Jesús Rivera-Navarro
The Lancet Neurology, Vol. 4, No. 9, Sep 2005, pp 556-566

8: This statement can be found on at several sources like: library.med.utah.edu/kw/**ms**/overview.html

9. **Randomized controlled trial of yoga and exercise in multiple sclerosis**
by B.S. Oken, S. Kishiyama, D. Zajdel, D. Bourdette, J. Carlsen, M. Haas, C. Hugos, D.F. Kraemer, J. Lawrence, M. Mass
Neurology, 62, June 2004, pp 2058-2064

10. **Can yoga and climbing improve symptoms of multiple sclerosis? Influence of sports climbing and yoga on spasticity, cognitive function, mood and fatigue in patients with multiple sclerosis** by Velikonja O, Curic K, Ozura A, Jazbec SS.
Clin Neurol Neurosurg 2010; 112: 587–601. DOI 10.1111/j.2042-7166.2011.01091_11.x

11. **Multiple Sclerosis and its treatment** by Gavin Giovannoni, David H Miller
J R Coll Physicians Lond 1999;33:315–322

12. **Sense Malking in Multiple Sclerosis: The Information Needs of People during an Acute Exacerbation** by Lynda M. Baker
Qual Health Res, January 1998, vol. 8, no. 1, pp 106-120

13. **In Bewegung kommen. Erfahrungsbericht einer Multiple-Sklerose-Patientin** by Renate Frommhold
Pala-Verlag, 1st edititon Okt 2005