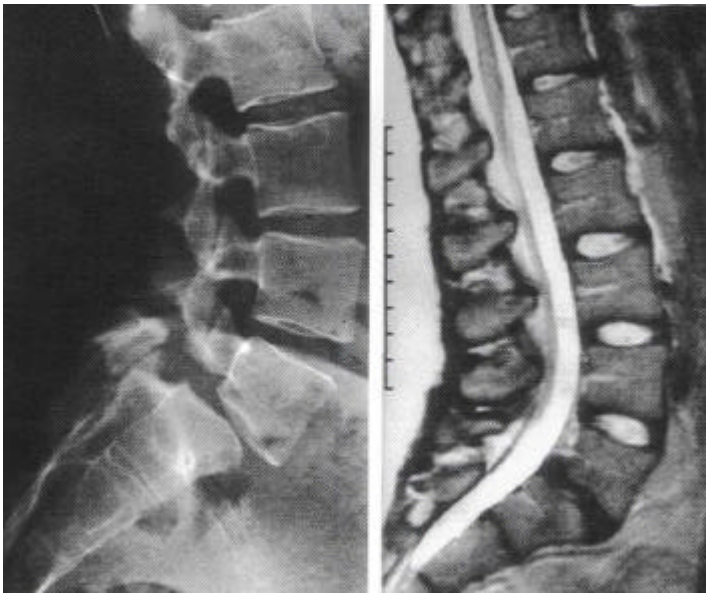
THE PHENOMENON SPONDYLOLISTHESIS FROM AN OSTEOPATHIC POINT OF VIEW

An approximation to a pathology which is determined by a multitude of factors – supported by a comparative study of the subjective modifications of pain and the quality of life



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1 Introduction

Spondylolisthesis was first described by the obstetrician Herbiniaux (1782). He reported the case of a woman who had a complicated delivery, and was suffering from spondyloptosis. At that time, spondylolisthesis was thought to occur acutely. Kilian (1854) observed the gradual, chronic process of the slip (cf. Figure 1) and also gave the phenomenon its name spondylolisthesis (in Greek *spondylos* means vertebra and *olithesis* means slip).

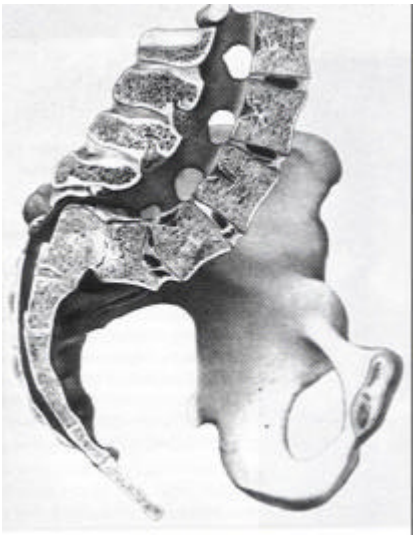

Figure 1: anatomical specimen of a severe spondylolisthesis: so-called Paderborn pelvis (according to Kilian 1854). The vertebral body L5 has slipped ventrally by the complete width of the sacrum (corresponding to a spondylolisthesis grade IV according to Mayerding) and shows a massive kyphosis. Accordingly, the lumbar spine shows a compensatory hyperlordosis and the sacrum is verticalized.

Neugebauer (1888) distinguished two types of spondylolisthesis: with and without defect in the interarticular portion. Since that time isthmic and dysplastic spondylolisthesis have been connected with a host of unsolved questions. The discussion of aetiology and pathogenesis is as controversial as the indication for conservative or surgical therapy, to say nothing of surgical strategies of stabilisation with and without repositioning.
The development of the isthmic defect is not yet settled. Whereas, so far, pre-existing dysplasias of the vertebral arch have been assumed as the main causes, studies by Niethard (1997) suggest that the dysplasia and the interruption of the interarticular portion

are also the consequence of disturbed spinal growth, such as spina bifida occulta, which can be observed in approximately 50% of the spondylolisthesis cases. The mechanical aspect of the development of lysis is also of great importance. Sports with increased axial strain as well as hyperextension and rotation of the lumbar spine can loosen pathologic-anatomical inactive pseudarthroses in the interarticular portions of the vertebral arch or they can lead to spondylolyses due to recurring micro traumata during the growth phase (Engelhardt et al, 1997).

Spondylolisthesis can also result from degenerative changes with segment instability. In this case no osseous defect of the interarticular portion can be detected. In the wake of an intervertebral disc degeneration, shear movements increase within the segment. The increased mechanical strain causes major alterations on the vertebral joints, so that the joints can no longer absorb the anterior shear forces (Sammut and Searle-Barnes, 2000).

As patients with spondylolisthesis keep presenting themselves in the osteopathic practice, I have set myself the goal to give an overview of the existing knowledge, to explain my osteopathic approach and to test it by means of a study of the subjective modifications of pain and the quality of life of patients having undergone either traditional orthopaedic treatment or osteopathic treatment.

1.1 Frequency

Spondylolyses cannot be detected in very young children. The defect first occurs during the first years of life, and reaches the frequency of the adult population with children aged 6 to 7 years. This frequency is dependent on the people: In case of Central Europeans it is 5 – 7% for men and 2 – 3% for women, in case of Japanese it is 7 – 10%, in case of Lapplanders 13% and in case of Inuit 25 - 45%, but, often, spondylolyses can be detected within the same individual at several levels.

Most often, the spondylolysis is found at L5/S1 (93 – 98% of all cases), but it can also occur at L4/5, L3/4 or cranially of that position (Jeanneret, 2001).

1.2 Classification

The classification of spondylolisthesis according to Wiltse (1976) is very common.

Type I: dysplastic

Type II: isthmic: lesion of the pars interarticularis

-Subtype a: lytic (spondylolysis)

-Subtype b: elongation without lysis

-Subtype c: fracture of the pars interarticularis

Type III: traumatic

Type IV: degenerative

Type V: pathologic

Type VI: post-surgical (was added by the authors in 1989)

Whereas this classification is not beyond contention, the subdivison of spondylolisthesis in grade I - IV according to Meyerding (1932) is generally accepted.

Grade I: slip in dorsal third

Grade II: slip in middle third

Grade III: slip in ventral third

Grade IV: spondyloptosis

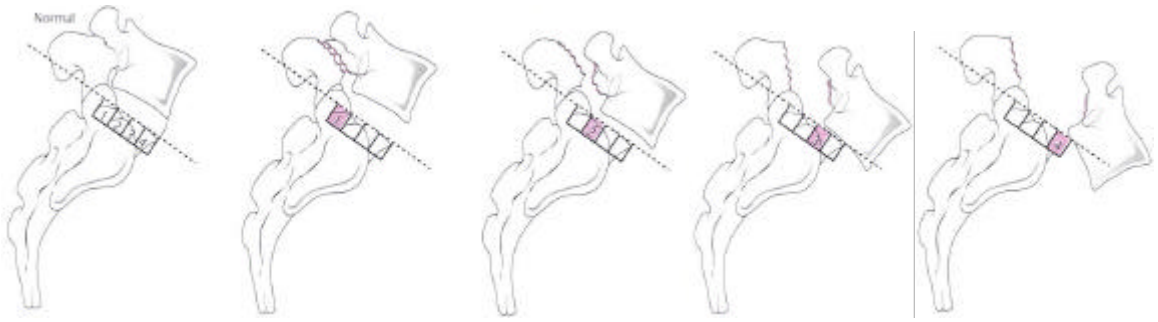

Figure 2: Classification of spondylolisthesis in four stages according to Mayerding

1.3 Symptoms

Discomfort often occurs spontaneously, but can also be connected with sports or a trauma. Most often it is a matter of dull back pain, pain in the buttock and sciatica, occasionally muscular tensions of the erector muscle of spine as well as the hamstring muscles. In case of strain the discomfort increases. Real radicular pain is rare.
In case of low grade slipping the patient's posture and gait pattern are usually normal. There is tenderness to pressure around the spinous process and in most cases one can palpate a step in the row of spinous processes. The mobility of the lumbar spine is free or restricted because of pain and muscle tension. The majority of patients have normal motor functions, muscular intrinsic reflexes and skin sensation in the lower extremity.
In case of a high grade slip (over 50%), typical postural alterations can be observed: The pelvis is retroverted and the sacrum is steeply erect. There is a lumbosacral kyphosis as well as a compensatory hyperlordosis of the lumbar spine that can reach up to the thoracic spine, frequently combined with a secondary scoliosis. Standing upright, the patient is not able to fully stretch the knee and hip joint. The gait pattern reminds one of a tightrope walker. The ischiocrural muscles are extremely tense (hip joint ankylosis). Gait disturbances, paraesthesias, motor pareses or cauda-equina-symptoms can occur. However, there is no direct connection between the seriousness of the subjective and objective symptoms and the extent of the slip. Surprisingly, even in case of a severe slip neurological deficits are relatively rare, and, despite obvious postural alterations, many patients have little discomfort from their subjective point of view (Schlenzka, 1997).
As detecting a spondylolysis or spondylolisthesis is frequently an incidental radiological finding, the cause of the discomfort should not be automatically deduced from that, especially if the patient is more than 40 years old and for the first time complains about back pain or pain in the leg (Sammut, 2000).

1.4 Economic impact of back pain

In the industrialised countries back pain reaches a prevalence of 70%, i.e. epidemic proportions (Winkelmüller, 2001). Back pain is a major clinical and public health problem. It is the most common cause of disability among younger adults. The costs of back problems are huge. In part they are due to the direct costs of medical care but in addition many disabled workers receive disability benefits. A major element is the loss of production.

Epidemiological studies show that a previous history of pain problems, lower social class, prevalence of psychological distress, dissatisfaction with work, marriage and increasing numbers of children increase the risk of back pain. Surprisingly, this increase was similar or if anything greater in males than females. It therefore appears that of back pain is not so much associated with the actual pregnancy or any procedures associated with it but rather to child rearing and perhaps due to increased lifting or carrying or increased psychological stress (Ehrlich and Khaltaev, 1999). Many studies show that non-biological causes such as social pressure and other psycho-social problems are the most common causes, or that they have a tremendous impact on a course that is usually unproblematic. Most of the persons affected can take up physical activity after a few days, 90% are active after one month, and only 5% remain permanently unfit for work (Bigos et al, 2001).

2 Basics

2.1 The lumbar spine

Bones:

The lumbar spine consists of 5 vertebrae, whose size increases evenly from L1 to L5. Together with the sacrum and the pelvic girdle it constitutes the foundation of the spine (axial organ) and bears the weight of the upper part of the body.

The erect gait leads to the formation of lumbar lordosis and to the angulation of the lumbar spine against the sacrum (promontory).

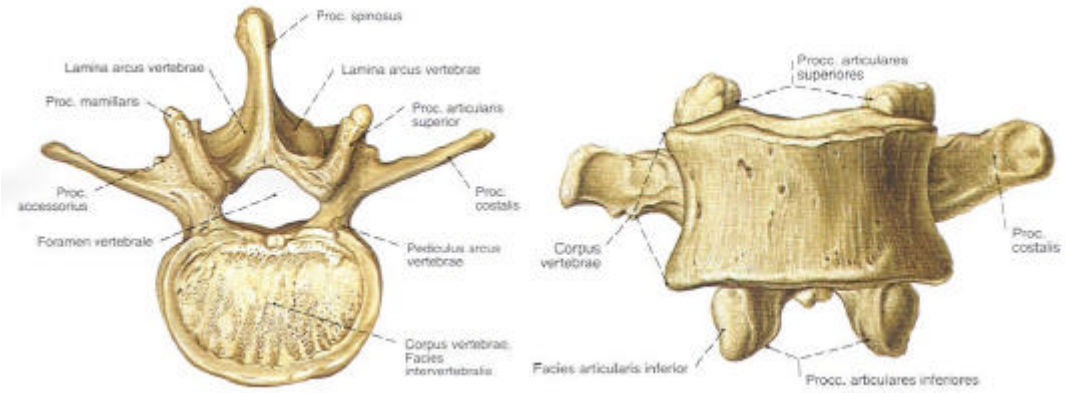

Figure 3: Fourth lumbar vertebra cranial view/ ventral view

The lumbar vertebral body (cf. Figure 3) is shaped like a kidney and noticeably wider than high. The pedicles form the upper and lower border of the intervertebral foramina. The laminae merge into the strong spinous process. The chondrified articular surface of the superior articular process points to the medial and slightly dorsal plane. The articular surface of the inferior articular process points to the lateral and slightly to the ventral plane. The isthmus is defined as that point of the lamina, where the lower and the upper articular process meet. This is the weak point, where, in case of spondylolisthesis, the continuity of the vertebral arch is interrupted. The costal processes are rib rudiments, the accessory processes correspond to the transverse processes of the thoracic vertebrae.

The vertebral foramen is formed by the vertebral body and vertebral arch and is shaped like an equilateral triangle.

Special features of the fifth lumbar vertebra:

The vertebral body of L5 is ventrally considerably higher than dorsally. The distance between the lower articular processes is wider than with the other lumbar vertebrae and their alignment approaches the frontal plane (parallel to the alignment of the superior articular processes of the sacrum).

Ligaments:

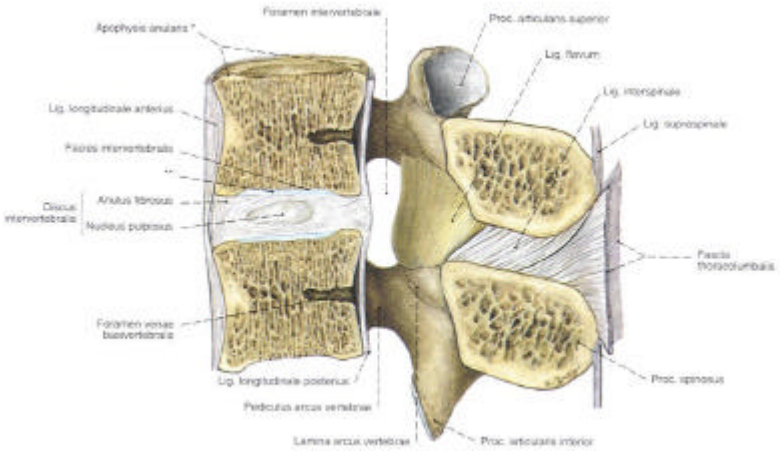

Figure 4: Ligaments of a lumbar segment

The anterior longitudinal ligament (cf. Figure 4) reaches from the occiput to the sacrum and is in constant connection with the vertebral bodies, but not with the intervertebral discs. The posterior longitudinal ligament runs parallel to it on the back side of the vertebral body, and, conversely, it is connected with the intervertebral discs, but not with the vertebral bodies. These interspaces contain the internal vertebral venous plexus (cf. Figure 7). The subflaval ligaments connect the laminae and close the vertebral canal towards dorsal. They are extraordinarily elastic. The facet joints are surrounded by anterior and posterior capsular reinforcing ligaments. The vertebral processes are connected with the interspinal, supraspinal and intertransverse ligaments.

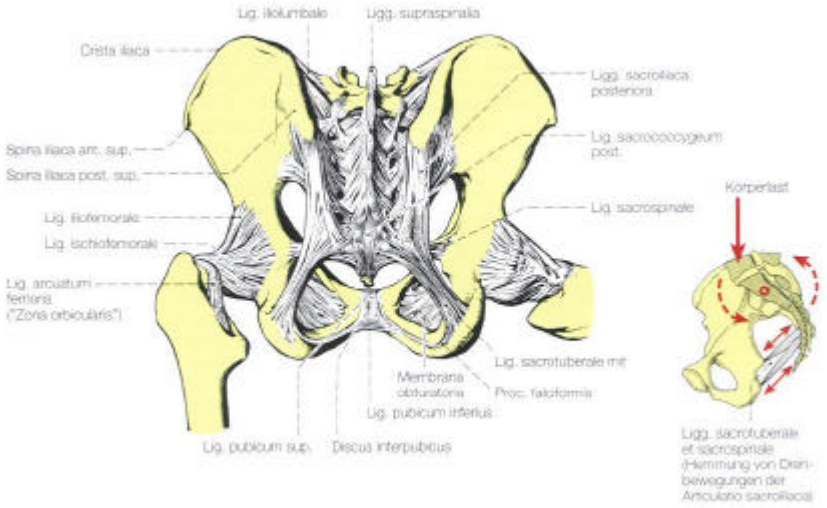

Figure 5: Dorsal view of pelvis ligaments, lumbo-sacral-shear

The iliolumbar ligaments (cf. Figure 5) connect L4 and L5 with the iliac crest. Together with the iliosacral ligaments and the sacrospinous and sacrotuberous ligaments they form the reins for the lumbo-sacral-shear, which is the shock absorber system of the pelvis.

Muscles:

The intrinsic back muscles that lie dorsally and close to the vertebral column divide into a deep, medial strand (interspinal muscles, intertransverse muscles, multifidus muscle) and a superficial, lateral strand, which is formed by the iliocostal muscle in the lumbar spine. The quadratus lumborum muscle is located anterior or lateral to the vertebral column and in front of it is the psoas major muscle. Both interlace superiorly with the medial crus and lateral crus of the diaphragm. On its lateral and anterior margins the dome-shaped diaphragm continues into the transverse muscle of abdomen. The external oblique muscle of abdomen, internal oblique muscle of abdomen and the rectus abdominis muscle are also of importance for the stability and mobility of the lumbar spine. The inferior border of the sacrovertebral area is formed by the pelvic floor consisting of the pelvic diaphragm (levator ani muscle, coccygeus muscle) and the urogenital diaphragm (superficial transverse muscle of perineum and profundus muscle).

Vertebral canal:

The vertebral canal protects the spinal cord and is lined by the meninges (cf. Figure 6). They absorb tensile forces and protect the spinal nerves and spinal cord from overextension. The pia mater is a thin layer with numerous blood vessels that lies directly on the spinal cord. It is on the pia mater that a fluid compartment borders, in which cerebrospinal fluid (CSF) flows. On the outer side two tightly packed adjacent layers confine the fluid compartment or sub arachnoid space. The arachnoid mater, a strong tense structure is attached to the pia by numerous, small collagen fibres outside of it, the dura mater, a very strong and tension-proof structure. Ventrally, the dura mater is attached to the vertebral bodies by means of fine dural ligaments, the so-called Hoffmann-ligaments. The space between dura mater and the vertebrae contains fat cells, blood vessels and lymphatic vessels and allows shifts of the dura mater with regard to the osseous cover. Dorsally the dura mater is attached to the vertebral arch by means of a long dorsomedial septum.

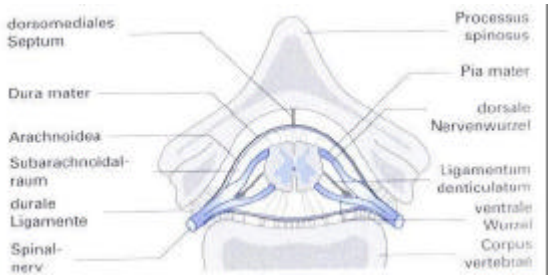

Figure 6: In the vertebral canal the spinal cord is encased in the meninges. They, in turn, are attached to the vertebrae by means of ligaments.

Bending and stretching of the vertebral column cause tension in the tension-proof dural sac, whereas the vulnerable neural structures hang safely in the fluid bath of the CSF. The paired denticulate ligaments pass as lateral pial extensions and hold the spinal cord in a fixed position centrally by attaching to the dura. It runs from cervical to the middle of the lumbar spine and connects pia layer and dura. At the skull the dura is attached to the foramen magnum. At the caudal end it is attached to the coccyx by means of the elastic

external filum terminale. Since this terminal filament is more elastic than the spinal cord, it can absorb tensile stress (de Morree, 2001).

2.2 The vertebral segment

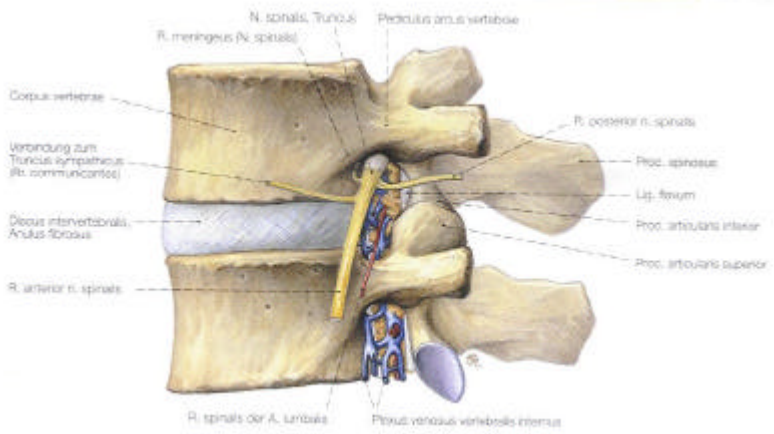

Figure 7: Lumbar vertebral segment

A vertebral segment (cf. Figure 7) consists of two bordering vertebrae and the structures in between and forms a functional unit. The vertebral bodies have a predominantly static function, while the vertebral joints have a more dynamic function for the mobility of the trunk. The vertebral joints define form and direction of a movement, but the vertebral bodies with the intervertebral discs determine the extent of motion. The ligaments and facet joint capsules limit mobility passively, whereas the deep and superficial muscular layers maintain the active fine adjustment of the posture segmentally but also in the whole body.

2.3 Embryology

The third week is the beginning of a six-week period, during which the embryonic disc, formed in the course of the second week, quickly develops into the embryo. In the growing embryo fundamental changes happen by transforming the diploblastic into the triploblastic

embryonic disc (gastrulation). This is the start of embryogenesis. Gastrulation begins at the end of the first week with the appearance of the entoderm. In the second week it continues with the formation of the ectoderm and ends during the third week by forming the intraembryonic mesoderm through the primitive streak (cf. Figure 8: primitive groove and primitive node). The embryonic ectoderm forms the skin, the nervous system, the sensory epithelial tissues of eye, ear and nose and the dental enamel. The embryonic entoderm develops the lining of the digestive and the respiratory tract. The embryonic mesoderm becomes muscle tissue, connective tissue, bones and blood vessels (Moore, 1996).

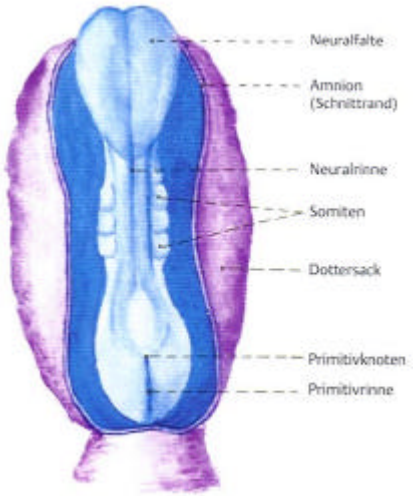

Figure 8: Dorsal view of a human embryo with three somite pairs (ca. 20th day). The amnion that encloses the embryo dorsally has been removed and allows for a view into the amniotic cavity. Caudally the connecting stalk (schematic)

The embryo has got a primitive axial skeleton, the chorda dorsalis (cf. Figure 9), an elongated pipe, which is located ventrally to the neural tube. At the end of the third week the first somite pair emerges directly caudally of the cranial end of the chorda dorsalis. The following pairs develop in a craniocaudal sequence. The somites (cf. Figure 8) form distinctly visible elevations of the embryo's surface and are approximately triangular on transversal sections. They contain the cellular material for the vertebral column (sclerotome), for the entire striated trunk musculature and the extremities (myotome) as

well as for the subcutaneous tissue (dermatome). They are embryonic organs that temporarily develop in the embryo and dissolve without cellular differentiation. The disintegration of the somites begins with the migration of the sclerotome cells towards the chorda in order to form the bud for the vertebral column there.

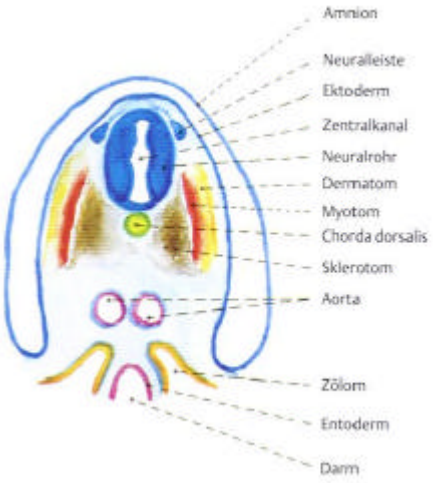

Figure 9: Cross section of a young human embryo (semi-schematic). The somites differentiate into dermatome, myotome and sclerotome. The aortic bud is still paired.

The definitive segment structure is orientated towards the osseous vertebrae. A vertebral body develops by fusing the cranial and the caudal half of two somites (cf. Figure 10). This is due to functional reasons, because, thus, the myotome spans the intervertebral disc and enables the movement of the vertebral column. The reorganization of the body axis is called resegmentation (Drews, 1993).

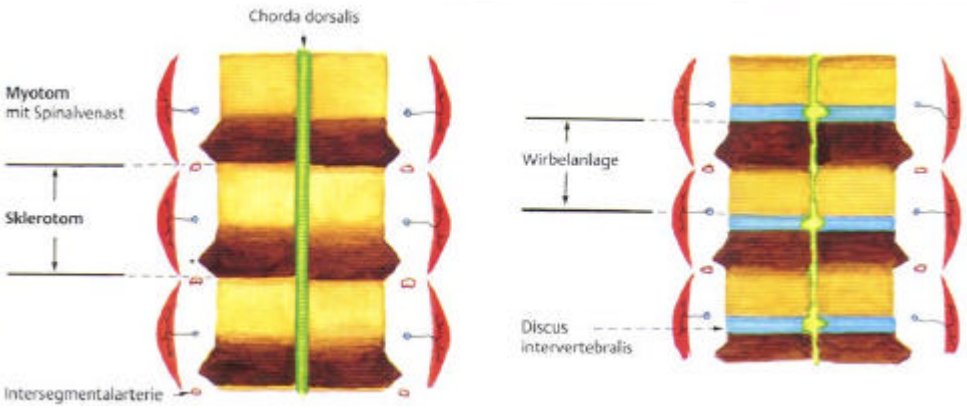

Figure 10: Highly schematic overview of the resegmentation within the sclerotomes with formation of the vertebral buds and of the intervertebral discs.

First, the myotome plates of the somites are orientated towards the solid epithelial structure of the dermatome (cf. Figure 10 left). The resegmentation begins with the reorientation of the muscle plates from the dermatome to the muscular processes of the vertebral buds (cf. Figure 10 right). The segmental muscle plates of the myotomes span the joints, which function as intervertebral discs. The dense caudal sclerotome segment gives rise to the intervertebral disc as well as to the vertebral arch, the transverse processes and the ribs of the caudal vertebra. The cranial sclerotome segment gives rise to the caudal section of the cranial vertebral body. The muscle fibres originate from the transverse processes and vertebral arches of the vertebral column.

After the disintegration of the sclerotomes, the sclerotome cells that migrated ventrally to the chorda constitute a uniform tissue column around the chorda. Then the disc-shaped compressions for the intervertebral discs appear, in which one part of the chorda remains as the gelatinous nucleus (nucleus pulposus). The material between the discs, initially appearing to be more loosely structured and hypocellular, is transformed into hyaline cartilage. At this stage the buds of the vertebrae, the neural arches of vertebra, which are still open, the transverse processes and the ribs form a connected structure consisting of hyaline cartilage (cf. Figure 11). The foramina for the spinal nerves remain free and are located at the level of the intervertebral discs.

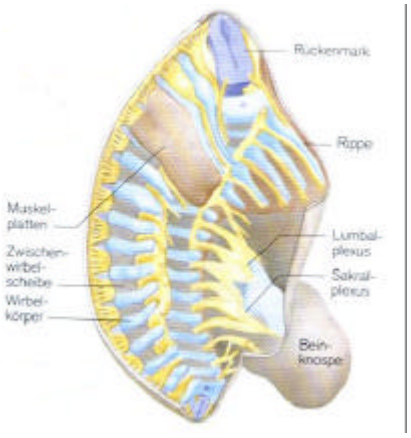

Figure 11: Human vertebral column in stage 16 (8-11 mm), 37-42 days). The striated musculature from the myotomes fuses into the lengthways oriented fibre bundles of the back muscles, which insert cranially on the cartilaginous bud of the os occipital. In the lower limb bud only the femur is chondroitically sketched.

The subdivision into vertebrae and ribs possibly happens under functional strain and has finally ended only after the endochondral ossification. The first ossification centres appear in the 12th week of pregnancy. The lumbar vertebrae develop as all vertebrae from three properly vertebral ossification points, one in the vertebral body and one in the left and right lamina respectively. The osseous halves of the arch start to join in the first year, while the fusion of arches and bodies starts between the age of 3 and 6. The rib buds give rise to the costal processes. The development of the sacrum also follows this scheme, but in the area of the transverse lines of sacrum an osseous fusion of the marginal ridges with the intervertebral discs takes place. The ossification of the individual sacral segments goes on until the age of 25 (Kahle et al, 1986).

2.4 Biomechanics

The intervertebral discs and the posterior elements, including the facet joints and the spinal ligaments, all play a significant role in stabilizing the spinal motion segment. Although the intervertebral disc determines the extent of movement between the vertebral bodies, the facet joints determine the direction of movement. The facet joints also are essential in resisting anterior translatory motion between two adjacent vertebral bodies. The ligamentum flavum is prestressed, due to its high content of elastin and compresses the two adjacent vertebral bodies and their posterior elements against each other. A pars interarticularis defect significantly reduces the role of the posterior elements in stabilizing the spinal motion segment. Gravity acting on the torso above the slip level, activity of the truncal muscles and forces generated during motion are the forces generating the shear forces to the superior vertebra. As long as the disc retains its normal biochemical and biomechanical properties, the spinal motion segment will remain stable (Floman, 1993). The structure of the disc is shaped in such a manner that it not only absorbs compression forces on the ventral vertebral column, but also compensates for shear forces and torsional forces, especially by means of the structure of annulus fibrosus. In the long term,

these passive compensation mechanisms can compensate for the shear forces, only if they are actively supported by the tension band wiring system of the dorsal muscle groups. In combination with that the dorsal ligaments act, which also have an important function with regard to the compensation of shear forces (cf. Figure 12) (Metz-Stavenhagen et al, 1997).

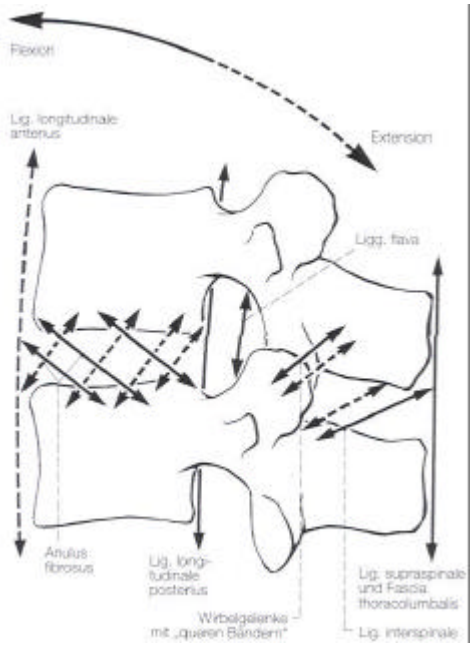

Figure 12: Guidance of movement in the motion segments of the lumbar spine. In the lumbar spine all ligaments are solidly formed. Apart from the anterior longitudinal ligament and apart from the subflaval ligaments, they are aligned obliquely or diagonally to the longitudinal axis of the vertebral column. Thus, they are able to slow down motions passively and effectively. Additional guidance is provided by the autochthonous muscles, which are embedded in an osteofibrous tube.

Although the ligament apparatus in the area of lumbosacral transition is especially reinforced (iliolumbar ligaments, sacroiliac ligaments) and the articular surfaces of the lumbosacral joints take on an almost frontal position, the fifth lumbar vertebra has a tendency to slip on the sloping plane of the sacrum (the inclination of the sacral plateau to the horizontal is approx. 32°). In case of patients with spondylolysis this angle is often much higher and can reach up to 60°. The iliolumbar ligaments develop during the first ten years of life as a result of the verticalisation. They serve as origin for the quadratus lumborum muscle. Furthermore, the psoas major muscle, the muscles of abdomen, the

autochthonous back muscles, the great hip muscles and the thoracolumbar fascia are of great importance for the dynamic stabilisation of pelvis and lumbar spine. The thoracolumbar fascia forms a passive extension system, which acts through flexion movements of the vertebral column, through the pull of the laterally attached muscles (transversus abdominis muscle), through the increased pressure in the muscle compartments of the erector spinae muscle and through the intraabdominal pressure. It continues in the fasciae of the buttocks, of the latissimus dorsi muscle and in the sacrotuberous and sacrospinal ligaments, and, thereby, establishes a connection to the tensions of the extremities here (Klein, 1995). 80% of the axial compression forces that act on the lower lumbar spine segments are compensated by the ventral section of the lower lumbar vertebral column and only 20% of the axial compression forces act as shear forces on the dorsal facet joints and ligaments.

Pathological movement patterns are dependent on degenerations or defects in these structures and are reinforced by pathological changes in the anterior sections of the vertebral column (Kahle, 1986).

Studies about the actual range of motion in the listhesis segment did not reveal any clear results.

2.5 Weak points

The lower lumbar spine segments, especially the lumbosacral transition, are weak points within the vertebral column's stability. The segment L4/5 is the most flexible. The slope of the sacrum plateau determines the tendency of L5 to slip down and towards the front. Anatomical variants (inclination of the sacrum) additionally favour the pathological shear forces (cf. Figure 13). Due to the special anatomic localisation within the lumbosacral transition, biomechanical alterations in one segment can cause an imbalance and structural changes of the entire axial organ and of the pelvis. If the sacrum is verticalised, the pelvis retroverts and the hip joints shift to the anterior. This reinforces the anterior

shear force on L5 and, thus, the slippage (Kahle, 1986). In case of degenerative spondylolisthesis the increase of the shear forces is primarily due to the degeneration of the disc. Even without interruption of the interarticular portion the permanent instability overstrains the posterior structures. The result is degeneration of the facets and elongation of the ligaments with a consecutive ventral shift, increase of the shear forces and development of a segment kyphosis, which leads to a vicious circle.

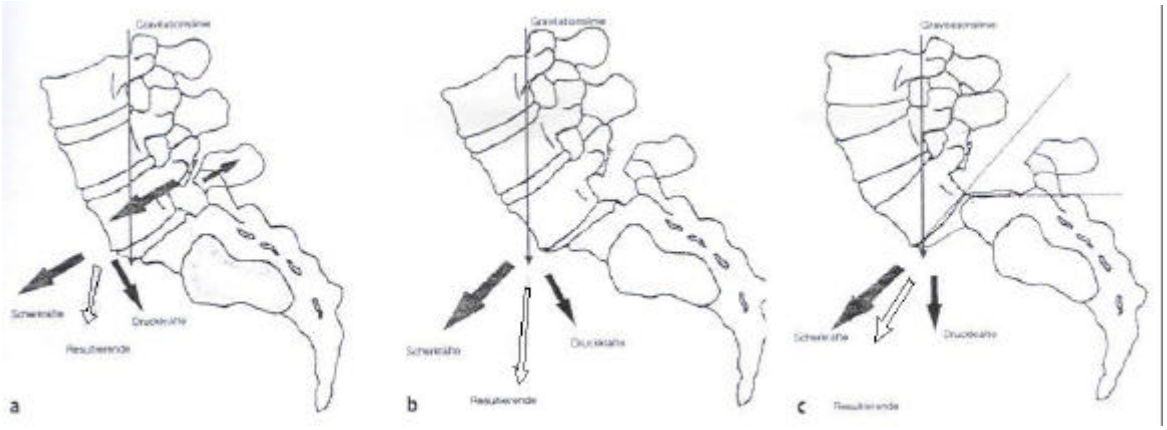

Figure 13: Changes of the shear forces during the progression of spondylolisthesis

So far only the antelisthesis has been treated. A comparative study among patients with retrolisthesis, degenerative spondylolisthesis and without signs of vertebral shifts. The orientation of facet joints in segments with retrolisthesis was not different from segments without shifts, whereas the facet joints in patients with were oriented more sagittally. The overall lordosis of the lumbar spine and the endplate inclination were considerably reduced in patients with retrolisthesis. Disc height was comparable in retrolisthesis and degenerative spondylolisthesis, but was reduced compared to segments without shifts. Retrolisthesis is correlated with a reduction of lumbar lordosis, endplate inclination and segmental height (Berlemann et al, 1999).

A segment's axis of movement should be near the nucleus pulposus, otherwise all lever arms change, which results in a considerable influence on its function (Floman, 1993). Sakamaki et al (2002) found in their radiologic study of 10-18 year-old paediatric patients

that the instantaneous axis of L4/5 and L5/S1 is located in the disc space or in the caudal vertebral body in patients without spondylolisthesis. In an early stage defect (spondylolisthesis at L5) the axis of rotation of L5/S1 stays in the caudal vertebra, whereas it is located in the cranial vertebra in most of the progressive stage patients. The instantaneous axis of rotation of L4/5 is not located in the cranial vertebra of any patients. A significant correlation between the degree of wedging and the cranial deviation of the instantaneous axis of rotation was demonstrated.

So far the actual movement within the listhesis segment and its cause have been controversially discussed: Penning and Blickman (1980) described the condition of spondylolisthesis as a result of hypermobility of the intervertebral disc. The presence of instability suggests that these subjects will present with abnormally large movements. Pearcy and Shepherd´s biplanar radiography study (1985) showed that this was not the case, as intersegmental motion was observed to be less than in normal subjects. This restriction in range of motion in subjects with spondylolisthesis was attributed to the effects of ligament tension and protective muscle spasm preventing the slip from progressing as a result of motion. This muscle action was postulated to be related to the patient´s symptoms as opposed to the patient´s pathology. This is in contrast to a more recent study by Mc.Gregor et al (1997), which observed that the gross motion of the lumbar spine in subjects with a spondylolisthesis was greater than in the normal population. In all of these studies, however, the degree and type of spondylolisthesis were not taken into account. The results of a further study by McGregor et al (2001) showed that subjects with an actual slip tended to be hypomobile whereas subjects with a defect only and no slip tended to present with a spinal hypermobility. Little differences were seen between types of spondylolisthesis in that all presented with a trend towards hypomobility, apart from the isthmic group. These findings are in contrast to those of Wood et al (1994), who suggested that the type of spondylolisthesis does not influence the motion characteristics. Dick and Elke (1997) proposed that the deformity in spondylolisthesis

consists of two components: the parallel anterocaudal slip of the sponylolisthetic vertebra, and its tilt into kyphotic malposition. The anterocaudal slippage is compensated for by generating an increase in the lumbar lordosis, whereas the kyphotic deformity has a high impact on trunk imbalance and the sagittal profile. In severe cases it is compensated by hyperlordosis of the lumbar spine, verticalization of the sacrum generated by contracture of the hamstrings and rotation of the pelvis about the hip.

All these studies have been limited to gross movements of the lumbar spine. Studies to date have been limited by current technologies.....

A recently published MRI-study by McGregor et al (2002) showed that there are no segmental mobility differences, in terms of angular and translational motion between the subjects with spondylolisthesis and those with no history of low back pain and that a spondylolytic defect does not lead to detectable instability or hypermobility in the lumbar spine.

3 Conventional therapeutic approaches

On one hand, the aim of treatment is pain relief and, thereby, to improve the patient's quality of life, on the other hand it is to maintain or regain the fitness for work. The treatment always depends on the extent of discomfort. If the discomfort is comparatively minor and if the patients can cope with their pain, the treatment will be conservative according to the symptoms. If the patient is disabled by his or her discomfort despite conservative treatment, operative treatment must be considered.

3.1 Diagnostics

As it is generally the case with the symptoms of back pain, there is a considerable lack of clarity with regard to the diagnostic delimitation.

Causes of back pain		
Mechanical (Back/ Leg) 97%	**Non-mechanical (~1%)**	**Visceral (2%)**
Non-specific lumbago (70%), static, functional, muscular **Degenerative processes** on intervertebral discs and facets, due to age (10%) **Compression fracture in case of osteoporosis** (4%) **Herniation of intervertebral disc** (4%), radicular pain **Spinal stenosis** (3%), radicular pain **Spondylolisthesis** (2%) **Traumatic fracture** (<1%) **Congenital causes** (<1%) Severe kyphosis Severe scoliosis Transitional vertebra **Spondylolysis** **Discogenic pain** (anulus fissure) **Instability**	**Neoplasia** (0.7%) Multiple myeloma Metastases Lymphoma and leukaemia Tumours of the spinal cord Retroperitoneal tumours Primary vertebral tumours **Infection** (0.01%) Osteomyelitis Discitis Paraspinal abscess Epidural abscess Herpes zoster Rheumatic arthritis (0,3%) Bechterew's disease Psoriasis arthritis Reiter's syndrome Intestinal inflammation Scheuermann's disease Paget's disease	**Pelvis** Prostatitis Endometriosis **Kidney** Nephrolithiasis Pyelonephritis Perinephritic abscess **Aortic aneurysm** **Gastrointestinal** Pancreatitis / Ca. Cholecystitis Penetrating ulcer

Table 1: The terms spondylolysis, discogenic pain and segmental instability represent clinical pictures or concepts that, according to the current state of the art, have to be located in the no man's land between specific diseases and non-specific back pain. (Deyo and Weinstein, 2001)

Normally, specific diseases can be sufficiently securely clarified by means of the current diagnostic procedures, particularly imaging studies. Only a small percentage of patients with back pain suffer from severe diseases with an unfavourable prognosis (cf. Table 1). The examples of spondylolistheses show clearly how difficult the diagnostic delimitation is. There are various possible degrees between high-level and minimum spondylolistheses. In the case of juvenile patients with progressive spondylolisthesis of the 3rd and 4th grade there is broad consensus on the correlation between pain and structural disturbance of the vertebral column and an indication for operative repair.

The extent of the spondylolisthesis is verified on the conventional lateral radiograph of the lumbar spine (cf. Figure 15). Oblique projections often present the lysis better (collar, cf. Figure 14).

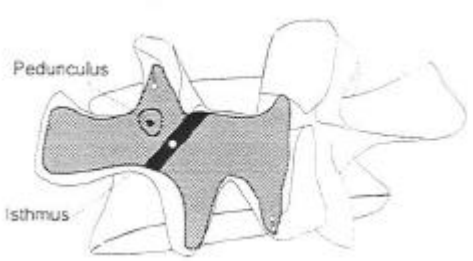

Figure 14: Schematic of the "little dog" with "collar" in the case of an isthmus rupture

Functional radiographs of the lumbar spine in maximum inclination and reclination can give an indication of the stability of the motion segment. Compared to magnetic resonance imaging (MRI), the significance of the computer tomography (CT) is minor. Although the spondylolysis is clearly visible in a CT-scan, the nerves, the intervertebral discs as well as the other soft parts are insufficiently represented. MRI is indicated, when nerve root impairment is investigated or operative treatment is being considered. It shows the degree of hydration of the disc concerned and also the other intervertebral discs (cf. Figure 15). Furthermore, an impairment of nerve roots can be diagnosed in the spinal canal, in the lateral recess, in the foramen or outside of it (Jeanneret, 2001).

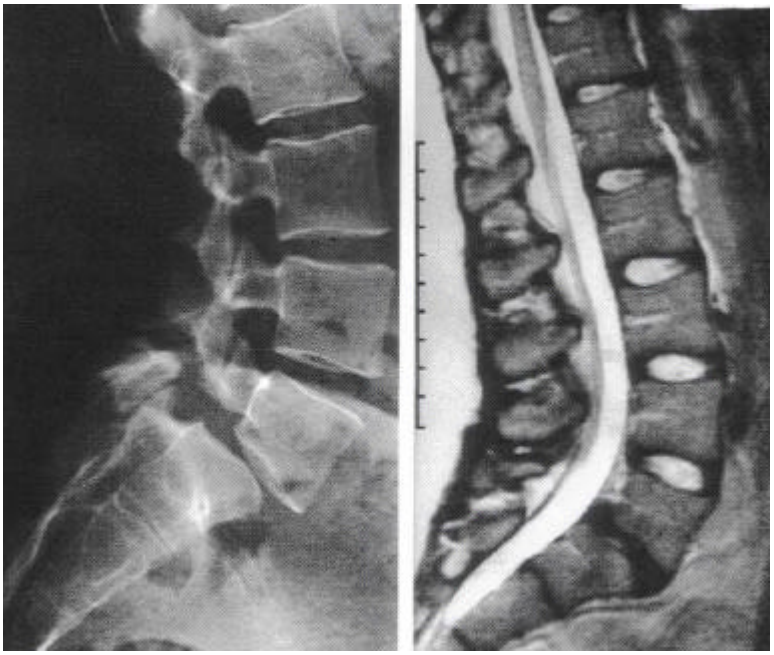

Figure 15: Lateral radiography of a spondylolysis with a listhesis grade I-II according to Mayerding in a 15 year old girl (left). In the T2-weighted MRI, the intervertebral disc L5/S1 shows degenerative alterations and deformations: It is dehydrated (dark) and shows a dorsal protrusion. The other intervertebral discs show normal signal intensities (bright) and normal hydration (right).

3.2 Conservative approaches

The short-term aim is to alleviate acute pain. To achieve this, pain killers, and antalgesic physiotherapeutic measures such as massages, heat, electrotherapy etc. are used. It is particularly important to allow the painful sections of the vertebral column to rest, by temporarily refraining from sports and all painful activities. In case of severe pain the lumbar spine is temporarily immobilized by means of a lumbar corselette.

3.3 Surgical approaches

An indication for an operation is given, only if pain persists in spite of conservative therapy, if there are neurological blackouts, and if different examinations indicate that the patient will benefit from a fusion, because the listhesis causes the pain. It is not sufficient to remove the instability by means of a fusion, but a three-dimensional (3D) correction also has to be performed and the physiological statics of the motion segment has to be completely reconstituted by neutralising the axial compression and the lumbosacral shear forces. From a biomechanical point of view this means: Through repositioning, the pathologically altered lever arm is reduced and the axial force vector is brought into the physiological position. The pathological dorsal tension band wiring is normalised. The shear forces acting on the adjacent segments are transferred into a physiological range, so that the ratio of 80% (axial force) to 20% (normalisation of the shear forces) is reconstituted by means of dorsal instrumentation and spondylodesis. This can prevent secondary alterations, which are due to the pathological biomechanics in the adjacent segments of the cranial vertebral column and in the pelvic area. In order to permanently neutralize the, yet again physiologically acting, axial forces, the ventral instability must also be removed in the area of the degenerated disc. The intervertebral space is refilled and fused.

Common methods:
Non-instrumented, posterior spondylodesis techniques (fusion in situ) can relieve the painful instability, but they show high rates of pseudarthrosis, even in case of long postoperative immobilization. In the case of the isolated ventral spondylodesis the majority of the axial compression forces will be absorbed, but the pathology of the dorsal parts remains, which also leads to a high rate of pseudarthrosis.

Grade I-III: The dorsoventral spondylodesis is performed by means of dorsal repositioning via transpedicular screws and replenishment of the intervertebral space with corticospongious blocks.

Grade IV: Due to the shortening of the psoas muscle and the deformation of the sacral plateau, dorsal repositioning is not possible. By removing the dorsal lamina and by means of an osteotomy of the dysplastic S1-plateau room is made for the repositioning. The repositioning of the spondylolisthesis and the reconstitution of the segment lordosis is achieved by means of repositioning devices located outside of the site and subsequent axially stable fixation via implants (Metz-Stavenhagen et al, 1997).

4 Osteopathic considerations

The current medical reflections and methods concerning spondylolisthesis strongly refer to the local circumstances and structural pathologies in the lumbar spine. In the literature there is great uncertainty concerning the cause of the syndrome which orthodox medicine commonly names lumbago. In the course of the usual diagnostic procedures, X-rays often detect a spondylolisthesis incidentally, which is then assumed to be the cause. The preceding explanations make it obvious that even high-level listheses are often asymptomatic and that the presence of a listhesis does not cause any significant pathological changes in the lumbar spine's or the segment's range of motion. Thus, the search for connections and causes has to be conducted from a holistic perspective.

4.1 The body's adaptation to gravity

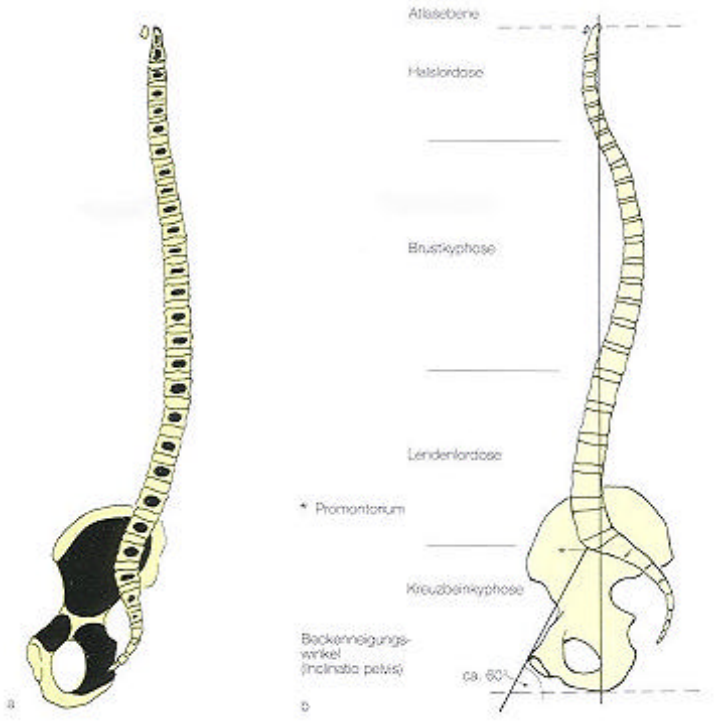

Figure 16: Development of the curvature of the vertebral column (a) median sagittal section through the vertebral column of a foetus in the 7th month of development (enlarged to the length of the adult vertebral column). The curvatures are only sketched. (b) Vertebral column of an adult with perpendicular.

The vertebral column is a structured rod, whose building blocks are the vertebrae. The S-shaped curvatures (cervical lordosis, thoracic kyphosis and lumbar lordosis) develop only after birth through the increasing influence of muscular tension and gravity (cf. Figure 16).

4.2 Biomechanics of the complete spine

Not only is the morphology of each vertebra, but also the structure of the entire vertebral column as a unit important for an understanding of the vertebral column's axial stability. The Three-Column Spine Concept (cf. Figure 17) by René Louis (1985) illustrates this point clearly.

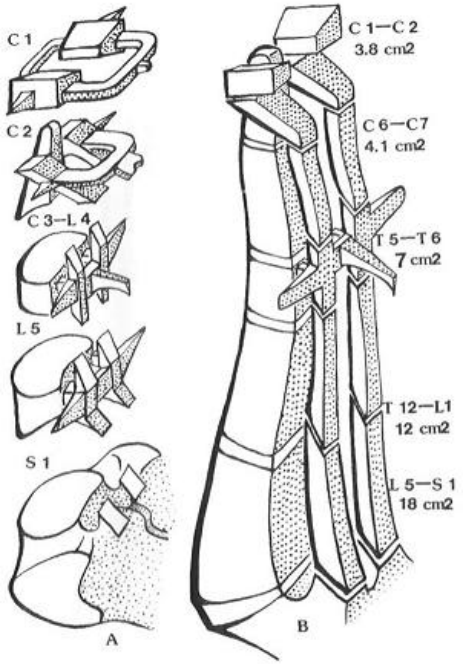

Figure 17: Illustration of morphology of vertebrae (A), and overall architecture of the spine (B), showing the vertical columns, which are two columns at the C1-C2 level and three columns form C2 to the sacrum. The total joint surface of a motion segment is increasing form the C1-C2 level to the L5-S1 segment

The ossification pattern of vertebrae supports this concept. Each column originates from a single primary ossification centre: the centrum in the vertebral body for the anterior column and the two vertebral arch centres in the laminae for the two posterior columns. The disturbance of growth leads to scoliosis, kyphosis, or hyperlordosis.

The cranium transfers its weight to the spine through the two pillars of the atlas lying in the same coronal plane. The two pillars become three columns in the body of the axis, which is thus a veritable crossroad for the transmission of the forces. The forces are then transferred down the three columns, which are arranged in a triangle, to the sacral base. When the spine is subjected to forces perpendicular to its axis, the points of weakness are located in the intervertebral motion segments. The coupling of bony stops and ligamentous brakes is stabilizing the spine.

During flexion, the bony stops or buttresses are, in the C1-C2 motion unit, the dens against the anterior arch; between C2-C3 and L5-S1 motion units, the articular processes and the anterior edge of end plates against each other. The ligamentous brakes are, in the C1-C2 motion unit, the transverse ligament, the posterior atlantoaxial membrane, and the articular capsules of the lateral atlantoaxial joints; between C2-C3 and L5-S1 motion segments, the ligamentous brakes are all the ligaments located posterior to the nucleus pulposus, i.e. the posterior part of the annulus fibrosus, the posterior longitudinal ligament, the articular capsules, the ligamenta flava and the inter- and supraspinous ligaments.

During extension the most posterior parts of the articular and spinous processes come into contact with each other and with the laminae, and the posterior margin of the end plate. The ligamentous brakes brought into play are those situated anterior to the nucleus pulposus, i.e., the anterior longitudinal ligament and the anterior part of the annulus fibrosus.

During inclination coupled with rotation, the bony stops are the articular processes, together in the cervical spine the uncinate processes and the reciprocal pseudoarticulations between the lower surface of the cervical transverse processes and the upper articular processes. In the thoracic spine lateral inclination and rotation are considerably limited by the costovertebral joints, despite the facility of such movement afforded by the circular orientation of the articular facets in this region. In the lumbar region the sagittal aspect of the facets and the lateral margin of the end plates are acting

as bony stops. The ligamentous brakes are the intervertebral ligaments of the side opposite the tilt.

Degenerative changes are likely to provoke instability but usually with morate displacement (degenerative spondylolisthesis).

M. M. Panjabi (1993) remarks in the summary of a chapter on the dysfunction of the spinal stabilizing system and its restabilization that a dysfunction of the control system may result in unbalanced activation of the muscle groups, leading to increased loads on the muscles and spinal column components. Muscle spasm is the body´s attempt at stabilizing a potentially unstable spine. Practically no experimental or biomechanical research has been done on this aspect of the stabilizing system.

4.3 Fascial connections

One fundamental function of the fasciae is to safeguard the physical and physiological integrity of the human body. Fasciae are present on all levels of the body. They are located there to protect the anatomic structures from tensile forces, stress and violence, to which the human body is constantly exposed. Fasciae are especially adaptable and differently shaped, depending on which part of the body they protect. In the body's periphery they are thicker and more robust in the zones with the greatest strain. They sheathe joints and, above all, the stabilizing ligaments are especially thick and strong. Fasciae may be tough and robust, but they are never hard and stiff. This is the case only with pathologic alterations, but even then a certain elasticity remains to meet the demands of the affected zone.

The trunk fasciae (thoracolumbar fascia, thoracoabdominal fascia) support the statics in the thoracic and abdominal region because they consist of several layers with a different alignment. They continue the superficial layer of the cervical fascia (fascia cervicalis superficialis) in the shoulder girdle. They end at the upper limit of the pelvic inlet and, then, continue in the fasciae of the lower extremities. In the median line they originate

anteriorly from the sternum and posteriorly from the spinous processes. They split up several times in order to sheathe the muscles in the thoracic and abdominal region. In the upper part of the trunk, they continue in the fasciae of the armpit and of the upper extremities. In the lower part of the trunk, they become much stronger in order to compensate for the relative lack of muscles. In the abdominal region, the fasciae pull ever deeper and unite with the *fascia transversalis*. The deepest posterior section is the *fascia iliaca*. In the pelvic area the trunk fasciae are connected with the fasciae of the perineal muscles, in particular the superficial and middle fasciae (*fascia perinei superficialis* and *fascia diaphagmatis urogenitalis*). Finally, at the front, they have a connection to the organs of the lesser pelvis and to the pelvic fascia (*fascia pelvis*) via the vesicoumbilical fascia (Paoletti, 2001).

Fasciae influence directly or indirectly the body's health via the coordination with the musculo-skeletal system, the cooperation of the circulating body fluids, and by providing extensive transitional and accompanying passages for nerves. This system of connective tissue tunics and sheaths, which is also anywhere within and between the muscles, supports the transmission of forces in the entire movement system. Disturbances within the fascial areas can be expressed by venous and lymphatic congestion, by reduced breathing, by abnormal reflexes, by a reduced extent of movement and visceral restrictions (Fossum, 2003).

4.4 The importance of the body cavities

Thorax and abdominal space, which are subdivided by the diaphragm, form the lining of the osseous axial skeleton. Disturbances and losses of mobility in this area directly influence the vertebral column. The lungs follow the movement of chest and diaphragm because of the negative pressure between parietal pleura and visceral pleura. Deficits and diseases of the lungs and bronchial tubes frequently cause a reduced vital capacity and, thereby, loss of volume in the entire thorax. To guarantee the best possible oxygen

supply, the thorax is fixed in the inspiratory position, which entails an increased tension in the cervicodorsal muscles and a thoracic-spine-kyphosis. Normally, the vertebral column compensate for this by increasing the cervical and lumbar spine-lordosis. Thereby, the local hypomobility disperses to a greater area of the body.

The digestive organs break down the food and absorb the nutrients. They have a very good blood supply and lymphatic drainage. The peritoneum as lining and cover is responsible for attaching the various abdominal organs to the body's rear wall and the diaphragm as well as for providing intraabdominal mobility. Anteriorly, the abdominal cavity is limited only by the soft abdominal muscles, so that the shape of the abdomen can vary considerably. Space has to be provided for different degrees of filling of the digestive tract and for the expansion of the uterus during pregnancy. The pelvic floor is the inferior border of the abdominal cavity. It is very common that the abdomen protrudes because of indigestion, overweight or unfavourable postural habits. In this case the abdomen pulls the lumbar spine into the hyperlordosis. Thoracic spine and cervical spine follow by reinforcing their physiological curvatures. The pelvic floor muscles lose tone, which may lead to stress incontinence, descent of the organs of the lesser pelvis and venous congestion.

The two body cavities communicate via the diaphragm. It transmits the negative pressure of the thoracic cavity to the upper gastrointestinal tract in order to reduce its weight. At the same time, through its trampolinesque rhythmic up-and-down-movement, it provides for a massage of the digestive organs and for a pumping effect on the venous and lymphatic system. Its function is to balance or transmit tension between sternum, costal arches and thoracolumbar transition and, thereby, completes the connection between thoracic inlet and pelvic floor.

4.5 Respiration

The function of the respiratory system is to provide the body with oxygen and remove carbon dioxide. The expansion of the thorax during inspiration produces a sub atmospheric pressure that makes air flow into the lungs. Then a complicated mechanism in the lungs extracts the oxygen from the inhaled ambient air, which is transported to the body's tissues. In exchange, metabolic waste products such as carbon dioxide and water vapour leave the body with the exhaled air. Breathing also maintains the acid-base-balance, which is an important prerequisite for all metabolic processes.

Inspiration is an active process that depends on strong muscles (diaphragm, external intercostal muscles). The volume expands in all directions. The volume expansion is more sagittal in the upper thoracic spine, and more frontal in the lower thoracic spine. The sternum moves towards anterior superior and is, at the same time, somewhat verticalised.

Expiration is mainly passively conditioned due to the retraction tendency of the lungs' parenchyma and the chest's own elasticity. During expiration particularly the cartilaginous connections between sternum and ribs that are contorted due to their form during inspiration lead the ribs back into their initial position. As soon as the inspiratory muscles stop pulling, the ribs will induce the opposite movement. During intensive breathing the expiration is supported by expiratory accessory respiratory muscles (internal intercostals muscles).

With increasing age, the thorax tends to block itself in inspiration through loss of elasticity of the lungs parenchyma and calcification of the rib cartilage. This causes irritation at the transition points of the aorta, vena cava inferior, oesophagus and the vegetative nerve cords. Due to the reduced pumping effect of the diaphragm, the lymphatic system (chyle cistern) and the venous backflow from the lower half of the body receive insufficient support. States of congestion in the thoracic inlet (scalene muscles, brachial plexus,

confluence of the ductus thoracicus and the ductus lymphaticus dexter, stellate ganglion) can also result from this.

Due to the close spatial relation of the diaphragmatic crura to the psoas major muscle and the quadratus lumborum muscle, there is a direct relation between respiratory mechanics and lumbar region. The diaphragm has visceral connections with both kidneys, liver, stomach, pancreas, duodenum, spleen and with theTreitz´s fascia. Autonomous neurogenic relations run via the celiac plexus (stomach, liver, duodenum, spleen, pancreas, and adrenal glands), the superior mesenteric ganglion (small intestine, ascending and transverse colon) and the inferior mesenteric ganglion (descending colon, sigmoid colon, and rectum). Thus, respiration is a very complex process that has considerable influence on the vitality and functionality of the entire body.

4.6 Pressure distribution and pressure diversion

The skeleton provides the body with a supporting framework, which prevents the body from collapsing into an amorphous mass of tissue through gravity.

When we run or jump, the capsules and ligaments of the vertebral column absorb a considerable part of the energy of stepping. However, it is the muscles of the legs, the hips and the back that predominantly absorb the energy of landing. The energy that is absorbed by heel contact in the muscles of the bent legs (knee extensor and calf muscles) is approx. 85%. Only 15% have to be absorbed by the structures around the vertebral column and by the discs. Landing with stretched legs and a straight back after jumping from a high wall can cause considerable traumas in the vertebral column. Static compression with heavy loads can be functionally processed by the vertebral column. Weightlifters are extreme cases in point. In the case of jerking and holding 250 kilograms, which is an extreme explosion of force in a very short time, top athletes in the highest weight classes hardly ever get hurt. They suffer myorrhexis in the extremities rather than damage in the vertebral column (de Morree, 2001).

If the pelvis is balanced the forces that act on the sacrum will be identical, which is the key element in pelvic mechanics while sitting and standing. The points of rest, i.e. ischial bones and acetabular cavities, are vertically oriented. The weight of the trunk, which the tip of the sacrum directs laterally through the pelvic arches to the femoral heads, tends to spread out the pelvic arch. However, this is counteracted by the support function of the pubic bones on the iliac bones, which are supported by the communicating muscles and ligaments in the pelvic arch. The femoral bones are further supporting pillars of the iliac bones because they put up resistance through pressure on the acetabulum. These lines of force are lines of an upwardly directed force that meet the compression forces of the body weight transmitted through the vertebral column in the pelvis. Balanced contacts in the joints affected create a steady tension of the respective ligaments and muscles, and the lines of force cancel each other out in the lumbosacral and Iliosacral joint. If muscles and ligaments are unevenly strained or if the time emitter system that controls the antagonists is disturbed, the weight will meet a construction that is not prepared for it (Todd, 2001).

The pelvis' task is to relay weight. The iliopsoas muscle and the pectineal muscle help to centre the pressure, which rises from the femur via the hip joints, on its way to the iliosacral joints and to the lumbar vertebrae. On the other side, the obturator muscles and the piriformis muscle shift the pressure to the front and away from the centre and sacrum. These muscular actions have to be commensurate and antidromic in order to keep the pelvis in balance on the hip joints.

The even weight distribution on the pelvis begins at the level of L5, on which the whole weight of the trunk rests. Up to this point it was passed down almost completely by the vertebral bodies. At the fifth lumbar vertebra, the convex curvature of the lumbar spine passes into the concave curvature of the sacrum. Anteriorly, the base of L5 and the respective intervertebral disc is located distinctly deeper. The resulting tendency to slip is countered by the transverse processes and articular processes of the vertebra. The

weight runs therefore on three levels over three contact surfaces: the two facet joints and the vertebral body that enclose a strong blunt wedge, which is the basis of the sacrum. The lumbosacral joint is shaped like two pyramids that fit on each other and allow a good transmission of weight. If one watches the 5th lumbar vertebra from the side and sees its position in the curved lumbar spine, it will stand more stable than it seems. The entire vertebra is located below the iliac edges and is therefore protected from lateral pressure and pushing (Todd, 2001).

4.7 Shear forces

Unlike with four-legged animals, the influence of gravity in the human form meets the vertebral column at various angles. The soft conjunctive tissue has to compensate for this obliquely arriving impact. If the distance between breast bone and pubic bone is insufficient due to unfavourable postural habits, visceroptosis and a hollow back can result from the shear forces acting on the vertebral column (Todd, 2001).

At the articular level, movement not only causes compression forces but also shear forces along the articular surface. Due to the guidance of the joint ligaments, articular surfaces tend to slide or to glide lengthways on each other rather than roll during movement (de Morree, 2001).

4.8 Posture

To ensure that the vertebral column erects itself in its full length, the body has to be able to work in such a way that the compression forces posteriorly are in line and act with the tensile forces anteriorly (cf.Figure 18).

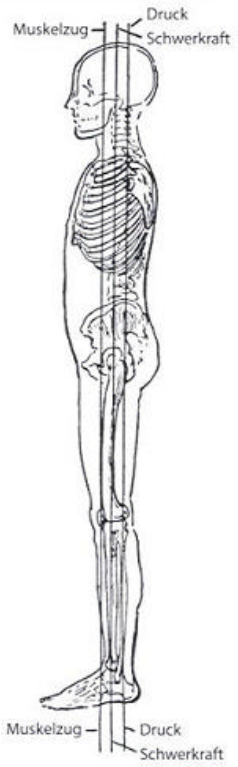

Figure 18: Axes of the forces acting on the body: (muscular) traction force, gravity and pressure

Every change of position of a body part leads to additional demands on the adjacent parts and unnecessary strain of the muscles affected.

Pelvis and thorax belong together, they constitute important parts of the protective body wall and are connected in the back via the lumbar spine. Laterally and at the front there is a connection via the abdominal muscles. The bowels are arranged in such a way that they can perform their vital functions, but are not disturbed by the outer activities of the skeletal structure. If pelvis, vertebral column and ribs with the aid of the muscles that connect them are well arranged along the vertical axis of the vertebral column, the deep vertebral column can relay in a controlled manner all the weights to the pelvis, where they get to the

femoral bones via the sacrum. The weight of the body's front side hangs on the head, cervical muscles and ribs and is diverted to and absorbed by the vertebral column via these tensile elements. This way the front body wall can keep fatigue-proof its solidity and straight lines as hanging element.

As soon as L4 and L5 tend to shift to the front, a shear strain emerges between them and the erector spinae muscle which becomes tense and pulls the sacrum to slow down the sliding load. All muscles of the body's front side should pull upwards in order to compensate for the compression forces of the vertebral column. The sagging of the pelvic bones at the front causes an increased lordosis that strains the anterior ligaments, the Iliopsoas muscles, the diaphragmatic crura as well as the anterior ligaments of the lumbosacral and Iliosacral joint. Ultimately, the sagging is passed on to the abdominal wall, and the balance between tensile and compression forces is lost (cf. Figure 19).

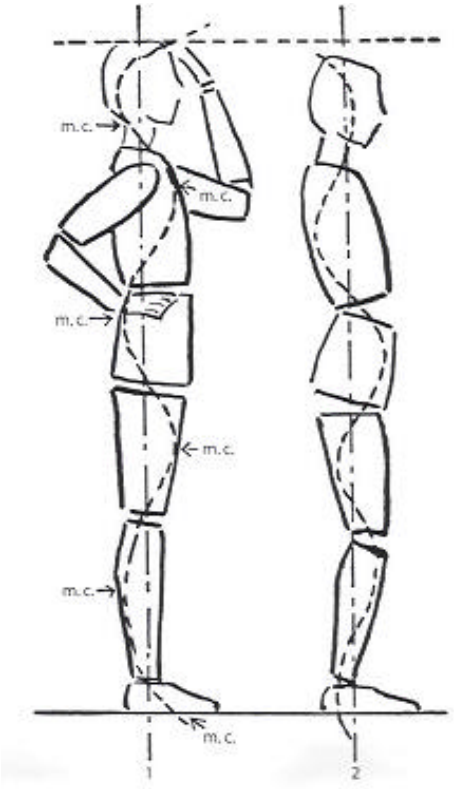

Figure 19: Compensation for gravity: 1. Muscle centres (m.c.) on both sides of the gravity line achieve a weight balance. If the skeleton moves, the muscles will create the new balance. 2. If the bones of the skeleton are not in balance over the gravity line, the muscles will have to hold the uneven weights and get into constant tension.

4.9 Posture and respiration

If the balance changes for one part of the vertebral column, this will necessitate the constant adaptation of the entire vertebral column. Lifting of the ribs and fixation of their movable parts during inspiration stretches the lumbovertebral region as much as it increases the chest. Changes in equilibrium that were caused by the muscles and ligaments of the upper vertebral column are compensated and ensure a good contact between L4, L5 and sacrum, if they are accompanied by movements of the costal joints. A lack of coordinated movement of smaller, upper body parts disturbs the lower lumbar muscles. This especially affects the function of the diaphragmatic crura and the deep-seated further respiration mechanism including the iliopsoas, transversus abdominis and levator ani muscles.

The diaphragm anchors at T12. Its spinous process is the lowest anchorage point of the trapezius muscle, the vertebral body serves as origin for the psoas major muscle. An imbalance in this area has negative effects on the vertebral column's curvatures, and changes the capacity to act of the vertebral column and the transmission of weight.

4.10 Ergonomics

When we stand or sit, we are rarely inactive. We mostly work with our hands or our eyes focus on a near activity, such as reading, computer work, drawing, looking through a microscope, etc. Such types of work, connected with mental concentration, are the consequences of our civilisation. They cause straining types of behaviour that the body tries to encounter by movements of the trunk and the legs so as not to collapse in upon itself. If these activities continue over a longer time span, the body's unconscious trials to reduce the strain (Todd, 2001) will not be sufficient any more. It is necessary to adapt the work place and the environment to the individual needs and so support the unstable postural balance from the outside.

4.11 Pain and quality of life

It is beyond contention that pain, particularly chronic pain, reduces the quality of life. Various studies investigated the interaction of quality of life and back pain. Sustained stress loads in private or professional life could be identified as relevant predictors for the first occurrence of back pain as well as for the chronicity of acute pain. Continuous or recurrent emotional distress increases the activity of the lumbar back stretcher muscles. If a depressive mood occurs together with passivity and retreat, longer inactivity can cause muscular atrophy, which very quickly becomes painful under stress. If motion-dependent, radicular pain is accompanied by fear, the corresponding motions will be easily and quickly interrupted. By way of classical conditioning, protective postures and protective movements arise, which can be triggered by lighter pain stimuli. There is typical behaviour for coping with pain. Among the pain-related cognitions, numerous studies demonstrated the unfavourable effect of subjective interpretations in terms of doom-feelings, helplessness/hopelessness and the so-called fear-avoidance-beliefs. This is closely linked to passive protection- and avoidance-behaviour (cf. Figure 20) while coping with pain. The study by Hasenbring et al (1994) suggests a differentiation into the following aspects: avoidance of physical activities and avoidance of social activities. Avoidance of physical activities occurs, if patients no longer pursue their sports activities, if they avoid specific professional activities, household chores or leisure activities. An example of extreme avoidance behaviour is, if a patient spends several hours during the day in bed. Avoidance of social activities means e. g., that a patient does not cultivate social contacts any longer, i.e. neither invites guests nor visits friends because he or she cannot sit for more than 30 minutes.

The constant avoidance of social get-togethers with other people favours and reinforces a depressive mood, because apart from short-term anxiety and conflict reduction a long-term loss of booster develops, i.e. a loss of potentially pleasant feelings, a loss of joy or

distraction, which can be triggered by being with other people. Above all avoiding of physical activities can lead via the under-use of muscles to muscular atrophy, which, due to neurophysiological sensitization processes, becomes more painful under stress (Zimmermann, 1999).

However, also the opposite, i.e. marked endurance despite severe pain leads to chronicity. Frequent repetition of pain-inducing activities stimulates processes of neuronal sensitization, which, in turn, pave the way into chronicity on the neurophysiological level (Hasenbring, 1993).

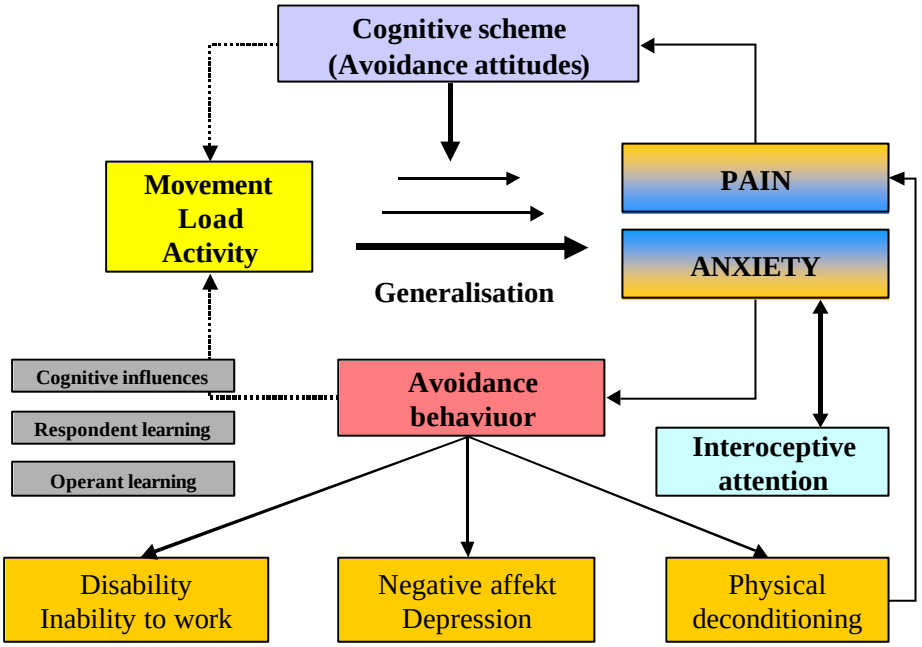

Figure 20: Cognitive -behavioural chronicity model (Pfingsten, 2000)

5 Osteopathic treatment approach

A human being's individual posture is the result of a permanent, comprehensive adaptation process to gravity, to the workplace, to traumas and other physiological and psychological stressors. The preceding chapters explained these inter-relations extensively.

The body's adaptation happens on different planes: in the sagittal plane with a change of the anterior-posterior curvatures of the vertebral column and of the posture, in the frontal plane with lateral curvatures of the vertebral column caused by specific somatic dysfunctions, by sacral obliquity, by leg length discrepancy (LLD) or scoliosis, and in the horizontal plane with rotation of body parts to each other. A present spondylolysis or spondylolisthesis is part of this system and, thus, a weak point, where adaptation processes can concentrate.

5.1 Removal of hypomobilities to relieve the listhesis segment

A spondylolytic segment facilitates increased tilting movements and shear movements in a very restricted space. Hypomobilities in other regions of the body can find an outlet there and support the problem. Subsequently, there is frequently a local form alteration of the intervertebral foramina and of the spinal canal, which can result in various non-specific states of pain.

Particularly important are the transitions of the vertebral column sections to each other and to the head, thorax, abdomen and pelvis. The cranio-cervical and the cervicothoracic transition, the thoracoabdominal region and the pelvis region (pelvis ring and lumbosacral area) constitute the connections of the vertebral column with these three body regions: head, thorax and pelvis. With each of these levels a diaphragm is associated (Teeporten,1987). The diaphragms move body fluids and air by producing pressure differences within the body cavities. The longitudinal fascial tension in the body has to be

considered with regard to tension and function of the diaphragm. The normal functions of these transversal planes are mutually dependent on their compensatory capacity in the horizontal plane, which, in turn, strongly depends on the osteoarticular system and the compensatory capacity (compliance) of the adjacent regions (Fossum, 2003). Especially the transitions between the curvatures of the vertebral column and the diaphragms must be able to move freely. In case of a hypomobility they have to be treated carefully.

5.2 Individual training of posture, movement and respiration

It is often the removal of the hypomobilities that creates the precondition for a correction of posture, because the body regains lost range of motion. An individual training of posture, movement and breathing is of utmost importance, because postural abnormalities and non-physiologic breathing and movement patterns often cause the pain and contribute to maintaining or deteriorating of discomfort through the permanent impact.

It is favourable for the course of a back pain episode, if the patients are told that the cause of their discomfort is nothing serious and that they should retain their normal activities (Malmivaara et al, 1995). Starting from the individual posture and breathing pattern, the training of a differentiated body perception can lead to a gradual change of automated unfavourable postural habits and, most importantly breathing because this is a constantly and unconsciously occurring movement. Thus the influence of gravity can be used in a positive way to train the postural and respiratory muscles during the whole day and to relieve the bone-cartilage-ligament apparatus. The aim is a balance between compression and tensile forces for all movements by means of specific training of sitting, standing, walking, getting up, lying down, lifting, carrying and breathing in the horizontal and vertical position.

It is very helpful to give the patients some basic knowledge of the anatomy and physiology of the vertebral column and respiration by demonstrating on a skeleton, so that they can better visualise the functional interplay of vertebral column, chest, diaphragm, pelvic floor,

and back and leg muscles. The importance of sleep and relaxation for the regeneration of mind and body should also be emphasized.

6 Method

6.1 Pilot study

The experience of my fellow students showed that, within the daily work in the practice, it is difficult to reach a sufficient number of candidates for osteopathic studies. After reviewing the file cards of the patients who I treated osteopathically during my years of study (1997 –2001, this corresponds to my 3rd to 6th years of training and later) I found 160 persons with the diagnosis spondylolisthesis /pseudospondylolisthesis. As the treatments and their documentation had already been closed and therefore no consistent, statistically applicable data could be used, the question of the long-term changes of the quality of life presented itself. This is a very important question for all back pain patients. As there are no reliable physiological indicators for chronic pain, we had to rely almost exclusively on the patients' experience, their behaviour and their statements for the diagnosis and measurements (Heinl, 1998).

Inclusion criteria:

Subjects aged between 20 and 70 years with the diagnosis of pseudospondylolisthesis (degenerative form) or spondylolisthesis (lysis of the isthmus). Grade I and II slippage on the scale of Mayerding will be included as well. The segments to be included will be L3/4, L4/5 and L5/S1.

All subjects included in this study received osteopathic treatment between 1997 and 2001. The time span of a course of treatment was between 1 and 5 months, with between 3 and 10 individual treatment sessions in this period.

Exclusion criteria:

- Previous lumbar spine or lower extremity surgery
- Rheumatic diseases
- Major neurological illnesses
- Serious pathologies e.g. bone neoplasm, osteoporosis…..

After the selection process the study group consisted of 48 persons.

6.2 Control group

The control group consists of patients who had the diagnosis spondylolisthesis /pseudospondylolisthesis in 2001, and received only medical therapy, such as spinal infiltrations, pain medication and lumbar support corsets. In the practice of the attending doctor, the computer selected them because of the diagnosis. After applying the exclusion criteria, 42 people out of 106 people remained in the control group.

Control group:

Patients, who were in medical (non osteopathic) therapy in the same period (spinal infiltrations, pain medication, and lumbar corselette for support)….

6.3 Study design

The basis for the study is the “Oswestry Pain Questionnaire”, which is well suited for a survey of the quality of life which is impaired by pain. This is a retrospective study. The respondents had to compare conditions of pain from different times with each other on the basis of their memory, i.e., before the start of treatment, after the end of treatment and at the time of survey. These data were used for statistical analysis.

The questionnaire also included questions regarding age, sex, occupation, chronicity of discomfort, type of treatments and a comparative pain drawing.

In order to achieve a very high response rate for the questionnaires, I had a short telephone conversation with every available person. I informed them of the anonymity of the analysis and about the purpose of the study, i.e. to find out how effective the current methods of treatment against back pain are in the everyday life of the people affected. "Osteopathy" and "spondylolisthesis" were not mentioned in order to avoid influencing the patients' pain sensations.

These respondents received a questionnaire and a business reply envelope. To be able to distinguish among the returning anonymous questionnaires between study group and control group, they were printed on differently coloured paper (cf. Tab. 2).

Response rate:

Questionnaire	**Study group** white	**Control group** green
Sent off	33	24
Returned	27	18
Valid	**22**	**13**

Table 2: Response rate of the questionnaires

6.4 Explanation of the questionnaire

The following data were surveyed:

- Sex
- Age
- Occupation
- Is it acute/chronic pain
- Pain drawing before start of treatment/ at the time of survey
- Type of treatment (3 categories: medication; physical therapy, kinesitherapy)
- Date of last treatment
- Oswestry Pain Questionnaire before start of treatment/ after the end of treatment/ Gat the time of survey

In the framework of the Oswestry Pain Questionnaire 10 sections were surveyed:

1. Pain intensity
2. Personal care
3. Lifting
4. Walking
5. Sitting
6. Standing
7. Sleep
8. Social life
9. Travelling
10. Changes in pain intensity

In each section, the respondents could choose from six intensity gradings (A=100% to F=0%) and so document the course of their pain history.

7 STATISTICAL EVALUATION OF THE DATA

7.1 General remarks

The results of the study group and the control group gathered from the questionnaires were evaluated by means of a computer and then statistical tests were performed (WinStat 3.1) to compare the study group with the control group.
On the one hand the replies to the 10 questions of the Oswestry-Pain-Questionnaire were used (Part 1), on the other hand the pain drawings before treatment and at the time of survey were evaluated (Part 2).

7.2 Procedure

Part 1

The following procedure was chosen to evaluate the results of the Oswestry-Pain-Questionnaire:

1. Substitution of the letter codes by numerical values from 0 to 100 in 20%-steps (corresponding to A - F).
2. Formation of the differences $\Delta 1$ from the values before (B-values) and after the treatment for each patient of both groups for each of the 10 questions (thus, improvements in the pain characteristics result in negative values, deteriorations in positive values, an unchanged condition gives the difference 0).
3. Formation of the differences $\Delta 2$ from the values after the end of treatment and at the time of survey for each patient of both groups for each of the 10 questions to test the lasting effect of the treatment.

4. Comparison of the sum of the actual changes with the sum of the theoretically possible changes by forming the quotient of the sum of the Δ1-values with the sum of the B-values in each group.
5. Formation of the sums Δ1g and Δ2g from the difference values of all 10 questions for each patient for the assessment of the total change or the total lasting effect . The values received were divided by 10 and normalised on a scale between 0 and 100.
6. Determination of the sum of frequencies of negative Δ1–values in each section for both groups (as measure for a success of treatment) and of the sum of frequencies of positive Δ1–values and of the values=0 (as measure for a failure of treatment).
7. Determination of the sum of frequencies of negative Δ2–values and of the values=0 in each section for both groups (as measure for the lasting effect of treatment) and of the sum of frequencies of positive Δ2 –values (as measure for the lack of lasting effect).
8. Analysis of the basic data and the calculated data (cf. items 2-6 above) with regard to normal distribution to select appropriate statistical test methods.
9. Analysis of the basic data and the calculated data (cf. items 2-6 above) with regard to statistical basic parameters (mean, standard deviation, variance, ...).
10. Analysis of the comparability of the initial situation in both groups by means of statistical procedures and based on the statistical basic parameters.
11. Comparison of the osteopathic treatment group with the control group by means of statistical procedures (WinStat 3.1.). Due to partly missing normal distribution of the data, not only a t-test, for which a normal distribution of the data is a prerequisite, but also a non-parametric test (u-test according to Mann-Whitney) was performed. The level of significance or error probability was assumed as α= 0.05.

Part 2

All the patients' entries before the first treatment and at the time of survey in the pain drawings were individually compared and analysed. Above all, these data provide information about the lasting effect of treatment. The changes were classified as follows:

- PAINLESSNESS achieved through treatment (2)
- +...IMPROVEMENT due to treatment (1)
- =... despite treatment UNCHANGED PAIN (0)
- -...DETERIORATION after treatment (-1)

These data were also used for a u-test.

The hypothesis was tested that additional osteopathic treatment will cause an improvement in the success of treatment of back pain (one-sided question).

8 Results

8.1 Preliminary remarks

As can be seen in Table 3, the two groups (O...osteopathic treatment group, C...control group) do not differ significantly with regard to social structure (age, sex) and the utilisation of other therapies:

	Number		Percentage	
	O	**C**	**O**	**C**
Size n	22	13		
Sex				
Male	8	2	36.4	15.4
Female	14	9	63.6	69.2
Not specified	-	2	-	15.4
Age				
Minimum	31	36		
Maximum	77	70		
Mean	63.4	59.7		
Median	63	63		
Other therapies				
Medication	17	8	77.3	61.5
Physical therapy	17	11	77.3	84.6
Kinesitherapy	*	8	*	61.5
Support corset	11	8	50.0	61.5
Last treatment				
(average estimator from the present data)	approx. 1.6 years ago	approx. 1 year ago		

Table 3: Comparison of the two groups with regard to number, sex, age, other therapies and date of the last treatment

Evaluation of the survey regarding quality of life (Part 1)

There are restrictions due to different initial situations regarding severity of the pain situation and due to small group sizes. To elucidate the restrictions due to small group sizes the results of the evaluation of the success of treatment are presented already in Table 4. The results of the individual questions will be discussed subsequently.

	Proportion of the actual improvement compared to theoretically possible improvement*)			O/C-ratio of the means of the actual improvement***)
	Ost. treatment group	Control group	O/C **)	
Question 1	68.8%	68.0%	1.01	0.92
Question 2	62.5%	50.0%	1.25	1.64
Question 3	18.5%	20.0%	0.93	0.98
Question 4	53.1%	68.8%	0.77	0.91
Question 5	41.0%	52.4%	0.78	0.86
Question 6	32.7%	31.6%	1.04	0.84
Question 7	51.4%	50.0%	1.03	1.25
Question 8	40.5%	31.6%	1.28	1.48
Question 9	37.5%	33.3%	1.13	1.18
Question 10	44.1%	48.5%	0.91	0.96
Total	43.2%	42.6%	1.01	1.03

*) for each question calculated from $\Delta 1/B$ for both groups
**) for each question $\Delta 1/B$ (O)/ $\Delta 1/B$ (C) for both groups
***) for each question $\Delta 1$(O)/ $\Delta 1$(C)

Table 4: Results of the evaluation of treatment successes (max. effectiveness = 100%)

These data show that, because of the small amount of data, the means of the individual changes in both groups are influenced by the initial situation and, thus, can be used only with caution to assess the differences. If one used e.g. the results for question 6 to illustrate this problem, on comparing the means $6\Delta 1$ (O/C-ratio of the actual improvement) the control group would score better (value<1) than the study group. If one normalises the change to the theoretically possible improvement, one realizes that the results of the osteopathic treatment group come closer to the theoretically possible improvement (O/C-ratio >1).

8.2 Individual results

Section 1: Pain intensity

	Question 1	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Improvement	18	81.8	12	92.3
Failure	Unchanged	4	18.2	1	7.7
	Deterioration	0	0.0	0	0.0

Table 5: Relative and absolute figures on the success of treatment with regard to pain intensity

	Question 1	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Lasting effect	**Improvement**	6	27.3	2	15.4
	Unchanged	10	45.4	5	38.5
No lasting effect	**Deterioration**	6	27.3	6	46.1

Table 6: Relative and absolute figures on the lasting effect with regard to pain intensity

Question 1	1V	1N	1D1	1J	1D2	Results of the u-tests of the individual results	
						1D1	1D2
Mean (O) n=22	70	21.8	-48.2	30	8.2	u=130.5 z=-0.44 p=0.33	u=164.5 z=0.77 p=0.22
Mean (C) n=13	76.9	24.6	-52.3	32.3	7.7		

Table 7: Means and results of the u-tests for section 1 - pain intensity

From a statistical point of view, the initial situations of both groups (**1V**) do not differ significantly; the standard deviation is very similar for both groups; the means differ in so far as the average initial situation of the control group is worse than that of the study group. This increases the possibility of improvements, which is also reflected by the mean for improvement (**1D1**). It is not significantly higher in the control group (-52.3%) compared to the osteopathic treatment group (-48.2%).

Relatively, more patients of the control group experience a successful treatment. All things considered, the differences between the two groups are not significant with regard to pain intensity.

In view of the lasting effect of treatment **(1D2),** the osteopathic treatment group exhibits a deterioration of 8.2, while the control group has a deterioration of 7.7. These differences are statistically not significant either.

Regarding the lasting effect, a higher percentage can be observed for patients in the osteopathic treatment group. However, due to the higher dispersion of the results for this group (positive as well as negative extreme values) significant differences cannot be found. The u-test according to Mann-Whitney also shows no significant differences.

Question 1	Proportion of the actual improvement compared to theoretically possible improvement			Statistically significant difference between O and C
	Ost. treatment group	Control group	O/C	
	68.8%	68.0%	1.01	NO

Table 8: Ratio of actual compared to theoretically possible improvement. Section 1 - pain intensity

If one considers the values in table 8, it will be found that, related to the possible improvements in the osteopathic treatment group, the value is higher. The χ^2-test (success/failure of treatment) is not indicative because of too small class frequencies.

Section 2: Personal care

	Question 2	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Improvement	13	59.1	7	53.8
Failure	Unchanged	9	40.9	6	46.2
	Deterioration	0	0.0	0	0.0

Table 9: Relative and absolute figures on the success of treatment with regard to personal care

	Question 2	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Lasting effect	Improvement	3	13.6	3	23.1
	Unchanged	15	68.2	8	61.5
No lasting effect	Deterioration	4	18.2	2	15.4

Table 10: Relative and absolute figures on the lasting effect with regard to personal care

Question 2	2B	2N	2D1	2J	2D2	Results of the u-tests of the individual results	
						2D1	2D2
Mean (O) n=22	36.4	13.6	-22.7	14.5	0.9	u=170 z=0.98 p=0.16	u=129 z=-0.57 p=0.29
Mean (C) n=13	27.7	13.8	-13.8	12.3	-1.5		

Table 11: Means and results of the u-tests for section 2 - personal care

The initial situations of both groups (**2B**) differ in view of a higher mean, i.e. a stronger impairment with regard to the personal care in the osteopathic treatment group, but the variance is similar for both groups. The mean for improvement (**2D1**) for washing and getting dressed is somewhat lower in the control group (–13.8) than in the osteopathic treatment group (–22.7), but here the dispersion of the values is higher. The u-test shows only a moderately significant trend (p=0.16).

The mean of the lasting effect of treatment **(2D2)** is slightly positive (0.9%) in the osteopathic treatment group, i. e. deteriorations occur, but slightly negative in the control group (-1.5%), i. e. improvements occur. However, these differences cannot be considered to be occurring consistently (u-test).

Question 2	Proportion of the actual improvement compared to theoretically possible improvement			Statistically significant difference between O and C
	Ost. Treatment group	Control group	O/C	
	62.5%	50.0%	1.25	NO

Table 12: Ratio of actual compared to theoretically possible improvement. Section 2 - personal care

With normalisation to the theoretically possible success of treatment, the results in the osteopathic treatment group are better by 25%. If the classes are reduced to success/failure and a subsequent χ^2-test is performed, the difference between the two groups will not be significant.

Section 3: Lifting

	Question 3	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Improvement	8	36.4	5	38.5
Failure	Unchanged	11	50.0	5	38.4
	Deterioration	3	13.6	3	23.1

Table 13: Relative and absolute figures on the success of treatment with regard to lifting

	Question 3	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Lasting effect	Improvement	6	27.3	1	7.7
	Unchanged	13	59.1	9	69.2
No lasting effect	Deterioration	3	13.6	3	23.1

Table 14: Relative and absolute figures on the lasting effect with regard to lifting

Question 3	3B	3N	3D1	3J	3D2	Results of the u-tests of the individual results	
						3D1	3D2
Mean (O) n=22	49.1	40	-9.1	38.2	-1.8	u=145.5 z=0.09 p=0.46	u=179 z=1.43 p=0.08
Mean (C) n=13	46.2	36.9	-9.2	44.6	7.7		

Table 15: Means and results of the u-tests for section 3 -lifting

From a statistical point of view, the initial situations of both groups (**3B**) do not differ significantly; comparability of the two groups is given.

The mean for improvement (**3D1**) regarding lifting is similar for both groups (O: -9.1; C: -9.2), the dispersion around the mean is somewhat higher in the control group. The u-test shows no significant differences.

The lasting effect of treatment (**3D2**) has, on average, slightly negative values (-1.8%) in the osteopathic treatment group, and positive values in the control group (7.7%). This means that improvements after treatment are more probable in the osteopathic treatment group than in the control group.

Question 3	Proportion of the actual improvement compared to theoretically possible improvement			Statistically significant difference between O and C
	Ost. treatment group	Control group	O/C	
	18.5%	20.0%	0.93	NO

Table 16: Ratio of actual compared to theoretically possible improvement. Section 3 - Lifting

Compared to the theoretically possible improvement, the value for the control group is somewhat higher.

Section 4: Walking

	Question 4	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Improvement	13	59.1	6	46.2
Failure	Unchanged	8	36.4	7	53.8
	Deterioration	1	4.5	0	0.0

Table 17: Relative and absolute figures on the success of treatment with regard to walking

	Question 4	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Lasting effect	Improvement	5	22.7	1	7.7
	Unchanged	14	63.6	11	84.6
No lasting effect	Deterioration	3	13.6	1	7.7

Table 18: Relative and absolute figures on the lasting effect with regard to walking

Question 4	4B	4N	4D1	4J	4D2	Results of the u-tests of the individual results	
						4D1	4D2
Mean (O) n=22	29.1	13.6	-15.5	11.8	-1.8	u=150 z=0.25 p=0.40	u=152.5 z=0.41 p=0.34
Mean (C) n=13	24.6	7.7	-16.9	6.2	-1.5		

Table 19: Means and results of the u-tests for section 4 -walking

From a statistical point of view, no difference can be found between the initial situations of both groups (**4B**).

The mean for improvement **(4D1)** for walking is insignificantly higher in the control group (C: -16.9; O: -15.5).

With regard to the lasting effect of treatment **(4D2),** both groups show a slight improvement. However, neither u-test, nor χ^2-test indicates statistically significant differences.

Question 4	Proportion of the actual improvement compared to theoretically possible improvement			Statistically significant difference between O and C
	Ost. treatment group	Control group	O/C	
	53.1%	68.8%	0.77	NO

Table 20: Ratio of actual compared to theoretically possible improvement. Section 4 - walking

Section 5: Sitting

	Question 5	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Improvement	11	50.0	6	46.2
Failure	Unchanged	11	50.0	7	53.8
	Deterioration	0	0.0	0	0.0

Table 21: Relative and absolute figures on the success of treatment with regard to sitting

	Question 5	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Lasting effect	Improvement	4	18.2	1	7.7
	Unchanged	17	77.3	9	69.2
No lasting effect	Deterioration	1	4.5	3	23.1

Table 22: Relative and absolute figures on the lasting effect with regard to sitting

Question 5	5B	5N	5D1	5J	5D2	Results of the u-tests of the individual results	
						5D1	5D2
Mean (O) n=22	35.5	20.9	-14.5	17.3	-3.6	u=143 z=0 p=0.50	u=179 z=1.6 p=0.05
Mean (C) n=13	32.3	15.4	-16.9	20	4.6		

Table 23: Means and results of the u-tests for section 5 – sitting

From a statistical point of view, the initial situations of both groups (**5B**) are comparable.

Means and variances are very similar.

The mean for improvement (**5D1**) is higher in the control group (C: -16.9; O: -14.5), but the variance is lower for the osteopathic treatment group. With regard to the lasting effect of treatment (**5D2**), the osteopathic treatment group exhibits a slight improvement (–3.6%), the control group a deterioration (4.6). These differences are displayed as significant in the u-test (p=0.05).

Question 5	Proportion of the actual improvement compared to theoretically possible improvement			Statistically significant difference between O and C
	Ost. treatment group	Control group	O/C	
	41.0%	52.4%	0.78	NO

Table 24: Ratio of actual compared to theoretically possible improvement. Section 5 - sitting

With normalisation to the actually possible improvements, a better result can be observed in the control group. However, more patients from the control group have a lower improvement rate than those from the osteopathic treatment group. The u-test as well as the χ^2-test indicates insignificant differences.

Section 6: Standing

	Question 6	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Improvement	13	59.1	9	69.2
Failure	Unchanged	8	36.4	4	30.8
	Deterioration	1	4.5	0	0.0

Table 25: Relative and absolute figures on the success of treatment with regard to standing

	Question 6	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Lasting effect	Improvement	3	13.6	2	15.4
	Unchanged	16	72.7	8	61.5
No lasting effect	Deterioration	3	13.6	3	23.1

Table 26: Relative and absolute figures on the lasting effect with regard to standing

Question 6	6V	6N	6D1	6J	6D2	Results of the u-tests of the individual results	
						6D1	6D2
Mean (O) n=22	47.3	31.8	-15.5	32.7	0.9	u=133.5 z=-0.35 p=0.36	u=148.5 z=0.23 p=0.41
Mean (C) n=13	58.5	40	-18.5	38.5	-1.5		

Table 27: Means and results of the u-tests for section 6 - standing

The initial situations of both groups (**6V**) are relatively different, so that an assessment is only possible to a limited extent.

The mean for improvement **(6D1)** is higher in the control group, which is also more probable due to the markedly worse initial situation (C: -18.5%; O: -15.5%). The dispersion around the mean is approximately identical for both groups. The u-test shows no significant differences.

With regard to the lasting effect of treatment **(6D2)**, a further improvement has to be noted in the control group (-1.5), whereas the osteopathic treatment group exhibits a slight deterioration (+0.9). More patients experience improvements in the control group, but the

total lasting effect is higher in the osteopathic treatment group due to the rarer deteriorations. The u-test shows no statistically significant differences.

Question 6	Proportion of the actual improvement compared to theoretically possible improvement			Statistically significant difference between O and C
	Ost. treatment group	Control group	O/C	
	32.7%	31.6%	1.04	NO

Table 28: Ratio of actual compared to theoretically possible improvement. Section 6 – standing

With normalisation to the theoretically possible improvements, a somewhat higher success of treatment can be observed in the osteopathic treatment group.

Section 7: Sleeping

	Question 7	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Improvement	12	54.5	6	46.2
Failure	Unchanged	10	45.5	7	53.8
	Deterioration	0	0.0	0	0.0

Table 29: Relative and absolute figures on the success of treatment with regard to sleep

	Question 7	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Lasting effect	Improvement	2	9.1	2	15.4
	Unchanged	16	72.7	9	69.2
No lasting effect	Deterioration	4	18.2	2	15.4

Table 30: Relative and absolute figures on the lasting effect with regard to sleep

Question 7	7B	7N	7D1	7J	7D2	Results of the u-tests of the individual results	
						7D1	7D2
Mean (O) n=22	33.6	16.4	-17.3	19.1	2.7	u=164 z=0.78 p=0.22	u=133 z=-0.43 p=0.33
Mean (C) n=13	27.7	13.8	-13.8	15.4	1.5		

Table 31: Means and results of the u-tests for section 7 -sleep

From a statistical point of view, the initial situations of both groups (**7B**) differ only marginally. The means for improvements **(7D1)** are higher in the osteopathic treatment group (O: -17.3; C: -13.8), but the u-test shows no significant differences.

The lasting effect of treatment **(7D2)** is lower in the osteopathic treatment group. Pain-induced (recurrent) deteriorations during sleep are somewhat more distinct and more frequent (O: 2.7; C: 1.5). These differences do not show statistical significance.

Question 7	Proportion of the actual improvement compared to theoretically possible improvement			Statistically significant difference between O and C
	Ost. treatment group	Control group	O/C	
	51.4%	50.0%	1.03	NO

Table 32: Ratio of actual compared to theoretically possible improvement. Section 7 - sleep

Section 8: Social life

	Question 8	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Improvement	10	45.5	4	30.8
Failure	Unchanged	12	54.5	8	61.5
	Deterioration	0	0.0	1	7.7

Table 33: Relative and absolute figures on the success of treatment with regard to social life

	Question 8	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Lasting effect	Improvement	4	18.2	2	15.4
	Unchanged	15	68.2	9	69.2
No lasting effect	Deterioration	3	13.6	2	15.4

Table 34: Relative and absolute figures on the lasting effect with regard to social life

Question 8	8B	8N	8D1	8J	8D2	Results of the u-tests of the individual results	
						8D1	8D2
Mean (O) n=22	33.6	20	-13.6	21.8	1.8	u=165 z=0.84 p=0.20	u=147.5 z=0.19 p=0.43
Mean (C) n=13	29.2	20	-9.2	21.5	1.5		

Table 35: Means and results of the u-tests for section 8 -Social life

The initial situations of both groups (**8B**) differ only marginally. Means and dispersion are situated in a similar range.

In the osteopathic treatment group a higher mean for improvement **(8D1)** can be found (O: -13.6; C: -9.2). However, neither in the u-test, nor in the χ^2-test can the differences be rated as significant.

With regard to the lasting effect of treatment **(8D2)**, the two groups do not differ substantially (O: 1.8; C: 1.5), but the dispersion and, thus, the variance is greater for the osteopathic treatment group. No statistically significant differences can be inferred from the tests.

Question 8	Proportion of the actual improvement compared to theoretically possible improvement			Statistically significant difference between O and C
	Ost. treatment group	Control group	O/C	
	40.5%	31.6%	1.28	NO

Table 36: Ratio of actual compared to theoretically possible improvement. Section 8 - Social life

Section 9: Travelling

	Question 9	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Improvement	9	40.9	5	38.5
Failure	Unchanged	13	59.1	8	61.5
	Deterioration	0	0.0	0	0.0

Table 37: Relative and absolute figures on the success of treatment with regard to travelling

	Question 9	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Lasting effect	Improvement	2	9.1	0	0.0
	Unchanged	17	77.3	10	76.9
No lasting effect	Deterioration	3	13.6	3	23.1

Table 38: Relative and absolute figures on the lasting effect with regard to travelling

Question 9	9B	9N	9D1	9J	9D2	Results of the u-tests of the individual results	
						9D1	9D2
Mean (O) n=22	29.1	18.2	-10.9	18.2	0	u=149.5 z=0.25 p=0.40	u=166.5 z=1.1 p=0.14
Mean (C) n=13	27.7	18.5	-9.2	23.1	4.6		

Table 39: Means and results of the u-tests for section 9 –travelling

In the statistical tests, the initial situations of both groups **(9B)** differ only marginally and insignificantly, but the high differences in variance are striking.

The mean for improvement **(9D1)** is approximately the same in both groups (O: -10.9; C: -9.2). The percentage of the successfully treated patients is somewhat higher in the study group. The t-test shows insignificant differences.

With regard to the lasting effect of treatment **(9D2)**, an unchanged condition (μ=0) was observed in the osteopathic treatment group, and a deterioration (4.6) in the control group.

Question 9	Proportion of the actual improvement compared to theoretically possible improvement			Statistically significant difference between O and C
	Ost. treatment group	Control group	O/C	
	37.5%	33.3%	1.13	NO

Table 40: Ratio of actual compared to theoretically possible improvement. Section 9 – travelling

Section 10: Changes in pain intensity

	Question 10	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Improvement	14	63.6	10	76.9
Failure	Unchanged	8	36.4	3	23.1
	Deterioration	0	0.0	0	0.0

Table 41: Relative and absolute figures on the success of treatment with regard to changes in pain intensity

	Question 10	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Lasting effect	Improvement	6	27.3	3	23.1
	Unchanged	12	54.5	5	38.5
No lasting effect	Deterioration	4	18.2	5	38.5

Table 42: Relative and absolute figures on the lasting effect with regard to changes in pain intensity

Question 10	10B	10N	10D1	10J	10D2	Results of the u-tests of the individual results	
						10D1	10D2
Mean (O) n=22	53.6	30	-23.6	31.8	1.8	u=137 z=-0.21 p=0.42	u=164 z=0.77 p=0.22
Mean (C) n=13	50.8	26.2	-24.6	33.8	7.7		

Table 43: Means and results of the u-tests for section 10 - changes in pain intensity

The initial situations of both groups **(10B)** differ only marginally and insignificantly.

The mean for improvement **(10D1)** is similar in both groups (O: -23.6; C: -24.6). The u-test shows insignificant differences.

With regard to the lasting effect of treatment **(10D2)**, a lower recurrent deterioration (O: 1.8%, C: 7.7) can be observed in the osteopathic treatment group.

Question 10	Proportion of the actual improvement compared to theoretically possible improvement			Statistically significant difference between O and C
	Ost. Treatment group	Control group	O/C	
	44.1%	48.5%	0.91	NO

Table 44: Ratio of actual compared to theoretically possible improvement. Section 10 - changes in pain intensity

Even after the normalisation to the theoretically possible improvement, the ratio between the two groups hardly changes.

Total change due to treatment (composite parameter Δ1s)

	D**1s**	Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Improvement	20	90.9	12	92.3
Failure	Unchanged	1	4.5	1	7.7
	Deterioration	1	4.5	0	0.0

Table 45: Relative and absolute figures on the success of treatment with regard to the total change due to treatment

D1**s**	**Vs**	**Ns**	D**1s**	Results of the u-test of the individual results	Result of the χ^2-test Success of treatment/ -failure *)
				D**1s**	
Mean (O) n=22	41.7	22.6	-19.1	u=148.5 z=0.19 p=0.43	χ^2=0.0439 p=0.83
Mean (C) n=13	40.2	21.7	-18.5		

*) Classification of the 10 individual questions for 22 or 13 patients in successfully treated / not successfully treated (220 or 130 data respectively)

Table 46: Means and results of the u-tests with regard to the total change due to treatment

The average total changes, formed by the sums of the Δ1-values of all 10 sections and divided by 10, yield a mean of –19.1 for the osteopathic treatment group, and a mean of -18.5 for the control group, but the latter has a somewhat lower variance. In the u-test, the two groups differ only insignificantly. Even if the condition before treatment (ΔB) is taken into account, only moderate differences appear.

D**1s**	**Proportion of the actual improvement compared to theoretically possible improvement**			**Statistically significant difference between O and C**
	Ost. treatment group	**Control group**	**O/C**	
	43.2%	42.6%	1.01	NO

Table 47: Ratio of actual compared to theoretically possible improvement: total change due to treatment

Total lasting effect of the treatment (composite parameter Δ2s)

	D**2s**	**Proportion of the osteopathically treated patients**		**Proportion of the patients from the control group**	
		n	**%**	**n**	**%**
Lasting effect	Improvement	10	45.5	5	38.5
	Unchanged	5	22.7	2	15.4
No lasting effect	Deterioration	7	31.8	6	46.2

Table 48: Relative and absolute figures on the total lasting effect of treatment

D2**s**	**Ns**	**Js**	D**2s**	**Results of the u-test of the individual results**	**Result of the c^2-test Success of treatment/ failure of treatment*)**
				D**2s**	
Mean (O) n=22	22.6	23.5	0.9	u=168.5 z=0.88 p=0.19	χ^2=3.18 p=0.07
Mean (C) n=13	21.7	24.8	3.1		

*) Classification of the 10 individual questions for 22 or 13 patients in lasting effect/ no lasting effect (220 or 130 data respectively)

Table 49: Means and results of the u-tests for the total lasting effect of the treatment

As a measure for the total lasting effect of treatments the sums of the differences of the Δ2-values of all 10 sections are calculated and divided by 10 for the purpose of normalisation in a percentage scale. In this connection, the candidates of the osteopathic treatment group exhibit lower (recurrent) deterioration (O: 0.9; C: 3.1).

Here too, the standard deviation of the data of the osteopathic treatment group is higher than that of the control group, which is due to greater improvements but also stronger

deteriorations. Accordingly, here too no striking significance can be attributed to the findings.

If one uses the number of patients having received treatment with lasting effect or without lasting effect as distinctive feature, the χ^2-test will provide at least a hint to a possible difference in the lasting effect between the two groups (p=0.07). In relative figures, 31.8% of the patients in the osteopathic treatment group experience no lasting effect, whereas in the control group this proportion is 46.2%.

Evaluation of the individual replies:

If the individual replies of the osteopathic treatment group (O) and of the control group (C) are assigned to the categories success/failure and lasting effect/no lasting effect, one will receive the following result:

	n(O)	%(O)	n(K)	%(K)		n(O)	%(O)	n(K)	%(K)
Success	121	55	70	53.8	**Lasting effect**	186	84.5	100	76.9
Failure	99	45	60	46.2	**No lasting effect**	34	15.5	30	23.1
Total	220	100	130	100	Total	220	100	130	100

Table 50: Relative and absolute figures on the individual replies

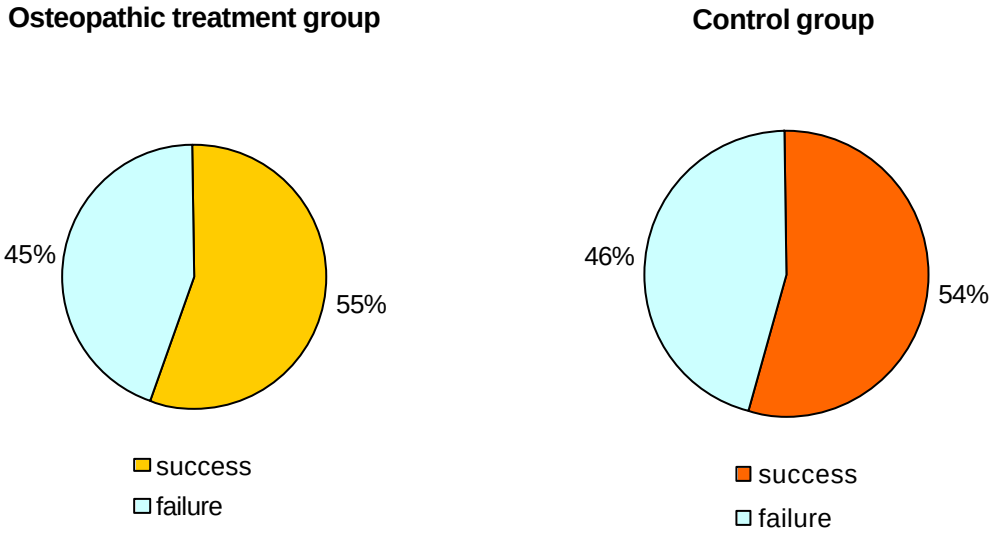

Figure 21: Results of the individual replies with regard to success of treatment

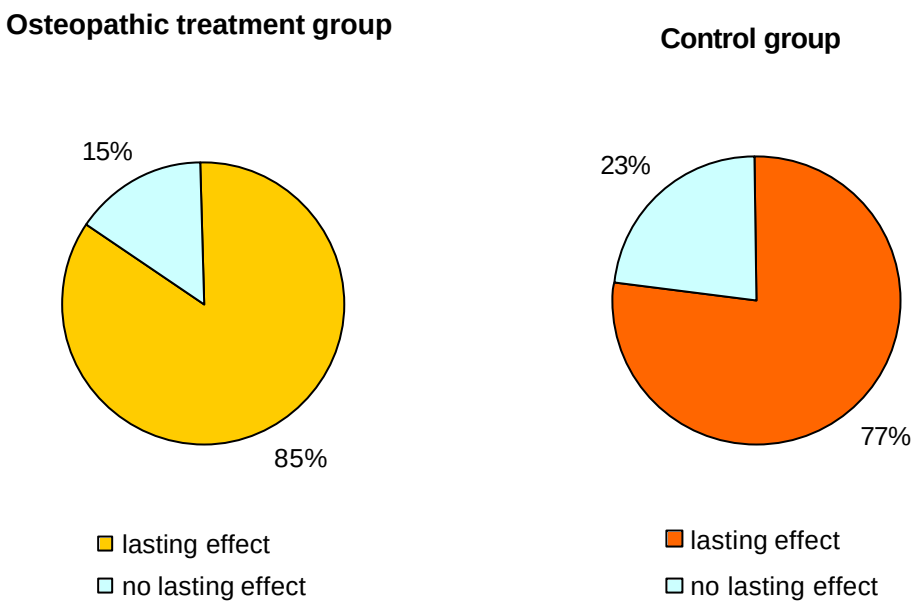

Figure 22: Results of the individual replies with regard to lasting effect of treatment

The figures 21 and 22 give the percentage that was calculated from the sums of the respective individual replies in the questionnaires. Here, too, can be seen that the osteopathic treatment group and the control group are very close together. With regard to lasting effect, the osteopathic treatment group has 8% more positive replies.

The results of part 1 do not indicate any statistically significant difference between the two groups, which does not confirm the hypothesis that the osteopathic treatment leads to better results with regard to quality of life. However, the trend appears that osteopathic treatments bring about a slower, but continuous and long-term improvement of the quality of life or a lower recurrent deterioration.

Evaluation of the pain drawing (Part 2)

On comparing the condition before treatment with the condition at the time of survey, the pain drawings provide the following results:

		Proportion of the osteopathically treated patients		Proportion of the patients from the control group	
		n	%	n	%
Success	Painlessness	7	31.8	1	7.7
	Improvement	10	45.5	5	38.5
Failure	Unchanged	3	13.6	4	30.8
	Deterioration	2	9.1	3	23.1

Table 51: Relative and absolute figures on the success of treatment

Results of the u-test of the individual results	Statistically significant difference between O and C
u=85.5 z=-2.07 p=0.02	YES

Table 52: Means and results of the u-test of the pain drawing

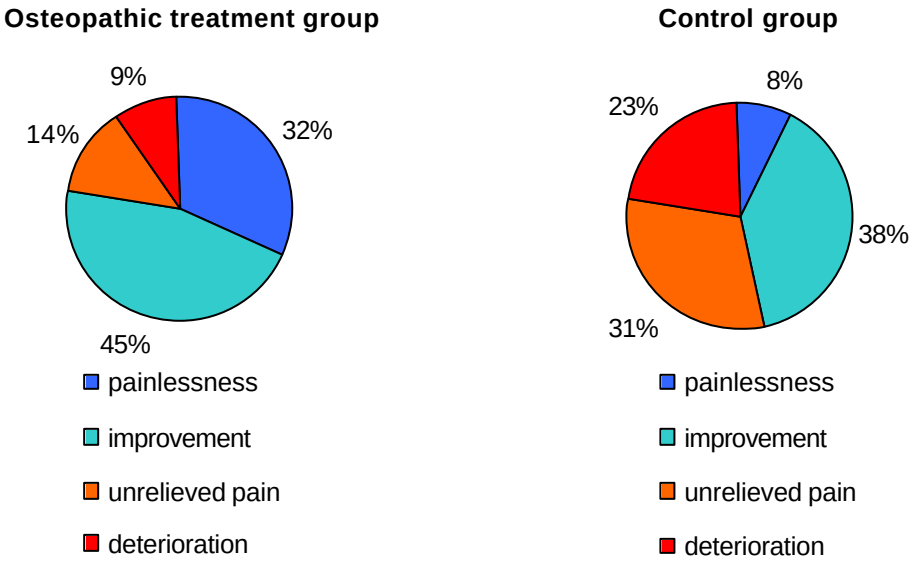

Figure 23: Results of the pain drawings (percentage)

Figure 23 shows the percentage of the replies from the pain drawings.

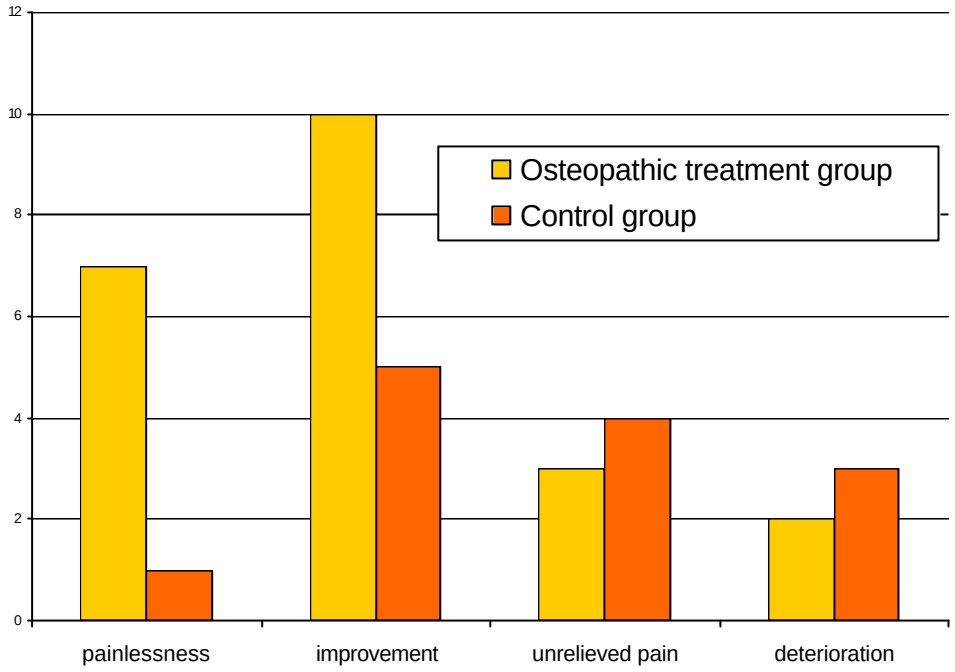

Figure 24: Results of the pain drawings (number of patients)

Figure 24 presents the number of patients in the respective categories. A clear improvement can be seen regarding the pain condition in the osteopathic treatment group.

The results of part 2 do indicate a statistically significant difference between both groups, which confirms the hypothesis that the osteopathic treatment leads to better results with regard to pain.

9 Discussion

The aim of the study was to determine how effective the actual osteopathic treatments were in the long run for patients who also received additional painkillers, support corsets and physical therapies. In a preferably neutral way information was to be gathered on the changes of pain localisation, pain intensity and quality of life, because these parameters are the constant companions in everyday life as well as at work.

They determine mobility, fitness for work, *joie de vivre*, spontaneity in social life, and the readiness for an active life, but not the objective finding of an X-ray picture or an MRI-scan.

I have seen many patients with the diagnosis spondylolisthesis, who were very insecure because of such an “obvious“ finding, and did not know which movements they were “allowed” to make, and which were ”dangerous“. The recurrent topic was fear of a major vertebral column operation or of the wheelchair, partly caused by the preceding conversation with the doctor.

The results of the biomechanical studies of spondylolisthesis reveal that with regard to mobility of segments and vertebral column only unclear statements can be made. The clinical picture does not differ from that of non-specific back pain.

Since approximately 1990 the majority of publications have indicated that somatic factors play a minor role in the prognosis of non-specific back pain. Obviously, there is no connection between the body’s performance parameters (force, endurance, mobility) as well as their improvement and the success parameters.

An important factor are the “fear-avoidance-beliefs“, which have already been mentioned in section 4.11 “Pain and quality of life“. The fear that activity, strain and movement damage the back and cause or reinforce pain gives rise to a strong motivation to avoid potentially painful activities and clearly leads to a longer immobilisation. Conversely, there are also patients who can no longer perceive their own endurance limits because of their

high demands on the body. In case of repeated failure, frequent, but aimless exertion can ultimately lead to helplessness and depression. It is difficult to change this behaviour, because the patients hardly ever have experiences where stimulus (movement) and pain are not necessarily connected. Apart from the impact on the body, there are also psychosocial consequences which reinforce the role of sick person and the avoidance behaviour.

The patients themselves assess the success of a treatment via bodily factors such as increased strength and mobility, although in the statistics both factors do not have a connection with success (Mellin, 1993).

Thus, the body treatment parts probably have a considerable psychological importance within the “fear-avoidance-model“, because the patients can unlearn the associative connection between movement/strain and their back pain due to the intensive movements and therapeutically dosed strain (Waddel and Main, 1998).

I interpret the results of my study in this context. The review of the individual questionnaires makes clear that, according to the pain drawing, the condition of painlessness was often reached due to the osteopathic treatments, but in individual sections such as lifting or walking, pain was indicated as an obstacle towards reaching the full endurance (i.e. the complete theoretically possible improvement). This can be a protection against overload because of the improved body perception, but also, as mentioned above, conditioned avoidance behaviour.

Basically, it can be stated that osteopathic treatments have a positive effect on the long-term improvement of the pain situation and the quality of life of patients with back pain, even if the patients are simultaneously treated according to other methods.

In the short run, patients who receive pain medication have an advantage. However, long term observations indicate that the patients who received a holistic, osteopathic treatment achieve an improvement in their pain and quality of life. This is also documented by the

data of the most recent treatments, which date back longer in the osteopathic treatment (mean approx. 1.6 years) than in the control group (mean approx. 1 year).
I think that this is due to an increased compensatory capacity of the entire organism. Through the relief of hypomobile zones, even in the adjacent organ systems, and through the improved mobility, forces, such as the lifting of weights, abrupt balancing reactions and voluntary movements will be better absorbed by the body and will not concentrate on the unstable zones. Knowledge about the back friendly posture, efficient breathing and preventive measures makes it possible that patients take responsibility for and care of their health and, thereby, contribute to a stabilisation of the condition. Because of the improved body perception the body's warning signals can be discerned in time, and adequate relief will be facilitated.

The therapist's behaviour and attitude play also an important role in the lasting effect of treatment. Hippocrates emphasized that the doctor´s practical role as healer cannot be separated from his social role of helping human beings to cope with illness and suffering. The influence of health care professionals can be powerful. Information given to the patients that is vague, incomplete or inaccurate can have deleterious effects. Repeated investigations and use of expensive technology and impressive therapies induce fear and chronicity in the patient. It makes patients over-dependent on medical care. With a good history and clinical examination, with clinical reasoning and positive attitude, the differential diagnosis of the low back pain problem can be resolved with confidence by excluding the specific low back pain from the non-specific low back pain syndromes. Physical, psychological and social factors interact to determine the outcome of low back pain. The longer pain persists, the more likely it is that non-physical alterations are at play. Recurrent clusters of personality traits found in chronic pain patients are now interpreted to be the result of illness and not its cause. Beliefs about illness and cognitive coping do not exist before pain begins, but they are developed at the onset of back pain and are

important determinants of effect and behaviour. The identification of these cognitive factors in acute illness may provide a basis for the prevention of chronicity. A good understanding of the various somatic, psychological and social factors that play a role in the development of the chronic pain condition in an individual patient should guide the treatment. The patient must be offered clear and consistent information about his problems and what to do about them. If the patient understands the role of his coping and illness beliefs and other somatic and psychosocial factors, the patient will become more engaged in the therapeutic process.

In this context, osteopaths have special possibilities. Osteopathy is medical treatment without devices. The osteopath depends on his/her hands, his/her knowledge of anatomical and functional connections and on his/her social competence.

Osteopathy attaches importance to a holistic approach, on the unity of body, mind and soul. The osteopath's access takes place via the body, is a truly hands-on process via touching.

Each treatment is an individual treatment, which can offer the optimum support for this patient on this specific day. There is time for a conversation, in which the various facets of pain and the patient's situation can be addressed. The respectful body contact (touch) creates additional room for nonverbal communication. The patient's body lets the skilled hands of the osteopath feel, where it wants to be mobilised, relaxed or held, so that the osteopath can apply the appropriate techniques. A crucial difference between osteopathy and orthodox medicine is also that the healthy parts are reinforced and not that merely a diagnosis is made or a symptom is treated. There is great potential: to increase awareness of personal strengths on the physical level as well as on other levels, and to extend the possibilities for individual actions.

Finally, I would like to address the difficulty of designing a good questionnaire. On the one hand it should be as simple as possible, short and easy to understand, on the other hand

it should query all the relevant clinical information. In its ”Low Back Pain Initiative“ (Ehrlich and Khaltaev, 1999) the WHO has also dealt with this question and described some relevant factors:

- The surveys must be relevant to the patient’s problem.
- The questionnaire must be reliable and lead to similar results, regardless of the time of the survey and of the interviewer.
- The questionnaire must have validity. The conclusions that are drawn from the answers must be appropriate, meaningful and useful for the underlying interest.

The appendix lists questionnaires that the WHO has used for surveys in various countries because they can be useful for this kind of survey (Oswestry Disability Questionnaire, Short-Form McGill Pain Questionnaire, Modified Somatic Perception Questionnaire, Modified Zung Index)

10 Summary

As patients with spondylolisthesis keep presenting themselves in the osteopathic practice, I have set myself the goal to give an overview of the existing knowledge, to explain my osteopathic approach and to test it by means of a study of the subjective modifications of pain and the quality of life of patients having undergone either traditional orthopaedic treatment or osteopathic treatment.

Since their discovery in mid-19th century spondylolistheses have been linked to a host of unsolved questions. The discussion of aetiology and pathogenesis is as controversial as the indication for conservative or surgical therapy. The literature documents a great deal of uncertainty with regard to the cause of the syndrome that the orthodox medicine frequently calls lumbago. In the course of the usual diagnostic procedures, X-rays often detect a spondylolisthesis incidentally, which is then assumed to be the cause. The diagnosis „spondylolisthesis“ as such is not sufficiently meaningful for the prognosis and the type of therapy, but it has to be assigned to the range of non-specific low back pain. Spondylolisthesis can also result from degenerative changes without osseous defect of the interarticular portion. Even high-level listheses are often asymptomatic and the presence of a listhesis does not cause any significant pathological changes in the lumbar spine’s range of motion or the segment’s. Thus, the search for connections and causes has to be conducted from a holistic perspective.

If the balance changes for one part of the vertebral column, this will necessitate the constant adaptation of the entire vertebral column. A present spondylolysis or spondylolisthesis is part of this system and, thus, a weak point where adaptation processes can concentrate. The current medical reflections and methods concerning spondylolisthesis strongly refer to the local circumstances and structural pathologies in the lumbar spine. The short-term aim is to ease acute pain. To achieve this, pain killers, and antalgesic physiotherapeutic measures such as massages, heat, electrotherapy etc. are

used. It is particularly important to allow the painful sections of the vertebral column to rest, by temporarily refraining from sports and all painful activities. In case of severe pain the lumbar spine is temporarily immobilized by means of a lumbar corselette.

In the osteopathic treatment the focus is on the removal of adjacent and distant relative hypomobilities. This creates the precondition for a necessary correction of posture, because the body regains lost range of motion. An individual posture, movement and respiratory training support these efforts. Postural abnormalities and non-physiologic breathing and movement patterns which often cause or deteriorate discomfort are reduced.

Various studies examined the interaction of back pain and quality of life. Sustained stress loads in private or professional life could be identified as relevant predictors for the first occurrence of back pain as well as for the chronicity of acute pain. Since approximately 1990 the majority of publications have indicated that somatic factors play a minor role in the prognosis of non-specific back pain.

However, the patients themselves assess the success of a treatment by means of bodily factors. Thus, holistic, body-related treatments such as osteopathy have a considerable psychological importance, because the patients can “unlearn” the associative link between movement/strain and back pain.

The results of my study indicate that the improvements of the pain situation and of the quality of life of back pain patients with the diagnosis spondylolisthesis/ pseudospondylolisthesis are more lasting in the osteopathic treatment group than in the control group, even though the patients have been treated by means of other methods at the same time. Thus, the advantage of osteopathy is the lasting effect of treatment. The therapist’s behaviour and attitude also play an important role in the lasting effect of treatment. I have seen many patients with the diagnosis spondylolisthesis who were very insecure because of such an “obvious“ finding, and did not know which movements they were “allowed” to make, and which were „dangerous“. The recurrent topic was fear of a

major vertebral column operation or of the wheelchair, partly caused by the preceding conversation with the doctor. With a good history and clinical examination together with clinical reasoning and positive attitude, the differential diagnosis of the low back pain problem can be resolved with confidence by excluding the specific low back pain from the non-specific low back pain syndromes. The patient must be offered clear and consistent information about his problems and what to do about them.

In this context, osteopaths have special possibilities. Osteopathy is medical treatment without devices. The osteopath depends on his/her hands, his/her knowledge of anatomical and functional connections and on his/her social competence.

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CONCEPT for DIPLOMA THESIS

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THE PHENOMENON SPONDYLOLISTHESIS FROM AN OSTEOPATHIC POINT OF VIEW

An approximation to a pathology, which is contributed by many influences – supported by a comparative study about the subjective modifications of pain and quality of life

INTRODUCTION
Osteopathy places great importance on optimal function of the whole body and within that, the lumbar spine. The aim of this study is to explore whether osteopathic treatment can cause a sustained improvement in the condition of patients with spondylolisthesis.

It is often found that the subjective degree of suffering in patients with vertebral pathologies such as spondylolisthesis has a crucial influence on the quality of life. In the longer term, it may also affect the rates of sick leave or the ability to work. Furthermore, there is the probability of longer-term medical and physical treatment. This study will represent an important insight into the efficacy of osteopathic treatment on patients suffering form this condition.

Hypothesis: Osteopathy enables a continuous improvement

Structure of the paper:

Description of the anatomical, biochemical and functional connections and causes of the gliding of the vertebra and the associated symptoms

Description of the underlying approach to osteopathic treatment: reduction of hypo-mobility in all systems of the body to release the hyper-mobile listhesis-segment, so that the optimum balance of the entire spinal column is structurally and functionally ensured

Description of the principles of the individual posture-, movement- and breathing – training, which is necessary to eliminate constant influence of disadvantageous habits

Description and analysis of the study:
This will be a retrospective study using the previously validated Oswestry Pain Questionnaire. Subjects will be drawn form a pool of patients treated by Martha Schiener at Praxis of Osteopathy, Neusetzgasse 4/2, 1100 Wien between 1997 and 2001. A pilot study has indicated that there are 40 subjects available for participation in this study.

METHODOLOGY

Relative qualities of pain (before and after treatment) are collected by means of the Oswestry Pain Questionnaire.

The analysis takes place by means of statistical tests (e.g. t-test) and descriptively.

Inclusion criteria:

Subjects aged between 20 and 70 years with the diagnosis of pseudospondylolisthesis (degenerative form) or spondylolisthesis (lysis of the isthmus). Grade I and II slippage on the scale of Mayerding will be accepted for inclusion. The segments to be included will be L3/4, L4/5, L5/S1.
All subjects included in this study received osteopathic treatment between 1997 and 2001. The time span of a course of treatment was between 1 and
5 months, with between 3 and 10 individual treatment sessions in this period.

Exclusion criteria:

Previous lumbar spine or lower extremity surgery
Rheumatic diseases
major neurological illnesses
serious pathologies e.g. bone neoplasms, osteoporosis…..

Control group:

Patients, who were in medical (non osteopathic) therapy in the same period (spinal infiltrations, pain medication, lumbar corselette for support)

Questionnaire

Dear Patient!

I want to ask you to fill out the following questionnaire as exactly and truthfully as possible.

This questionnaire was developed in order to find out how much your everyday life is influenced by your back pain.
It shall help to examine the effectiveness of the treatments you have had.

Your answers are evaluated in the context of a research work over back pain. The evaluation of the data takes place anonymous, i.e. it is not possible to draw conclusions to you as an individual.

Since as much as possible answered questionnaires increase the evidence of the study, I appreciate your effort and time taken.

Please send the filled out questionnaire back to me with the attached cover immediately.

Thank you for your assistance!

Yours sincerely

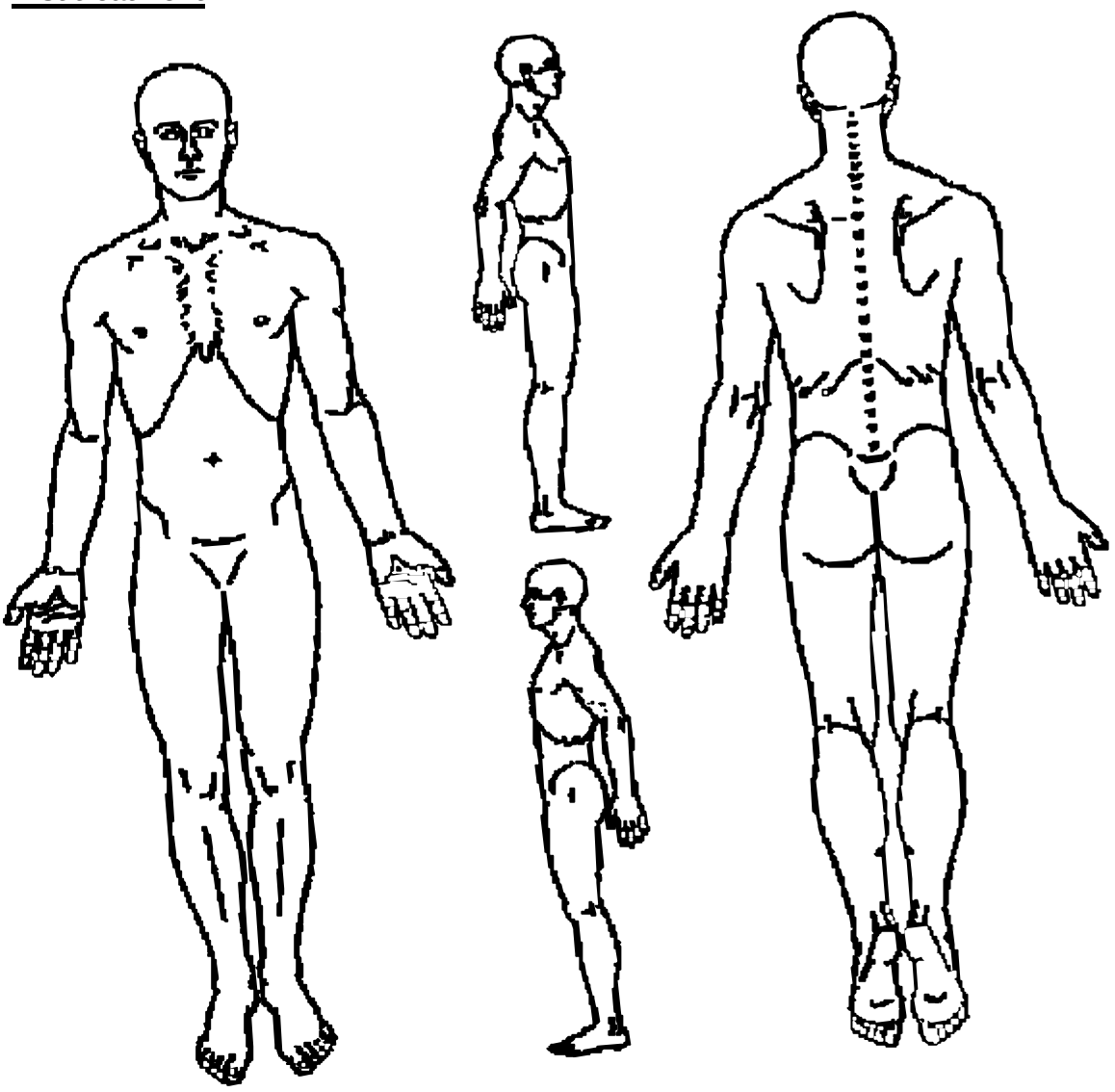
Martha Schiener
Dipl. Physiotherapist, Osteopath

Gender: m / f Age: Profession:

1. Do/Did you suffer from acute or chronic back pain?

My pain appeared suddenly.	I have recurrent pain since……. years.

2. On the diagram below, please indicate where you were experiencing pain **before your first treatment**:

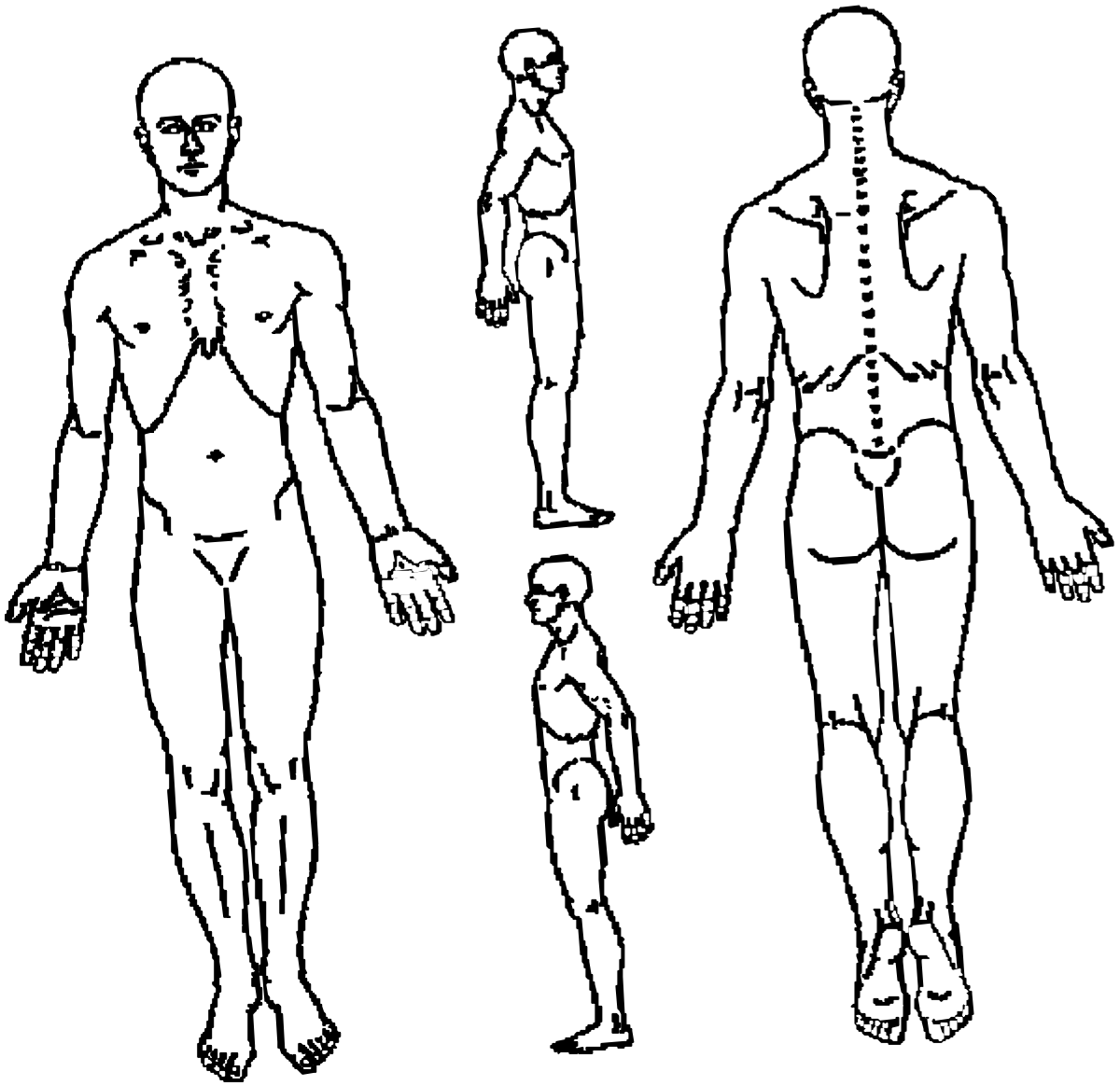


A=ACHE	B=BURNING	N=NUMBNESS
P=PINS & NEEDLES	S=STABBING	O=OTHER

3. How was your back pain treated until now? (please mark or complete)

Medication – which? Tablets Injection/Infiltration – where? Infusion	Physical therapy: Current therapy Ultrasound Massage	Physiotherapy Ergonomic advise Chiropraxy Osteopathy
Lumbar corselette for support	Other:	

4. When was your last treatment?
5. On the diagram below, please indicate where you are experiencing pain, **right now**:



A=ACHE	B=BURNING	N=NUMBNESS
P=PINS & NEEDLES	S=STABBING	O=OTHER

Please answer each section by circling the one choice in each column that most applies to you. (left = condition before the beginning of treatment, middle = condition at the end of treatment, right = present condition)

SECTION 1: PAIN INTENSITY	Before	After	Now
The pain comes and goes and is very mild.	A	A	A
The pain is mild and does not vary much.	B	B	B
The pain comes and goes and is moderate.	C	C	C
The pain is moderate and does not vary much.	D	D	D
The pain is severe but comes and goes.	E	E	E
The pain is severe and does not vary much.	F	F	F

SECTION 2: PERSONAL CARE	Before	After	Now
I would not have to change my way of washing or dressing in order to avoid pain.	A	A	A
I do not normally change my way of washing or dressing even though it causes some pain.	B	B	B
Washing and dressing increase the pain, but I manage not to change my way of doing it.	C	C	C
Washing and dressing increase the pain and I find it necessary to change my way of doing it.	D	D	D
Because of the pain, I am unable to do any washing and dressing without help.	E	E	E
Because of the pain, I am unable to do any washing or dressing without help.	F	F	F

SECTION 3: LIFTING	Before	After	Now
I can lift heavy weights without extra pain.	A	A	A
I can lift heavy weights, but it causes extra pain.	B	B	B
Pain prevents me from lifting heavy weights off the floor.	C	C	C
Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, e.g. on the table.	D	D	D
Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.	E	E	E
I can only lift very light weights, at the most.	F	F	F

SECTION 4: WALKING	Before	After	Now
Pain does not prevent me from walking any distance.	A	A	A
Pain prevents me from walking more than one mile.	B	B	B
Pain prevents me from walking more than one mile.	C	C	C
Pain prevents me from walking more than ½ mile.	D	D	D
I can only walk while using a cane or on crutches.	E	E	E
I am in bed most of the time and have to crawl to the toilet.	F	F	F

SECTION 5: SITTING	Before	After	Now
I can sit in any chair as long as I like without pain.	A	A	A
I can only sit in my favourite chair as long as I like.	B	B	B
Pain prevents me from sitting more than one hour.	C	C	C
Pain prevents me from sitting more than ½ hour.	D	D	D
Pain prevents me from sitting more than ten minutes.	E	E	E
Pain prevents me from sitting at all.	F	F	F

SECTION 6: STANDING	Before	After	Now
I can stand as long as I want without pain.	A	A	A
I have some pain while standing, but it does not increase with time.	B	B	B
I cannot stand for longer than one hour without increasing pain.	C	C	C
I cannot stand for longer than ½ hour without increasing pain.	D	D	D
I cannot stand for more than 10 minutes without increasing pain.	E	E	E
I avoid standing because it increases pain right now.	F	F	F

SECTION 7: SLEEPING	Before	After	Now
I get no pain in bed.	A	A	A
I get pain in bed, but it does not prevent me from sleeping.	B	B	B
Because of pain, my normal night´s sleep is reduced by less than one-quarter.	C	C	C
Because of pain, my normal night´s sleep is reduced by less than one-half.	D	D	D
Because of pain, my normal night´s sleep is reduced by less than three-quarters.	E	E	E
Pain prevents me from sleeping at all.	F	F	F

SECTION 8: SOCIAL LIFE	Before	After	Now
My social life is normal and gives me no pain.	A	A	A
My social life is normal, but increases the degree of my pain.	B	B	B
Pain has no significant effect on my social life apart from limiting my more energetic interests, e.g., dancing, etc.	C	C	C
Pain has restricted my social life and I do not go out very often.	D	D	D
Pain has restricted my social life to my home.	E	E	E
Pain prevents me from sleeping at all.	F	F	F

SECTION 9: TRAVELLING	Before	After	Now
I get no pain while travelling.	A	A	A
I get some pain while travelling, but none of my usual forms of travel make it any worse.	B	B	B
I get extra pain while travelling, but it does not compel me to seek alternative forms of travel.	C	C	C
I get extra pain while travelling which compels me to seek alternative forms of travel.	D	D	D
Pain restricts all forms of travel.	E	E	E
Pain prevents all forms of travel except that done lying down.	F	F	F

SECTION 10: CHANGING DEGREE OF PAIN	Before	After	Now
My pain is rapidly getting better.	A	A	A
My pain fluctuates, but overall is definitely getting better.	B	B	B
My pain seems to be getting better, but improvement is slow at present.	C	C	C
My pain is neither getting better nor worse.	D	D	D
My pain is gradually worsening.	E	E	E
My pain is rapidly worsening.	F	F	F

Thank you once more!

Evaluation Part 1 / Part 2

Ausgangsdaten								
ID	Geschlecht	Alter	Beruf	chronischer Schmerz	akuter Schmerz	Schmerzcharakteristik (W,K,B,S,T,A)	Position (eigene Angabe)
O 1	M	70	Pension	c / 25 J.		W,S,~~T~~,A	~~W re. LWS, re. HWS~~; S li. Knie; ~~T bde. USCH und Füße~~; A re. Handrücken
O 2	W	61	Stationsgehilfin	c / 8 J.		~~W~~,S,~~T~~	~~W bde. Handflächen, S re. Lat. OSCH, T~~ li. Post. Crista iliaca
O 3	W	63	Pension	c / 6 J.		K,S	K Fingerspitzen bds., S Schultern und cervikodorsaler Übergang bds.
O 4	M	63	Schlosser	c / 5 J.		W	W cervikodorsaler und lumbosakraler Übergang
O 5	W	77	Pension		a	~~W~~	~~W Gluteen bds.~~
O 6	W	72	Pension	c		~~T~~	~~T re. Gluteal- und post. OSCH Region~~
O 7	W	75	Pension	c		~~W,S~~	W,S im re. ISG-Bereich
O 8	W	75	Pension	c		W	W re.Schulter, Hals, re. Glutealregion und Leiste
O 9	W	71	Pension	c /12 J.		W,~~A~~	W im lumbosacralen Übergang, beide Trochanter; ~~A(Steifigkeit)~~ im cerviko-dorsalen Übergang ~~und beiden Schultern~~
O 10	M	56	Angestellter		a	~~W~~	~~W inferior der li. Crista iliaca~~
O 11	M	58	PKW-Verkäufer	c/ 3 J.		W	W gesamte LWS
O 12	M	59	Pharmazeut	c / 15 J.		~~W,T~~	~~W li. Glutealregion, T ausstrahlend in den post. Li. OSCH~~
O 13	M	63	Pension	c/ 15 J.		S,T	S in LWS, T im Nacken und li. OSCH
O 14	W	65	Pension	c / 10 J.		~~W,S~~	~~W im re. Schulter/Nackenbereich S im lumbosacralen Übergang~~
O 15	W	63	Pension	c / 3 J.		W,~~B~~	W,~~ B (heiß)~~ im lumbosacralen Übergang
O 16	W	70	Pension	c / 15 J.		W,K,T	W im Nacken, LWS, re. Scapula, K in beiden Händen und posterior im linken Bein, T im linken Fuß
O 17	W	70	Pension	c / 15 J.		W,S,T	W im Glutealbereich bds.,S und T im li. OSCH
O 18	W	75	Hausfrau	c / 20 J.		~~W~~	~~W vom Sacrum posterior bis zur linken Ferse~~
O 19	M	42	Büroangestellter	c / 9 J.		~~W,A~~	~~W in der HWS, vom lumbosacralen Übergang posterior bis zum re. Knie, A in der re. Kniekehle~~
O 20	M	55	Verkäufer	c / 12 J.		A	A (ziehend) vom lumbosacralen Übergang posterior bis zum re. Knie
O 21	W	61	Pension	c		W,~~S~~	W im lumbosacralen Übergang und W und ~~S in beiden ant. OSCH~~
O 22	W	31	Ergotherapeutin	c		~~W~~	~~W im gesamten unteren Rücken zwischen Th10 und S1~~

	Sonst. Ther.				Aktuelle Daten			
ID	Med.	Phys. Th.	Bew.th.	Stützmieder	Letzte Behandlung (soweit angegeben)	aktuelle Schmerzcharakteristik (W,K,B,S,T,A)	aktuelle Position (eigene Angabe)	Nachhaltigkeit
O 1	M	P		S	Jun.02	W,S,A	W re. Fuß; S li. Knie; A re. Handrücken	1
O 2		P		S	2000	S	S im dorsolumbalen Übergang, li. Post. Crista iliaca	1
O 3	M	P			1997	K,S	K Fingerspitzen bds., S Schultern und cervikodorsaler Übergang bds.	0
O 4	M	P				S	gelegentlich S cervikodorsaler und lumbosakraler Übergang	1
O 5	M			S	1998			2
O 6	M	P			2001			2
O 7	M	P		S			Schmerz im re. ISG-Bereich nur bei längerem Stehen	1
O 8				S	2000	W,S,A	W re. Scapula und Arm, re. Hüfte und Bein bis USCH	-1
O 9		P			Mai.02	W	W im cervikodorsalen und lumbosacralen Übergang, beiden Trochantern	1
O 10					Mär.02			2
O 11					2001	W	W LWS(Bereich kleiner)	1
O 12	M	P			Aug.02	S,A	S im li. Knie, A gelegentliches Ziehen entlang der WS in beide Beine	1
O 13	M	P		S	Mär.02	S,T	S in LWS, T im Nacken und li. OSCH	0
O 14	M	P			Feb.02			2
O 15	M	P		S	2000	W	W im lumbosacralen Übergang	1
O 16	M	P			Jän.02	W,K,T	W im Nacken, LWS, re. Scapula, K in beiden Händen und posterior im linken Bein, T im linken Fuß	0
O 17	M	P		S	2001	W,B,S,T	W im Glutealbereich bds., beiden Knien und Tibiakanten ,B in der HWS,S und T im li. OSCH	-1
O 18	M	P		S				2
O 19	M	P		S	2000			2
O 20	M	P		S	1996	A	gelegentlich A (ziehend) vom lumbosacralen Übergang posterior bis zum re. Knie	1
O 21	M	P				W	W im lumbosacralen Übergang und linken ant. OSCH	1
O 22	M				Okt.02			2

	Abschnitt 1:Schmerzintensität					Abschnitt 2: Körperpflege					Abschnitt 3: Heben				
ID	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2
O 1	80	0	80	0	0	20	0	20	0	0	80	80	0	80	0
O 2	100	0	100	40	-40	20	20	0	20	0	40	40	0	40	0
O 3	60	0	60	80	-80	60	0	60	20	-20	40 60	60	-20	80	-20
O 4	40	40	0	0	40	20	0	20	0	0		40	20	20	20
O 5	100	40	60	20	20	20	20	0	0	20	40	20	20	0	20
O 6	40	20	20	0	20	60	0	60	0	0	40	20	20	0	20
O 7	100	40	60	0	40	80	40	40	60	-20	40	80	-40	80	0
O 8	40	20	20	100	-80	40	40	0	40	0	60	60	0	60	0
O 9	40	40	0	40	0	40	40	0	40	0	20	20	0	20	0
O 10	100	0	100	0	0	40	0	40	0	0	80	40	40	20	20
O 11	40	40	0	40	0	20	20	0	20	0	40	40	0	40	0
O 12	40	0	40	0	0	20	20	0	20	0	0	0	0	0	0
O 13	100	60	40	60	0	40	20	20	20	0	40	20	20	20	0
O 14	80	40	40	20	20	60	40	20	20	20	40	40	0	20	20
O 15	80	40	40	0	40	60	40	20	0	40	40	60	-20	80	-20
O 16	40	40	0	40	0	0	0	0	0	0	80	80	0	80	0
O 17	60	0	60	100	-100	0	0	0	40	-40	60	60	0	100	-40
O 18	40	0	40	40	-40	40	0	40	0	0	40	40	0	40	0
O 19	100	0	100	0	0	60	0	60	0	0	80	0	80	0	0
O 20	80	40	40	40	0	0	0	0	0	0	0	0	0	0	0
O 21	100	20	80	40	-20	40	0	40	20	-20	100	60	40	60	0
O 22	80	0	80	0	0	60	0	60	0	0	60	20	40	0	20

	Abschnitt 4: Gehen					Abschnitt 5: Sitzen					Abschnitt 6: Stehen				
ID	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2
O 1	0	0	0	0	0	40	40	0	40	0	20	20	0	20	0
O 2	20	0	20	20	-20	40	40	0	40	0	60	20	40	60	-40
O 3	40	20	20	0	20	60	40	20	0	40	40	60	-20	20	40
O 4	40	0	40	0	0	60	40	20	20	20	40	20	20	20	0
O 5	0	0	0	0	0	20	20	0	0	20	20	20	0	20	0
O 6	60	20	40	20	0	0	0	0	0	0	20	20	0	20	0
O 7	80	20	60	0	20	80	20	60	20	0	80	40	40	40	0
O 8	60	40	20	60	-20	40	40	0	40	0	60	40	20	60	-20
O 9	20	20	0	20	0	40	40	0	40	0	40	40	0	40	0
O 10	0	0	0	0	0	0	0	0	0	0	60	20	40	20	0
O 11	0	0	0	0	0	40	40	0	40	0	20	20	0	20	0
O 12	0	0	0	0	0	40	20	20	20	0	60	40	20	40	0
O 13	0	0	0	0	0	60	40	20	40	0	80	60	20	60	0
O 14	60	40	20	20	20	40	20	20	20	0	40	40	0	40	0
O 15	60	40	20	0	40	60	40	20	0	40	100	60	40	40	20
O 16	20	60	-40	60	0	0	0	0	0	0	20	20	0	20	0
O 17	40	20	20	60	-40	0	0	0	40	-40	80	60	20	100	-40
O 18	40	0	40	0	0	40	20	20	20	0	60	20	40	0	20
O 19	20	0	20	0	0	40	0	40	0	0	20	0	20	0	0
O 20	0	0	0	0	0	0	0	0	0	0	20	20	0	20	0
O 21	20	0	20	0	0	40	0	40	0	0	60	40	20	40	0
O 22	60	20	40	0	20	40	0	40	0	0	40	20	20	20	0

	Abschnitt 7: Schlafen					Abschnitt 8: Sozialleben					Abschnitt 9: Reisen				
ID	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2
O 1	40	40	0	40	0	0	0	0	0	0	20	20	0	40	-20
O 2	60	20	40	40	-20	40	40	0	40	0	20	20	0	20	0
O 3	60	20	40	40	-20	80	60	20	20	40	80	40	40	20	20
O 4	20	0	20	0	0	40	40	0	20	20	20	20	0	20	0
O 5	20	0	20	0	0	0	0	0	0	0	0	0	0	0	0
O 6	0	0	0	0	0	40	40	0	40	0	0	0	0	0	0
O 7	60	20	40	0	20	80	60	20	40	20	60	20	40	20	0
O 8	20	20	0	60	-40	20	20	0	60	-40	20	20	0	40	-20
O 9	20	20	0	20	0	0	0	0	0	0	20	20	0	20	0
O 10	20	0	20	0	0	40	0	40	0	0	40	20	20	20	0
O 11	40	40	0	40	0	20	20	0	20	0	40	40	0	40	0
O 12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O 13	40	20	20	20	0	40	20	20	20	0	40	20	20	20	0
O 14	20	20	0	20	0	60	40	20	40	0	40	20	20	20	0
O 15	60	40	20	20	20	60	40	20	20	20	80	60	20	20	40
O 16	40	40	0	40	0	20	20	0	60	-40	20	20	0	20	0
O 17	20	20	0	40	-20	0	0	0	60	-60	20	20	0	20	0
O 18	60	20	40	20	0	40	0	40	0	0	40	0	40	20	-20
O 19	40	0	40	0	0	40	0	40	0	0	20	0	20	0	0
O 20	0	0	0	0	0	40	40	0	40	0	20	20	0	20	0
O 21	80	20	60	20	0	40	0	40	0	0	40	20	20	20	0
O 22	20	0	20	0	0	40	0	40	0	0	0	0	0	0	0

	Abschnitt 10: Veränderung der Schmerzintensität				
ID	V	N	Δ1	J	Δ2
O 1	60	60	0	60	0
O 2	100	20	80	80	-60
O 3	80	40	40	20	20
O 4	60	40	20	20	20
O 5	0	0	0	0	0
O 6	0	0	0	0	0
O 7	80	40	40	20	20
O 8	40	20	20	60	-40
O 9	20	20	0	20	0
O 10	40	0	40	0	0
O 11	60	40	20	40	0
O 12	80	40	40	40	0
O 13	60	60	0	40	20
O 14	80	40	40	40	0
O 15	80	60	20	20	40
O 16	60	60	0	80	-20
O 17	0	0	0	60	-60
O 18	80	20	60	20	0
O 19	40	0	40	0	0
O 20	60	60	0	60	0
O 21	60	40	20	20	20
O 22	40	0	40	0	0

Ausgangsdaten								
ID	Geschlecht	Alter	Beruf	chronischer Schmerz	akuter Schmerz	Schmerzcharakteristik (W,K,B,S,T,A)	Position (eigene Angabe)
K 1				c / 20 J.		W	W im lumbosacralen Übergang
K 2	W	61	Pension	c / 10 J.		W,B,A	W im Nacken, ~~im re. Oberarm~~, in der LWS, B im re. lateralen OSCH, A (ziehen) in beiden USCH und Knien
K 3	W	48	Kindergärtnerin	c		W	W im cervikodorsalen Übergang, vom lumbosacralen Übergang bis zum rechten Trochanter
K 4	M	36	Triebfahrzeugführer	c / 8 J.		W,~~K,T~~	W entlang beider Beckenkämme, ~~K im li. anterioren OSCH, T im li.posterioren OSCH~~
K 5	W	60	Sekretärin	c / 30 J.		W,S	W und S in der Schulter-Nackenregion
K 6	W	64	Pension	c / 10 J.		~~W~~	~~W im lumbosacralen Übergang~~
K 7				c / 38 J.		B	B entlang der Beckenkämme bis zur Symphyse
K 8	W	63	Pension	c / 1,5 J.		B,S	B, S vom Sacrum bis zum re. Trochanter
K 9	M	70	Pension		a	W	W vom li. Gluteus linienförmig bis zum li. medialen Knie
K 10	W	53	kaufm. Angestellte	c / 11 J.		W,B,T,A	W im lumbosacralen Übergang, B in der mittleren BWS, gelegentlich T im li. dors. OSCH, A (Steifheit) in der HWS
K 11	W	69	Pension	c / 50 J.		W	W entlang der ges. LWS
K 12	W	64	Pension	c / 18 J.		W	W im unteren Rücken und li. Gesäß
K 13	W	69	Pension	c / 15 J.		W	W zwischen Rippen und Beckenkämmen

	Sonst.Ther.				Aktuelle Daten			
ID	Med.	Phys. Th.	Bew.th.	Stützmieder	Letzte Behandlung (soweit angegeben)	aktuelle Schmerzcharakteristik (W,K,B,S,T,A)	aktuelle Position (eigene Angabe)	Nachhaltigkeit
K 1		P	B	S	Aug.02	W	W im lumbosacralen Übergang	0
K 2	M	P	B		Nov.01	W,B,A	W im Nacken, in der LWS, B im re. lateralen OSCH,A (ziehen) in beiden USCH und Knien	1
K 3	M	P		S		W	W im cervikodorsalen Übergang, vom lumbosacralen Übergang bis zur rechten Crista iliaca	0
K 4	M	P			Okt.01	W,S	W entlang beider Beckenkämme, S lateral am li. Beckenkamm	1
K 5		P	B	S	Mär.02	W,S,T	W und S in der Schulter-Nackenregion, in der LWS, T im re. anterioren OSCH	-1
K 6		P		S	1998			2
K 7	M	P	B	S	2001	S,T,A	S, T der li. Zehen, A (ziehen) in beiden dors. OSCH	-1
K 8		P	B		Dez.01	W,S	B, S vom Sacrum bis zum re. Trochanter	0
K 9	M		B	S	Feb.02	W	W gelegentlich vom li. Gluteus linienförmig bis zum li. medialen Knie	1
K 10	M	P	B	S	Apr.02	W,B,T, A	W im lumbosacralen Übergang und re. Kniekehle, B in der mittleren BWS, gelegentlich T im li. dorsalen OSCH, A (Spannen) in der HWS und Steifheit re. Schulter	-1
K 11	M	P	B	S		W	W entlang der ges. LWS selten	1
K 12	M	P		S	Jun.05	W	W im unteren Rücken und li. Gesäß	0
K 13	M	P	B		Sep.01	W	W gelegentlich von L1-L4	1

	Abschnitt 1:Schmerzintensität					Abschnitt 2: Körperpflege					Abschnitt 3: Heben				
ID	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2
K 1	0	0	0	20	-20	0	0	0	0	0	20	20	0	20	0
K 2	80	40	40	40	0	20	20	0	20	0	20	20	0	20	0
K 3	100	40	60	40	0	40	20	20	0	20	100	40	60	20	20
K 4	80	0	80	40	-40	60	0	60	20	-20	80	20	60	20	0
K 5	80	20	60	20	0	60	40	20	40	0	40	80	-40	80	0
K 6	100	60	40	40	20	0	0	0	0	0	20	40	-20	80	-40
K 7	80	40	40	60	-20	20	0	20	20	-20	20	0	20	60	-60
K 8	100	60	40	40	20	40	40	0	40	0	60	60	0	60	0
K 9	60	0	60	20	-20	0	0	0	0	0	0	0	0	0	0
K 10	80	40	40	60	-20	40	20	20	20	0	80	60	20	60	0
K 11	80	0	80	0	0	0	0	0	0	0	60	20	40	20	0
K 12	80	20	60	40	-20	40	20	20	0	20	40	60	-20	80	-20
K 13	80	0	80	0	0	40	20	20	0	20	60	60	0	60	0

	Abschnitt 4: Gehen					Abschnitt 5: Sitzen					Abschnitt 6: Stehen				
ID	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2
K 1	0	0	0	0	0	0	0	0	0	0	40	40	0	40	0
K 2	40	0	40	0	0	40	20	20	20	0	80	60	20	40	20
K 3	60	60	0	20	40	40	0	40	0	0	80	80	0	20	60
K 4	60	0	60	0	0	80	0	80	20	-20	60	20	40	20	0
K 5	20	0	20	0	0	60	20	40	40	-20	80	60	20	60	0
K 6	20	20	0	20	0	40	20	20	0	20	100	40	60	60	-20
K 7	0	0	0	0	0	40	20	20	60	-40	80	60	20	80	-20
K 8	0	0	0	0	0	20	20	0	20	0	60	60	0	60	0
K 9	20	0	20	20	-20	0	0	0	0	0	0	0	0	0	0
K 10	20	20	0	20	0	20	20	0	20	0	60	40	20	40	0
K 11	20	0	20	0	0	20	20	0	20	0	40	20	20	20	0
K 12	60	0	60	0	0	40	40	0	40	0	40	20	20	40	-20
K 13	0	0	0	0	0	20	20	0	20	0	40	20	20	20	0

	Abschnitt 7: Schlafen					Abschnitt 8: Sozialleben					Abschnitt 9: Reisen				
ID	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2	V	N	Δ1	J	Δ2
K 1	0	0	0	0	0	0	0	0	0	0	40	40	0	40	0
K 2	40	20	20	20	0	40	40	0	40	0	20	20	0	20	0
K 3	40	40	20	20	20	60	40	20	20	20	60	20	40	40	-20
K 4	80	0	40	40	-40	60	20	40	40	-20	20	20	0	20	0
K 5	40	20	20	20	0	20	20	0	20	0	20	20	0	20	0
K 6	0	0	0	0	0	0	0	0	0	0	20	20	0	20	0
K 7	60	40	40	20	20	60	20	40	20	0	40	20	20	40	-20
K 8	40	20	20	20	0	40	40	0	40	0	20	20	0	20	0
K 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K 10	20	20	0	20	0	40	40	0	20	20	20	20	0	20	0
K 11	0	0	0	0	0	0	0	0	0	0	20	0	20	0	0
K 12	20	0	0	20	-20	40	0	40	40	-40	40	20	20	40	-20
K 13	20	20	0	20	0	20	40	-20	40	0	40	20	20	20	0

	Abschnitt 10: Veränderung der Schmerzintensität				
ID	V	N	Δ1	J	Δ2
K 1	20	20	0	20	0
K 2	20	20	0	20	0
K 3	100	40	60	60	-20
K 4	80	40	40	80	-40
K 5	60	40	20	80	-40
K 6	60	40	20	20	20
K 7	80	20	60	60	-40
K 8	60	40	20	0	40
K 9	0	0	0	0	0
K 10	60	40	20	20	20
K 11	40	0	40	0	0
K 12	40	20	20	60	-40
K 13	40	20	20	20	0

Ausgangsdaten							Aktuelle Daten		
O 1	m	70	Pension	C / 25 J.	W,S,~~T~~,A	~~W re. LWS, re. HWS~~; S li. Knie; ~~T bds. USCH und Füße~~; A re. Handrücken	W,S,A	W re. Fuß; S li. Knie; A re. Handrücken	1
O 2	w	61	Stationsgehilfin	c / 8 J.	~~W~~,S,~~T~~	~~W bds. Handflächen, S re. Lat. OSCH, T~~ li. Post. Crista iliaca	S	S im dorsolumbalen Übergang, li. Post. Crista iliaca	1
O 3	w	63	Pension	c / 6 J.	K,S	K Fingerspitzen bds., S Schultern und cervikodorsaler Übergang bds.	K,S	K Fingerspitzen bds., S Schultern und cervikodorsaler Übergang bds.	0
O 4	m	63	Schlosser	c / 5 J.	W	W cervikodorsaler und lumbosakraler Übergang	S	gelegentlich S cervikodorsaler und lumbosakraler Übergang	1
O 5	w	77	Pension	A	~~W~~	~~W Gluteen bds.~~			2
O 6	w	72	Pension	C	~~T~~	~~T re. Gluteal und post. OSCH Region~~			2
O 7	w	75	Pension	C	~~W,S~~	W,S im re. ISG-Bereich		Schmerz im re. ISG-Bereich nur bei längerem Stehen	1
O 8	w	75	Pension	C	W	W re.Schulter, Hals, re. Glutealregion und Leiste	W,S,A	W re. Scapula und Arm, re. Hüfte und Bein bis USCH	-1
O 9	w	71	Pension	C /12 J.	W,~~A~~	W im lumbosacralen Übergang, beide Trochanter; ~~A(Steifigkeit)~~ im cerviko-dorsalen Übergang ~~und beiden Schultern~~	W	W im cervikodorsalen und lumbosacralen Übergang, beiden Trochantern	1
O 10	m	56	Angestellter	A	~~W~~	~~W inferior der li. Crista iliaca~~			2
O 11	m	58	PKW-Verkäufer	c/ 3 J.	W	W gesamte LWS	W	W LWS(Bereich kleiner)	1
O 12	m	59	Pharmazeut	C / 15 J.	~~W,T~~	~~W li. Glutealregion, T ausstrahlend in den post. Li. OSCH~~	S,A	S im li. Knie, A gelegentliches Ziehen entlang der WS in beide Beine	1
O 13	m	63	Pension	c/ 15 J.	S,T	S in LWS, T im Nacken und li. OSCH	S,T	S in LWS, T im Nacken und li. OSCH	0
O 14	w	65	Pension	c / 10 J.	~~W,S~~	~~W im re. Schulter/Nackenbereich S im lumbosacralen Übergang~~			2
O 15	w	63	Pension	c / 3 J.	W,~~B~~	W,~~B (heiß)~~ im lumbosacralen Übergang	W	W im lumbosacralen Übergang	1
O 16	w	70	Pension	c / 15 J.	W,K,T	W im Nacken, LWS, re. Scapula, K in beiden Händen und posterior im linken Bein, T im linken Fuß	W,K,T	W im Nacken, LWS, re. Scapula, K in beiden Händen und posterior im linken Bein, T im linken Fuß	0
O 17	w	70	Pension	c / 15 J.	W,S,T	W im Glutealbereich bds.,S und T im li. OSCH	W,B,S,T	W im Glutealbereich bds., beiden Knien und Tibiakanten ,B in der HWS,S und T im li. OSCH	-1
O 18	w	75	Hausfrau	c / 20 J.	~~W~~	~~W vom Sacrum posterior bis zur linken Ferse~~			2
O 19	m	42	Büroangestellter	c / 9 J.	~~W,A~~	~~W in der HWS, vom lumbosacralen Übergang posterior bis zum re. Knie, A in der re. Kniekehle~~			2
O 20	m	55	Verkäufer	c / 12 J.	A	A (ziehend) vom lumbosacralen Übergang posterior bis zum re. Knie	A	gelegentlich A (ziehend) vom lumbosacralen Übergang posterior bis zum re. Knie	1
O 21	w	61	Pension	C	W,~~S~~	W im lumbosacralen Übergang und W und ~~S in beiden ant. OSCH~~	W	W im lumbosacralen Übergang und linken ant. OSCH	1
O 22	w	31	Ergotherapeutin	C	~~W~~	~~W im gesamten unteren Rücken zwischen Th10 und S1~~			2

Ausgangsdaten						Aktuelle Daten		
ID	Geschlecht Alter Beruf	akuter / chronischer Schmerz	Schmerzcharakteristik (W,K,B,S,T,A)	Position (eigene Angabe)	aktuelle Schmerzcharakteristik (W,K,B,S,T,A)	aktuelle Position (eigene Angabe)	Nachhaltigkeit
K 1		c / 20 J.	W	W im lumbosacralen Übergang	W	W im lumbosacralen Übergang	0
K 2	w 61 Pension	c / 10 J.	W,B,A	W im Nacken, ~~im re. Oberarm~~, in der LWS, B im re. lateralen OSCH, A (ziehen) in beiden USCH und Knien	W,B,A	W im Nacken, in der LWS, B im re. lateralen OSCH,A (ziehen) in beiden USCH und Knien	1
K 3	w 48 Kindergärtnerin	c	W	W im cervikodorsalen Übergang, vom lumbosacralen Übergang bis zum rechten Trochanter	W	W im cervikodorsalen Übergang, vom lumbosacralen Übergang bis zur rechten Crista iliaca	0
K 4	m 36 Triebfahrzeugführer	C / 8 J.	W,~~K,T~~	W entlang beider Beckenkämme, ~~K im li. anterioren OSCH, T im li.posterioren OSCH~~	W,S	W entlang beider Beckenkämme, S lateral am li. Beckenkamm	1
K 5	w 60 Sekretärin	c / 30 J.	W,S	W und S in der Schulter-Nackenregion	W,S,T	W und S in der Schulter-Nackenregion, in der LWS, T im re. anterioren OSCH	-1
K 6	w 64 Pension	c / 10 J.	~~W~~	~~W im lumbosacralen Übergang~~			2
K 7		c / 38 J.	B	B entlang der Beckenkämme bis zur Symphyse	S,T,A	S, T der li. Zehen, A (ziehen) in beiden dors. OSCH	-1
K 8	w 63 Pension	c / 1,5 J.	B,S	B, S vom Sacrum bis zum re. Trochanter	W,S	B, S vom Sacrum bis zum re. Trochanter	0
K 9	m 70 Pension	a	W	W vom li. Gluteus linienförmig bis zum li. medialen Knie	W	W gelegentlich vom li. Gluteus linienförmig bis zum li. medialen Knie	1
K 10	w 53 kaufm. Angestellte	c / 11 J.	W,B,T,A	W im lumbosacralen Übergang, B in der mittleren BWS, gelegentlich T im li. dors. OSCH, A (Steifheit) in der HWS	W,B,T, A	W im lumbosacralen Übergang und re. Kniekehle, B in der mittleren BWS, gelegentlich T im li. dorsalen OSCH, A (Spannen) in der HWS und Steifheit re. Schulter	-1
K 11	w 69 Pension	c / 50 J.	W	W entlang der ges. LWS	W	W entlang der ges. LWS selten	1
K 12	w 64 Pension	c / 18 J.	W	W im unteren Rücken und li. Gesäß	W	W im unteren Rücken und li. Gesäß	0
K 13	w 69 Pension	c / 15 J.	W	W zwischen Rippen und Beckenkämmen	W	W gelegentlich von L1-L4	1

Oswestry Disability Questionnaire

Name: Patient No.:

Date:

This questionnaire has been designed to give us information about how your back or leg pain has effected your ability to manage in everyday life. Please answer every section and mark only the one box in each section which applies most to you. We realize you may consider that two of the statements in any one section relate to you, but please mark just the one box which most clearly describes your problem.

Section 1: Pain Intensity

I have no pain at the moment	O
The pain is very mild at the moment	O
The pain is moderate at the moment	O
The pain is fairly severe at the moment	O
The pain is very severe at the moment	O
The pain is the worst imaginable at the moment	O

Section 2: Personal Care (washing, dressing, etc.)

I can look after myself normally without causing extra pain	O
I can look after myself normally but it causes extra pain	O
It is painful to look after myself and I am slow and careful	O
Need some help but manage most of my personal care	O
I need help every day in most aspects of self care	O
I do not get dressed, wash with difficulty, and stay in bed	O

Section 3: Lifting

I can lift heavy weights without extra pain	O
I can lift heavy weights but it gives extra pain	O
Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently placed, e.g. on a table	O
Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned	O
I can lift only very light weights	O
I cannot lift or carry anything at all	O

Section 4: Walking

Pain does not prevent me from walking any distance	O
Pain prevents me from walking more than 1 mile	O
Pain prevents me walking more than ½ mile	O
Pain prevents me walking more than ¼ mile	O
I can only walk using a stick or crutches	O
I am in bed most of the time and have to crawl to the toilet	O

Section 5: Sitting

I can sit in any chair as long as I like	O
I can sit in my favourite chair as long as I like	O
Pain prevents me from sitting more than 1 hour	O
Pain prevents me from sitting more than ½ hour	O
Pain prevents me from sitting more than ¼ hour	O
Pain prevents me from sitting at all	O

Section 6: Standing

I can stand as long as I like without extra pain	O
I can stand as long as I like, but it gives me extra pain	O
Pain prevents me from standing for more than 1 hour	O
Pain prevents me from standing for more than ½ hour	O
Pain prevents me from standing for more than 10 minutes	O
Pain prevents me from standing at all	O

Section 7: Sleeping

My sleep is never disturbed by pain	O
My sleep is occasionally disturbed by pain	O
Because of pain I have less than 6 hours sleep	O
Because of pain I have less than 4 hours sleep	O
Because of pain I have less than 2 hours sleep	O
Pain prevents me from sleeping at all	O

Section 8: Sex life (if applicable)

My sex life is normal and causes no extra pain	O
My sex life is normal and causes some extra pain	O
My sex life is nearly normal, but is very painful	O
My sex life is severely restricted by pain	O
My sex life is nearly absent because of pain	O
Pain prevents any sex life at all	O

Section 9: Social life

My social life is normal and causes no extra pain	O
My social life is normal but increases the degree of pain	O
Pain has no significant effect on my social life apart from limiting My more energetic interests, e.g. sports, etc.	O
Pain has restricted my social life and I do not go out as often	O
Pain has restricted my social life to home	O
I have no social life because of pain	O

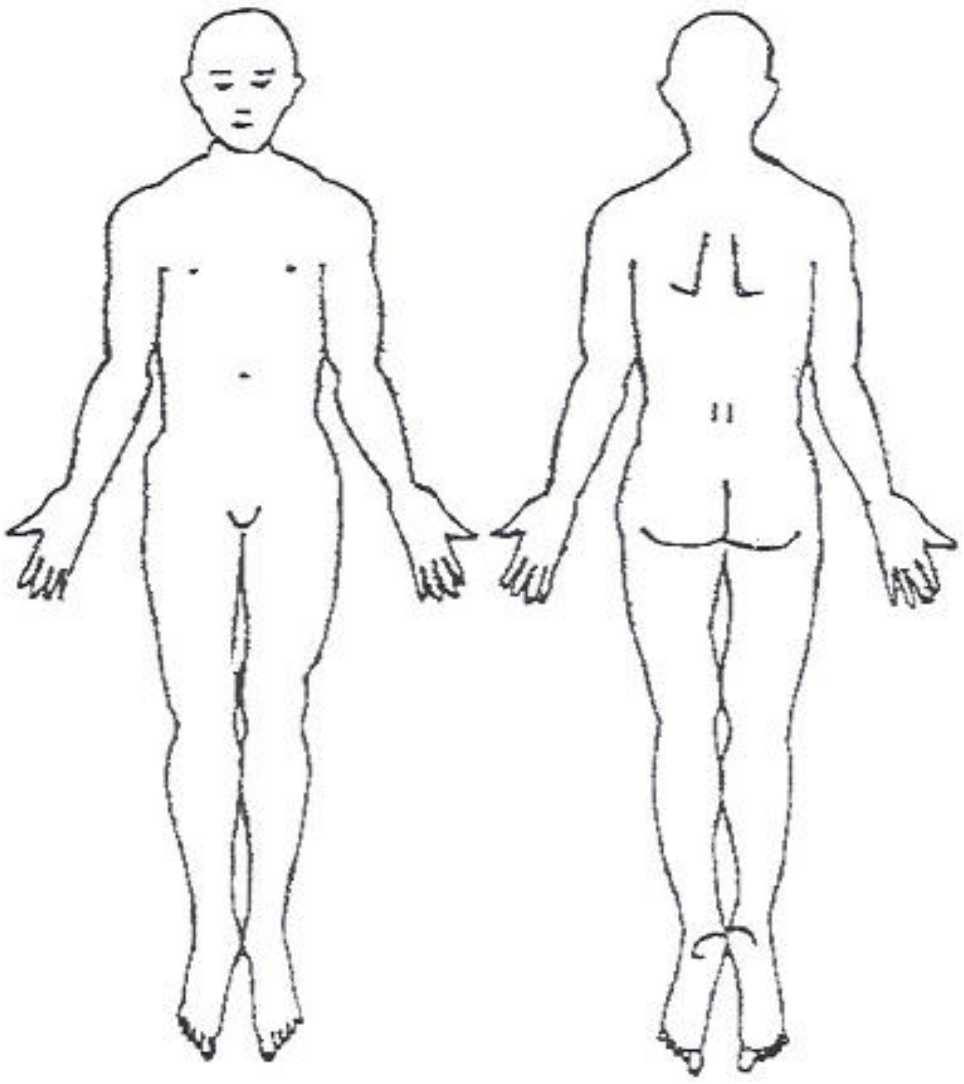
Section 10: Travelling

I can travel anywhere without pain	O
I can travel anywhere but it gives me extra pain	O
The pain is bad, but I manage journeys over 2 hours	O
Pain restricts me to journeys of less than 1 hour	O
Pain restricts me to short journeys under 30 minutes	O
Pain prevents me from travelling except to receive treatment	O

ODI=_____x 20=_____%

Mark the areas on your body where you feel these sensations. Use the symbols below and mark all the affected areas.

Numbness	Pins and Needles	Ache	Pain
========	OOOOOO	XXXXXX	///////////
========	OOOOOO	XXXXXX	///////////



Short - Form McGill Pain Questionnaire

Name: Patient No.:

Date:

Please select from the list below words that you would use to describe your pain:

	None (0)	Mild (1)	Moderate (2)	Severe (3)
Throbbing				
Shooting				
Stabbing				
Sharp				
Cramping				
Gnawing				
Hot/Burning				
Aching				
Heavy				
Tender				
Splitting				
Tiring/Exhausting				
Sickening				
Fearful				
Punishing/Cruel				

Please mark a cross on the line below to indicate the intensity of your pain:

No pain _____ Worst pain

Present pain index:

Which of the following words explains your present pain?

0	No pain	
1	Mild	
2	Discomforting	
3	Distressing	
4	Horrible	
5	Excruciating	

Modified Somatic Perception Questionnaire

Name: Patient No.:

Date:

Please describe how you have felt during the past week by placing a cross in the appropriate box. Please answer all questions and do not think too long before answering.

	Not at all	A little/ slightly	Quite a bit	Extremely/ Could not have been worse
Heart rate increasing				
Feeling hot all over				
Sweating all over				
Sweating in a particular part of the body				
Pulse in neck				
Pounding in head				
Dizziness				
Blurring of vision				
Feeling faint				
Everything appearing unreal				
Nausea				
Butterflies in stomach				
Pain or ache in stomach				
Stomach churning				
Desire to pass water				
Mouth becoming dry				
Difficulty swallowing				
Muscles in neck aching				
Legs feel weak				
Muscles twitching or jumping				
Tense feeling across forehead				
Tense feeling in jaw muscles				

Modified Zung Index

Name: Patient No.:

Date:

Please indicate for each question the answer which best describes how you have been feeling recently. Please answer all questions.

	Rarely or none of the time (less than 1 day a week)	Some or little of the time (1-2 days per week)	A moderate amount of time (3-4 days per week)	Most of the time (5-7 days per week)
I feel downhearted and sad				
Morning is when I feel best				
I have crying spells or feel like it				
I have trouble getting to sleep at night				
I feel that nobody cares				
I eat as much as I used to				
I still enjoy sex				
I notice I am losing weight				
I have trouble with constipation				
My heart beats faster than usual				
I get tired for no reason				
My mind is as clear as it used to be				
I tend to wake up too early				
I find it easy to do the things I used to				
I am restless and can't keep still				
I feel hopeful about the future				
I am more irritable than usual				
I find it easy to make a decision				
I feel quite guilty				
I feel that I am useful and needed				
My life is pretty full				
I feel that others would be better off if I were dead				
I am still able to enjoy the things I used to				

13 Abstract

THE PHENOMENON SPONDYLOLISTHESIS FROM AN OSTEOPATHIC POINT OF VIEW

An approximation to a pathology which is determined by a multitude of factors – supported by a comparative study of the subjective modifications of pain and the quality of life

by Martha Schiener

Keywords: spondylolisthesis, lumbar spine, back pain, osteopathy, quality of life

Aim: Osteopathy emphasises the optimum functioning of the entire body and so also of the lumbar spine. The aim of this thesis is to find out, whether osteopathic treatments can achieve a lasting improvement of the condition of spondylolisthesis patients. Particularly in the case of spine pathologies such as spondylolisthesis, the subjective degree of suffering has a decisive influence on the quality of life and, thus, on the length of sick leaves, on the fitness for work and on the necessity of recurring medical and physical treatments of the symptoms. This thesis constitutes an important building block in order to demonstrate how efficient osteopathic treatments are for patients with this syndrome.

Study design: comparative, retrospective, statistically evaluated clinical study. The standardised Oswestry Pain Questionnaire to record the quality of life and a pain drawing were used. The success of treatment and the lasting effect of treatment were examined.

Method: The questionnaires of 22 patients having undergone osteopathic treatment were compared with those of 13 patients having undergone orthopaedic treatment. All participants were diagnosed as having spondylolisthesis (isthmus lysis) or pseudospondylolisthesis (degenerative form) grade I-II. Serious pathologies and surgery of the lumbar spine and the lower extremity were excluded.

Results: With regard to the improvement of the quality of life no statistically significant differences could be demonstrated. However, the group having undergone osteopathic treatment shows a tendency for a greater lasting effect of the treatments. The results of the pain drawing clearly show the benefit of osteopathic treatments for spondylolisthesis patients. The group of patients that is pain-free in the long run is four times bigger than in the control group.

Conclusion: The diagnosis „spondylolisthesis“ as such is not sufficiently meaningful for the prognosis and the type of therapy, but it has to be assigned to the range of non-specific lower back pain. The osteopathic treatment places the main emphasis on removing adjacent hypomobilities. The body regains its lost range of motion, and the listhesis segment is relieved. Various studies indicate that continuous stress at work or in private life contributes to the occurrence of back pain and its chronicity. Somatic factors are of only little importance in the prognosis of non-specific back pain. However, the patients themselves assess the success of a treatment by means of bodily factors. Thus, holistic, body-related treatments such as osteopathy have a considerable psychological importance, because the associative link between movement/strain and back pain can be suspended.