WIENER SCHULE FÜR OSTEOPATHIE

THESIS

Mobility and other parameters of the musculoskeletal system before and after an osteopathic treatment of the eye and its directly connected structures with patients having myopia, hyperopia and/or astigmatism.

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C O N T E N T S

CHAPTER 1: I N T R O D U C T I O N

More than half of the Austrian people suffer from chronic impairment of vision in the sense of **myopia** (short-sightedness – i.e. the patient can only see perfectly at a short distance), **hyperopia** (far-sightedness – this disease only allows normal sight at a long distance), and/or **astigmatism** (weak-sightedness, mostly due to abnormal corneal curvature, less frequently due to abnormal lens curvature). Surveys showed that about 24 per cent of the Austrians wear glasses occasionally. About 27 per cent wear glasses or contact lenses regularly. Internationally, the number of eye diseases is even increasing considerably. According to ophthalmologists, more and more children and young people too have visited their practices. (cf: Semrau, News Nr. 31, August 2001).

Furthermore, a significant number of people suffer from dysfunctions of the musculoskeletal system, which has been clearly shown by the following figures: Every other Austrian occasionally suffers from backache, every fifth person even regularly. Diseases of the musculoskeletal system have even affected a considerable number of children. It is also an interesting fact that the foremost cause for loss of working hours due to illness are diseases of the musculoskeletal system and complaints in the vertebral spine. In the year 1994, for example, they were responsible for early retirement related to illnes in 45 per cent of the cases. (cf: Medizin populär - 1997).

When applying osteopathic treatment to the eyes of patients with impairment of vision the author could observe again and again that the patients felt reactions such as prickling, stretching, heat, etc. in different areas of the musculoskeletal system. At many times a significant improvement of various parameters in the musculoskeletal system was observed, too, immediately after release of the eye region. These circumstances became the initial motive for the author to carry out this study.

From the anatomical and physiological point of view the eye is integrated into the organism in a very complex way– probably most elaborately of all the sense organs. Intensive neural, fascial, structural and, last but not least, embryological interrelationships of the eye within the organism inevitably cause numerous interactions with other body systems (cf: Liem, Praxis der Kraniosakralen Therapie, 2000). Osteopathy attaches enormous importance to this interaction between different body systems. This is very clearly reflected in the following osteopathic principle coined by Andrew Still M.D., the father of osteopathy:

„THE BODY FUNCTIONS AS A UNIT“.

Another principle of osteopathy absolutely has to be mentioned within this context, too:

„STRUCTURE GOVERNS FUNCTION AND FUNCTION GOVERNS STRUCTURE“.

These two principles mentioned above become particularly significant if diseases occur in the organism. Because if the ideal state of harmony or homoeostasis in our body is disturbed, there can be no optimal function, either. Minimal balance disorders can already lead to lesions often occuring far from the place of their triggering. The ways the organism compensates and adapts to disorders are infinitely numerous and complex. With chronic diseases the resulting dynamic processes can lead to all the more serious consequences. (cf: Ligner, Gelenke der unteren Extremität: Mobilisation und Korrektur; 1993)

On the basis of the interrelationships mentioned before there are grounds for the assumption that dysfunctions in the individual systems of the organism affect the eye region and, vice versa, particularly chronic dysfunctions in the eye region such as myopia, hyperopia, and/or astigmatism react upon the organism.

Therefore, we can further assume that these chronic dysfunctions in the eye region mentioned before affect structure and the musculoskeletal system. This would mean that if the eye region is free of strain, the musculoskeletal system manages to fulfill its purpose in a completely different way than if the eye region was strained.

So we can put forward the present ideas from the anatomical, physiological and pathophysiological point of view as a **hypothesis**.

HYPOTHESIS:

If, because of the interconnections within the organism, tensions in the eye region as they occur with myopia, hyperopia, and/or astigmatism impair the function of the musculoskeletal system, the functional status of the musculoskeletal system compared with clearly defined baseline values has to improve after osteopathic treatment of the blocked eye region.

In this study the author examined to what extent osteopathic treatment of the eye in patients with chronic impairment of vision affects the musculoskeletal system, thereby checking the correctness of the present theoretical ideas in practice. At the same time, the osteopathic principles already mentioned above should be verified as well.

It should be emphasized here that in those research patients enrolled in the study who were in the study group **o n l y** the eyes and the directly connected structures were treated. This means that no particular osteopathic technique was examined, much rather those techniques were applied to the eyes which appeared to be necessary on account of the lesions present in the eye region and the structures directly communicating with it.

The interrelationships mentioned above frequently appear in osteopathic literature, but the effect of an osteopathic eye treatment on the musculoskeletal system as mentioned in this hypothesis has, to my knowledge, not yet been proved by studies or other papers. Therefore, I think that this study might be of great importance for osteopathy, too.

In the field of orthodox medicine, too, a paper on this subject could not be found in either the special field of ophtalmology or that of orthopaedics. Therefore, a study on this subject is also of interest from the orthodox medicine's point of view.

Maybe the present study can interest orthodox medicine in holistic interrelations within the human organism on the one hand and, on the other hand, substantiate osteopathic ideas and hypotheses, which have been practically applied with remarkable success for decades, within the framework of Evidence Based Medicine.

CHAPTER 2: B A S I S

2.1 RELEVANT ANATOMY OF THE EYE AND ITS ANATOMIC AND FUNCTIONAL INTERRELATIONSHIP WITH THE MUSCULOSKELETAL SYSTEM

This chapter will mainly deal with the anatomic structures of the eye and the anatomic and functional interrelations between the eyes and the musculoskeletal system that are relevant from the osteopathic point of view, with respect to this study in particular.

2.1.1 EMBRYOLOGY OF THE EYE AND THE RESULTING INTERRELATIONSHIP WITH THE MUSCULOSKELETAL SYSTEM

Embryology is one of the most important scientific pillars of osteopathy.

Starting from day 22 the eye develops from the **neuro-ectoderm** (retina, pigmentary epithelium, optic nerve), from the **superficial ectoderm** (lens and anterior corneal epithelium), and from the **mesenchyme** (uvea and sclera, vitreous body).

With respect to this study, the fact that the eyelids develop from two cutaneous folds comprising the ectoderm and the mesoderm is of great importance. In the beginning the embryonic eye is wide open, whereas later the cutaneous folds grow together and become adherent, closing the eyes from week 10 onwards. Only in week 26 the eyelids begin to open again. (cf: Langmann, Medizinische Embryologie – 1989)

The interesting fact is that the musculoskeletal system develops from the **mesoderm** as well as, as we have mentioned before, the eyelid does.

Therefore, we can assume that, to an extent, an energetic relation between the eyelid and the musculoskeletal system continues to exist even after birth. This inevitably results in the above-mentioned interactions between these two systems. We may also therapeutically influence the musculoskeletal system by treating the eyelid, which develops from the mesoderm. (cf: Liem, Kraniosakrale Osteopathie – 1998)

2.1.2 RELATIONSHIP OF THE EYE TO THE MUSCULOSKELETAL SYSTEM THROUGH THE CRANIOSACRAL SYSTEM

In this connection the meninges and the base of the skull are vitally important.

THE MENINGES

Continuity is established mainly by the meninges (dura mater, arachnoid and pia mater), which are continuous with the dura of spinal cord, thus being able to influence the spinal column, the pelvis and the limbs. The meninges contribute, above all, to the construction of the eyeball. They also ensheath the optic nerve, cover the bony orbit, and they are continuous with the eyelids, too.

The eyeball (bulbus oculi) consists, among other things, of an outer fibrous coat (sclera and cornea) equivalent to the tight dura mater, and an intermediate coat equivalent to the vascular arachnoid and pia mater.

The outer protective sheath of the optic nerve is made up of the dura mater, which fuses with the sclera at the back of the eyeball. The arachnoid and the pia mater constitute the inner sheath of the optic nerve.

The cavity of the orbit is approximately pyramidal in shape with a quadrangular base and is formed by seven cranial bones. It is covered by the periorbita (= periosteum of the eye socket), which is continuous with the dura mater at the openings. In the optic canal it fuses with the dural sheath.

In anterior direction the periorbita merges into the orbital septum, which constitutes the anterior margin of the orbit and serves as the attachment for the eyelids.

Smooth muscle fibres are imbedded in the periorbita at the inferior orbital fissure. Their tonus influences the position of the eyeball.

THE BASE OF THE SKULL

In this chapter the cartilagenous joint between the sphenoid bone and the occipital bone – the sphenobasilar synchondrosis - plays a key role. Owing to its anatomic features the sphenoid bone is directly assigned to the eye region. The connection to the musculoskeletal system and the thereby possible interactions is made possible by direct contact between the base of the skull and the spinal column (craniovertebral joints). There is also a direct connection to the sacrum and numerous other structures of the musculoskeletal system through the dura of spinal cord.

In connection with this the eye muscles are important. They are connected with the sphenoid bone and are continuous with the meninges as well.

The four rectus and the two oblique eye muscles, with the exception of the inferior oblique muscle, arise from a fibrous ring or common annular tendon surrounding the anterior end of the optic canal and the medial end of the superior orbital fissure. The inferior oblique muscle arises from the orbit inside the inferior medial angle.
Owing to their fascial coverings, the eye muscles are connected to the meninges, which, for their part, are continuous with the musculoskeletal system, as we have mentioned before.

With regard to the functional interrelationship between the orbit and the musculoskeletal system, the anatomic fact that the bones of the orbit are directly or indirectly connected with the spenoid bone and the sphenobasilar synchondrosis is also important.

(cf: Liem, Praxis der Kraniosakralen Osteopathie – 2000)

2.1.3 RELATIONSHIP OF THE EYE REGION TO THE MUSCULOSKELETAL SYSTEM THROUGH THE FASCIAL SYSTEM

The “central fascia” provides continuity here. Among others, those fascial structures that connect the central tendon of the pelvic floor with the pharyngeal tubercle of the base of the skull are called the central fascia. As we have already discussed in detail, there is a close interrelationship between the base of the skull and the eye region.

In connection with this the fasciae of the neck should also be mentioned. Lamina superficialis fasciae cervicalis, Lamina praetrachealis fasciae cervicalis, and Lamina praevertebralis are connected through some fascial fibres to the base of the skull and can therefore transmit tensions from the eye region through the sphenoid bone to the musculoskeletal system.

(cf: Liem, Praxis der Kraniosakralen Osteopathie – 2000)

2.1.4 RELATIONSHIP OF THE EYE REGION TO THE MUSCULOSKELETAL SYSTEM THROUGH THE NERVOUS SYSTEM

Here the autonomic nervous system is the connecting link between the musculoskeletal system and the eye region. Segmental integration of viscerovegetative impulses through the sympathetic nervous system is most important here. The sympathetic vegetative centres responsible for the eye lie in the upper region of the thoracic spine. These are the segments from the seventh cervical vertebra to the third thoracic vertebra. The superior cervical ganglion acts as a relay station. With regard to this study it should be mentioned that there is a close anatomic association of this ganglion with the first rib.

For the interrelationship between the musculoskeletal system and the eye region the interconnections of the eye muscles with the central nervous system are of great importance, too. The latter links proprioceptive information with that of the vestibular organ and integrates it with the information of the visual organ. The body endeavours to ensure the best possible balance of the horizontal axes in relation to the vertical median line. This is why the eye muscles are closely related to body posture and especially to the tonus of the neck muscles –the short ones in particular – and to the vestibular organ.

(cf: Liem, Kraniosakrale Osteopathie – 2000)

2.2 PATHOLOGY OF THE EYE AND FUNCTIONAL PATHOLOGY WITH REGARD TO THE EYE AND THE MUSCULOSKELETAL SYSTEM – primarily from the osteopathic point of view.

2.2.1 MYOPYA, HYPEROPIA AND ASTIGMATISM – WITH CONSIDERATION OF THE OSTEOPATHIC POINT OF VIEW.

In **myopia or short-sightedness** the orbit is enlarged in its longitudinal diameter mostly due to an extension lesion of the sphenoid bone, i.e. the greater sphenoidal wings are situated in a posterior, superior and medial position and the posterior part of the body of sphenoid bone has been shifted downwards. Because of this the eyes of the concerned person appear a bit more deep-set. As a result of the enlarged orbit the eyeball, too, expands along the anterior-posterior axis so that parallel rays are focused on a plane in front of the retina. The effect on visual power is that nearby objects produce a sharp image on the retina whereas the rays from distant objects, as described above, are focused in front of the retina and therefore those objects cannot be seen clearly.

Glasses with concave lenses correct the visual defect so that distant objects, too, produce a sharp image on the retina.

In **hyperopia or far-sightedness** it is the other way round. Here the orbit is shortened in its longitudinal diameter, mostly due to a flexion lesion of the sphenoid bone, i.e. the greater sphenoidal wings are situated in an anterior, inferior and lateral position and the posterior part of the body of sphenoid bone has shifted upwards so that the eyeball is not optimally extended along the anterior-posterior axis, either. The latter fact is the reason why the eyes are a bit more protruding. Therefore, the eye must already accommodate for distant vision, using up part of its accommodation width, i.e. the refractive power is insufficient for near vision. The effect on visual power is that distant objects produce a sharp image, whereas the rays from nearby objects are focused on a plane behind the retina so that the far-sighted person cannot see these objects clearly.
In order to correct this refractive error and to focus the light rays in the right plane the person must wear glasses with convex lenses.

In regular **astigmatism** the curvature of the cornea varies, i.e. the cornea is more curved in one -mostly vertical- axis than in the other. From the osteopathic point of view this might be the result of dysbalances of tensions within the skull and the orbit. Due to this pathologic radius of curvature the light rays are not all focused on the right points on the retina. The negative effect of this difference in refractive power in the two axes on visual power is that a point appears as a line (one plane appears blurred!) regardless of the object's distance.

To complete the picture, irregular astigmatism should be mentioned here, too. In this condition irregular distorted images occur, resulting, for example, from corneal scarring.

This error of eye structure can be corrected by the use of so-called cylindrical lenses, which are curved only in one axis.

Not only the described malpositions of the sphenoid bone may lead to chronic visual problems. All the bones of the orbit involved can lead to impairment of vision, too, if there are dysfunctions. In addition, disturbances in the vascular and nerval supply of the eye can irritate vision and cause weak-sightedness.
Causes of the described orbital dysfunctions can be of primary traumatic as well as of secondary origin. A few of the possible causes are prenatal dysfunction between the presphenoid and the postsphenoid or birth trauma, falls, blows or orosurgical interventions with dysfunction of the orbital bones, or disturbances of the sphenobasilar synchondrosis.

(cf: Sergueff, Die Kraniosakrale Osteopathie bei Kindern – 1995; Silbernagl, Taschenatlas der Physiologie – 1988; Abel et al, Mein Körper – Mein Leben – 1998; Liem, Praxis der Kraniosakralen Osteopathie – 2000;)

2.2.2 FUNCTIONAL PATHOLOGY EYE – MUSCULOSKELETAL SYSTEM

On the basis of the osteopathic theories, which have already been described in detail in the introduction, it can be assumed that the orbital dysfunctions mentioned above can affect the musculoskeletal system through the described connections.
The impaired structures in the eye region are the beginnings of **lesion chains**, which reach the musculoskeletal system along the paths already described in detail. Along these chains tensions which have manifested in

the orbit region due to chronic visual problems can spread out and disturb the musculoskeletal system.

Looking at the fact that during an average lifetime of 76 years we blink 415 million times (cf: Geolino, Juli 2001), the embryology-based energetic interrelations between the eye or the eyelid and the musculoskeletal system should be considered quite important. Through the described connections dysbalances in the eye region can spread out and eventually cause disturbances in the musculoskeletal system.

A strained eyeball or strained eye muscles may possibly cause strain of the dura of spinal cord through the base of the skull. This could lead to a restriction of the sacrum and cause numerous problems in the musculoskeletal system. Furthermore, dysbalance of the sphenobasilar synchondrosis caused by the eye region may also directly lead to disturbances in the region of the craniovertebral joints.

Strains in the fascial system primarily caused by the eyes and the effects thereof on the postural apparatus are also possible.

Furthermore, shifting of the eyes, for example, can lead to a compensatory position of the head, which in turn causes the axes of the semicircular canals to change. This leads to a change of the body’s postural integrity, as, for example, an augmentated muscle tonus of the extensor muscles of the opposite lower extremity.

These examples only show a few of many possible results. Which lesion chains become activated in the individual patient varies considerably, of course, and eventually depends on numerous factors.

At first, movement of tissues and articulations in the musculoskeletal system can become more or less restricted due to these pathologic dynamic processes. In consequence, more severe changes of the tissue can develop, such as loss of flexibility, swells, sclerosis formation, fibrosis formation, etc. The tissue's susceptibility to injuries can also increase considerably, and body posture can deteriorate, too. Which consequences occur in the musculoskeletal system, eventually depends on the kind and intensity of the cause, the individual condition of the tissues, and the activity, age and emotional state of the individual patient with chronic impairment of vision.

(cf: Liem, Kraniosakrale Osteopathie – 1998 und Praxis der Kraniosakralen Osteopathie – 2000; Ligner, Gelenke the unteren Extremität – 1993)

CHAPTER 3: M E T H O D O L O G Y

3.1 GENERAL

Two groups of 10 test persons each were set up for the study – a study group and a control group.

The groups were randomized. In this study the patients were randomly divided into the individual groups according to the following system: Alternately the test persons were assigned to the study group or the control group.

The test persons of the control group received osteopathic treatment in the classic sense after the end of the study. As treatment of the test persons of the study group was confined to the eye region, they were offered an osteopathic treatment after the study, too.

Inclusion criterion for test persons of both groups was one or more of the following chronic eye diseases:

myopia, hyperopia and/or astigmatism.

The test persons of the study group were osteopathically treated **once, only** at their eyes or the directly communicating structures, if they were found blocked, until the afflicted region was free of tensions. Treatment techniques will be explained more precisely later on in this chapter.

N o treatment, however, was conducted on the probands of the control group. The probands lay on the examination couch for about 15 minutes.

As the test persons of both groups spent at least 15 minutes in supine position on the examination couch, an improvement of the test parameters for the musculoskeletal system in the study group owing only to relaxation could be ruled out.

Descriptive data analysis was carried out using conventional statistical methods.

3.2 INCLUSION AND EXCLUSION CRITERIA FOR PATIENTS

1 The probands were selected from a group of male and female students between 18 and 35 years old. Prerequisite was at least one of the above mentioned eye diseases. The eye problems had to exist for at least two years. The disease in the eye region had to make some visual aid (contact lenses or eyeglasses) necessary, at least sometimes (only while driving a car, for example).

In addition, the patients had to meet the following requirements:

- no earlier or present severe problems in the musculoskeletal system (such as herniated disks, long lasting massive restricted movements of one or more articulations, etc.)

- no grave accidents (such as craniocerebral trauma, spinal column injuries, car accidents at high speed, complicated bone fractures, etc.)

- no acute diseases in the eye region (such as conjunctivitis, etc.)

- no serious earlier or present general diseases or major surgical operations (such as meningitis, pronounced hypertension, diabetes, muscle diseases, heart surgery, head surgery, eye surgery, etc.)

- no taking of medication prescribed by a doctor due to illness in the last four weeks before the study;

3.3 PROCEDURE

3.3.1 Study group

The test persons were examined and treated once. The procedure can be summarized as follows:

Test – treatment –re-test.

The following procedure was pursued and kept on record:

- Patient documentation
- Medical history (a form already filled in by the patient before the session was discussed with the patient)
- Registration of the primary test criteria
- Osteopathic examination of the eye and the directly communicating structures
- Osteopathic treatment of the structures given in 3.5.2, if they were found blocked and treatment appeared useful
- Registration of the primary test criteria

3.3.2 Control group

The test persons were also summoned only once. The procedure in this group can be summarized as follows:

Test – about 15 minutes in supine position w i t h o u t treatment – re-test

The following procedure was pursued and kept on record:

- Patient documentation
- Medical history (a form already filled in by the patient before the session was discussed with the patient)
- 15 minutes lying supine on the examination couch w i t h o u t treatment
- Registration of the primary test criteria

3.4 PRIMARY TEST CRITERIA

Registration of the primary test criteria was carried out by the therapist.

3.4.1 MOBILITY OF THE MUSCULOSKELETAL SYSTEM

1. Upper extremities – general rapid test

   Test description: The test person is sitting on the examination couch with his/her pelvis erect at maximum. Both hollows of the knees touch the edge of the bed. The test person abducts both completely extended arms in the frontal plane to maximum until the hands touch each other at their radial sides. In addition, the test person carries out maximum pronation of both forearms, so that the backs of the hands get closer to each other without the radial sides of the hands losing contact.

   Evaluation: examination of the range of movement of the sternoclavicular articulation, the acromioclavicular joint, the glenohumeral articulation, the elbow and the joints of the hand.

Measurement: Both hands are marked at the posterior side of the head of the fifth metacarpal bone. The distance between the two marks is measured.

Unit of measurement: cm

2. Cervical spine – active flexion and extension

   Test description: The test person is sitting on the examination couch with his/her pelvis erect at maximum. Both hollows of the knees touch the edge of the bed. The examining person fixes the shoulder girdle with both hands on the right and on the left. The test person bends his/her head forward and backward to maximum.

   Measurement: The distance chin – jugular incisure of sternum is measured in each position.

   Unit of measurement: cm

3. Patrick-Kubis-Test

   Test description: The test person is in supine position and puts the foot that is to be tested on the opposite knee. The proband lets the bent knee drop to achieve as much abduction as possible, the examining person at the same time fixing the side of the pelvis opposite of the tested leg.

   Measurement: A point at the lateral area of the fibular head is marked. The distance between the examination couch and the mark is measured. The measurement is carried out on the right and on the left.

   Unit of measurement: cm

4. Knee-joint – active flexion

   Test description: The test person is in prone position, his/her arms lying next to the body. His/her head is in neutreal position. The proband flexes the knee-joint of the examined leg as much as possible, while the

examining person monitors the pelvis for evasive motions and, if necessary, fixes it with his hand.
Measurement: A point in the middle of the gluteal groove – at the level of the ischiadic tuber – is marked as well as a point at the calcaneal tuber. The distance between the two marks is measured.
Unit of measurement: cm

5. Talocrural ankle joint – active dorsiflexion and plantar flexion
   Test description: The test person is in supine position, the leg on the examined side flexed at the knee-joint at right angles. The talocrural ankle joints on the right and on the left are examined by means of a goniometer.
   Measurement: Points of reference on the lower leg are the lateral malleolus and the anterior edge of the tibia and on the foot its lateral border.
   Unit of measurement: angular degrees

3.4.2 TRIGGER POINTS

Intensity of pain in the tested structures was registered by asking the test persons. They had to assign the pain they felt to a scale of five grades:

0 = no pain
1 = light pain
2 = moderate pain
3 = strong pain
4 = very strong pain

The following structures were examined with regard to trigger points:

In relaxed sitting position with the patient's hands lying on the thighs:

- Lateral point of the right and left transverse process of the atlas;
- First rib right and left;
- Transverse part of the trapezius muscle right and left;
- Costal part of the abdominal diaphragm right and left; if there were more trigger points, only the most painful trigger point or the one closest to the median plane on each side was evaluated;

In supine position:

- Iliopsoas muscle right and left with extended legs;
- Gluteal region right and left; for this the leg on the examined side is flexed at an angle of about 90°;
- Popliteal fossa right and left with extended legs;
- First tarsometatarsal articulation right and left;

3.4.3 COMPUTER-AIDED TELEMETRIC MEASUREMENT OF THE SPINAL COLUMN

The so-called MediMouse is a modern medicotechnical device for clinical use. The form and mobility of the bony spinal column in the sagittal plane can be determined by simply running it manually over the back in different positions, in the course of which the back's length (in mm) and its local inclination to the perpendicular (in angular degrees) between the vertebral bodies of the first thoracic vertebra and the third sacral vertebra is measured. With the aid of these data the sagittal outline of the back (thoracic spine, lumbar column and sacrum) can be determined.

An intelligent recursive algorithm calculates the outline of the underlying bony spinal column from the superficial form, taking the local curvation (kyphosis formation or lordosis formation) into account.

As a final result we get an exact localisation of all vertebral bodies in the sagittal plane by projecting their centres to the back's superficial outline. Furthermore, we get the segmental angles of all movable segments of the thoracic spine and the lumbar column and the position of the pelvis in the sagittal plane (forward or backward tilt). These data are set out in a table of numbers and a graph.

The following measurements were carried out for the study:

1. Inclination – whole body habitus

   The line between the first thoracic vertebra and the first sacral vertebra is called inclination line. The angle between this line and the perpendicular is called inclination. This can be illustrated as follows: a person standing upright in a military fashion stands perpendicularly, i.e. a perpendicular dropped from the seventh cervical vertebra intersects with the trochanter major and meets the weight-supporting surfaces of the feet at their centre. In that case inclination is zero degree. Physically fit probands adopting whole body habitus usually stand a bit bent forward, so that inclination is between 5 and 10 degrees. Negative inclination is called reclination.

   Measurement: The proband is standing in relaxed upright position, his/her weight resting equally on the two feet, his/her arms hanging down at the side, his/her eyes looking straight ahead;

   Unit of measurement: angular degrees (as described above);

2. General movement of the hip joints/sacrum, lumbar column and thoracic spine in flexion;

   The evaluated parameter is the so-called change in inclination, which represents the general mobility of a person and comprises the mobility of the thoracic spine, the lumbar column and the hip joint. As the ranges of movement of the thoracic spine, the lumbar column and the hip joint partly compensate each other, inclination is not simply the total of these ranges of movement. Therefore, the change in inclination is a general measure for the mobility without differentiating which articulations take part to what extent (analogous to Distance Finger-Floor).

   Flexion of the rump is measured with extended legs, the patient's feet waist-wide on the floor, his/her head and his/her arms relaxed, hanging down, his/her eyes looking at the hands.
   Unit of measurement: angular degrees;

3. General movement of the hip joints/sacrum, lumbar column and thoracic spine in extension;

   The evaluated parameter is the change in inclination – see above.
   Unit of measurement: angular degrees;

Note on measuring: The parameters are measured twice in a row in each position. Only the mean of each two measures is evaluated.

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3.5 OSTEOPATHIC TREATMENT OF THE EYE REGION

3.5.1 TREATMENT TECHNIQUES

The following osteopathic techniques were applied:

1. Intraosseous techniques
2. Suture techniques
3. Membrane techniques
4. Release techniques
5. Muscle energy techniques (for the eye muscles)

3.5.2 TREATED STRUCTURES

The following structures were treated according to osteopathic principles, if they were found abnormal from the osteopathic point of view and treatment seemed to be useful with regard to the organism as a totality :

1. The sphenobasilar synchondrosis
2. The orbit as a whole, i.e. the bones that take part in the formation of the orbit; also the sutures in the orbital region;
3. Intracranial dural membranes (especially the tentorium cerebelli because the nerves of the eye muscles run along there);
4. The optical nerve (in its entire path)

5. The eyeball
6. The eye muscles

The therapist treated the eye region until the so-called primary respiratorial mechanism in that zone was in harmony again to an extent that the therapist got the feeling of having done not too little and not too much.

Here the term “primary respiratorial mechanism“ (in the following called PRM) should be described in more detail for those not too familiar with osteopathy. The PRM consists of the following factors:

1. Motility (inherent motion) of the brain and the spinal cord
2. Fluctuation of the cerebrospinal fluid (CSF)
3. Mobility of the intracranial and intraspinal membranes
4. Mobility of the cranial bones
5. Involuntary mobility of the sacrum between the pelvic bones.

The mechanism is called p r i m a r y because it is directly related to the internal tissue respiration of the central nervous system, which regulates the pulmonary respiration and all body functions (the important centres around the fourth ventricle, for example). Furthermore, it acts before the pulmonary respiration.

It is called r e s p i r a t o r i a l because it is, like pulmonary respiration, a rhythmic process that has to do with exchange processes. It is a metabolic process, anabolic and catabolic as well, which takes place intracranially at first and is connected with the nervous system and the CSF. Owing to the rhythmic drainage of the entire body tissue, it also plays a major role in the tissue respiration of the entire organism. The tissue respiration of the nervous system and the rest of the body works autonomously and involuntarily.

It is called m e c h a n i s m because it consists of parts together constituting the mechanism or motor which makes the craniosacral impulse possible.

(cf: Liem, Kraniosakrale Osteopathie, 1998)

3.5.3 PRECAUTIONS – with regard to the treatment

No treatment would have been carried out, if on the basis of an osteopathic examination it could have been assumed that the patient would become destabilized due to an isolated eye treatment. The treatment would have been stopped, if the patient had felt reactions that the experienced therapist would have had to consider unusual or dangerous (aggravating pain, for example). In the latter case, the patient would have immediately received further treatment in the classic osteopathic way, if indicated.

CHAPTER 4 - R E S U L T S

1. DESCRIPTIVE ANALYSIS

1.1 MOBILITY

An improvement could be noted in 54 % of the patients of the study group, in contrast to 37 % of the control group. It is also notable that in the study group 8 % of the findings showed worse results than before treatment, in the control group, however, it was 41 %.

Are the results positive?

If we look at the average change it shows that in the control group, too, slightly positive developments can be observed for the most part, whereas in the study group considerably more significant progress can be noted (see the respective "t" tests). The 80 % confidence intervals are almost entirely positive in the study group, in the control group, however, mostly around zero.

Is a significant difference between the study group and the control group measurable?

Especially in the following mobility tests an improvement in the study group in comparison to the control group could be measured with a probability of more than 95 %: cervical spine (active flexion and extension), right knee joint (active flexion). The same is true, to a lesser extent, for the two tests on the right talocrural ankle joints (active plantar flexion and dorsiflexion). The following test showed no significant improvement (a probability of less than 50 %): Patrick-Kubis-Test right and left, left knee joint (active flexion) and left talocrural ankle joint (active dorsiflexion).

Further particularities

The mobility test on the right knee joint (active flexion) showed a significant worsening in the control group, but a significant improvement in the study group (a probability of more than 95 % each). In the mobility test on the left talocrural ankle joint (active dorsiflexion) a significant improvement could be measured in both groups.

It should be pointed out here that no particular differences could be noted in comparing the means at baseline of the individual articulations in both groups. This means that both groups showed nearly the same conditions, as far as the range of movement of the individual articulations is concerned.

1.2 TRIGGER POINTS

Are the results positive?

In the study group an improvement of half a degree (0,57) in the mean could be achieved. In the control group only an insignificant improvement was achieved in pain sensation – merely 0.19 degrees. Especially in pain in the gluteal region and in the abdominal diaphragm very good progress was shown (right gluteal region: study group 1.33 degrees and control group 0.6 degrees; right abdominal diaphragm: study group 1.0 and control group 0.33). In some pain points, however, patients of the study group showed no or an insignificant improvement compared with the patients of the control group (lateral point of the transverse process of the atlas, first rib right and left, left trapezius muscle and left popliteal fossa).

Only patients feeling pain were included for assessment of the changes. As more than 40 % of the control points in the patients of the control group were painless, the sample size was considerably reduced.

Is a significant difference between the study group and the control group measurable?

The trigger points in the following regions showed some improvement in the study group in comparison to the control group with a probability of more than 90 %: iliopsoas muscle right, popliteal fossa right, gluteal region right and first tarsometatarsal articulation right and left.

The trigger points in the following regions showed an insignificant improvement (less than 50 % probability): lateral point of the transverse process of the atlas right, first rib right and left, trapezius muscle left, abdominal diaphragm left and popliteal fossa left.

1.3 TELEMETRIC DATA

An improvement could be noted in 80 % of the patients of the study group, in contrast to only 62 % in the patients of the control group. In the study group 33 % of the findings showed worse results than before treatment, compared with 54 % in the control group.

Are the results positive?

While a significant improvement in flexion in standing position can be noted in the study group (plus 2 degrees in the mean), the control group showed only a slight improvement (plus 0.8 degrees in the mean). Both groups showed a similar (marginal) positive change in extension in standing position.

However, it should be noted that both sets of measurements were subject to very strong fluctuations, therefore, due to the small sample size no verified conclusions can be drawn.

Is a significant difference between the study group and the control group measurable?

With a probability of 85 % no changes owing to treatment occur in extension. An improvement can be observed in flexion with a certainty of 58 %. However, this is not sufficient for drawing reliable conclusions.

NOTE: The telemetric data regarding upright standing position (=inclination) could not be included due to the enormous fluctuations.

4.2 GRAPHIC REPRESENTATION OF THE RESULTS

4.2.1 FIGURES 1 to 4

Star charts show the results in absolute numbers. Each line represents the number of patients that showed a positive or negative change or no change at all in the individual tests.

Comparing the study group and the contol group, the visual contrast between the size of the areas marked in blue outline, for example, is interesting. These areas represent the number of patients in whom a positive change in the individual tests could be established. The statistical figures mentioned at the beginning of this chapter are very clearly reflected in these charts.

4.2.2 FIGURES 5, 6, 9 and 10

Bar charts show the results here.

4.2.3 FIGURES 7 and 8

These two charts show the confidence intervals in the mobility tests.

4.2.4 FIGURE 11

This chart shows the probability of changing means in the individual tests after carrying out the treatment following the procedure as defined in chapter 3.

4.3 FIGURES

FIGURE 1 – open Mircrosoft-Excel Arbeitsblatt "FIGURES"

SUPPLEMENT TO FIGURE 1

The numbers of the lines (Nr. 1-11) correspond to the the following tests:

Nr. 1 - Upper extremities – general rapid test

Nr. 2 - Cervical spine – active flexion

Nr. 3 - Cervical spine – active extension

Nr. 4 - Patrick-Kubis-Test right

Nr. 5 - Patrick-Kubis-Test left

Nr. 6 - Knee-joint right – active flexion

Nr. 7 - Knee-joint left – active extension

Nr. 8 - Talocrural ankle joint right – active plantar flexion

Nr. 9 - Talocrural ankle joint left – active plantar flexion

Nr. 10 - Talocrural ankle joint right – active dorsiflexion

Nr. 11 - Talocrural ankle joint left – active dorsiflexion

FIGURE 2 – open Microsoft Excel-Arbeitsblatt " FIGURES"

SUPPLEMENT TO FIGURE 2

The numbers of the lines (Nr. 1 – 11) correspond to the following tests:

Nr. 1 - Upper extremities – general rapid test

Nr. 2 - Cervical spine – active flexion

Nr. 3 - Cervical spine – active extension

Nr. 4 - Patrick-Kubis-Test right

Nr. 5 - Patrick-Kubis-Test left

Nr. 6 - Knee-joint right – active flexion

Nr. 7 - Knee-joint left – active flexion

Nr. 8 - Talocrural ankle joint right – active plantar flexion

Nr. 9 - Talocrural ankle joint left – active plantar flexion

Nr. 10 - Talocrural ankle joint right – active dorsiflexion

Nr. 11 - Talocrural ankle joint left – active dorsiflexion

FIGURE 3 – open Microsoft Excel-Arbeitsblatt "FIGURES"

SUPPLEMENT TO FIGURE 3

The numbers of the lines (Nr. 1 – 16) correspond to the following structures:

Nr. 1 - Atlas right

Nr. 2 - Atlas left

Nr. 3 - First rib right

Nr. 4 - First rib left

Nr. 5 - Trapezius m. right

Nr. 6 - Trapezius m. left

Nr. 7 - Abdominal diaphragm right

Nr. 8 - Abdominal diaphragm left

Nr. 9 - Iliopsoas m. right

Nr. 10 - Iliopsoas m. left

Nr. 11 - Gluteal area right

Nr. 12 - Gluteal area left

Nr. 13 - Popliteal fossa right

Nr. 14 - Popliteal fossa left

Nr. 15 - First tarsometatarsal articulation right

Nr. 16 - First tarsometatarsal articulation left

FIGURE 4 – open Microsoft Excel-Arbeitsblatt "FIGURES"

SUPPLEMENT TO FIGURE 4

The numbers of the lines (Nr. 1 – 16) correspond to the following structures:

Nr. 1 - Atlas right

Nr. 2 - Atlas left

Nr. 3 - First rib right

Nr. 4 - First rib left

Nr. 5 - Trapezius m. right

Nr. 6 - Trapezius m. left

Nr. 7 - Abdominal diaphragm right

Nr. 8 - Abdominal diaphragm left

Nr. 9 - Iliopsoas m. right

Nr. 10 - Iliopsoas m. left

Nr. 11 - Gluteal area right

Nr. 12 - Gluteal area left

Nr. 13 - Popliteal fossa right

Nr. 14 - Popliteal fossa left

Nr. 15 - First tarsometatarsal articulation right

Nr. 16 - First tarsometatarsal articulation left

FIGURES 5 – 11 – open Microsoft-Arbeitsblatt "FIGURES"

CHAPTER 5 - D I S C U S S I O N

The main aim of this study was to prove that exactly defined chronic impairment of vision and the tensions in the eye region inevitably associated with it can influence certain parameters of the musculoskeletal system in a negative way. So the task was to investigate whether a pathologic eye region as it can be found with manifest weak-sightedness can constitute a so-called primary lesion and is able to influence the musculoskeletal system through lesion chains. In this study ten persons with chronic impairment of vision were osteopathically treated once, o n l y at the eye region, and the effects on certain parameters of the musculoskeletal system were registered.

It should be mentioned here once again that studies dealing with the subject summarized before were not available to the author.

Looking at the results of statistical data analysis we can see a statistically relevant connection between the pathologic eye region and parameters of the musculoskeletal system in the study group, in contrast to the control group.

In the field of **mobility** a significant improvement of the range of movement of articulations could partly be noted in the study group. In the control group, however, more stagnating developments could be registered. Moreover, the probands of the control group even showed worsening in mobility compared with baseline in 41 % of the findings. In **triggerpoints** more than twice as many positive changes could be noted in the study group compared with the control group. The **telemetric data** concerning the mobility of the thoracic spine and the lumbar column in flexion and extension, however, showed nearly equal positive developments in both groups.

The lumbar and pelvic region on the right and the lower right extremity showed a significant improvement in the study group compared with the control group. The reason for this cannot be explained even on intensive examination of the patient documentations and the treatments at the eye region of the probands. Neither did the patients show worse visual defects either in the right or the left eye, nor were the eyes treated more or less intensively on one particular side.

A significant improvement of the study results concerning the mobility of the cervical spine (active flexion and extension), however, can be explained by the anatomic connections between the eyes and the cervical region. As already described in detail in chapter 2, “Basis“, sympathetic fibres of the autonomic nervous system, for example, arise in the cervical region and eventually merge into the eye region. Several more anatomic planes connect these regions with each other – see also chapter 2, “Basis“. On the basis of the results found we can assume that interaction in both directions is possible. This means that, for example, tensions in the eye region can have a negative effect on the mobility of the cervical spine.

As for evaluation of the results it absolutely must be mentioned here that the sample size of ten probands per treatment group in this study must be regarded as relatively small by international standards. For studies in the field of orthopaedic and physical medicine dealing with subjects of manual medicine a sample size of fifty probands is considered sufficient as a rule of thumb. So the results of this study, concerning internal validity, should be qualified. Thus, it is better to speak of developments or tendencies in connection with the evaluated data.

In assessing the results it must also be taken into account that the study is not blinded, i.e.examination and treatment was carried out solely by the author. This procedure had to be chosen due to organisational difficulties. In addition, it should be pointed out once more that the probands enrolled in this study could conclude from the procedure whether they were treated or not. So the possibility of better results for the control group in case of placebo treatment cannot be ruled out. No placebo treatment was carried out because it was not the aim of the study to check the effectiveness of a particular osteopathic technique or osteopathy itself but to examine the effect of relaxation of the pathologic eye region on the musculoskeletal system. Nevertheless, the results of the study should also be qualified as for methodological quality.

On the other hand, the results of data analysis are quite remarkable, not least for the following reasons:

1. Probands were only included in the study if their patient documentation could be classified normal –regarding the musculoskeletal system, too. This means that the test persons considered themselves physically fit or slightly impaired regarding the musculoskeletal system at study entry.

2. Treatment of the eye region was carried out only between five and fifteen minutes.

Nevertheless, as already described in detail, much better results could be achieved in the study group compared with the control group.

It was a secondary aim of this study to open new horizons for further studies. As the changes of the parameters in the study group compared with the control group were distinctly positive, it could be worthwhile, to work out new hypotheses and bases for further studies.

A study, for example, carried out along the same lines but including a follow-up would be of interest in order to observe long-term effects of treatment of the pathologic eye region on the musculoskeletal system.

In addition, further studies could be carried out with probands suffering from chronic impairment of vision in whom acute and/or chronic diseases in the musculoskeletal system can be diagnosed. It could be investigated whether chronic impairment of vision is connected with pathologic processes in the musculoskeletal system, and if so, to what extent. Particularly interesting in the author's opinion would be diagnoses regarding the cervical spine, the abdominal diaphraghm, the thoracic region, the right lumbar and pelvic region, the right knee joint and both feet. For in these body regions either the triggerpoints or the mobility in the study group compared with the control group could be significantly improved in the present study.

This study can show to a certain extent that it is of vital importance to start from the assumption that the individual body systems are subject to interaction. Too little attention might be paid to this fact by orthodox medicine. This might be the reason why, especially with chronic diseases, the therapeutical approach in orthodox medicine is often confined to symptomatic treatment strategies. This way of thinking is mirrored particularly in orthopaedics. The present study and, hopefully, further future studies based on it, could lead to orthopaedists also taking the eye region into consideration as one among other trigger factors of complaints in the musculoskeletal system in patients with chronic problems of the visual system. Chronic impairment of vision might even be classified as a primary lesion leading to pathologic changes of the musculoskeletal system.

The logical consequence of this would be a complex therapeutical approach that osteopathy with its principles - see chapter 1, ”Introduction “ - would be apt to deal with. So a synthesis of orthodox medicine and osteopathy would help the patients to receive more effective treatment. The problems in the musculoskeletal system, for example, could be treated in a more target-oriented way and, therefore, more individually.

Because of this, osteopathy would eventually become much more embedded in the field of orthodox medicine and play a more important role. Judging from the results it can be assumed that the present study has made a small contribution to this.

CONCLUSION

1. It shows that in persons with relatively modest or no subjective muskoloskeletal complaints isolated osteopathic treatment of the irritated

eye region can partly improve or even eliminate pathologic symptoms of the musculoskeletal system – trigger points and disturbances of articulation mobility.

2. Therefore, the significance of orbital dysfunctions for certain pathogenic abnormalities of the musculoskeletal system is remarkable.

3. This substantiates the two osteopathic principles that the body functions as a unit and structure and function reciprocally influence each other.

4. The hypothesis put forward in the introduction that the eye region irritated by chronic impairment of vision adversely influences the musculoskeletal system can be verified on the basis of the overall results.

CHAPTER 6 - S U M M A R Y

Owing to the intensive anatomic and functional physiological interrelationships of the eye within the organism it can be assumed that chronic dysfunctions of the eye region can influence other body systems. In the present study the changes in mobility and other parameters of the musculoskeletal system were investigated after isolated osteopathic treatment of the eyes in patients with hyperopia, myopia and/or astigmatism.

The procedure was based on the following hypothesis: If, owing to the interrelationships within the organism, strains in the eye region as they occur with chronic diseases such as myopia, hyperopia and/or astigmatism adversely influence the function of the musculoskeletal system, the functional status of the musculoskeletal system compared to baseline must improve after osteopathic treatment of the blocked eye region.

In addition, the following two principles of osteopathy were to be substantiated in this context:

1. The body functions as a unit.
2. Structure governs function and function governs structure.

The 10 probands of the study group were osteopathically treated once, only in the eye region. The 10 test persons of the control group merely lay in supine position on the examination couch for 15 minutes. Only persons feeling no or little impairment of the musculoskeletal system who were either short-sighted or far-sighted and/or astigmatic were included in this study.

A summary of the outcome analysis shows the following: Mobility could partly be improved significantly in the study group whereas rather stagnating

developments could be observed in the control group. As for trigger points, more than twice as many positive changes could be registered in the study group compared to the control group.

Particularly worth mentioning is the significant improvement in the probands of the study group in the following regions of the musculoskeletal system:

Cervical spine, abdominal diaphragm, right gluteal region, right knee joint and right foot.

On the basis of these results the hypothesis can be verified. In addition, the principles of osteopathy could be substantiated.

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CHAPTER 8 - A P P E N D I X

8.1 Contents – Thesis

8.2 Contents – Figures

8.3. Measured values – open Microsoft Excel-Arbeitsblatt "MEASURED VALUES"

8.4 I N D E X

CHAPTER 9 - A B S T R A C T

TOPIC: Mobility and other parameters of the musculoskeletal system before and after an osteopathic treatment of the eye and its directly connected structures with patients having myopia, hyperopia and/or astigmatism.

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KEYWORDS: hyperopia – myopia – astigmatism – musculoskeletal system – interrelationships eye-musculoskeletal system - bodily functional unity – interrelationships structure-function – lesion chains

In the present study the changes in mobility and other parameters of the musculoskeletal system were investigated after isolated osteopathic treatment of the eyes in patients with hyperopia, myopia and/or astigmatism. The procedure was based on the following hypothesis: If, owing to the interrelationships within the organism, strains in the eye region as they occur with chronic diseases such as myopia, hyperopia and/or astigmatism adversely influence the function of the musculoskeletal system, the functional status of the musculoskeletals system compared to baseline must improve after osteopathic treatment of the blocked eye region. The 10 probands of the study group were osteopathically treated once, only in the eye region. The 10 test persons oft the control group merely lay in supine position on the examination couch for 15 minutes. Only persons feeling no or little impairment of the musculoskeletal system who were either short-sighted or far-sighted and/or astigmatic were included in this study. A summary of the outcome analysis shows the following: Mobility could partly be improved significantly in the study group whereas rather stagnating developments could be oberserved in the control group. As for trigger points, more than twice as many positive changes could be registered in the study group compared to the control group.