

Preface

Back pain is the most common cause of disability in adults of working age throughout the developed world, and involves huge costs to individuals and society. The World Health Organisation's current Low Back Pain Initiative, which is bringing together chiropractic and medical experts, seeks to foster better understanding in interdisciplinary management of back pain, which is "a major clinical and public health problem" that continues to grow and "has reached epidemic proportions".

For chiropractors and physicians to work together in managing patients with back pain and a variety of other complaints commonly seen in chiropractic practice, it is important that they understand each other. This places an onus on the chiropractic profession to present information on chiropractic education, principles and practice in a format and language suitable for physicians.

Recently the Norwegian Chiropractic Association (NCA) met this challenge in Norway in its very impressive booklet titled Disorders of the Neuromusculoskeletal System: An Introduction to Chiropractic Management. This was distributed to physicians throughout Norway, was favourably reviewed in the Norwegian Medical Journal, and has led to much greater co-operation between the two professions in clinical practice in that country.

The NCA has now completed this English translation of the original booklet in Norwegian, and is making it available to chiropractors worldwide. Although some of the data and comment are specific to Norway, the great majority of the text and illustrations – including the key sections on education, examination and diagnosis, treatment, scope of practice and the role and effects of manipulation – is of relevance and strong value everywhere.

On behalf of the World Federation of Chiropractic and its 70 member national associations, I recommend this introduction to chiropractic to all physicians and health care managers, and offer warm congratulations to the NCA for making this fine publication available in the English language.

Bruce Vaughan DC
President

World Federation of Chiropractic, www.wfc.org

Editorial committee: Øistein H. Haagensen (Editor),
Jakob Lothe, Kyrre Myhrvold



Table of contents

Chiropractic	4
Examination and diagnosis	5
Treatment	6
Scope of practice	8
From structure to function	10
Functional Spinal Lesion (FSL)	11
From passive to active treatment	14
The effect of manipulation	15
Side-effects	16
Degenerative changes of the spine	17
In brief:	18
DISC PROLAPSE	18
SCIATICA	18
SEGMENTAL INSTABILITY	19
HYPERMOBILITY	19
PELVIC PAIN AND PREGNANCY	19
HEADACHE	20
WHIPLASH INJURIES	20
DIZZINESS AND DISTURBED POSTURAL CONTROL ...	21
CURRICULUM OF UNIVERSITY LEVEL	22

Chiropractic

The practice of chiropractic involves the diagnosis, treatment and prevention of disorders in the neuro-musculo-skeletal system, particularly conditions involving the spinal column.

Chiropractic is a complementary discipline to traditional medicine; it must not be regarded as an alternative to it. A chiropractor is someone who has been authorised to practise chiropractic by the Norwegian Board of Health. The chiropractor has the status of a primary contact, and has an independent treatment liability like that of a medical practitioner, dentist or psychologist.

TRAINING

Chiropractic education is standardised at minimum five years at university level. Up to now, Norwegian chiropractors have received their training from colleges and universities in Australia, the USA, the UK, South Africa and Canada that are approved by the Norwegian authorities. On the initiative of the Nordic Council, a Nordic training scheme has recently been established at Syddansk University in Odense, Denmark. Some places are assigned each year to Norwegian applicants. Nordic medical and chiropractic students share, to a large extent, a common syllabus and instruction during the pre-clinical part of their

courses. A curriculum map is given at the back of this booklet.

LICENCE TO PRACTISE

To practice as a Chiropractor one must graduate from an approved academic programme in chiropractic, followed by a one-year internship in Norway as in most other European countries.

CLINICAL EXPERIENCE

In 1995, publicly licensed chiropractors in Norway carried out around one million patient consultations. In the course of one year, the average chiropractor holds 5,000 consultations (data from the Norwegian Chiropractic Association). In Norway, manipulative therapy is mainly performed by publicly licensed chiropractors (*Norwegian Board of Health 1988*).

The number of patients visiting chiropractors is steadily rising. A Danish survey shows that 37% of those suffering from back complaints have seen a professional therapist over the past year; 24% a medical practitioner, 11% a chiropractor and 10% a physiotherapist (some patients consulted therapists in more than one profession). On average, a chiropractor dealt with 18 times as many back patients as a general practitioner and nine times as many as a physiotherapist (*Lonnberg 1997*).

HISTORY

The word chiropractic is Greek and means done by hand. The history of chiropractic started over 100 years ago in the USA when the founder of chiropractic, D.D. Palmer (1845–1914), postulated the first chiropractic theory of illness by relating the function of the spinal column to the integrity of the nervous system.

Over the years, chiropractic has developed through scientific studies and research. It is now a profession that deals with those illnesses on which experience has shown chiropractic treatment has the best effect: back pain and other musculoskeletal disorders (*Pedersen P 1994, Breen AC 1996*).

Norway got its first chiropractor in 1922; the Norwegian Chiropractic Association was founded in 1935. In 1988 the Storting, Norway's parliament, voted to institute public authorisation of chiropractors.

THE ROLE OF THE CHIROPRACTOR

With a public authorisation arrangement in place, chiropractors became the fourth group of health professionals in Norway with independent responsibility for the treatment they provide. Up to then, only medical practitioners, psychologists and dentists had the right to be the

primary patient contact. However, it is still the case that only patients who have been referred by their doctor are entitled to a partial reimbursement of chiropractor fees from the social security system. Surveys have shown that around a third of chiropractors' patients are referred by their doctors, while the other two-thirds make appointments with chiropractors directly (*Kilvær A et al. 1992, 1997*).

A medical practitioner who refers a patient to a chiropractor is liable for his or her own diagnosis. Relevant symptoms, findings and any X-ray results must be stated on the referral. According to the Norwegian Board of Health (1989), the chiropractor is legally liable for his or her own examination, diagnosis and treatment, irrespective of whether the patient has been referred by a medical practitioner or not. Under present-day rules, chiropractors cannot refer a patient to a specialist, write a doctor's note in case of illness, or prescribe medication.

WHERE ARE CHIROPRACTORS TO BE FOUND?

There are presently around 200 publicly authorised chiropractors in Norway. They practise mainly in large towns and densely populated areas. A list of publicly authorised

Examination and diagnosis

The disorders treated by a chiropractor have a multifactorial aetiology. Developments in modern society have led to great changes in the use of, and strains on, our bodies and mind. In order to make a diagnosis, the chiropractor needs information about the patient's work situation, psychosocial conditions, level of physical activity and lifestyle in general.

CLINICAL EXAMINATION

The chiropractor analyses the function of the neuromusculoskeletal system and assesses whether any dysfunctions relate to the patient's symptoms. In addition to orthopaedic and neurological diagnostic tests, the clinical examination consists of special palpatory techniques by which the chiro-

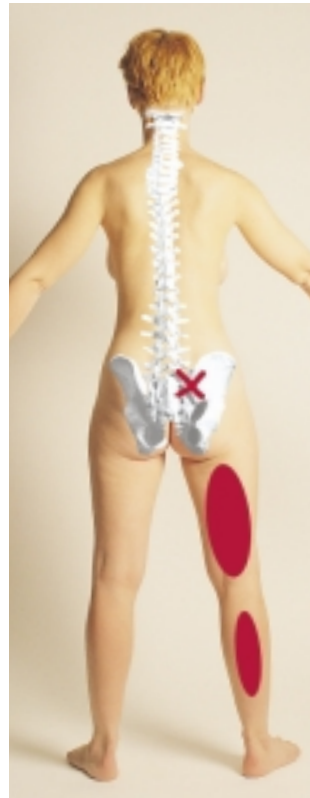
practor notes changes in muscle tone and joint movement patterns. The patient's reports of pain during the clinical examination are important. Chiropractors carry out an examination both before and after the treatment in order to evaluate its efficacy.

X-RAY EXAMINATIONS

often supplement the clinical examination. Chiropractors are trained to carry out and interpret X-ray examinations of the skeleton. Many have their own X-ray equipment, equipment which is subject to public regulations.

In Norway chiropractors can also request X-ray and CT examinations from institutes and hospitals. These are paid for by the social security services as if the patient had been referred by a medical practitioner.

X-rays are used by the chiropractor mainly to exclude any contraindications to treatment. In addition, emphasis is placed on anomalies and degenerative changes that may be significant to the chiropractor in his or her choice of treatment technique. In order to evaluate alignment, the chiropractor often prefers to take X-rays with the patient standing up instead of lying down.



A diagnosis that purely describes the symptoms, such as "low back pain (LBP) (with radiating pain)" may therefore represent several different diagnoses or combinations of these depending on clinical findings, such as:

- Acute LBP with or without radiation/leg pain due to FSL at level L5/S1 and/or
- Acute LBP with or without radiation/leg pain due to symptoms from a disc lesion L4/5 affecting the fifth lumbar nerve root and/or
- Acute LBP with or without radiation/leg pain due to a dysfunction of the sacroiliac joint

CASE RECORDS

Chiropractors keep case records of each consultation. Exact notes show the development of symptoms and clinical findings compared with the treatment. The diagnosis will often be a working diagnosis at first, to be reassessed in relation to the response to the treatment. Hence response to specific treatment can be helpful in localising pain sources in a way similar to the use of diagnostic injections.

DIAGNOSIS

To the chiropractor, a so-called pathoanatomical (*disease or injury causing anatomical changes*) (Norwegian Board of Health 1995) diagnosis is only part of a wider, functional diagnosis. Such a diagnosis is based on an integrated understanding of findings at several levels:

- Identify functional spinal lesions (FSL – see separate section)
- Localise any pathoanatomical sources of pain
- Assess any pain and other symptoms in relation to a) and b)



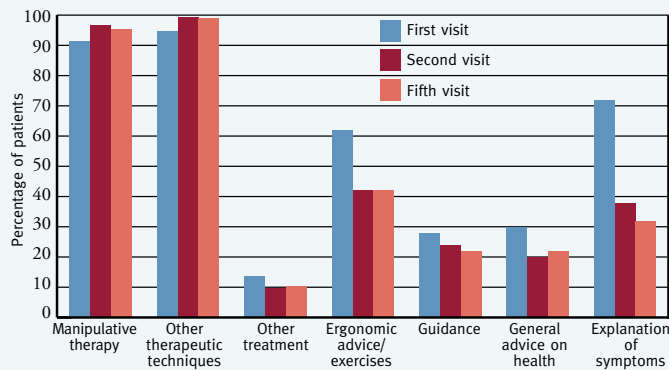
Treatment

The most important chiropractic method of treatment is manipulation of the spinal column, but a number of other treatment techniques are also used (Pedersen P 1994, Breen AC 1996).

Both the intensity of the treatment and the choice of

technique are continuously assessed during the course of treatment. The cause of the disorder is often revealed by how the patient reacts to treatment, both physically and mentally, so that the diagnosis and treatment together form a dynamic process.

MODES OF CHIROPRACTIC TREATMENT



Case records of the treatment of 1,013 patients (Data from the "A survey of chiropractic practice in Europe", Pedersen P 1994.)

MANIPULATIVE THERAPY

can be described as a fast, passive stretch of the structures around a joint. This usually causes a clicking sound as the joint surfaces separate. A number of neurophysiological effects are associated with this phenomenon. These are discussed in further detail in a separate section.



TRACTION

Chiropractic traction treatment is slightly different from that used standard physical medicine. The chiropractor uses an adjustable special treatment table that can move in several planes during the traction treatment, in order to achieve a pumping mobilisation of the discs and joints below the segment that is stabilised.



MECHANICAL AIDS

As an alternative to traditional manipulation, several particularly gentle techniques have been developed, where the patient is given a manipulation-like impulse with a controlled depth and power. This is administered either by using a handheld instrument or on a purpose-built bench with an adjustable, mechanical drop.

SOFT-TISSUE TREATMENT

Chiropractic soft-tissue techniques exist in many different forms and are mainly used to affect muscle tone. Manual trigger-point treatment is frequently used, often in combination with passive stretching. Heat, electrotherapy, ultrasound and laser therapy are not often used by chiropractors.



EXERCISES

Exercise and training are a natural part of the treatment of patients with pain syndromes and repetitive-strain injuries. Training may include strengthening exercises, conditioning training, or stretching and relaxation techniques. The patient is given individual instruction as required, or the chiropractor recommends the patient to contact a physiotherapist for supervised follow-up training.



The chiropractic exercise centre at the Palmer College of Chiropractic around 1935

ADVICE/INSTRUCTION

Information to the patient in the form of advice and guidance is an important part of the treatment. It is often necessary to examine the patient's work and family situation, his or her leisure time activities and general level of physical activity in order to provide the right guidance. The chiropractor gains a good overview of the patient's overall situation by taking his or her case history, carrying out clinical examinations, examining X-rays, making a diagnosis, providing

treatment and following up on the treatment.

WHEN SHOULD TREATMENT BE INITIATED?

The significance of rapid pain relief, reassuring the patient and advice on early activity is pointed out in literature as being most important for preventing chronification (Shekelle PG, Adams AH *et al.* 1991, *Royal College of General Practitioners* 1996).

Most chiropractors have arranged their practice so that unnecessary waiting between

examination and treatment is avoided. If X-rays are necessary, these are taken promptly, and any findings explained by those chiropractors who have their own X-ray equipment.

REFERRAL FROM A CHIROPRACTOR

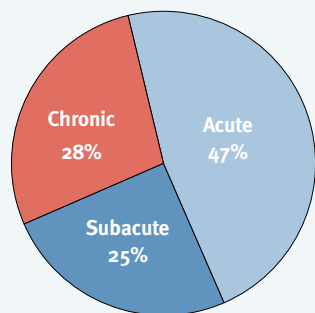
In Norway two-thirds of patients use the chiropractor as their primary contact. Many are referred for further evaluation or treatment. The present Norwegian regulations stand in the way of a formal referral from a chiropractor to a speci-

alist or physiotherapist, so the patient's GP has to make the referral; a somewhat wasteful arrangement in terms of time and costs.

However, in 2001 a two-year trial will commence in three Norwegian countries where chiropractors may refer to a medical specialist and physiotherapist as well as give patients leave of absence. In the same trial period, all chiropractic patients will have automatic partial reimbursement.

Scope of practice

DISTRIBUTION OF PATIENTS ACCORDING TO THE LENGTH OF ILLNESS

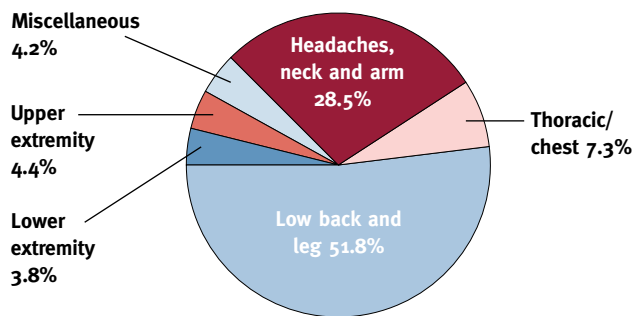


Criteria used in this survey:
 Acute: less than 4 weeks
 Subacute: from 4 weeks to 6 months
 Chronic: more than 6 months
 (Data from "A survey of chiropractic practice in Europe", Pedersen P 1994.)

A chiropractor's field of activity has traditionally been perceived as the treatment of back pain. However, chiropractic has a wide indication area that includes all conditions involving functional lesions in the neuromusculo-skeletal system.

Two European surveys show that almost half of all chiropractic patients came for treatment within four weeks of the onset of pain. Around 25% came more than six months after the onset of pain – see left-hand figure (Pedersen P 1994, Leboeuf-Yde et al. 1997).

ANATOMICAL AREAS OF COMPLAINT



Painful areas reported by 1,013 patients.
 (Data from "Survey of chiropractic practice in Europe", Pedersen P 1994.)

LOW BACK PAIN AND SCIATICA

People with these complaints represent between 50 and 80% of chiropractic patients (Pedersen P 1994, Leboeuf-Yde et al. 1997, Kilvør et al. 1997). Publicly appointed multidisciplinary expert panels in the USA, the UK and Canada have evaluated chiropractic treatment and found it to be safe and effective. This applies to both acute low back pain (Shekelle PG, Adams AH et al. 1991, Royal College of General Practitioners 1996), and chronic low back pain (Manga P et al. 1993).

CLINICAL GUIDELINES

In 1994, the US Department of Health published new, evidence-based, clinical guidelines for back care in the USA. A multidisciplinary expert panel carried out a critical examination of the available documentation on the diagnosis and treatment of back pain – a total of almost 4,000 titles (Shekelle PG, Adams AH et al. 1991). The conclusions of this report agree to a great extent with that of later clinical guidelines for dealing with acute low back pain prepared in the UK (Royal College of General Practitioners 1996). The RCGP guidelines recommend grouping patients according to a diagnostic triad that forms the basis of further examinations, referrals and treatment.

THE DIAGNOSTIC TRIAD

- 1) Simple back pain
- 2) Nerve root pain
- 3) Possible spinal pathology

Since the vast majority of back patients have neither serious pathology nor nerve root pain requiring surgery, most of them belong in the groups with uncomplicated back pain and nerve root pain that can be treated without surgery. Most chiropractic patients also belong in these groups.

The RCGP guidelines recommend manipulative therapy within the first six weeks – usually complemented by other measures – for the group with acute, simple back pain, in order to alleviate the pain and enable the patient to return to a normal activity level as quickly as possible. The RCGP guidelines advise against staying in bed for more than a couple of days, as a treatment for acute back pain.

Clinical experience and research also demonstrate the good results of chiropractic treatment of low back pain and sciatica (Kirkaldy-Willis WK 1983, Meade et al. 1990, 1995, Stern et al. 1995).

NECK PAIN AND HEADACHE

The second largest group of chiropractic patients, about a third, has neck pain and headache. The conclusions drawn by international expert panels are positive to manipulative therapy in this group of patients as well (*Spitzer et al. 1995, Hurwitz EL et al. 1996*).

In practice, chiropractors treat both acute neck pain, such as in the case of acute torticollis, and more chronic neck, shoulder and arm syndromes. Headaches, dizziness and posttraumatic neck pain, i.e. a whiplash injury, are discussed later in a separate section.



PAIN IN THE THORACIC SPINE AND THE THORAX

Dysfunctions in the thoracic spine are normal and may cause symptoms in the arms, shoulders and neck. The thoracic spine is often a stress barometer, along with the thorax it is the biomechanical basis for the respiratory function. The thoracic spine is also the anchor point for the shoulder, arm and neck musculature. General tenseness, stress and repetitive arm movements can affect breathing and often manifest themselves as dysfunctions in this area.

Acute dysfunctions in the cost-overtebral joint can cause dramatic pain in the front of the chest that spreads to the upper extremities and can cause breathing difficulties. The pain can be frightening, and a differential diagnosis is important. Patients usually respond rapidly to chiropractic treatment. The number of treatments needed to treat such conditions may vary with the degree of chronicity and severity. In most cases 2-6 treatments will suffice.



OTHER CONDITIONS

Clinical experience has shown that chiropractic treatment may in some cases help disorders caused by other organ systems as well. Several clinical research projects are under way to shed light on this.

OTHER JOINTS AND SPORTS INJURIES

Various chiropractic examination and treatment techniques have been developed for all the joints in the body. These are important for

treating both acute sports injuries and chronic repetitive-strain injuries. Chiropractic thus has a role to play in the treatment of both acute sprains/strains and chronic tendonitis, for example. Many doctors refer

patients with such complaints to chiropractors, and the chiropractor should have a natural place in the medical teams around top athletes. Chronic dysfunctions in the extremities may be an underlying cause of back pain, and can easily be overlooked. For example, it may be relevant to examine and treat the foot/ankle/knee of a patient with back pain. The opposite may also be true, and the chiropractor will always examine how the spinal column functions if the patient has chronic tendonitis, for instance.



From structure to function



Ever since Mixter and Barr described disc prolapse as the cause of LBP with or without radiation/leg pain, the intervertebral disc has been the focus of spinal research up to the present time (*Mixter WJ, Barr SJ 1934*). As a result of this, the treatment of spinal disorders has mainly been based on structural findings, such as disc pathology and degenerative changes.

The reasons for disc degeneration are still largely unknown. Risk factors such as lifting heavy loads, sedentary lifestyle, vibration and smoking seem to be less important than previously assumed, while hereditary factors play a greater role (*Battie et al. 1995*).

A lack of correlation between degenerative changes in the disc and facet joint and back symptoms has also been demonstrated (*Fullenlove TM, Williams AJ 1957, Boos et al. 1995*). With the use of CT scans, disc prolapse has been found in up to 40% of asymptomatic individuals at the age of 40 (*Wiesel SW 1984*), and, with the use of MRI, disc prolapse has later been found in all of 76% of asymptomatic individuals (*Boos et al. 1995*). The picture is further complicated by the fact that patients with severe pain often have no degenerative changes or disc lesions at all. Thus, traditional back diagnoses based on structural findings are not necessarily associated with pain.

Sixty years after Mixter and Barr's famous article, we still do not know why some people get back pain and others do not. At the same time, we see that the economical cost of back pain has grown enormously over the past few decades.

These developments show that there is a need for innovative thinking in this area. Disciplines that are new in this context, such as immunology, biochemistry and neurophysiology, will most likely significantly enhance our understanding of the nature of back problems (*Saal J 1995*).

Functional Spinal Lesion (FSL)

The concept of a functional spinal lesion has recently been introduced in the chiropractic literature (Triano JJ 1992).

DEFINITION

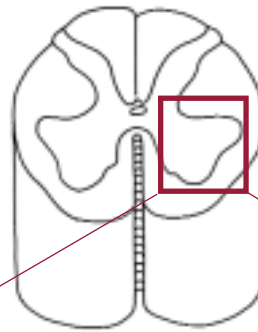
In order to define an FSL, we must assume that a normal function can be defined on the basis of a movement pattern that contains a harmonious interaction between the spinal joints and musculature. Activity in the spinal musculature results in movement in the spinal joints. Receptors in the spinal joints provide continuous feedback via the nervous system about the joint movements, so that muscle activity can be adjusted. When the interaction between the nervous system, joints and musculature is disturbed, this is called an FSL.

INNERVATION AND CONTROL OF THE DEEP SPINAL MUSCULATURE

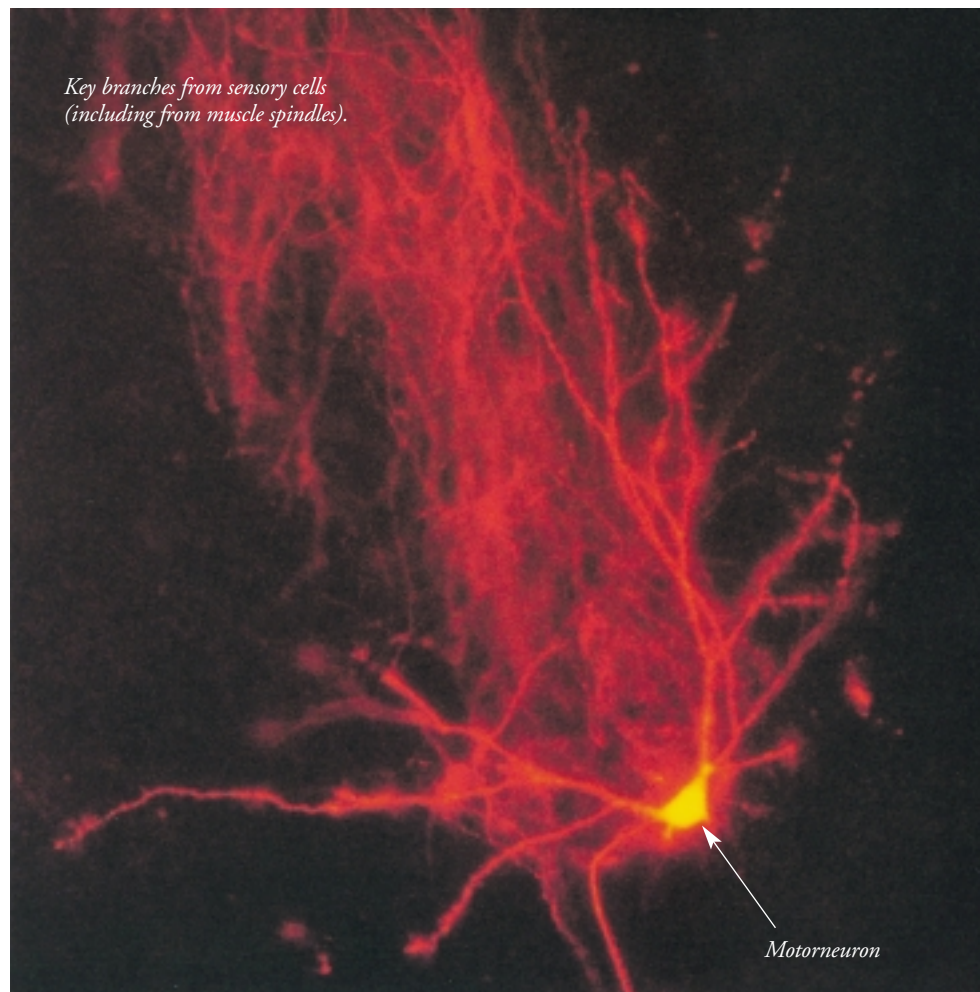
The deep spinal musculature is not under direct voluntary control to any great extent. Impulses from thousands of nerve cells converge on one single motoneuron, which in turn integrates sensory information with signals from downward motor circuits.

It is the overall synaptic activity in the individual motoneuron that determines the activity to be emitted from the same motoneuron to its associated muscle fibres (*motor*

unit). This will always be the case initially, but it has also been proven that the activity (*frequency of action potential*) in a motoneuron can operate independently of the incoming synaptic activity in certain circumstances. In literature, this is described as the motoneurons' bistable firing properties or plateau potentials (Hounsgaard et al. 1988).



MOTORNEURON
Retrograde marked with D:1.
(Approx. L2 Level in chicken)
A.L. Eide, Department of Physiology,
University of Oslo.



Key branches from sensory cells
(including from muscle spindles).

Motoneuron

A brief, synaptic activity in monosynaptic links from muscle spindles has been shown capable of starting a long-lasting train of action potentials in the motorneuron, i.e. long-lasting muscle contraction in the motor unit in question. Similarly, a brief inhibitory impulse (such as from antagonistic musculature) can stop the signal train in the motorneuron (Chrone et al. 1988). Chiropractic treatment can probably provide a similar inhibitory impulse.

This could explain what we observe clinically in manipulative therapy. Long-lasting contractions of the back musculature seem to cease immediately in connection with a short-lasting mechanical stimulation that possibly generates an inhibitory impulse. The experimental observations made in this field of research will be of great importance to the future understanding of chiropractic treatment.

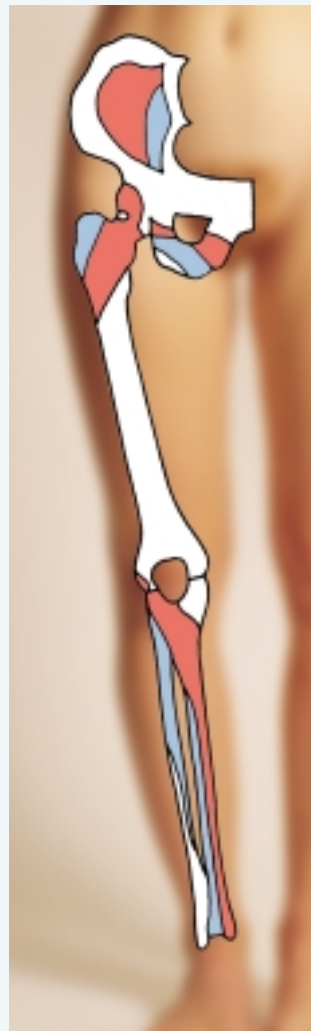
PAIN THEORY

Tissue damage causes the release of potassium, prostaglandins, bradykinin and other signal substances with a local effect that activate peripheral pain receptors (Ottesen S 1993). Persistent static contractions of deep back muscles will probably have the same effect on the pain receptors owing to the accumulation of metabolites. The pain receptors are free nerve endings, and the pain signal is led into the spinal cord's posterior horn. Reduced mobility results in less activity in the fast-conducting sensory fibres from the mechanoreceptors in the spinal muscles, tendons and joint structures. According to the gate theory, the signal traffic in these fibres

normally inhibits the pain signals from slow-conducting C fibres, (Melzack and Wall 1965).

In the field of pain physiology, much attention is now given to the changes that take place in the spinal column's posterior horn. The pain signals from peripheral receptors are transmitted via synaptic links to secondary sensory nerve cells in the posterior horn. The synaptic strength is important for how the stimulus in question is received and transmitted in the nervous system.

In the case of intense pain



SCLEROTOMES
L4 (red) and L5 (blue) sclerotomes in the lower extremity

over a long period of time, the synaptic strength may change. These changes can be regarded as a learning mechanism; the nerve cell in the posterior horn "learns" to transmit pain. Such inherent plasticity seems to be an important mechanism in developing chronic pain. Effective pain relief from the onset of pain may thus prevent the development of chronic pain (Tjølsen A, Hole K 1993).

Because chiropractic treatment has a documented pain-relieving effect (Terret AGJ, Vernon H 1984, Vernon T et al. 1990, Cassidy JD et al. 1992), chiropractic treatment may also play a role in preventing chronic pain.

REFERRED PAIN

Mechanical or chemical stimulation of the pain receptors in the back can give distal pain or so-called referred pain (Travell 1983). Discs and facet joints are well documented pain sources in the case of back and neck pain, while the musculature's role as a source of pain is more uncertain (Bogduk 1995). When an FSL gives referred pain, this is usually felt along the corresponding level's sclerotome (Kirkaldy-Willis 1983). This differs slightly from the corresponding dermatome from the same level.

THE AUTONOMIC NERVOUS SYSTEM

Activity in the autonomic nervous system is affected by stimulation of mechanoreceptors. This has been documented through demonstrable changes to the pupil diameter, blood pressure, sweat production and local circulation after such stimulation (Yates et al. 1988, Briggs L, Boone WR

1988, Harris W, Wagnon RJ 1987, Chiu TW, Wright A 1996). Somatovisceral reflexes, in which the stimulation of structures in the spinal column leads to changed activity in the visceral organs, have also been proven (Sato 1992).

This may explain why chiropractic treatment can affect conditions such as infant colic, asthma and menstrual pain (Klougart et al. 1989, Miller 1975, Hviid C 1978, Boesler D et al. 1993).

CHANGED MUSCLE ACTIVITY

Experiments have proven that the activity pattern in the deep spinal musculature (multifidus) changes if the tissue in the disc and facet joints is irritated. Irritation of the tissue caused changes in the activity pattern both bilaterally and over several segmental levels – depending on the structures that were stimulated (Indahl et al. 1995). On the basis of these and other findings, tissue irritation may probably result in an imbalance in the normal activity pattern in the form of an FSL.

In patients with acute/sub-acute low back pain, ultrasound scans have shown unilateral atrophy in the multifidus on one level. The level of atrophy corresponded with the clinical determination of the level of the painful segment (Hides JA et al. 1994).

WHY RECURRENT PAIN?

Even several weeks after the pain had ceased, and the patients had returned to normal activity levels, there was still evidence of multifidus atrophy. The authors conclude that the change in muscle activity does not cease automati-

cally when the pain stops (Hides JA et al. 1994). A muscular imbalance, as in the case of an FSL, will probably make the patient susceptible to recurrent low back pain.



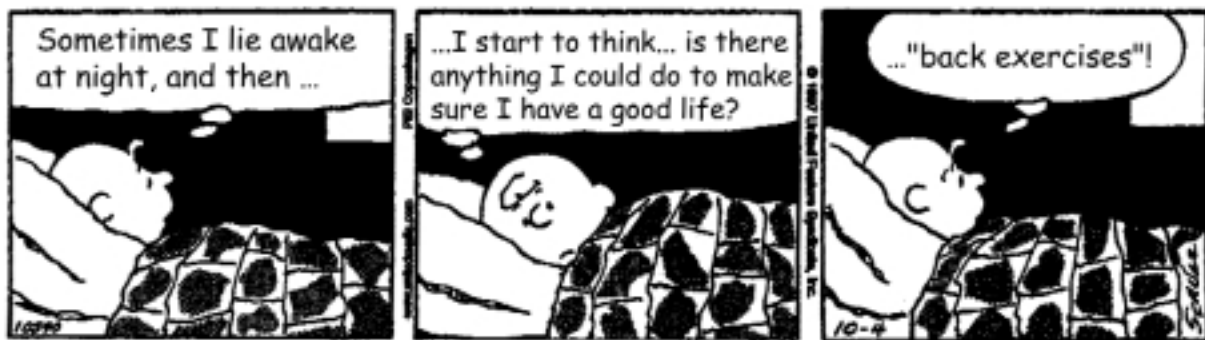
From passive to active treatment

Swedish studies show that around 10% of back disturbance sick days are due to disturbances that last for more than three months. It is also worth noticing that the long-term absentee back patients account for 85% of the costs associated with back care. Although most of those absent due to

1995). In the worst case, treatment that makes the patient passive gives rise to increased dependency on the therapist, contributes to chronifying the complaints and deprives the patient of responsibility for his or her own health. This may also apply to chiropractic treatment, although encouraging patients

greater effect on the group that was given chiropractic treatment. The difference between the groups grew over the next three years and the survey's conclusion indicated positive long-term effects from the chiropractic treatment.

In another study, with only a six-month follow-up period,



back disturbances return to work within four weeks, more than half of these have recurrent pain within one to two years (*Nachemson A 1991*).

As regards treatment, an increasing amount of data indicates that activity-promoting treatment has the best effect, and that unnecessary passivity is harmful (*Royal College of General Practitioners 1996*).

A Norwegian study has recently shown that making the situation less dramatic and encouraging the patients to be active clearly reduced the time lost due to illness, compared with a control group given different treatment (*Indahl et al.*

to be physically active is a basic chiropractic principle.

Up to now, there has been little research on the long-term effects of various treatment forms as regards the risk of recurrence and chronicity.

In an extensive survey, in which more than 700 patients were followed over three years, the effect of chiropractic treatment was compared with hospital outpatient treatment (*Meade TW et al. 1990, 1995*).

This survey – a clinically controlled, randomised study published in the *British Medical Journal* – showed that both forms of treatment had an effect, initially with a significantly

no significant difference was shown in the effects of physiotherapy and chiropractic treatment on patients with neck and back pain (*Skargren et al. 1997*). This proves that more research is needed to identify which subgroups among back patients respond best to various forms of treatment. Clinical experience indicates that this may vary from patient to patient, depending on the diagnosis and other known and unknown factors.

The effect of manipulation

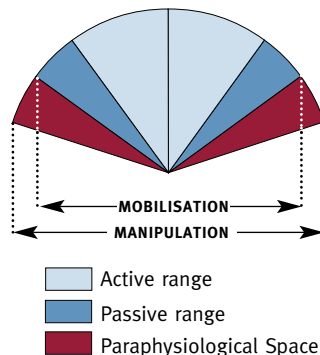
An immediate, temporary increase in the passive joint movement and improved symmetry in the joint occurs after manipulation (*Christensen HW, Nilsson N, Hartvigsen J 1996*). The increased mobility in the joints can be explained by the fact that the ligament, joint capsule and deep musculature are stretched. When the surfaces of the joint are separated, a vacuum occurs in the joint resulting in the formation of a gas bubble inside the joint. The gas bubble increases the joint volume for the first 20 minutes after the clicking noise that is associated with the formation of the gas bubble (*Mierau D, Cassidy JD et al. 1988*).

The joint movement can be divided into three areas (*Sandoz R 1978*). The first area represents the active turning movements. In addition, the joint can be stretched passively into the next area, so that the elastic elements around the joint are stretched. The limit for the passive movement is called the physiological limit. The last limit is the anatomical one, and this represents the limit of how far the joint can be stretched. The movement area between the physiological and anatomical limit is called the paraphysiological space.

Mobilisation is defined as a technique in which the joint is only moved within its physiological limits up to the limit of its passive movement, while manipulation moves the



joint further into the paraphysiological space towards its anatomical limit. The joint may be damaged if the anatomical limit is exceeded. Good technical skills and long training are necessary for carrying out such treatment properly (*Kirkaldy-Willis WH 1983, Mierau D, Cassidy JD et al. 1988*).



The stages of an adjustment and definition of joint manipulation.

(From: Sandoz R: Some physical mechanisms and effects of spinal adjustments. Ann Swiss Chiropr Assoc 6:91, 1976.)

NEUROPHYSIOLOGICAL EFFECT?

Manipulative therapy stimulates the mechanoreceptors in the joint capsules, ligaments and muscles immediately, due to both the speed and depth of the manipulation. This stimulation of the mechanoreceptors activates fast-conducting, thick nerve fibres that impede impulses from slow-conducting pain fibres (the pain gate theory). Experiments have shown that manipulation results in increased pain tolerance (*Terret AGJ, Vernon H 1984*) and less joint pain (*Vernon T, Aker P et al. 1990, Cassidy JD, Lopes AA et al. 1992*).

Furthermore, immediate effects have been observed on the autonomous nervous system, such as a lowering of blood pressure (*Yates et al. 1988*), and changes to the pupil diameter (*Briggs L, Boone WR 1988*) and skin temperature (*Harris W, Wagnon RJ 1987, Chiu TW, Wright A 1996*).

LONG-TERM EFFECTS

Manipulation is meant to normalise the movement in hypomobile joints and will therefore lead to increased stimulation of the mechanoreceptors and a reduction in pain after the manipulation. This provides a basis for rehabilitation activities that are also very important to the joint's function and the plasticity of the nervous system.

WHAT HAPPENS TO THE MUSCLES?

The back's musculature has long surface muscles and short, deep intersegmental muscles. The deep musculature is a reflexively controlled stabilization musculature that controls the back's fine mechanics.

Following experimental stimulation of the disc and facet joints by injections, reflex contractions of the multifidus have been demonstrated in a specific segmental distribution (*Indahl 1995*).

Chiropractic manipulation techniques aim for a high degree of specificity in order to isolate the involved joints and associated musculature as far as possible. The treatment attempts to change the tonus of the deep musculature by stimulating the stretch and spindle receptors. A normalised joint function involves a normalised muscle tonus and vice versa (*Caillet R 1995*).

Side-effects

As with all efficient treatment, chiropractic treatment may give rise to side-effects.

Slight to moderate reactions to treatment arise regularly after manipulation. Through the analysis of data from several thousand chiropractic treatments in parallel surveys in Norway and Sweden, these side effects have now been charted as regards their character, frequency and predictors (*Senstad et al. 1996-97, Leboeuf-Yde et al. 1997*).

During a series of up to six treatments, around half the patients in the survey had a treatment reaction. Of these, local tenderness was the most frequently reported (53%), followed by headaches (12%), tiredness (11%) and radiating pain/discomfort from the area treated (10%).

Most of the reactions occurred shortly after the treatment and were described as mild to moderate and of short duration. They usually lasted for less than 24 hours. Reactions lasting for more than two or three days were extremely rare.

These reactions were probably caused by tissue irritation in joints and musculature after the mechanical stimulation of a painful area, and can best be compared with the stiffness and tenderness felt after unusual physical activity.

More uncommon reactions to treatment were dizziness (5%), nausea (4%), a skin

heat sensation (2%) and others (2%).

No permanent or serious side-effects/complications were found in these surveys, which covered 1,683 chiropractic patients who received a total of 6,570 treatments.

COMPLICATIONS

Serious complications as a result of manipulation of the neck may arise as a result of an acute failure in the cerebrovascular circulatory system, normally in the form of ischaemia/infarction in the brain stem in a vertebrobasilar distribution. Such complications occur very rarely, and have been estimated to occur in one out of 1.3 million neck treatments in Denmark (*Terret AGJ 1987, Terret AGJ, Kleynhans AM 1992, Hurwitz EL et al. 1996, Klougart et al. 1996*).

Treatment using techniques that involve rotating the upper part of the neck seem to be associated with greater risk than techniques with little or no rotation of the neck, so therefore are the latter to be recommended (*Klougart et al. 1996*).

However, most cases (80%) of injury to the vertebrobasilar artery occur spontaneously without any prior mechanical event such as manipulation (*Haldemann S 1996*). It is therefore possible that the figures above represent an over-reporting of the actual risk involved in neck treatments (*Leboeuf-Yde et al. 1996, Terret AGJ 1995*).

The risk of developing cauda equina syndrome as a complication after the manipulation of the lower back is estimated to be one in 100 million treatments (*Haldemann S, Rubinstein SM 1992, Shekelle P 1994*).

Compared with the far higher risk of serious complications involved in other treatment alternatives, such as the medicinal treatment of a headache or neck and back pain, manipulation is a very safe treatment choice based on any medical criterion (*Dabbs V and Lauretti WJ 1995*).

CONTRAINDICATIONS

Extra caution must be shown in cases of moderate or severe osteoporosis and with patients on blood-thinning medicine. These are therefore relative contraindications.

Absolute contraindications are neoplasm (primary and secondary), pathological fractures and joint dislocations, infections or acute rheumatoid inflammations of the joints. Likewise some forms of congenital anomalies involving the danger of instability/luxation, aneurysms of the carotid artery and vertebrobasilar arterial insufficiency, signs and symptoms of progressive nerve root compression and acute cauda equina syndrome are absolute contraindications (*Guidelines for Chiropractic Quality Assurance and Practice Parameters 1993*).

Degenerative changes of the spine

A model describing low back pain as a pathophysiological process has been developed in close collaboration between orthopaedists and chiropractors at a Canadian university hospital. The model is based on the understanding that back pain results from changes in function. Structural or degenerative changes occur as a result of a functional change over a period of time (Kirkaldy-Willis WH 1983). This model has won widespread acceptance in professional environments.

In the pathophysiological model, the process is normally divided into three successive phases; dysfunction, instability and stabilization.

THE DYSFUNCTION PHASE

During the dysfunction phase, which represents the first stage of the pathophysiological process, there are few, if any, demonstrable structural changes. The phase is characterised by changes to the movement pattern in the spine as occurs with a functional spinal lesion as described earlier.

The majority of all so-called unspecified back and neck complaints are to be found here. Experience shows that such dysfunctions are reversible, and the prognosis is good if this patients receive chiropractic treatment.

The segmental movement is determined by anatomical conditions such as the three-dimensional shape of the verte-

brae, the height of the disc and the elasticity of the joint capsules and ligaments. Changes to these anatomical structures (degenerative bone changes, reduced disc height or scar tissue in the joint capsule or ligament) may alter the mobility. It is well known that a reduction in the mobility of joints over time leads to degenerative changes in the joint cartilage and disc (Videmann T 1987).

The intervertebral disc is the body's largest avascular structure and is therefore particularly dependent on movement for the supply of nutrients through diffusion. Reduced segmental mobility may thus over time increase the risk of developing a prolapsed intervertebral disc (Kirkaldy-Willis WH 1983). Disc lesions may also lead to facet joint arthrosis, since in biomechanical terms the facet joints and the disc function as a three-jointed unit.

THE INSTABILITY PHASE

The theory is based on the fact that this breakdown of the joint structures may lead to instability in the affected joints. The degenerative process does not necessarily have many symptoms and may take place in quiet intervals over the

space of many years (Kirkaldy-Willis WH 1983). In some cases, so-called segmental instability may arise. This is described in a separate section.

THE STABILIZATION PHASE

In time, the degenerative changes will usually compensa-

intermittent flexion and traction treatment is used on degenerative conditions such as lumbar stenosis and pseudodyololisthesis.

Functional spinal lesions that often respond to chiropractic treatment can be found during all the phases of a back disorder.

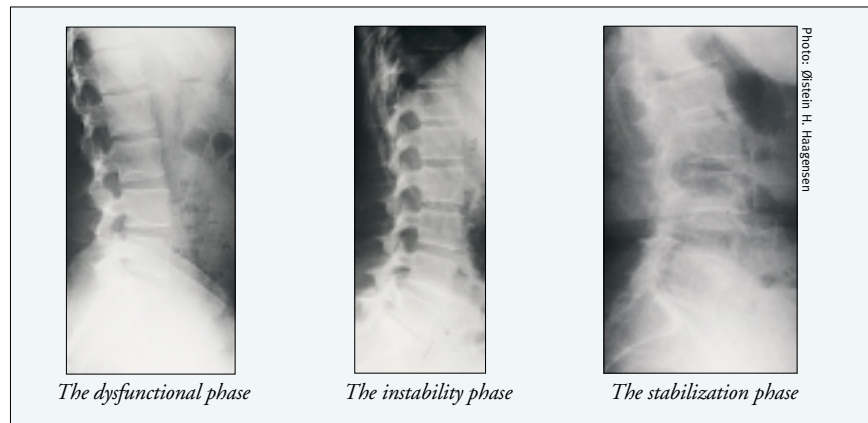


Photo: Østein H. Haagenen

te to a certain extent for the instability, and the patient will eventually enter the last phase; the stabilization phase.

This involves more definite degenerative changes in the form of obvious facet joint arthrosis, disc degeneration, and spondylosis/osteophytosis which may lead to constriction resulting in lateral and/or central spinal stenosis. During this phase, the patients often experience that the pain recedes while they grow stiffer.

Some of this stiffness and pain may be due to elements of dysfunction, and clinical experience shows that chiropractic treatment can reduce the symptoms and muscular stiffness. Often, a combination of

der. The prognosis is best during the dysfunctional phase, during which little or no degenerative changes take place, but experience shows that chiropractic treatment can also have a good effect on lesions during the instability and stabilization phases (Kirkaldy-Willis WH 1983).

During both the instability and stabilization phases, chiropractors may find what they call coexisting lesions in the same patient; a sciatica patient with a disc prolapse might have co-existing sacroiliac joint dysfunction that also gives radiating pain. The response to the treatment will often reveal such links and be of diagnostic value.

In brief:

DISC PROLAPSE

A herniated disc demonstrated by diagnostic imaging was previously considered to be an indication for disc surgery. However, with the increasing

use of CT and MR scans very high false positive rates have been found (*Wiesel SW 1984, Boos et al. 1995*).

Any surgical treatment must be based on both clinical and

radiological findings. In general, therefore, conservative treatment should be attempted as long as there is no progressive nerve root dysfunction or intolerable pain (*Norwegian Board of Health 1995, Royal College of General Practitioners 1996*). Manipulation in side posture has been a controversial issue for some time. According to the literature on the subject, manipulation is now regarded as a safe, effective way of treating most of these patients, but there is a need for more research in this area before definite conclusions can be drawn (*Nwuga VCB 1982, Kuo PP, Loh ZC 1987, d'Ornanon et al. 1990, Cassidy JD et al. 1993, Stern et al. 1995, Hartvigsen et al. 1996*).

The annulus fibrosis in the disc is designed to resist rotational forces. A normal disc has been proven to withstand a 23 degree rotation before damage occurs and a degenerated disc can withstand a 14 degree rotation (*Farfan et al. 1970*). The facet joints only allow for 2 to 3 degrees of rotation, so that it is difficult to imagine that injury to the disc or a worsening of existing disc injury will arise through manipulation when the patient is lying in a lateral position.

SCIATICA

True compression of the nerve root will always result in neurological deficits and motor loss.



Recent research shows that the pain of sciatica is mainly due to the inflammatory response around the nerve root following a disc prolapse (*Gronblad M 1994*). A disc prolapse may cause circulatory changes with local oedema and ischaemia of the nerve root. Over time, this may lead to fibrosis of the nerve root and chronic pain (*Cooper et al. 1995*). Manipulative therapy has been proven to have a good effect on radiating symptoms in the case of a disc prolapse (*Stern et al. 1995*), but there is no evidence that the size of the prolapse is reduced by such treatment (*Cassidy JD et al. 1993*). It may well be, therefore, that manipulative treatment for nerve root pain has a favourable effect on the inflammatory response and local circulation, rather than reducing the size of the prolapse.

However, repeated MR examinations following chiropractic treatment have also shown a reduction/resorption of prolapses in 63% of the patients. In addition to manipulation, traction techniques, soft-tissue techniques and exercises were also used in these cases (*BenEliahu DJ 1996*).

Structures other than the nerve root may also give rise to sciatic pain. For example, an irritation in both the facet joints and the sacroiliac joint may give referred, radiating pain in the buttocks, thigh, groin or calf. In the same way, myofascial trigger points in the buttock musculature, for example, may also give referred pain down the legs. The chiropractor can treat all these functional lesions in sciatica patients.

SEGMENTAL INSTABILITY

This term describes a pathological hypermobility or slippage at a level in the spinal column. Patients with segmental instability often have a history of recurrent attacks/episodes of acute back pain. They often experience that these attacks occur more and more frequently and are of longer duration. Some patients get sudden attacks of intense pain when they make certain movements. They often have an antalgic posture and experience pain, both with and without radiation to the leg. Some develop so-called dynamic, lateral stenosis, in which certain movements cause compression of the nerve root due to the segmental instability.

X-rays can confirm clinical suspicions of segmental instability. X-rays reveal segmental instability by showing degenerative changes to the disc, facet joints, joint capsules and ligaments. Postural errors and slippages (spondylolisthesis, retrolisthesis or laterolisthesis) can also be seen. X-rays taken with maximum movements (function X-rays) can reveal such segmental instability in the form of pathological slippages when under strain (*Dupuis et al. 1985*).

In the case of instability, the movement pattern in the spinal column changes due to the structural changes. This predisposes it to dysfunctions. It is important for the chiropractor to identify any instability in the joints, since this must be taken into account in the patient's further treatment. Clinical experience shows that most patients in the instability phase benefit greatly from chiropractic treatment methods that do not involve an increase in segmental instability.

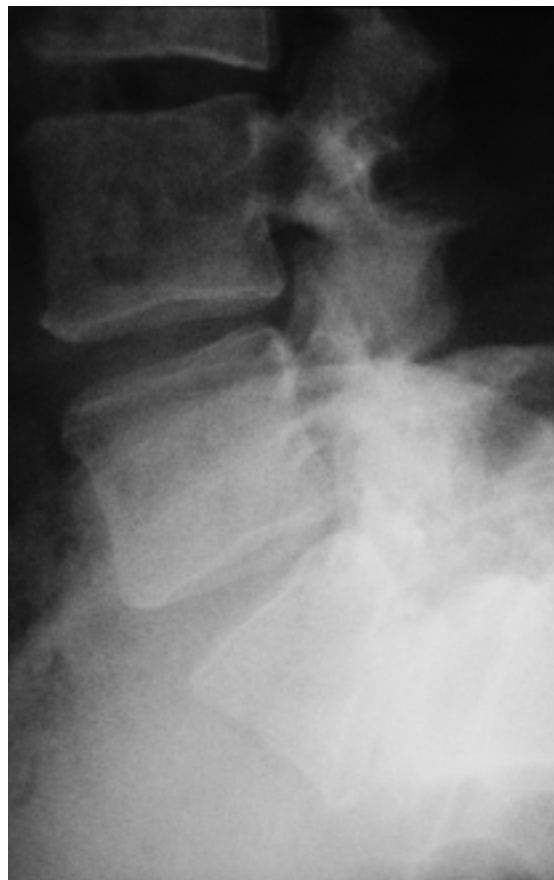


Photo: Olefin H. Haagenen

HYPERMOBILITY

So-called hyper-mobile patients can also consult a chiropractor, since these may have dysfunctions in some joints that require specific manipulative therapy. Correctly performed manipulative therapy does not lead to increased hypermobility.

PELVIC PAIN AND PREGNANCY

Pregnancy may lead to back and pelvic pain due to factors such as an increase in weight, change of posture and hormonal influences on the ligaments. A normal pregnancy is no contraindication to chiropractic treatment.

In our experience, low back pain, pain in the groin and sciatic pain during/after pregnancy are often due to functi-



onal lesions in the pelvis or lower back. On the other hand, patients with strong instability of the pelvic girdle and strong pain in the symphysis benefit less from chiropractic treatment.

HEADACHE

Headache patients are a large, heterogeneous group including diagnoses from tension headaches to migraine. The so-called cervicogenic headaches, in which the pain is due

to referred pain from the neck, are of special interest. Around 1–5% of the adult population is estimated to suffer from cervicogenic headaches. According to a Danish study, this represents 8–32% of the diagnoses for patients who often have a headache (*Nilsson N 1995*).

A controlled clinical study showed that chiropractic treatment had a significant, positive effect on cervicogenic headaches (*Nilsson N 1997*).

Even though some studies have reported positive treatment effects both for migraine (*Parker GB et al. 1978*) and tension headache (*Boline et al. 1995*), more research is necessary before we know which sub-groups respond best to chiropractic treatment (*Vernon HT 1995*).

Chiropractic treatment may therefore be a medication-free treatment alternative for headaches, with the advantages this entails, not least avoiding the side-effects of drugs (*Dabbs and Lauretti 1995*).

When treating headaches, trigger-point treatment of the neck, jaw and face musculature is also used in addition to manipulation. Temporomandibular joint dysfunction is also assessed and treated when relevant, possibly in cooperation with a dentist.

WHIPLASH INJURIES

A report from the Quebec Task Force on Whiplash Associated Disorders, presented in Stockholm in May 1995, evaluated all the available scientific material on the cause, diagnosis and treatment of conditions triggered by whiplash injuries. The seriousness of the injuries

were graded from 1 to 4 (Spitzer *et al.* 1995):

Grade 0: No subjective complaints, no clinical findings.

Grade 1: Neck complaints consisting of pain, stiffness, tenderness, no clinical findings.

Grade 2: Neck complaints and clinical findings of muscle/skeleton injuries that reduced movement as well as tender points.

Grade 3: Neck complaints and clinical neurological findings, such as reduced tendon reflexes, power and sensitivity findings.

Grade 4: Neck complaints and fractures/dislocation.

The report pointed out that many of the therapeutic interventions in normal use for whiplash injuries lack scientific documentation. This applies to heat-treatment, massage, ultrasound and laser treatment, for instance.

The report found sufficient evidence to warn against the long-lasting use of collars and muscle-relaxant medication. Injection treatment was found to be documented as ineffective. Furthermore, the report cautions against other long-lasting treatment that renders the patient passive and involves a danger of dependency.

For grade 1 injuries, the report recommends no treatment, and that grade 1–3 injuries should be treated by calming the patient and encouraging a return to normal activities as soon as possible. The report states that only in exceptional cases are there indications that a patient should rest his or her neck, and that in these few cases, activating measures should

start within four days. The report recommends some analgesics (NSAIDs and non-opioid medication) for pain relief. Grade 4 injuries, however, require immediate admission to hospital.

For grade 2 and 3 injuries, the report found sufficient scientific evidence to recommend the use of activity-promoting treatment, such as manipulation, mobilisation and exercises. There was agreement that manipulative therapy was favourable both for pain relief and to improve the neck's mobility. The treatment should be limited in time and carried out by health personnel with special expertise. The report warns against repeated manipulative therapy over a long period of time unless a multi-disciplinary assessment of the patient has been carried out.

DIZZINESS AND DISTURBED POSTURAL CONTROL

In order for normal co-ordination to take place in the movement apparatus, signals from the mechanoreceptors in the muscles and joints must be integrated centrally with information from the vestibular system and the eyes. In litera-

ture, this is called the “Postural Control System”.

A hypothesis has been put forward as to how metabolites from long-lasting muscle tension affect the proprioceptors (Johansson H, Sojka P 1991).

Of the centrally integrated sensory signals, the signals from the neck's mechanoreceptors are assumed to be of great significance. Therefore, altered impulse activity from a functional spinal lesion may well cause symptoms such as dizziness or reduced motor control (Wyke B 1979).

This is supported by a study showing that patients with chronic neck and arm pain have reduced postural control (Karlberg *et al.* 1995).

A Norwegian study showed that whiplash patients have disturbed eye-muscle control. The eye-muscle control worsened when the examination was carried out while the neck was rotated in relation to the body. The authors conclude that this is probably due to disturbances in the neck's mechanoreceptors (Gimse *et al.* 1996).

For dizziness due to functional spinal lesions in the upper part of the neck, so-called cervicogenic vertigo, chiropractic

treatment may have a positive effect, and clinical tests to differentiate cervicogenic vertigo from other types of dizziness have been described (Fitz-Ritson D 1991).

In some other forms of dizziness, such as when vertebro-basilar arterial insufficiency is suspected, manipulation of the neck is contraindicated (Guidelines for Chiropractic Quality Assurance and Practice Parameters 1993).



CURRICULUM OF UNIVERSITY LEVEL CHIROPRACTOR TRAINING IN SCANDINAVIA

Medical and Clinical Biomechanics curricula at Odense University (1998)	Courses exclusively for medical students	Common courses for medical and clinical biomechanics students	Courses exclusively for chiropractor students
First year		Anatomy 1 (168 hours) Chemistry (160 hours) Physics (74 hours) Lifestyle related diseases (50 hours) First aid (20 hours)	Theoretical biomechanics (40 hours)
Second year	Histology (40 hours)	Anatomy 2 (110 hours) Molecular biology (60 hours) Biochemistry (130 hours) Communication (25 hours) Ethics (30 hours) Physiology (68 hours)	Theoretical biomechanics (40 hours) Clinical biomechanics and techniques (40 hours)
Third year	Microbiology (51 hours) Pharmacology (24 hours) Family medicine (30 hours) Biochemistry (13 hours) Radiology (12 hours)	Human genetics (14 hours) Physiology (106 hours) Neurobiology (50 hours)	Pathology (75 hours) Microbiology (40 hours) Pharmacology (30 hours) Epidemiology and statistics (60 hours) Radiology (12 hours) Sports medicine (15 hours) Clinical biomechanics and techniques (135 hours)
Degree:			B.Sc. (Biomechanics)
Fourth year	Epidemiology & statistics (60 hours) Microbiology (53 hours) Pharmacology (84 hours) Psychology (48 hours) Environmental medicine (90 hours) Dermatology (30 hours) Sociology (36 hours)		Case history taking and physical examinations (24 hours) Radiography (36 hours) Radiology (24 hours) Principles of diagnostics (144 hours)* Clinical biomechanics and techniques (120 hours)
	2–4 week practical course in a hospital, covering gynaecology, oncology, anaesthesiology, psychiatry, neurology and dermatology.		3 week course in hospital in general medicine and general surgery
Fifth year	Pathology (120 hours) Psychiatry (60 hours) Forensic medicine (40 hours) Ophthalmology (40 hours) Paediatrics (45 hours) Radiology (12 hours) Ear-nose-throat (40 hours) Gynaecology/obstetrics (60 hours) Cases – problem solving techniques (120 hours)		Principles of diagnostics (144 hours)* Radiology (72 hours) Clinical biomechanics and techniques (72 hours) In a clinic: practice and theory (= 500 hours) Project thesis
			3 week course in emergency medicine in a hospital
Degree:			Cand. Manu.
Sixth year	Clinical practice in a hospital: internal medicine, surgery, paediatrics, general medicine etc.		
Degree:	Cand. Med.		
License as:	Physician		Chiropractor

* The course in principles of diagnostics in the fourth and fifth years of the chiropractic programme is organised as a case-oriented course following the McMaster model.

In Norway: Followed by a oneyear internship