The Change In The Clinic In Lumbar Disc Herniation After Osteopathic Treatment

Master Thesis zur Erlangung des Grades

Master of Science in Osteopathie

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niedergelegt von

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ERKLÄRUNG

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1. Introduction

There is hardly a human being who does not suffer from problems caused by degenerative changes in his vertebral discs in the course of his life. (Krämer 1997). Pathologic-anatomic examinations by Junghans et al. (1968) have shown that every human being shows degenerative changes of his vertebral discs after the age of 30. 68% of patients are between the age of 30. and 60 with the frequency reaching the peak among the 40 to 50-year-olds.
Among the patients who receive outpatient treatment men with 47,2% are nearly as frequently affected as women with 52,8%. However, the male sex dominates with regard to serious lumbar syndromes that require surgery.
61,94% of disc prolapses are localized in the lumbar spine and 36,1% in the cervical spine. In the thoracic spine vertebral disc syndromes are very rare (1,96%). (Krämer 1997)

The course of treatment of patients who suffer from lumbar disc prolaps can vary a great deal. If symptoms and clinic improve fastly, the question is, in how far the localisation i.e. the pathologic condition of the disc has changed and whether the cause of the patient's problems is dependent on the disc herniation in the first place. Many diagnosed disc prolapses seem to be random results rather than the root cause of the patient's symptoms. Because of frequent use of imaging techniques the conclusion that the problems and pains are connected to the disc prolaps, is drawn too fast.

In 1993 *E. Ernst* already posed the question, whether a disc prolaps generally has to be **operated**. In his analysis he came to the result that there is a large grey area for an indication to operation. But he states that, seen statistically, an operation would lead to better results in the first year, which however, is not to be verified four years later.

St. Atlas et al. (2001) came to a similar result. They examined 402 patients who had a sciatica caused by a slipped disc. 220 of the patients were **operated** and 182 received **conservative** treatment. Within five years 19% of the operated patients had to undergo surgery once again. Among the conservatively treated patients this number amounted to only 16%. By contrast, the symptoms improved in 70% of the operated patients and only in 56% of the non-operated. However, it has to be noticed that the patients who were operated had shown worse symptoms at the beginning and a worse functional condition than the non-operated patients! This shows that the groups were not randomised. Furthermore, the study does not show which conservative ways of treatment the patients received (e.g. osteopathic or physiotherapeutic treatment). After 5 years the results of the two groups did not show any relevant differences anymore.

A contradictory result was produced by *A. Burtons et al.* (2000) in their randomised study the observation period of which was 12 months. They examined patients with symptomatic lumbar disc prolaps and divided them into two groups one of which was treated with **osteopathic manipulation** whereas the other group was treated by **chemonucleolysis**. By 12 months both groups had improved so that no statistically significant difference could be observed. But in the group that has been treated with osteopathic manipulation the symptoms improved faster in the first few weeks and in addition the cost of treatment was lower.

Concerning the **reoperation ratio** *M. Haag* (1999) could observe the following: 89 patients were observed 28 months after the operation, 69 patients described the result of the treatment as good or satisfactory; 16 of the followed up patients had to be reoperated, 75% of them already during the first 3 months. The reooperation ratio in the group in which leg pain disappeared within the first week amounted to 10% and to 38% in the group with longer persistence. In this connection the renowned

orthopaedist *A. Nachemson* stated in 1992 that the best progress is reached when all the unnecessary surgical interventions for which there is no evidence in connection with back pain are avoided. In the US 20-40% of operations are unsuccessful and lead to chronic pains, the “failed back syndrome”.

D. Brötz et al. (2001) carried out a study in which they examined the efficacy of conservative physiotherapy with methods of treatment according to **McKenzie and Maitland** for lumar disc prolapses in 21 patients. 14 patients had sensitivity disorders at the time of admission and 8 patients had a paresis. The treatment was stationary (12 days on average) and was supported with analgesic and muscle relaxing medication. Quantitative and qualitative examination was carried out at the time of their discharge after 42 and after 262 days. The results showed a significant improvement in the short-run as well as in the long-run. Only two patients had to be operated afterwards, 3 patients could not be followed-up. The other 16 patients were free of symptoms or reported only minor problems.

R. Galm et al. (1997) conducted a study in which they examined the frequency of **dysfunctions of the sacroilial joints** among patients with sciatic pains and radiologically proved disc herniation. 150 patients were examined who however, did not have any sensomotor failures. In 46 patients (Group A) sacroiliac dysfunctions could be found which were solved with chiropractic. In group B no indications of a blockage were found. Both groups received in-patient treatment with an emphasis on physiotherapy. 74% of group A reported an improvement of pain, 5 did not have pain anymore. In group B more than 57% reported an improvement, none of them however, was free of pain. 5 patients (10,8%) of group A and 19 patients (18,3%) of group B suffered from persistent pain and an indication to nucleotomy had to be made. The result of the study says that patients should always get an additional chirodiagnostic examination, independent of the radiological results. Possible wrong indications to nucleotomy might thus be avoided.

An interesting study with regards to the inclusion criteria is was made by *J.David* (1996) who examined **clinical and anatomic changes** in patients with cervical or lumbar disc prolaps. He examined 27 patients with the following inclusion criteria: Cervical or lumbar, heavy pain with radiation in die upper or lower extremity as well

as limited mobility and a positive MRI result. Furthermore, sensitivity, reflexes, motor weakness and the Lasegue were examined. At least three of the clinical tests had to be related to the MRI result. The patients were treated intensely with tractions, thrust-techniques, physiotherapy and training therapy between 6 weeks and 6 months. As soon as the clinical findings, the pain, the mobility and the sensors had improved, a control-MRI was arranged for with the radiologist not being informed about the symptoms. 80% showed a distinct pain improvement and the prolaps had decreased significantly or even was completely reabsorbed. 17 patients had an 80% pain improvement. In 5 patients the clinic as well as the MRI had not improved, two of them even reported a deterioration but the objective and subjective tests were not corresponding (according to the MRI a deterioration could not be proved).
Although this study has very strict inclusion criteria, it has to be viewed critically because no control group was used. Taking into consideration the fact that vertebral discs can be reabsorbed by phagocytosis, it is impossible to find out how many patients would have improved without treatment within the scope of the study!

A purely **chiropractic study** was conducted by *J.Cassidy* (1993).Out of 14 examined patients 13 showed a significant reduction of pain after a three-week treatment with daily rotatory manipulation in a lateral position. 5 patients only had a minor change and one patient a complete reabsorbtion.

Zhao and Feng (1996) are of different opinion. They examined 22 patients with disc herniation in more than one level and 39 patients with one prolaps. In the 86 motion segments that were examined altogether no difference could be observed neither in the size nor in the position. They argue that in studies in which a reduced disc herniation owing to **manipulation** (thrust-technique) could be proved, natural shrinkage was the cause. On the contrary, forceful manipulation can even lead to a deterioration of the prolaps or to a the development of a sequestrum.

The same opinion is held by *P. Huijbregts et al.* (1998) who conducted a literature review on the topic. The come to the conclusion that a **rotatory manipulation** does not have any positive effects on the position of a slipped disc. The manipulation is even a contraindication since it can lead to a reinforcement of the prolaps. A constant

traction would at least lead to a short-term change in the position, probably caused by the resulting negative pressure, and would hence result in a pain reduction.

A **progressive dynamic strength training** is chosen by *Ph. Weishaupt et al.* (1999) as the appropriate treatment for patients with chronic back pain. 15 patients with disc prolaps in the lumbar spine underwent a biomechanic function analysis according to *Denner* (1997). After 12 weeks of special strength training 43,8% were completely free of pain, all other patients reported a reduction of the intensity of pains.

A similar result was reached by *A. Hack et al.* (2002) with **muscle training** in case of a slipped disc in the lumbar spine. 44 persons took part in the study, 12 of them however, had to be excluded due to severe orthopaedic diseases. The therapy was focussed on muscular strengthening, stretching, relaxation and functional gymnastics in a period of 12 weeks with two training units each week. Immediately after the training 20% were free of pain and 83% had less pain, but after 6 months it came to a relaps although the persons had carried out a exercises to strengthen their back on their own at home. Only 12% were free of pain afterwards but 72% reported an improvement. It became clear that supervised continued training is necessary in order to keep the improved functional condition up.

In a twelve-week longitudinal study carried out by *Denner et al.* (1997) with 674 subacute and chronic back patients 38,9% of test persons were completely free of pain afterwards, in 80,8% the intensity of pain was reduced with a **strengthening** of the isometric maximum strength of the lumbar extensors.

The varying results of these studies raise the question whether an ostheopatic treatment, i.e. a concept that comprises only passive applications, is sufficient to grant freedom of pain to a patient in the long run. Or is it necessary for patients with lumbar disc herniation to carry out additional exercises for stabilisation and strengthening to reach freedom of pain in the long run?

In this work the result of two conservative methods of treatment for patients with diagnosed disc herniation shall be examined with the help of a clinical trial. The patients of group A underwent osteopathic treatment, the control group B was treated

with physiotherapy. The emphasis of physiotherapeutic measures was on exercises for stabilisation and strengthening.

The following points were examined in particular:
Can surgery be avoided for a patient with diagnosed disc prolaps?
Does osteopathic treatment influence the clinic with patients with a slipped lumbar disc (it is of interest whether or not the position of the disc is changed)?
Is osteopathic treatment sufficient or are exercises for stabilisation and strengthening indispensable in case of this syndrome?
Is the vertebral disc the real cause for the symptoms Is in case of a diagnosed disc herniation?

The work is not only of great relevance for osteopathy but also for orthodox medicine since the patients could get round surgery after a successful treatment.

2. Basics

In this section embryologic, anatomic connections in the lumbar spine and the functional relations to the locomotor system will be discussed, which are of relevance for the osteopathic method of treatment and especially for this trial will be discussed.

2.1. Embryology

Already an embryo with a vertex-coccyx-length of 12mm has a spinal layout, that consists of the cartilaginous vertebrae and sections between the vertebrae and is interlard with the chorda dorsalis. When a length of 50mm measured from vertex to coccyx is reached the corda in the vertebra is edged out by the growth-induced pressure exercised by the cartilaginous cells and remains in the section between the vertebrae.

The parachordal disc-layout consists of an outer and an inner zone. Out of the outer zone the **annulus fibrosus** with longitudinal fibrils develops. Out of the inner zone and the chorda segment the **nucleus pulposus** develops.

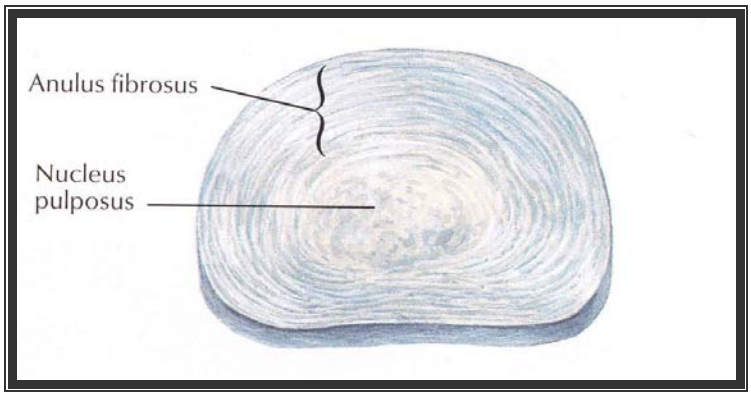


Figure 1: Discus intervertebralis (Netter, 1997)

Between the discs and their adjacent vertebral bodies the **cartilage end plate** with its cartilaginous border develops. This end plate becomes bony afterwards. All structures in the sections between the vertebrae that are necessary for later mechanic load already exist at the time of birth.

In the embryo and the infant the section between the vertebrae is supplied with blood vessels. The central sections however, are only fed by diffusion from the beginning.

In the second year the blood vessels regress and cannot be found any more in the four-year-old. There is no explanation for this regress of the vessels. This deteriorated basis of nutrition is one reason for the early degeneration of the discs. Furthermore, it has to be noted, that during birth the vertebra and the section between the vertebrae are of the same height. After growth ends it only has 1/3-1/5 the height of the adjacent vertebra. Qualitative changes as well can already be observed in the youth (rapid decrease of the water content).
(Krämer 1997)

Due to the regression of the vessels and the resulting unfavourable nutrition situation an early degeneration is nearly expected from the start. This seems to be furthered by bad posture, more and more sitting occupations and a lack of compensating exercises that already decreases during childhood.

2.2 Anatomy

2.2.1 The motion segment

Seen from a functional point of view Junghanns (1979) speaks of a motion segment that represents the functional unit of the spine (see Figure 2). This consists of section between the vertebrae and cartilage end plate, the latter belonging to the vertebra seen from a evolutionary point of view. Furthermore, the motion segment comprises half of the adjacent vertebrae, anterior and posterior longitudinal ligament, ligamentum flavum, vertebral joints and all soft parts that are located in the vertebral canal, in the foramen intervertebrale and between the spinous process and the transverse processes (see figure 2)

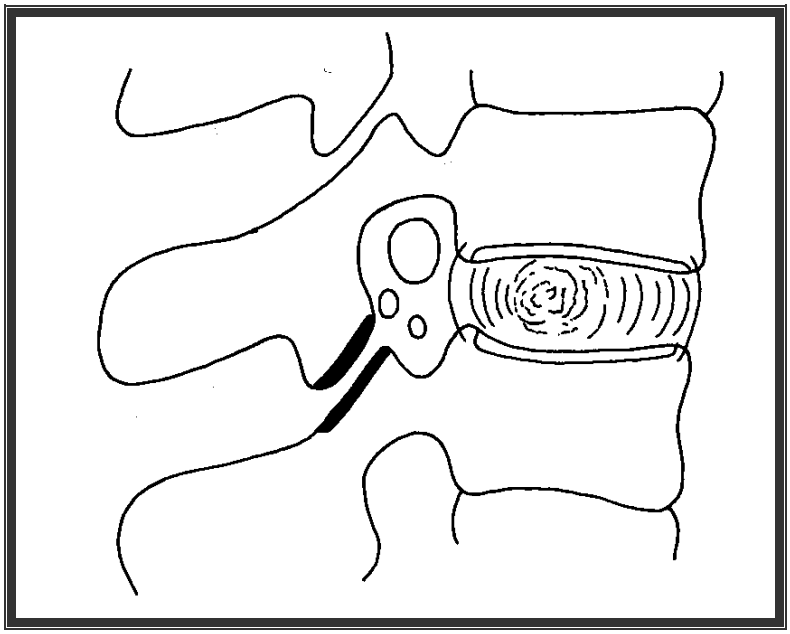


Figure 2: Motion segment according to Junghanns (Krämer 1997)

The anterior longitudinal ligament covers the front of the vertebrae and the annulus fibrosus. It is easily detachable, i.e. it is not deeply rooted in the disc.
Unlike the anterior longitudinal ligament the posterior longitudinal ligament is tightly connected to the disc. It is broader cranial and narrows in the region of the lumbar spine.

In disc preparations it could be noticed that the posterior longitudinal ligament does not fully cover the disc-border at the back side, it leaves the dorso-lateral sections uncovered. This anatomic peculiarity could be another reason for disc herniations which are known to appear quite frequently in this region. (Stahl 1977).

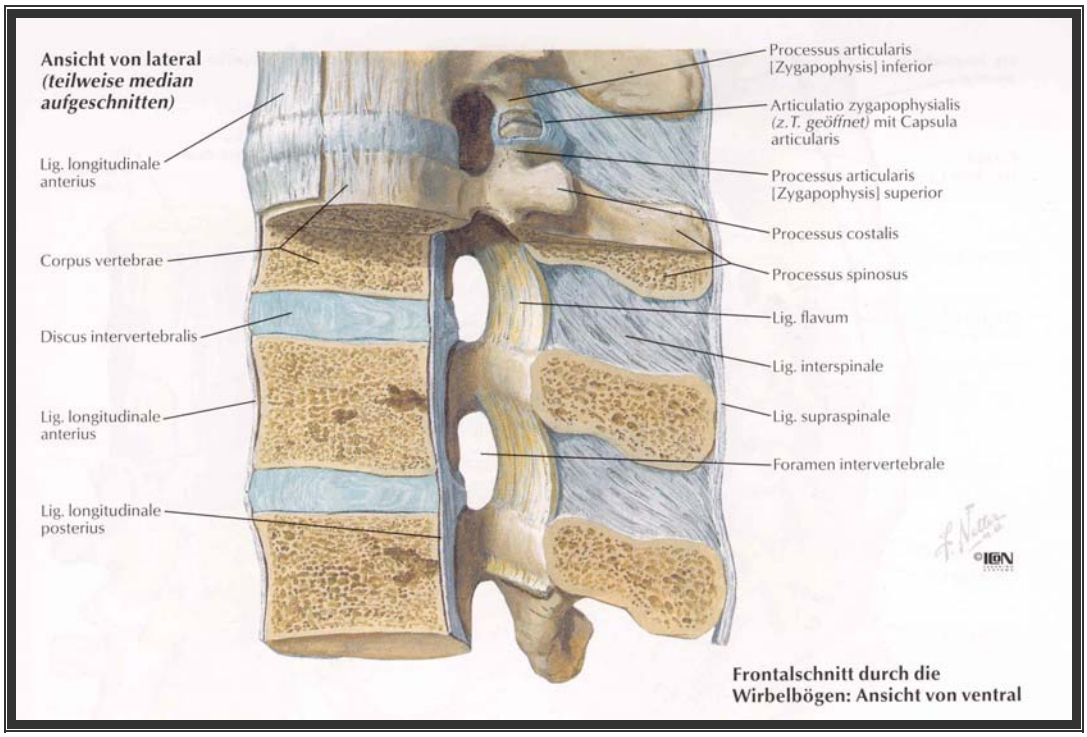


Figure 3: front-section of the spine (Netter 1997)

2.2.2 The vertebral disc

The discus intervertebralis consists of an outer, taut annulus fibrosus and a soft, jelly-like nucleus, the nucleus pulposus.

The **annulus fibrosus** is a ring consisting of skrew-shaped fibres which run from vertebra to vertebra. The ring consists of layers of concentric fibres with the adjacent fibrils running diagnoally and crossing each other. The peripher fibrils run vertically, becoming more diagonal, nearly horizontal towards the inside. (Kapandij 1992)

At the edges of the annulus fibrosus there are coarse so called Sharpey's Fibres, that are deeply rooted in the bony borders. It has to be noticed that the lamellae are more numerous and thicker ventrally and laterally than dorsally. Dorsally and dorso-laterally the ring is narrow and there are only few quite thin lamellae. (Krämer 1997)

The outer zone of the annulus fibrosus consists of lamellae, taut connective tissue and the inner zone resembles a fibro-cartilaginous tissue that turns into the nucleus pulposus without a strict border. The fibrous structure of the lamellae consists at 90% of collagen fibres and at about 10% of elastic fibres. The collagen fibres consist of type-1 and type-2 collagen, with type-1 predominately being found in the outer zone and type-2 being predominately found in the inner zone. In the ring the

glycosaminoglykane mainly contain keratan sulfate, that has a high ability to bind water. (Rauber 1987)

The **nucleus pulposus** mainly contains type-2 collagen. The basis of the nucleus pulposus consists of remaining tissue of the chorda dorsalis. Next to the chorda cells there are net-shaped cords the mesh spaces of which contain fluid basic substance. This way a complex hollow space is formed that is filled with synovia-like fluid at the beginning and later on is filled with gelatinous tissue. At a more senior age the tissue of the jelly-like nucleus can easily be pulled apart and has hollow spaces. In these hollow spaces fluid can be instilled easier (1-2 cm^2) than in the youth where cohesion is very strong. (Krämer 1997)

2.2.3. Structures that are anatomically connected to the vertebral discs

The anterior and the posterior longitudinal ligament (see 2.1.1.)
M. psoas major: The deep part of the muscle originates from the lateral surfaces of the 12. thoracic vertebra and the 1.-4. lumbar vertebra as well as of the disci intervertebrale lying in between. From an osteopathic point of view there is a close functional connection between this muscle and the disc. This assumption however, has not been proved neither experimentally nor clincally.
Diaphragma: The pars lumbalis consists of a crus mediale and laterale. The crus mediale dextrum originates of the 1.-4. and the crus mediale sinistrum of the 1.-3. lumbar vertebra. The crus laterale is divided among other things into a psoas arcade originating from the 1.-2. lumbar vertebrae.
Sacrum: The articulation lumbosacralis is the jointed connection between the 5. lumbar vertebra and the sacrum. Between the sacrum and the 5. lumbar vertebra there is a lumbosacral disc.
Vertebra: Every disc is communicates with two vertebrae (except for the 5. lumbar vertebra that is connected to the sacrum caudrally).

2.3. Histology and Biochemistry

The tissue is built of connective tissue cells which amounts to 20 and 30% of the entire volume of tissue. Furthermore, there are fibroplasts, cartilage cells and chorda cells in the tissue. The connective tissue cells produce basic substance and fibrils, partly intercellular and partly extracellular. For a synthesis of the extracellular macro-molecules the cells need low-molecular metabolic substrates like amino acids, salts, glycosis and water. The cell-density depends on the nutrition situation, that's why there are less cells in the centre of the disc.
(Stairmand et al. 1991)
Besides the interstitial fluid there are also minerals, enzymes, organic matrix and small quantities of fat in the tissue. The basic substance belongs to the organic matrix, its content increases from the ring to the nucleus. In this basic substance there are mainly glycoproteins and high-molecular polysaccharides.
Glycoproteins consist of protein and carbohydrates and have a strong attraction for water and a high viscosity. Among the polysaccharides there are mainly the acid mucopolysaccharides like hyaluron acid, chondroitinsulfate, keratan sulfate and heparin. The mucopolysaccharides form a highly polymeric three-dimensional lattice that gives viscosity to the basic substance. The macromolecules form a large portion of the disc fluid due to their high hydrodynamic volume. (Krämer 1997)
Because of the high content of glycosaminoglycane in the nucleus pulposus an accordingly large quantity of water can be bound. The nucleus has the mechanical function of a "hydraulic press" and evenly passes on the pressure to the annulus fibrosus and the end plates in case of a centric load. (Rauber 1987)
When parts of the nucleus come out it can be assumed that the described function is at least limited.

2.4. The disc as an osmotic system

(Krämer 1997)

Between the inner area of the disc, the end plates, the annulus fibrosus and the paravertebral tissue or the spongiosa of the neighbouring vertebrae there is an exchange of substance and fluid. The limiting layers of tissue of the intervertebral foramen have the features of a semipermeable membran. (Figure 4)
The inner space of the disc and the paravertebral tissue or spongiosa differ among other things with respect to the hydrostatic pressure. In the spongiosa and in the soft parts next to the discs there is the normal tissue pressure, by contrast the disc is subject to high pressure that can amount to more than 1000N. The flow of fluid necessary for metabolism has to take place against this slope of pressure. Among other things this is possible with the help of osmotic forces. The mucopolysaccharides have a high attraction for water and can hold and absorb fluid in high pressure load. This suction pressure is called osmotic pressure and takes place against the load pressure. In addition to the osmotic pressure there is also the swelling pressure. The latter is the pressure with which a swellable body expands against resistance in case of in water supply. The osmotic pressure together with the swelling pressure results in the oncotic pressure.

Tissue pressure on the outside of the vertebral disc and suction power of the discal tissue are opposed to the intradiscal tissue pressure and to the extradiscal suction power. When one side predominates shifts in fluid and substance take place. For the discal nutrition the interplay between hydrostatic and oncontic pressure are of great importance.

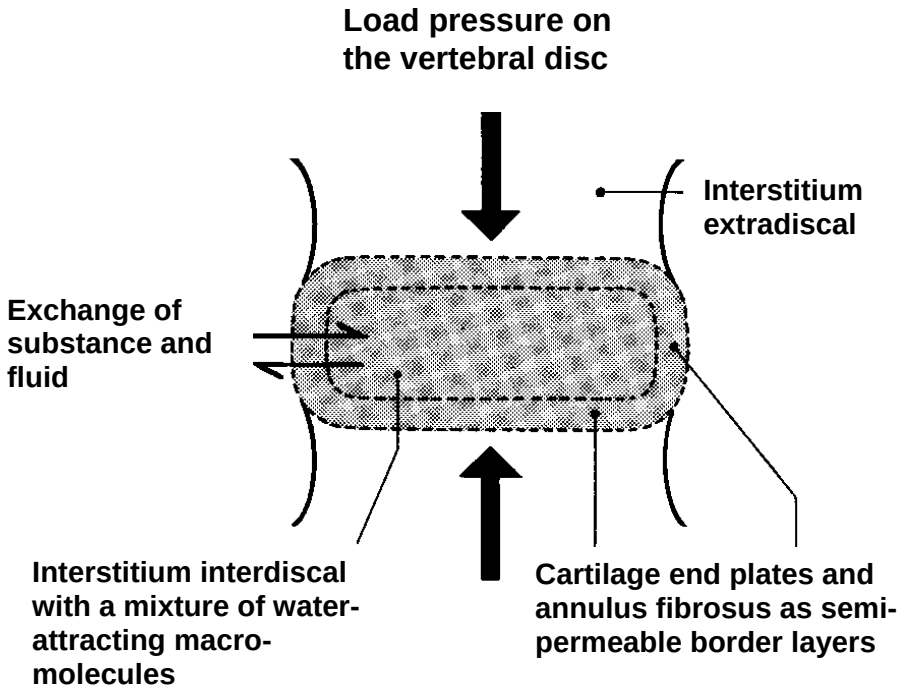


Figure 4: Osmotic System (Krämer 1997)

2.5. Intradiscal Pressure

In an upright posture especially the lower sections of the spine are subject to heavy loads. The weight of all above sections has to be carried on a few cm^2. In a supine position a pressure of about 5 Pa is exercised on the vertebral discs. In standing this pressure increases to about 100 Pa and to about 220 Pa in bending forward with weights. It is noticeable that in an upright unsupported sitting position the load on the disc with 140 Pa is higher than it is in a standing position. In view of the high load pressures that often last for hours in our daily routine the fact that degeneration occurs in a relatively poorly nurtured tissue is not surprising (Krämer 1997)
In an experiment lumbar discs can be pressed together to a narrow slit by a compression lasting for 12 hours and a load pressure of 200 Pa. In a subsequent relief they regain their original height by absorbtion of fluid. In vivo these changes in height are considerably lower but still clearly measurable.
(Krämer 1973)
The disc's increase in height when the intradiscal pressure is reduced can be used therapeutically. In extension the lumbar disc widen by 1,1 mm each! With age however, the difference in length decreases. Since a minimum relief on the nerve of

the protruded disc can have a soothing effect, this minor change in height can be of relevance for the removal of pain.

Figure 5 shows the intradiscal pressure in the third lumbar disc in varying positions. Additionally, it can be seen in which positions the disc absorbs or releases fluid.

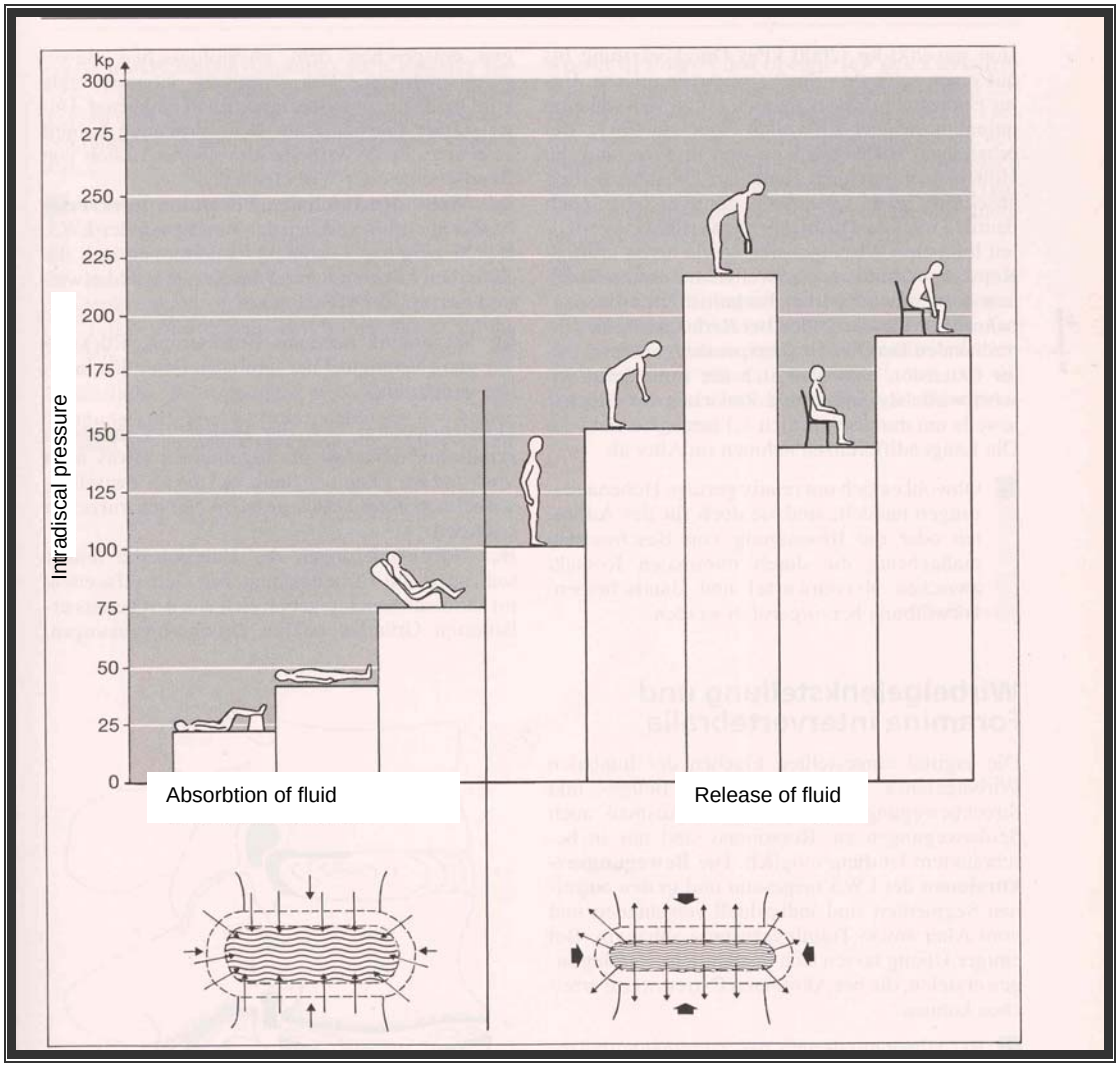


Figure 5: Intradiscal pressure (Krämer 1997)

2.6 Mechanic Function

Since this work is a clinical trial, the biomechanic function of the disc is only delt with in short.

The disc has mainly static functions. Due to its tremendous elasticity it works like a shock absorber with axial strains. The nucleus pulposus transmits the axial pressure evenly to the end plates and the Epiphyseal ring, the fibres of which are then subject to tension. In asymmetric load the nucleus moves to the less overworked part of the disc, e.g. in the case of bending forward it moves to dorsal. When the asymmetric load is over the nucleus moves back to the centre. If however, there are repeated long lasting decentralisations with an uneven load this can cause the development of pathologies of the disc .

In Addition to the static function the discs also determine the extent of motion. The disc is can be formed and, with its limited compressability and elasticity, gives a certain room to move to the vertebral joints. (Krämer 1997)

Like a ligament the annulus has a restrictive effect on all movements. The individual collagen fibres extend and resist the movement as soon as their insertions drift apart. Due to the arrangement of the collagen fibres (they run diagonally and vertically, see 2.2.2 The Vertebral Disc), they can resist movements towards different directions. Mathematical calculations have shown that an orientation of 65° is optimal to enable the annulus to withstand tractions on the one hand and gliding and rotatory movements on the other hand. The varying orientation of the fibres in the alternating lamellae is the decisive factor for giving resistance in rotations to the left and to the right. (Bogduk 1997)

2.7 Possible causes for the lumbar disc herniation

Up to now in-vitro trials have not been able not show a model for the development of a primarily mechanically caused disc herniation. Accidents where **hyperflexion with simultaneous high axial strain** is involved are excepted. Knowledge is incomplete, because an in-vitro simulation of long lasting and/or cyclic loads has not been possible up to now (Brinckmann 1997)
Epidemiologic studies indicate a connection between heavy physical load and the emergence of a disc herniation for certain professional groups. The conducted trials are however, exposed to biases so that a connection can not be inferred from them undisputed. The problem of the causal connection between a load on the spine and the emergence of a disc herniation is unsolved because in vitro trials are not feasible due to the irreversible consequences. In general it is assumed that, in case of an existing preliminary damage of the disc mechanic factors can further and bring on a disc herniation, especially in the case of an axial load with simultaneous side bending and rotation of the trunk. (Brinckmann 1997).

In their model study *M. Lu et al.* (1996) observed a connection between the combination of **bending over, side bending and rotation** and a disc herniation. They constructed a three-dimensional model and simulated a bending and rotating movement while at the same time the strain was increased steadily. In the posterior inner part of the annulus at the connection between the disc and the end plate the simulation always resulted in the emergence of maximum pressure and rupture, respectively. As soon as the liquidity content was lowered by 10%, the probability of a rupture decreased. Thus, he concluded that nutrition and degeneration, respectively was decisive for a disc herniation.

G. Elsner et al. (1997) examined **work-related degenerative discopathies** in he region of the lumbar spine. They found out that in women standing occupations, carrying of loads with a weight of up to 20kg and sitting occupations lead to a heightened risk. In men, postures like squatting or bending-over, vibrational loads on parts of the body and exposure to whole body vibrations prevailed but also climatic strains like humidity or cold represent a heightened risk.

The statement that **mechanic pressure** accelerates the degeneration of the disc and thus increases the risk of a disc herniation was proved by *GBJ. Andersson* in 1997. *A. Elfering et al.* (2002) came to a similar result, too. In a 5-year MRI study they examined all risk factors that cause the degeneration of the disc and hereby took into consideration clinical, morphologic, physical, psychosocial and occupational components. 41 asymptomatic test persons have been examined for 5 years with constant MRI checks. In 41% a shift of the disc took place. There was however, only a weak connection between the degeneration and the pain in the lumbar region. The conclusion was that **a lack of exercise and night shift work** are significant risk factors.

M. Adams (1996) examined the lumbar motion segment in 27 corpses. In the lumbar motion segment pressure indicators were exposed to **increasing pressure load**. When the load was increased a reduction of the hydrostatic pressure in the nucleus and a transfer of fluid to the annulus took place with the mechanic load especially increasing in the posterior part. A further increase in load leads to an overall reduction of the vertebral disc. The concentration of pressure in the annulus can lead to pain and rupture or to changes in the metabolism.

G.B.J. Andersson (1999) posed the question whether the **height of the disc and the size of the cross-section** influence the change of the disc. Hereto three models of different height and cross-section with different weights. The result of the study was that in the disc with the maximum height and the minimum surface the pressure was higher and a larger protrusion of the disc took place. Therefore, the risk of injury of the disc is bigger in the morning since the disc is larger at this point in time than in the evening. This would also be an explanation why the frequency of disc herniations diminishes with age because the disc becomes smaller with increasing age. The changes in the content of fluid in the disc were not allowed for in the study.

A. Takato (2002) wanted to find out whether the measurements of the **ligamentum iliolumbale** have an influence on the early degeneration of the disc. In 25 male and 27 female corpses the longitudinal and cross measurements of the iliolumbal ligament were examined. Where degeneration between L4 and L5 was considerably advanced compared to L5 and S1, the length of the posterior ligament and the sum

of the anterior and the posterior ligament were significantly shorter. In addition the cross-section of the posterior ligament and the sum of the anterior and the posterior ligament were significantly larger; i.e. when the ligamentum iliolumbale is short and has a large cross-section the segment L5/S1 is obviously more stabilised than L4/L5. Therefore, according to Takato, a degeneration of the disc can take place earlier.

In 83% of cases a disc herniation is to be found on the side of the **opening distortion (divergence)** and/or on the opposite side of the **closing distortion (convergence)** of the vertebral joints. In only 9% it is on the opposite side. In 8% it is turned to medial. It is imaginable that one-sided compression and rotation of the disc is jointly responsible for the emergence of a disc herniation. *A. Hack* (2000) came to this conclusion and recommends a treatment of the motor disturbance of the vertebral joints with Muscle Energy Technique according to Mitchel.

Thus the cause of a disc herniation can be a mechanical one. However, since it is not clearly established whether the complaints are originally caused by the disc herniation, the treatment should always involve an osteopathic assessment and close attention should be paid to the symptoms of the patient. This means that in the course of this study a pragmatic treatment process was followed.

2.8. Nerve supply

The discs do not have any nerve fibres, sensitive nerve endings could only by found in the outer layers of the annulus fibrosus and on the posterior longitudinal ligament (Mendel 1992).
The r. meningeus of the spinal nerve comes into the vertebral canal again and supplies the inner parts of the joint capsule, vertebral periosteum, posterior longitudinal ligament and the coats of the spinal cord with efferent, afferent and sympathetic fibres.

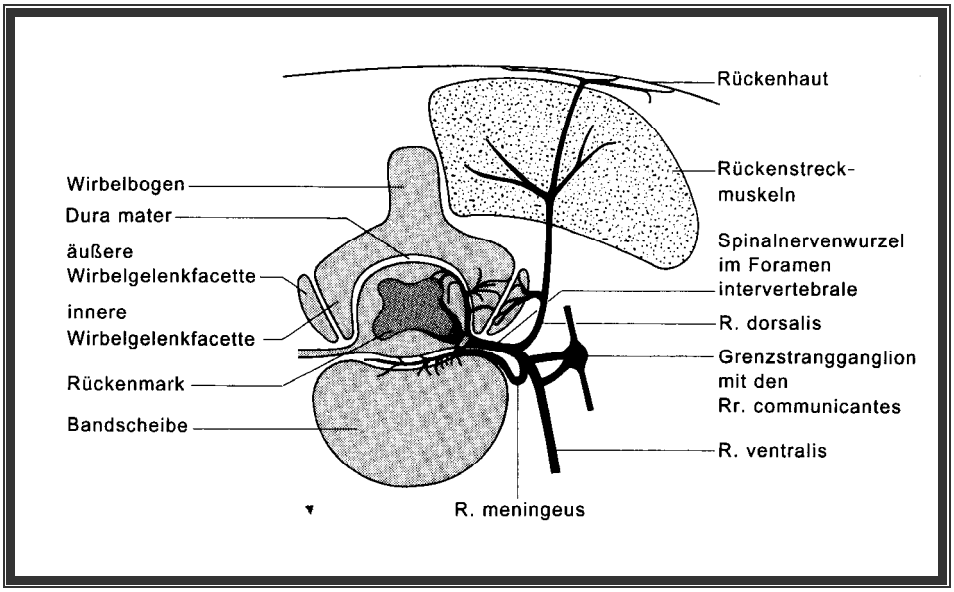


Figure 6: R. meningeus (Netter 1997)

At the longitudinal ligament, the joint capsule and the spinal nerve itself there are especially irritable and sensitive nerve elements. By a shift of the disc tissue to the posterior longitudinal ligament or to the spinal nerve pain that can be called primary discogene pain is caused. Secondary discogene pain originates from the vertebral joints or the trunk muscles. Pain that is causally connected to the vertebral disc can only originate from the dorsal disc ring. (Krämer 1997)

2.9 Pathology

The following pathologic conditions are known:

- Development disorders (remainders of chorda, juvenile Kyphosis, congenital malformation)

- Inflammations (bacterial and rheumatic disc inflammation)
- Disc sclerosis and ossifications
- Disc degeneration (discosis)
- Traumatic disc rupture
- Loosening of the disc (reduction of the water content in the basic substance and loss of elasticity in the fibres)
- Disc protrusion and disc prolaps

In connection with this work only protrusion and prolaps are dealt with, since the other pathologic conditions belong to the exclusion criteria in the test group as well as in the control group.

Division of protrusion and herniation (Krämer 1997)

- **protrusion level 1**: intradical shift of mass:
  here, the central disc tissue pushed the intact annulus fibrosus over the rear edge of the vertebra.
  Clinic: lumbago or protrusion sciatica

- **protrusion level 2**: subannular sequestrum:
  At this stage dislocated disc tissue has broken through the radiar fissures to the outer layers of the annulus fibrosus. The main mass however, is still in front of the rear edge so that a backward shift is still possible.

- **protrusion level 3**: subligamentar or submembranous sequestrum:
  dislocated disc tissue is in the epidural space, only covered with the posterior longitudinal ligament or a thin epidural membrane. Clinically there can already be a persistant root syndrome.

- **herniated disc**: In this case annulus fibrosus, posterior longitudinal ligament or epidural membrane are broken through by the disc tissue that has moved forward. The sequestrum can still be connected to the disc or it can be separated and move in every direction.

In the first stage the volume is increased because of the fluid that is absorbed by the prolapsed tissue. This leads to a deterioration of the clinical condition. After a couple of weeks a dehydration connected to a reduction in volume starts and the pressure put on the nerve root decreases. Furthermore, small seqestra are resorbed enzymatically by phagocytosis. (Hirabayachi 1990)
Larger parts of the disc are reduced by vascularisation and a connective tissue-like organisation from the surrounding fatty tissue. Nucleus-pulposus-tissue is reduced by macrophages and t-cells. The duration of this procedure depends on the mass and the position of the vertebral canal. (Nohara 1993)

2.10. Diagnosis

Ever since Barr found out that back pain can originate from the vertebral disc, this structure has been studied with great effort. Once, the vertebral disc was even said to be the only cause for back pain. Nowadays it is known that many different structures can be responsible for back pain (Sammut 1998). With modern imaging techniques (CT, MRI) disc injuries can even be shown in asymptomatic patients (Krämer 1997). Therefore, it is very difficult to make a clear diagnosis. Up to now there are no reliable clinical tests that can inform about the exact cause for back pain. A herniated disc can be proved diagnostically with CT or MRI but the clinical significance of such results can only be judged in connection with the clinical symptoms.
Besides the many neighbouring structures of the disc that can also cause sciatica, the irritation of certain organs has to be taken into account from a medical and osteopathic point of view. In osteopathy special attention is paid to those organs that are fastened to the posterior abdominal wall; the kidney, the visceral afferent system, the inner female sexual organs, the prostata, the pancreas and the aorta abdominalis. Internal diseases can also be connected to pain in the area of the spinal column, among other things, stomach diseases as well as gall bladder diseases belong to these diseases. (Sammut 1998).
In contrast, Krämer claims that most sciatic pain is disc-induced and caused by degenerative changes in the two lower lumbar motion segments.
Endometriosis and a shift of position of the uterus as causes for back pain are overrated according to the author.
(Krämer 1997).

In addition to the medical diagnosis however, osteopathic results which take into consideration all structures that could be connected to the patient's pain are necessary.
The author's opinion is that often we come too quickly to the conclusion that the complaints are caused exclusively by the disc herniation. However, this cannot be scientifically proven. By treating the muscles in the lumbar and pelvic regions the common symptoms of the patients could be provoked. By treating these symptoms most of the patients could be relieved from their complaints.
Thus the medical diagnosis is an important element for a successful treatment, but clinical considerations and osteopathic findings must not be disregarded.

3. Methodology

3.1 General Information

For the study two groups were made – a test group the members of which were treated with osteopathy and a control group that received physiotherapeutic treatment.

The patients were referred to the Fachpraxis für Osteopathie und Physiotherapie (specialised practice for osteopathy and physiotherapy), Wolf Dietrichstr. 10, 5020 Salzburg by the following physicians, all practising in Salzburg:
Dr. Sommerauer (specialist in neurology)
Dr. Selhofer (specialist in physical medicine)
Dr. Lassmann (specialist in orthopaedics)
Dr. Scheibelbrandner (specialist in neurosurgery)

The patients were randomised and divided into two groups with the test persons not being informed as to whether they were in the test group or in the control group. In all patients a herniated disc or a disc protrusion had to be diagnosed. The diagnosis had to be proved by a computer tomogram (CT) or by Magnetic Resonance Imaging (MRI).

3.2. Inclusion criteria

- diagnosed lumbar herniated disc or disc protrusion, proved by CT or MRI.
- patients have to be between the age of 20 and 50, independent of their sex.
- a conservative therapy has to be ethically acceptable for all patients, i.e. an approaching surgery is not precluded but the symptoms do not call for immediate surgical treatment. The decision on this subject is primarily up to the referring physician.

3.3. Exclusion criteria

- developmental disturbance of the disc
- inflammation of the disc
- disc sclerosis and disc ossifications
- disc degeneration (discosis)
- traumatic disc rupture
- loosening of the disc (reduction of the water content in the basic substance and loss of elasticity in the fibres)
- maximum muscle failure in the lower extremity.
- spondylolisthesis
- neurologic diseases, (multiple sclerosis, hemiphlegia).
- diseases of the rheumatic sphere.
- patients with problems with their bowels or their bladder that are caused by the disc prolaps.

3.4. Case History

Prior to the first treatment an anamnesis was carried out for the patients of both groups. Symptoms and medical history as well as the general physical condition were especially dealt with.
Taking of analgesics connected to the disc prolaps was documented as a criterion for the results. A loss of working hours (sick leave) is documented as well.

Occupation, exercise and psychic situation were dealt with.
(see 6. Appendix)

3.5. Diagnostic findings

After the anamnesis diagnostic findings were made for every patient. They consist of clinical and osteopathic tests. The most important tests, especially those that are relevant for the results of this study is dealt with in the following sections.

When the tests were selected reliability and validity were especially considered. Manual mobility tests were foregone because of their questionable validity, e.g. an objective test of the mobility between L5-S1 is very hard to obtain. Furthermore, back pain cannot be inferred from this test. The tests that were used in this study are easily carried out and do not require any expensive measuring instruments.

3.5.1. Active mobility test of the spinal column

- Flexion (finger-floor-distance)
The patient is in a standing position and is asked to bend over and try to touch the floor with his hands while the knees have to be extended. The distance between the hands and the floor is measured.
Unit of measurement: cm

- lateral flexion (finger-floor-distance)
The patient is in a standing position and is asked to bend the trunk to the side with the hand at the side of the leg. The distance between hand and floor is measured. The test is carried out on the left side and on the right side.
Unit of measurement: cm

3.5.2. Proprioceptive skills

With this test the sensitivity to depth is measured. The perception of the position and the movement of the body in space is measured. Specific receptors (proprioreceptors) register information on muscle length, muscle tension, position and movement of the joints. This information is passed on to the central nervous system in afferent channels.

The following test results from these facts:

The patient is asked to stand on one leg. When he does so, swerving movements are observed and timing is done until the patient touches the floor with the second leg.

The patient should be able to stand on one leg for at least 30 seconds.

The test is carried out on different surfaces.

- normal floor (Figure 7)
- a double folded gymnastics mat (Figure 8)
- a balance board (Figure 9)

Timing is not done before the third try on the left and on the right side.

Unit of measurement: Seconds

Figure 7: Standing on one leg on the floor

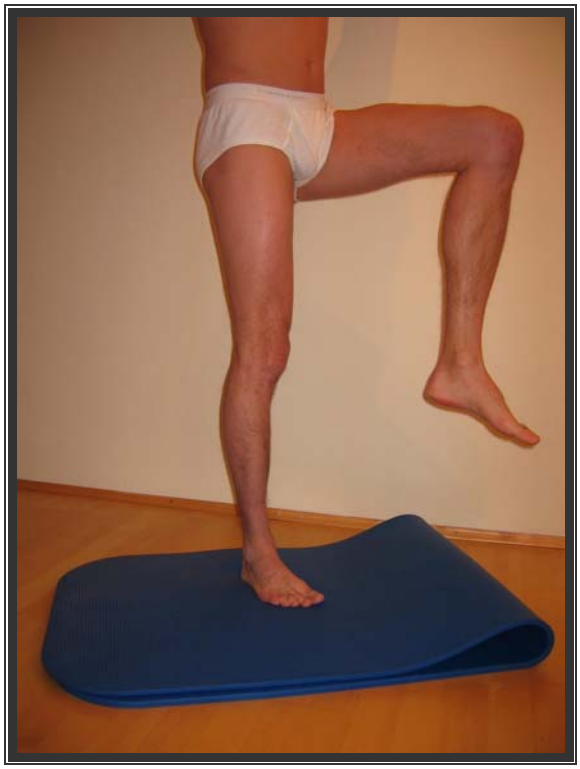


Figure 8: Standing on one leg on a double folded mat

Figure 9: Standing on one leg on the balance board

3.5.3 Neurologic tests

- Straight leg raising test

The patient is in a supine position, the therapist lifts up the extended leg until pain starts or until the limit of the movement is reached. This causes a extension stimulus on the n. ischiadicus that – in case of a disc prolaps with a radicular component – can lead to lightening pain in the dermatom concerned.

The test is carried out on the left side and on the right side and the results of the two sides are compared to each other. If the test is positive, the angle between couch and leg is reported.

Unit of measurement: Degrees

- Reflexes

With the reflex hammer an extension is caused on the chord. This stimulus causes an activation of the monoynaptic reflex arc in the muscle spindle and as a result a contraction in the muscle takes place (so called stretch reflex of tendon reflex).

A reduction or an annulment can take place when the peripher nerve is affected at the root, e.g. by a disc prolaps.

- Patellar reflex

The n. fermoralis and thus the segments L3/L4 are tested. The patient sits on a couch the knees are in 90° of flexion. With the reflex hammer the therapist causes a reflex on the patellar tendon. It is judged whether the reflex is there or whether it is weakened.

Test result: positive, negative, weakened.

- Ankle jerk

The segment L5/S1 is tested (N. Tibialis)
The patient kneels on the couch so that one foot juts out over the edge of the couch. The therapist's one hand causes a reflex on the Achilles tendon with the reflex hammer while the other hand checks on the contraction of the M. triceps-surae on the patient's foot.
Test result: positive, negative, weakened.

- Sensitivity

The surface sensitivity is the ability to perceive different stimuli (touch, pressure, temperature). Via the afferent nerve and the spinal cord a receptor passes the impulse to the sensitive cerebral cortex.
If the peripher nerve or the nerve root is compressed by an outwardly bulged disc or disc prolaps a sensitivity disorder in the concerned dermatom can be the result. It can be lacking entirely (analgesis) or only be weakened (hypalgesis).
The test requires the patient's co-operation. A patient's subjective sensation cannot be precluded.
The assessment is difficult to state on a scale, therefore only the test results positve or negative and the region (dermatom) were documented.

- Motor activity

In a DP atrophy or the paralysis of certain muscles can take place.
Certain muscles can be used as an indicator for a lesion in a certain spinal segment, e.g. if the m. quadriceps is atrophied, there can be a DP in the segment L4.
Motor failures were recorded in the findings as positive or negative and the affected muscle was documented.

3.5.4. Pain

Pain is one of the most important indicators for the patient. However, it is difficult to measure and is always subject to **subjective** judgement by the patient. In the findings the localisation and the severeness of the pain was taken into consideration. The patient has to report the pain on a visual analogue scale with 6 degrees, with 6 being the maximum pain. Furthermore, the patient is asked to report the region in

which he feels pain. It was taken into consideration how pain changes in the course of the day and how the situation is perceived during the night.
Scale from 1-6.

3.5.5. Number of treatments and duration

The last result that was used for the evaluation is the number of treatments that have been necessary until the patients were free of pain or until a distinct improvement of symptoms could be observed. Since the patients' pain and symptoms differed from patient to patient the number of therapies could not be fixed in advance. The therapist determines the number of treatments after which the final findings are made.
The duration of treatment is documented in weeks. Four months are deemed to be the maximum duration, after which the final findings are made automatically.

3.5.6. Critical Discussion of the Methodology

In the **tests of active movements** (flexion and side-bending) the finger-floor-distance was measured. This is a quite simple test with a good validity. (cf.: Kool 1997). However, in case of a bad result the test does not reveal which anatomical structure is responsible for the restricted movement. Thus the test does not assess whether a disc herniation is the cause for the bad movement.
In addition, the **proprioceptive skills** of the patients were tested. While standing on one leg on the floor was too easy so that no big differences could be observed, standing on one leg on a wobble board was too difficult so that it was hard to make any measurement in the relatively short time.
As regards **neurological tests** the patients' reflexes were tested. The problem in this context is that errors can occur due to the different handling of the reflex hammer.
As already mentioned above, **pain** is a subjective sensation of the individual patient. But since pain is one of the most important parameters for the patient, the test was also carried out.
Since several practitioners participated in this study, there can be variations in the **duration and number** of treatment sessions. Every practitioner finished the treatment according to his/her best judgment.

3.6. Osteopathic treatment

The patients were treated individually according to their symptoms. The therapy was carried out pragmatically, i.e. the treatment is carried out according to the pain and not according to the diagnosis. Thus, there is no predetermined course of therapy, rather, every patient was treated individually according to osteopathic principles. Osteopathic therapy consists of purely passive techniques, the patients were not instructed to carry out any physiotherapeutic exercises, they were not shown any exercises for stabilisation or strengthening.

Since the causes of a disc prolaps can vary greatly from patient to patient, the treatment is always based on the individual osteopathic findings.

“The human body is a unit, no part of it works independently” said Dr. Arthur Still, the founder of osteopathy. Therefore, in every part of the body osteopathic dysfunctionalities were treated to reinforce the condition of homeostasis and to ease the clinical symptoms of the herniated disc.

The objective of the treatment is to reinforce the normal function of the spine if possible (regarding the measuring data of the tests described above) and to ease the pain. There is however, no fixed therapeutic procedure in the case of the lesion of the disc. A thorough first examination is of utmost importance in order to be able to notice every abnormal function and to find out it’s cause. It is not sufficient to notice a somatic dysfunction and to treat it. It is necessary to deal with the cause that can be far from the region in which pain is felt.

(Sammut 1998).

In the treatment structural techniques, thrusts, visceral and cranio sacral techniques were used. Within the scope of this clinical study only the main areas of the therapy are described.

- Structural treatment:

It comprises all techniques that refer to the locomotor system. Thrust-techniques were frequently used in the thoracic spine and in the thoraco-lumbar junction (most frequent segments: C7; Th4; Th6; Th9; Th10; Th12-L1).

Furthermore, a correction of the ilia and the sacrum and thus also a correction of the iliosacral joints was often necessary.

The hip joint and the ankle joint were the joints for which most corrections in the lower extremity were necessary.

In nearly every patient trigger points in the region of the lumbar spine and the pelvic region had to be treated. (most frequent muscles: m. iliocostalis lumborum, m. longissimus, m. multifidi, m. piriformis, m. gluteus med. and min., m. quadratus lumborum, m. iliopsoas).

(Travell et al., 1998)

The following techniques to provide relief of the strain were used: The patient is in a prone position, the therapist stands on the side on which the patient feels pain. The therapist fixes the 4. lumbar vertebra with the thumb of one hand on the processus spinosus. With his other hand on the anterior ilium the therapist turns the pelvis to dorsal (on the contra-lateral side). Because of that, an opening forms at the facet between L5/S1 on the ipsilateral side that results in a relief of the load on the intervertebral disc and a subsequent soothing of the pain.

In the same way the orifice of the foramen intervertebrale in a lateral position reached by a combination of the components flexion, lateral flexion and rotation a soothing effect was reached.

Fascial techniques – according to the Facial Distortion Model - were applied frequently, too (especially trigger ligaments on the dorsal thigh, trigger-point hernia in the gluteal region and cylinder distortion).

(St. Typaldos 1999).

- Visceral treatment:
Very often, tensions in the diaphragma were found and treated accordingly. Furthermore, too deep right kidneys and tensions in the 2. section of the duodenum had to be corrected frequently.
(Barral 2002)

- Cranio-sacral techniques:
membranous balance on the sacrum (a hypermobility on the sacrum was diagnosed quite frequently)
Synchronisation between occiput and sacrum
Extension of the dura mater
CV 4 – technique
In literature no specific techniques in the cranio-sacral therapy for diseases of the intervertebral discs are documented.

3.7. Physiotherapeutic Treatment

The patients in group B were as well examined by a therapist at the beginning (see 6.4. Diagnostic findings). The focus in the treatment of this group was mainly on exercises for stabilisation and strengthening of the trunk and the concerned spinal segments. If necessary, also manual techniques like mobilisation for limited joints or spinal sections were used. For the detonisation of tensed up muscles soft parts-techniques and treatment of the trigger points was used.

The physiotherapeutic treatment was carried out adjusted to the following phases. (Wingerden 1995)

- phase of inflammation
- phase of prolieration
- phase of remodulation

Phase of inflammation: (between two days and one week)
The first objective in this phase was to soothe pain by relieving positions and by detonisation (e.g. the treatment of trigger points). Furthermore, the patient was

instructed as to how he can behave as ergonomically as possible in their daily routine.

Phase of proliferation: (from one week to 3/4 weeks)

- proprioceptive training: exercises for the stabilisation of the trunk

Segmental stabilisation: Activation of the m. multifidi and the m. transversus abdominales.

- Mobilisation with reduced lifting: controlled movements and co-ordination training in the segment concerned with low leverage.
- Automobilisation of the thoracic spine if necessary.
- Neurodynamic mobilisation: If necessary, the nerve is mobilised by active movement of the patient as opposed to the nerve's adjacent tissue. (Butler 1995)
- Co-ordination training without load as a preparation for strength training. Ergonomy in the daily routing and at work.

Phase of remodulation: (from 3/4 weeks to one year)

- Strength and stamnia training: 30 repetitions per exercise, 2-3 series with a load of 70% according to the patient's subjective sensation.
- Co-ordination training
- Cardiovascular training

In the most cases treatment was completed In this phase and the patient was prepared for a training that he can carry out on his own behalf.

At the end of the treatment the final diagnostic findings were made like in group A.

4. Results

4.1 Descriptive interpretation

The test group comprised 13 persons, in the control group 11 persons were tested, (9 of them female and 15 male) with two of them undergoing surgery during the test period and thus could not be allowed for in further analysis. In the following section the entire group of test persons is characterised in brief by means of the tests that have been carried out (see section 3).

Table 1: Descriptive distribution of items in the first measurement

Variable	*mean*	*md*	*sd*	*min*	*max*
Pain	3.67	4.0	1.59	0	6
Finger-floor-distance in cm					
Flexion	29.52	26.0	22.03	0	70
Lat. flex. on the left	49.48	51.0	6.10	30	57
Lat. flex. on the right	50.35	50.0	5.08	40	60
Proprioceptive Skills					
Floor on the left	26.74	30.0	9.00	0	30
Floor on the right	27.27	30.0	8.83	0	30
Double mat on the left	26.48	30.0	8.44	0	30
Double mat on the right	27.73	30.0	7.52	0	30
Balance board on the left	4.00	3.0	3.38	0	10
Balance board on the right	6.81	6.0	4.79	0	20
Sick leave	1.13	0.0	2.26	0	9
Number of treatments	7.74	7.0	2.73	4	15
Duration of treatment	6.59	5.0	3.62	2	17

The values on the pain scale range from zero (= no pain) to a maximum value of 6 (= very strong pain). The mean at the beginning of the treatment is 3.67, with only one person reporting to be free of pain.

On average the distance between the hands and the floor in flexion is nearly 30 cm, for the lateral flexion on the left and on the right the distance between hand and floor is on average about 50 cm.

The test persons had to stand on one leg on different levels of difficulty for a maximum time of 30 seconds. 87,0% could carry out the exercise successfully with the left leg on the floor, 90,9% with the right leg on the floor. When standing on a double mat the test persons were successful in 82,6% (left) and 90,9% (right) of cases, respectively. The times on the balance board were considerably shorter. On average the test persons could only stand on the left leg for four seconds and nearly seven seconds on the right leg. The maximum time of 30 seconds could not be reached by any of the test persons.

On average the test persons were on sick leave for one week, with 70% not having any sick leave at all. The average number of treatments is between seven and eight, the average duration of treatment is a little bit more than six and a half weeks.

Table 2 shows further information on neurologic dysfunctions in the test persons at the beginning of the trial. For these tests however, it is only checked whether there a dysfunction exists or not; the extend of the dysfunction is not allowed for due to methodological reasons. The Lasegue test was positive in more than half of cases. Paraesthesiae can be observed in nearly one third of cases. 40% of test persons showed sensitivity disorders. In reflexes the portion of dysfunctions is smaller, it is only 4,3% for the patellar reflex as well as for the ankle jerk. Symptoms of partial paralysis could be observed in 10% of test persons.
Finally it has to be noted, that nearly one half of test persons takes analgesics.

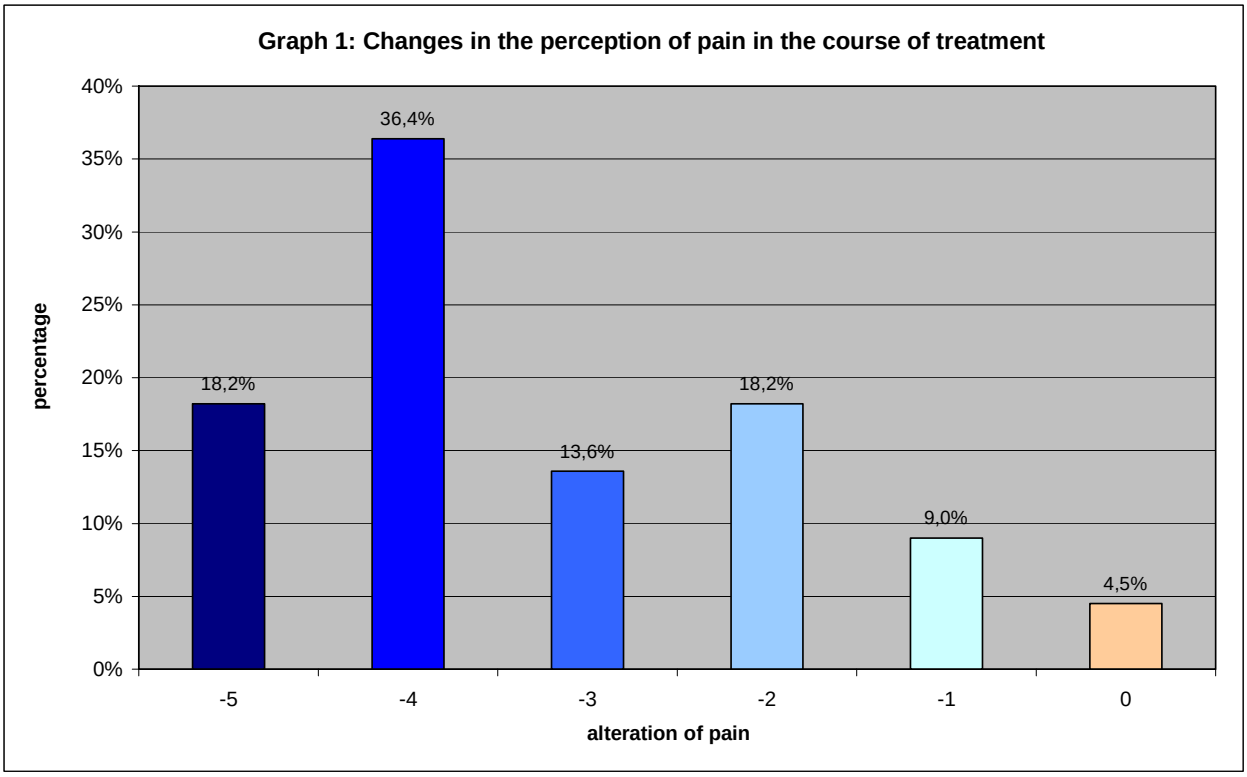
Table 2: Percentage of dysfunctions in various tests at the beginning of treatment

Variable	*Percentage*	*s.d.*
Straight leg raising test	52.2	0.51
Paraesthesiae	30.4	0.47
Sensitivity disorder	39.1	0.50
Reflexes		
Patellar reflex	4.3	0.21
Ankle jerk	4.3	0.21
Paresis	8.7	0.29
Medication	43.5	0.51

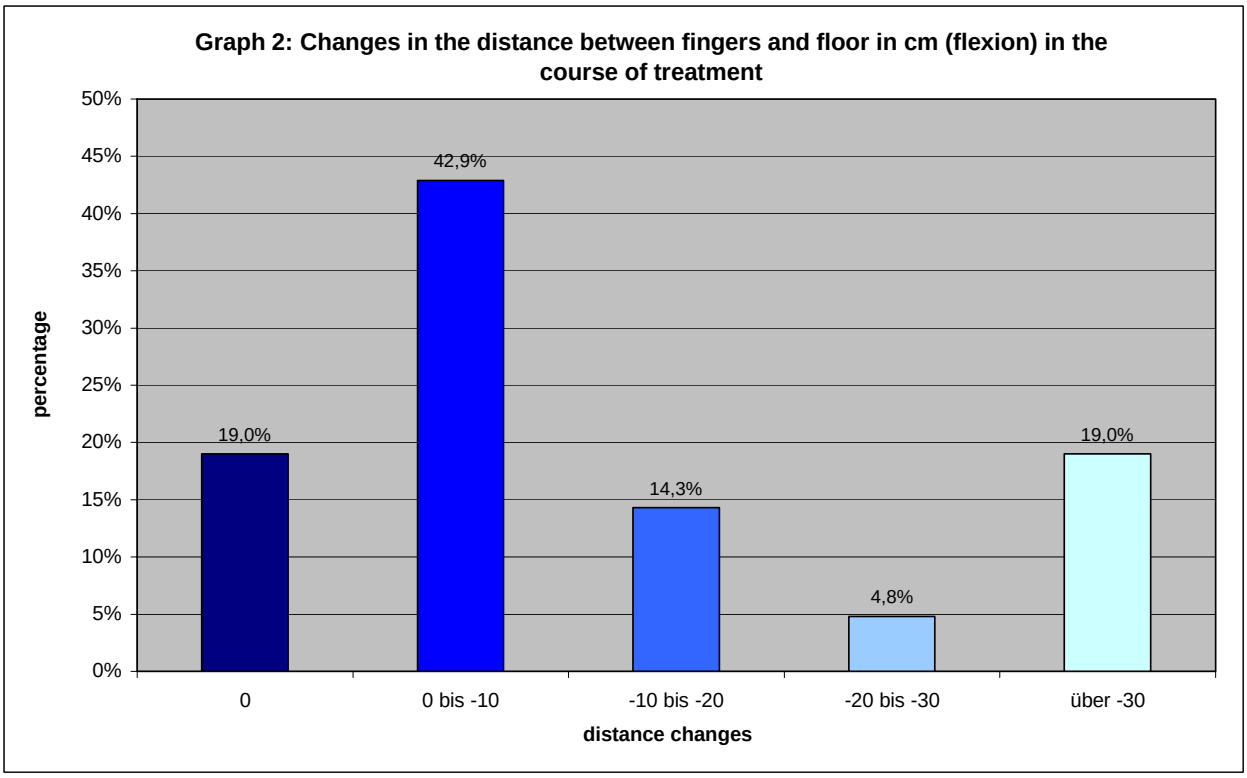
4.2. Changes during the period of treatment

In this section it is shown how the various dysfunctions have changed in the course of treatment. At the beginning no distinction between test group and control group is made.
In figure x the change in the perception of pain as the difference between the measurement at the end of the treatment and the measurement at the beginning of the treatment is shown. In more than 95% of test persons a reduction of pain could

be reached. A large portion of patients even shows a considerable reduction so that at the end of the treatment more than one quarter of the patients claim to be entirely free of pain. The change between the two times of measurement is also statistically significant (p< .001)

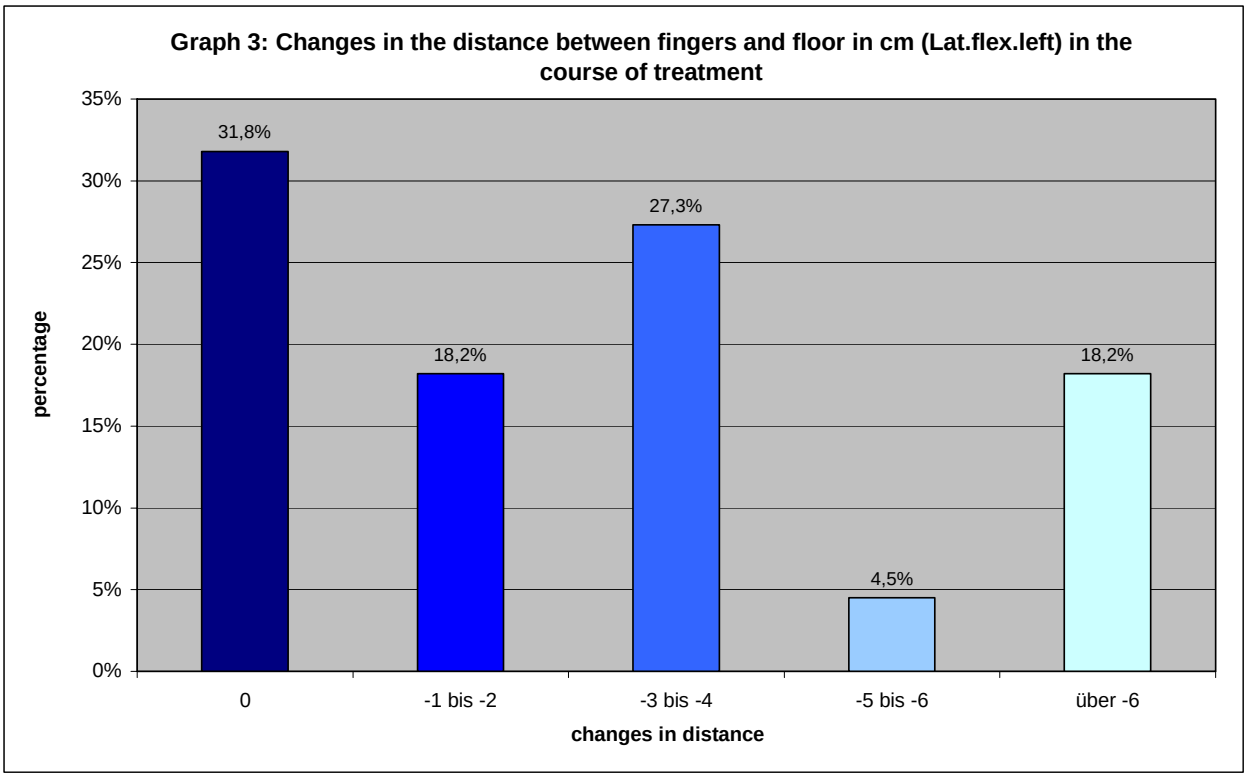


As far as the change of the distance between fingers and floor is concerned an improvement can be observed for a large portion of the test persons, too. Only in 19% of test persons the distance between hands and floor could not be reduced. Nearly 43% could reduce the distance by up to 10 cm, for one fifth of persons the distance could even be reduced by 30 cm. This change is so strong that it can be described as statistically highly significant (p < .001).

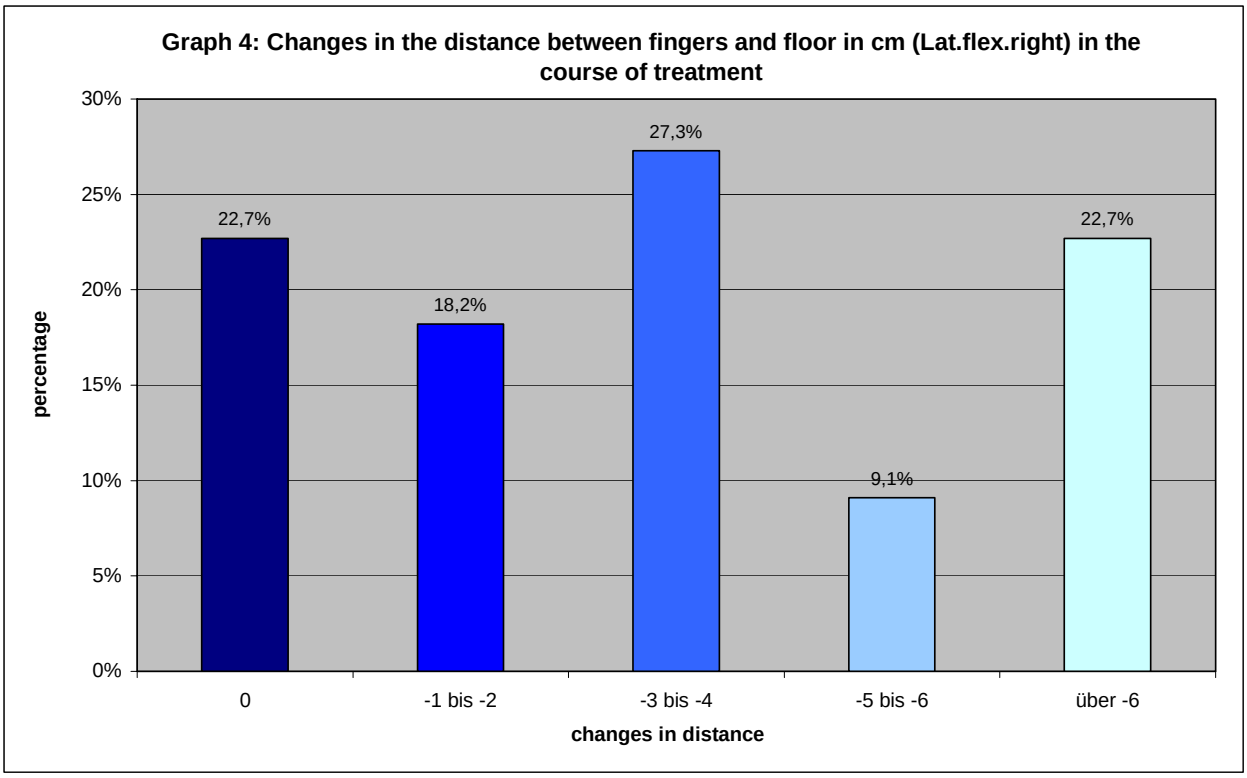


Regarding the distance between fingers and floor (lateral flexion) the situation is as follows:

With 30% the percentage of persons for which no change could be observed is slightly higher than before although the patients reached considerably worse times in this area at the beginning of the treatment. It seems that for an even more distinct increase in this area a longer duration of therapy is required. The extent of the alteration is considerably smaller in total, too. About 18% reduced the distance by one to two cm, for a further 27% a change by three to four cm can be observed and about a fifth of the test persons reached a reduction of the distance of more than six cm. In spite of that, the difference between the two measurements is statistically significant as well ($p<.01$).

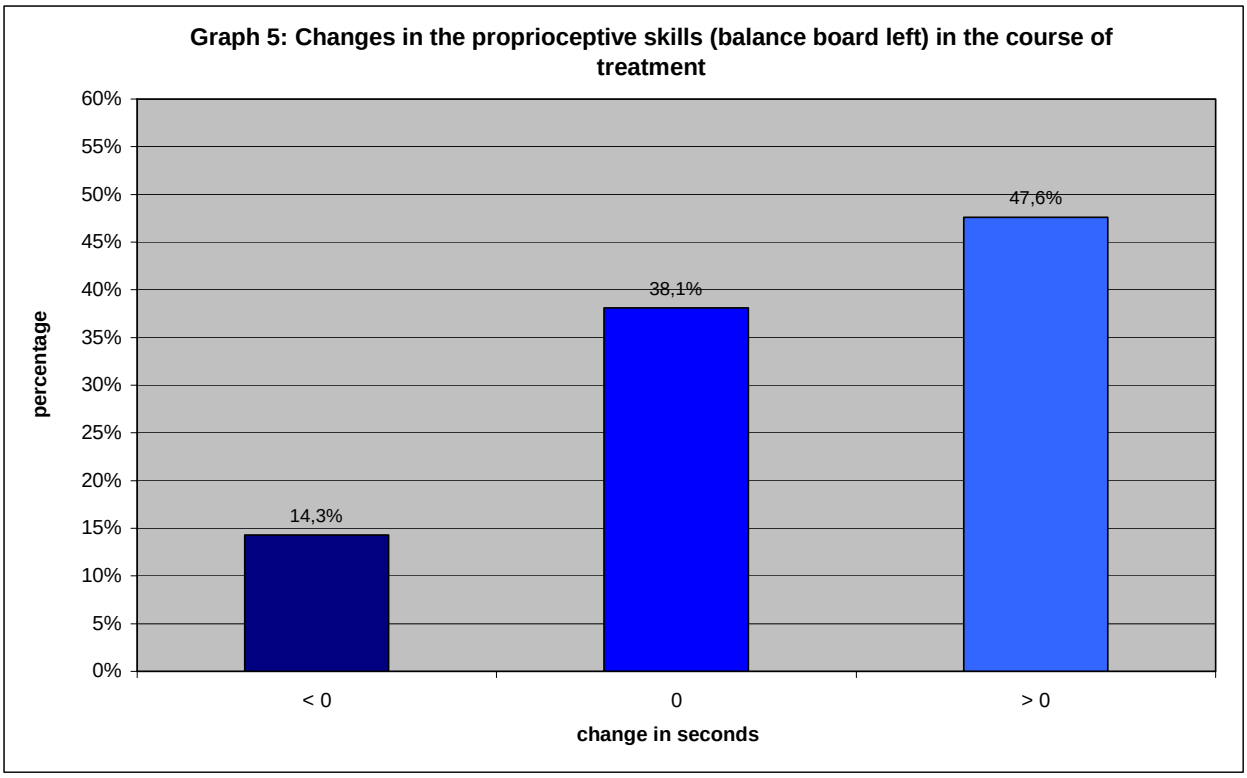


The results for the changes in distance between fingertips and floor lat. flex. right are quite similar. There is a tendency towards a stronger improvement than could be reached for lat. flex. left. Only for about one fifth no change could be measured. Simultaneously, a reduction in distance by more than six cm could be observed for 20%. Here, too, there is a considerable statistically significant change between the two times of measurement ($p < .01$)

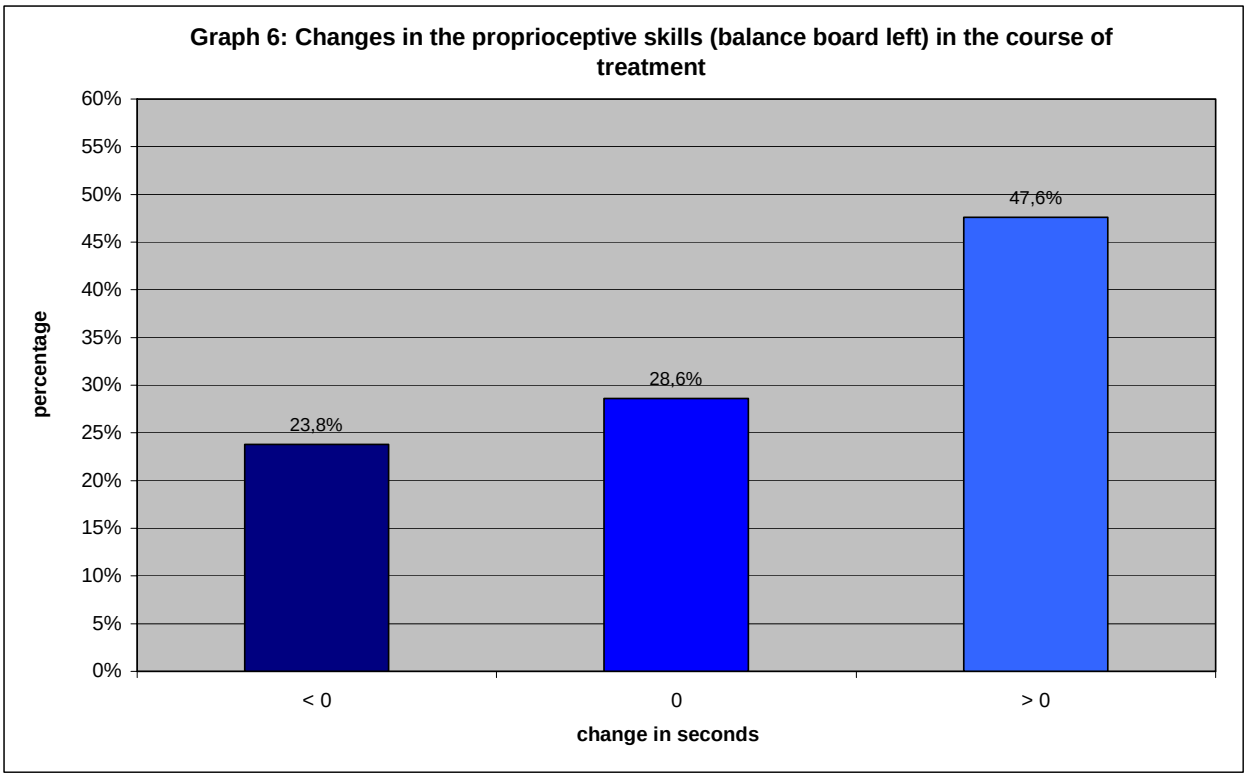


As far as the proprioreceptive skills are concerned virtually no change for the standing position on one leg, neither on the right side nor on the left side can be observed. This of course, is due to the fact that the test persons had hardly had problems in this area at the beginning of the trial. When standing on a double mat the changes are a little bit more noticeable. For the right leg an improvement could be reached for 4,5% of patients, for the left leg for 13% of patients.

The strongest change can be observed for the most difficult exercise in this area, namely the standing position on one leg on the balance board. The following two diagrams show the changes in values for the left and the right leg, respectively. For nearly half of the test persons the time they are able to stand on one leg increases, for about 40% no change can be observed and for 14% the values deteriorate.



Regarding the standing position on one leg the situation is as follows: On the one hand the portion of persons for which the result improved corresponds with the results for the left leg, on the other hand the percentage of persons for which a deterioration of the time they were able to stand on one leg on a balance board was measured is higher. For both tests on the balance board however, it can be said that the change could not be proven sufficiently by means of statistics.



In the straight leg raising test no change could be observed for 81,8%. For 18,2% an improvement could be noticed. If however, only those patients are allowed for who had problems in this area at the beginning of the therapy, the neurological state can be improved for more than one third of the group. On average the values of the Lasegue test could be improved from 71,6 to 85,5 degrees. Regarding the paraesthesiae and the sensibility disorders an improvement for about one third of patients can be reached. Regarding the reflexes and the paresis there are only slight changes. This is due to the fact that there had only been very few problems in this area at the beginning of the therapy.

4.3 Comparison between test group and control group

In this section the main question of the present work is dealt with. Namely, whether it is possible to reach better results with an osteopathic strategy of treatment than with a physiotherapeutic method of treatment.
For this purpose it is examined whether the changes in the results of the tests providing an insight into the clinical condition result in different outcomes in the two groups. For the statistical test of these differences t-tests for independent samples are calculated.

First of all, a comparison of those variables that were only surveyed once but still allow to draw certain conclusions concerning the success of a therapy, is carried out.

The duration of sick leave is slightly higher in the control group and is on average about half a week longer than in the test group. Statistically however, this difference is not sufficient to prove such a statement with the required probability (95%).

Table 3: Comparison of the duration of sick leave between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	0,92	2,57
Control group	10	1,40	1,90

t=0,49; p=.628

The number of treatments is also higher in the control group. On average they call on 1,7 treatments more than the persons in the test group. The difference however, with p of .18 is not strong enough to be statistically significant.

Table 4: Comparison of the number of treatments between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	7,00	1,87
Control group	10	8,70	3,43

t=1,41; p=.181

The higher number of treatments is connected to a considerably longer duration of treatment in the patients of the control group. The average period during which they receive therapeutic support is nearly three weeks longer. The required level of significance of 5% is only missed slightly.

Table 5: Comparison of the duration of treatment between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	5,31	2,32
Control group	10	8,25	4,41

t=1,92; p=.078

In spite of a shorter duration of treatment the pain caused by the disease can be reduced by more than 4 points on the scale in the test group with osteopathic therapy. This is nearly twice as much as in the control group in which a reduction in pain can also be reached on average. This reduction however, amounts only to about two points on the scale.

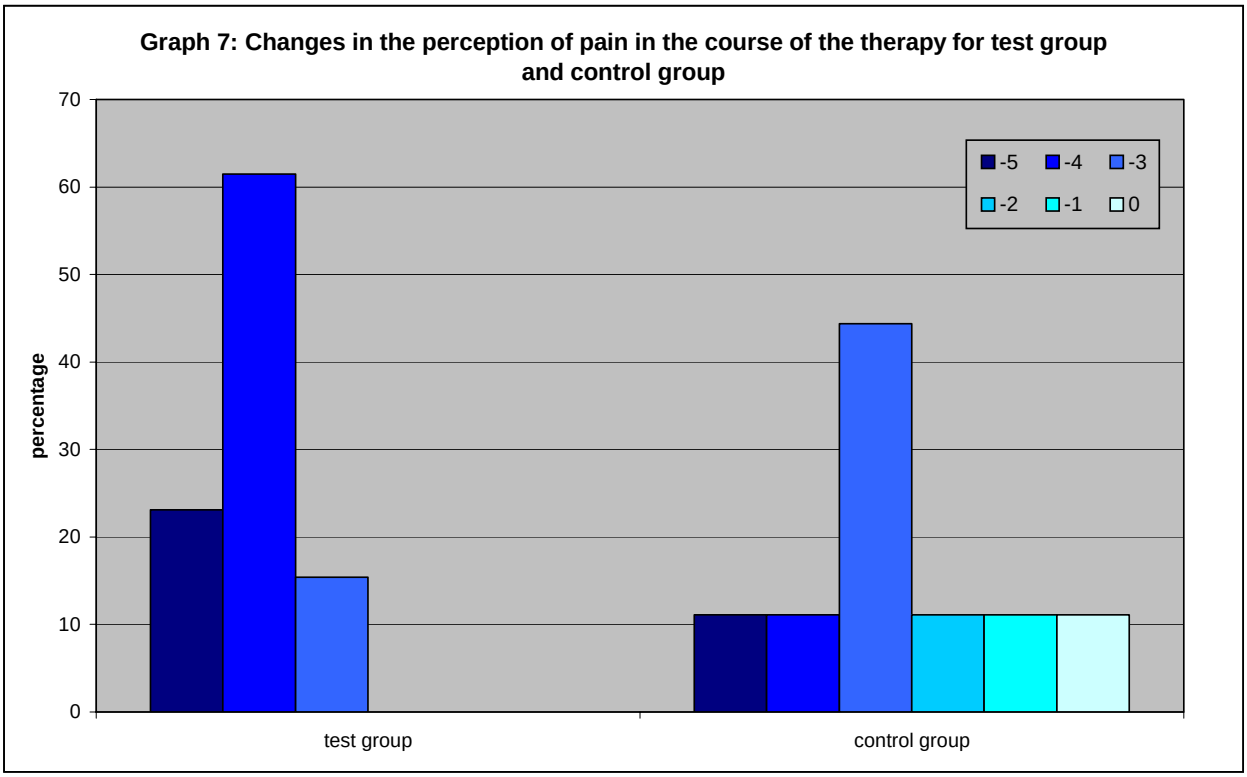
Table 6: Comparison of the change in pain between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	-4,08	0,64
Control group	10	-2,06	1,38

t=4,64; p < .001

This difference can be shown graphically. It is shown that in the test group nearly 85% can reduce their pain by 4 to 5 points on the scale while this number amounts to

about only 20% in the control group. For about 10% of the group no difference is noticed. This difference between the two groups is statistically highly significant.



Regarding the distance between fingers and floor (flexion) the change is considerably higher in the control group than in the test group. This difference can be explained by the different starting points. The persons of the test group have already achieved better ratings in this exercise at the beginning of the trial and are therefore not able to reduce the distance to the extent that is reached in the control group. This fact as well can be proved with high statistical significance.

Table 7: Comparison of the change in the finger-floor-distance (flexion) between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	-3,75	4,37
Control group	10	-29,44	17,83

t=4,23; p < .002

Regarding the change in lateral flexion on the left side there is a tendency towards a stronger improvement of the condition in the group who received osteopathic treatment. On average they reduce the distance by 3,7 cm, while the persons of the control group reach an average change of 2,4 cm. Statistically however, the extent of the difference is not sufficient for the comparatively small sample to prove it sufficient probability.

Table 8: Comparison of the change in the finger-floor-distance (lateral flexion on the left) between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	-3,69	4,15
Control group	10	-2,44	2,79

t=0,78; p =.442

The extent of the difference regarding the lateral flexion on the right is similar. Here as well the results for the test group can be improved more distinctly than for the persons in the control group. Here again, the differences between the two means are too small to obtain a statistically significant result.

Table 9: Comparison of the change in the finger-floor-distance (lateral flexion on the right) between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	-5,15	5,61
Control group	10	-3,22	2,77

t=0,95; p =.353

The results for the standing position on one leg on the floor can not be interpreted clearly. In general, no changes occurred regarding the standing position on the right leg and for the left leg, too, changes are only marginal. Most persons have already been able to carry out this exercise at the beginning of the trial so that no improvement was possible for the majority of patients.

Table 10: Comparison of the change in the duration of the standing position on one leg (on the left) between test group and control group

Gruppe	*n*	*mean*	*sd*
Test group	13	1,15	4,16
Control group	10	0,00	0,00

t=0,87; p =.393

For the standing position on one leg on a double mat the statements are of conditioned value as well, since here again, the results have generally been very good at the beginning of the treatment. Both groups can at least improve their results a little regarding their ability to stand on the left leg. With an average improvment of two seconds The persons of the control group improved slightliy more than the persons of the test group. Statistically however, this difference is not significant.

Table 11: Comparison of the change in the duration of the standing position on one leg on the mat (on the left) between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	0,77	2,77
Control group	10	2,00	5,66

t=0,69; p =.499

In standing on the mat on the right leg the results in both groups show virtually no change.

Tabelle 12: Comparison of the change in the duration of the standing position on one leg (on the right) on the mat between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	0,00	0,00
Control group	10	0,22	0,67

t=1,00; p =.347

The most difficult exercise for the test of the proprioreceptive skills, namely standing on one leg on a balance board, aims at providing more distinct insights.
Here, the persons of the test group can on average hold the position for two more seconds, while in the control group the results even deteriorate. The difference in the means slightly misses the required level of significance.

Tabelle 13: Comparison of the change in the duration of the standing position on one leg (on the left) on the balance board between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	1,77	3,49
Control group	10	-0,63	3,07

t=1,59; p =.127

In the course of the treatment the varying development in the two groups becomes even clearer regarding the standing position on the right leg. In the group with osteopathic treatment the patients can hold the position for nearly three more seconds. The results of the patients who have undergone physiotherapeutic treatment on the other hand, deteriorated by all but two seconds. This difference in the means is also statistically significant on the 5% level.

Table 14: Comparison of the change in the duration of the standing position on one leg (on the right) on the balance board between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	2,69	3,77
Control group	10	-1,75	5,29

t=2,25; p =.036

In the straight leg raising test a slightly stronger change is observed in the control group. This is also due to the fact that in the test group the portion of persons with neurological problems at the beginning of the trial was not as large as in the control group. The differences between the two groups however, are not strong enough to be statistically significant on the 5% level.

Table 15: Comparison of the changes in the results of the straight leg raising test between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	9,62	15,06
Control group	9	17,78	20,93

t=1,07; p =.299

Regarding the paraesthesiae a clearer effect can be observed in the test group as well. The difference in this area however, is not that distinct compared to the control group.

Table 16: Comparison of the change in the paraesthesiae between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	-0,38	0,51
Control group	9	-0,22	0,44

t=0,78; p =.446

The same changes can be observed for the sensitivity disorders. Here again, there is a tendency towards better results in the test group. However, the difference is not large enough to be statistically significant.

Table 17: Comparison of the change in sensitivity disorders between test group and control group

Group	*n*	*mean*	*sd*
Test group	13	-0,38	0,51
Control group	9	-0,22	0,44

t=0,78; p =.446

Medicament consumption can be considerably reduced in both groups. At the end of the therapy not one of the examined persons had to take analgesics anymore.

Altogether however, it can be assumed that the considerations stated in section 3 hereof have been proved. Although the differences are not very distinct in some sub-areas, the therapeutic effects in the test group are stronger than in the control group. The result is especially obvious with regard to the change of the perception of pain. In spite of a shorter period of treatment persons who have been treated osteopathically show a more distinct improvement than the persons of the control group.

5. Discussion

The main objective of the present work has been to examine whether osteopathic treatment significantly improves the clinical condition in patients with lumbal disc herniation. From the comparison of the statistical data analysis of test group and control group the following can be concluded:
In patients in the test group the duration of sick leave was reduced by half a week on average. An even clearer difference shows in the **duration of treatment**. Patients of the test group were treated for three weeks less than the control group. Furthermore,

the patients of the test group took by 1,7 less **treatments** to reach a distinct reduction in pain. For statistic means however, these differences are too small to be significant.

As far as the **motion** of the entire spine is concerned the flexion in the patients of the control group improved clearly. However, the starting level of the two groups has varied considerably. In the test group the flexion has been quite unproblematic and therefore could not be improved that strongly. In lateral flexion on the left as well as on the right there was a tendency towards a considerable improvement in the test group as opposed to the control group.

A decisive significance showed in the parameter **pain**. In the test group an average improvement by 4-5 points on the scale (on a scale from 1 to 6) could be observed while in the control group the improvement amounted to only two points on the scale. It is of interest that the **standing position** on the balance board on the left leg as well as on the right leg has improved significantly in the test group although the proprioception was practised in the control group but not in the test group. In the control group the results even deteriorated statistically in the final diagnostic findings as compared to the initial diagnostic findings.
Paraesthesiae and **sensitivity disorders** decreased, with the differences between the two groups not being that distinct.
Medication with analgesics could already be stopped before the final diagnostic findings.

In view of these results the first hypothesis that osteopathic treatment improves the clinic in patients with a lumbar disc herniation could be confirmed.

Surgery could be avoided in patients who fulfilled the inclusion and exclusion criteria. No patients with motor failures or bladder or bowel disorders were included in the study. *St. Atlas et al.* (2001) proved in their study that 70% of patients in the group who underwent surgery reached an improvement as opposed to only 56% in the group that was treated with conventional methods (see 1. Introduction). In our study no control group with patients who underwent surgery was included so that an opposing statement can not be proved here.

However, taking into consideration the risks and strains connected to surgery, conventional therapy should be preferred to surgery.
This point of view is also emphasised by *A. Burton et al.* (2000). As opposed to *St. Atlas* they proved in their study that the patients who were treated osteopathically had less problems after only a few therapies than those who underwent surgery (see 1. Introduction). In addition he emphasised the lower cost in the osteopathically treated group.

Our findings prove clearly that **osteopathic treatment** is successful regarding the examined symptom. In practice the treatment could be extended by adding exercises for stabilisation and strengthening to osteopathic treatment.
The question is how **clinic and symptoms** will develop in the years to come.
A. Hack (2002) observed that – after muscle exercises – symptoms improved considerabley in patients with lumbar disc herniation. However, after six months the improvement was not noticeable any more. This means that continuous training is required in order to preserve freedom from pain (see 1. Introduction). The osteopath tries to treat the cause and not only the symptoms. The present work however, could not prove whether the patients in the test group or those in the control group will be free of pain for a longer period of time, since the period of observation has been too short. A follow-up would definitely be of interest. It would however, go beyond the scope of the present work.

The question whether in a diagnosed disc herniation the **disc is the cause for the symptoms** is difficult to answer. In the treatment the procedure was pragmatic and every patient was treated individually. In chapter 3.6 Osteopathic Treatment the most common techniques were dealt with. Except for the relieving techniques the disc was not dealt with directly, rather all structures that could be connected to the patient's symptoms were allowed for.
It was conspicuous that through some muscles in the pelvic region (e.g. m. gluteus max. and med. , m. piriformis, m. iliopsoas) the patient's pain could be reproduced and that symptoms improved quickly after the treatment of these muscles (trigger points). In these cases it can be assumed that the disc herniation has only been a random diagnosis.

Dr. Walter Packi (2003) writes, that the cause for a disc herniation lies in the contracted m. psoas. Furthermore, he claims that the cause for misperceptions and paralyses does not lie in the compressed nerves but rather in the geometric malfunctioning of the m. iliacus.
It is a matter of myogene and not neurogene paralyses. This would prove that a treatment of the pelvic muscles would be successful.

J. Cassidy (1993) found in his study that **rotatory manipulation** leads to an improvement of symptoms in disc herniations and that even a resorption of the disc is possible. (see 1. Introduction).
In this study the therapist has not used any manipulations (thrust techniques) in the segment concerned in order to avoid the possible risks of a deterioration of the herniation. It has not been the objective of the study to examine whether thrust techniques pose a threat to patients with disc herniation. Despite of this the author shares the opinion of *Zhao and Feng* (1996) and *P. Huijbregts et al.* (1996). They proved in their study that there is no improvement in the disc herniation (in the acute stage) when manipulation is used.
In osteopathically treated patients however, thrust techniques were used frequently in this study in the segments above the prolaps (e.g.: TH12/L1 and in the thoracic spine) (see 3.6. Osteopathic Treatment). According to the patients' subjective sensation this led to a distinct improvement of symptoms. However, this result could not be proved scientifically.

As far as the **evaluation of the results** is concerned it has to be mentioned that the number of test persons has been relatively small in both groups. Therefore, the results of the study have to be seen in perspective and it should be spoken of developments and tendencies regarding the results.
The study was carried out **single-blinded.** The patients were not informed as to whether they belonged to the test group or to the control group. However, it was one and the same therapist who carried out examination and treatment. It would have increased the internal validity of the study if the initial examination and the final diagnostic findings had been carried out by out by a third person. This person should not be informed as to which group a patient belongs. Because of organisational difficulties a double-blinded study could not be carried out.

Furthermore, the work would be extended if a third group consisting of patients who have undergone surgery was examined as well. This comparison would bring in some interesting additional aspects.
In this connection the lack of a placebo group has to be mentioned as well. This however, was foregone intentionally on ethical grounds.

A possible inexactness lies in the **inclusion criteria** which should be extended. All patients should have had at least one neurologic symptom. Then, the probability that the pain results from the diagnosed disc herniation would have been higher. However, it proved very difficult to find enough patients for the study and therefore the inclusion criteria could not be chosen more rigidly.
More accurate inclusion criteria than we could apply were used by *J. David* (1996) in his study (see 1. Introduction). The fact that he had not used a control group however, reduces the validity of his study to a great extent. His period of observation was up to 6 months. It can be assumed that the disc was resorbed partly with or without treatment and thus induced a reduction in pain. This fact was proven in a study by *M. Benoist* (2002). He claims that within 6 months a resorption caused by macrophages takes place. On the other hand there are also asymptotic patients with constant prolaps according to Benoist.

Regarding the **propioceptive tests** the first test, the standing position on one leg, was carried out on the floor. All patients could easily carry out the test. Therefore, the results of these tests have to be seen in perspective. By contrast, the third test on the balance board was very difficult. The patients could only stand on the balance board for a short time. Therefore, it was difficult to measure the time properly and thus the result was perhaps restorted.

Originally it was planned to have a second **MRI or CT** made in the final results. On ethical grounds (because of the exposure to radiation connected to the CT) however, this has been foregone. By chance, a CT made after the end of the treatments could be compared to a CT made before the beginning of the treatment for one patient of the test group. In this case the prolaps in the L4/L5 segment turned out to have diminished from 4mm to inconspicuous results. In the L5/S1 segment a prolaps of

5mm that affected the nerve root. In the second results the nerve structures were free. In this test person a reduction of the prolaps took place. It could not be proved whether this reduction was caused by the treatment or by resorbtion.
This observation may encourage discussion and possibly inspire further research.

6. Appendix

6.1. Evaluation of group A

Results:

Patient: A1
CT or MRI dorsal symmetric disc protrusion L4/L5

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	4		0	
2. Finger-Floor-Distance in cm				
Flexion	5		0	
Lat.flex.left	30		27	
Lat.flex. right	40		38	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	3	4	3	5
4. Lasegue	-		-	
5.Paraesthesiae	-		-	
6. Sensitivity Disorders	pos. thigh lat.		pos.	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis	-		-	
9. Medication	yes		none	
10. Sick leave	none			
11. Number of treatments	6			
12. Duration of treatment	5 weeks			

Results:

Patient: A2
CT or MRI L5/S1 central DP coming out on the left and on the right (5mm)
Limitation of the rec.lat. on the left.

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	6		1	
2. Finger-Floor-Distance in cm				
Flexion	neg. pain, not possible		6	
Lat.flex.left	50		50	
Lat.flex. right	51		42	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	3	10	5	15
4. Lasegue	-		-	
5.Paraesthesiae	-		-	
6. Sensitivity Disorders	numb, pos.		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis	none			
9. Medication	none			
10. Sick leave	none			
11. Number of treatments	5			
12. Duration of treatment	4 weeks			

Results:

Patient: A3
CT or MRI L4/L5 right medio-lateral disc herniation (2000)

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	4		0	
2. Finger-Floor-Distance in cm				
Flexion	-		-	
Lat.flex.left	39		36	
Lat.flex. right	42		37	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	0	6	4	9
4. Lasegue	-		-	
5.Paraesthesiae	pos.!		-	
6. Sensitivity Disorders	-		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis	none			
9. Medication	none			
10. Sick leave	none			
11. Number of treatments	9			
12. Duration of treatment	6 weeks			

Results:

Patient: A4
CT or MRI right-dorsal medio-lateral DP

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	4		0	
2. Finger-Floor-Distance in cm				
Flexion	30		17	
Lat.flex.left	53		45	
Lat.flex. right	54		50	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	8	9	10	10
4. Lasegue	-		-	
5.Paraesthesiae	-		-	
6. Sensitivity Disorders	-		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis	-		-	
9. Medication	none			
10. Sick leave	none			
11. Number of treatments	6			
12. Duration of treatment	9 weeks			

Results:

Patient: A5
CT or MRI L4/L5 left medio-lateral DP 5mm, nerve root L5 pushed aside

	Initial Diagnostic Findings	Final Diagnostic Findings
1. Pain 1-6	4	0
2. Finger-Floor-Distance in cm		
Flexion	0	0
Lat.flex.left	51	51
Lat.flex. right	48	48

3. Proprioceptive skills standing on one limb in seconds

	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	3	6	5	8

4. Lasegue	pos. starting with 60°	-
5.Paraesthesiae	pos.!	-
6. Sensitivity Disorders	-	-
7. Reflexes		
Patellar reflex	-	-
Ankle jerk	left side weakened!	-

8. Paresis	none
9. Medication	none
10. Sick leave	none
11. Number of treatments	8
12. Duration of treatment	2 months

Results:

Patient: A6
CT or MRI L5/S1 coming out in the left and on the right, discretly pressed nerve root S1
L4/L5 dextro-lat. disc protrusion 3-4mm
L3/L4 dextro-lat DP 5-6mm nerve root free

	Initial Diagnostic Findings	Final Diagnostic Findings
1. Pain 1-6	3	0
2. Finger-Floor-Distance in cm		
Flexion	24	22
Lat.flex.left	52	50
Lat.flex. right	50	49

3. Proprioceptive skills standing on one limb in seconds	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	5	neg.	6	7

4. Lasegue	-	-
5. Paraesthesiae	pos.	-
6. Sensitivity Disorders	pos. thigh interior right!	-
7. Reflexes		
Patellar reflex	-	-
Ankle jerk	-	-

8. Paresis	none
9. Medication	none
10. Sick leave	none
11. Number of treatments	7
12. Duration of treatment	4 weeks

Results:

Patient:	A7
CT or MRI	L4/L5 left medio-lat. disc protrusion 5mm L5/S1 left dorso-lat DP 10mm with pressing the nerve root S1

	Initial Diagnostic Findings	Final Diagnostic Findings
1. Pain 1-6	4	0
2. Finger-Floor-Distance in cm		
Flexion	0	0
Lat.flex.left	48	45
Lat.flex. right	46	42

3. Proprioceptive skills standing on one limb in seconds

	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	10	10	12	10

4. Lasegue	-	-
5.Paraesthesiae	pos. left foot!	-
6. Sensitivity Disorders	-	-
7. Reflexes		
Patellar reflex	-	-
Ankle jerk	-	-

8. Paresis	none
9. Medication	none
10. Sick leave	none
11. Number of treatments	9
12. Duration of treatment	2 months

Results:

Patient: A8
CT or MRI L4/L5 right medio-lat. DP 8mm, presses the nerve roots L5 and L4
L5/S1 DP 5mm, nerve root S1 pushed aside

	Initial Diagnostic Findings	Final Diagnostic Findings
1. Pain 1-6	4	0
2. Finger-Floor-Distance in cm		
Flexion	25	23
Lat.flex.left	52	52
Lat.flex. right	51	51

3. Proprioceptive skills standing on one limb in seconds

	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	3	10	8	18

4. Lasegue	pos.	-
5.Paraesthesiae	pos.	-
6. Sensitivity Disorders	-	-
7. Reflexes		
Patellar reflex	weakened on the right!	-
Ankle jerk	-	-

8. Paresis	none
9. Medication	yes
10. Sick leave	none
11. Number of treatments	7
12. Duration of treatment	1 month

Results:

Patient:	A9
CT or MRI	L4/L5 dorso medial DP 10mm, presses the root L5, L5/S1 dorso-med. protrusion 4mm

	Initial Diagnostic Findings	Final Diagnostic Findings
1. Pain 1-6	5	0
2. Finger-Floor-Distance in cm		
Flexion	26	23
Lat.flex.left	45	40
Lat.flex. right	45	37

3. Proprioceptive skills standing on one limb in seconds	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	2	2	7	8

4. Lasegue	pos. 60°	-
5.Paraesthesiae	-	-
6. Sensitivity Disorders	-	-
7. Reflexes		
Patellar reflex	-	-
Ankle jerk	-	-
8. Paresis	none	-
9. Medication	yes	-
10. Sick leave	3 weeks	
11. Number of treatments	4	
12. Duration of treatment	2 weeks	

Results:

Patient: A10
CT or MRI L5/S1 lateral disc protrusion coming out to the left and to the right 3mm
L4/L5 central DP coming out to the left and to the right 5mm

	Initial Diagnostic Findings	Final Diagnostic Findings
1. Pain 1-6	5	1
2. Finger-Floor-Distance in cm		
Flexion	0	0
Lat.flex.left	52	52
Lat.flex. right	49	49

3. Proprioceptive skills standing on one limb in seconds

	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	8	6	10	9

4. Lasegue	-	-
5.Paraesthesiae	none	-
6. Sensitivity Disorders	pos. on the thigh	-
7. Reflexes		
Patellar reflex	-	-
Ankle jerk	-	-
8. Paresis	none	-
9. Medication	yes	-
10. Sick leave	none	
11. Number of treatments	9	
12. Duration of treatment	2 months	

Results:

Patient:	A11
CT or MRI	L4/L5 dorso-median disc protrusion 5mm L5/S1 on the right, dorso-median disc protrusion 5mm

	Initial Diagnostic Findings	Final Diagnostic Findings
1. Pain 1-6	5	0
2. Finger-Floor-Distance in cm		
Flexion	24	22
Lat.flex.left	50	22
Lat.flex. right	52	48

3. Proprioceptive skills standing on one limb in seconds

	Initial Diagnostic Findings		Final Diagnostic Findings	
	left	right	left	right
Floor	20	-	-	-
Double Mat	15	-	-	-
Balance Board	3	3	4	6

	Initial Diagnostic Findings	Final Diagnostic Findings
4. Lasegue	-	-
5.Paraesthesiae	-	-
6. Sensitivity Disorders	pos. toes!	-
7. Reflexes		
Patellar reflex	-	-
Ankle jerk	-	-

8. Paresis	-
9. Medication	none
10. Sick leave	none
11. Number of treatments	9
12. Duration of treatment	5 weeks

Results:

Patient:	A12
CT or MRI	L4/L5 dxtro-lat. DP 5mm, discrete nerve root alteration L5/S1 cenral disc protrusion coming out on the right

	Initial Diagnostic Findings	Final Diagnostic Findings
1. Pain 1-6	5	1
2. Finger-Floor-Distance in cm		
Flexion	44	54
Lat.flex.left	54	46
Lat.flex. right	55	45

3. Proprioceptive skills standing on one limb in seconds

	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	7	10	10	14

4. Lasegue	60 on the right, 50 on the left!!	-
5.Paraesthesiae	-	-
6. Sensitivity Disorders	pos. right lower leg	-
7. Reflexes		
Patellar reflex	-	-
Ankle jerk	-	-
8. Paresis	-	-
9. Medication	yes	-
10. Sick leave	9 days	
11. Number of treatments	8	
12. Duration of treatment	4 weeks	

Results:

Patient:	A13
CT or MRI	L5/S1 central, annulus fib. promenading to the left and to the right and sinistro-lat. DP 3mm

	Initial Diagnostic Findings	Final Diagnostic Findings
1. Pain 1-6	3	0
2. Finger-Floor-Distance in cm		
Flexion	13	5
Lat.flex.left	57	43
Lat.flex. right	58	38

3. Proprioceptive skills standing on one limb in seconds

	Initial Diagnostic Findings		Final Diagnostic Findings	
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	2	4	4	4

4. Lasegue	-	-
5.Paraesthesiae	-	-
6. Sensitivity Disorders	-	-
7. Reflexes		
Patellar reflex	-	-
Ankle jerk	-	-
8. Paresis	-	-
9. Medication	none	
10. Sick leave	none	
11. Number of treatments	4	
12. Duration of treatment	2 weeks	

6.2. Evaluation of group B

Results:

Patient: B1
CT or MRI L4/L5 dorsal DP with emphasis on the right side 7mm
L5/S1 right dorso-median DP 8mm, root S1 is pressed

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	1		0	
2. Finger-Floor-Distance in cm				
Flexion	64		7	
Lat.flex.left	55		52	
Lat.flex. right	57		53	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	10	2	5	5
4. Lasegue	pos. 60 on the right, 90 on the left		pos. 100 on left and on the right	
5.Paraesthesiae	pos. thigh dorsal		-	
6. Sensitivity Disorders	-		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis	-		-	
9. Medication	yes		-	
10. Sick leave	1 week			
11. Number of treatments	6			
12. Duration of treatment	2 months			

Results:

Patient: B2
CT or MRI DP L4/L5

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	3		0	
2. Finger-Floor-Distance in cm				
Flexion	70		28	
Lat.flex.left	52		43	
Lat.flex. right	53		44	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	neg.	neg.	neg.	neg.
4. Lasegue	30 on the left, 70 on the right !		80 on the left and on the right	
5.Paraesthesiae	-		-	
6. Sensitivity Disorders	-		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis	-		-	
9. Medication	none			
10. Sick leave	3 weeks			
11. Number of treatments	11			
12. Duration of treatment	3 months			

Results:

Patient: B3
CT or MRI L4/L5 dors. Protrusion 7mm, root L5 is pressed

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	6		1	
2. Finger-Floor-Distance in cm				
Flexion	47		0	
Lat.flex.left	46		46	
Lat.flex. right	48		46	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	neg.	neg.	20	6
4. Lasegue	30 on the right		100 on the left and on the right	
5.Paraesthesiae	-		-	
6. Sensitivity Disorders	pos. foot 1. and 2. toe		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis	pos. discrete extensors		-	
9. Medication	yes		-	
10. Sick leave	none			
11. Number of treatments	15			
12. Duration of treatment	3 months			

Results:

Patient: B4 **PATIENT WAS OPERATED!!! THERAPY WAS CUT SHORT AFTER THE SECOND UNIT**

CT or MRI L3/L4 prominent disc 4mm
L4/L5 prominent disc 5mm
L5/S1 DP 7mm, root S1 is pressed

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	5			
2. Finger-Floor-Distance in cm				
Flexion	60			
Lat.flex.left				
Lat.flex. right				
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor				
Double Mat				
Balance Board				
4. Lasegue				
5.Paraesthesiae				
6. Sensitivity Disorders				
7. Reflexes				
Patellar reflex				
Ankle jerk				
8. Paresis				
9. Medication				
10. Sick leave				
11. Number of treatments				
12. Duration of treatment				

Results:

Patient:	B5			
CT or MRI	posterior-median disc prolaps coming out to the left, L4/L5 with limitation of the root L4 and the exit of the left root L5			
	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	0		0	
2. Finger-Floor-Distance in cm				
Flexion	36		20	
Lat.flex.left	43		40	
Lat.flex. right	43		40	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	6	7	12	10
4. Lasegue	pos. 30°	40°	70°	70°
5.Paraesthesiae	pos. thigh and lower leg		_	
6. Sensitivity Disorders	pos. 4. and 5. toe		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis	-			
9. Medication			none	
10. Sick leave			none	
11. Number of treatments			10	
12. Duration of treatment			5 weeks	

Results:

Patient: B6
CT or MRI DP L5-S1 on the right

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	2		0	
2. Finger-Floor-Distance in cm				
Flexion	50		45	
Lat.flex.left	50		50	
Lat.flex. right	55		50	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	8	10	8	12
4. Lasegue	pos. 45°	65°	45°	65°
5.Paraesthesiae	-		-	
6. Sensitivity Disorders	-		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis			-	
9. Medication			analgesics 2-3 weeks	
10. Sick leave			none	
11. Number of treatments			10	
12. Duration of treatment			10 weeks	

Results:

Patient:	B7			
CT or MRI	dorsomed. Prolaps 7mm imprssion of the dural sac			
	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	1,5		0	
2. Finger-Floor-Distance in cm				
Flexion	33		13	
Lat.flex.left	45		45	
Lat.flex. right	50		50	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	3	3	10	8
4. Lasegue	pos. 55°	45°	70°	65°
5.Paraesthesiae	-		-	
6. Sensitivity Disorders	-		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis	-			
9. Medication	analgesics 2 weeks			
10. Sick leave	none			
11. Number of treatments	4			
12. Duration of treatment	3,5 weeks			

Results:

Patient: B8
CT or MRI DP L4/L5 dorso-med.

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	5		3	
2. Finger-Floor-Distance in cm				
Flexion	60		30	
Lat.flex.left	55		53	
Lat.flex. right	60		56	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	neg.	neg.	neg.	neg.
Balance Board	neg.	neg.	neg.	neg.
4. Lasegue	-		-	
5.Paraesthesiae	-		-	
6. Sensitivity Disorders	-		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis			-	
9. Medication			none	
10. Sick leave			1 month	
11. Number of treatments			7	
12. Duration of treatment			6 weeks	

Results:

Patient:	B9	**PATIENT WAS OPERATED, THERAPY WAS CUT SHORT AFTER THE 6. UNIT!**
CT or MRI	DP L4/L5 sin	

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	4,5			
2. Finger-Floor-Distance in cm				
Flexion	20			
Lat.flex.left	53			
Lat.flex. right	50			
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-		
Double Mat	-	-		
Balance Board	neg.	neg.		
4. Lasegue	pos. 60°	-		
5.Paraesthesiae	-			
6. Sensitivity Disorders	left thigh			
7. Reflexes				
Patellar reflex	-			
Ankle jerk	-			
8. Paresis	-			
9. Medication	analgesics			
10. Sick leave	yes			
11. Number of treatments	6			
12. Duration of treatment	4 weeks			

Results:

Patient: B10
CT or MRI DP L5-S1 left medio-lateral

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	2		0	
2. Finger-Floor-Distance in cm				
Flexion	38		0	
Lat.flex.left	56		53	
Lat.flex. right	53		51	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	-	-	-	-
Balance Board	neg.	neg.	neg.	neg.
4. Lasegue	pos. 45°	65°	45°	65°
5.Paraesthesiae	-		-	
6. Sensitivity Disorders	-		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis	plantar reflex on the left		-	
9. Medication	none			
10. Sick leave	5 days			
11. Number of treatments	12			
12. Duration of treatment	17 weeks			

Results:

Patient:	B11
CT or MRI	DP L4/L5 dext.

	Initial Diagnostic Findings		Final Diagnostic Findings	
1. Pain 1-6	2		0	
2. Finger-Floor-Distance in cm				
Flexion	10		0	
Lat.flex.left	50		48	
Lat.flex. right	48		48	
3. Proprioceptive skills standing on one limb in seconds				
	left	right	left	right
Floor	-	-	-	-
Double Mat	7	9	10	12
Balance Board	neg.	neg.	neg.	neg.
4. Lasegue	-		-	
5.Paraesthesiae	-		-	
6. Sensitivity Disorders	-		-	
7. Reflexes				
Patellar reflex	-		-	
Ankle jerk	-		-	
8. Paresis	-			
9. Medication			none	
10. Sick leave			none	
11. Number of treatments			6	
12. Duration of treatment			5 weeks	

6.3. Anamnesis

Number: Profession: Date:

Ager: Sport:

Diagnosis: diagnostic findings:

Symptoms

Daily course: improves:

deteriorates:

medical history:

previous therapies:

general health:

AZ:

Accidents:

Operations:

Respiration:
Digestion:
Diet: Alcohol: Nicotine:
Headache:
Allergies:
Sleep:
Gyn:
Parturitions: Cycle:
RR: Pulse:
Drugs:
Gen. diseases:
Psych. assessment bzw. experiences:
Sick leave (number of days):

6.4. Diagnostic Findings

Inspection (walk):

Protrusion: leg length:
Cervical spine: active: passive:
Thoracic spine: active: passive:
Lumbar spine: active. passive:

Spine: Finger-Floor Distance in cm
Lateralflex.: left right Flexion:

Ilium:
Sacrum:
Shoulder girdle, ribs:
Extremities: active: passive:

Cranio-Sacral Tests:

Visceral Tests:

Neurologic Tests:Lasegue:

Patellar reflex:

Ankle jerk:

Pain (1-6)

Sensitivity:

Proprioceptive Skills: Standing on one limb:	Floor:	left	right
	Mat, double:	left	right
	Balance board:	left	right
	(Third trial in seconds)		

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8. Table of Figures

9. Abstract

Topic: The change in the clinic in lumbar disc herniation after osteopathic treatment
Author: Norbert Seifner
Key words: sciatica, disc prolaps, osteopathic treatment
physiotherapy, manipulation, training therapy
Background and purpose: The aim of this study was to determine the efficiency of Osteoapthic treatment in cases of lumbar disc herniation. In the study it was examined whether surgery can be avoided in patients with lumbar disc herniation with osteopathic treatment and whether the clinical condition can be changed in a positive way. In comparison a group that received physiotherapeutic treatment was examined as well. In this group the emphasis was on stabilisation and strengthening exercises.
Subjects: 13 subjects were treated in the experimental group,
11 acted as controls and had physiotherapeutical treatment. In all patients a herniated disc or a disc protrusion had to be diagnosed. The diagnosis had to be proved by a computer tomogram (CT) or by Magnetic Resonance Imaging (MRI).
Methods: A controlled clinical trial (pretest-posttest control group design) was used to evaluate possible differences due to several clinical outcome measures (dependent variables) such as: pain, finger-floor-distance, standing on one leg (test of proprioceptive skills), straight leg raising test and test of reflexes (patellar reflex and ankle jerk).
Results: To test the significance of changes within the test group and between test group and control group the t-test was used.
On the whole, the test group - in spite of a shorter period of treatment and less units of therapy - produced significantly better results. A decisive significance showed in the parameter pain. In the test group an average improvement by 4-5 points on the scale (on a scale from 1 to 6) could be observed ($p<0.001$) while in the control group the improvement amounted to only two points on the scale. Altogether, the statistical evaluation shows strong positive effects of osteopathic treatment in patients with lumbar disc herniation.

Conclusion and Discussion: In view of these results the first hypothesis that osteopathic treatment improves the clinic in patients with a lumbar disc herniation could be confirmed. Our findings prove clearly that osteopathic treatment is successful regarding the examined symptom. In practice the treatment could be extended by adding exercises for stabilisation and strengthening to osteopathic treatment.

10.Appendix: Evaluation of group A

10.1 Osteopathic diagnosis and treatment

Patient	A1
Medical diagnosis	dorsal symmetric disc protrusion L4/L5
Osteopathic diagnosis	hypomobil in the thoracic spine – particulary TH10-TH12, (kyphosis in the thoracic spine), hypomobil in C7/TH1, tension in M.multifidus and rotatores at L4, L5, M.psoas left, M.quadratus lumb. left, M.gluteus med., cylinder distortion in the lumbar fascial (St. Typaldos 1999) ilium right anterior, right leg 1cm longer right kidney in caudal position sacrum in flexion lesion
Osteopathic treatment	mobilisation TH10-TH12, C7/TH1 soft tissues techniques and triggerpoint technique in the muscles fascial techniques (St. Typaldos 1999) correction of the right ilium correction for the right kidney membranous balance on the sacrum free of pain after four treatments
Patient	A2
Medical diagnosis	L5/S1 central DP
Osteopathic diagnosis	hypomob. TH7/TH8, TH9/TH10, TH12, C7 tension in M.piriformis right, M.iliocostalis M.psoas right, triggerband dorsal leg right (St. Typaldos 1999) left leg 1cm longer, hypomob. sacroiliacal joint right

	tension in the diaphragma
	both shoulders in an anterior position
Osteopathic treatment	thrust technique for the hypomobil segments
	triggerband technique and triggerpoint techniques
	mobilisation for the sacroiliacal joint
	structural techniques and soft tissues techniques for the diaphragma
	mobilisation for the shoulders
	membranous balance between the sacrum and the occiput
	free of symptoms after 5 treatments

Patient	A3
Medical diagnosis	L4/L5 right medio-lateral disc herniation
Osteopathic diagnosis	hypomob. TH6/TH7, TH12/L1, sternum and 2.rib right
	sacrum: left angulus caudal, right sulcus deep
	leason of the liver and the stomach
	triggerband right leg dorso-lateral (St. Typaldos 1999)
	tension M.piriformis, M.iliocostalis, M.levator scapulae
	star-triggerband (St. Typaldos 1999)
Osteopathic treatment	thrust techniques for TH6/TH7 ;TH12/L1 and second rib
	recall technique for the sternum and correction for the sacrum (recall and mobilisation)
	visceral techniques for liver and stomach
	triggerband technique for the pain in the leg
	triggerpoint techniques for the muscles
	membranous balance on the sacrum
	free of symptoms after 8 treatments

Patient	A4
Medical diagnosis	DP L5/S1
Osteopathic diagnosis	hypomobil in TH5/6, TH7/8, TH9/10 and TH10/L1

	blocked sacroiliacal joint right, ilium right inflare knee left less mobilisation in flexion and extension left leg 1cm longer high tension in the lig.inguinale right right shoulder in dorsal position kidney right in caudal position tension in M.psoas right, M.piriformis right, M.glut. med., M.quadratus lumb. triggerband dorsal leg right (St. Typaldos 1999) MRP general less in the sacrum
Osteopathic treatment	thrust techniques for the hypomobil segments mobilisation for the Ium right and muscle energie techniques, mob. for the sacroiliacal joint mobilisation for the shoulder right triggerpoint techniques for the muscles and muscle energie technique for the M.psoas triggerband technique for the leg (St. Typaldos 1999) membranous balance on the sacrum correction for the kidney free of symptoms after 6 treatments
Patient	A5
Medical diagnosis	DP L4/L5 5mm left medio-lateral, nerve root L5 pushed
Osteopathic diagnosis	hypomobil in TH10, TH8,TH6, L1/L2, sacrum: angulus left caudal and sulcus right deep sacrum: MRP less in flexion and extension tension in M.psoas, M.piriformis, M.trapecius, M.rectus capitis post., M.iliocostales right and rotatores at L4-S1 triggerband left leg dorsal (St. Typaldos 1999) high tension at duodenum part 2, and at the cardia, also at the diaphragma, naviculare left in cranial position

Osteopathic treatment	thrust techniques for the hypomobil segments triggerpoint techniques and triggerband technique for the muscles release from duodenum, cardia and diaphragma mobilisation and recall for the sacrum thrust for the naviculare, membranous balance on the sacrum, fascial techniques in the lumbar area free of symptoms after 8 treatments

Patient	A6
Medical diagnosis	DP L5/S1 nerve root S1 pressed, DP L4/L5 3-4mm DP L3/L4 5-6mm
Osteopathic diagnosis	general hypomobil thoracic spine, particulary TH12/L1 tension in M.piriformis right, M.iliocostalis right, both M.trapecii, M.rectus capitis post. triggerband right leg med. (St. Typaldos 1999) triggerpoint-hernie right M.gluteus (St. Typaldos 1999) cranio sacral: occiput in flexion, temporale right in rotation kidney right in caudal position
Osteopathic treatment	mobilisation of the thoracis spine, Thrust TH12/L1 mitchel techniques for the muscles triggerpoint and triggerband for the muscles (St. Typaldos 1999) correction of the occiput and temporale cranial mobilisation of the kidney fascial techniques and cylinder technique in the lumbar area free of symptoms after 7 treatments

Patient	A7
Medical diagnosis	DP L4/L5 5mm, L5/S1 10mm with pressing the nerve root S1
Osteopathic diagnosis	hypomob. in TH12/L1, TH6, TH9, tension in M.longissimus at L2-L5, M.psoas left, M.piriformis, M.trapecius, supraspinatus both sides tension at spincter odi and colon ascendens ilium right in anterior position , high tension in the lig.inguinale right hypomob. right hip cranio sacral: temporale right in rotation
Osteopathic treatment	thrust techniques of the hypomobil segments triggerpoint and Mitchel techniques of the muscles release of spincter odi and the colon mobilisation of the ilium and the hip correction of the temporale, membranous balance on the sacrum free of symptoms after 9 treatments

Patient	A8
Medical diagnosis	DP L4/L5 8mm,presses the nerv roots L5 and L4 DP L5/S1 5mm, nerve root S1 pushed
Osteopathic diagnosis	kyphosis in the thoracic spine, Hypomob. in C7, TH4, TH9, TH12/L1, C0/C1, tension in M.longissimus, M.piriformis, M.psoas, M.rectus, M.gluteus max. and med. right ankle hypomob. triggerband right leg anterior (St. Typaldos 1999) tension in the colon ascendens unsynchronous between occiput and sacrum

	high tension in the diaphragma and in the fascia thoracolumbales
Osteopathic treatment	mobilisation of the thoracis spine, Thrusts for C7, TH4, TH9, TH12, soft tissues techniques for Co/C1 triggerpoint techniques of the muscles triggerband technique right leg (St. Typaldos 1999) mobilisation of the ankle membranous balance on the sacrum and the occiput release of the diaphragma, fascial techniques in the lumbar area free of symptoms after 7 treatments

Patient	A9
Medical diagnosis	DP L4/L5 10mm, presses the root L5 DP L5/S1 4mm
Osteopathic diagnosis	hypomob. TH9, TH12/L1 tension in M.psoas both, M.piriformis left, M.longissimus and M.iliocostales in the thoracic and lumbar spine, very high tension in the fascia thoracolumbales
Osteopathic treatment	thrust for TH9, TH12/L1 triggerpoint techniques for the muscles fascial techniques for the fascia thoracolumbales free of pain after 2 treatments

Patient	A10
Medical diagnosis	DP L5/S1 3mm, DP L4/L5 5mm
Osteopathic diagnosis	hypomob. C7, Th4, TH9, L3, hypomob. sacroiliacal joint right, left leg longer 5mm shoulder left in cranial position, hypomob. left hip leason of the bladder,

	tension in M.quatratus lumb., M.tensor fasciae latae, M.rectus capitis post., M.trapecius both, M.gastrognemius left
	unsynchronous between occiput and sacrum
Osteopathic treatment	thrust techniques of the hypomobil segments
	mitchel techniques of the muscles
	membranous balance on the sacrum and the occiput
	correction of the bladder
	mobilisation of the shoulder and the hip
	mobilisation of the sacroiliacal joint right
	membranous balance on the sacrum
	fascial techniques for the fascia thoracolumbales
	free of symptoms after 7 treatments
Patient	A11
Medical diagnosis	DP L4/L5 5mm, DP L5/S1 right 5mm
Osteopathic diagnosis	hypomob. TH9,
	hypomob. sacroilial joint right
	less mob. in the right hip and in the right knee
	triggerband right leg dorsal
	triggerpoints in M.psoas, M.piriformis, M.glut.med.,
	tension in the lig.collaterale tibiale right
	leason in the uterus
Osteopathic treatment	thrust for Th9
	mobilisation from the sacroiliacal joint right
	mob. right hip and the knee
	triggerband and triggerpoint technique
	fascial techniques in the lumbar area
	correction from the uterus
	membranous balance on the sacrum
	free of symptoms after 8 treatments

Patient	A12
Medical diagnosis	DP L4/L5 5mm, discrete nerve root alteration
	DP L5/S1 right
Osteopathic diagnosis	hypomob. L1/L2
	hypomob. sacroiliacal joint left
	tension in M.piriformis left, M.gluteus left,
	M.peroneus and tib.ant. left
	less mob. in the ankle left
	high tension in the lig.talofibulare ant. left
	leason in the colon descendens
	MRP general less in the sacrum
	high tension in the fascia thoracolumbales
Osteopathic treatment	thrust L1/L2
	mob. of the sacroilial joint left
	triggerpoint techniques
	correction of the colon
	fascial techniques
	membranous balance on the sacrum
	free of symptoms after 6 treatments

Patient	A13
Medical diagnosis	DP L5/S1 3mm
Osteopathic diagnosis	kyphosis in the thoracic spine
	hypomob. C7/TH1, TH9, TH12/L1
	tension in M.longissimus and M.iliocostales
	tension in the diaphragma and in the fascia
	thoracolumbales,
	kidney right in caudal position
	tension in duodenum
	triggerband right leg dorsal
	cylinder distortion (St. Typaldos 1999)

Osteopathic treatment	thrusts C7/TH1, TH9, TH12
	triggerpoint and triggerband techniques for the muscles
	release of the diaphragma
	fascial techniques
	correction of the kidney and duodenum
	cylindertechnique (St. Typaldos 1999)
	free of symptoms after 4 treatments

10.2 Main areas which are mostly concerned with herniated disc patients

Hypomobility in following segments:	C7/TH1, TH4, TH6, TH9, TH10, TH12/L1
	generally in the thoracic spine
High tension in following muscles:	M. ilicostalis, M.longissimus, M.rotatores lumborum, M.multifidus, M.gluteus max. and med., M.piriformis, M.quadratus lumb., M.psoas,
	triggerbands and triggerpoints were founded
Hypomobility in following joints:	sacroiliacal joint, hip, ankle
High tension in:	diaphragma
	fascia thoracolumbales
	cylinder distorsion (St. Typaldos 1999)
Most concerned organs:	kidney
	lever
	colon
	duodenum
Cranio sacral leasons:	at the occiput,
	sacrum
	temporale
	synchronisation between occiput and the sacrum,
	tension in the dura mater