The influence of osteopathic treatments on the flexibility, technique and performance of juvenile high performance swimmers and high performance triathletes

Master thesis to obtain the academic
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recorded at
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by

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Note of thanks

My family: My wife Christine, my children Marian and Elena who had to spend many weekends without me.

Content

1 Foreword

Through my past as a professional triathlete (10 years) my relationship with the medium of water is not insignificant. At the time my interest went so far that I was taught to be a swimming coach, officially recognized by the state.

In the context of my coaching activity I have trained many of the best Austrian triathletes. I didn’t have to stand on the edge of a pool and check the sequences of movements. I have always cooperated with swimming coaches, but I am still fascinated by the unbelievably technical kind of sport and I keep up to date. In the meanwhile I am the physiotherapist for the Austrian triathlon Olympic team.

Knowing that every kind of improvement of mobility improves technique and therefore performance, I decided to arrange a battery of tests.

My osteopathic approach stems from treating a high number of patients with upper body rotation restrictions, whether they be painful or limiting. In almost all cases a subjectively strong improvement in rotation could be achieved. In order to get objective results and to be sure that my feelings were not deceiving me, I decided to proceed systematically and to attach an examination.

The interests from the two areas have inevitably led to a symbiosis of sports and osteopathy and ultimately to a master thesis.

The data of the experimental part of this work was used in the context of a completion work in 2004.

2 Definition of the problem and hypothesis

If one recognizes from the beginning, that manual treatments lead to an improvement in mobility - in the area of upper body rotation and arm reach – then from my point of view, it follows that these improvements must lead to an increase of the performance and improvement in technique as well.

With this idea as its starting point and basis, the hypotheses of this study are stated as follows: ·

Osteopathic treatments on young swimmers and young triathletes, who train in the high performance arena, lead to an improvement in the upper body rotation.

Osteopathic treatments on young swimmers and young triathletes, who train in the high performance arena, lead to an improvement in the arm reach.

Through which an improvement in performance is achieved ·

Through which an improvement in technique is achieved.

3 References for Osteopathy

The demand for objective criteria and comparative possibilities is very great in our time. In order to meet these criteria it is necessary to work scientifically. This is only possible if one takes into consideration statistical quality criteria.

As long as no studies are at hand, it can only be asserted that “subjective” improvements have been achieved through osteopathic treatments.

The approach for my thesis is exactly to take these measurability requirements into consideration. All variables, although very simply arranged, are configured according to strict objective guidelines in order not to offer any breeding ground for critics.

Such objective criteria are of very great importance in sports science. If this master’s thesis is interspersed with positive, i.e. measurable results, I am convinced that osteopathy will be recognised from a performance-oriented viewpoint in competitive sports as a justified mosaic stone. This is interesting because an additional possibility of increase in performance opens up with this treatment, in which the athlete is only burdened with marginal time involved. This represents a great advantage in the top sector, because time has become a massive limiting factor. Moreover, the athlete does not have to contribute towards success, but on the contrary can relax in the treatment time.

With the help of literary studies I would like to prove why the improvement of mobility – i.e. upper body rotation and arm reach – are so decisive.

4 Literature search

After the input of the catchword “sport” in the Medscape website, the computer indicated 2,326 hits. After the input of “sport + swimming”, only 232 articles remained. After the catchword input “mobility”, only 48 articles remained, and only 20 articles after the input “performance”.

Only one article – by Baxter, Reilly (1983) – dealt with the topic “upper body rotation”. The reason for the study was to research whether time-of-day fluctuations of upper body rotational ability exist and whether any subsequently resulting performance differences are ascertainable. As Weineck (1990) also determined, mobility is poorest in the morning, increases in the course of the day, has its best expressivity in the afternoon, and diminishes again in the evening.

Most osteopathic schools do not have any possibility to fall back on theses. The following schools offer the possibility to gain support from theses:

COE, Europäisches Kolleg für Osteopathie

CS, College Sutherland

DAMP, Osteopathieschule

DAOM, Deutsche Akademie für osteopathische Medizin

IFAO, Institut für Angewandte Osteopathie

OAM, Osteopathie Akademie München

OSD, Osteopathie Schule Deutschland

SKOM, Privatschule für Klassische Osteopathische Medizin

Still Academy

All in all, after perusal of 107 dissertations, I unfortunately had to realise that no sports theme had been worked on.

At the Collège d´ Etudes Osteopathiques, Deutsches Osteopathie Kolleg, Swiss International College of Osteopathy and Canadian College of Osteopathy, a total of 5 sports themes have been drawn up since 1996, but none were in connection with mobility, performance improvement or swimming.

I made a strike only with the input “osteopathic research”, the research platform of the British School of Osteopathy and the Vienna School of Osteopathy (WSO).

A total of 14 papers are listed under the input “sport”.

The range of studied sports extends from golf via football, rowing, climbing, squash and riding, but also includes swimming.

The one article by Wisson (2000) deals with shoulder instability and impingement with swimming, whereas the other article by Tilbury (2002) goes into the nutritional habits of elite swimmers.

I was able to find 3 papers under the catchword “mobility” and 2 papers – Böhmüller (2007) and Haberl (2007) – under “fitness”, which both aim at fitness in connection with osteopathic treatments.

Böhmüller (2007) attempts to influence the fitness of a top athlete and to prove this with the help of heart rate variability (HRV). The pilot study shows that osteopathic treatments represent a possibility of improvement of homodynamic balance. However, no relationship between osteopathic treatments and HRV could be determined.

With his study, Haberl (2007) would like to prove that osteopathic treatments have positive effects on the fitness of hobby runners. The means of choice was spiroergometry in conjunction with lactate tests.

Although very few athletes were available, the hypothesis was confirmed: to train the performance as well as the improvements of endurance.

4.1What is sports performance?

Zintl (1997) believes that sports performance has to be seen as a complex consisting of a multitude of individual aptitude areas, abilities, elements and conditions. In model-like terms, one can imagine this component complex as in the table shown below. These abilities, elements and conditions are to be seen as distinguishable aspects, but not as clearly delimitable areas of (human) sports performances. They always have a strong influence; their transitions are partially very fluent.

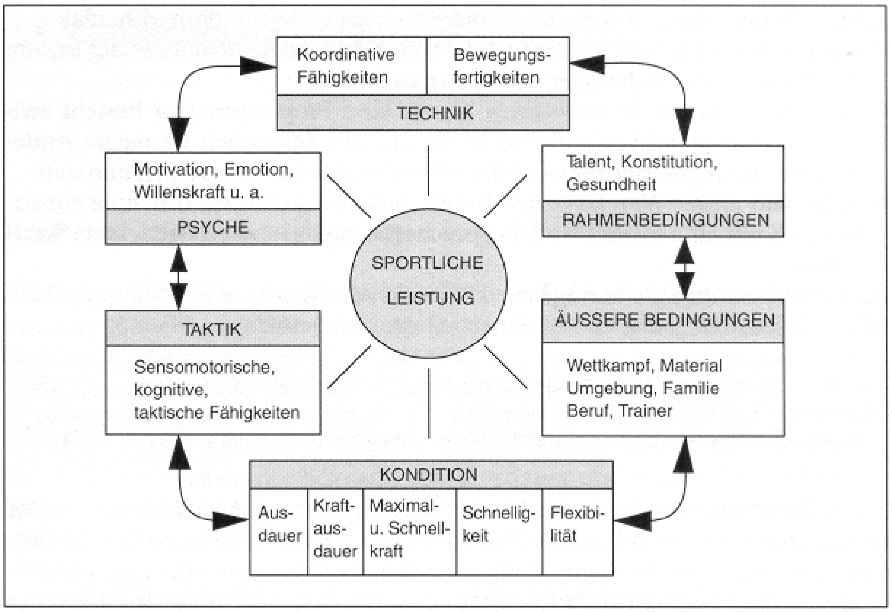


Illustration 1: Sports performance from Zintl 1997, S. 16

It thus appears that flexibility or also motor skills are two of the influence criteria.

In common parlance one speaks of condition and thus means stamina. But Mende (1989) understands condition as general mental and physical factors, physical fitness. Motor skills, which should be in an optimal relationship with each other, are based on this. The motor elements of condition are strength, speed, stamina and agility.

4.2Techniqus for freestyle and back stroak

Before I will go into mobility in detail, I would like to introduce the freestyle as well as the backstroke technique, and then refer in detail to the phases where upper body mobility or arm reach are necessary.

4.2.1 Freestyle

a. Description of freestyl techniques in general:

The following illustration depicts the freestyle technique:

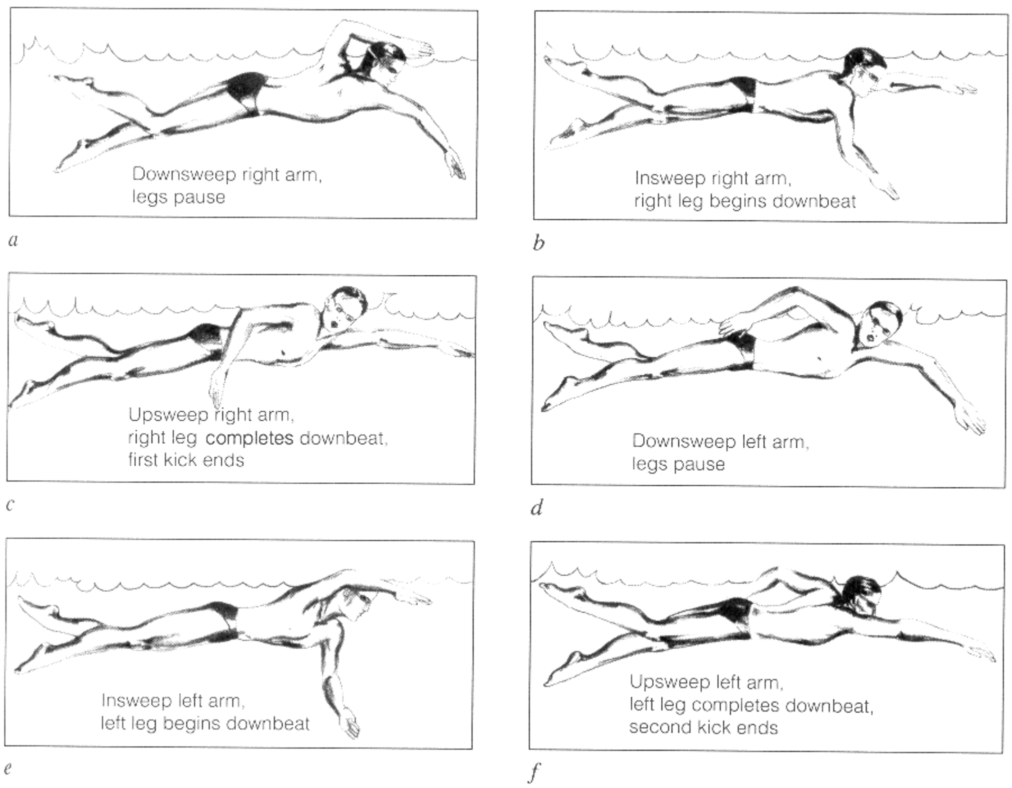


Illustration 2: Freestyl techniques from Maglischo 1993, S 382

b. Description of freestyltechniques in detail

The freestyle technique can be performed with various breathing rhythms. The most common rhythms are the double or triple rhythm.

Staying with the most common and simplest rhythm – the double rhythm – means nothing other than that the swimmer always breathes on the same side, after every 2nd breath.

With the triple rhythm, however, one breathes alternately once on the right and once on the left, after every third breath.
There is also a similar rhythm with regard to leg stroke. For the sake of completeness I would like to list the variations without going into detail: double rhythm, double rhythm crossover (in which the legs cross over), triple rhythm, quadruple rhythm, quadruple rhythm crossover and sextuple rhythm.
In simplified terms, it can be stated: the shorter the distance (50 m, 100 m), the greater the frequency. There the leg stroke is also utilised as means of thrust for acceleration. In general, the leg tempo should be particularly applied for sprint distances. Furthermore, at the start and finish line sprint of middle distances and long distances, explains Maglischo et al.
In contrast to that: the longer the distance, the lower the frequency. While doing so, the legs mainly have a stabilising function. Maglischo (1993) emphasises that the energy expenditure of the leg stroke is out of proportion to the effect. On the contrary, the leg tempo rather serves for stability.

4.2.2 Back stroke techniques

a. Description of backstroke the techniques in general

The steady head posture with view slanting forward is responsible for a stable, steady position in the water. The hips lie deeper than the shoulder (lower angle of attack). The rolling movement occurs around the body's longitudinal axis; the head remains the stabilising element in this connection. The shoulder axis is rotated to at least 45° in order to enable a more effective utilisation of the arms with deeply-positioned shoulders. The lifting-out of the other highly-positioned shoulder causes a reduction of frontal resistance. The ‘good timing of the rotation’ is important: as soon as the hand passes the shoulder, the rotation has to actively occur in the opposite direction. The coordination between arm and leg movement has to be fluent. As described in J+S Schwimmen (2002), six leg strokes normally follow one arm cycle.

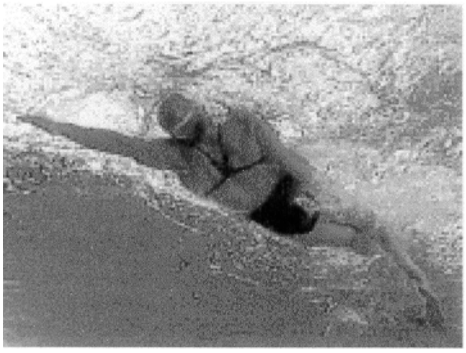


Illustration 3: Backstroke techniques of J+S Schwimmen Schweiz, 2002

4.2.3 Connection between freestyl techniques and flexibility

From the illustrations above it is evident that opposite extremities make counter movements, and the body is strained as a result. Thereby it is also understandable that an increased extent of mobility is necessary.

“In the aptitude area mobility, the elementary characteristics are compiled which are necessary for performance of movements with large amplitudes.” (Spikermann 1992, p. 18)

In particular, the body’s rotation around a longitudinal axis on the scale of at least 30° - 40° on both sides seems important to Maglischo (1993). The rolling movement also helps during the recovery phase beforehand to prevent the body from leaving the central axis on both sides and starting to “wiggle”.

The body should also be able to roll to a sufficient extant, says Maglischo (1993), to ensure that the shoulder is out of the water during the majority of the recovery phase. If this is not ensured, this leads to lateral movements of the lower extremity and thus to a much larger frontal point of attack. The result is loss of speed.

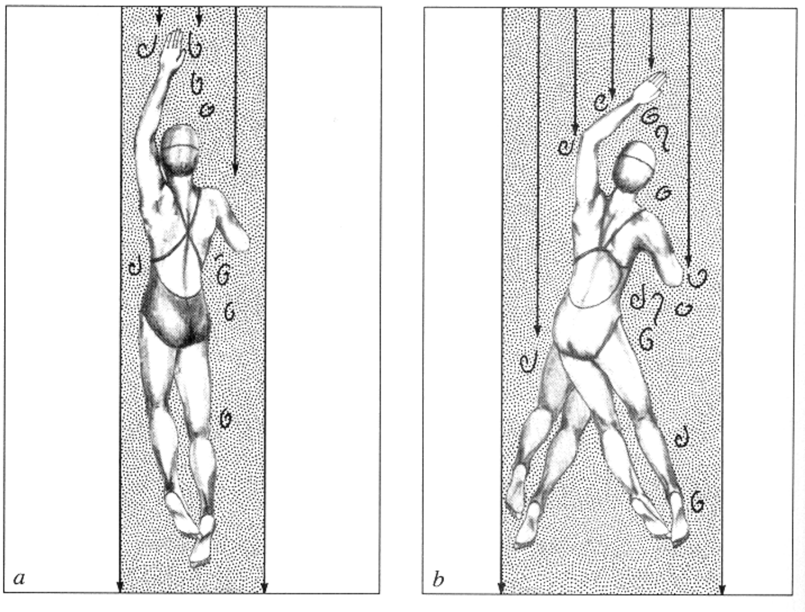


Illustration 4: The effect of excessiv side to side bodymovements on drag from Maglischo 1993, S 398

The swimmer in Illustration A maintains the central axis, whereas the swimmer in Illustration B massively veers on both sides as a result of not enough mobility. As a result, he needs much more space and has more point of attack, which results in speed reduction.

4.2.4 Connection between backstroke techniques and flexibility

In a similar vein to freestyle swimming, the same also applies to back crawl (backstroke) technique. Maglischo (1993) also states here that a rotation around the longitudinal axis is important and necessary. Reischle (1988) describes the advantages of the body's rotation around a longitudinal axis as follows. The spatial lane of the recovery and pull-push phase, and thus the partial centroids of the arms are shifted towards the centre of the body. As a result of this, the active torque (around the depth axis) – and thus the angular momentum around the depth axis – will be smaller. The shoulder on the recovery side is outside of the water, which reduces the resistance. The driving upward-inward-backward portion of the push-pull phase is extended, since the preliminary “water-grabbing” (downward portion) is more pronounced through the rolling movement.

Maglischo (1993) emphasises that with backstroke swimmers the extent of rotation around the longitudinal axis should amount to a minimum of 45° on both sides.

The upward stroke of the diagonal leg occurs at the moment in which the arm breaks through the surface of the water. A massive hyperextension comes about as a result. This is very helpful in order to be able to apply an effective leg stroke. According to Maglischo et al., the leg stroke should occur diagonally in the same rhythm.

4.2.5 Definition Performance

According to Wikipedia (2007), performance is defined in physical terms as follows:

To cover a distance (ds) with the velocity (v) in a certain time (dt).

$$v = \frac{\mathrm{d}s}{\mathrm{d}t}$$

The means of choice for verification of the performance is the time measurement on a predetermined distance.

4.2.6 Flexibility tests used in practice

After perusal of available literature, the following tests were able to be found with Maglischo (1993) for measurement of mobility. However, all of these tests were not relevant for mobility improvement objectives, since the parameters “arm reach” or “upper body rotation” are not tested anywhere. Here is a brief extract:

Shoulder mobility: These tests pertain to the mobility of the shoulder by means of a rod, on which a measuring tape is affixed. The reach with which the arms can be extended parallel to the rear in an outstretched position will be measured.

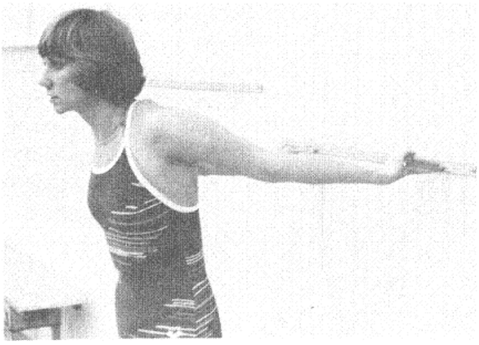


Illustration 5: Measuring method for shoulder mobility, from Maglischo 1993, p. 659

Hyperextension of the torso: The swimmer lies in prone position on the floor. The legs are immobilised and he has to attempt either with his arms or his nose to move as high up as possible along a vertically aligned measuring tape.

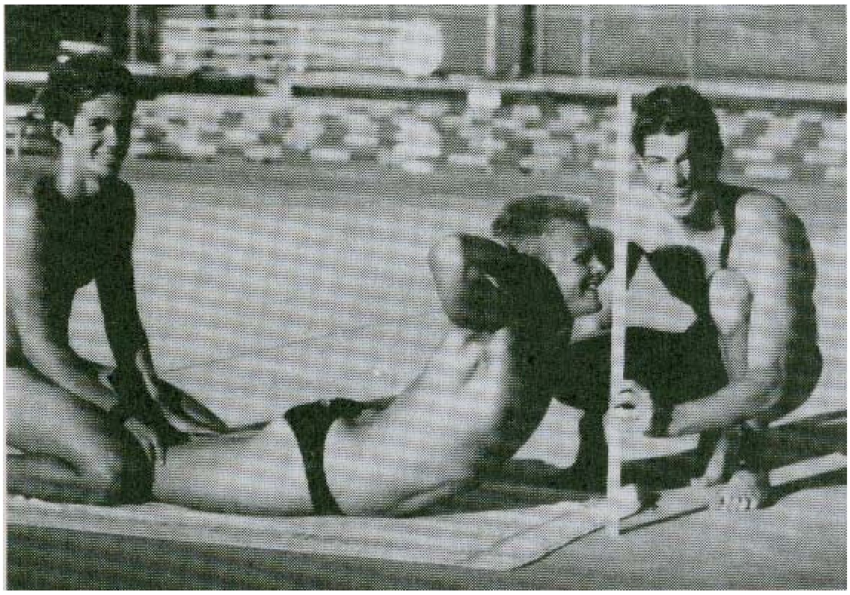


Illustration 6: Procedure for measuring back hyperextension from Maglischo 1993, S659

Hyperextension of the arms: The swimmer sits in front of a scale, encloses the palms of his hands and moves his outstretched arms as far as possible in hyperextension.
Dorsal and plantar reflection of the foot: The swimmer sits on the floor and moves the foot in front of a scale in dorsal and plantar reflection.

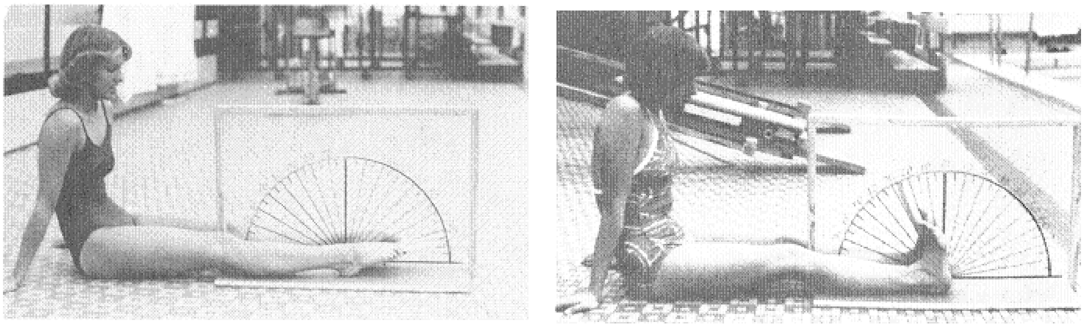


Illustration 7: Procedure for measuring ankle extension ability from Maglischo 1993, S660

Inversion and eversion of the foot: The swimmer sits once again on the floor. The foot is placed on a scale, and a needle indicates the extent of movement in the extension of the sole of the foot.

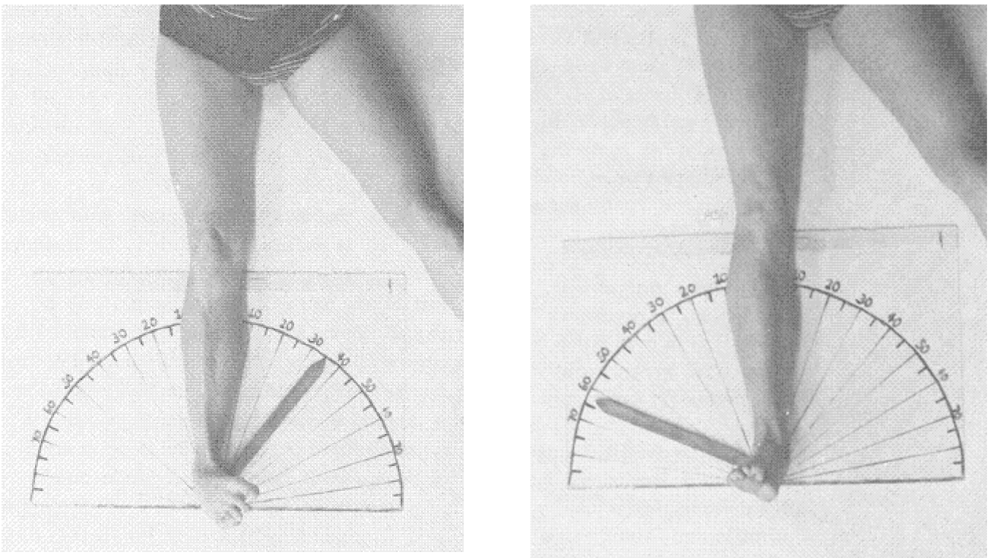


Illustration 8: Procedure of measuring ankle inversion and eversion from Maglischo 1993, S661

The measuring methods of the foot have encouraged me to evaluate torso mobility with a similar scale.

4.3 Techniques

„The term "technique" implies an optimal (ideal-typical) solution procedure of a sports exercise task. The technique has a transmission function in this connection. It enables the utilisation of conditional and constitutional performance prerequisites in view of the exercise task." (Spikermann 1992, p. 22)

As evident previously with the definition of performance, mobility is one of the conditional criteria. Thus it is clear that mobility is also necessary for improvement of technique. And so the inverse conclusion is also possible, that improvement of mobility had to bring about an improvement of technique.

Spikermann et al. also explained that an improvement of the locomotor system requires an increase of performance-relevant conditional characteristics, and so certain spatial-temporal and dynamic-temporal motional characteristics, "tempo" and "rhythm", are necessary.

It is evident that with change of technique the dynamic-temporal motional characteristic should also change.

According to Reischle et al., one possibility to prove this exists through the aid of minute frequency, cycle length and swimming speed. The arm strokes per minutes will be counted during the minute frequency. An improved technique means that the minute frequency decreases because the stroke path length or cycle length increases. Only with adapted strength will the frequency increase, which requires an adaptation period of several months, however.

4.4 Participation of anatomical structures in freestyle and backstroke

Particular attention is paid to upper body rotation or the upper body. Since it is not so relevant within the scope of my work, arm and leg movement will not be surveyed in detail.

4.4.1.1 Boney structures and joints

- Hip and ISJ

According to Leonhard et al. (1998), the iliosacral joint (ISJ) has low-grade rotational motions as well as translation motions. During rotation the position of the transversal axis will be adopted either in the region of the attachment sites of the interosseous sacroiliac ligaments or in the centre of the auricular face. “Torsion” throughout the entire body, and thus an anterior rotation of the hipbone on the one side and a posterior rotation of the hipbone on the opposite side comes about especially through the leg tempos.

- Total spinal column

Leonhard et al. (1998) describe that the rotational ability of the spinal column is individually different in the individual regions. The vertical axis of rotation runs dorsal from the centre of the vertebral body through the nucleus pulposus (pulp of the intervertebral disk). The extent of rotation in the cervical spine region amounts to about 45°, about 40° in the thoracic spine region and about 5° in the lumbar column region, on each side. The rotation in the region of the cervical spine is inevitably combined with a lateral reflection due to the angle of inclination of the articular surfaces. With stationary feet the entire body can be rotated backward on each side up to 180° from the neutral “0” position by utilising the spinal column’s entire range of movement, including the head joints as well as the lower extremities. With this rotational movement about 70° of the motional excursion are attributed the joints of the lower extremities. Several systems of the autochthonous dorsal muscles (transversospinal system, spinotransversal system and sacrospinal system) as well as the muscular loop of the oblique abdominal wall muscles are involved in the rotation of the spinal column.

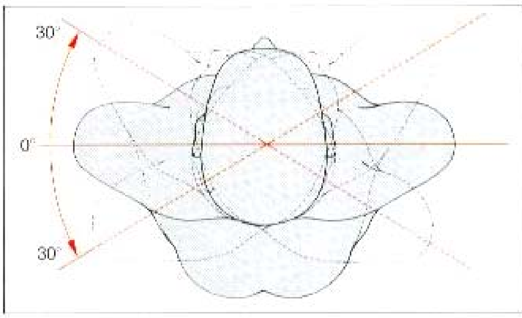


Illustration 9: Torsorotation standing from Leonhard, Tillmann, Töndury, Zilles 1998 S 55

As evident from the anatomical description, the thoracic spine particularly plays a leading role with a range of movement of 40° in the upper body rotation. The lumbar column has a subordinate rotational quality with modest 5°. Kapanji (1999) gives the cervical spine a separate status with regard to rotational capability. According to Maglischo (1993), the rotation of the cervical spine is performance-decisive for efficient respiration. This is why it is absolutely necessary that a 45° range of movement is free.

According to Dvorak et al. (1997), $C_{0,1}$ assumes 5° and $C_{1,2}$ assumes 34°.

Kapanji (1999) describes rotational movements as well as bending and stretching in the lower head joint (atlanto-axial joint). Rotational movements occur in the median atlanto-axial joint around an axis running through the dens of the axis. The median atlanto-axial joint corresponds mechanically to a pivot hinge. Atlas and occiput form a function unit during the rotation.

According to Leonhard et al. (1997), the extent of rotational movement varies between 34°-55° total rotation. With maximum rotation the entire neck and the upper thoracic spine up to the 4th thoracic vertebra are involved in the rotation.

As one sees, the range of movement in the region $C_{1,2}$ can be considerable, and it mainly assumes the rotation.

❖ Ripp mechanism

The analysis of the mechanism of movement is complicated, since it does not concern movement of individual joints, but rather the summation of movements most varying joints. Leonhard et al. (1998) explain that the head-of-rib, costotransverse, sternocostal and interchondral joints as well as the flexibility of the costal cartilage are responsible for this. The head-of-rib and costotransverse joints are independent joints with their own capsule and ligamentous apparatus. But in functional terms the two joints form one unit, in which the ribs are linked with the spinal column, so that only one rotational movement is possible. The lifting and sinking of the ribs occurs through the rotation of the ribs around the longitudinal axis of the neck of the ribs, which is dorsilaterally aligned. The movement excursion is strongly restricted through the rigidly structured ligamentous apparatus. A change of the position of the rib surfaces comes about with rotational movements around the axis of the neck, in which case the outer surface of the anterior parts of the ribs facing the skin is conversely raised or lowered. The positional change of the ribs is made possible through the considerable elasticity of f the costal rings. The cartilages of the middle and lower ribs are strongly snapped-off. The cartilaginous angle and the angle between ribs and sternum increase with inspiratory lifting of the ribs. The greater the lateral movement of the costal bone is, the longer the cartilaginous connecting piece has to be. In the upper ribs with less oblique axes, the rib cartilage is shorter and less strongly bent. Lifting the ribs also causes a rotation of cartilage and a twisting against the sternum. The motional axes run sagittal to the sternocostal joint. The rib movements during respiration are the sum of rotations in the costovertebral and sternocostal joints as well as the sum of elastic deformations of the osseous and cartilaginous portions of the ribs. Costosternal connections only partially concern joints. One regularly finds joints between the sternum and the 2nd to 5th rib. Synchondrotic connections show the 1st, 6th and 7th rib with the sternum. As evident from the comments, the costal joints are subject to very complex mechanisms, which must be examined and treated very carefully.

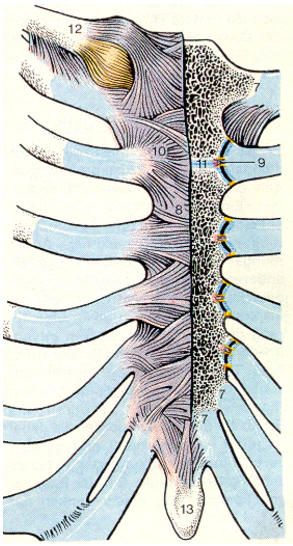


Illustration 10: Sternocostal joint from Kahle, Leonhard, Platzer 1979, S69

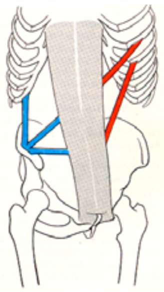
4.4.1.2 Muscles

- ❖ Diaphragm and muscles supporting respiration

Kahle et al. (1979) describe that with steady respiration the external intercostals muscles, the intercartilaginous muscles of the upper intercostals spaces and above all the scalene muscles act as “rib lifters” (akin to the Levatores costarum muscles). The lifting of the ribs is additionally supported through the serratus anterior muscle as well as the Pectoralis major and Pectoralis minor muscles. The caudal ribs will be stabilised by the quadratus lumborum and serratus posterior inferior muscles. The lateral parts of the diaphragm strongly flatten out. As a result, the thoracic cage is substantially extended, and the lower portions of the lungs shift into the costodiaphragmatic recesses. As a result of its deepening during the inspiratory phase, the diaphragm not only contributes towards enlargement of the vertical thoracic diameter, but a simultaneous expansion of the lower thoracic inlet in a sagittal and transversal direction comes about. In this case, the central tendon serves as a fixed point so that the costal part and the sternal part are able to actively lift the lower ribs and the sternum.

❖ Muscles for torso rotation

Lateral rotation occurs through the internal oblique abdominal muscle (blue) of the same side and the external oblique abdominal muscle of the other side. It is to be



maintained that the external oblique abdominal muscle (red) and the internal oblique abdominal muscle (blue) of the same side function once as synergistic muscles with lateral bending and once as antagonistic muscles, as Kahle et al. (1979) explain.

Illustration 11: Abdominal muscles for the mechanism of torso rotation from Kahle, Leonhard, Platzer 1979, S 91

According to Benninghoff, Goerttler (1975), the rotational movement of the torso occurs through the abutment of muscular pulls along the same sequential direction. The torso is thus laterally twisted like a muscular screw. Tittel (2003) speaks of "muscular loops".

Weineck (1993) describes muscular activities on the back side of the body with a leftward rotation from the left side of the neck via the left shoulder side and torso side continuing further forward towards the oblique external abdominal muscles on the right or the oblique internal muscles on the left.

The involved muscles depicted according to Weineck (1993) in the example of leftward torso rotation are the torso front side of the dextral oblique external abdominal muscle and the sinistral oblique internal abdominal muscle, since the direction of travel of the oblique external abdominal muscle continues via the aponeurosis of the rectus abdominis muscle. Furthermore, the dextral Pectoralis major muscle for performance of the right shoulder and the dextral serratus anterior muscle, whose effect is described similar to the preceding muscle.

The sternocleidomastoid muscle supports head rotation.

On the back side of the torso, however, with a leftward rotation from top to bottom there is the splenius sinister muscle for head rotation, the transversospinalis muscle, the levatores costarum muscles and the external or internal intercostals muscles of the right or left side. On top of that are the muscles lying on or above the surface, which particularly have an effect on shoulder rotation, such as latissimus dorsi muscle, the trapezius muscle and the rhomboideus major and minor muscles, all pertaining to the left portion.

Illustration 12: Participation of muscles in torso rotation from Weineck 1993, S 184

❖ Participation of leg muscles at freestyle and backstroke

Weineck (1993) describes the iliopsoas muscle for the downward stroke of the hip flexor and the gluteus maximum for the upward stroke of the hip flexor, and the ischiocrural muscles as performance-determining musculature.

Myers (2004) speaks of spiral lines, which include similar muscle groups such as the aforementioned, and he also attributes rotations and spiral movements to them.

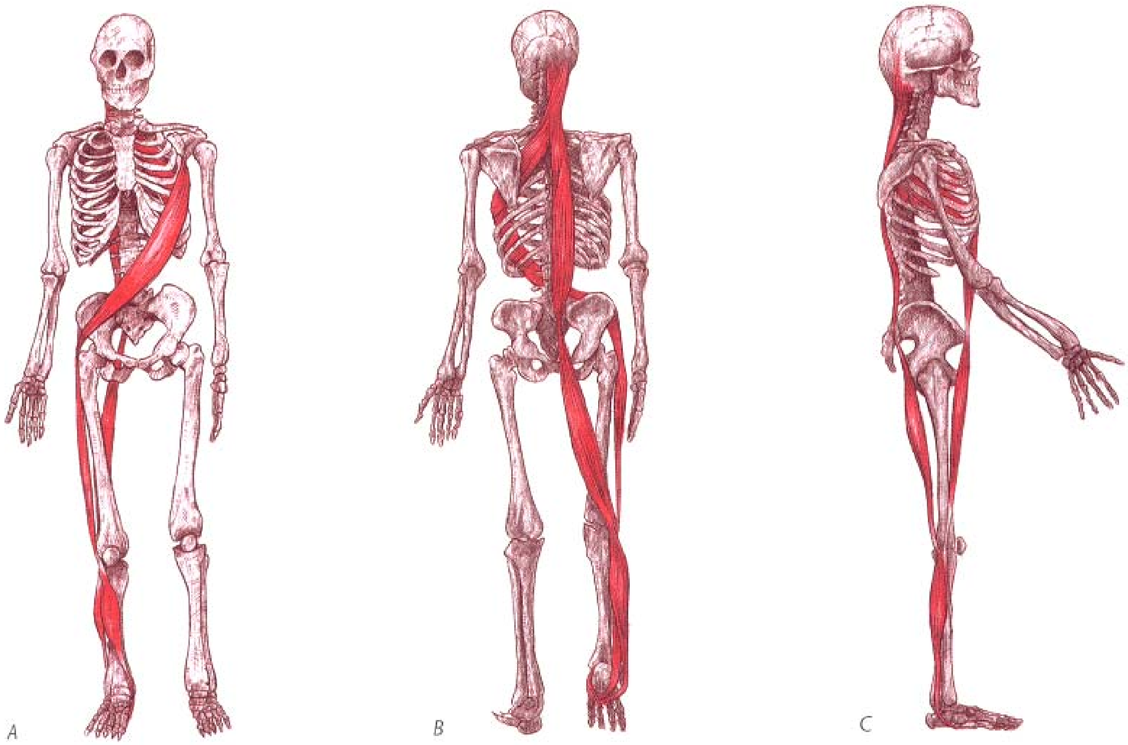
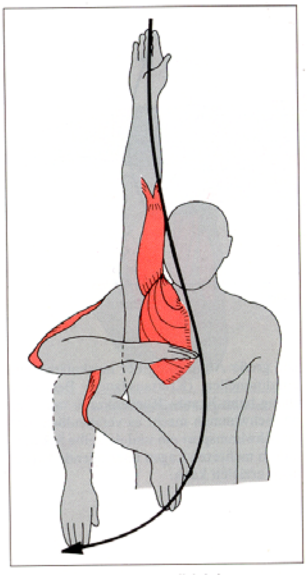


Illustration 13: Spiral lines from Myers 2004, S 137

❖ Participation of arm and shoulder muscles in freestyle and backstroke



The swimmer makes use of the arm abductor and arm flexor muscles and flexors of the hand for the pull phase, whereas the arm abductors and the arm extensor muscle triceps brachii as well as flexors of the hand will be strained. According to Weineck (1993), particularly the deltoid muscle will be utilised for the recovery phase.

Illustration 14: Stroke mechanics of freestyle from Weineck 1993; S 215

The movement of the backstroke swimmer is comparable with the freestyle swimmer, emphasises Weineck (1993), merely in a different position. The anterior portion of the deltoid muscle is particularly strained in the recovery phase.

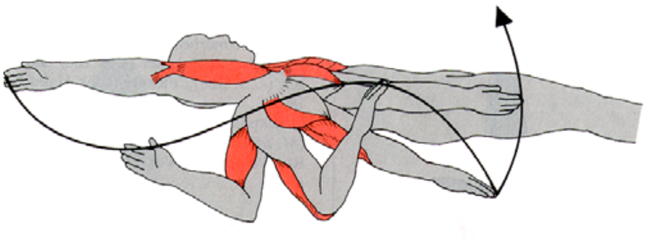


Illustration 15: Stroke mechanism in backstroke from Weineck 1993, S 216

Myers (2004) describes arm lines which on the one hand have a holding function, such as is necessary in the course of the 1st supporting phase of the crawl movement, and further movement functions; the pull movements are very frequently utilised in combination with the spiral lines in daily life.

In relation to swimming this corresponds to the pull phase and the recovery phase.

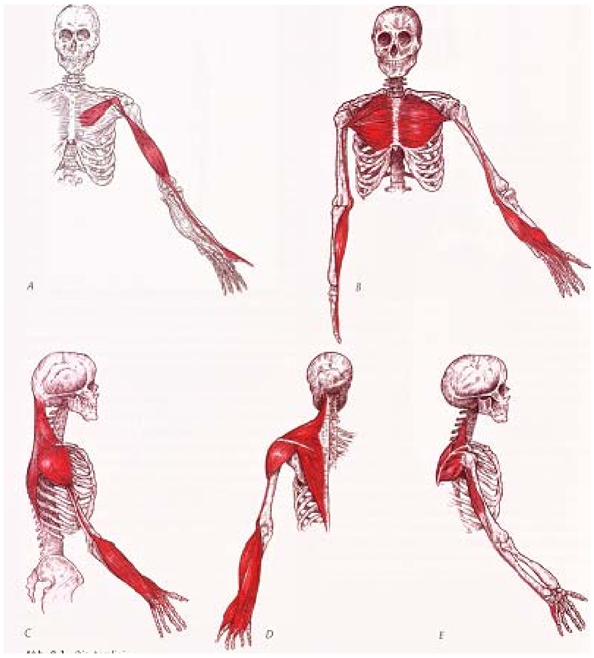


Illustration 16: Arm lines from Myers 2005, S 154

4.4.1.3 Fascia

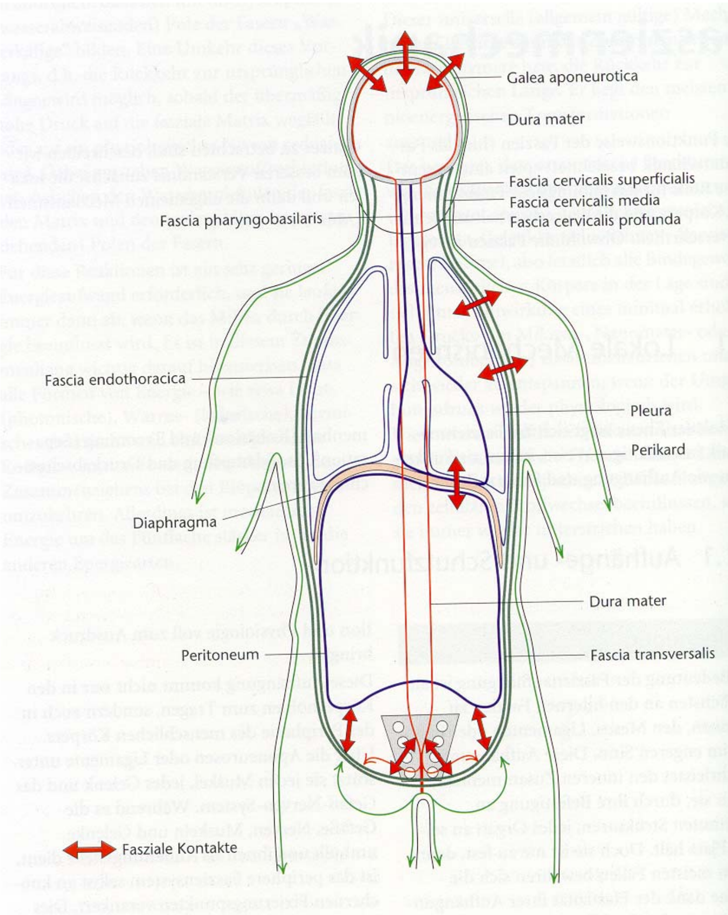


Illustration 17: Overview of the fascial conditions of Paolette 2001, S 158

❖ Endothoracal fascia and transversalis fascia

Paoletti (2001) describes the continuation of the median and deep cervical fascia in the endothoracic fascia, which extends via the diaphragm as a point of intersection to the transversalis fascia. In turn, the endothoracic fascia has the following connections: on its outer side to the inner side of the thoracic cavity, on its inner side towards the pleura and pericardium, downward towards the diaphragm and afterwards towards the transversalis fascia. The transversalis fascia has the following connections: upward towards the diaphragm and towards the endothoracic fascia on its outer side to the deep abdominal aponeuroses as well as towards the renal fascia and on its inner side to the peritoneum; on one side, downward to the fascia of the small pelvis, and on the other side via runners to the inguinal ligament, to the fascia of the lower extremity. A connection to the outer side of the body is thus created.

From the exposition it is evident that quite a few important structures must be treated via the endothoracic fascia or transversalis fascias, which are of particularly great importance, with regard to upper body rotation.

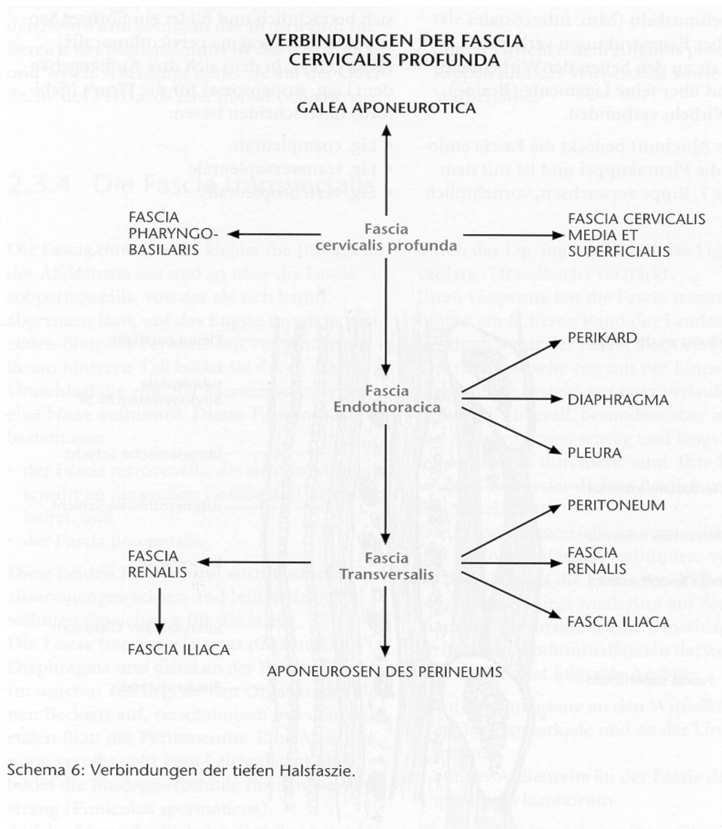


Illustration 18: Schemes from Paoletti: Connection endothoracic and transversalis fascia and the surrounding fascial structures 2001, S 57

❖ Mechanics of fascia

In his model, Paoletti (2001) compares fascia with ropes, which are tasked with transferring forces by means of guide pulleys in the body. The musculature has the function of propulsion, but forms an inseparable functional unit with the tendons and fasciae.

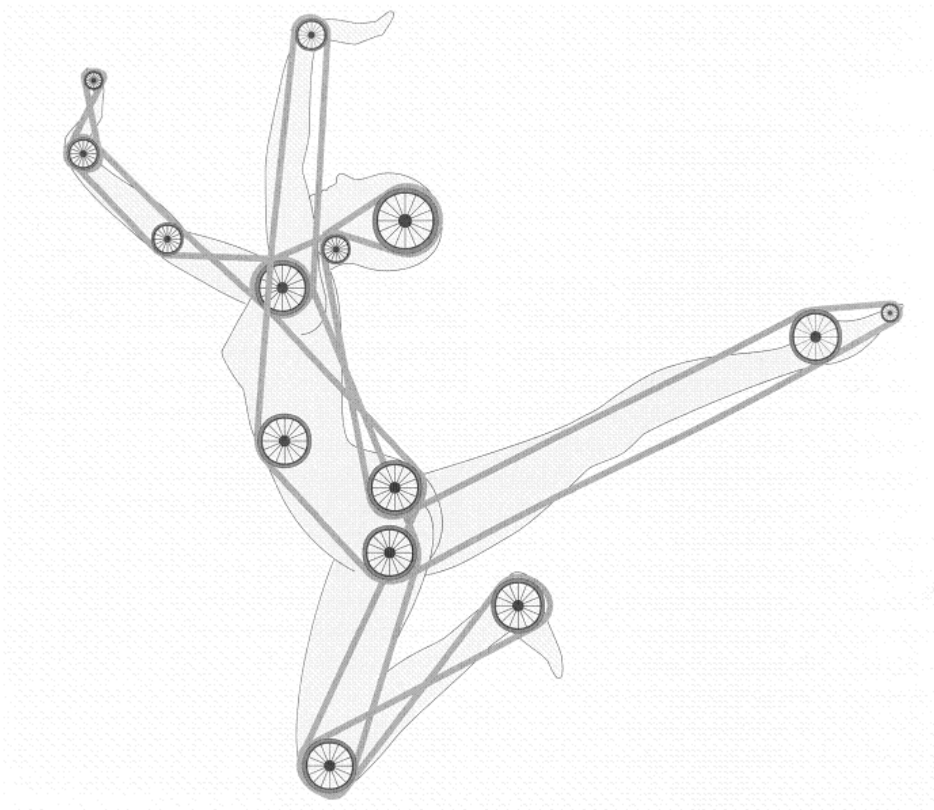


Illustration 19: The system of ropes and pulleys from Paoletti 2001, S 178

Paoletti (2001) differentiates between the external fascial chain of the lower limbs, the external fascial chain of the upper limbs, the internal fascial chain and the meningeal fascial chain.
Peripheral, central and mixed fascial chains essentially differ with the internal fascial chain. He places the starting point for the peripheral fascial chain in the perineum, from which it has the following course. It has a transition in the transversalis fascia or the peritoneum, to the coordinating point in the height of the diaphragm, with the endothoracic fascia to the shoulder girdle, where there is another coordinating point and finally approximate to the external fascial chains towards the base of the skull. It is to be noted that the peripheral fascial chains

can also follow the pleura up into the height of the cervicothoracic diaphragm in order to reach the shoulder and from there, like all fascial chains, to ascend towards the base of the skull.

Paoletti (2001) takes the diaphragm as the starting point for the central fascial chain. In this connection it may not be forgotten that an entire organ-supporting fascial system is located underneath, and that the abdominal fasciae are linked with the pelvic fasciae. The central fascial chain starts at the diaphragm and has the following course: at the pericardium along towards the pharyngobasilar fascia, in the region of the thoracic aperture, where there is a connection with the median and deep cervical fascia, through which a portion of the tensions can be transferred to osseous structures. Then via the coordinating point at the hyoid bone, where the superficial cervical fascia can take over a portion of the burden, further towards the base of the skull via the pterygo-temporomandibular fascia and the interpterygoid fascia, and from there via nerve sheaths possible further towards the intercranial dura mater.

Paoletti (2001) explains that the mixed fascial chain at the on the perineum starts from there and runs from the vesicoumbilical fascia towards the coordinating point at the navel. At this point it can be adopted by the transversalis fascia or follow the round ligament of the liver or the falciform ligaments of the liver. As previously described, the peripheral or central fascial chains run from the diaphragm coordinating point.

At the German College of Osteopathy, the model of a central chain according to Philippe Druelle (2000) is assumed. The central chain is an array of structures in the body, which ideally lie on one axis in the middle of the body. These structures, “fulcrums”, are located more or less on one axis. Rotation comes about if they are located beyond this axis.

According to Wikipedia (2007) in the Internet under the input “axis and rotation”, pure rotation is a movement of the body around a rotational axis. All points which lie exactly on this axis come to a standstill, and all other points move with a speed which is proportional to the distance from the axis, on an ideal circular orbit. In this case the axis is located in the body itself, which leads to a self-rotation (rotation around its own axis), or lie away from the body, which one designates as rotational system (rotation around a common axis).

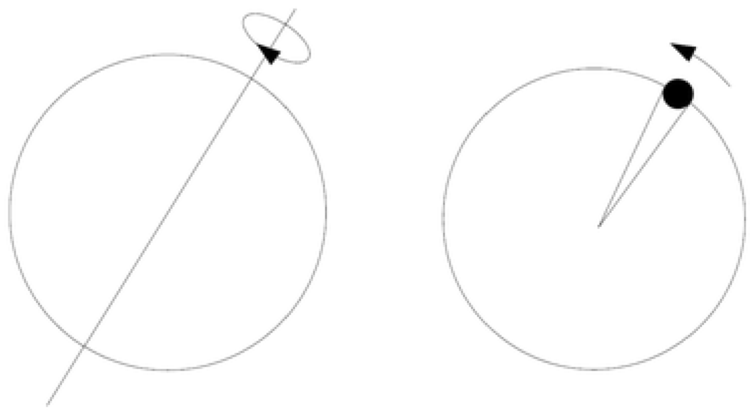
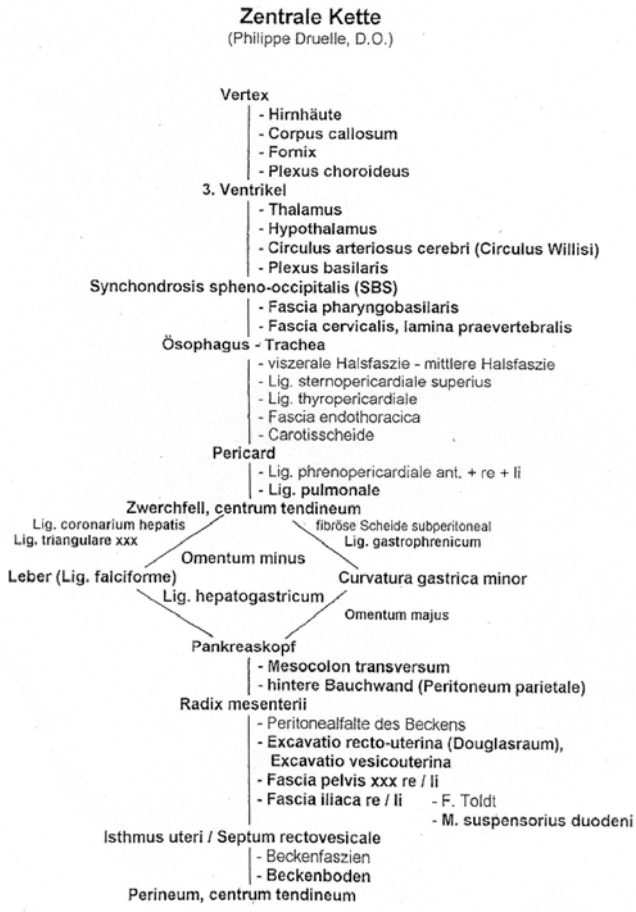


Illustration 20: Rotation of ist own and rotation system of Wikipedia 2007

If portions of the central chain are outside of the middle, these portions of the axis are in motion (rotational system), which must be re-centred again, what a majority of my treatments will present.



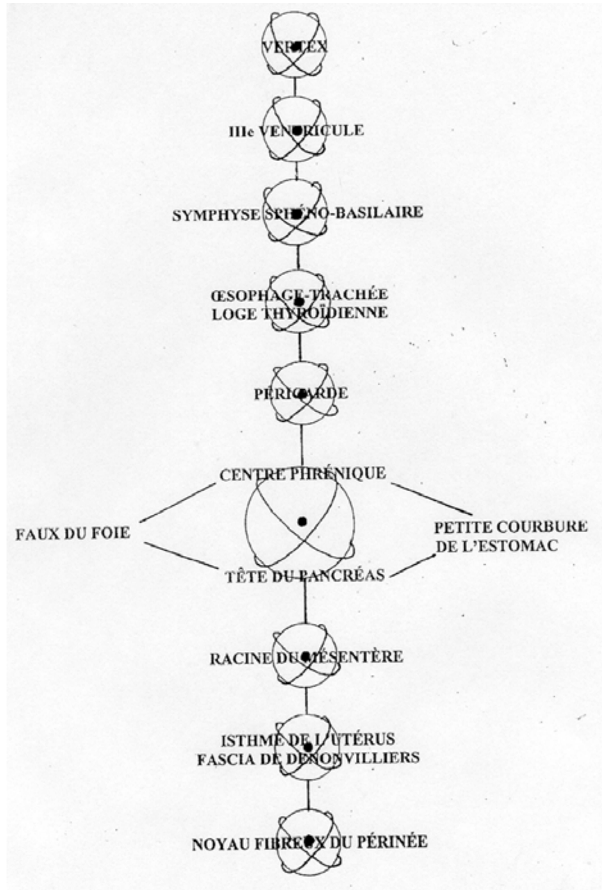


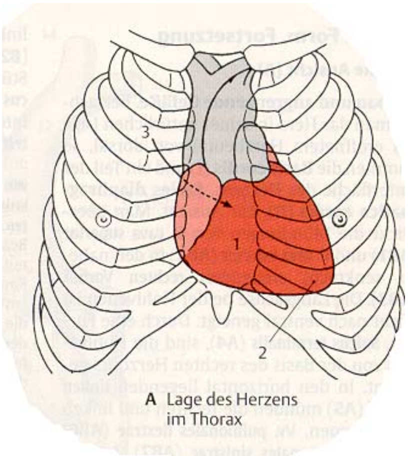
Illustration 21 und 22: Structures and fulcrums of the central cain from Druelle 2001

4.4.2 Viscera and fascial conditions

4.4.2.1 Cranial organs of the diaphragm and their connections

❖ The heart

The position of the heart is thus described by Frisch, Kühnel (2001):



The heart lies oblique to the body axis in the thoracic region, so that the apex of the heart (cardiac apex) shows to the left lower forward, and the base of the heart (cardiac base) shows to the right upper rear. The size of the heart depends, amongst other things, on the individual’s sex, age and training condition.

Illustration 23: Position of the heart from Frisch, Kühnel 2001, S 11

As one sees from the illustration, the position of the heart is not exactly in the middle.

If one also views the fascial adhesions it is easy to understand that the heart could have an influence on the body’s rotation. As one sees from Paoletti (2001), the fasciae additionally have a direct influence on the diaphragm and thus on respiration, which could again be a performance-limiting factor.

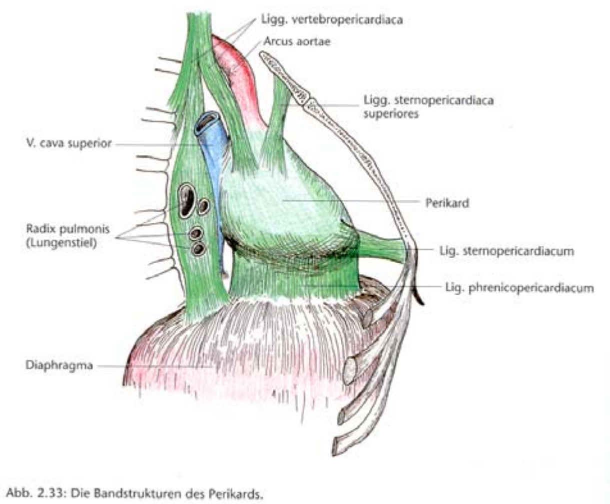


Illustration 24: Fascial conditions of the heart from Paoletti 2001, S 80

As Paoletti (2001) describes, the phrenicopericardiac ligaments concern three very rigid ligamentous structures from the endothoracic fascia. The front ligament is attached to the diaphragm, whereas the right ligament is located to the right of the inferior vena cava and the left ligament is located to the left of the inferior vena cava.

❖ Lung with pleural conditions

The pleura has the following connections, describes Paoletti (2001): medial to the pericardium, lateral to the endothoracic fascia and across it towards the internal wall of the thoracic cage, caudal to the diaphragm, and upward towards the endothoracic fascia and via it and the pleural ligaments to the cervical fasciae. Several runners – which stabilise it – branch off from the pericardium. The two latter mentioned ligaments surround the inferior vena cava and form the lateral phrenicopericardiac ligaments.

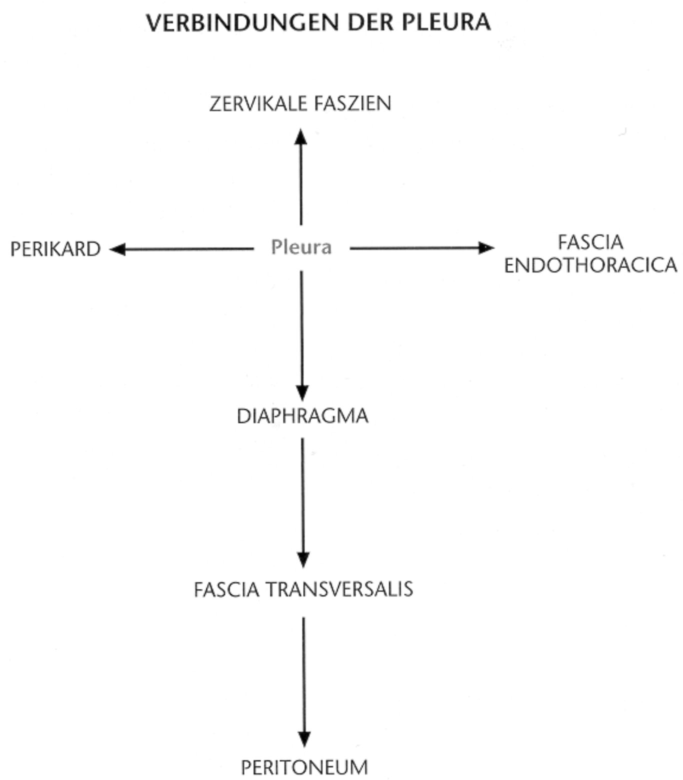


Illustration 25: Pleural condiotions from Paoletti 2001, S 87

4.4.2.2 Organe caudal of the diaphrag and their connections

❖ The liver

Frisch, Kühnel (2001) explain that the liver lies for the most part under the right dome of the diaphragm and has a brownish-red colour. Its lower margin coincides with that of the right costal arch. In the medioclavicular line the liver margin runs diagonally through the median epigastric region, to the left. With the exception of the bare area of the liver, the liver is covered by visceral peritoneum, i.e. it lies intraperitoneal. It is connected via the falciform ligament of the liver with the parietal peritoneum of the anterior abdominal wall, via the lesser omentum or the hepatoduodenal ligament with the duodenum and via the hepatogastric ligament with the lesser curvature of the stomach. The liver’s surface is as smooth as glass through the peritoneal covering.

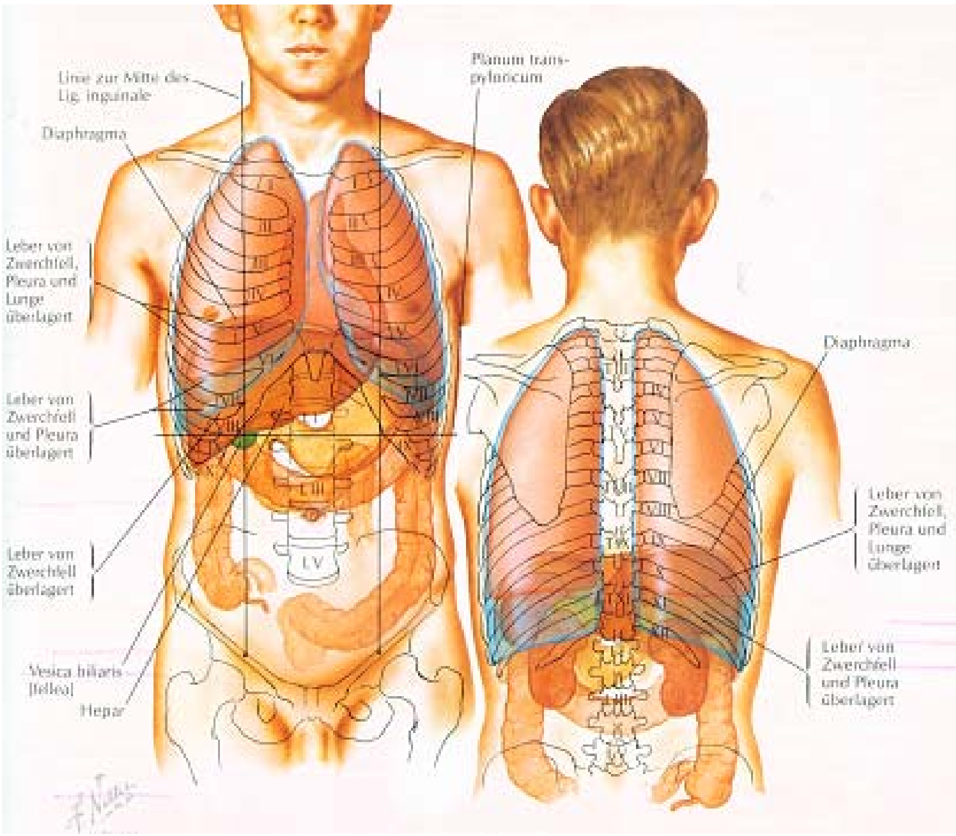


Illustration 26: Position of the liver from Netter 1994, S 269

❖ The stomach

According to Frisch, Kühnel (2001), the stomach is a wide, horn-shaped intraperitoneal hollow organ. It lies in the upper abdomen below the left dome of the diaphragm, partially hidden behind the left costal arch, and – depending on form and level of filling – reaches far into the epigastrium.

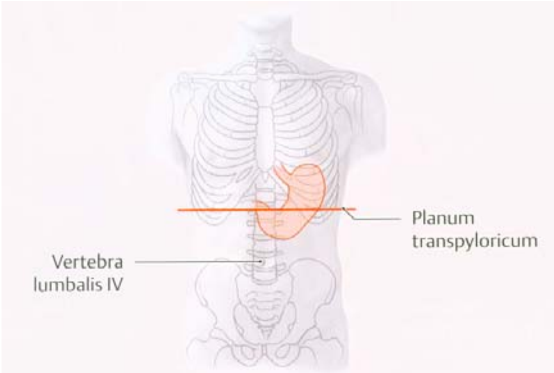


Illustration 27: Position of the stomach from Schünk, Schulte, Schumacher, Voll, Wesker 2005, S 182

❖ The fascial connections of the stomach

Waligora, Perlemuter (1975) believe that the stomach is embedded like in an envelope, surrounded on the front side by the anterior gastric peritoneum and on the back side by the posterior gastric peritoneum. The two portions join cranial to the gastrophrenic ligament, whereas initially the gastrocolic ligament and then the greater omentum develop. To the right of the lesser curvature (of the stomach) the lesser omentum extends in the direction of the liver and to the left the gastrosplenic ligament extends towards the spleen.

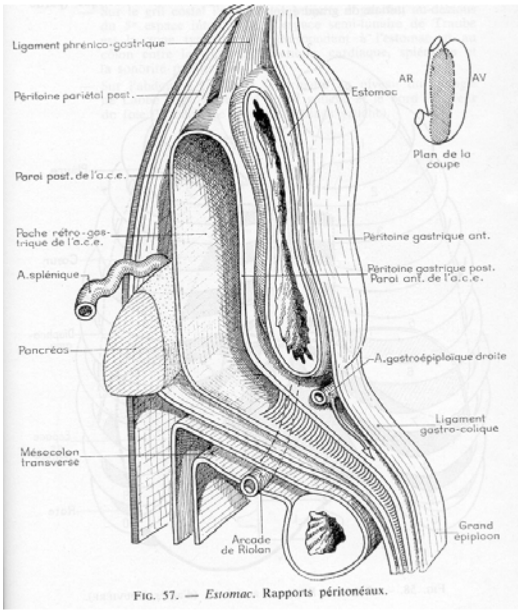


Illustration 28: The fascial connections of the stomach from Waliroga, Perlmuter 1975, S 75

5 Examination method

(Quasi-experimentel blinded)

5.1 Design of the study

30 swimmers were evaluated by the osteopath initially for inclusion and exclusion criteria as well as for a profile of osteopathic lesions.

On the following day the tests for performance and technique took place. Once again on the following two days the athletes were treated osteopathically. Again, 10 days later, they were treated for a half an hour.

One day later the last test of performance and technique took place.

5.2 Criteria of inclusion

- Female and male swimmers between 15 and 18 years old.

5.3 Criteria of exclusion

- fresh traumatic shoulder injuries
- swimmers with asthma
- swimmers with bronchitis
- prior history of hepatitis
- stomach ulcers and inflammatory conditions of the digestive tract
- congenital heart problems

all swimmers who have received osteopathic treatment within the last 6 months.

5.4 Methods of measuring

An independent persons takes over the measuring.

After a test heat 2 measurings are taken; each before and after anamnesis. 2 measurings are taken again, after

another heat, right and left. Both take place before and after the 1st treatment.
As with the other measurings, before and after the 2nd treatment, measurings take place with a similar process as before.

6 Variablen

6.1Rotation

At the height of 3 m. a strong Halogen light was mounted in order to project a shadow of 2 pointers, which were mounted on belts attached to the body of the swimmers, onto a scale on the floor.
On the floor, a round disc was installed. The athlete had to stand on exactly defined points.

The 1st belt with a mounted pointer on it was placed right underneath the arms. The pointer was oriented on the midline of the sternum. The 2nd belt was mounted on the hips right underneath the SIPS. Both pointers' shadows should have been in a congruent position. The projected shadow showed the amount of rotation. In this way, one can read the total rotation of the body up to the shoulders and the rotation of the pelvis. A second person took over the measuring.

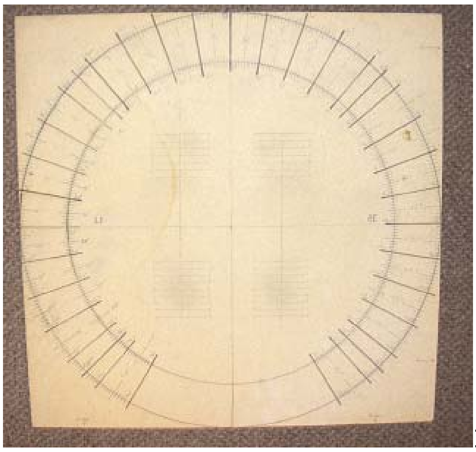


Illustration 29: Scale for measuring the rotation

The measurements were compared before and after the first and second treatment. Each athlete was tested twice so overall 12 tests of torso rotation and 12 measurements of arm reach took place.
The athlete had to stretch the arm, on the side to which they were rotating, vertically with the arm touching the ear, while the controlateral arm laid on the flank, reaching downward.

6.1.1 Procedure

An independent person takes over measuring.

6.1.1.1 1. Measuring

After a test heat 2 measurings take place right befor and after anamnesis.

6.1.1.2 2. Measuring

After a test heat another 2 measurings take place right and left. Both take place befor and after the first treatment.

6.1.1.3 3. Measuring

Similar to the other measurings they take place before and after treatment in the same way.

6.2 Arm reaching

The swimmer had to stand on tiptoes, their heels on the wall to reach with extended arms right and left as far as possible on a measuring tape. Their head had to touch the scale. The measurements taken before and after the first and second treatments were compared.
A second independent person was responsible for the measurement. They had to read the measuring results of a scale screwed onto a wall.

Both tests had to be checked in a standardized procedure performed with 20 persons. A minimum of 0.95 correlation coefficient was reached.
Reliability tests were taken of all tests of flexibility (torso rotation, pelvis rotation, arm reaching) before the first treatment took place. On the 6 measurements a minimum of 0.90 was reached, which confirmed that the test has a high reliability.

6.2.1 Procedere

An independent person takes over measuring.

6.2.1.1 1. Measuring

After a test heat 2 measurings take place right befor and after anamnesis.

6.2.1.2 2. Measuring

After a test gateway another 2 measurings take place right and left. Both take place befor and after the first treatment.

6.2.1.3 3. Measuring

Similar to the other measurings they take place before and after treatment in the same way.

6.3 Comparison of performance

Time measurements were taken for the 100 m and 1000 m freestyle as well as for the 100 m and 500 m backstroke. The swimmers were tested within a period of 10 days between measurements in order to exclude training improvements. Measurements were done on an electronic basis, comparable to an ordinary swimming competition.
The swimmers were requested to swim during both performance tests at the same speed.

Following every performance test the swimmers had independently to measure the heart rate. This process is definitely usual because this is handled so also in the course of the training.
Due to improvement of technique on the one hand and an improvement in the economy of movement on the other hand I hoped to find a reduction of heart rate.

6.4 Comparison of Techniques

6.4.1 Measuring the frequency cycle

All following examination methods are from Reischle (1995) on the occasion of training for swimming trainers in 1995.
The determination of frequency cycle is made with the help of a stroke timer (the stroke timer utilised is HEUER-ROWLINGIST, calibrated on four arm cycles).
- One counts “zero-one-two-three-four”; the immersion of an arm starts with “zero”; the clock starts at the same time
- The clock stops with “four” (immersion of the same arm with the fifth stroke); the minute frequency can be directly read off.

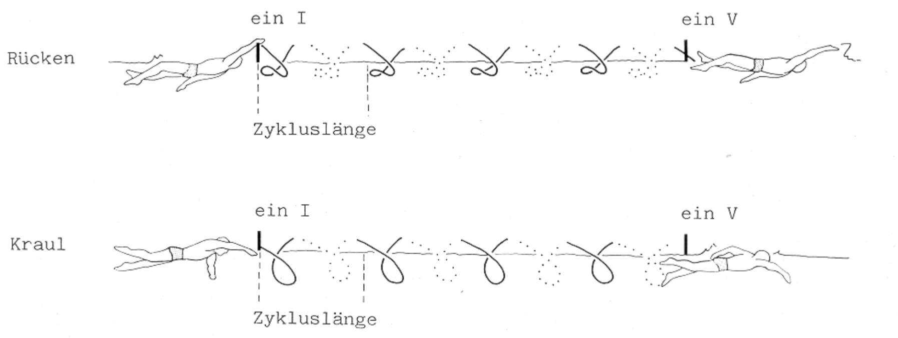


Abb. 50:
Die Zykluslänge – pro Armzyklus zurückgelegte Schwimmstrecke – beim Delphin-, Rücken- und Kraulschwimmen. Bei der Bestimmung der Minutenfrequenz mit Hilfe der Schlagzahluhr (HEUER-ROWING) müssen vier Armzugzyklen berücksichtigt werden, d. h. ein Arm taucht fünfmal ein (EIN I . . . EIN V).

Abb 1: Inquiry of the frequency cycle from Reischle 1995, S 5

The frequency cycle measurement is taken to make sure that the same frequency cycle has been utilised with test and retest.

6.4.2 Measuring the length of the cyclus

The cycle length test is an additional test for survey of technique improvement. The pull stroke of every swimmer can be individually recorded by means of cycle length measurement. This will be surveyed at a point in time unknown to the swimmer during the 1,000 m test over 1,000 m crawl as well as over 500 m backstroke. However, it must be surveyed at the same point in time with every swimmer between 500 m and 800 m within both tests.

The goal of the measurement is to ascertain whether the pull stroke has extended, which shall be should be achieved on the basis of mobility improvement.

Procedure:

- Measurement of the minute frequency…within a market measuring stretch (s), e.g.: S_{10} =10 m; for instance, the measured minute frequency amounts to: MF=60[1/min];
- At the same time, the time (t_{10}) which the simmer requires for the predetermined measuring stretch (S_{10}) is taken (head passage!); e.g.: T_{10} =5[S];
- The average swimming speed (V_s) is calculated, e.g.:

$V_s = S_{10}/T_{10} = 5/10 = 2$[m/s].

- One calculates the average cycle length as follows:

$V_s = L_X.MF/60$ [m/s]

(To calculate the cycle length, the formula according to L_x has to be solved)

$L_x = V_s.60/MF$

V_s = swimming speed [m/s]

L_X = cycle length [m]

MF = minute frequency [1/m]

The technique has then improved if the pull stroke is longer with constant frequency cycle.

According to Reischle (1995), to extend the cycle length means an increase of efficiency with given frequency cycle or swimming speed.

6.4.3 Cyclus tests on 25 m

The aim is the counting of arm cycles on 25 m before the 1st treatment and after the 2nd treatment.

For this purpose the swimmers were tasked with lying in an outstretched position in the water and touching the wall with their toes in order to avoid a powerful push-off and thereby a falsification.

Accordingly, they had to attempt to make as few arm strokes as possible on the 25 m stretch and to count the cycles.

6.5 Statistics

Examination of the quality criteria (reliability, objectivity, validity) of the applied test methods for review of capabilities (mobility).

6.5.1 Test of the reliability & repeatability of the tests

This was reviewed with the retest method.

On two successive days, 20 test persons performed tests regarding upper body rotation and arm reach. The mean value was calculated from the 2 evaluation passages.

The arm reach-length test was immediately undertaken.

The correlation coefficients according to Pearson were calculated from the measurement series of the two days, which resulted in the following values during the individual tests:

Upper body rotation, right (0.956) and left (0.961)

Arm reach, right (0.995) and left (0.997)

6.5.2 Measuring of reliability

Measurements were taken in all mobility tests before the 1st treatment, and the intra-class correlation coefficient was subsequently calculated. The following values resulted according to this method:

Upper body rotation, right (0.9216)
Pelvic rotation, right (0.9149)
Upper body rotation, left (0.9115)
Pelvic rotation, left (0.9115)
Arm reach, right (0.9992)
Arm reach, left (0.9995)

The single-factor variance analysis with repetition of measurement was utilised for examination of the change within the 6 measurements.

As a significance barrier, the probability of error will be specified with Alpha = 5 %

6.5.3 Objectivity

All tests will be conducted by independent second persons.
One person was trained for the implementation of the mobility tests. All 2,800 data were surveyed by the same person.
The performance tests were carried out by an experienced trainer (my ex-trainer Harald Bergmann), who was always on duty throughout the course of 10 years as a race director at all swimming competitions in the Innsbruck area.

6.5.4 Validity

For the mobility tests it is assumed that they are valid in terms of content, since the measured value is a direct expression of the utilised ability.
The same procedures were taken on day x+1.
The correlation factor will be surveyed, in which case a factor of minimum 0.99 was obtained.

7 Results

The overall group consisted of 30 athletes: 9 swimmers from the Tyrol Swimming Training Centre, 12 triathletes from the Tyrol Triathlon Training Centre and 9 swimmers from the Telfs Swimming Club, where work on a vary high level is also performed with a professional swimming trainer.

The Swimming Training Centre has approx. 10 swimming units/week with a volume of approx. 50-60 km; the triathletes approx. 5-6 swimming units/week with a volume of 30-35 km; and the Telfs swimmers have 6 units and a volume of 40-50 km/week.

In the following tables, the different groups will be differentiated in colour: the overall group with **blue**, the elite performance swimmers with **red**, the triathletes with **orange** and the Telfs swimmers with yellow.

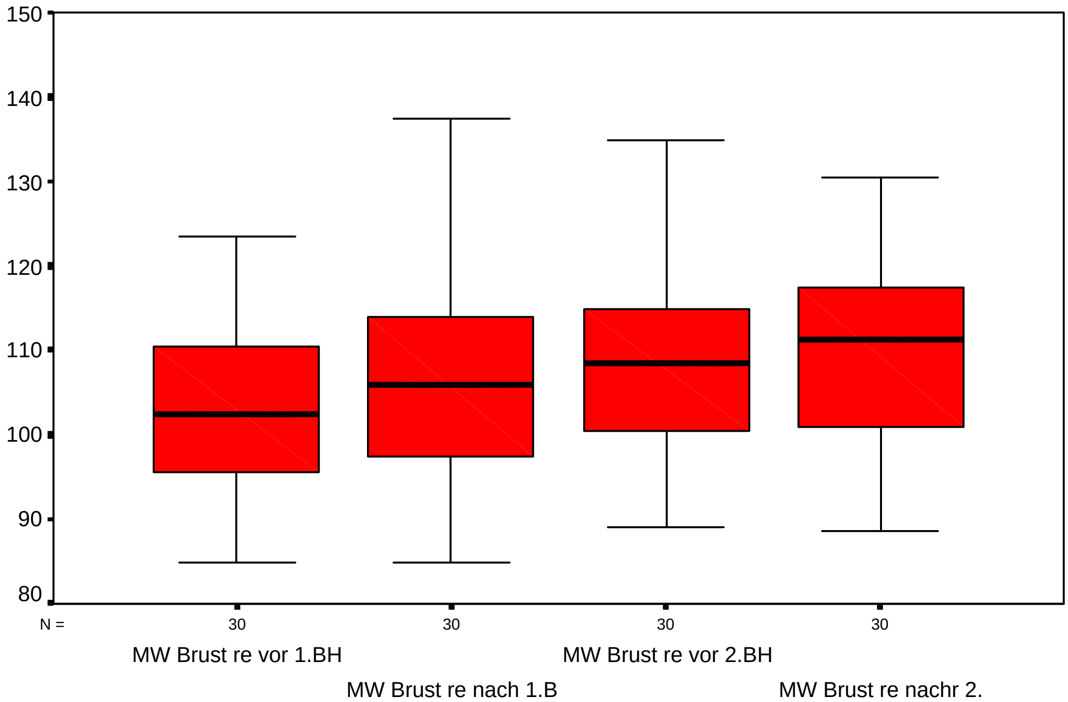
7.1 Uperbody (UB) Rotation (Rot) right (ri)

7.1.1 The reliability of the UB ri before anamnesis (A) before the 1st treatment (T)

```
  R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E   (A L P H A)
Intraclass Correlation Coefficient
Two-Way Mixed Effect Model (Absolute Agreement Definition):
People Effect Random, Measure Effect Fixed
Single Measure Intraclass Correlation =    .6612*
95.00% C.I.:            Lower =    .5226          Upper =    .7917
F =  13.5791   DF = (    29,  145.0)   Sig. = .0000  (Test Value = .0000 )
Average Measure Intraclass Correlation =    .9213**
95.00% C.I.:            Lower =    .8677          Upper =    .9580
 F =  13.5791   DF = (    29,  145.0)   Sig. = .0000  (Test Value = .0000 )
*: Notice that the same estimator is used whether the interaction effect
   is present or not.
**: This estimate is computed if the interaction effect is absent,
    otherwise ICC is not estimable.
```

The Intraclass Correlation according to the evaluation with SPSS is 0.9213. Due to the result the reliability was very high so the test can be described as very valid.

7.1.2 Common lineare course UB Rot ri before 1.T and after 2.T



The mean average values were ascertained from 2 measurings taken before and after the 1st treatment, and before and after the 2nd treatment. At the establishing of the mean average values of the upper body rotation to the right, before the 1st treatment and after the 2nd treatment, a rising tendency is evident.

7.1.3 Results of the variance analysis

Quelle		Quadratsumme vom Typ III	df	Mittel der Quadrate	F	Signifikanz
	Huynh-Feldt	756.473	2.759	274.147	9.023	.000
	Untergrenze	756.473	1.000	756.473	9.023	.005

As one can see by looking at the statistical evaluation, the data is strongly significant.

7.1.4 Correlation and siginfancie with paired samples

		N	Korrelation	Significance
Pairs 1	MAV UB ri before 1.T & MAV UB ri after 1.T	30	.824	.000
Pairs 2	MAV UB ri after 1.T & & MAV UBri before 2. T	30	.761	.000
Pairs 3	MAV UB ri before 2.T & MAV UB ri after 2.T	30	.859	.000

The statistical results of the paired samples showed a strong significance.

This means that there is also a significance between the two measurements and not only between the smallest and the highest values.

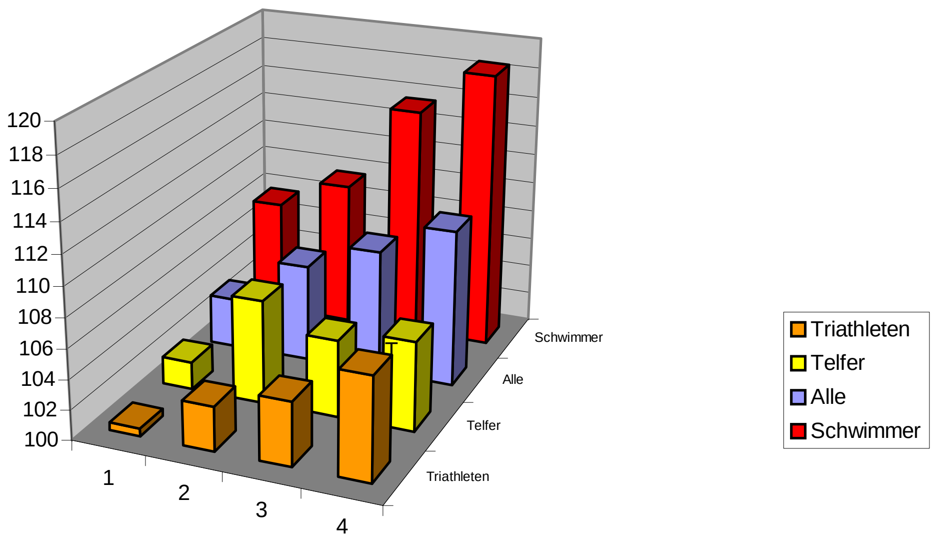
The 30 swimmers showed a significant improvement between all measurings. Which means that improvements were achieved before and after the first treatment.

However, the osteopathic treatment seemed to have a continued effect because between the measurings taken after the first treatment and before the second treatment, an improvement was achieved.

7.1.5 Mean value (MV) of the group concerning UB Rot ri

The following data, represented graphically, shows the mean value evaluation of the group swimmers of the state-level association, triathletes of the state-level association and performance swimmers of the Telfer Swim Club:

UB Rotation ri in degrees



	1	2	3	4
Triathleten	100,50	102,95	104,25	106,85
Telfer	101,86	106,91	105,14	105,95
Alle	103,36	106,53	108,31	110,47
Schwimmer	107,72	109,72	115,56	118,61

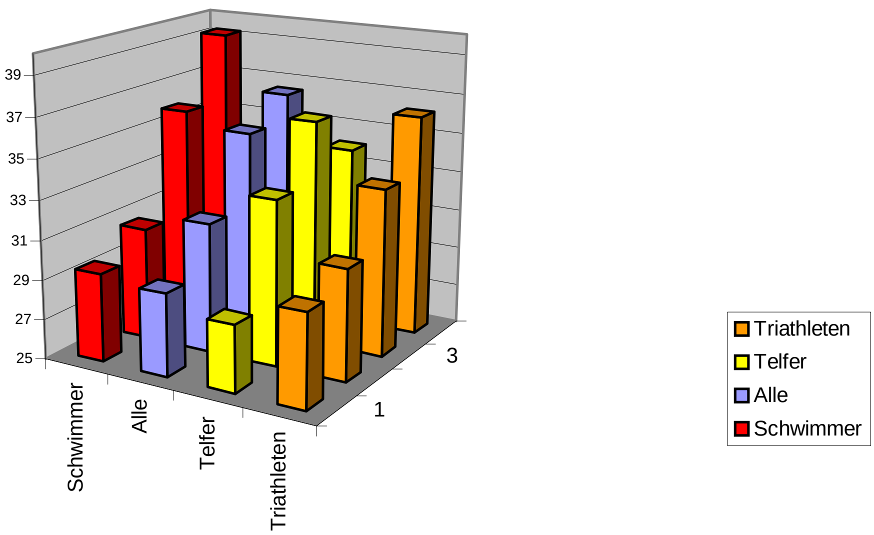
It can be seen from the graphics that the different groups have improved differently.

The complete group by 7.11°, the triathletes by 6.35°, the swimmers by 10.89° and the Telfer swimmers on average by 4.11°.

7.1.6 MV UB Rot minus pelvisrotation ri

To state the upper body rotation improvement even more exactly, the pure upper body rotation around a longitudinal axis was subtracted from the pelvis rotation, to get the true thoracic rotation.

UB Rot minus pelvisrot re in degrees



	1	2	3	4
Triathleten	29,70	30,60	33,45	36,20
Telfer	28,36	33,32	36,27	34,05
Alle	29,17	31,53	35,20	36,49
Schwimmer	29,44	30,67	35,89	39,22

The average improvement in all swimmers is 7.32°.

The swimmers have improved by 9.88°, the Telfer swimmers by 5.69° and the triathletes by 6.50°.

7.2 Pelvisrotation (PR) ri

7.2.1 Reliability with pelvisrotationtest ri before anamnese and before 1.T

Method 1 (space saver) will be used for this analysis

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E (A L P H A)

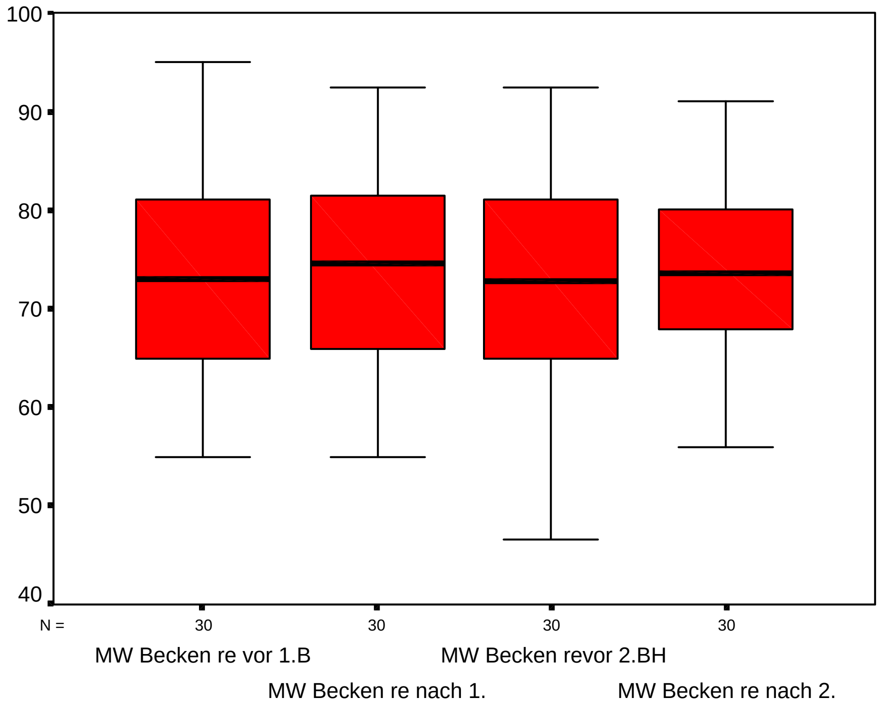
Reliability Coefficients

N of Cases =   30.0   N of Items = 6

Alpha =   .9149

The data of reliability is 0,9149. It can be seen from this that the reliability is very high.

7.2.2 Common linear effect with PR re befor 1.T and after 2.T



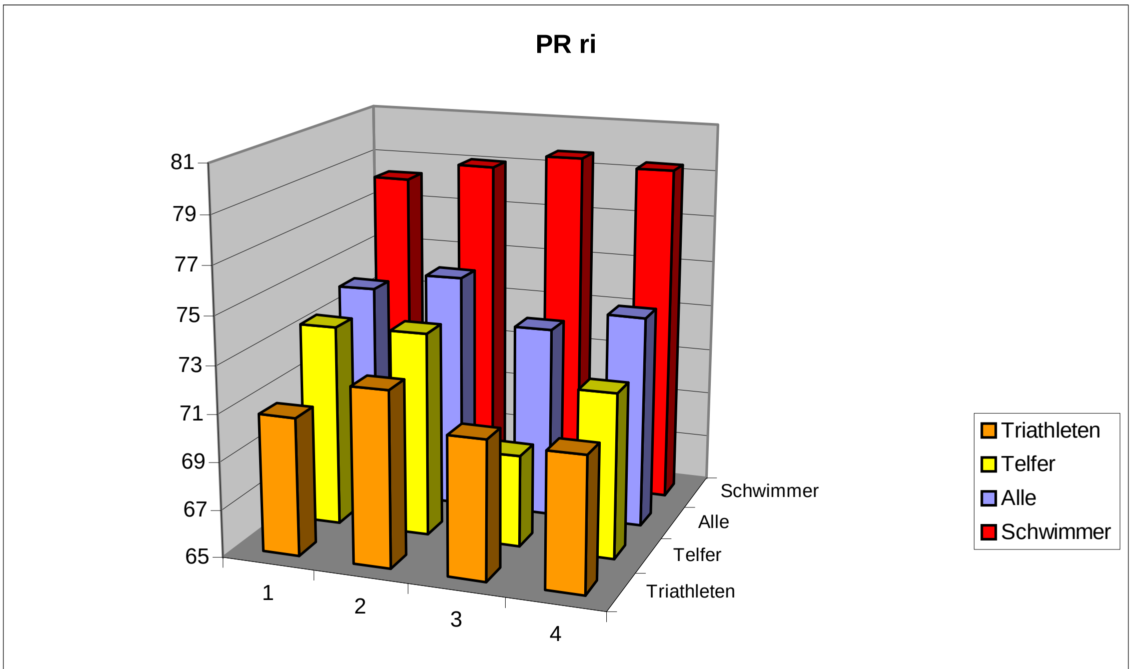
7.2.3 Results of the variance analysis

Measure: MEASURE_1

Source	FACTOR1	Type III Sum of Squares	df	Mean Square	F	Sig.
FACTOR1	Linear	13.202	1	13.202	.637	**.431**
	Quadratic	.300	1	.300	.026	**.872**
	Cubic	52.215	1	52.215	1.886	**.180**

There is no change, what indicates that no change has taken place with respect to pelvis rotation improvement.

7.2.4 MV PR ri before 1. T and after 2. T



	1	2	3	4
Triathleten	70,80	72,35	70,80	70,65
Telfer	73,50	73,59	68,86	71,91
Alle	74,19	75,00	73,11	73,98
Schwimmer	78,28	79,06	79,67	79,39

As seen from the data the pelvis rotation right has been nearly stabile during the course of the tests.

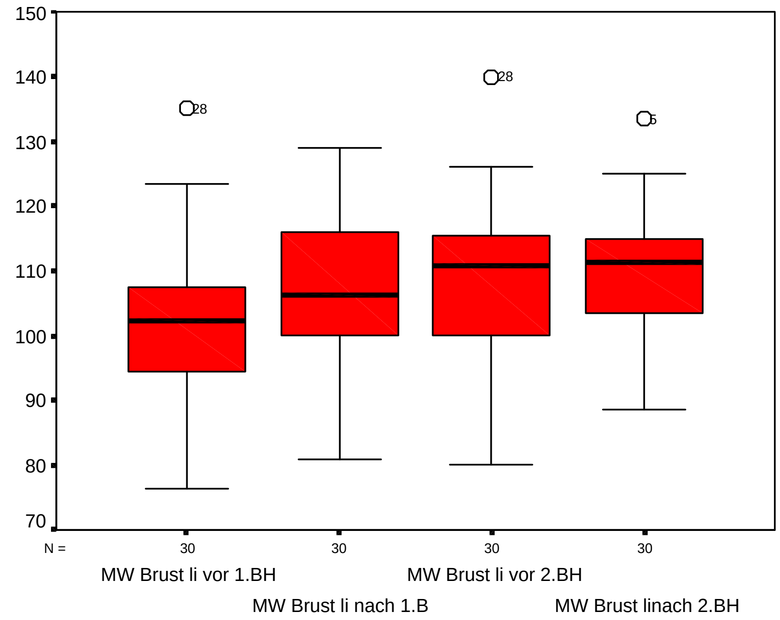
7.3UB Rot li

7.3.1 Tue reliability of the UB left (le) before anamnes and before 1. T

```
                 Intraclass Correlation Coefficient

Two-Way Mixed Effect Model (Absolute Agreement Definition):
People Effect Random, Measure Effect Fixed
 Single Measure Intraclass Correlation =    .8373*
    95.00% C.I.:            Lower =    .6592          Upper =    .9226
 F =  13.0576   DF = (    29,   29.0)   Sig. = .0000  (Test Value = .0000 )
 Average Measure Intraclass Correlation =    .9115**
    95.00% C.I.:            Lower =    .7920          Upper =    .9600
 F =  13.0576   DF = (    29,   29.0)   Sig. = .0000  (Test Value = .0000 )
*: Notice that the same estimator is used whether the interaction effect
   is present or not.
**: This estimate is computed if the interaction effect is absent,
    otherwise ICC is not estimable.

Reliability Coefficients     2 items

Alpha =   .9234          Standardized item alpha =   .9247
```

At the evaluation of the data of the upper body rotation to the left before anamnesis, after anamnesis and before the 1st treatment the reliability was checked. What this means is that the test has a high reliability of 0.9247.

7.3.2 Effect UB Rot le before 1.T and 2.T



The graphic shows that there is a clear linear increase.

7.3.3 Results of the variance analysis

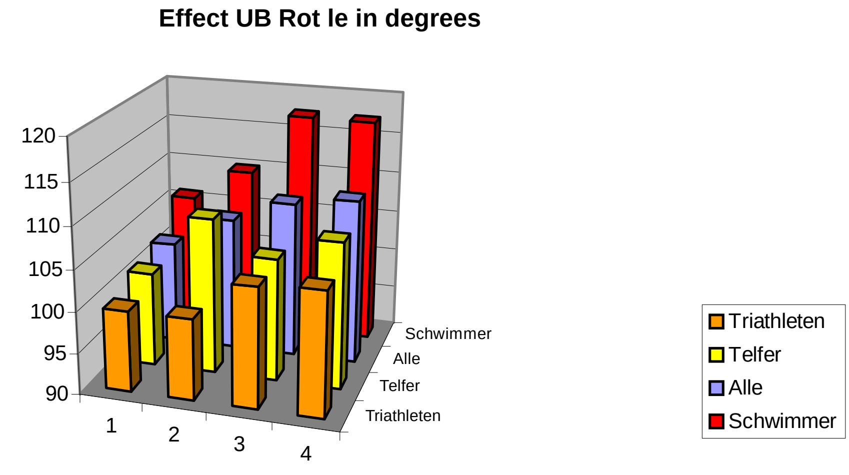
Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
FACTOR1	Sphericity Assumed	21.292	3	7.097	29.817	.000

As seen from the statistical data the variance analysis is strongly significant.

7.3.4 MV of the group or UB Rot le

The following data of the upper body rotation left, represented graphically, shows the mean average value evaluation of the group swimmers of the state-level association, triathletes of the state-level association and performance swimmers of the Telfer swimmers:

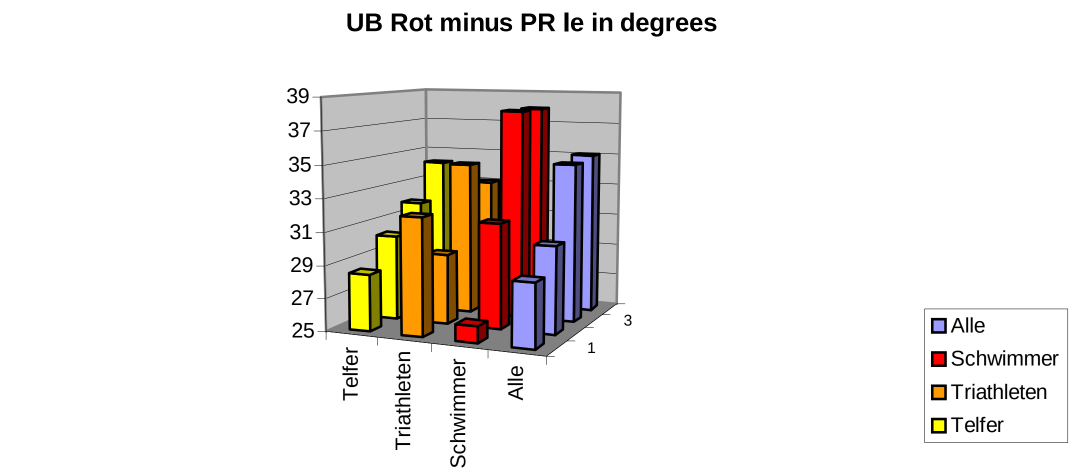


	1	2	3	4
Triathleten	99,85	99,85	104,55	105,05
Telfer	101,41	108,86	104,91	107,73
Alle	102,40	106,22	108,97	110,04
Schwimmer	105,94	109,94	117,44	117,33

The improvement in the individual groups showed the following values in degrees: complete group by 7.64°, swimmers by 11.39°, triathletes by 5.20° and Telfer swimmers by 6.32°.

7.3.5 MV UB Rot minus PR le

To state the upper body rotation improvement left even more exactly, the pure upper body rotation around a longitudinal axis was subtracted from the pelvis rotation, to get the true thoracic rotation.



	1	2	3	4
Alle	28,85	30,32	34,77	35,04
Schwimmer	26,00	31,44	37,94	37,94
Triathleten	32,10	29,30	34,50	33,00
Telfer	28,45	30,23	31,86	34,18

Here are listed the improvements in rotation:

Whole group: 6.19°

Swimmers: 11.94°

Triathletes: 0.9°

Telfer swimmers: 5.73°

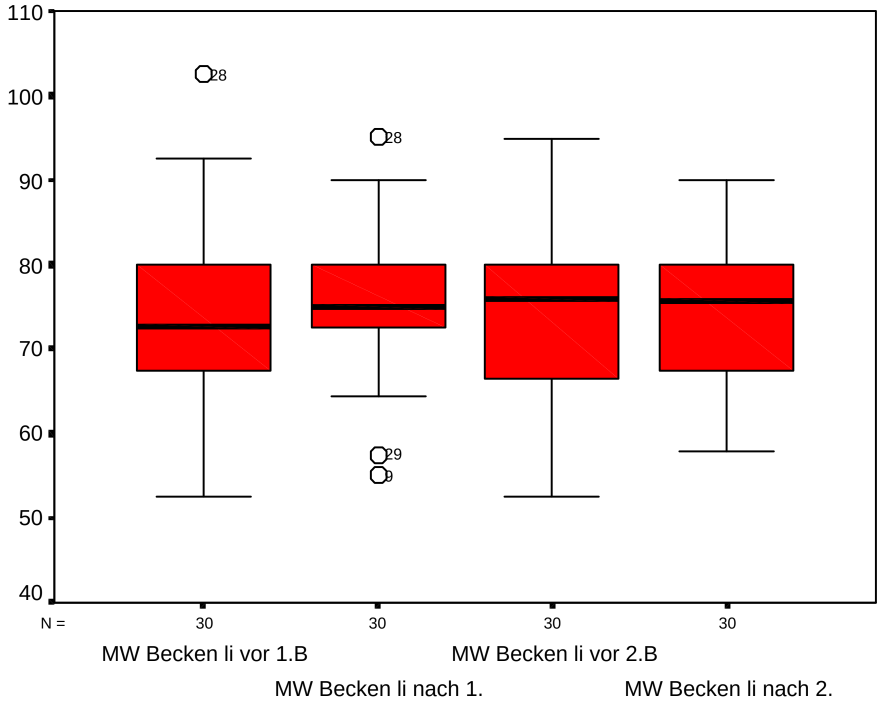
7.4 PR le

7.4.1 Reliability PR le before anamneses and before 1.T

```
Intraclass Correlation Coefficient

Two-Way Mixed Effect Model (Absolute Agreement Definition):
People Effect Random, Measure Effect Fixed
 Single Measure Intraclass Correlation =    .8373*
    95.00% C.I.:            Lower =    .6592          Upper =    .9226
 F =  13.0576   DF = (    29,   29.0)   Sig. = .0000  (Test Value = .0000 )
 Average Measure Intraclass Correlation =    .9115**
    95.00% C.I.:            Lower =    .7920          Upper =    .9600
 F =  13.0576   DF = (    29,   29.0)   Sig. = .0000  (Test Value = .0000 )
*: Notice that the same estimator is used whether the interaction effect
   is present or not.
**: This estimate is computed if the interaction effect is absent,
    otherwise ICC is not estimable.

Reliability Coefficients     2 items

Alpha =   .9234           Standardized item alpha =   .9247
```

The data is of reliability of 0.9115. It can be seen from this that the reliability is very high.

7.4.2 Common linearer effect PR le before 1.T and after 2.T



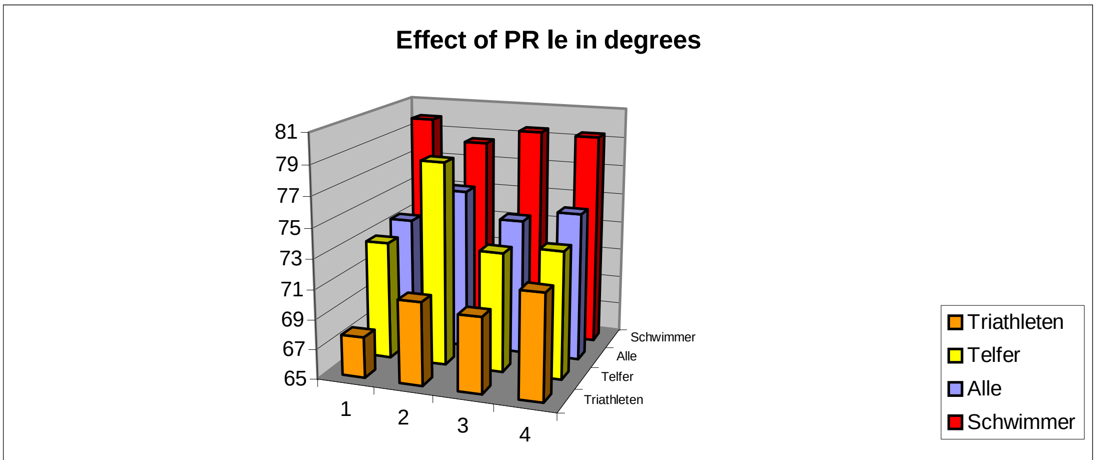
7.4.3 Results of the variance analysis

Measure: MEASURE_1

Source	FACTOR1	Type III Sum of Squares	df	Mean Square	F	Sig.
FACTOR1	Linear	9.627	1	9.627	.336	**.567**

As seen by the statistical evaluation of the data there is **no significant improvement** of flexibility. This shows that no change of pelvis rotation was recognized within this period.

7.4.4 Results of the MV of the single groups before 1.T and after 2.T



	1	2	3	4
Triathleten	67,75	70,55	70,05	72,05
Telfer	72,95	78,64	73,05	73,55
Alle	73,55	75,90	74,20	74,99
Schwimmer	79,94	78,50	79,50	79,39

Once more the pelvis rotation to the left is very stabile and it shows no linear improvement.

7.4.5 Interpretation of the data UB Rot

As seen the upper body rotation before testing was around 30° and after treatment somewhere around 40°. It seems that further treatments would be recommended to reach the perfect range of motion of 45°. Freestyle swimmers should roll in the range of 30° to 40° degrees to each side.

The measuring showed also that pelvis rotation remained relatively stabile, while the range of motion of the upper body improved considerably as hoped.

The 30 swimmers have significant improvements between all measurings to the right and to the left.

This means that an improvement was achieved before the first and the final treatments.

However osteopathic treatment seemed to have a continuing effect, because between the measuring an improvement was also reached, after the 1st treatment and before the 2nd treatment.

7.5 Arm reaching (AR) ri

7.5.1 Reliability AR ri before anamnese and before 1.T

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E (A L P H A)

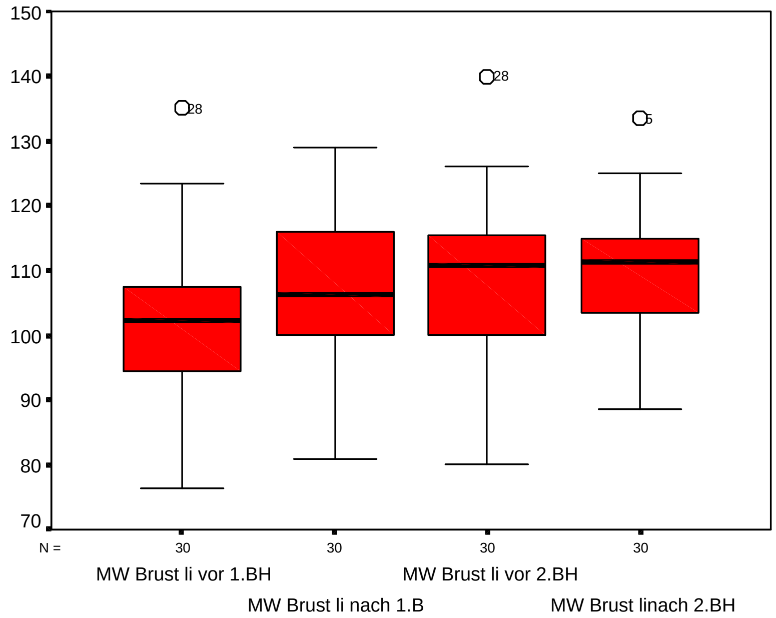
Reliability Coefficients

N of Cases = 30.0   N of Items = 6

Alpha = .9992

The Intraclass Correlation according to the evaluation with SPSS is 0.9992. Based on this result the reliability was very high so the test can be described as very valid.

7.5.2 Linear effect of AR ri before 1.T and after 2.T



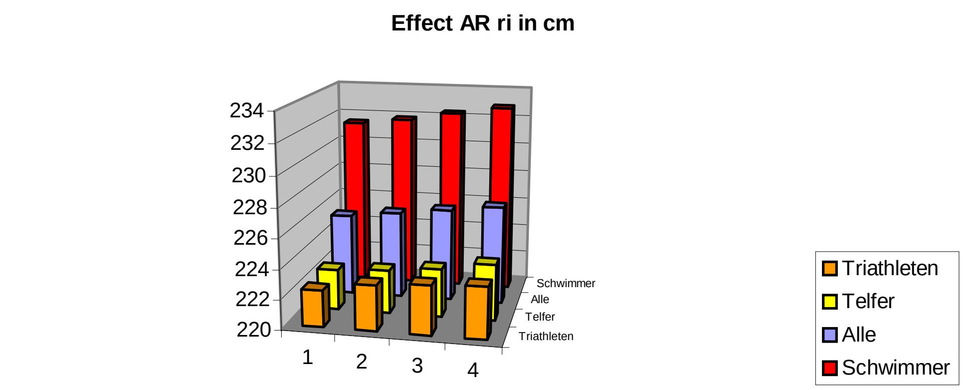
The graphic shows a linear increase of mean average values concerning arm reaching to the right before the first treatment after the final treatment.

7.5.3 Results of the variance analysis AR ri

Effect		Value	F	Hypothesis df	Error df	Sig.
	Pillai's Trace	.718	22.964	3.000	27.000	.000

A high significance can be seen once again.

7.5.4 Effect of the MV AR ri of the single groups



	1	2	3	4
Triathleten	222,45	223,05	223,30	223,45
Telfer	222,73	222,91	223,23	223,77
Alle	225,54	225,91	226,29	226,69
Schwimmer	231,44	231,78	232,33	232,83

The improvement of arm reaching shows a very small but linear rising.

The data of the single groups:

Whole group improvement 1.15 cm

Swimmers 1.39 cm

Triathletes 1 cm

Telfer swimmers 1.04 cm

7.6 AR le

7.6.1 Reliability AR le before anamnese and before 1.T

R E L I A B I L I T Y   A N A L Y S I S   -   S C A L E (A L P H A)

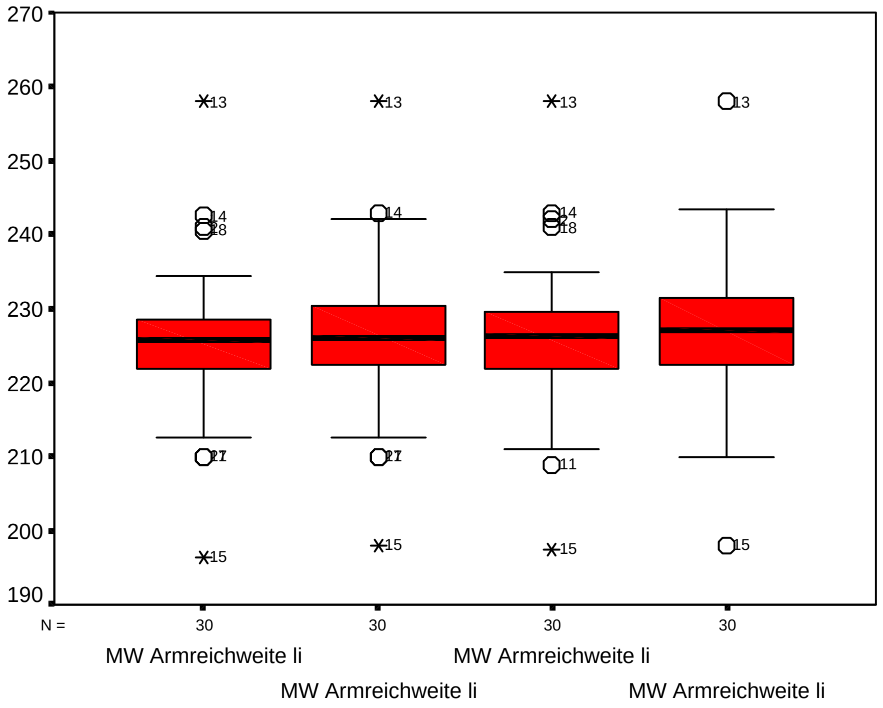
Reliability Coefficients

N of Cases = 30.0 N of Items = 6

Alpha = .9995

The data of reliability armreaching left is 0,9995. The reliability is very high.

7.6.2 Linear effect AR le before 1.T and after 2.T



The graphic shows that there is a clear linear increase of arm reaching left.

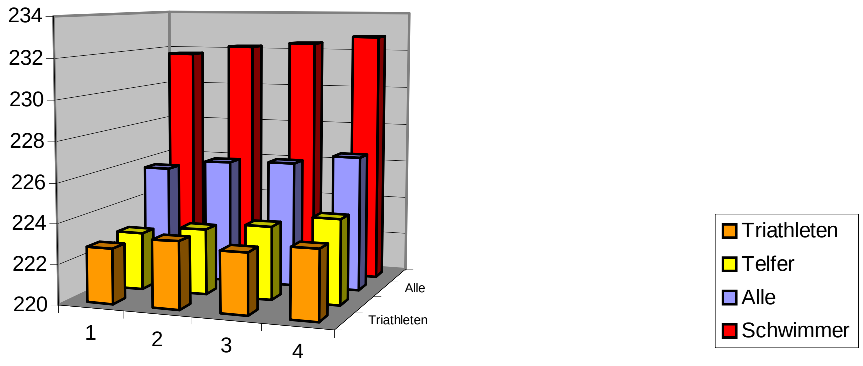
7.6.3 Results of the variance analysis AR le

Effect		Value	F	Hypothesis df	Error df	Sig.
FACTOR1	Pillai's Trace	.620	14.671	3.000	27.000	.000

The data of the inner subjective effectivity shows a strong siginificance.

7.6.4 MV of AR le of the single groups

Effect AR le in cm



	1	2	3	4
Triathleten	222,75	223,35	223,05	223,45
Telfer	222,91	223,32	223,68	224,27
Alle	225,79	226,28	226,37	226,83
Schwimmer	231,72	232,17	232,39	232,78

The data of the single groups:

Whole group 1.04 cm

Swimmers 1.06 cm

Triathletes 0.7 cm

Telfer swimmers 1.36 cm

7.6.5 Interpretation of the data AR

Once again it seems the conclusion can be drawn that osteopathic treatments have a positive effect on arm reaching. Also improvement of movement within every single measuring is significant.

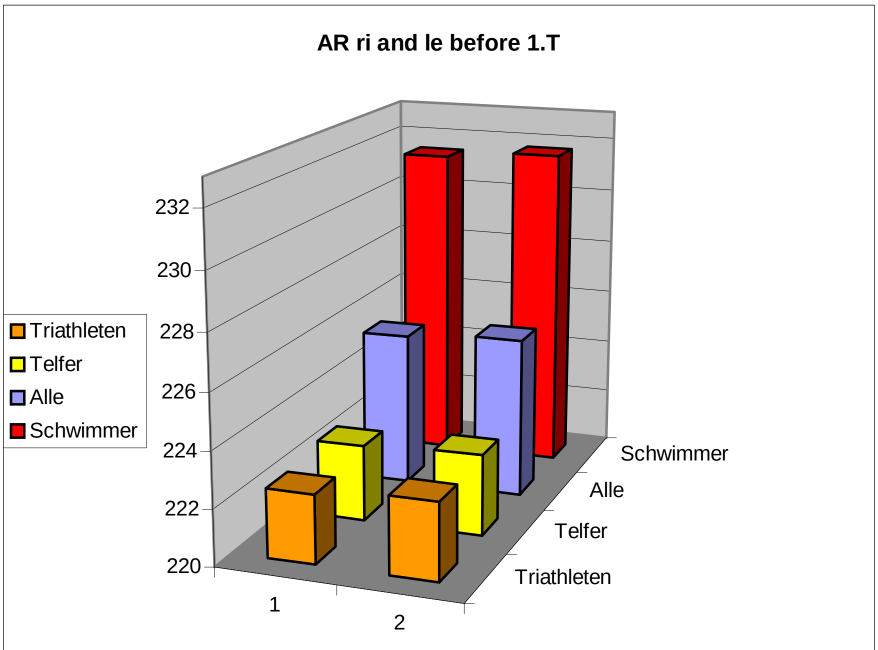
On first sight a prolongation of arm reaching of 1 cm doesn’t seem to be worth mentioning, but on average a swimmer needs somewhere around 60 strokes per 100m. At the final count it is a gain of more than 60 cm.

According to a personal best of 60 sec this would be a gain of 0.6 sec. This doesn't seem to be very much either.

At the top level one tries to reach an improvement in performance of 4% within a year.
That would be in the case of a personal best of 60 sec, an improvement in the course of a year of 2.4 sec. 0.6 sec is 25% of the aimed for improvement without effort. Under these circumstances the improvement is very big.

7.7 Comperison AR ri and le

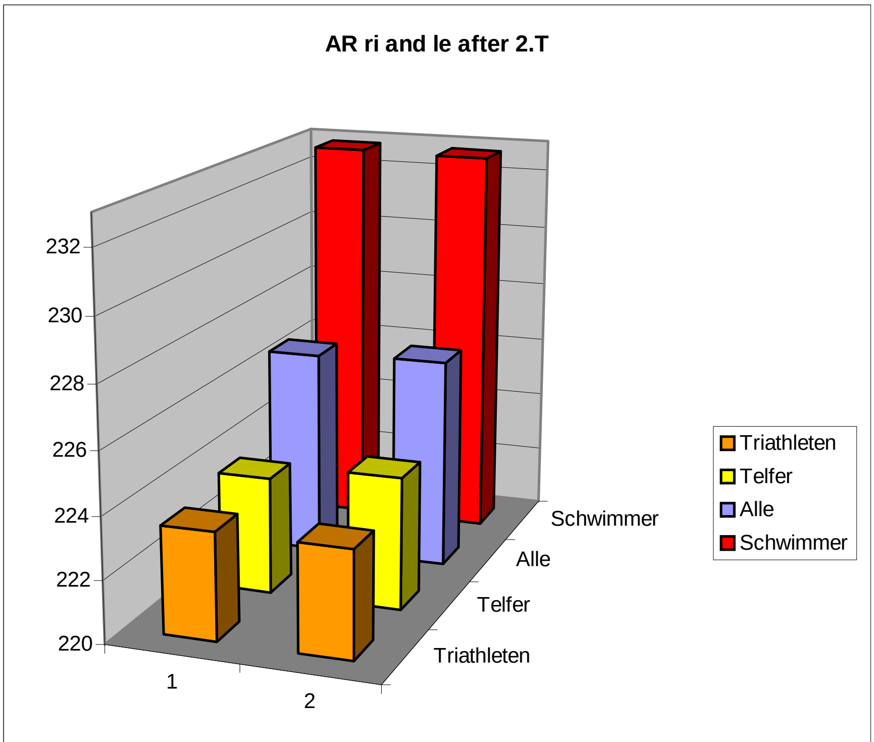
7.7.1 AR ri and le before 1.T



	1	2
Triathleten	222,45	222,75
Telfer	222,73	222,91
Alle	225,54	225,79
Schwimmer	231,44	231,72

According to the data there is a slightly better mobility on the left side.

7.7.2 AR ri and le after 2.T



	1	2
Triathleten	223,45	223,45
Telfer	223,77	224,27
Alle	226,69	226,83
Schwimmer	232,83	232,78

Still there is a slightly better mobility concerning arm reaching on the left hand side, however not so striking.

7.7.3 Interpretation of the data AR ri le

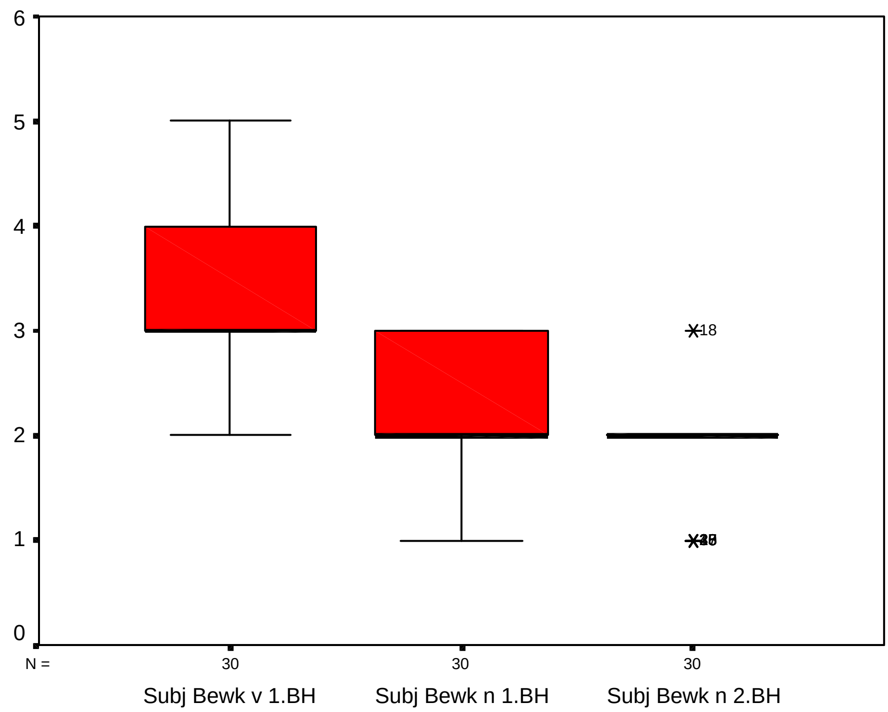
Comparing the data on arm reaching it is obvious that originally the swimmers flexibility concerning arm reaching is better on the left hand side. After final treatment there still seems to be a tendency of better arm reaching on the left, though no longer so distinctive.

The swimmers and triathletes are almost symmetrical, whereas the Telfer swimmers after final testing are even more left sided.

7.8 Subjective assessment of mobility using questionnaires

All athletes had to fill in a subjective questionnaire concerning their individual mobility on a 5-part evaluation scale.
The interview took place before the 1st treatment, after the 1st treatment and after the 2nd treatment.
The evaluation shows the following data.

7.8.1 Subjective (subj) assessment of mobility (Mob) before 1.T and after 2.T



The graphic shows the subjective assessment of mobility before first and after final treatment.

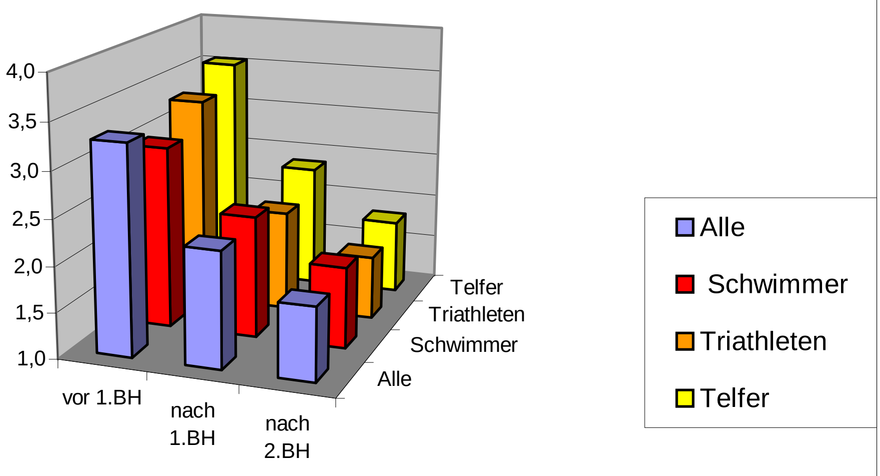
7.8.2 Results of the variance analysis of the subj Mob before 1.T and after 2.T

		N	Correlation	Sig.
Pair 1	Subj Bew vor 1.BH & Subj Bew nach 1.BH	30	.713	.000
Pair 2	Subj Bew nach 1.BH & Subj Bew nach 2.BH	30	.626	.000

The data of the inner variance analysis shows once again a strong significance.

7.8.3 Asessment of the MV of the subjective assessment concerning the mobility on a 5-part scale

Subjective range of mobility before 1.T, after 1.T and after 2. T



	vor 1.BH	nach 1.BH	nach 2.BH
Alle	3,28	2,27	1,80
Schwimmer	3,00	2,33	1,89
Triathleten	3,30	2,10	1,70
Telfer	3,55	2,36	1,82

The athletes judged their improvement as following:

Whole group 1.48 points

Swimmers 1.11 points

Triathletes 1.11 points

Telfer swimmers 1.73 points on a 5-part scale.

7.8.4 Interpretation subjective Mobility before and after 1.T and after 2.T

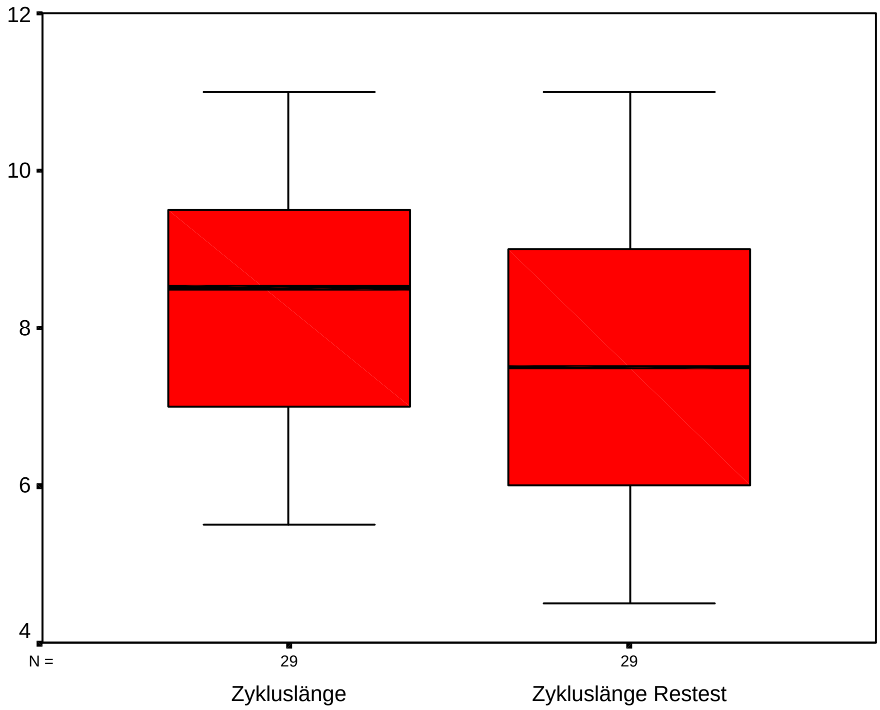
The athletes seem subjectively to classify the osteopathic treatments as promoting mobility.

They also state that they’re more relaxed in the water during training. Primarily the recovery phase above water seems to profit from increased upper body range of motion. It seems to be more relaxed.

7.9 Technique

7.10 Evaluation of the cyclustest 25 m

7.10.1 Graphic representation of the cyclustest 25 m



As seen in the graphics the number of arm cycles are reduced on freestyle over a distance of 25 meters.

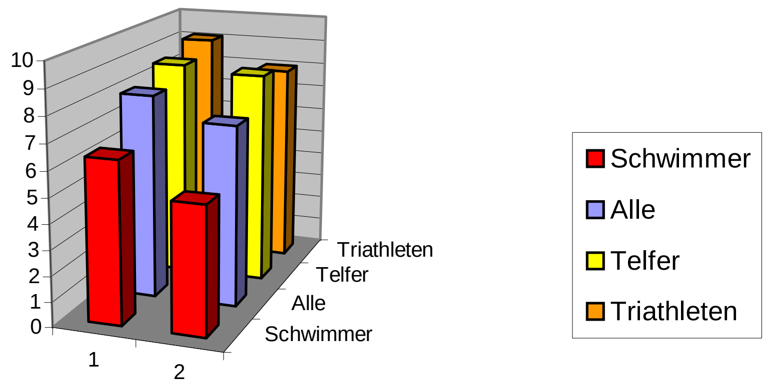
7.10.2 Results of the variance analysis of the cycle tests 25 m

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	3585.103	1	3585.103	566.666	.000

The data of the variance analysis shows a significant improvement.

7.10.3 MA of the cycles 25 m bevor 1.T and after 2.T

MAV of the cycles 25 m bevor 1.T and after 2.T



	1	2
Schwimmer	6,4	5,1
Alle	8,0	7,2
Telfer	8,6	8,4
Triathleten	9,1	8,0

As seen in the graphic the swimmers had to use on average distinctly less arm cycles over a distance of 25 meters.

Whole group 0.8 cycles less
Swimmers 1.3 cycles less
Triathletes 1.1 cycles less
Telfer swimmers 0.2 cycles less

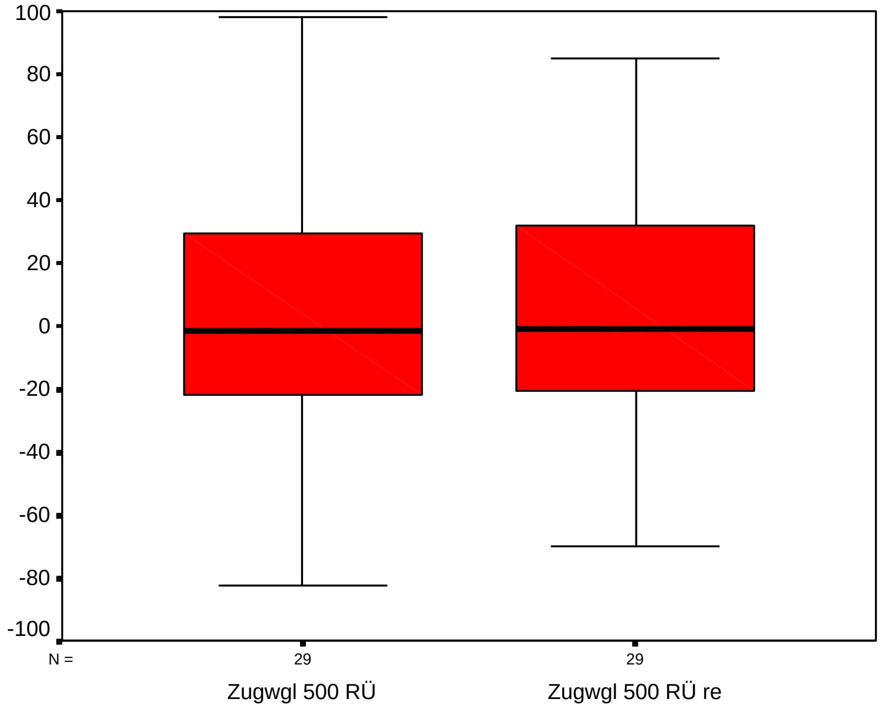
7.10.4 Interpretation of the cyclustest 25 m

It seems that the improvement in mobility would lead to a improvement of a better efficiency of the underwater phase. The complete group needed almost 2 arm cycles less on 25 m. If one assumes that less arm pulls had to be used, one can assume that each individual arm stroke had become longer. This means by the same token that the technique must have improved as well.

7.10.5 Measuring the length of the stroke due to frequency

7.10.6 500 m bs

7.10.6.1 Dokumentation of the data length of stroak 500 m bs



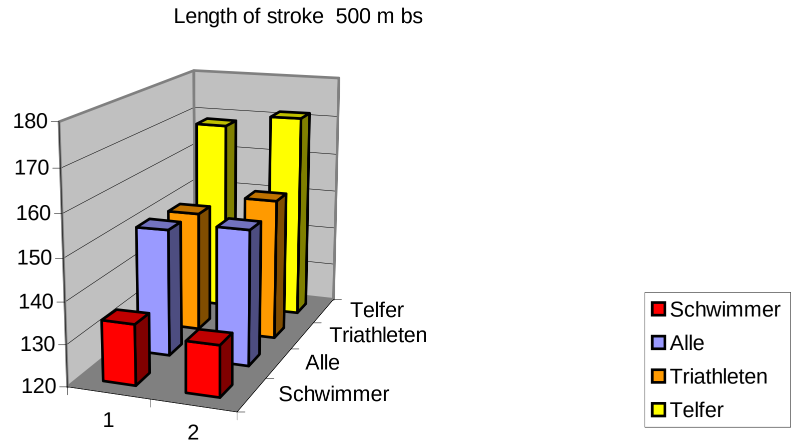
Based on the table graphics one can cite only a small increase of length of stroke.

7.10.6.2 Check of significance by means of the stroke length 500 m bs

		N	Correlation	Sig.
Pair 1	ZW5001 & ZW5002	29	.822	.000

The data of the variance analysis shows a strong significance.

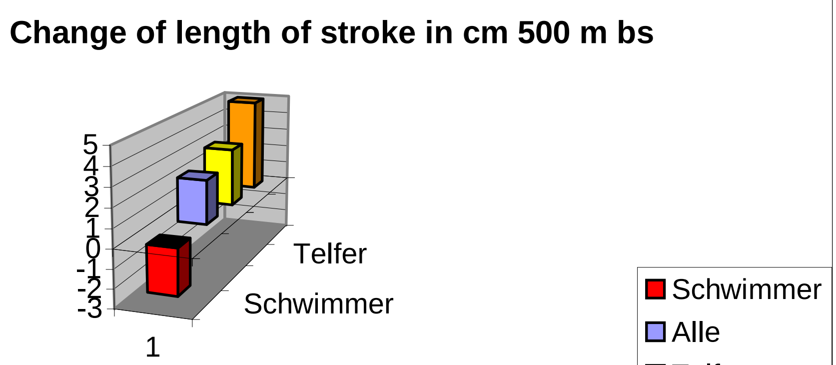
7.10.6.3 Length of stroak 500 m bs



	1	2
Schwimmer	134,45	132,19
Alle	150,88	152,80
Triathleten	149,84	154,80
Telfer	168,35	171,42

Evaluating the length of the arm stroke’s mean value, one sees that the length of stroke on the back stroke has improved. It can to be seen in detail in the following graphics.

7.10.6.4 Change of length of stroke in cm 500 m bs

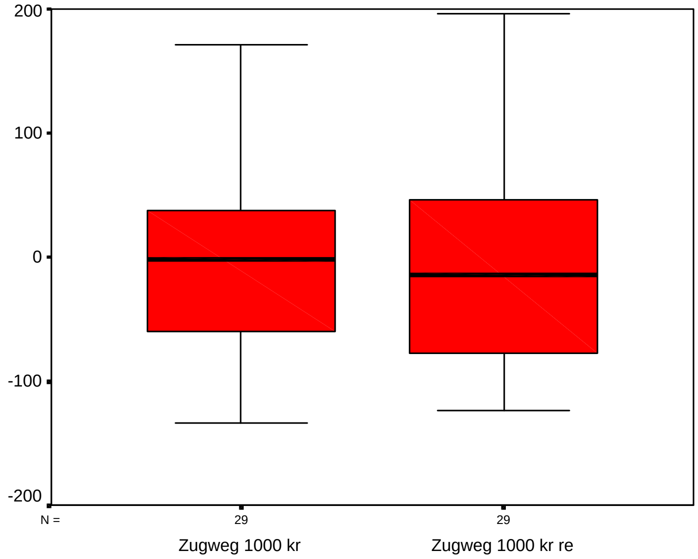


	1
Schwimmer	-2,44
Alle	2,34
Telfer	3,07
Triathleten	4,97

The length of stroke of the whole group on average has been lengthened 2 cm. The swimmers have lost 2 cm in length of stroke, while the Telfer swimmers were able to increase more than 3 cm and the triathletes almost 5 cm.

7.10.7 1000 m f

7.10.7.1 Dokumentation of the data length of the stroke 1000 m f



Due to the graphics showing the length of stroke on 1000 m freestyle the length of the stroak seemd to shorten

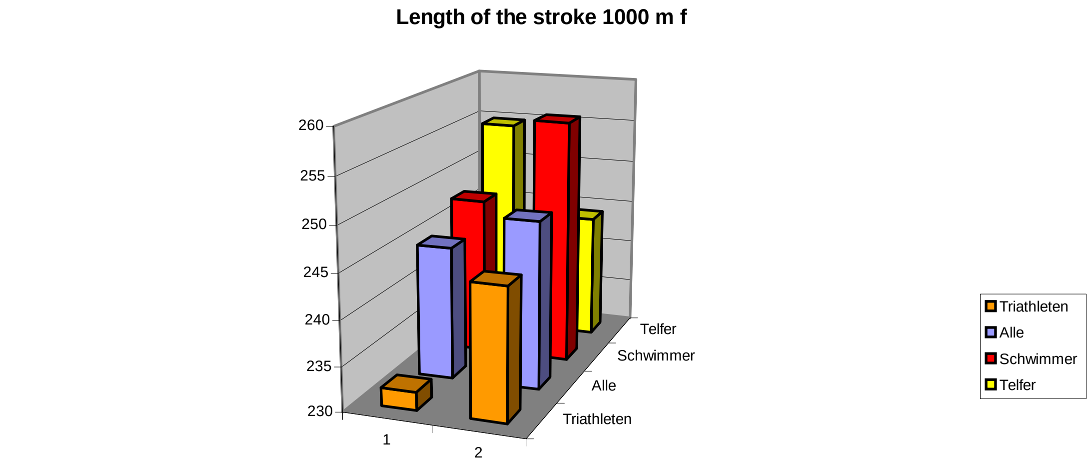
7.10.7.2 Checking the significance of the length of the stroke 1000 m f

Paired Samples Correlations 1000m Kraul Zugweglänge

		N	Correlation	Sig.
Pair 1	ZW10001 & ZW10002	29	.795	.000

The check of the significance yielded a positive result.

7.10.7.3 Length of the stroke 1000 m f

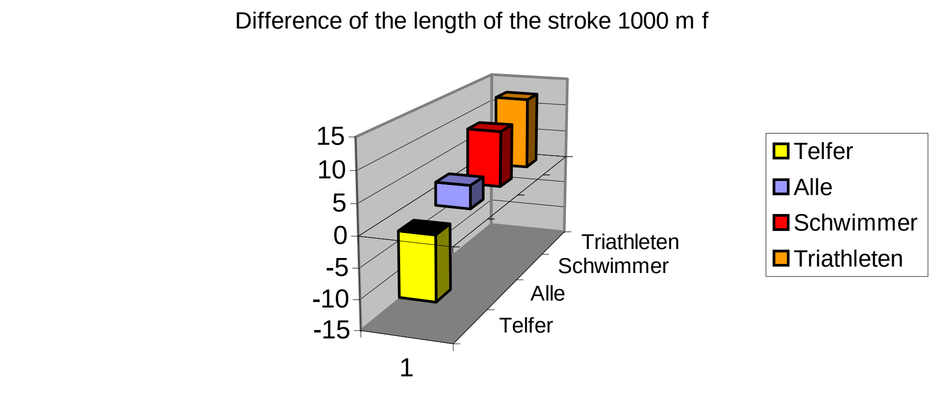


	1	2
Triathleten	232,02	244,62
Alle	244,86	248,74
Schwimmer	247,76	257,46
Telfer	254,79	244,14

The evaluation of the mean average values shows that the complete group has improved by 3.88 cm regarding the length of stroke in the 1000 m freestyle.

The Telfer swimmers shortened the length of stroke by 12.60 cm. Both of the other groups were able to lengthen their stroke. The swimmers by 9.7 cm and the triathletes even 12.6 cm.

7.10.7.4 Difference of the length of the stroke 1000 m f



	1
Telfer	-10,65
Alle	3,88
Schwimmer	9,70
Triathleten	12,60

7.10.7.5 Interpretation of the difference of the length of the stroke 1000 m f

It seems as if the mobility has positive influences on the lengthening of the stroke. Especially the triathletes and swimmers showed an impressive improvement.

8 Performance

8.1Evaluation of the performance test

For the performance tests only 29 athletes showed up because of the illness of one athlete.

T-Tests

Statistic of paired samples

	Mean value	N	Deviation of standard	Standard mistake of the mean value
100 freestyle time	69.90	29	6.173	1.146
100 freestyle time retest	70.68	29	5.9721	1.1090
100 freestyle heart rate	26.52	29	2.20	.41
100 freestyle heart rate retest	24.86	29	2.72	.51
100 back stroke time	85.30	29	8.6190	1.6005
100 back stroke time retest	85.76	29	7.9392	1.4743
100 back stroke heart rate	25.86	29	2.26	.42
100 back stroke heart rate retest	25.28	29	2.17	.40
500 back stroke time	486.73	29	45.78	8.50
500 back stroke time retest	485.88	29	49.30	9.16
500 back stroke heart rate	24.21	29	2.32	.43
500 back stroke hear rate retest	23.07	29	2.19	.41
1000 freestyle time	894.09	29	87.87	16.32
1000 freestyle time retest	887.81	29	87.64	16.27
1000 freestyle heart rate	24.31	29	2.55	.47
1000 freestyle heart rate retest	23.83	29	2.47	.46

Test of paired samples

	Paired	difference	T	df	Sig. (2-sides)
	Mean value	Deviation of standard			
100 freestyle time - 100 freestyle time retest	-.7776	4.1037	-1.020	29	.316
100 f heart rate - 100 freestyle heart rate retest	1.66	2.18	4.097	29	.000
100 bs time - 100 back stroke time retest	-.4634	2.8981	-.861	29	.396
100 bs heart rate - 100 bs heart rate retest	.59	1.52	2.071	29	.048
500 bs time - 500 back stroke time retest	.84	27.36	.166	29	.869
500 bs heart rate - 500 bs heart rate Retest	1.14	1.88	3.252	29	.003
1000 freestyle time - 1000 freestyle time retest	6.28	56.23	.602	29	.552
1000 f heart rate - 1000 f heart rate retest	.48	2.08	1.249	29	.222

The specification for the swimmers was reached at the retest at the comparably same time. The mean standard deviation is obvious from the table of the test of paired samples.

In the 100 m freestyle the complete group swam 0.78 seconds slower, with 1.66 beats lower pulse/10 seconds which corresponds to 9.96 beats per minute. This improvement is strongly significant.

In the 100 m backstroke the complete group was 0.46 seconds slower with a 0.59 lower heart rate in 10 seconds which corresponds to 3.54 beats per minute. The significance could not be proven.

In the 500 m backstroke the complete group was exactly 0.84 seconds faster with a reduced heart rate of 1.14/10 seconds which corresponds to 6.84 beats less in 1 minute. There exists once more a significant result.

In the 1000 m crawl the complete group swam 6.28 seconds faster with a 0.48 beats/10 seconds lower pulse which corresponds to 2.88 less beats per minute. A significant improvement could not be proven.

In order to be able to better compare how the swimmers within the group improved, we use the calculation of the average deviation, in order to judge, in the case where no significance could be proven, whether an improvement has taken place or not.

The calculation formula of the average deviation is $(x_i - x)/n$.

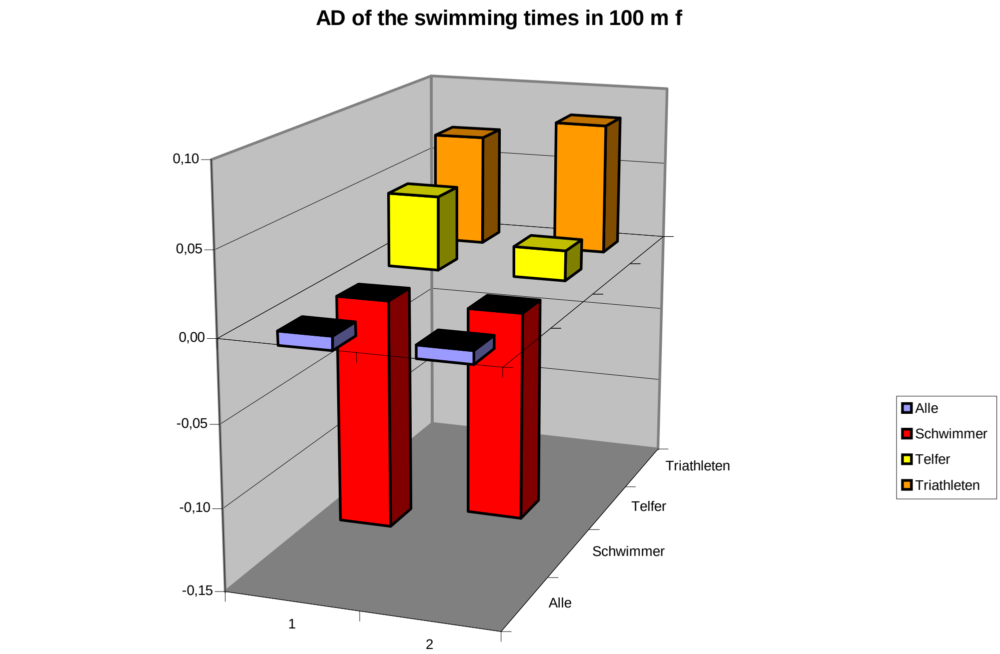
x_i is the mean value of the complete group, x is the individual swimming time or the pulse value of the single swimmer and n is the number of swimmers.

If the result is positive the swimmer or the group was slower.

If the value is, however, negative, then an improvement can be declared.

8.1.1 Evaluation of the data 100 m Freestyle (F)

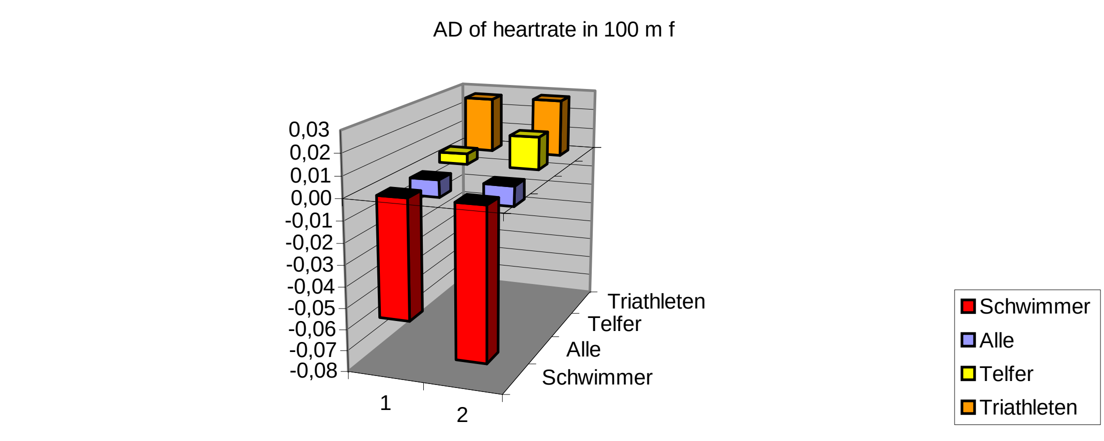
8.1.1.1 Average deviation (AD) of the swimming times in 100 m f



	1	2
Alle	-0,01	-0,01
Schwimmer	-0,14	-0,13
Telfer	0,05	0,02
Triathleten	0,07	0,08

According to the values only the finishing time of the triathletes improved. All other groups clocked slower times. On the average all swimmers have clocked approximately the same time.

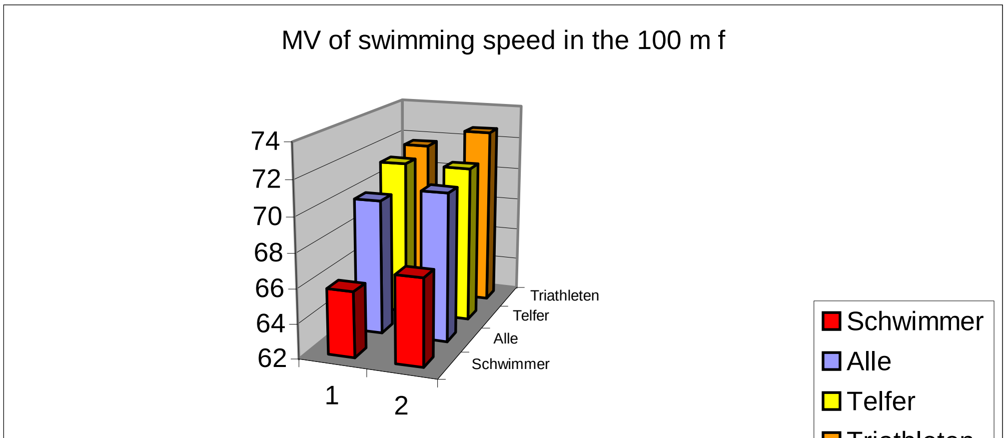
8.1.1.2 AD of heartrate in 100 m f



	1	2
Schwimmer	-0,06	-0,07
Alle	-0,01	-0,01
Telfer	0,01	0,02
Triathleten	0,03	0,03

The graphic representation of the pulse values shows that the heart rates of the average deviation are a little lower at the retest. Primarily the swimmers have lowered the internal stress.

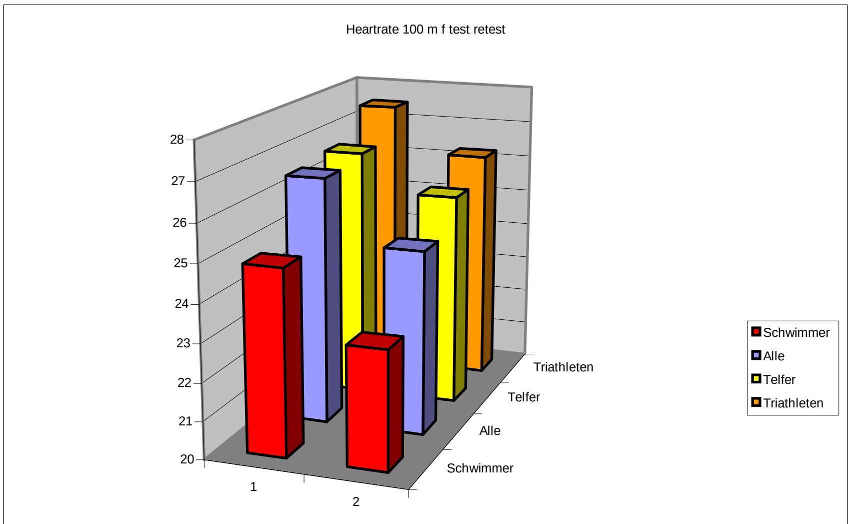
8.1.1.3 MV of swimming speed in the 100 m f



	1	2
Schwimmer	65,8	67,04
Alle	69,90	70,68
Telfer	71,26	71,23
Triathleten	71,62	72,69

As seen in the graphic results the whole group except the Telfer swimmers didn’t reach their correct time in the retest; they swam slower. Only the Telfer swimmers swam faster - by 0.03 seconds.
The complete group swam 0.78 seconds slower in the 100 m freestyle.

8.1.1.4 Heartrate 100 m f test retest



	1	2
Schwimmer	24,88	23,13
Alle	26,52	24,86
Telfer	26,67	25,67
Triathleten	27,50	26,25

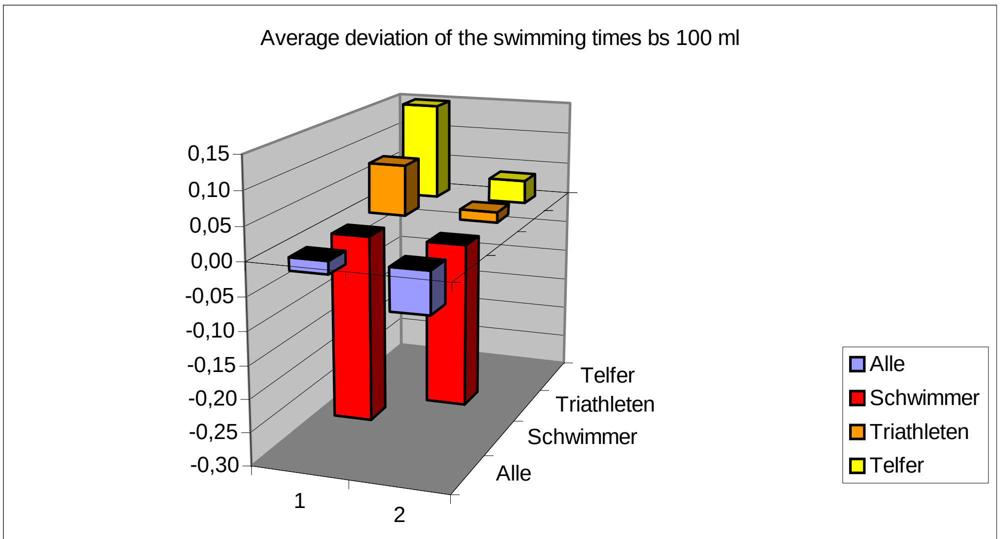
The whole group had a lower heart rate at the retest. On the average 1.66 beats per 10 seconds lower, which corresponds to 9.96 beats per minute.
The improvement is with 0.000 highly significant.

8.1.1.5 Interpretation of the data 100 m F test retest

The slightly higher final time in the retest with only 0.8 seconds slower compared to the test in the beginning is refutable. Therefore it seems fair to say there was an improvement in performance because the complete group has reached this time with a 10 beats lower heart rate.

8.1.2 Evaluation of the data 100 m back stroak (bs)

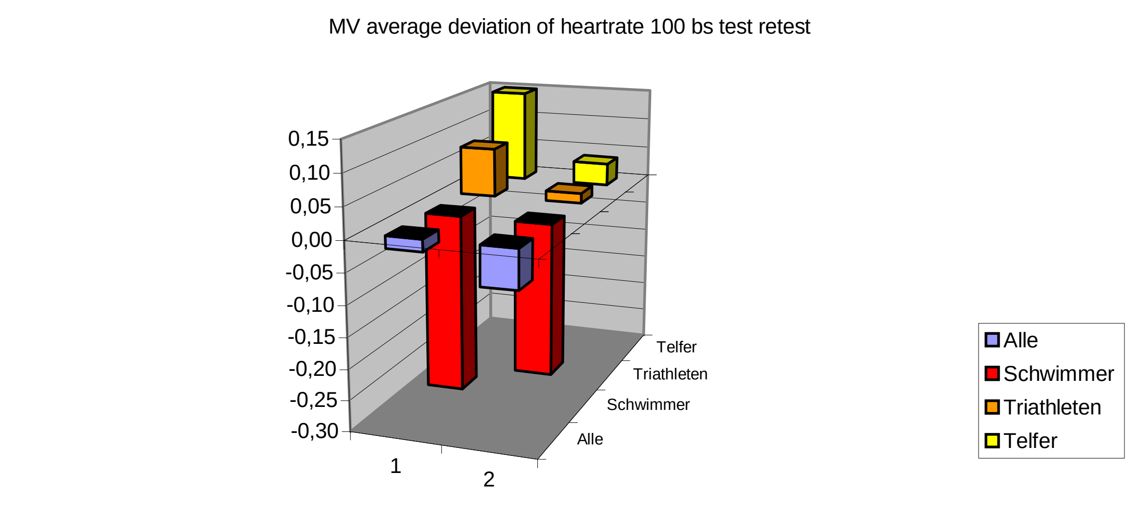
8.1.2.1 Average deviation of the swimming times bs 100 m



	1	2
Alle	-0,02	-0,06
Schwimmer	-0,29	-0,24
Triathleten	0,08	0,02
Telfer	0,15	0,04

As can be seen in the table the triathletes and Telfer swimmers have been able to improve their 100 m back stroke time moderately, the swimmers have considerably worse swimming times. So the total time also has worsened.

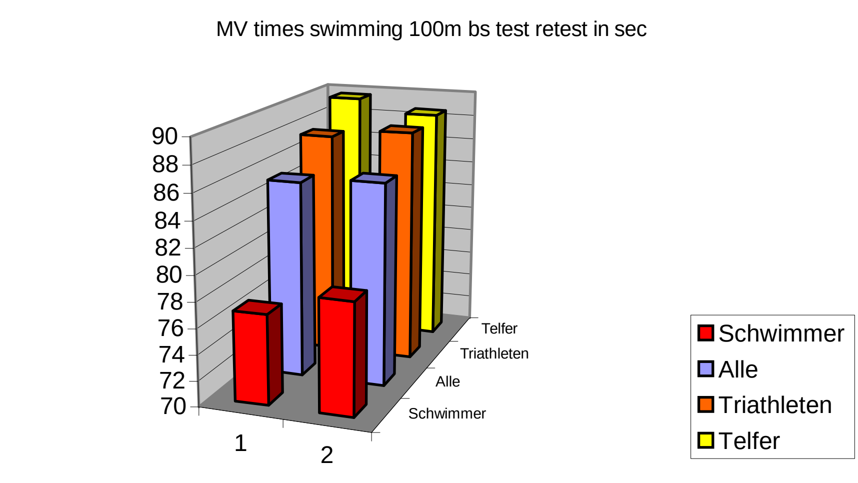
8.1.2.2 MV average deviation of heartrate 100 bs test retest



	1	2
Alle	-0,02	-0,06
Schwimmer	-0,29	-0,24
Triathleten	0,08	0,02
Telfer	0,15	0,04

The graphic shows that only the swimmers have higher heart rates in the retest compared to the test in the beginning. The overall group has improved.

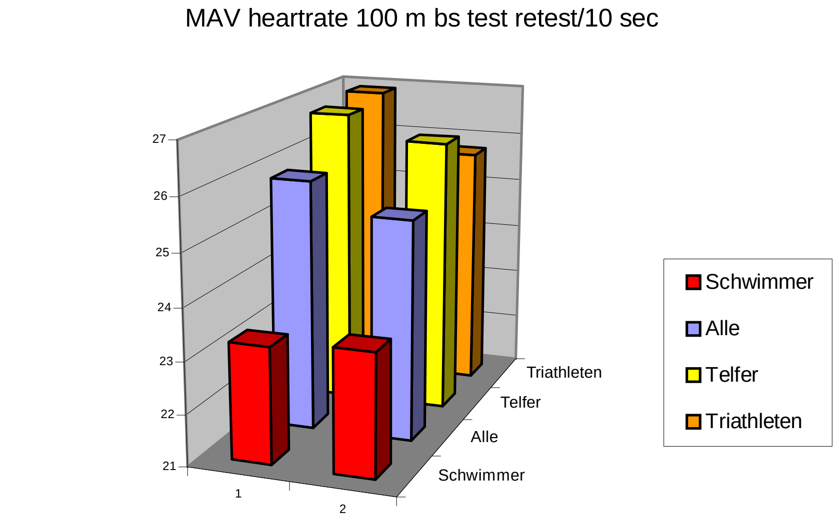
8.1.2.3 MV times swimming 100m bs test retest



	1	2
Schwimmer	76,99	78,72
Alle	85,30	85,76
Triathleten	87,59	88,30
Telfer	89,63	88,64

Both the swimmers and the Triathletes could not reach exactly the same time and clocked worse times. The Telfer swimmers, however, were able to lower their times.
The complete group swam 0.46 seconds slower.

8.1.2.4 MV heart rate 100 m bs test retest



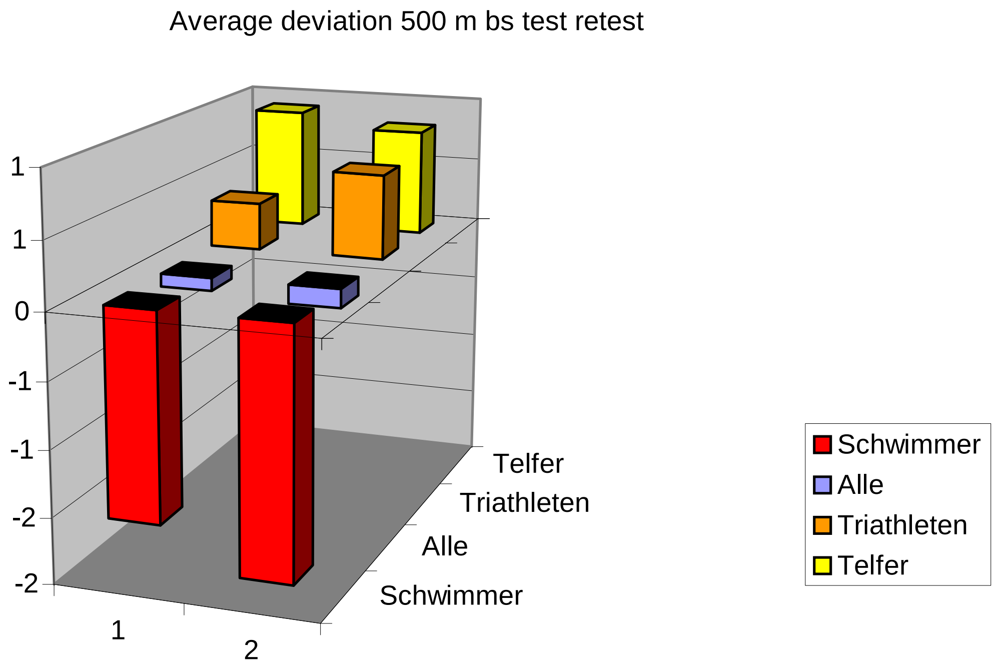
	1	2
Schwimmer	23,25	23,38
Alle	25,86	25,28
Telfer	26,78	26,33
Triathleten	26,92	25,75

The swimmers measured a slightly higher heart rate, whereas the rest of the group reduced their effort.
The complete group reduced their heart rate 0.59 beats per 10 seconds, which corresponds to 3.54 beats per minute.

8.1.2.5 Interpretation of the data average deviation 100 m bs

By the performance deterioration of the swimmers the minimal improvement in the two other groups is reduced slightly in the overall picture. Although in the back stroke a clearer improvement had to be expected compared to freestyle, the performance has remained approximately the same. Once again it is obvious that the Telfer obtained roughly the same time with a lowered pulse, which corresponds to a slight increase of performance.

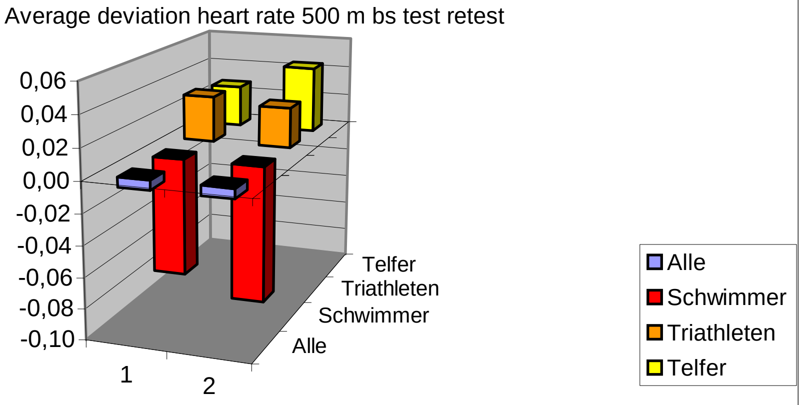
8.1.2.6 Average deviation 500 m bs test retest



	1	2
Schwimmer	-1,57	-1,88
Alle	-0,10	-0,14
Triathleten	0,36	0,65
Telfer	0,92	0,81

The swimming times of the swimmers are slightly better whereas those of the Telfer and primarily the triathletes turned out worse. The complete group has at the final count slightly improved.

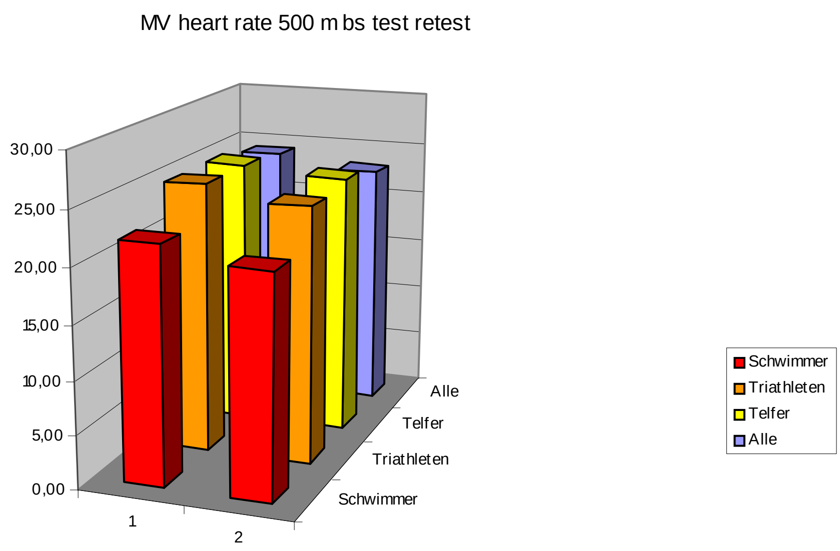
8.1.2.7 Average deviation heart rate 500 m bs test retest



	1	2
Alle	-0,01	-0,01
Schwimmer	-0,08	-0,09
Triathleten	0,03	0,03
Telfer	0,03	0,04

The values of the average deviation have remained approximately the same.

8.1.2.8 MV heart rate 500 m bs test retest



	1	2
Schwimmer	22,00	20,50
Triathleten	25,08	23,83
Telfer	25,00	24,33
Alle	24,21	23,07

The average pulse values have, however, fallen considerably. With the swimmers by 1.5 beats, the triathletes by 1.15 beats, the Telfer swimmers by 0.67

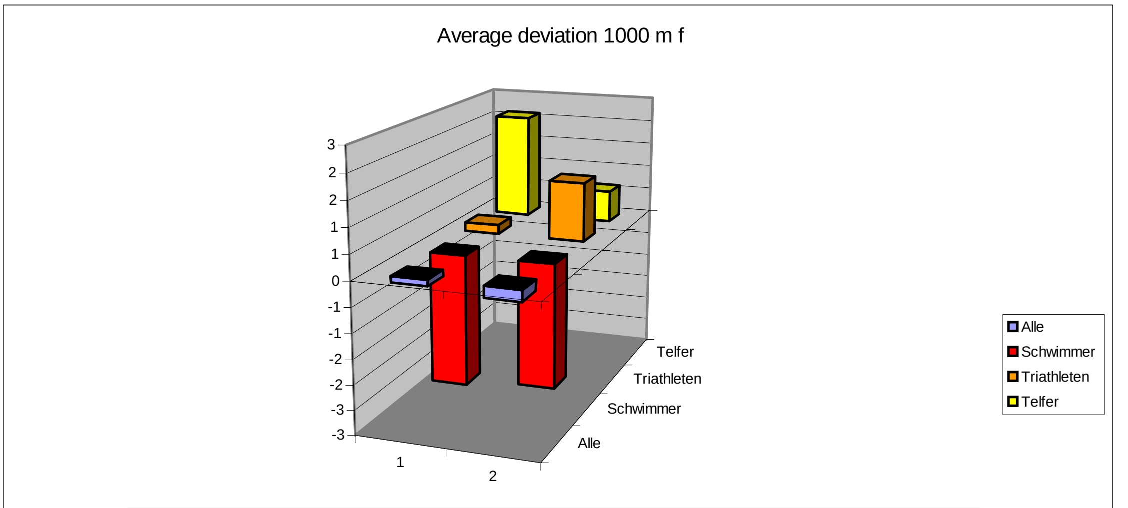
beats and with the complete group by 1.14 beats per 10 seconds, which corresponds to 6.84 heart rate beats per minute.

8.1.2.9 Interpretation of the data 500 m bs

If one compares the values of the swimming time and pulse rate, one recognizes that approximately similar times were reached which were achieved with lower heart rate values, though. In this case it’s fair to say that an increase of performance is highly significant with a value of 0.003.

8.1.3 1000 m freestyle

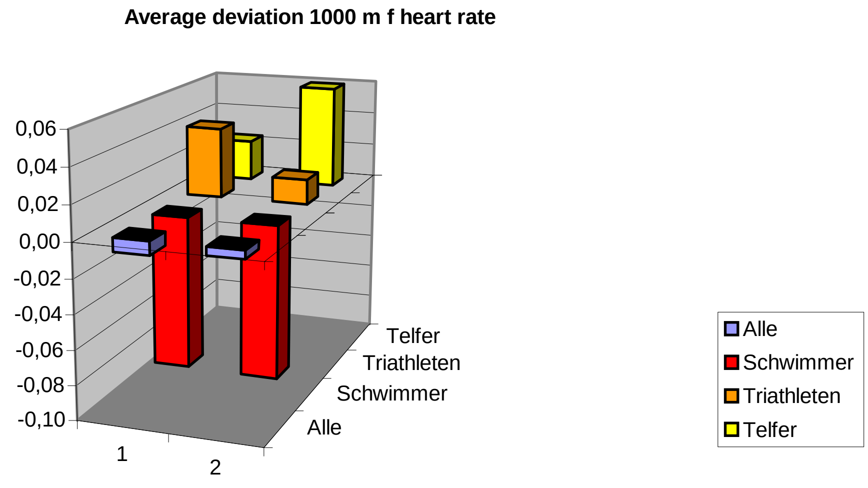
8.1.3.1 Average deviation 1000 m f



	1	2
Alle	-0,12	-0,23
Schwimmer	-2,66	-2,51
Triathleten	0,19	1,19
Telfer	2,12	0,64

The complete group reached improved times thanks to the improvement of the speed of the swimmers and primarily the time improvement of the Telfer swimmers. The swimming times the triathletes reached were, however, much slower.

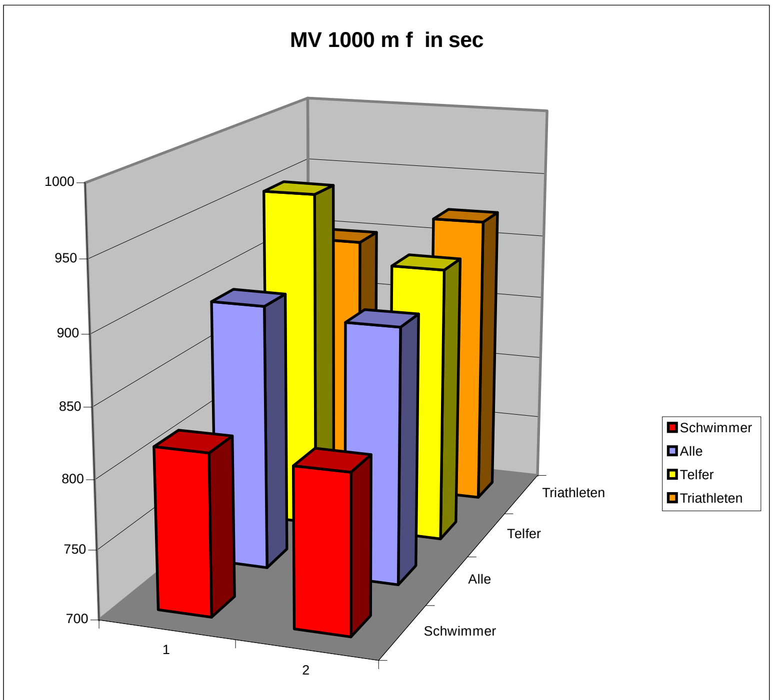
8.1.3.2 Average deviation 1000 m f heart rate



	1	2
Alle	-0,01	0,00
Schwimmer	-0,09	-0,09
Triathleten	0,04	0,01
Telfer	0,02	0,06

The pulse values of the swimmers remained the same, those of the triathletes fell and those of the Telfer rose, which led to similar result at the final count comparing test and retest.

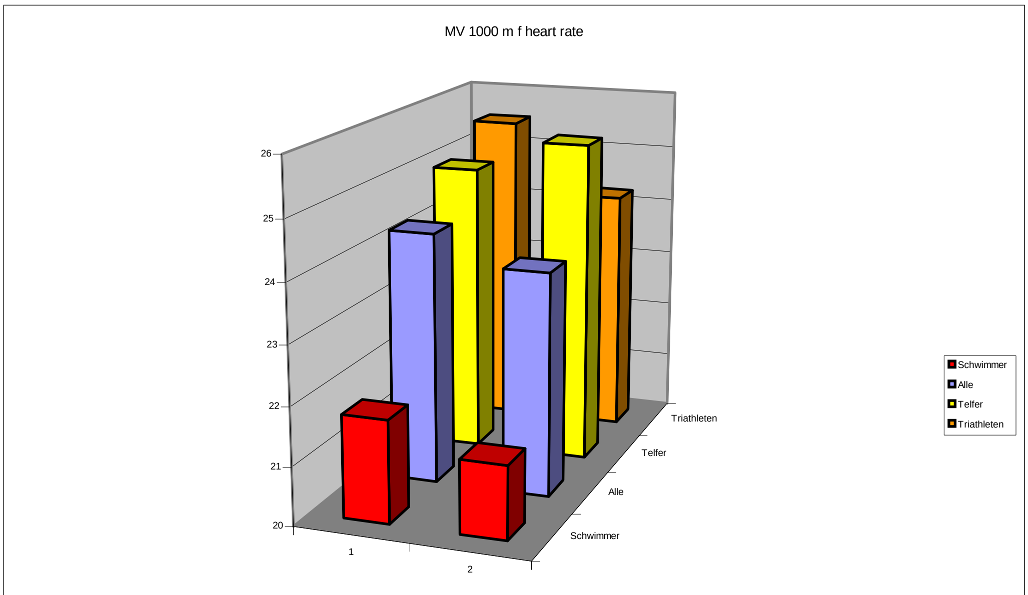
8.1.3.3 MV 1000 m f



	1	2
Schwimmer	817,00	815,04
Alle	894,09	887,81
Telfer	955,44	906,44
Triathleten	899,47	922,48

The swimming times on average have improved for the Telfer by 21 sec, those of the triathletes worsened by 23 sec while the swimmers improved by 2 seconds. The total time improved by 9 seconds.

8.1.3.4 MV 1000 m f heart rate



	1	2
Schwimmer	21,75	21,25
Alle	24,31	23,83
Telfer	25,00	25,56
Triathleten	25,50	24,25

The swimmers reduced their heart rate at the retest by 0.5 beats, the Telfer recorded 0.5 beats more and the triathletes recorded 0.75 beats less. The complete group had a reduction of 0.48 beats per 10 seconds, which is 2.88 beats less per minute.

8.1.3.5 Interpretation of the data 1000 m f

The complete group swam the 1000 m freestyle 9 seconds faster with 0.48 heart beats/10 seconds less. The swimmers have almost reached identical times with 0.5 heart beats less. The performance of the triathletes and Telfer remained approximately the same.

Again here it’s fair to say, cautiously, that there is an increase of performance without stating a statistical certainty for this.

9 Discussion

It seems beyond question that osteopathy has positive influences on mobility. All tests and analyses have quite impressively substantiated this. It was also nice that the swimmers have noticed this change to the same extent.

At the start of the study it was conspicuous that the athletes came more reluctantly than cooperatively to the introductory analysis, partially with considerable delay.

But then the treatment appointments were adhered to quite punctually and the young people were for the most part involved in the matter with full concentration, because they felt that osteopathy is something that can help them further.

As far as my personal expectation is concerned, I was very curious from the outset of the study when coming up with the hypothesis regarding performance improvement and improvement of technique.

According to my investigations, this has never been formulated in such a concrete manner, which was also somewhat daring.

As it turned out, the test profile for verification of performance improvement was also not selected very providentially, although 2 performance tests – over 100 m crawl and 500 m backstroke – rendered significant results.

According to my personal conviction, the 1,000 m crawl test also could have turned out significantly if the overall group would have swum about 6.28 seconds slower, since the pulse rate also would have been automatically lower as a result.

The aim was to swim the retest with the same time and then to see whether the pulse rate is lower. This seems to have been a very difficult guideline.

Possibly I would have had to require the athletes to swim with 100 % effort, which would only be practical to test with lactate measurements, and which would have been an enormous undertaking in terms of effort. The swimming tests took up about 2.5 hours time, whereas lactate performance tests one would have had to take up twice the amount of time. Apart from financial expenditure, being able to rent indoor swimming pools for a longer period of time is very difficult, because the schedule of swimming pool arrangement is very stringently organised.

Apart from that is the fact that these tests would have had to be conducted by a specially trained team, which would once again have been linked with a massive financial expenditure.

Another problem is the different training cycle of the individual groups.

The swimmers had their first week of training in the week between the 1^{st} and 2^{nd} treatment, in which they swam up to 40 km, and entered the 2^{nd} test somewhat tired as a result. Despite critical remarks, this is practically the only time of the year where all swimmers are available in a relatively rested state.

The Telfs swimmers had their adaptation week where no volume had been trained. This group had the optimal general setup, as it were.

On the other hand, the triathletes were exactly at their end of their competitive season and had their 1^{st} regeneration week. This group had no contact whatsoever with water, which is very difficult for a development of technique – apart from a conversion of an improved technique into performance.

In terms of time, 2 test groups had to be selected. The first 23 swimmers had their 1^{st} swimming tests on the day after their introductory examination on 10 September 2003. The retest was on Sunday, 21 September 2003. The 2^{nd} group

had their 1st swimming test on 21 September 2003 (for school reasons) and the retests on Tuesday, 30 September.
One swimmer from the group of elite performance swimmers was not able to participate in the swimming rest due to illness. All 30 test persons were able to duly carry out the mobility tests.
The significant result with regard to the development of technique was then encouraging. Surprisingly, the group of triathletes profited the most, especially with regard to 1,000 freestyle (crawl) swimming: 12 cm in pull stroke extension is an astounding result. It is not to be anticipated that the performance could not be improved to the same extent within 10 days, because a longer pull stroke is also linked with a greater effort, and this first has to be developed and cannot be achieved within a week.
As mentioned above, the triathletes had no contact with water, and consequently no increase of strength could be achieved, which also would not have been the aim of this study.
The critical point – time of the swimming tests – could still be stated.
Although I have every effort to conduct both tests in the afternoon or at the same time, this was not possible, since no other indoor swimming pool times were available.
It seems to substantiate the hypothesis that osteopathic treatments with up-and-coming swimmers and up-and-coming triathletes induce performance with regard to upper body rotation, arm reach and related improvement of technique.
The influence on performance could not be proven in any test.

Abstract

Clinically, osteopathic treatment on the adolescent swimmer improves torso rotation and arm reaching as well as improves technique and performance.

With swimmers doing freestyle and backstroke, torso rotation and arm reach is a limiting factor in execution of proper technique.

My osteopathic interest originates from the treatment of numerous patients with torso rotation restrictions.
In nearly all cases a massive rotation improvement was reached. The hypothesis of this thesis became clear that these results had to be proven experimentally.

Hypothesis

Clinically, osteopathic treatments on the adolescent high level swimmers and high performance triathletes improves torso rotation and arm reach as well as improves technique and performance.
With swimmers doing freestyle and backstroke, torso rotation and arm reaching is a limiting factor in execution of proper technique.

Design of the study

30 swimmers were evaluated by the osteopath initially for inclusion and exclusion criteria as well as for a profile of osteopathic lesions.
On the following day the tests for performance and technique took place. Once again on the following two days the athletes were treated osteopathically. Another 10 days later they were treated for half an hour again.

One day later the last test of performance and technique took place.

Criteria of inclusion

- Female and male swimmers between 15 and 18 years.

Criteria of exclusion

- fresh traumatic shoulder injuries
- swimmers with asthma
- swimmers with bronchitis
- prior history of hepatitis
- stomach ulcers and inflammatory conditions of the digestive tract
- congenital heart problems
- all swimmers who had received osteopathic treatment within the last 6 months.

Method of measuring

For the torso rotation

At 3 m height a strong light bulb was mounted.
On the floor, there was a round disc plate installed. The athlete had to stand on exactly defined points.
The 1st belt with a mounted pointer on it was placed right underneath the arms. The pointer was oriented on the midline of the sternum and the 2nd belt was mounted on the hips right underneath the SIPS. Both pointers shadows should have been in a congruent position. The projected shadow showed the amount of rotation. In this way one can read the total rotation of the body up to the shoulders and the rotation of the pelvis. A second person took over the measuring.
The measurements were compared before and after the first and second treatment. Each athlete was tested twice so that

overall 12 tests of torso rotation and 12 measurements of arm reach took place.
The athlete had to stretch the arm, on the side they rotated, vertically with the arm touching the ear, while the controlateral arm had to touch the body facing downward.

Arm reach test

The swimmer had to stand on tiptoes, the heels against the wall, to reach with the outstretched arm as far as possible on a measuring tape. This they would do in turn with the right arm and the left arm. The measurement was compared before and after the first treatment and before and after the second treatment.
A second independent person was responsible for the measurement.
Both tests had to be checked in a standardized procedure performed with 20 persons. A minimum of 0.95 of a correlation coefficient was reached.

Reliability tests were taken of all tests of flexibility (torso rotation, pelvis rotation, arm reaching) before the first treatment took place. On the 6 measurements a minimum of 0.90 was reached, which confirmed that the test has a high reliability.

Questionnaire due to flexibility

Additionally the athletes had to fill in a form, where the athletes had to evaluate their ability of flexibility on a scale from 1 to 5. They had to give their rating before and after the first treatment and after the second treatment.

For technique

Measurement was recorded of the length of each stroke during the 500 m backstroke and the 1000 m freestyle tests in order to prove that the torso rotation improves the length of each stroke. It was to be measured both times at the same point on the 500 m backstroke between 300 and 400 m, and on the freestyle between 500 m and 800 m.
The swimmers had to count arm cycles on the 25 m distance before the first treatment and after the second one.

For performance

Time measurements were taken for the 100 m and 1000 m freestyle as well as for the 100 m and 500 m backstroke. The swimmers were tested within a period of 10 days between measurements in order to exclude training improvements. Measurements were done on an electronic basis, comparable to an ordinary swimming competition.
The swimmers were requested to swim during both performance tests at the same speed. Due to improvement of technique on the one hand and an improvement in the economy of movement on the other hand I hoped to find a reduction of heart rate.

Examination results

Torso rotation

The statistical conclusion of the torso rotation to the right brought significant results between every single test and between the first and final testing.
In detail the whole group improved in the mean value to the right from 29.17° to 36.49° for an improvement of 7.32° and to the left from 28.85° to 35.04° for an improvement of 6.19°. To the right this is a increase of 21.35% and to the left an improvement of 17.86 %.

The results of the pelvic rotation didn’t show a significant statistical improvement as expected, because the athletes where not treated in this area.
It seems that osteopathic treatments confirm the hypotheses and osteopathic treatments improve torso rotation.

Arm reach

The statistical conclusion of the arm reach to the right and left gave significant results in the course of the measuring as well as after the final testing and between each measuring.
In detail the whole group improved in the mean value to the right from 225.54 cm to 226.69 cm for 1.15 cm and to the left from 225.79 cm to 226.83 cm for 1.04 cm.
Once again it seems that osteopathic treatments confirm the hypotheses and osteopathic treatment improve arm reach.

Questionnaire due to flexibility

The statistical conclusion shows highly significant results. The mean of the group showed a subjective improvement in flexibility from 3.28 points to 1.80 which means an improvement of 1.48 points.

Technique

The significant result of the test of arm cycles for the 25 m brought the following result. The whole group reduced their arm cycles from 8 to 7.2, which means a reduction of 0.8 cycles.
Measurement of the length of each stroke during the 500 m backstroke and the 1000 m backstroke tests, in order to prove that the torso rotation improves the length of each arm movement, brought the following results:

On the backstroke for the 500 m they improved their length from 150.88 cm to 152.80 cm which means an improvement of 2.34 cm.
And on freestyle the group improved on average from 244,86 cm to 248,74 cm an improvement of 3,88 cm.
To improve the arm reach by 2 or 3 cm does not seem so impressive. But when one knows that the swimmer invests about 40 strokes per minute on the 1000 m freestyle and swims a final time of 15 minutes this would be an improvement of 12 m or they save about 5 strokes.
The improvement of the length of the stroke was significant again.
Again, in this case it seems that osteopathic treatments confirm the hypotheses and osteopathic treatment improve technique.

Performance

100m freestyle

By comparing the mean value swimming time on the test and retest the overall group reached almost the same time. The second swimming time was only 0.78 seconds slower compared with the first but the heart rate proved to be quite a bit lower. On the retest the overall group had a 9.96 lower heart rate which is a highly significant improvement.

100m back stroke

The overall group swam 0.46 seconds slower on the 100 m backstroke distance. The same group was able to reduce the heart rate 0.59 beats per 10 seconds, which is a reduction of 3.54 beats per minute.
In this case I can subjectively cite a slight improvement of performance without giving statistical proof; the test of significance gave a result of 0.048 which is not significant.

500 m back stroke

As the overall group was able to swim the 500 m backstroke in both tests with almost the same speed, I was able to compare the heart rates of the two tests. The overall group was able to swim the retest with a 1.14 lower heart rate per 10 seconds which means a reduction of 6.84 beats per minute. Statistically the result is a significant improvement(0,003).

1000m freestyle

The overall group reached the goal of swimming similar times on the second performance test with a time of 6.28 seconds slower. But they had a 0.48 beats lower heart rate. In this case it’s fair to say there is an improvement of performance without giving statistical proof.

Conclusion

It seems that osteopathic treatments have significant positive influence on flexibility. All tests and research gave positive results.

It was also nice, that the group realized the improvement too and was able to give a proper feedback.

Very positive are the results concerning improvement of technique. The biggest improvement was reached surprisingly within the group of triathletes. They where able to improve the length of stroke for 12 cm on the 1000 m freestyle swim.

When all is said and done, it seems that osteopathic treatments have a significant positive influence on technique.

Concerning the performance tests it is nice to have an improvement being proved statistically with a significant improvement on the 100 m freestyle and 500 m backstroke distances. To be honest I had hoped to have clearer results.

It is on the other hand not surprising that they were not able to improve the state of their performances more. Usually a certain amount of training is necessary to improve the exertion factor to have benefit from the longer stroke and it is impossible to improve this within 10 days.

I had hoped that the swimmers would be able to swim more economically after the treatments, which would have been more impressive.

It seems to be evident that I was not very lucky with the testing profile for performance.

I’m personally convinced that the result of the 1000 m freestyle test would have been significant as well, if the overall group would have been able to swim the retest 6.28 seconds slower. Automatically the heart rate would have been lower as well.

The improvement of performance was not able to be proven statistically significant on the 100 m backstroke and the 1000 m freestyle distance. In both cases I can cite an improvement of performance without giving statistical proof.

It was the aim to swim both tests at the same speed to be able to compare the heart rate of the two tests. On the second test the heart rate should have been lower.

Possibly it would have been better to force the swimmers to swim at full speed. But to prove this it would have been necessary to make lactate acid tests.

The problem is that the swim test lasted about 2.5 hours. With lactate acid tests it would have lasted approximately twice as much time. From the logistic point of view this is almost impossible to get the swimming pool two times for such a long time because they are completely booked up.

What’s more, is that a team would have been necessary to make the blood tests, which would have been very expensive.

10 Appendix

10.1.1 Treatment methods

10.1.2 General osteopathic treatment

The superficial osteopathic lesions will be treated after a detailed anamnesis, without having to pay attention to the improvement of mobility and performance in this connection. These are above all compactions in the realm of sphenobasilar synchondrosis and the sacrum, ptoses of organs, non-physiological lesions without respect to axes; further non-physiological lesions without respect to axes, physiological lesions with respect to axes and diaphragms.

10.1.3 Special osteopathic treatment with focus of attention on pelvis, thorax, diaphragm and organs

The following approach represents only one extract of which had actually been applied in treatment techniques.

10.1.3.1 Osseous structures and joints with parietal lesions

❖ ISJ

- Sacral lesion L/L

Direct parietal technique according to Druelle (1998).
The patient lies on his axis.
The therapist stands in front of the patient, between the patient’s legs. The patient’s right leg rests on the therapist’s upper leg, in that position where the sacrum is reached.

The therapist's left hand is at the height of the posterior superior iliac spine, perpendicular to the hipbone, the elbow in extension of the arm. The right hand is on the patient's hand, on his side.
The head is extended with a view to the ceiling.
Find the balance, rock the patient back and forth.
The patient is rolled posterior for so far until this movement posteriorises the right sacral base.
Build up tension until shortly before the articular barrier.
The lower leg has to be stretched.
The hipbone is adjusted to the anterior.
The therapist's pelvis is utilised as a "3rd hand"; from the pelvis comes the downward thrust or the thrust from the knees as soon as the passage has been found.
The impulse occurs at the height of the pelvis with the entire body during the expiration after a deep inspiration.

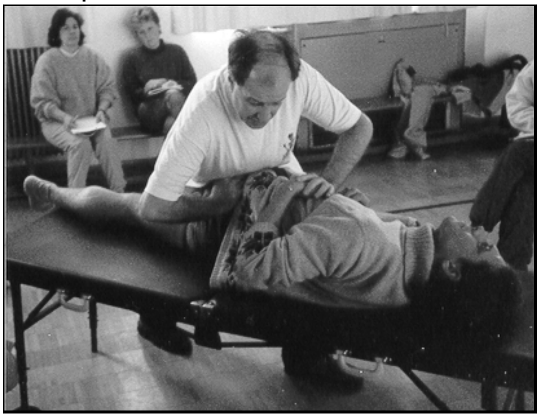


Illustration 29: Treatment of ISJ sacral lesion L/L from Druelle 1998

- Sacral lesion s L/R

Direct structural technique according to Druelle et al.
The patient lies once again on his axis, on the left side.
The therapist stands in front of the patient, between the patient's legs. The patient's right leg rests on the therapist's upper leg, in that position where the sacrum is reached.
The therapist's left hand is at the height of the sacral base, perpendicular to the hipbone, the elbow in extension of the arm. The right hand, utilised as a thumb-forefinger forceps, grasps the spinous process from L_5.
The head is extended with a view to the ceiling.

The patient is rolled so far to the right until this movement arrives at L_5.
Build up tension until shortly before the articular barrier.
The lower leg has to be stretched.
The pelvis is turned to the left. The anterior pelvic region is oriented as much a possible in the direction of the floor. The impulse occurs at the height of the pelvis with the entire body during the expiration after a deep inspiration.

❖ Spinal column

- Mid thoracic spine “polyvalent technique”

Direct technique according to Druelle (1999).

Patient sits on a couch, hands folded in the back of the neck and elbows together.
Therapist stands on the side, forearm on the elbows; other hand in a soft position on the thoracic spine, legs in a striding position (front foot at the height of the hand under the thoracic spine).
Take the patient in the entire volume, go into ‘resort’.

Pass under the thoracic spine up to the hand; once again build up tension; in which case I bring the forearm from supination somewhat into pronation, and extend my upper arm like an impulse across the front leg – wave-like movement (dorsal/cranial and ventral direction) with supination.

Illustration 30: Polyvalent technique for thoracic spine phase I+II Druelle 1999

- ARS_{li} Th_9 structural
- Direct technique according to Druelle (1999).

The therapist stands on the patient’s left side and lays the ball of the thumb (thenar) on the left hand (or hypothenar if the therapist stands on the right) on the transverse muscle. The therapist lays the hypothenar on the transverse muscle of the opposite side, caudal (in order to avoid a continuation of the correction).
The other forearm is placed on the elbows of the arms folded behind the head, and the patient bends slightly to the right.
Unroll the spinal column.
Impulse in the direction of the correction.
The left transverse muscle is brought into an anterior position through the ball of the thumb, and into a posterior position through the downward rolling of the vertebra.
Afterwards, employ the groove technique on the other side.

Illustration 31: ARS_{li} Th_9 1.+ 2. phase Druelle 1999

- PRS_{li} Th_5 structural

Direct technique according to Colfort (2000).
With a left facet which is blocked in closure, it is convenient to stand on the other side of the lesion.
Place the ball of the small finger on the left facet, or stand on the lesion side and place the ball of the thumb.
Adjust the lateral inclination to the right and rotation to the right.
The emphasis on the opening of the respective facet is important with this technique.
Afterwards, employ the groove technique on the other side.

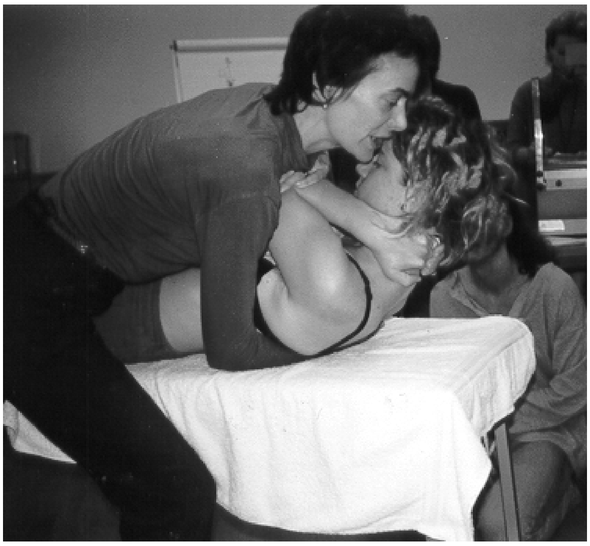


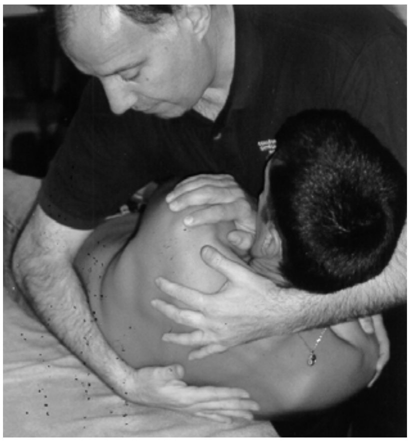
Illustration 32: PRS $_{li}$ from Colfort 2000

❖ Ribs

- Clean up ribs on the left side

Direct technique according to Druelle (1999).

General technique in order to treat costal joints



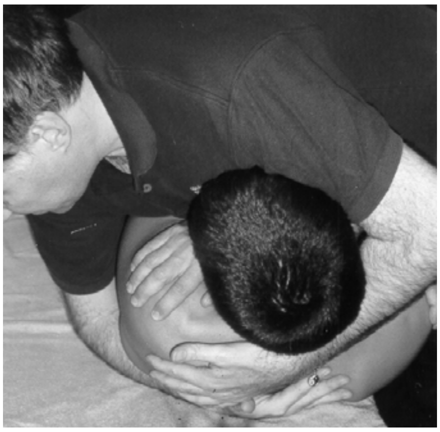


Illustration 33: Cleanup phase I & II from Druelle 1999

The patient’s left leg is placed across the right leg.

The patient’s right arm is placed on the left shoulder, while the left arm is placed on the right shoulder. The therapist stands on the right side, takes the upper body by supporting the head, and makes a lateral inclination to the right. The ball of the thumb on the left hand is placed paravertebral to the rib heads. The patient is then rhythmically swayed leftward by means of these balls of the thumb, in which case the therapist’s breast transfers a gentle impulse – which comes from the therapist’s legs – in the direction of the base support.

- Posterior rib, structural
- Direct technique according to Druelle (1999).

Posterior rib, above or below

Patient sits in an upright sitting position: back upright, feet in dorsal reflections, hands folded in the back of the neck. Therapist stands on the opposite side of the lesion, proceeds with the hypothenar to the posterior rib. Lay the other arm on the patient’s elbows.

Breathe in, bring the elbow down, and unroll down to the rib. Adjust the greatest rigidity via lateral inclination and the elbows. (If the left rib protrudes, the lateral inclination to the left will be more rigid).

Employ a more energetic impulse in a wave movement in the direction of the base support.

Then employ polyvalent technique/groove technique on the other side (starting position with upright posture is okay; dorsally reflected feet).

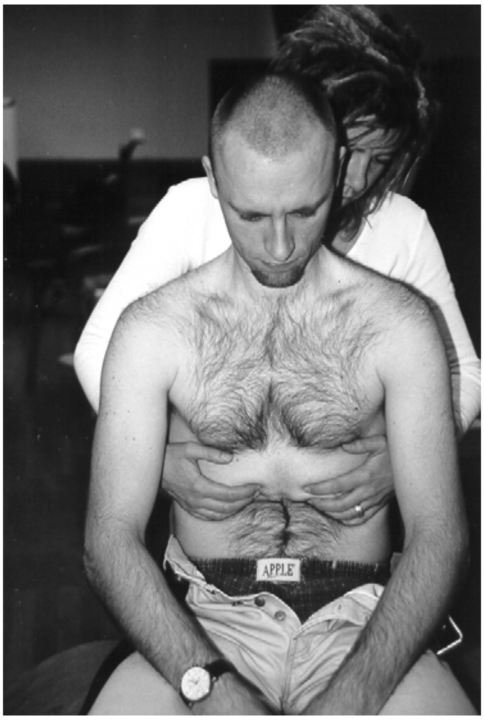
10.1.3.2 Muscles

- Diaphragm
- Fascial work according to Druelle (1999).

Patient sits on ischiadic stools.

The therapist stands behind the patient and places his hands on the anterior costal arches. Take the ring of the breast and proceed with the fingers into the depth, and upwards towards the diaphragm. Bring the entire torso in a ventral and dorsal direction, and with the exhalation proceed increasingly in-depth towards the central tendon (of the diaphragm).

Accumulate all parameters in the lightness.



Then also adjust the spinal column; as the need arises, ventral, dorsal, to the side; also accumulate rotation in lightness.
Adjust the head, in order to optimally centre on the central tendon via pharyngoprevertebral fascia.
Adjust balance point, wait on still point. End with deep inhalation and exhalation, and conclude with circumductions.

Illustration 34: Functional diaphragm from Druelle 1999

- Abdominal muscles for torso rotation

Muscle energy technique according to Goyenetche (2001).
Place patient in the “lumbar roll position”.
Position the patient varyingly in order to reach the various fibre paths.

- Oblique muscles, proceeding from above and behind to forward and below (e.g. external oblique muscle of the abdomen)

Bend the patient’s upper leg and roll the shoulder girdle in a posterior direction. Roll the pelvis further in an anterior direction with the caudal arm, whereas the cranial arm (under the patient’s fixated forearms) brings the upper body further in a posterior direction.
Strain the patient in a ventral direction with the shoulder girdle, whereas the pelvic girdle builds up tension in a posterior direction. Relax after 4 seconds; the therapist adjusts in the newly acquired range of movement. Repeat 3-4 times.

- Straight lateral portion

Place the patient once again in the same position on the side, with a pad stowed underneath. The therapist’s caudal forearm builds up tension with a caudal grip on the iliac crest. The cranial arm builds up tension with cranial extension on the rib cage. Improve the range of movement according to the principles of muscle energy technique.

- Oblique muscles, proceeding from below and forward to above and behind

Bend the patient's lower leg; leave the upper leg stretched. Roll the pelvis to the rear, whereas the upper body is rolled forward. The arms (placed again on the side) once again move apart from each other, according to the principles of muscle energy technique.

10.1.3.3 Fasciae

- Endothoracic fascia

Fascial work according to Colfort (2000).

- Anterior portion

“Lumbar roll position”: lateral position, legs bent

Place arms on the thoracic cage. Turn shoulder girdle backwards.

Proceed in-depth; 50-50 tension build-up, and wait on the release with direct adjustment.

Illustration 35: Anterior fascial region; Variation 1 from Colfort 2000

See above with regard to starting position: only with legs stretched, crossing over each other, hands on top of each other on the side.

Proceed in the anterior portion of the thorax with both forearms in a reciprocal tensional relationship.

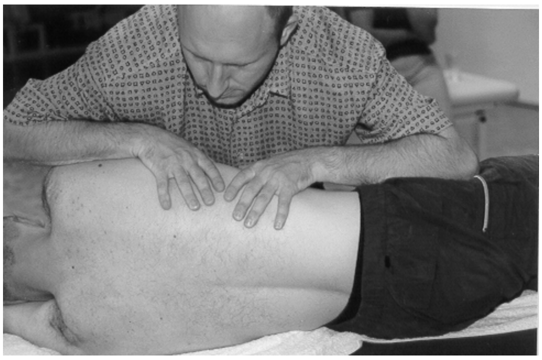


Illustration 36: Anterior fascial region; Variation 2 from Colfort 2000

- Posterior fascial portion

Starting position same as above: place both hands on the rigid thoracic region.
Test all parameters in the container, and accumulate in the rigidity: lift, compression, shift upward/downward, roll forward/backwards.
Wait for the relaxation.
Treat on several rigid positions.

10.1.3.4 Treatment of the fascial conditions of the viscera

- Organs cranial the diaphragm and their adhesions
  - Treatment of phrenicopericardial ligaments according to Druelle (2003).

Patient lies in a supine position with legs bent, therapist on the right side.
Place the caudal hand with the edge of the little finger on the diaphragm in the 5th intercostals space, classic cranial position on the heart in the direction of the axis.
Feel the heart in volume.
It is really important to work in the 2nd feather region in the heart. If one has to bend forward, a feather region has to be there.
If a zone is more rigid, the central fulcrum is visualised and the rigid position is compensated (tension build-up between more rigid region and fulcrum).
Still point – release; go out with inhalation

Illustration 37: Phrenicopericardial liggaments from Druelle (2003)

- Global reciprocal tension build-up for pleura, according to Cies (2002).

Patient lies in supine position.
Raise pleura above arm in elevation and lower the bent knee in opposite direction.
Therapist stands at the side of the lowered knee.
Cross hands at the lower hemithorax, otherwise to the side of the head or also on the arm.
With the accelerated exhalation one tests rather the costal and cervical pleura, with accelerated inspiration rather the diaphragmatic portion and the costodiaphragmatic recess.
Evaluate which portion has more tension.
Build up tension between the hands.

Work with accelerated respiration.
Continue with the exhalation, hold back with the inspiration.
Repeat 4-6 times and/or also work with rebound/pumping.

Illustration 38: lobal reciprocal tension build-up for pleura from Cies (2002)

- rgans caudal the diaphragm and their adhesions
  - Treatment of the right triangular ligament (of the liver), according to LaFrance (2001).

Patient sits on the tubers. Therapist stands posterior on the left, behind the patient. Localisation is more posterior/lateral, very wide right lateral.

Lift the lever until tension of the ligament is achieved. .

The patient makes a lateral inclination to the left, in order to bring it even higher. Then one holds the liver above with the fixed point of the finger, and allows the patient to make a lateral inclination to the right and rotation to the left (small movement). As a result, I hold the liver firmly and build up the tension of the ligament via the movement of the thoracic cage.

Illustration 39: Treatment of the right triangular ligament of the liver from LaFrance 2001

- Treatment of the left triangular ligament (of the liver), according to LaFrance (2001).

Proceed to the left aspect of the liver, slightly to the left of the xiphoid process.

Lift the liver.

Then make a lateral inclination to the left and rotation to the right.

See above for the rest of the treatment.

Illustration 40: Treatment of the left triangular ligament (of the liver) from LaFrance (2001)

- Treatment of the greater omentum, according to Laette (2001).

Patient sits in the “rider’s position”.

Therapist stands behind the patient with a towel stowed below.

Bring patient into kyphosis.

Go deeper via torso rotation to the right.

Then rotate the torso to the left, until the greater omentum comes under tension. Do not lose the stomach!

Allow the patient to cough and continue.

Repeat a few times.

Illustration 41: Normalisation of the greater omentum in sitting position, from Laette (2001)

11 On-due dates at the anamnesis

During the survey of the anamnesis it was conspicuous that from the 30 swimmers, 20 (60 %) had some kind of osteoarticular lesion in the region Th_{7-9}, and 18 athletes (54 %) had a lesion in the head joint region.

From my point of view, the thoracic spine – especially in the region of Th_9 – could possibly be so massively burdened because this is the myofascial vertebra. Within one arm movement when crawling, the arm and the leg on the opposite side make a countermovement so that a tension of the entire body comes about. All other vertebra will be fully mobilised, as it were, whereas the vertebra around the 9^{th} thoracic vertebra remain relatively stable.

On the other hand, I could imagine that through the forward movement in a medium that offers no resistance, swimmers employ the conscious point in their spinal column as a fixed point.

In turn, the head joints – and in particular here the axis – will probably be strongly overstrained through the constant rotational motion in the crawl movement, and thus possibly develop into a lesion in the long run.

It was also conspicuous that these lesions were not to be found amongst the very muscular athletes.

Declaration in lieu of an oath

I hereby declare that I have written this submitted master thesis on my own. All passages that have been taken literally or roughly from another person’s work, whether it be published or unpublished, have been marked as such. All sources and aids that I have used for this are indicated. No thesis of the same content has previously been presented to any other another examination authority.

------------------   ------------------------

Date   Signature

Infobogen männlich

Name:___________________________________ Datum 1:__________

Geb-Datum:________________ Datum 2:__________

Sportart:_________________

Trainingseinheiten pro Woche:______

Akute Schmerzen wo:____

Bewegungseinschränkungen:__________________________________ _

Bewertung der Beweglichkeit vor 1. Behandlung:

1 2 3 4 5 1 sehr gut

2 gut usw.

Bewertung der Beweglichkeit nach 1. Behandlung:

1 2 3 4 5

Bewertung der Beweglichkeit nach 2. Behandlung:

1 2 3 4 5

Infobogen weiblich

Name:___________________________________ Datum 1:__________

Geb-Datum:________________ Datum 2:__________

Tag der 1. Regelblutung wann:_________________

Sportart:_________________

Trainingseinheiten pro Woche:______

Akute Schmerzen wo:____

Bewegungseinschränkungen:__________________________________

Bewertung der Beweglichkeit vor 1. Behandlung:

1 2 3 4 5 1 sehr gut

2 gut usw.

Bewertung der Beweglichkeit nach 1. Behandlung:

1 2 3 4 5

Bewertung der Beweglichkeit nach 2. Behandlung:

1 2 3 4 5

Teilnahmeerlaubnis und Termine

Ich erlaube meiner/m Tochter/Sohn

____

an der Osteopathiestudie von Wolfgang Kattnig teilzunehmen. Die Untersuchung und Behandlung wird nach den Grundsätzen des Deutschen Osteopathiekolleg durchgeführt.

Eingangsuntersuchung

____

1.Behandlung____

2.Behandlung____

Unterschrift des Erziehungsberechtigten

____

Ich Bitte darum spätestens 15 min vor der Behandlung anwesend zu sein, weil dort die Rotationsmessungen und Armreichweitemessungen stattfinden. Nachdem im Anschluss an Eingangsuntersuchung und Behandlungen Kontrollmessungen durchgeführt werden muss mit je 1 Stunde Zeitaufwand gerechnet werden.
Von Innsbruck aus ist meine Praxis mit der IVB Linie D leicht zu erreichen. Die Haltestelle ist „Absam Dorf Mitte“. Meine Praxis befindet sich direkt schräg gegenüber im Haus der Apotheke mit Eingang nordseitig. Die Anfahrzeit vom Marktgraben aus ist ungefähr mit 25 min zu veranschlagen.

Herzlichen Dank im Voraus
Euer Wolfgang

Liebe Schwimmer/innen! Absam, am 03.09.03

Liebe Eltern!

Mein Name ist Wolfgang Kattnig. Über 10 Jahre lang war ich Triathlonprofi. Dadurch habe ich ein gewisses Naheverhältnis zum Schwimmsport aufgebaut.
Nach meiner Ausbildung zum Physiotherapeuten 1998 konnte ich Anfang Juli die 5-jährige berufsbegleitende Ausbildung zum Osteopathen erfolgreich abschließen.

Was ist Osteopathie in kurzen Worten?

OSTEO = Struktur (ursprünglich Griechisch)
PATHOS = Ausdruck
Das Gewebe drückt über Spannungen der Struktur seine Funktion/Funktionsstörungen aus.

- Genaue Anamnese (Befunderhebung) und Untersuchung ist Voraussetzung für eine osteopathische Behandlung.
- Ganzheitliche Methode, die sich für Diagnostik (Untersuchung) und Therapie der Hände bedient.
- Ganzheitlich bedeutet, dass Ursachen gesucht und nicht Symptome behandelt werden. Gesucht wird in der Einheit des gesamten Menschen, nicht nur im Körper.

Mit dem Absolvieren der 1500 Stunden umfassenden Ausbildung ist es aber noch nicht genug.

Um auch den Titel eines Diplom Osteopathen tragen zu dürfen bin ich verpflichtet eine sogenannte These - was einer Diplomarbeit entspricht – durchzuführen.

Da musste ja noch etwas kommen!!

Um diese These durchführen zu können, muss ich auf eure Unterstützung zählen.
Ihr stellt mir eure kostbare Zeit zur Verfügung, dafür bekommt ihr eine eingehende Untersuchung inklusive 2 Behandlungen – selbstverständlich kostenlos.

Wie sieht diese Studie aus?
Meine Hypothese läuft darauf hinaus, dass ich beweisen will, dass mit Hilfe von osteopathischen Behandlungen die Oberkörperrotation, die Armreichweite und in weiterer Folge die Leistung bzw. Technik positiv beeinflussen lassen.

Wie soll dies funktionieren?
30 Schwimmer und Schwimmerinnen werden von mir untersucht.
Im Zuge der Untersuchung wird das Rotationsvermögen und die Armreichweite gemessen.
Danach werden noch genauer zu definierende Leistungstests und Techniktest in den Schwimmlagen Kraul und Rückenkraul erhoben.
Im Anschluss an die 1. und 2. Behandlung werden jeweils erneut Rotation und Armreichweite erhoben.
Zum Abschluss wird erneut ein Leistungstest und Techniktest durchgeführt.
Im Idealfall sollten sich alle erhobenen Daten verbessern.

Zum Schluss kann ich nur hoffen, dass ich auf eure Kooperation zählen kann. Sollten noch irgendwelche Fragen bestehen stehe ich selbstverständlich gerne zur Verfügung unter der Telefonnummer 05223/55932.

Mit sportlichen Grüßen
Euer Wolfgang

12 Illustration list

13Tables

Nr	Name	Oberkörperrotation: 1.Test 1.Versuch				1.Test 2.Versuch				2.Test 1.Versuch				2.Test 2.Versuch				Armreichlänge: 1.Test				2.Test			
		re B	re H	li B	li H	re B	re H	li B	li H	re B	re H	li B	li H	re B	re H	li B	li H	re	li	re	li	re	li	re	li
1.	Kattnig E.	90	65	90	55	90	70	90	55	91	66	91	57	91	73	90	57	187	188	187	188	187	187	187	188
2.	Kattnig M.	89	71	89	60	90	65	95	70	90	73	88	60	90	61	90	65	199	200	200	201	199	200	199	201
3.	Kattnig Ch.	66	45	61	49	70	56	49	61	70	48	65	55	68	50	63	56	212	212	212	212	212	212	212	212
4.	Kattnig H.	70	60	80	60	69	63	82	62	75	66	85	65	75	66	84	71	216	218	218	218	216	216	217	217
5.	Kattnig U.	87	62	73	57	92	68	77	55	88	64	74	59	89	62	77	57	232	232	232	232	232	232	232	232
6.	Garzaner A.	80	47	81	53	78	45	88	62	82	50	83	56	80	58	85	60	236	238	236	238	236	238	236	238
7.	Bierlein C.	92	68	105	70	92	75	95	75	92	75	95	75	90	71	93	72	215	213	214	214	215	213	214	214
8.	Schroll R.	52	43	41	37	48	38	43	39	55	45	41	38	52	46	55	38	233	233	234	234	234	233	234	233
9.	Garzaner S.	70	62	81	60	69	65	82	64	73	66	82	65	71	64	80	73	216	218	218	218	216	216	218	217
10.	Mayer J.	85	60	78	57	90	66	79	59	88	60	74	60	89	62	77	57	232	232	232	232	232	232	232	232
11.	Heiss W.	77	45	77	50	78	58	85	62	82	50	83	56	78	65	82	65	236	238	236	238	236	238	236	238
12.	Kattnig W.	85	60	71	55	90	66	75	53	86	62	72	57	87	60	75	55	228	228	228	228	228	228	228	228
13.	Gradl M.	65	30	58	46	73	35	66	49	71	36	52	44	76	46	58	45	248	249	247	249	246	248	247	248
14.	Klotz A.	70	60	80	60	69	63	82	62	75	66	85	65	75	66	84	71	216	218	218	218	216	216	217	217
15.	Felder P.	92	68	105	70	92	75	95	75	92	75	95	75	90	71	93	72	215	213	214	214	215	213	214	214
16.	Felder D.	52	43	41	37	48	38	43	39	55	45	41	38	52	46	55	38	233	233	234	234	234	233	234	233
17.	Felder M.	88	62	75	57	92	68	77	55	88	64	74	59	90	62	77	57	232	232	232	232	232	232	232	232
18.	Felder G.	68	45	63	49	70	56	49	61	70	50	65	55	68	50	63	56	212	212	212	212	212	212	212	212
19.	Fischler L.	85	63	71	55	91	66	75	53	86	62	72	57	87	60	75	55	228	228	228	228	228	228	228	228
20.	Kattnig G.	65	45	58	46	73	40	68	45	71	48	52	44	74	46	58	45	248	249	247	249	246	248	247	248

14 Source list

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Auszug aus dem BWS I Kurs DRUELLE 12/1999

Auszug aus dem BWS II Kurs COLFORT 2/2000

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Auszug aus dem Magenkurs LAETT 9/2001

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