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Temporomandibular- and Hip joint
-
an osteopathic relation?

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Eidesstattliche Erklärung

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Abstract

Diese Masterarbeit beschäftigt sich damit, Zusammenhänge zwischen Dysfunktionen im kraniomandibulären Bereich und Bewegungseinschränkungen im Hüftgelenk zu überprüfen und mögliche Erklärungsansätze dafür zu erarbeiten.

In der Literatur wurde eine Beziehung zwischen Kiefer- und Hüftgelenk explizit noch nicht erwähnt, dennoch lassen manche Veröffentlichungen eine solche zwischen den beiden Gelenken erkennen. Durch das Mechanische Modell der Wirbelsäule nach John M. Littlejohn, durch die anatomischen Faszienketten und die „Anatomy Trains" (Myofasziale Membrane) nach Thomas W. Myers können Verbindungen hergestellt werden. Die Entwicklung der beiden Gelenke vollzieht sich unabhängig voneinander. Lediglich die Vaskularisierung erfolgt gemeinsam in der zehnten Gestationswoche.

Aus der Sicht der traditionell chinesischen Medizin liegen beide Gelenke am Gallenblasen- und Magenmeridian. Sie kennt jedoch keine exklusive Beziehung zwischen zwei Gelenken, sondern betrachtet einzelne Strukturen immer im Zusammenhang mit dem ganzen Körper.

Es wurden an 32 Patienten mit diagnostizierter kraniomandibulärer Dysfunktion (CMD) die Beweglichkeit der Hüftgelenke mittels Neutral-Null-Methode vermessen sowie der Patrick-Kubis-Test (kein spezifischer Hüfttest) und der Trendelenburg-Dychenne-Test durchgeführt. Bei 50 bis 66 % der Patienten konnte eine Abweichung der Hüftbeweglichkeit von der Norm festgestellt werden. 75 % der Patienten reagierten auf den Patrick-Kubis-Test und lediglich 12,5 % auf den Trendelenburg-Dychenne-Test positiv. Die Datenauswertung erbrachte keinen signifikanten Nachweis für eine Beziehung zwischen kraniomandibulärer Dysfunktion und der Hüftbeweglichkeit.

Damit konnte in dieser Arbeit weder ein wissenschaftlicher Nachweis für eine Verbindung beider Gelenke erbracht noch konnte diese Verbindung ausgeschlossen werden.

Abstract

This master's thesis deals with the verification of the potentially existing correlations between dysfunctions in the craniomandibular region and decreased range of movement in the hip joints. A further concern is to work out explanatory approaches for this assumption.

A correlation between the temporomandibular joint and the hip joint has not been extensively explored in literature, but some publications indicate a connection between these two joints. The connections can be explained using John M. Littlejohn's mechanic model of the spinal column and Thomas W. Myers' explanation of anatomical fascia chains and anatomy trains (myofascial membranes). The development of the two joints takes place independently, merely the vascularisation occurs jointly in the tenth week of pregnancy.

From the point of view of traditional Chinese medicine (TCM), both joints lie on the Gall bladder- and Stomach-meridian. TCM however, does not recognize an exclusive relation between two joints, but always regards single structures in correlation with the entire body.

The mobility of the hip joint was measured in 32 patients with diagnosed craniomandibular dysfunction (CMD) by means of the neutral-0-method, the Patrick-Kubis test (no specific hip test) and the Trendelenburg-Dychenne test. Deviant results could be detected in 50% to 66% of the patients. 75% of the patients reacted positively to the Patrick-Kubis-test, while the Trendelenburg-Dychenne-test had 12.5% positive results. Evaluation of the data failed to show any significant correlation between craniomandibular dysfunction and the mobility of the hip significantly.

Consequently, in this paper a correlation between the two joints could be neither significantly proven nor excluded.

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Abbreviations

Abbrev.	Abbreviations from the statistic tables
AWMF	Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaft
Bl	Bladder-Meridian
CMD	craniomandibulare dysfunction
CRL	Length between the cranium and cocyx
DFL	deep frontal line
GB	Gall Bladder-Meridian
He	Heart-Meridian
KI	Kiddy-Meridian
l	left
LI	Large Intestines-Meridian
Li	Liver-Meridian
Lu	Lung-Meridian
NN	Normal-0-Test
p/d	probable / definite deviation
Pe	Pericardium-Meridian
P-K-Test	Patrick-Kubis-Test
PM&R	Physical Medicine and Rehabilitation
r	Right
s.a.	sine anno
SD	standard deviation
SI	Small Intestines-Meridian
SJ	San-Jiao-Meridian
Sp	Spleen-Meridian
St	Stomach-Meridian
TCM	Taditional Chinese Medicine
TMJ	Temporomandibular-joint

1 Introduction

I have been working as a physiotherapist at the Vienna General Hospital since 1996. After four years of working on the wards, I transferred to the outpatient department within the hospital and joined the Physiotherapy and Rehabilitation Department. More than half (up to as much as 90% at times) of the patients I have been assigned in the past suffered with diagnosed problems of the temporomandibular joint. Patients are referred to our clinic via close interdisciplinary liaison between the dentistry, maxillo surgery and orthodontic departments based on mainly myogenous or postural specific components. I have found that approximately two thirds of the patients' problems could be attributed to craniomandibular dysfunction (CMD).
The results of my osteopathy examination almost exclusively indicated treatment approaches, which not only affected the temporomandibular joint. Judging from my subjective experience, I not only treated the vertebral column in many patients, but also the hip joints and had reflective success in the temporomandibular joints. This corresponded with the contents of teaching from my osteopath training, where there is a strong correlation between the temporomandibular joint and the hip joint. We learned, that the mandible corresponds to the leg, the temporomandibular joint corresponds to the hip joint and the occipitomastoid suture corresponds to the sacroiliac joint (Nusselein, 2003; Van Assche, 2005).

Consequently, my hypothesis is that restrictions in hip range of movement frequently occur in patients with craniomandibular dysfunction.

Within the scope of this Masters thesis, I would like to objectively review and discuss my personal experiences within the context of our teachings on the course, with the aim of being able to debate the matter within the interdisciplinary exchange of experiences. Furthermore, my paper should hopefully contribute to improving the diagnostics in patients with temporomandibular joint disorders. Scientifically proven interrelations between two joints permit the identification of causative influence and the faster development of treatment approaches.

This paper has a theoretical part (chapters 2 and 3) and an empirical part (chapters 4 and 5).

The theoretical part contains medically based principles and definitions (chapter 2) as well as potential explanatory approaches, which could indicate a correlation between the temporomandibular joint and the hip joint (chapter 3).

The following four explanatory approaches were chosen:
Body posture or dysfunctions in the spinal column are important parameters in the treatment of temporomandibular joint problems. Thus, in chapter 3.1 a connection between the temporomandibular and the hip joint is elaborated with respect to body posture. Chapter 3.1.1 deals with the correlation of the two joints (independently of each other) with the spinal column. Studies available in literature are linked to the subject matter of this paper. In chapter 3.1.2 a connection between the temporomandibular joint and the hip joint is retraced in Littlejohn's much cited force model.

In my practical work with patients with temporomandibular disorders, I frequently use fascial or myofascial treatment techniques, which often produce fast and positive effects. This observation will be discussed in chapter 3.2 with reference to the temporomandibular joint and hip joint. For that purpose anatomical fascia structures (chapter 3.2.1) and myofascial chains in terms of myofascial meridians (chapter 3.2.2) will be considered.
Chapter 3.3 deals with the development of the temporomandibular joint and the hip joint. In addition, the development processes of both joints will be described, critical developmental stages will be contrasted and potential, coupled deviations of the norm will be shown or excluded.
The term 'somatotopy' refers to the presentation of the total organism on one part of its surface. The above mentioned somatotopic relation between temporomandibular joint and hip joint cannot be found, neither in the homunculus[1], nor the foot reflex zone or auricular, oral or occipital acupuncture areas (Gleditsch, 2005, 1; 34ff; 38; 49ff; 73ff). Acupuncture connects to traditional Chinese medicine. In chapter 3.4, a potential correlation between the temporomandibular joint and hip joint from the point of view of traditional Chinese medicine (TCM) will be established.

The choice of these four different explanatory approaches has been discussed previously and is only one part of many possible approaches. Neuroanatomical correlations, irritations

[1] Homunculus: schematic presentation of the cortical representation of motor and dermatomes (Pschyrembel, 1994, 658)

of the dura mater or position of the cranial bone in proportion to the pelvis among other things remain unconsidered.
The empirical part of this paper contains the methods (chapter 4) and results (chapter 5) of my clinical study, thus allowing me to draw conclusions about the hip mobility in patients with temporomandibular joint problems.
The hip joints were investigated in 32 patients with CMD (for selection criteria cf. chapter 4.1) were measured using the neutral-0-method, the Patrick-Kumis test and the Trendelenburg-Duchenne test (chapter 4.2).

Results were predominantly analysed using the methods as listed in chapter 4.3.

The results of this analysis will be dealt with in chapter 5. The results of the anamnestically evaluated data (chapter 5.1), the results of the Patrick-Kubis test (chapter 5.3) and the results of the Trendelenburg-Duchenne test (chapter 5.4) are given in nominal and percentage values. The descriptive characteristic values of the results using the neutral-0-method (minimum, maximum, mean value, standard deviation, median) will be contrasted with the limitations of normal mobility in chapter 5.2. The results of the neutral-0-method will be compared with those of the spinal column data in chapter 5.5 and with those of the Patrick-Kubis-test in chapter 5.6.
Chapter 5.7 deals with the question whether there is an accordance of the sides of the body with the affected temporomandibular and hip joint. Chapter 5.8 contains the summary of the results.

Chapter 6 closes with a discussion about the results of this paper and indicates outstanding or newly apparent questions.

2 Medical basics

On investigating the potential correlation between the temporomandibular joint and the hip joint, it is necessary to look at these joints in isolation from each other. In this chapter their individual anatomy, connections to the circumjacent structures of both joints and pathophysiology will be described.

2.1 Temporomandibular joint

In its function the temporomandibular joint is directly connected to ingestion (mastication, deglutition, lactation) and indirectly connected to articulation (speaking, singing), facial expression and respiration (Liem 2000, 255). The two temporomandibular joints build a functional entity with the masticatory apparatus.

The masticatory apparatus consists of the mandibular bone, the masticatory muscles including its nerves and vessels, as well as the teeth and the parodontium (Rauber, Kopsch 1998, 730).

2.1.1 Anatomy

The osseous structures of the temporomandibular joint are composed of the mandibular head, the articular cavity and the articular tuberculum. Both articular cavity and articular tuberculum are part of the external base of the skull, the squamous bone. In contrast to other joints, the articular surface of the head of mandible and that of the temporal bone are coated with fibrous cartilage and not with hyaline cartilage.

The mandibular fossa is twice or three times larger than the articular surface of the head of mandible (Rauber; Kopsch, 1998, 731). This missing conformity is called incongruity and is balanced by the articular disc, situated between the two articular surfaces.

The **head** forms part of the cylindrical end of the condylar process of the mandible. It is the anterior part of the head, which forms most of the articular surface. The posterior, smooth part lies in the joint capsule, but is not part of the joint (Liem 2000, 257). If the respective axes (axis of rotation) were lengthened through both heads, they would meet at the anterior aspect of the foramen magnum[2] of the occipital bone (Rauber, Kopsch, 1998, 731ff).

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[2] Foramen magnum: great occipital foramen

The **temporomandibular joint cavity** and the **articular tuberculum** form an s-shape in the sagittal plane. The inwardly and outwardly directed, concave part of the fossa joint passes forwardly into the saddle shaped tuberculum.

The mandibular fossa forms only the anterior part of the joint. The posterior part is situated outside of the joint capsule and is assigned to the pars tympanica[3] of the temporal bone (cf. Liem 2000, 258).

The **articular disc** is a biconcave articular disc, which is connected to the joint capsule peripherally. Thus, it divides the temporomandibular joint into an upper and a lower chamber and builds a functional articular cavity, which makes a combined rolling/sliding movement possible. Its function is to both influence the mobility and improve the pressure distribution in the temporomandibular joint.

The above part of the articular disc is attached to the petrosquamous fissure[4] and is involved in the posterior movement of the disc on adduction of the mandible joint. The lower, tighter part anchors the disc at the posterior surface of the mandibular head. This structure, also known as the disco-condylar ligament (Liem, 2000, 259) is essential for the coordination between both the disc and head during movement at the temperomandibular joint

The **joint capsule** encloses the joint and the articular tuberculum and has a loose sheath, which permits larger movements of the joint. It consists of an external and an internal capsule layer. The external layer is equipped with collagen fibres. The internal layer contains nerves, blood vessels, synovial cells and the synovia (Bumann, Lotzmann, 2000, 27).

The capsule is reinforced by ligaments on the inner side. On the medial side via the medial, sphenomandibular and the stylomandibular ligaments. The temporomandibular ligament is situated at the external side. The posterior section is firmly linked to the disc and is also called lateral collateral ligament (Liem 2000, 262). The anterior part of the capsule has a very lax connective tissue structure. Thus, anterior disc dislocation is often accompanied by an overexpansion of the anterior joint capsule (Bumann; Lotzmann, 2000, 26).

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[3] pars tympanica constitutes part of the external auditory meatus

[4] petrosquamous fissure is a part of the temporal bone.

The **ligaments of the masticatory apparatus** serve in stabilisation, initiating movement and limiting the range of motion. In literature numerous information can be found concerning both the number and nomenclature of these, details of which would far surpass the limits of this paper. In addition, to the previously mentioned ligament structures the following ligaments are described: Tanka-Ligament, pterygomandibular raphé, the anterior ligament of the malleus and the discomallear ligament (or Pinto's ligament). The last two ligaments also have a connection with the middle ear malleus (Bumann, Lotzmann, 2000, 28ff; Liem, 2000, 262).

The temporomandibular joint is supplied with **blood** via the maxillary artery and the superficial temporal artery. Both are branches of the external carotid artery. The venous outflow occurs via the superficial temporal vein and the maxillary and pterygoid plexus (Bumann, Lotzmann, 2000, 31).

The sensitive innervation of the temporomandibular joint occurs via the auriculotemporal, the masseteric and the temporal nerves, which are branches of the mandibular nerve. The sympathetic innervation occurs via the superior cervical ganglion, the ratio between the sympathetic and the sensory nerve fibres being 3:1 (Bumann, Lotzmann, 2000, 31f).

The temporalis, the masseter, the pterygoideus medialis and the pterygoideus lateralis muscles in the narrower sense belong to the masticatory musculature. The first three afore mentioned muscles are responsible for the jaw closure. The suprahyoid muscles, along with the pterygoideus lateralis form part of the muscle group responsible for jaw opening. However the pterygoideus lateralis, with its different parts is active in all movements of the mandible. Furthermore the fibres of the pterygoideus lateralis radiate into the disco-capsular complex, and thus have an important function in the 'harmonising the movement' between the three joints (Bumann, Lotzmann, 2000, 33ff).

The digastricus, mylohyoideus, geniohyoideus and the stylohyoideus form part of the suprahyoidal musculature. These muscles connect the hyoid with the mandible and the processus styloideus of the temporal bone. Thus establishing an immediate connection between the anterior structures of the neck and the subcranium (Bumann, Lotzmann, 2000, 37).

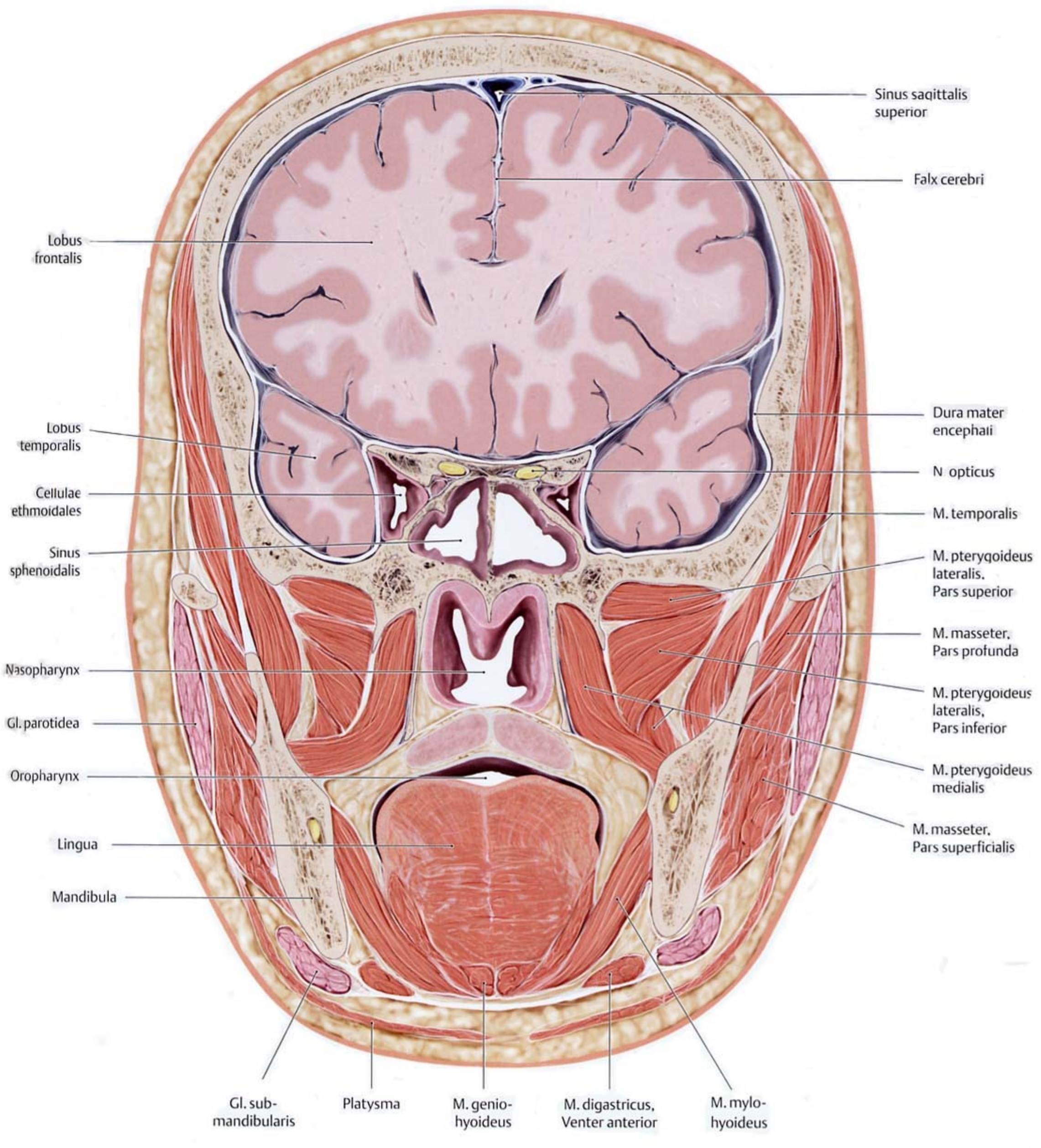

Figure 1: Masticatory musculature, frontal cut at the level of the sphenoidal sinus (Schünke et al. 2006, 51)

The tongue musculature (styloglossus, genioglossus, hyoglossus, longitudinalis lingua superior, transversus linguae and the verticalis linguae) and the mimic musculature (e.g. orbicularis oris muscle, mentalis, platysma, zygomaticus major and minorand major) can, in combination with the activation of one or of more masticatory muscles, have an impact on the position of the condyle and thus on the load on different joint structures (Bumann, Lotzmann, 2000, 42f).

The sternocleidomastoid muscle, which is part of the neck muscles, attaches to the clavicle, the sternum and the mastoid process of the temporal bone of the skull. It has an important function in positioning of the head (Platzer, 1991, 322). Its direct influence on the temporomandibular joint originates from its fascia, of which a band (maxillary tract) leads to the jaw angle. The maxillary tract tenses the fascia of the sternocleidomastoid muscle and thus protects the subjacent vein, artery and nerve bundles (Paoletti, 2001, 26).

2.1.2 Pathophysiology

According to AWMF[5] online, the disease pattern for craniomandibular dysfunction (CMD) is defined by the leading group of Anaesthetists dealing with pain and dentistry from the German society for Mouth, Jaw and Facial surgeons as follows:

> Pathogenetic multifactorial disease pattern with the cardinal symptom “pains in the temporomandibular joint and the masticatory musculature” and/ or “disturbance in the range of movement of the mandible” and/ or “temporomandibular joint sounds“. Craniomandibular joint dysfunctions can be combined with a pain-related impairment in daily activities, mental stress / strain and other unspecific somatic disturbances“. (AWMF online, 2004)

Moreover CMD is described as the most common form of facial pain with a predominantly unilateral pain localization. The nature of the pain changes in intensity, whereas a typical pressure pain can be evoked via the masticatory muscle group and the temporomandibular joints. This can lead to functional disturbances in the motion of the mandible and in mastication e.g. lateral deviation or s-shaped movements of the mandible in mouth opening, lockjaw, joint sounds and clicking of the joint. Furthermore unconscious malfunctions such as grinding (bruxism), pressing the tongue and cheek chewing etc. can occur. In chronic CMD there are reported increased cases of mental disorders, anxiety and referred pain (AWMF online, 2004).

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[5] AWMF: Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaft

2.2 Hip joint

The hip joint lies at the top of the leg, connecting the trunk to the lower extremity. Here the largest masses of the body, trunk and leg, are moved creating both shear- and centrifugal forces (Tschauner, 2004, 6). The hip joint provides the locomotion of the body (walking, running), and stooping and carrying. The head or femoral condyle is surrounded to a greater degree by the acetabulum. This structure constitutes a special type of ball-and-socket joint called a cotyloid joint, which is a very stable joint and the least prone to subluxation (Kapandji, 1992a, 2).

2.2.1 Anatomy

In the second decennium the three parts of the osseus of the hip bone (Os ilium, Os ischii, Os pubis) merge into the larger part of the hip bone in the region of the **acetabulum** (Rauber, Kopsch, 1998, 446). The concave acetabulum has an osseous rim (acetabular limbus) and presents below a deep notch, the acetabular notch.
Only one part of the acetabulum is covered with cartilage. The articular cartilage is semilunar in shape and constitutes a lunate surface, which covers and surrounds the fairly smooth acetabulum. The acetabular notch is not encapsulated and is bridged by the transverse ligament.

The lunate surface does not have an entirely circular outer rim and a very versatile inner rim (Tschauner, 2004, 6ff). The cavity floor is below the level of the lunate surface and is filled with a pad of fat (Rauber, Kopsch, 1998, 446).
The entire acetabulum is surrounded peripherally by a fibrocartilage lip called the acetabular labrum. The joint capsule joins onto the outside of the acetabular labrum.

The second part of the joint is the **head of the femur**, which corresponds to approximately two thirds of the surface of a ball with a radius of about 2.5 cm. The cartilaginous articular surface is 14 to 16 cm^2 and has its thickest part in the centre. The fovea capitis femoris is situated a little below and behind the centre of the femoral head and provides attachment to the ligamentum teres (Tschauner, 2004, 8). This intra-articular ligament connects the head of femur and the acetabulum. It has no mechanical function but serves as structural ligament. Whether these vessels also supply the head of femur is described differently within literature. Tschauner (2004, 12) only assigns a subordinate role to this supply in adults in contrast to Rauber and Kopsch (1998, 498), who ascribe it as having a major role into later life.

The **fibrous membrane of the articular capsule** is developed particularly strongly. It is strengthened by three ligaments, namely the iliofemoral ligament, the pubofemoral ligament and the ischiofemoral ligament.

The **synovial membrane** of the articular capsule for the most part emanates from the basis of the acetabular labrum. At the neck of femur there are synovial folds, which lead blood vessels to the head of femur (Tschauner, 2004, 11).

The **ligaments** provide joint stability and limit the mobility of hip articulation. They are arranged circularly around the neck of femur, twisting spirally in the case of hip extension against each other and thus press the head of femur into the acetabulum (Schünke et al, 2005, 381). The strongest ligament of the human body is the iliofemoral ligament. Its tensile strength is estimated to about 350 kg (Rauber, Kopsch, 1998, 500). It mainly limits the extension[6] in the hip joint, while the cranial fibres arrest the maximum adduction. The pubofemoral ligament inhibits the extension, the external rotation and the abduction[7] of the hip movement. The ischiofemoral ligament is tensed in extension and internal rotation and also partly in adduction (Klein, Sommerfeld, 2004, 188).
Deep fibres of the above mentioned three ligaments surround the head of femur as an orbicular zone (Tschauner, 2004, 10). It holds the head of femur in the acetabulum just like a buttonhole.

The **blood supply** for the hip joint is guaranteed by numerous anastomotic vessels. These vessels connect the femoral artery and the internal iliac artery, which not only supply the hip joint, but also the surrounding layer of muscle. The venous outlet occurs via the concomitant veins, which follow the arteries (Tschauner, 2004, 12).

The **lumbar plexus** (femoral nerve, obturator nerve) and the sacral plexus (superior gluteal nerve, inferior gluteal nerve, sciatic nerve and pudendal nerve) are responsible for the neurological innervation.

---

[6] Extension : Movement of the leg backwards

[7] Abduction: Movement of part of the body away from the body axis

The hip musculature is classified according to very diverse aspects. The muscles can be grouped according to their early development within the foetal development, their neurological provision, their anatomical position (medial/ lateral, single-/ double jointed, anterior/ posterior) or their function (vgl. Kapandji, 1992a, 38ff; Netter, 2000, 456ff; Platzer, 1991, 228; Rauber, Kopsch, 1998, 508ff; Schünke et al., 2005, 424ff).

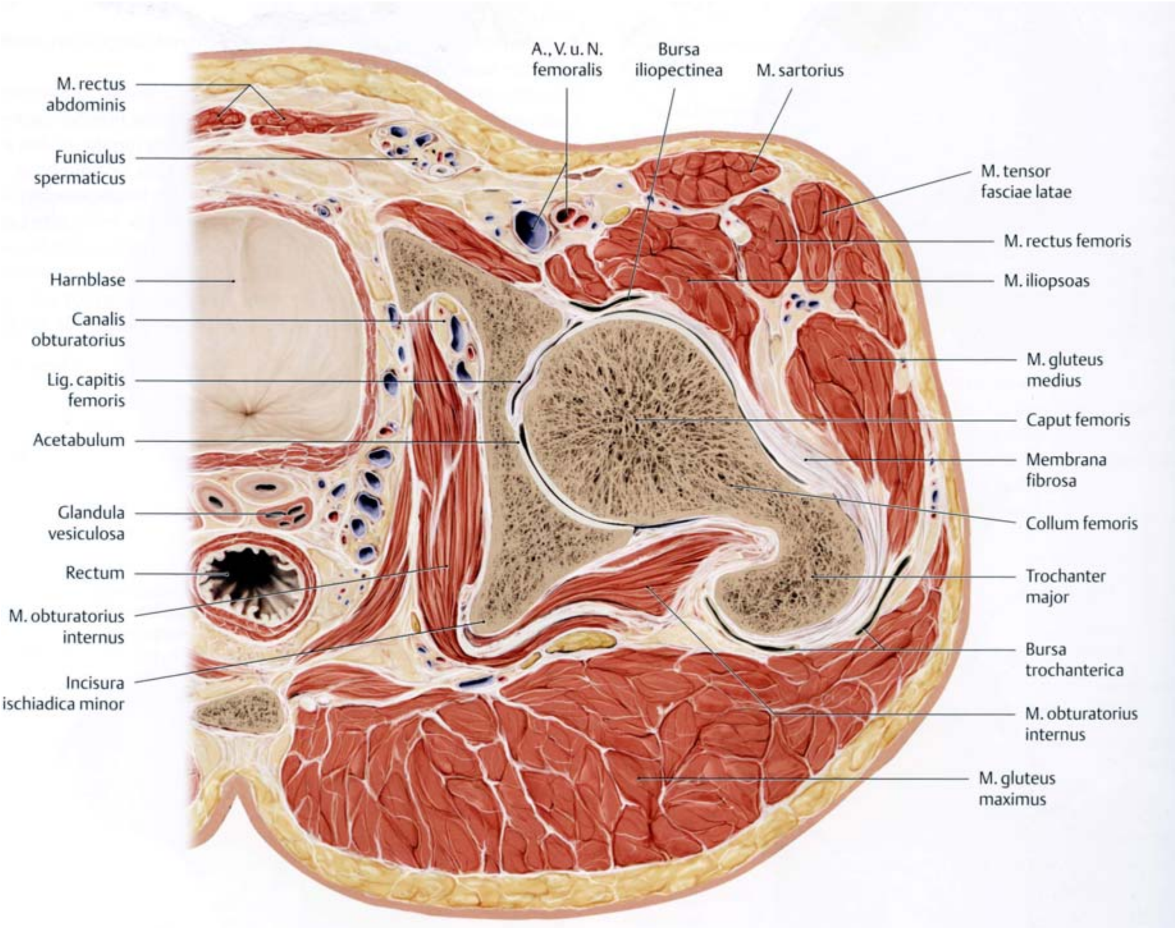

Figure 2: Horizontal cut through the right hip joint (Schünke et. al. 2005, 384)

The main hip muscles include the iliopsoas, gluteus maximus and minimus, tensor fasciae latae, piriformis, internal and external obturator, the superior and inferior gemellus, quadratus femoris, pectineus and the adductor muscles.

The psoas major is the only hip muscle that does not originate from the pelvic ring. It emanates from the lateral surface of the twelfth cervical vertebra and the related intermediate vertebra. It conjoins with the iliacus and attaches at the trochanter minor. The iliopsoas is the strongest hip flexor.

In those muscles, which originate at the pelvic ring and insert into the lower leg, function and strength for the movement in the hip joint also depend on the position of the knee joint.

These muscles are the gracialis, semimembranosus, semitendinosus, sartorius, rectus femoris and the biceps femoris.

The hip joint has three degrees of freedom. Thus, the individual muscles do not always have the same function in different joint positions (Kapandji, 1992a, 58). The gracialis, the pectineus and the adductor muscles support hip flexion up to 50°. Due to the altered position towards the transversal axis, they additionally serve as extensors (Rauber, Kopsch, 1998, 533).

2.2.2 Hip Joint range of movement

The range of motion of joints is given using the neutral-0-method in literature. With this measurement method the mobility is measured starting from a uniformly defined initial position, the neutral-0-position. In an erect stance, with loosely hanging arms and forward-turned palms the joints are in neutral-0-position (Platzer, 1991, 24). The foot- and lower leg longitudinal axes form a right angle and the feet are in hip joint distance apart (Trinkle, 2005, 39). In this position the distal joint is moved in one of the three body axes. The measurement of rotation is also conducted in an initial position of 90° hip and knee flexion. The measurement is described congruently in literature; the stated normal values however, are diverse, as can be seen in table 1. Merely Kloster et al. (1995, 662) and Schünke et al. (2005, 286), indicate a different range of motion in hip rotation with the hip initially flexed to 90° than with the neutral-0-position. Vleeming et al. (1985, 187) and Kloster et al. (1995, 154f) recommend the measurement of the active[8] and passive[9] joint mobility, but do not provide diverse measurement values. Dölken (2005, 64) too only describes the passive range of motion as being typically bigger than the active. The other authors in table 1 do not indicate neither active nor passive mobility. The mean values of the upper and lower limits were calculated for the statistical comparison (cf. chapter 4.2.2).

[8] Active mobility: the subject performs the movement of the joint into the final position on his/ her own

[9] Passive mobility: the movement of the joint into the final position is performed by a test person

	flexion / 0 / extension	**abduction / 0 / adduktion**	**external- / 0 / internal rotation** [90° hip flexion]
Fachlexikon der Orthopädie (Springorum et al., 1998, 118)	130-140 / 0 / 10-15	30-50 / 0 / 20-30	40-50 / 0 / 30-45
Hüftchirurgie in der Praxis (Meyer et al., 2005, 15ff)	130-140 / 0 /10-15	30-45 / 0 / 20-30	40-50 / 0 / 30-45
Leitfaden für Physiotherapie (Kloster et al., 1995, 663)	130 / 0 /15	30-45 / 0 / 20-30	30-40 / 0 / 40-50 [40-50 / 0 / 30-45]
Nichtoperative Orthopädie (Vleeming et al., 1985, 188ff)	125 / 0 / 15	45 / 0 / 20	45 / 0 / 45
Prometheus Lernatlas der Anatomie (Schünke et al., 2005, 386)	140 / 0 / 20	50 / 0 / 30	30 / 0 / 40 [50 / 0 / 40]
Angewandte Physiologie, Band 3 (Cabri, 2001, 223)	77-130 / 0 / 5-45	39-52 / 0 / 15-30	32-69 / 0 / 30-50
maximal values from the above cited literature	77-140 / 0 / 5-45	30-52/ 0 / 15-30	30-69 / 0 / 30-50

Table 1: Range of hip joint movement (measured in degrees)

3 Possible explanatory approaches for the correlation between dysfunctions in the temporomandibular joint and in the hip joint

In this chapter explanatory approaches, which point to a correlation between the hip joint and the temporomandibular joint will be gathered.

The effect of gravity and motion in the erect posture has a major influence on the human structure. The peculiarity of the human posture with reference to the temporomandibular joint and the hip joint will be discussed in chapter 3.1.

The structural correlation of the two joints will be explained by the anatomical interlinking of fascia and myofascial chains in chapter 3.2.

Chapter 3.3 will deal with the potential parallels of the temporomandibular joint and the hip joint in terms of their embryonic development.

The connection of somatotopy[10] to auricular acupuncture refers to Asian medical approaches. Therefore, the potential correlation between the temporomandibular joint and the hip joint from the point of view of traditional Chinese medicine will be discussed in chapter 3.4.

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[10] The term "somatotopy" has already been described initially.

3.1 Correlation between the temporomandibular joint and hip joint with reference to body posture

Kapandji (1992, 6) describes the position of the spinal column in the erect position as follows:

> „In an erect, straight posture occiput, back and glutei form a vertical plane, […]. The extent of the curvature at hand is characterised by the distance between this vertical plane and the curvature vertex."

Starting from this position, Fossum (2002, 78ff) defines two posture schemes (anterior and posterior), which he explains using the mechanics of the spinal column after Littlejohn (cf.Chapter 3.1.2).

Bacha, however, refers to the erect posture as an idealised variant of posture in terms of reference and not in terms of norm. Furthermore, the body's conflict with gravity is reflected in idealised posture. In this ideal case, the body segments are arranged on top of each other and are situated optimally against gravity. Thus, maximal efficiency is achieved by means of minimal use of energy.

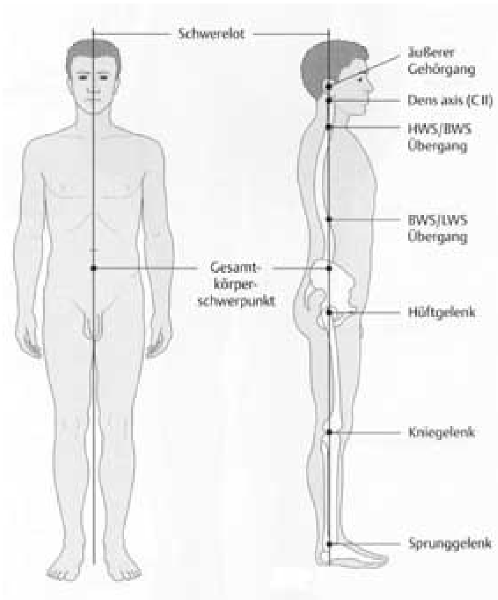

Figure 3:[11] Course of the gravity line (Schünke et al. 2005, 25)

The question that now arises is, whether the modified strain of a CMD can cause compensation in the hip joint via the spinal column, or whether a restriction of the function in the hip joint via the spinal column causes a CMD. For this, a connection of both joints to the spinal column should be proven. This logical supposition will be discussed in chapter 3.1.1. In chapter 3.1.2 a connection between temporomandibular joint and hip joint will be illustrated on the basis of Littlejohn's mechanic model of the spinal column.

[11] Schwerelot: gravity line; Gehörgang: auditory canal; HWS/BWS Übergang: cervical/thoracal area; BWS/LWS Übergang: rhoracal/lumbal area; Hüftgelenk: hip joint; Kniegelenk: knee joint; Sprunggelenk: ankle joint;

3.1.1 Connection of the temporomandibular joint and the hip joint with the spinal column

According to the third principle of osteopathy, the body is an entity (Delaunois 2002, 40f). This principle does not conceive the organism as an accumulation of independent body parts, but connects these parts. In order to comprehend the entity of the body and to prove it scientifically, it is helpful to investigate separate parts. The following statements from literature should contribute not only to a better understanding, but also to a more critical reflection of the connection between the temporomandibular and hip joint via the spinal column.

The temporomandibular joint, the atlanto-occipital and the atlanto-axial joints and the cervical spine are adjacent joints and therefore directly connected by anatomical structures. Parts of the integral tongue musculature as mouth opener interlink the mandible with the anterior cervical spine via the hyoid and its fixation (figure 1). The atlanto-occipital and the atlanto-axial joints and the cervical spine have an anatomical correlation with the temporal bone and the subcranium via fascia, ligamentous and muscle connections (cf. chapter 3.2.1). The influence of the atlanto-occipital and the atlanto-axial joints and that of the cervical spine on the temperomandibular joint is easy to measure in practice: On hyperextending the head, the distance between the teeth is larger than by the anatomical zero position of the head on the cervical spine vertebrae. Dentists, e.g. use this factor in the positioning of their patients by slightly hyperextending their patient's head in the dentist's chair.

Hochschild (2005, 39) describes the skeletal parts cranium, mandible, pectoral girdle and cervical spine as a functional unity with their parts mutually influencing each other via a series of joints. Liem (2000, 288) modifies Robert Samoian's model by demonstrating the integration of the temporomandibular joint into the vertical body statics. In this model not only head, neck and scapula, but also the entire back

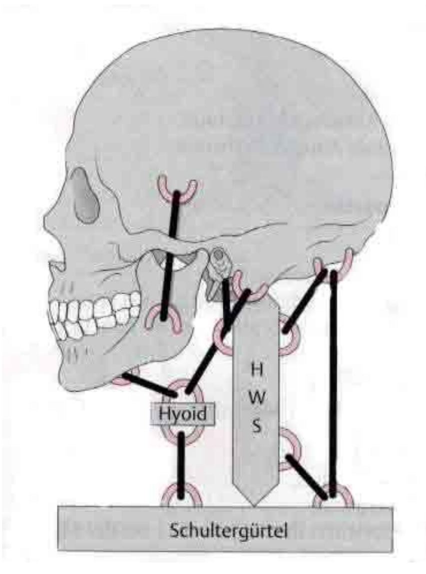

Figure 4:[12] Functional entity temporo-mandibular joint – cervical spine (Hochschild, 2005, 39)

[12] HWS: cervical spine; Schultergürtel: shoulder

muscles as far as the sacrum are taken into consideration.

Apart from the above mentioned authors, the reciprocal influence of the craniomandibular and the craniocervical systems is repeatedly shown in literature (FINK et al. (2004); Hülse, Losert-Bruggner (2002); Liem (2002); Lippold et al. (2006); Nicolakis et al. (1998)). Schupp (2005) came to the following conclusion in his literature survey „Craniomandibular dysfunction and its peripheral consequences“:

> "Craniomandibular dysfunctions can have manifold consequences on the craniovertebral system […]. In contrast to this, some malpositions and other orthopaedic problems are the cause of a CMD. Dysfunctions within the musculoskeletal system should be evaluated not only individually, but also in reciprocal correlation." (Schupp, 2005, 32)[13]

Here, Schupp (2005) already talks about the cranio-vertebral system, i.e. about the entire spinal column and not only about the craniocervical system. Consentient statements about the connection of the temporomandibular joint with the atlanto-occipital and the atlanto-axial joints can be found in literature. The more the interactions of the spinal column are addressed downwards, the less specific are the explanations.

Nicolakis et al. (1998) established a connection to the whole body's posture via the residual muscle tension of the masseter muscle. In thirty patients, diagnosed with CMD without occlusion problems, it was demonstrated that there was a significant correlation between postural asymmetry and asymmetry in the tone of the masseter muscle. The relaxed muscle tension of the masseter muscle was measured by means of a surface myograph. Postural asymmetry was determined by an asymmetry score, which consisted of eight postural parameters. The compilation of the asymmetry score was necessary, because individual postural parameters were only contingently significant for the evaluation of the complex compensation patterns in postural asymmetries. The study's authors came to the conclusion, that asymmetry in the pelvis, shortening of the quadratus lumborum muscle and the restricted rotation in the cervical spine are similar, while the increased shoulder elevation, the shortening of the trapezius muscle and the distance of the scapula from the mid line have few parallels to the hypertonia of the masseter muscle. Nikolakis et al. (1998) interpret the two postural parameters (shortening of the iliopsoas muscle and of the hip adductor muscles) as additional disorders, which can be referred back to the axial skeleton and the subcranium. The authors do not mention a direct correlation to the hip

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[13] this text was translated by the author

joint. An indication for problems with the hip joint can only be drawn on account of the function of the two last-mentioned muscle groups.

Additionally Nikolakis et al. (2000) posed the question whether a bad posture occurred more frequently in people with CMD than in those without. In order to be able to evaluate "poor" posture, the extent of mobility, muscle function and static postural positions were measured. Single-blind trials were conducted. Nikolakis et al. (2000) detected significantly more postural abnormalities in patients with CMD than in the control group. They state the following characteristic indicators for this static dysfunction ('poor posture") as being: head posture displaced anteriorly; an increased thoracic spine kyphosis; an intensified lumbar spine lordosis; weak abdominal muscles and shortening of the iliopsoas and dorsal thigh muscles. In this paper those results, which affect the hip, will be included. The iliopsoas muscle is shortened in 60% of the patients, but only in 16% of the control group. In their study published in 1998, Nikolakis et al. detected a shortening of the iliopsoas muscle in over 96.7% of the patients with CMD. Both studies indicate a frequent involvement of this muscle in the disease pattern. Nikolakis et al. (2000) measured an unphysiological position of the lordosis of the lumbar spine in 72% of the patients, but only in 40% of the control group. If or to which extent the iliopsoas muscle influences the lumbar spine, the pelvic ring or the hip joint, cannot be deduced from the results. As there is a significant correlation between lumbar disorders and hip joint problems, and the hip joint is a primarily muscularly supported joint (Klein, Sommerfeld, 2004, 139), a hip joint involvement can be assumed. Nikolakis et al.'s measurement results from 1998 reinforce this by showing the shortening of the adductor muscles of the hip in 76.7% of the patients.
Nikolakis et al. also showed that the dorsal thigh muscle was shortened in only 36% of the patients and in 48% of the control group. Merely hypothetically, this could be the result of shortened hip flexor muscles. The gluteus maximus muscle is weak in only 4% of the patients. This could lead to the conclusion that the dorsal chain of the hip muscles is not used to compensate for the changed static in CMD.
Ridder (1998) introduced a trial on patients with disorders in the stomatognathic system, who were treated using an edge-to-edge-occlusion brace, orthopaedic cranio-sacral therapy and orthodontic therapy. According to Ridder, an improvement was achieved in 70 to 100% of those patients, whose problems had been caused by temporomandibular joint dysfunction. On questioning the improvement of further symptoms and evaluating the questionnaire referring to the hip joint disorders, it resulted in an improvement of 3.5

points (1 to 6 possible). Temporomandibular joint and occlusion therapies resulted in a considerable improvement in hip disorders. This would support the hypothesis of a correlation between the temporomandibular joint and the hip joint.

Hülse and Losert-Bruggner (2002) do not, in comparison to Nikolakis et al., establish a relationship to body posture, but use an orthopaedic test for the hip joint, the sacro-iliac joint, and the lumbar spine to be able to provide a differential diagnosis for the temporomandibular joint. They claim to be able to determine whether a disorder in the craniomandibular region originates in the temporomandibular joint, or the cervical joints, atlanto-occipital and the atlanto-axial joints by means of a modified Patrick-Kumis test. This test, which is described in chapter 4.2.2, is conducted in 90°-hip-abduction; this results in a foot-knee contact and is implemented in an eight-step examination cycle. In the test, series manual therapeutic, orthodontic tests as well as the Patrick-Kubis test are performed with and without paper stripes between the molars. Hülse und Losert-Bruggner (2002) indicate, that the elevation of the molars using a paper stripe leads to a significant deterioration of the Patrick-Kubis test results of 15° and more. Depending on the test result, an orthodontic or a manual therapeutic treatment is regarded as purposeful. According to Hülse and Losert-Bruggner, the test results are meaningful and convincing even with heavily limited hip mobility. The actual mobility of the hip is irrelevant in this case; therefore the authors do not deal with it. Possible existing problems in the lumbar or sacral region are not differentiated. The validity of these trials will not be discussed here. For this paper, it is relevant to note, that the test for the lumbar and pelvic region generates significantly changed test results by only altering the tooth position. Hülse and Losert-Bruggner (2002) describe merely hypothetically which mechanisms or explanatory approaches make this phenomenon occur. They regard neuroanatomical phenomena like an irritation of the dura spinalis or the influence of the atlanto-occipital and the atlanto-axial joints via the descending channels from C2 downwards as imaginable.

Fink et al. (2004) proved in their trial on twenty healthy patients, that an artificially provoked occlusion disorder can lead to significantly changed results in manual therapeutic tests in the cervical spine and the lumbar, pelvic and hip area. They controlled the mobility of the upper cervical spine and by using the Forward Flexion test [14] and the Spine-test[15]

[14] Forward bend test, or flexion test, the symmetrical synkinesis of the Ossa ilii, bei der forward bending motion

the mobility of lumbar spine and the pelvic region. The trials were repeated three times. In the first examination results no abnormalities were detected. An artificial occlusion disorder (by inserting a 0,9mm tin foil on one side) was provoked for the second testing, which yielded significantly positive test results. After the removal of the tin foils, the subjects were re-examined with once again no detected abnormalities (except for one single-test result). Fink et al. did not only verify a correlation between occlusion disorders and functional alterations of the cervical spine, but showed the influence of an occlusion on manual cervical spine trials. Whether these alterations have pathogenetic relevance, has not been investigated yet. The result of these tests is relevant in practice, because positive test results of the cervical spine without local restrictions of the examined area can be caused by the tooth position.

Kopp et al. (2003) call it an empirical fact, that an alteration of the occlusion causes an alteration in the position of the cervical spine. In their pilot study, they introduce a measurement method applying a motion-record-system and a motion-analysis-system, which clearly proves that the long-term wearing of an orthodontic retainer brace causes alterations in the functional range of movement of the cervical spine.

In contrast, Lippold et al. (2006) could not detect a correlation between overbite and the diverse back structures in adults in their raster-stereographic study. They examined curvature of the spinal column in 84 healthy subjects with a diagnosed malocclusion. 48 of them had a normal, 38 an enlarged and 28 a reversed overbite. No significant difference in the structures of their backs could be detected between these three groups. There was however, a difference in the lordotic angle and the sacral position between women and men. The question, in how much the back structure of people with a normal tooth position was, was not answered.

Lippold et al. (2006) thus also contradict Liem (2000, 295ff), who postulated an influence of the tooth position on the body posture. He allocates the tendency for an anterior or posterior posture type to different tooth positions and lists various static signs as an indication of a CMD. He describes, among other things, oblique head posture, imbalance of the pelvic girdle, facial asymmetry or scoliosis as static signs for CMD. These are surely the most interesting indications for the therapist, who should not only look for dysfunctions in the area around the spinal column but also look in the organs and / or in the cranio-

[15] Spine-test: flexion of the hip in one-leg stance as far as possible (reflux phenomenon)

sacral system when interpreting the findings. A causal correlation between the various tooth positions and a distinct posture of the spinal column was disproved by Lippold et al. (2006).

Diverging statements can be found in literature to the question whether the tooth position actually influences the attachment apparatus or not, but predominantly interaction is alluded to. In the AWMF online (2004), the predisposing factors for CMD are not only occlusion and articulation disorders, misaligned teeth and dysgnathia[16], but also inappropriate stress of the supporting and attachment structures. One of the reasons for these controversial statements in literature could be, that the examination and the substantiation of the interactive correlation between tooth position, temporomandibular joint and body posture are based on varying assumptions. It is often not possible to compare the individual studies, because they lack precise quantification and orthopaedic terms. An intensive interdisciplinary cooperation however, seems to be an essential advantage for the successful recovery of a multitude of patients with temporomandibular problems. Krombacher et al. (2004) also holds this view, even if, despite the multitude of clinical studies, there are no unequivocal recommendations for the obligatory consultation of an orthopaedic doctor /specialist in the case of orthodontic patients.

The diverse views and discussions in literature reflect, among others, the complexity of this topic. Personally I would like to follow Kopp et al.'s statement (2003):

> "[...,] it has been known for years, that changes in the occlusion also provoke changes in the posture of the spinal column. Many therapy concepts are based on this empirical fact, though the "objective" proof has only partially been found." (Kopp et al., 2003,39)[17]

In contrast to this, the narrow functional context of the lumbosacral transition, iliosacral joints, sacrococcygeal joints, intercoccygeal joints, pubic joints and the coxofemoral joints has been proven. According to this, functional deterioration of one element affects all other parts as well (Klein, Sommerfeld, 2004, 140). So, Klein and Sommerfeld (2004, 140) comprehend that the movement within the pelvic ring and that of the pelvis as one entity. The pelvis as a total structure affects movements in the cervical spine and in the hip joints. Thus, a potential involvement of the hip joints can be assumed for all the above mentioned

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[16] Dysgnathias: Collective term for temporomandibular maldevelopment with defective occlusion, articulation and anomalous bite position (Pschyrembel, 1994, 357)
[17] text translated by the author

studies (e.g. Liem, 2002, Nikolakis et al., 1998 and 2000), which prove a connection to the cervical spine. Further comparative studies would be necessary in order to explicitly exclude a restriction of the hip mobility.

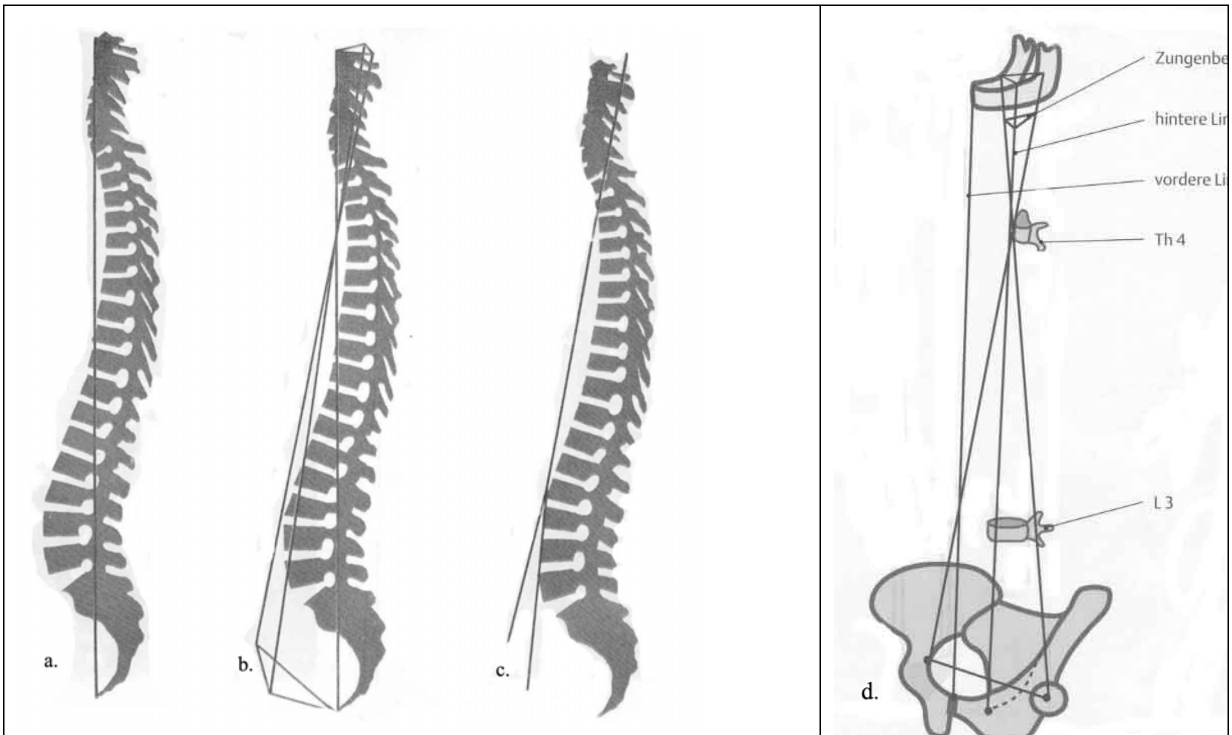
Recapitulating, in literature a correlation can be found between both, the temporomandibular joint and the spinal column, the hip joint and the spinal column. Consequently, a functional deterioration of the temporomandibular joint or the hip joint could influence the other joint respectively. Whether this also results in a functional deterioration of the spinal column, remains unanswered. Scientifically proven controls for a reciprocal relation of the two joints have not yet been published, just as there are no statements about the frequency and the clinical relevance of a potential correlation between temporomandibular joint and hip joint (cf. attachment investigation protocol).

3.1.2 Explanatory approach of the correlation between temporomandibular joint and hip joint after Littlejohn

In osteopathy the correlation between the spinal column to the entire body and its functions are explained with reference to John M. Littlejohn's mechanics of the spinal column (Folssum, 2002, 80; Liem, 2000, 287). Littlejohn (s.a.[18]) describes an anteroposterior and a posteroanterior line (figure 5). The anteroposterior line runs from the anterior rim of the foramen magnum to the coccyx and is called 'descending gravity line' by Liem (2000, 287), while the posteroanterior line is called 'ascending gravity line'. This starts through the pressure of both femoral heads in the acetabuli, passes up and meets at the anterior part of the third lumbar vertebrae and passes over the forth thoracic vertebra up into the posterior wall of the Foramen occipitale magnum. From these two lines, Littlejohn constructs the so-called 'Polygon of forces'. It consists of three triangles, which balance on the fourth thoracic vertebra and its processes.

The 'upper' triangle represents the base of the cranium and is the reason for the functional unity from the atlanto-occipital and the atlanto-axial joints via the cervical vertebrae to the forth thoracic vertebra. It is influenced in its function by an imbalance of the hyoid and its musculature (Liem, 2000, 287). The upper triangle is meant to be an explanatory approach for the reciprocal correlation between the temporomandibular joint and the hip joint or cervical spine.

[18] s.a: sine anno



a. Anteroposterior gravity line
b. Polygon of forces of the spine
c. Posteroanteriore gravity line (Littlejohn, s.a., last page)

d Gravity line after Littlejohn, modifyed by Liem (2000, 287)

Figure 5: Gravity line after Littlejohn

The 'lower' triangle relieves the third lumbar vertebra by transferring the tension to the femoral head (Liem, 2000, 287). Littlejohn (s.a.) does not, however, describe the role of the hip joint in this structure. He speaks about the balance of power between the lower limb and the sacrum, or rather between the pelvis and the lumbar spine. For the treatment in the lower lumbar spine region he recommends the following, "*[…] always begin by relaxing the leg and articulating the hip joint*" (Littlejohn s.a., 270) Based on this recommendation it can be assumed that the hip has a central function in this mechanical entity. The hip also represents the anatomical connection between the legs and the trunk. A primary or causal participation by the hip joint, however, cannot be derived.

The lower 'big' triangle and the upper triangle support the cervical spine and the organs. Littlejohn (s.a.) describes its specialised function as follows:

> "Maintains tension of neck; trunk and legs co-ordinate with the pressure in the internal cavities of the body via the D - L ligaments, which oppose the hip and leg movements in relation to the abdominal muscles and pelvic organs." (Littlejohn, s.a., last page)

According to Littlejohn's gravitation lines, a functional entity between the temporomandibular joint and the cervical spine and between the hip joint and the lumbar spine can be assumed. If these are regarded as the endpoint of the functional entity, a connection between temporomandibular joint and hip joint could exist. No mathematical proof in terms of calculating the force of vectors has been deduced yet. Whether a dysfunction of the temporomandibular joint can cause or rule out one in the hip joint or vice versa, is also not provable. Thus, a causal connection of the two joints cannot be proven.

The term "somatotopy" could also be derived from this model. If somatotopy not only, as initially stated, refers to the representation of the total organism on one part of the body surface, but is also regarded as some sort of reflection on the opposing side, this definition would present the temporomandibular joint on the one side of the spinal column and the hip joint on the other side. The pattern could be extended to the comparison of mandible and leg or occipitomastoid suture and sacroiliac joint. This however, can only be an approximate schematic thought, as the anatomical conditions on both sides of the spinal column are very different. This interpretation of the term somatotopy is not common in medical language use and could be misunderstood in an interdisciplinary exchange of experiences.

3.2 The connection between the temporomandibular joint and the hip joint via fasciae and myofascial chains

The anatomy of fasciae and above all their interconnections are treated insufficiently in literature. According to the surgical point of view, fascia is a connective tissue layer surrounding muscles, bones and joints. In an overview, Paoletti (2001, 2ff) tries to present the anatomy of fasciae as connective structures and to explain their function and their mechanism. His treatment techniques directly refer to anatomically circumscribed structures and body segments. In chapter 3.2.1 the influences of the fasciae in the temporomandibular joint and the hip joint will be explained mainly after Paoletti's anatomical description. Myers (2004, 24ff) regards the fasciae system much more extensively than Paoletti (2001), namely as being a communication network which unites and represents the entire body. He mainly works with anatomical trains, which he treats holistically. Chapter 3.2.2 will deal with the correlations between the temporomandibular joint and the hip joint from the point of view of Myers's "tensegrity model".

3.2.1 The interconnecting link between the temporomandibular joint and hip joint via the anatomical structures of fasciae

According to Paoletti (2001, 23ff), fasciae show ample connections from the body surface to the interior of the organism (spinal canal). The link runs from cranial to kaudal but also from external to internal. First the fasciae of the head-, temporomandibular – and neck region and those of the pelvic-, hip and thigh region will be described separately in order to clearly demonstrate the anatomical fasciae links of the trunk. Consequently the points of intersection of the neck fasciae will be interpreted as a connection to the hip joint.

Fasciae of the head-, temporomandibular and neck region:

The superficial connection of the head leads from the epicranial aponeurosis, via the temporal fascia and the masseteric fascia to the superficial cervical fascia. A further connection from the epicranial aponeurosis to the dura mater is also described. The superficial cervical fascia ends at the sternum, at the clavicle and at the spine of the scapula and from there merges into the thoracolumbar fascia.

The middle cervical fascia (pretracheal layer of cervical fascia) originates at the hyoid bone, is attached to the sternum and continues at the endothoracic fascia. It surrounds the anterolateral neck musculature, participates in the thyroid fascia and has a connection with the superficial and the deep cervical fascia.

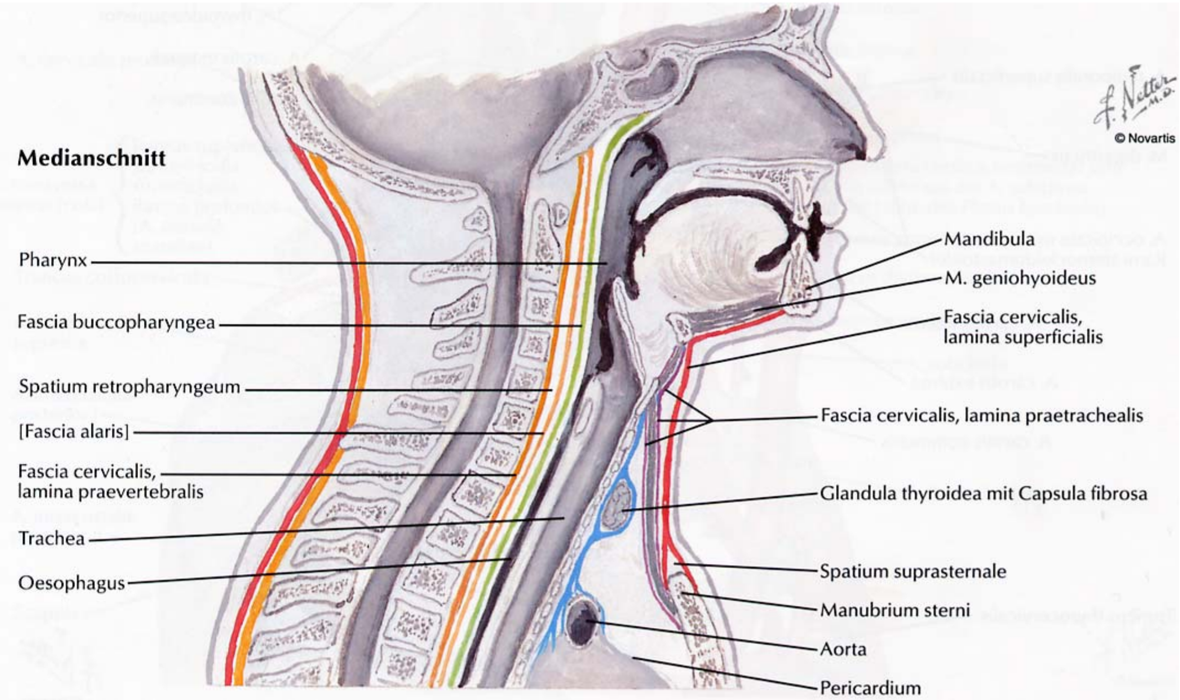


Figure 6: Median cut of the head and neck (Netter 2000, 30)

The deep cervical fascia originates in the basilar part of the occipital bone, is attached to the first thoracic vertebra and merges into the endothoracic fascia. It supports the cervical plexus and the cervical ganglia. It is also connected to the two other cervical fasciae and the pharyngobasilar fascia (Paoletti, 2001, 53).

The pharyngobasilar fascia connects at the dura mater via the palatine fascia, the pterygo-mandibular fascia and the interpterygoid fascia.

Thus, the superficial cervical fascia is closely associated with the temporomandibular joint via the masticatory muscles and its attaching points at the mastoid process and at the mandible. The middle cervical fascia influences the temporomandibular joint via the hyoidal structures and the deep cervical fascia via the subcranium.

Fascia of the pelvic-, the hip and the femoral region:

The fascia of the **iliopsoas muscle** forms a closed, funnel-shaped form, which ranges from the diaphragm and the iliac wing to the lesser trochanter. In the upper section it is a part of the lumbar fascia and is connected to the diaphragm via the medial lumbocostal arch. At the access into the large pelvis the fascia also encloses the iliacus and is called iliac fascia. The iliac fascia is continuous with the transversalis fascia and the internal abdominal fascia at the iliac crest. Thus, there is a connection to the transversus abdominis muscle, to the posterior wall of the rectus sheath and to the quadratus lumborum muscle. In the lesser pelvis it is linked to the fasciae of the pelvic region. At leaving the pelvic region, the iliopsoas fascia is grown together with the aponeurosis of the obliquus externis abdominis via the inguinal ligament. The deep crural arch (iliopubic tract) is a part of the iliac fascia and runs from the inguinal ligament to iliopubic eminence. The iliopubic tract separates the vascular lacuna from the muscular lacuna (Paoletti, 2001, 30ff).

The **internal obturator muscle** is continued by the powerful obturator fascia. It is continuous with the iliac fascia and belongs to the pelvic parietal fascia. The levator ani muscle originates at the obturator fascia, which explains the connection to the pelvic diaphragm musculature (Paoletti, 2001, 66).

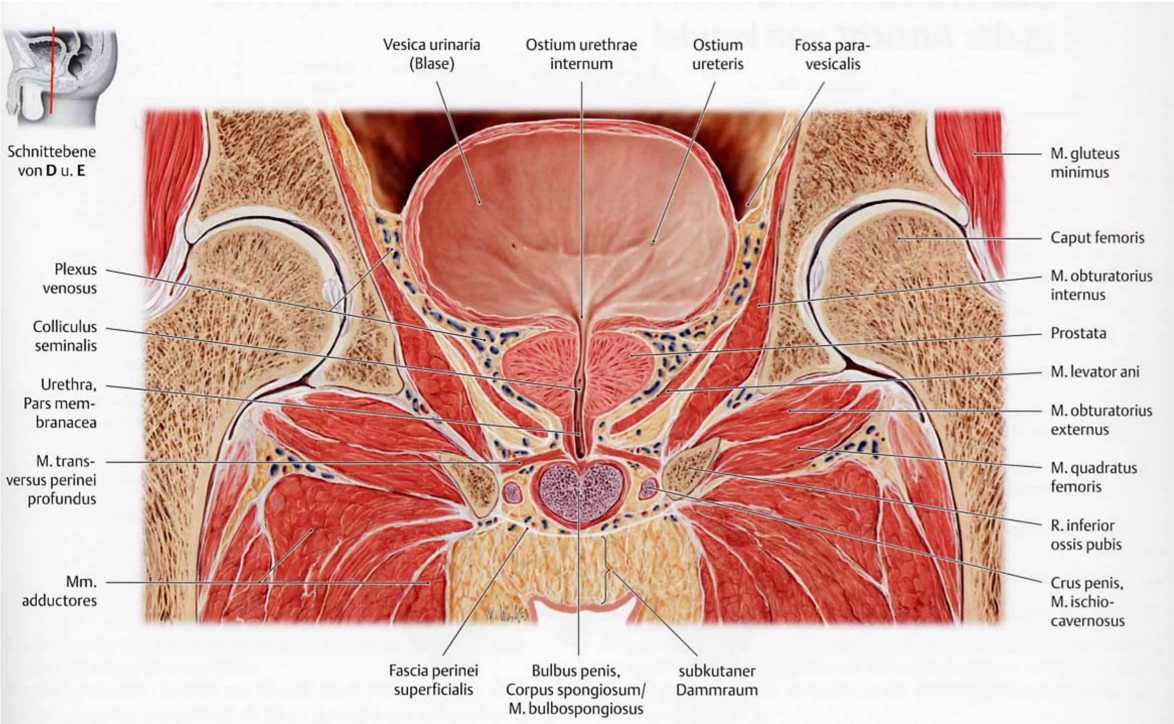


Figure 7: Frontal cut of the male pelvis (Schünke et al. 2005, 155)

The lumbar and abdominal fasciae are continuous with the **fascia of the lower limb**. This originates at the iliac crest, the sacrum, the pubic bone, the ischium and the inguinal ligament and ends at the foot, whereby it is attached to the knee and the ankle joint. Various septa branch off starting at the deep layer of the femoral fascia. These septa not only envelop and separate the individual muscles of the femur, but also serve as insertion for parts of the muscles (e.g. vastus medialis and lateralis muscles, caput breve of the biceps femoris muscle) (Paoletti, 2001, 42ff.). The **gluteal region** is covered by the gluteal fascia, which is part of the fascia lata. It is grown together with the iliac crest and the sacrum on the backside. Laterally it encapsulates the tensor fasciae latae, from where processes proceed into the depths. By this, the gluteus maximus receives a strong cover. The gluteus minimus is covered by its own fascia and is linked to the connective tissue of the retroperitoneal space and the pelvis via the supra- and infrapiriforme foramen (Paoletti, 2001, 44).

The fascia lata builds a connective tissue division, which is defined as the femoral canal at the upper ending and adductor canal at the lower. It serves as protection for the vessels running in the femoral canal (femoral artery and vein, saphenous nerve), in order to prevent them from being compressed or pulled in the course of abduction and external rotation of the hip (Paoletti, 2001, 46).

The fascia connection between temporomandibular joint and hip joint:

The superficial cervical fascia is continuous with the thoracolumbar fasciae. These end at the upper rim of the pelvic inlet and continue in the fasciae of the lower extremity. The fasciae of the trunk enclose the muscles of the thoracic and abdominal region, where they lead into depth more and more. They are connected to the transversal fascia, the iliac fascia, the perineal muscles, the vesicoumbilical fascia and the pelvic fascia (Paoletti, 2001, 32f). The fasciae in this area can easily be treated by deep fascial techniques and techniques of the deep connective tissue massage.

The medial and deep cervical fasciae are continuous with the endothoracic fascia. Thus they are connected to the pericardium, the pleura and the diaphragm, and via the transveral fascia they are linked to the peritoneum, the renal fascia, the iliac fascia and the fasciae of the lower extremity. For the fascia connection of the midaxis, the pharyngobasilar fascia has links to the pericardium and the palatine fascia, and the medial and the deep cervical fascia (Paoletti, 2001, 56f, 82f). Numerous visceral treatment techniques, which can be applied individually in the affected structures, can be encountered in osteopathy for the treatment of these deep-seated structures.

Paoletti (2001, 101) refers to the meninges as those fasciae which lie within osseous structures. Their external layer, the dura mater, has insertion points in the cranial part of the calvaria and in the skull base. From their interior septa originate, which subdivide the brain in various areas (e.g. tentorium of cerebellum, falx of cerebellum and diaphragm). The spinal dura mater is closely linked to the foramen magnum, the axis and the third cervical vertebra. In caudal direction it ends as a dead end at the second sacral vertebra, from where it leads to the coccyx. These it has an insertion at the posterior longitudinal ligament via the anterior sacrodural ligament. Furthermore, the dura mater is connected to the posterior longitudinal ligament via the frbrous processes in the cervical and lumbar region. Apart from that there are connections to the nerve roots (Paoletti, 2001, 101ff). The craniosacral osteopathy is the treatment method for these structures.

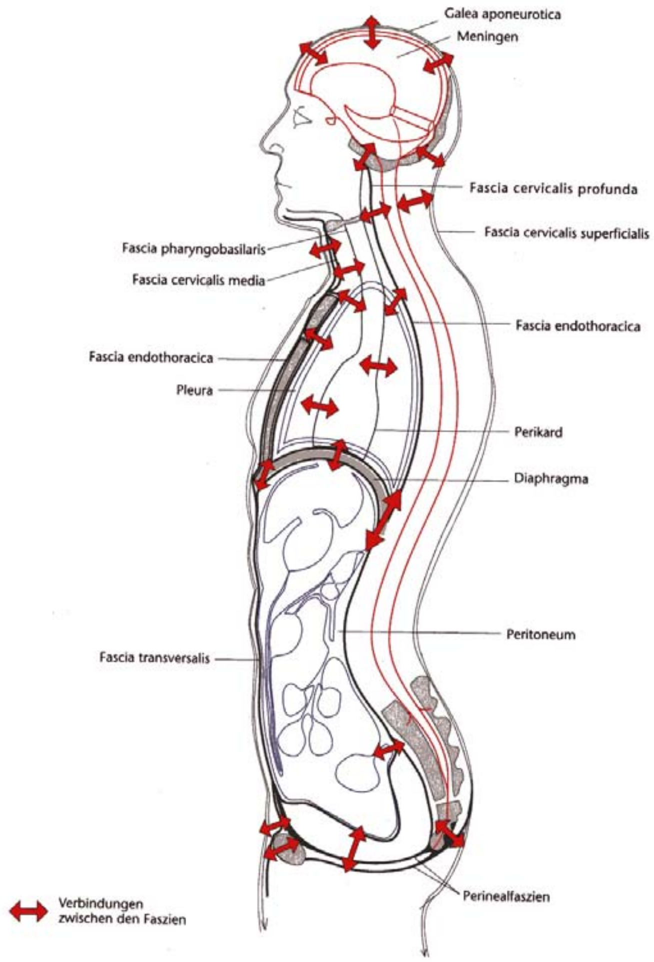


Figure 8: General structure of the fasciae and their connections (Paoletti 2001, 111)

The chains of fascia transfer their mobility to the entire body. Buffer zones are incorporated in order to prevent tensions from being transmitted to the body. Paoletti (2001, 185) describes the following crossing points as important buffer zones: pelvic girdle, diaphragm, shoulder girdle, hyoid bone and the cervico-occipital transition. The temporomandibular joint and the hip joint are situated in the area of influence of the zones of hyoid bone, cervico-occipital transition and pelvic girdle – thus at each opposing end of these ‘tension / pulling’ points. Thereby it could be explained, that dysfunctions in one joint also occur in the other joint as restricted function. The direct vicinity of the two joints to the trunk is however no proof for a causal correlation between the temporomandibular joint and the hip joint.

Recapitulating it can be stated, that both the external and the middle and internal chains of fascia indicate a connection between the temporomandibular joint and the hip joint. The fascia structures cannot be regarded as limited to one joint, therefore the question why a tension in the fasciae should occur right in the temporomandibular joint and the hip joint and not, for instance, also in the knee joint or ankle joint, remains unanswered.

3.2.2 Thomas W. Myers's "Anatomy Trains"

Thomas W. Myers (2004, 51) uses the term "anatomy trains" (myofascial meridians) mainly to describe the course of ligament and muscle structures, whose tension is transferred from one point to the other (from bone to bone). He explains human stability using a term from architecture, the "tensegrity model". Tensegrity[19] is composed out of the words "tension" and "integrity". What is meant by this, is a "girder system" which stabilises through pressure and tension. It consists of hard elements (bones), which are connected by "wire ropes" (ligament and muscle structures). The system aims at establishing an evened tonus along these fibre and tissue layers, so that bones and muscles within the fasciae can drift in elastic, balanced position (Myers, 2004, 51).

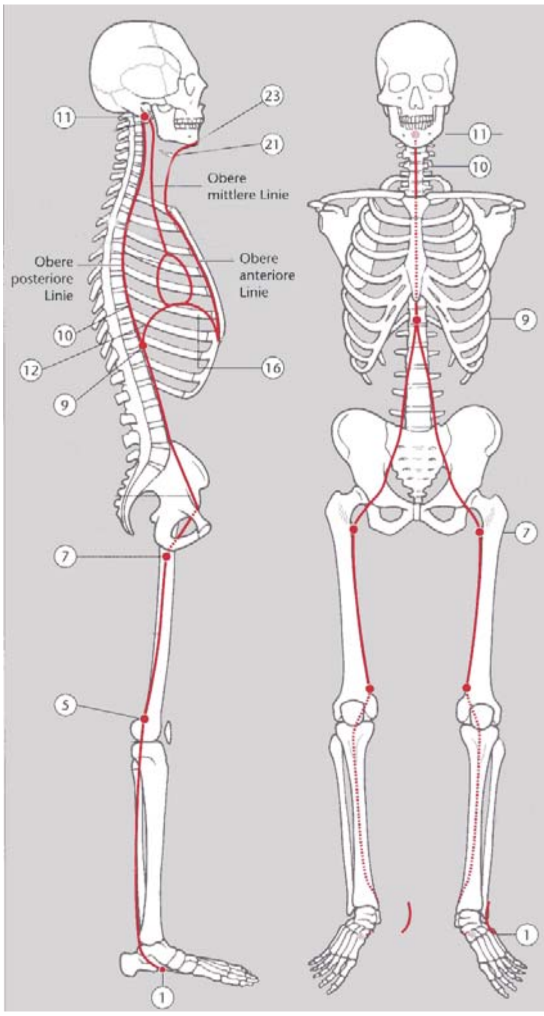
Demonstratively he compares his anatomy trains to the railway network:

- The tracks proceed in the stipulated direction without interruption.
- They are anchored at "osseous stations" or insertion points.
- They connect and branch at points and occasionally at sorting sidings.
- There are express and local trains.

On the basis of these points, Myers shows trains that connect the body three-dimensionally and stabilise it through the tensegrity model. He names a superficial dorsal and frontal line, lateral lines, spiral lines, arm lines, functional lines and a deep frontal line. These lines show a course partly similar to the before described fasciae structures. As the temporomandibular joint is only described by Myers in connection to the deep frontal line, the other "trains" will not be treated in this paper.

[19] Tensegrity: http://de.wikipedia.org/wiki/Tensegrity_%28Architektur%29

The deep frontal line (DFL) originates at the depth of the bottom side of the foot, runs behind the tibia and the hollow of the knee to the medial side of the thigh, to the hip joint, the pelvis and to the lumbar spine. It continues via various alternative routes in the chest and ends art he lower side of the neuro- and viscerocranium (Myers, 2004, 182). Myers (2004, 206) links it to the temporomandibular joint starting at the cervical fascia, via the hyoid muscles to the mandible. He indirectly draws a connection through the mandible to the masticatory musculature. The deep frontal line clearly takes up a three-dimensional space. It mainly contributes to postural compensation and movement stability. Through the tight contact to the hip joint it correlates the respiratory and the walking rhythm. It represents a counter balance to the superficial lines in the neck.



1: Plantare side of the Ossa tarsalia
5: Epicondylus medialis
7: Trochanter mayor
9: Vertebra boddy
10: Longitudinale anterior ligamentum
11: Basis of the occiput
12: Posterior part of the diaphragma
16: Anterior part of the diaphragma
21: hyoid bone
23: Mandibula

Figure 9: Deep frontal line (Myers, 2004, 184f)

A lack of tonus in the deep frontal line leads to a general shortening of the body. It promotes a collapse in the pelvis and the spinal column and helps in the negative compensatory adjustment of all other trains. As an example Myers (2004, 183) describes a shortening, in which the hip joint cannot reach full extension. In this case he does not render specific information for the compensatory posture. However, considering the “bad posture” introduced by Nikolakis et al. (2000) (a head posture displaced in anterior direction, a reinforced kyphosis in the thoracic spine, a reinforced lordosis in the lumbar spine, weak abdominal musculature and a shortening of the iliopsoas and the thigh musculature) (cf. chapter 3.1.1), this compensatory posture could also be found in Myers’s description. According to Myers (2004, 183), the hip adduction is the only movement which is exclusively controlled by the deep frontal line, which is continuous with the iliopsoas muscle. In contrast to this, Nikolakis et al. (1998) connect the shortening of the two structures with an elevated tonus of the masseter muscle.

Thus an express train (to express it with Myers's figurative language) could go directly from the hip joint to the temporomandibular joint and back. Whether and why a terminal stop should be right in the hip joint and the temporomandibular joint cannot be determined based on this concept. A connection between the two joints however, is easily comprehensible.

3.3 The development of the temporomandibular joint and the hip joint

The observation of the development of the two joints should explain or exclude probable causes of coupled deviations from the norm, which occur in both, the temporomandibular joint and the hip joint and which are already established during early human development. Thus, this chapter will deal with the developmental processes of those structures which represent the mutual precursors of the two joints. As far as those are known, they will be subsumed and after the differentiation of the tissues, they will be compared to the critical developmental periods of the two joints. Developmental processes, which do not causally correlate to the development of the two joints, will merely be indicated, but not be pursued exactly. The tables in the chapters 3.3.1 and 3.3.2 were created for this master's thesis, in order to enable the comparison of the prenatal development of the temporomandibular joint and the hip joint. They are excerpts from the individually cited literature from the medical fields of anatomy, embryology, orthopaedics and dentistry.

3.3.1 Mutual precursor structures of the two joints

A separation of the developmental process of the cranial skeleton (and thus also of the temporomandibular joint) from that of the remaining skeleton (and thus of the hip joint), is assumable as the basis for the further development of the hip bone and the formation of the neural crest from the ectoderm together with the development of the paraxial mesoderm from the mesoderm. This occurs in the third or fourth week of gestation. Therefore the developmental steps of the first two weeks of gestation will not be described here.

W.[20]	TEMPOROMANDIBULAR JOINT	HIP JOINT
3.	The dorsal chorda first develops as a length of cells, the head part, the central lumen, the chordal canal through cell migration from the primitive bud in the direction of the prechordial plate. Starting from the primitive streak and head part, cells also move in a cranial and lateral direction until they reach the rims of the blastoderm, where they unite with the amnion and the embryonic sac, extraembryonal mesoderm. The dorsal chorda induces the formation of the neural plate from the ectoderm (Moore, Persaud, 1993, 62- 64).	

[20] W.: Week

W.	TEMPOROMANDIBULAR JOINT	HIP JOINT
2-4	Second to fourth week: Cranial to the primitive budding a median thickening occurs, the neural plate. In the median plane, the neural groove and on both its sides the neural folds develop through an unfolding and folding process. These folds grow together and merge into the neural tube. In this process some cells proceed in a lateral direction and become the neural crest (Moore, Persaud, 1993, 64).	At the end of the third week, a thick cord, the *paraxial mesoderm*, develops on both sides of the dorsal chorda in the so far slack mesoderm (two columns running along the chorda) These columns are gradually continued laterally in the lateral plate mesoderm, which is connected to the extraembryonal mesoderm covering of the yolk sack and amnion. The paraxial mesoderm begins forming into cubical coupled somites, which determine the segmental structure of the spinal column segments, the ribs and the muscles, at both sides of the chorda (Moore, Persaud, 1993, 68). The thin *lateral plates* which border the paraxial mesoderm laterally split into a *parietal* and a *visceral mesoderm layer* on the twentieth day (Moore, Persaud, 1993, 69).

W.	TEMPOROMANDIBULAR JOINT	HIP JOINT
5	The neural crest cells form an initially continuous row of ganglia at the right and left of the neural tube. This then forms the head mesenchyma (along with the spinal ganglia, the ganglia of the cranial nerves and the autonomic nervous system and the pigmentary cells) (Moore, Persaud, 1993, 72).	Arm and leg buds form from the *parietal mesoderm layer*. Furthermore, it provides the basic material for the connective tissue and the musculature of the trunk including the ribs (Moore, Persaud, 1993, 81-83).

As this phase of development is extremely sensitive, it can be assumed, that deficits or damages would have more extensive consequences to the further development (premature abortion, missing limbs …) than the deviations from the norm treated with in the present study.

Thus an embryologic cause in this period can be excluded.

3.3.2 Sensitive phases in the formation of joints

W.	TEMPOROMANDIBULAR JOINT		HIP JOINT	
5			beginning 5	The arm-buds develop from the fourth cervical to the first thoracic somite. The leg-buds follow somewhat later from the lumbar and upper sacral somites (Thiemel, 2003, 12).
			beginning 5	The peripheral ectodermal ending of the buds is thickened into a rim crest of a rim. The crest of a rim induces the further growth of the buds from proximal to distal direction (Thiemel, 2003, 12).
			beginning 5	After a radial subdivision of the flattened budends into five beams, the development of fingers and toes is visible. Coarctations from the proximal limb region define hand, foot, upper arm, forearm, thigh and lower leg (Thiemel, 2003, 12).

W.	TEMPOROMANDIBULAR JOINT		HIP JOINT	
6	6-7	Lateral to Meckel's cartilage, which consists of the first pharyngeal arch, the development of the osseous mandible in both halves of the face starts (Bumann, 2000, 11) by the condensation of the mesenchyma of the upper jaw (desmal ossification) (Moore and Persaud, 1993, 220).	6	The paddle shaped foot plates in the distal region of the leg-buds is formed (Tschauner, 2004, 4).
			6	The elbow, hand and foot plates are identifiable (Thiemel, 2003, 12).
			6	Cartilaginous construction in the extremities (Thiemel, 2003, 12).
			6	Thigh and pelvis are recognizable as cartilaginous blastemas (Graf, 2003, 58).

3. Possible explanatory approaches for the correlation between dysfunctions in the teporomandibular joint and in the hip joint

W.	TEMPOROMANDIBULAR JOINT	HIP JOINT	
6		6	The mesoderm is still connected, there are no joints yet. Only after the formation of the cartilaginous model of the later skeleton parts, does a condensation of the surrounding mesenchyma into the perichondrium occur; as a result the capsule-ligament-apparatus of the joints becomes visible (Thiemel, 2003, 12).
		6-7	First cartilaginous constructions exist; the tissue in between remains present as interzonal connective tissue (Tschauner, 2004, 4).
		6-7	Three cartilaginous hip / leg processes have merged into the cartilage "hemipelvis" and build the flat acetabulum at the position of merging together (Tschauner, 2004, 4). .
		6-7	Another interzonal tissue exists between the acetabulum and the cartilaginous position of the femur, which means that there is no interarticular space yet. The acetabular labrum, a condensation of the interzonal connective tissue, is identifiable as an early articular lip (Tschauner, 2004, 4).
		6	Hip joint recognizable in histological steps (Graf, 2003, 585).
		6, 7	Cartilaginous femur is formed (Niethart, 1997, 82).

W.	TEMPOROMANDIBULAR JOINT		HIP JOINT	
7				Furchen Toes, big toes and knee grow craniolaterally (Tschauner, 2004, 4).
				Releasing within the interzonal tissue; cleft formation, slowly merging into the early articular cavity. Condensations of this tissue lead to the formation of the femoral head ligament, of the connective tissue content of the acetabular fossa and of the articular capsule. The latter bridges the joint space and is continuous in the perichondrium (Tschauner, 2004, 4).
	7-8	The *articular fossa* is visible as the first structure within the scope of the development of the temporomandibular joint in the seventh or eighth week (Burdi, 1992). It is presented first as a condensation of mesenchymal cells above a tissue area, which can be differentiated later as disk and capsule (Bumann, 2000, 12).	from 7	Beginning of the perichondral ossification of the femoral shaft, whereby an osseous tube is formed around a central narrow cavity (Tschauner, 2004, 5).
	7-8	The articular disk can be identified for the first time after 7.5 weeks (70 mm CRL[21]) as a horizontal condensation of mesenchyma (Bumann, 2000, 13).	from 7	Five segments in the crest of the rim develop through a programmed cell death. Thus the growth of the finger- and toes and a condensation of the mesenchyma to the central skeleton elements are induced (Thiemel, 2003, 12).
			from 7	90° outward rotation of the limb position at the upper extremity (thumb lateral, extensor musculature dorsal). 90° inwards rotation of lower extremity (big toe medial, extensor musculature ventral) (Thiemel, 2003, 13).

[21] CRL = length between the cranium and coccyx

W.	TEMPOROMANDIBULAR JOINT		HIP JOINT	
8				Development completed, followed by fetal period with maturing and growth (Tschauner, 2004, 5). Perichondrium, articular capsule and acetabular labrum are identifiable (Graf, 2003, 58). Complete arm and leg positions exist as cartilage model controlled by a cell group underneath the root of the arm and leg-buds (influence of vitamin A and retinoic acid is assumed) (Thiemel, 2003, 12). Beginning of enchondral ossification (Thiemel, 2003, 12).
	8-9	The blastema of the *condylar process* appears at the end of the embryonary period; shortly after the blastema of the *temporal bone* becomes visible (Rauber, 1998, 730).	End	All components of the joint are clearly developed; the joints are fundamentally developed; the greater trochanter can be identified more and more clearly (Tschauner, 2004, 5).
			8th week. until baby-hood	The cotyloid cavity consists of the osseous basis of the acetabulum. Moreover the acetabulum consists of the cartilaginous, not yet ossified acetabulum, which is set on the osseous part. This cartilaginous part is broadly connected to the "Y-shaped spiece" and builds a thick covering of the osseous acetabulum, whereby it is involved in the constitution of the acetabular roof. At this cartilage the proper articular surface, the facies lunata can be found. The cartilaginous acetabulum is enlargened towards the periphery via the fibrocartilaginous acetabular lip and at the lower side, where the articular surface and the articular labrum are intermitted, via the transverse acetabular ligament (Tschauner, 2004, 5).

W.	TEMPOROMANDIBULAR JOINT	HIP JOINT
9	9-10 In the embryo of approximately 53 mm -CRL the coronoid processand condylar process can clearly be distinguished (Bumann, 2000, 11). 9-11 The *articular capsule* can be identified for the first time between the ninth and the eleventh week as a thin stripe around the alleged latter joint region (Bumann, 2000, 13). 9-10 In the ninth and tenth week, the *lateral pterygoid muscle*, which inserts at the medial and central third of the disk and the capsule with its upper part and at the occipital condyle with its lower part, is visible for the first time. Fibres of the *masseter muscle* and the *temporalis muscle* also insert at the (Bumann, 2000, 13).	

W.	TEMPOROMANDIBULAR JOINT	HIP JOINT
10	In the tenth week the first blood vessels appear around the joint. The disk only shows small vessels at its periphery and itself is avascular (Bumann, 2000, 13).	The ligament of head of femur is vascularised: numerous blood vessels enter the femoral head and excavate vascular channels. The destruction of the cartilage and the formation of the ossification centre happen only after birth (Tschauner, 2004, 5).

W.	TEMPOROMANDIBULAR JOINT	HIP JOINT
10	The upper and lower joint spaces develop through small spaces in the mesenchymal condensation, from which the condyle, the disk and the fossa originated before. The *lower interarticular space* develops around the tenth week (50-65 mm CRL), temporally before the upper interarticular space, but is later overhauled in its development by it. Thereby the space is strongly compartmented at the beginning and the solitary cavity formation only merge later. The lower interarticular space tightly abuts the condylar blastema (Bumann, 2000, 14). The development of the *secondary cartilage* begins at the head of mandible in the tenth foetal week. It later appears at the position of the temporal bone (Rauber, 1996, 730). 10-11 The articular fossa begins ossifying between the tenth and eleventh week. The development of the cortical substance of the bone and of the bone trabecula happens faster than in the condyle. The fossa develops as a protrusion at the origin of the zygomatic arch and grows in medial-anterior direction. At the same time, the eminence starts its development. The first cartilaginous condyle develops between the tenth and eleventh week from an accumulation of mesenchymal cells laterally to the Meckel's cartilage. An enchondral ossification in apical direction, leads to the osseous fusion with the mandibular body (Bumann, 2000, 12).	Beginning of the enchondral ossification of the iliac bone (Graf, 2003, 58).

W.		TEMPOROMANDIBULAR JOINT	HIP JOINT
11	11-12	The biconcave form of the disk is indicated at 83 mm CRL. Already before the development of the joint space, the central part of the disk is thinner than the peripheral areas, which eventually leads to the biconcave form. The peripheral parts cannot be clearly limited in contrast to the surrounding, slack mesenchyma (Bumann, 2000, 15).	
	11-12	The upper 'belly' of the lateral pterygoid muscle inserts at the medial and central third of the articular disk and the lower 'belly' of the muscle at the condyle (Bumann, 2000, 11).	
	11-12	The bone positions of maxilla, zygomatic bone and temporal bone only touch at a CRL of approximately 76 mm (Bumann, 2000, 11).	

W.	TEMPOROMANDIBULAR JOINT	HIP JOINT
12	The two gum palates have joined towards the centre and thus performed the separation of mouth- and nasal cavity (Bumann, 2000, 11). In the area of the later foramen the infraorbital position of the bones of the maxilla develop which quickly extend in horizontal direction and increasingly fill in the space between mouth cavity and eyes (Bumann, 2000, 11). The branches of the trigeminal nerve and the auriculotemporal nerve are clearly visible in the twelfth week (Bumann, 2000, 13).	Primary ossification centres exist in all long bones (Thiemel, 2003, 12).

3. Possible explanatory approaches for the correlation between dysfunctions in the teporomandibular joint and in the hip joint

W.		TEMPOROMANDIBULAR JOINT		HIP JOINT
12		The *upper interarticular space* develops after approximately 12 weeks (60-70 mm CRL) and extends in dorsal and medial direction beyond the Meckel's cartilage according to the contour of the later fossa (Bumann, 2000, 14).		
	12-13	At 95 mm CRL, all structures of the temporomandibular joint are clearly identifiable and basically only alter in size (Bumann, 2000, 11).	End of 12	The shaft formation of the femoral shaft is completed and the proximal femoral epiphysis sits on the diaphysis of the bone (Tschauner, 2004, 5).
	12-14	The formation of the articular disk happens between the twelfth and the fourteenth week and directly involves the formation of the articular cavity. The origin of the articular disk is debatable. Some authors consider the intraarticular disc as a continuation of the lateral pterygoid muscle, while others think that the articular disk develops from the same blastema as the mandibular condyle and the mandibular fossa (Rauber, 1998, 730). At the beginning of its development the disk is nearer to the condylar process than to the later fossa. At that time there still is a layer of slack mesenchyma between the temporal bone and the upper interarticular space. The condylar process and the fossa only approach each other at a CRL of 95 mm, and the mesenchymal layer disappears (Bumann, 2000, 15).		

W.	TEMPOROMANDIBULAR JOINT	HIP JOINT
13	After thirteen weeks, the lower interarticular space is clearly developed and the upper joint space develops contours. Right from the beginning the upper interarticular space shows less individual divisions in the joint and grows bigger than the lower interarticular space (Bumann, 2000, 14).	

W.		TEMPOROMANDIBULAR JOINT		HIP JOINT
14		Starting from the fourteenth week, both joint spaces are completely developed (Bumann, 2000, 14).		

W.		TEMPOROMANDIBULAR JOINT		HIP JOINT
15		Starting from the fifteenth week, the chondrocytes are built up and the cartilage already shows the typical postnatal structures (Bumann, 2000, 12).		

W.		TEMPOROMANDIBULAR JOINT		HIP JOINT
16	16-22	Between the sixteenth and the twenty-second week, the volume of the chambers fit to the surrounding osseous parts of the joint. The fibrocartilaginous articular disk develops from the mesenchyma condensed between the divisions (Bumann, 2000, 14-15).	16	Beginning of the enchondral ossification of the ischial bone (Graf, 2003, 58).

W.		TEMPOROMANDIBULAR JOINT		HIP JOINT
17		After the seventeenth week, the articular capsule is clearly identifiable (Bumann, 2000, 13).		

W.		TEMPOROMANDIBULAR JOINT		HIP JOINT
19	19-20	Between the nineteenth and the twentieth week, the articular disk shows its typical fibrocartilaginous structure (Bumann, 2000, 13).		

W.		TEMPOROMANDIBULAR JOINT		HIP JOINT
25		In fetuses with a CRL of 240 mm, the mesenchymal tissue changes into dense fibrous connective tissue. The peripheral area is more strongly vascularised than the central area. The compression of the disk between the temporal bone and the condyle leads to an avascular central zone (Bumann, 2000, 15).		

W.		TEMPOROMANDIBULAR JOINT		HIP JOINT
26		After twenty-six weeks, the articular capsule, with all its cellular and synovial parts, is completely developed (Bumann, 2000, 13).		

W.	TEMPOROMANDIBULAR JOINT	HIP JOINT	
after birth	In the toothless mandible of the infant, the articular fossa is very flat and the articular tuberculum is still missing (Rauber, 1998, 730).		
	With the breakthrough of the milk teeth, the mandibular fossa deepens and the curvature of the articular tuberculum increases (Rauber, 1998, 730).		Beginning of the ossification of the head of femur (mostly second half of the first year of life) with the appearance of an ossification centre. What remains of the original cartilaginous femur, is joint cartilage and the growth zone, the epipyseal cartilage. The growth zone exists until it closes between the sixteenth and the twentieth year of age (Tschauner, 2004, 5).
	The temporomandibular joint reaches ist definite form only after the complete cutting of the permanent teeth (Rauber, 1998, 730).	14.-16. YA	Between the fourteenth and the sixteenth year of age, the “Y-shaped spice” synostosizes (Tschauner, 2004, 5).

Depending on the literature, the sensitive phase during the intrauterine development of the temporomandibular joint is between the seventh and the twelfth gestation week (Bumann, 2000, 11). No specifications concerning sensitive phases of the hip joint can be found in the accessible literature.

The growth of the hip joint considerably depends on mechanical influences before birth. If the hip joint is not moved because of slight neuromotorical disturbances, this can result in maldevelopment. The intrauterine narrowness can influence the growth in the last third of the pregnancy. During this time an increasing disaccord between the size of the head of femur and the depth of the cartilaginous acetabulum can arise.

Each slight dislocation of the head of femur can result in the deformation of the cartilaginous structures on the periphery (Niethart, 1997, 82).

These spatial influences are not to be expected to this extent during the development of the temporomandibular joint.

In my opinion, it can be assumed from the above-mentioned comparison, that the parallels in the development of the vascular supply of the joints in the tenth gestation week are the basis for the deviations from the norm in both joints. Apart from that, the developmental processes happen separately. While the acetabulum of the hip joint is recognizable already in the sixth gestation week, the articular fossa of the temporomandibular joint is only visible in the seventh or eighth week. The blastema of the condylar process is identifiable in the eighth or ninth week, thus at a time, when the articular capsule of the hip joint is already visible (it is recognizable in the ninth and eleventh week).

The *beginning* of ossification, i.e. the determination of the definite structures, does not follow the above pattern. The ossification of the temporomandibular joint already starts between the tenth and eleventh week with the ossification of the fossa, while these processes only happen after birth in the hip joint.

3.3.3 Developmental processes after birth

Postnatal alterations in the temporomandibular joint

Just like the form of the hip joint, the form of the temporomandibular joint is also determined by its movement. Therefore the form of the joint also depends on the development of the dentition and on the type of bite (there are strong postnatal changes in the form, above all, of the mandible). In persons with head bite/ overbite, the articular surfaces are rather flat. The stronger the overbite, the more does the articular tuberculum fall steeply in dorsal direction; the mandibular fossa is deep and the mandibular head shows a strong curvature. This phenomenon is developed best in pathological deep bite (Rauber, 1998, 730).

This is also reflected in the change that happens in the development of the temporomandibular joint from the toothless infant until the old man bite. According to Rauber (1998), the articular fossa in the mandible of the infant is very flat and the articular tuberculum is missing. With the cutting of the milk teeth, the mandibular fossa deepens and the curvature of the articular tuberculum increases.

The temporomandibular fossa only reaches its definite form after the complete cutting of the permanent teeth. The maintenance of the typical form of the joint depends on the functional condition of dentition. The toothless jaw-bone of the old man changes secondarily, which result in a flattening of the articular tuberculum and the articular fossa in the temporal bone (Rauber, 1998, 730).

Growth and maturing

The postnatal growth of the hip joint can be summed up as follows:
According to Niethard (1997, 82-88), the postnatal growth of the hip is directed by the endogenic growth programme and by biomechanical factors. The morphology of the hip joint can be regarded as a mirror of its functional loading. A weakening of the abductors results in a different hip form than a preponderance of the adductors (infantile cerebral paresis). The growth of the hip joint happens synchronously, so that the head of femur-acetabulum-relation stays the same. The ossification centre of the head of femur generally appears in the fourth month of life with a significant variation range. The spatial orientation of the head of femur is altered by the growth of the proximal epiphyseal cartilage; the antetorsion of the neck of femur reduces continuously and reinforces between the age of eight and ten and in puberty.
The acetabulum grows evenly until the pubertal growth spurt from the areas of the “Y-shaped piece” and of the area of the acetabular cup. In the acetabulum the definite deepening happens via the parietal ossification centres which occasionally accumulate at the osseous iliac bone. The growth of the hip is completed 2.5 - 3 years earlier in girls than in boys. The growth zones of the head of femur occlude earlier than those of the acetabulum. The apophyseal cartilage of the greater trochanter occlude last.
An authentic coverage of the mechanics in the growth process of the hip joint has not been possible yet, according to Niethard (1998, 87-88). Unclarities exist, above all, concerning the loading and its consequences on the growth in the saggital plane, and its dynamical factors. The influence of the muscular development however, is out of question.
The hip joint is in a flexed position from the fifth intrauterine month until the birth. During the first months of life it changes into an increasingly extended position. For the complete extension, the continued muscule tone and the muscular strength play a major role. A delayed positioning of the pelvis, with consequences for the growth of the hip joint, occurs in the case of muscular hypotonus. In the vascular supply of the growing hip joint, primarily the blood circulation of the head of femur and of the epiphyseal plate at the coxal ends of the femur are critical. The epiphysis is supplied by blood vessels, which run along the neck of femur intrarticularly and thus, can be damaged in all intrarticular processes. Generally, the epiphyseal cartilage is not penetrated by blood vessels. A unification of the vascular regions of meta- and epiphysis, happens only with the complete occlusion of the epiphyseal cartilage after puberty.

3.3.4 Resumée of the development of the temporomandibular joint and the hip joint

Recapitulating, the following critical parameters are of importance during the development and the maturing of the two joints:

- Vascularisation of the joints
- Possibility of movement of the two joints

While the development of the blood vessels happens simultaneously in both joints (i.e. in the tenth gestation week), the influences of mobility during the development are neither coupled chronologically nor structurally. Concerning the deviation from the norm occurring in both joints, it can be assumed that the joints are either vascularly underdeveloped or that a deviation from the norm in both joints at the same time is merely incidental, i.e. happens due to different influences in the two joints.

The development of the two joints is only completed when the osseous structure is fully developed. Mobility is of great importance in this long period of time (until the age of sixteen years, or the cutting of the last permanent teeth). The developmental processes of the joints are similar in this respect, even if they do not happen parallely.

3.4 Mandibular joint and hip joint from the point of view of Traditional Chinese Medicine

Traces of Chinese medicine can repeatedly be found in osteopathy, especially in visceral osteopathy. Barrall and Mercier (2002, 11) mention the energy flow with the organ clock in traditional Chinese medicine (TCM). The Vienna School of Osteopathy, where I trained as an osteopath, and in particular D.O. Bernard Ligner, director and lecturer, have frequently suggested parallels between osteopathy and TCM. The term somatotopy, especially in respect to auricular acupuncture, indicates a connection to Chinese medicine. Moreover, the AWMF-manuals recommend acupuncture as a complementary treatment (AWMF-online, 2004). Therefore, TCM could, being an approved treatment concept in Austria, contribute to the clarification of this paper's hypothesis. It must be remarked, that the author of this paper is not trained in Chinese medicine and thus, does not practise it. Consequently, personal and practical experience cannot be utilised. The statements in this chapter represent extracts of the attached literature and are based on conversations with experts.

Both osteopathy and TCM try to comprehend human beings holistically. They mostly work according to empirical findings, which often are not scientifically justified or which have not yet been explained. They are not to be regarded as "rivals" of traditional medicine, but provide good opportunities to supplement the mostly symptom- and organ-based, apparative treatment techniques of conventional western medicine. What osteopathy and TCM also have in common is that the hands are used for diagnosis and treatment. TCM additionally uses Chinese medication, dietics or techniques like acupuncture, cupping or moxibustion. Movement patterns such as 'Taiji' or 'Qigong', which are useful for the recovery or the maintenance of harmony, are also part of the philosophy of TCM.

3.4.1 The Basics of TCM

TCM has created the concept of Yin and Yang and the principle of the Five Phases (or Elements) (also called “wu-xing”) in order to reveal patterns of disharmony, so that complex dysfunctions in the human organism can be treated.
For that purpose the Chinese concept has on the one side the human physiology consisting of organ systems (zang-fu), the concept of meridians (jing-luo) and the theory of vital substances (qi, blood, …), and on the other side the influence of the environment in terms of intruding pathogenic factors (Focks, Hillenbrand, 2003, 25ff).

The Concept of Yin and Yang:

The theory of Yin and Yang is the basis of the Chinese philosophy of life and can be transferred to all domains of the universe. It describes two primal opposing but complementary forces and their interactions. All imaginable Yin / Yang elements have to be considered as equal parts of a superior entity (e.g. woman / man, night / day, body / mind, passive / active, etc.). Sympathetic / parasympathetic trunk, organ structure / organ function, bone / musculature or anabolic / catabolic can unambiguously be assigned to the complementary forces of Yin and Yang. Yin and Yang are complementary opposites rather than absolutes, meaning that nothing is absolutely Yin or absolutely Yang. In each Yin there is some Yang and vice versa. The knowledge about Yin and Yang is fundamental for the comprehension of the physiological and the pathological processes in the human body (cf. Gleditsch, 2005, 94ff, and Focks, Hillenbrand, 2003, 27ff).

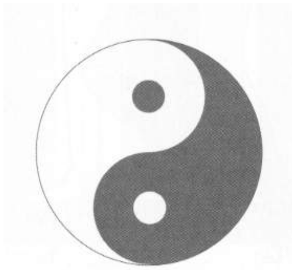


Figure 10: Yin-Yang-monad (Gleditsch, 2005, 94)

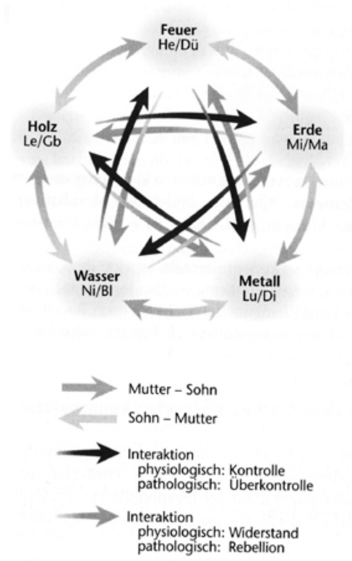


Figure 11:[22] Five Phases or Elements (Gleditsch, 2005, 98)

The Five Phases or Elements (Wu-xing):

The five phases describe both a generating cycle and an overcoming and restraining cycle of interactions between the phases. They are also called five elements. In TCM, the five

[22] Feurer: fire; Erde: earth; Metall: metal; Wasser: water; Holz: wood; DÜ: SI; Mi: Sp; Ma: St; Di: LI; Mi: Ki; Le: Li; Mutter: mother; Sohn: son;

phases stand for the constitutive aspects of the whole and are represented by the symbols of wood, fire, earth, metal and water. By the impair number of elements, a determined polarity can never be accomplished. The circle gains its own dynamics via alternating, appearing polar tension.

Regulation is done according to the classical “mother-child relationship”. It is based on the evolutionary sequence of the elements. The element, which follows another one clockwise, is the “child” (is nourished), while the foregoing element is the “mother” (is weakened). In another treatment rule called “opposition”, the next element but one represents the opponent. This way, each element is connected to two other elements, either in an active control function or in a passive counter measuring function (cf. Focks, Hillenbrand, 2003, 96ff). The five phases are mainly used to describe clinical processes and correlations and to provide a conceptual frame for the adequate treatment.

Organ systems (Zang-fu):

In contrast to conventional, rather structurally oriented medicine, organ systems are based on functional perceptions. Here the organs are conceived as function circles with a much wider scope of functions than in western medicine. They are interrelated and have to be considered in interaction.

The main role of the organs is to absorb the energies of the earth (food) and of the sky (air) and to transform them. They also produce and distribute the substances (cf. teaching substances) and excrete waste products.

They are classified into Zang-organs (solid organs – store, in particular vital substances), Fu-organs (hollow-organs – transform and digest) and extraordinary Fu-Organs. Each Zang is paired with a Fu, and each pair is assigned to one of the five elements. Zang- and Fu-organs together form a functionally complementing Yin/ Yang pair and are assigned to a functional circle or an element (Gleditsch, 2005, 96ff):

Zang-organs / Yin	**Fu-organs / Yang**	**Element**
Kidney (Ki)	Bladder (Bl)	water
Liver (Li)	Gall bladder (GB)	wood
Heart/Pericardium (He)	Small intestine (SI)	fire
Spleen/Pancreas (Sp)	Stomach (St)	earth
Lung (Lu)	Large intestine (LI)	Metal

Table 2: Attribution of the elements

Concept of Meridians (Jing-luo):

The meridians are channels that build an interconnected system in the organism. In their course, they connect all areas of the body e.g. the organs (Zang-fu), the surface of the body, the extremities and the sense organs. The meridians correspond with transport channels through which Qi[23] (cf. Vital substance beneath) and bodily fluids are transported. Thus, they supply all structures along their course.

Twelve main meridians are described in TCM (Focks, Hillenbrand, 2003, 48f): Lung (Lu), Pericardium (Pe), Heart (He), Spleen (Sp), Liver (Li), Kidney (Ki), Large Intestines (LI), San Jiao (SJ), Small intestines (SI), Stomach (St), Gall bladder (GB) and Bladder (Bl).

Respectively four meridians build three meridian cycles. These energy cycles appear in a circadian rhythm from which also, among others, the organ clock derives. There is a cycle from the chest to the hand, from the hand to the head, from the head to the foot and from the foot to the chest, which runs through three times (Focks, Hillenbrand, 2003, 49f).

No anatomical substratum for the meridians has been verified yet. As points of reference however, they mark an irreversible sequence.

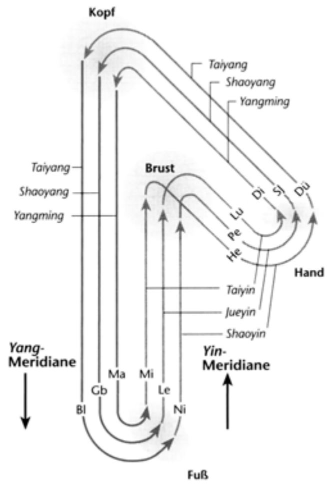


Figure 12:[24] **Meridian cycles** (Focks, 2006, 10)

The reality of these "Points of reference" is that they are also acupuncture points is morpho-histologically and biophysically documented (Gleditsch, 2005, 90). They are defined topographically, but can feature as an individual position. TCM uses them to be able to affect the body's own regulation mechanisms. In this paper the acupuncture points after Fock (2006, 679, 685) are defined as follows:

- Local points lie directly locally in the affected area.
- Regional points lie nearby the affected area.
- Distant / distal points lie "far" from the affected area, but have a therapeutic impact.
- Crosspoints are the crossing positions of multiple meridians or vessels. The needling influences all involve routing-channels.

[23] Qi stands for energy flow, breath, life force (compare http://en.wikipedia.org/wiki/Qi)

[24] Kopf: head; Brust: chest; Hand: hand; Fuß: food;

Besides the twelve main meridians, twelve additional muscular channels are described (see picture in chapter 3.4.3). They basically represent groups of muscles, sinews and ligaments, which support the mobility when combined with the respective joints. Their course generally follows that of the main meridians and they are named after them. Their expansion includes regions that are neither run through by the main meridians, nor by diverging channels. Tendino-muscular meridians do not have own points, nor direct connections to the organs. Under pathological circumstances, they manifest so-called "Ashi-" or triggerpoints (cf. Focks, 2006, 21).

Focks (2006, 21) also defines the following terms:

- Node: Spindle-shaped concentration of the tendino-muscular pathways.
- Collective point: Two or several tendino-muscular pathways are bundled together
- Distribution: Qi is spread in order to be brought into smaller muscle groups

Vital substances (Qi, blood, jing ...):

The bodily fluids or substances that are described in TCM are: Qi (energy), Xue (blood), Jinng (essence), Shen (spirit) and Jin ye (fluids / juices). These substances underlie the principle of yin (blood, fluids) and yang (essence, qi, spirit). They are in more or less close contact to each other. The functioning of the human organism can be ascribed to the interaction between the substances (Focks, Hillenbrand, 2003, 49f). Bodily fluids in respect to the arteries are also attributed in osteopathy as a considerable impact (fourth osteopathic principle). A restricted blood circulation causes stagnation, which can result in an aethological disorder (Delaunois, 2002, 41).

Pathogenic factors:

The identification of the pathogenic factors is essential for a treatment concept in TCM. They are climatic influences on the organism, like cold, heat, summer heat, dampness, dryness and wind. They enter the body and cause disease.

Pathogenic factors can enter the body if environmental stress is too high, or if the defence-qi is too weak. Such factors are climatic, epidemic or emotional factors, dietary mistakes, psychological over- and under loading, trauma or parasites. It is notable, that the climatic conditions and the personal circumstances in the industrialized countries clearly differ from the ones in China. That is the reason why they only can be partially taken into consideration (Focks, Hillenbrand, 2003, 51).

However, at the same time the pathogenic factors can be jointly responsible for the fact, that pains are more persistent in the treatment, than expected.

3.4.2 Temporomandibular joint and hip joint in TCM

In this paper the statements about diagnoses and treatment approaches for the temporomandibular and hip joint are based on a manual for Chinese medicine ("Leitfaden Chinesische Medizin") (Focks, Hillenbrand, 2003), on the "Atlas Akupunktur" (Focks, 2006) and on a book about the treatment of pain with the help of Chinese medicine and acupuncture ("Schmerzbehandlung mit chinesischen Arzneien und Akupunktur") (Peilin, 2005). The treatment of pain was chosen as a topic, because in the case of craniomandibular dysfunction the treatment of pain is one of the principal components of therapeutic intervention. More literature was not included since TCM compared to osteopathy is so extensive that it would exceed the scope of this paper.

Temporomandibular joint:

Peilin (2005, 109) allocates dysfunctions in the temporomandibular joint to the auricular region, while Fox and Hillenbrand (2003, 956f) consider odontalgia and temporomandibular pain as the main symptoms.

The following acupuncture points are situated in the temporomandibular area:

- Stomach (St) 5-8
- Gallbladder (GB) 2.12, 20
- San-Jiao (SJ) 17, 21
- Small intestine (SI) 19

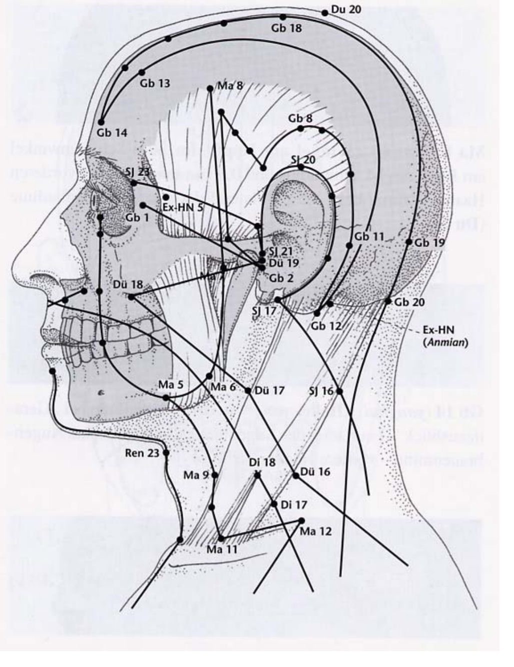


Figure 13: Acupuncture points in head and neck (Focks, 2006, 623)

According to Peilin (2005, 109ff), pains in the temporomandibular joint are provoked by the intrusion of pathogenic factors like wind-heat or wind-cold. He assumes that Liver-qi-stagnation, hyperactive Liver- and Gall bladder-fire, blood-stagnation, qi- and blood insufficiency or Liver and Kidney deficiencies are internal pathogenic factors for the above mentioned disturbances.

Focks and Hillenbrand recommend the following points for the treatment of the temporomandibular joint in their Manual for Chinese Medicine (2003, 1102f):

- Main points: St 42; Sp 4
- Additionally in case of wind-heat: GB 20; St 7; SI 18; St 44; St 4; LI 4; St 6
- Additionally in case of Stomach-fire: St 7; St 34; St 44; St 4; SI 4; St 6
- Additionally in case of yin-deficiency and Stomach-fire: Ki 3; Bl 34
- Additional local points: St 7; SI 18; St 6; St 4

Hip joint:

The following acupuncture points are situated in the hip joint area:

- Gall bladder (GB) 29,30
- Spleen (Sp) 12
- Stomach (St) 30, 31

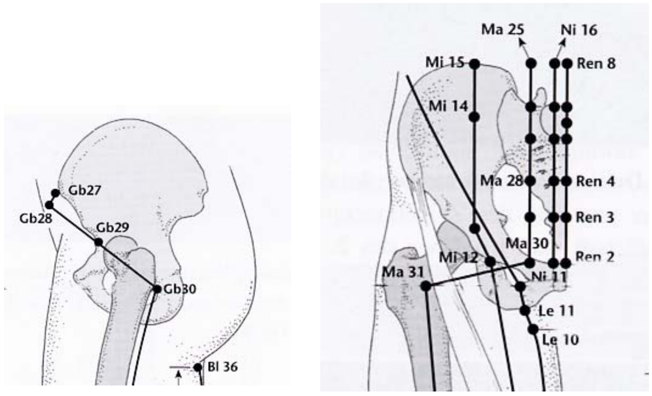


Figure 14: Acupuncture points in the hip (Focks, 2006, 646, 650)

Peilin (2005, 472ff) suggests, that pain in the hip is evoked by the intrusion of external pathogenic factors like wind in combination with cold and dampness, or in combination with damp-heat. As internal pathogenic factors for these disturbances, he mentions qi-blood-stagnation, qi- and blood insufficiency or Liver-Kidney- deficiency.

The following distant points are recommended for the treatment of the hip in the Manual for Chinese Medicine (Focks, Hillenbrand, 2003, 1102f):

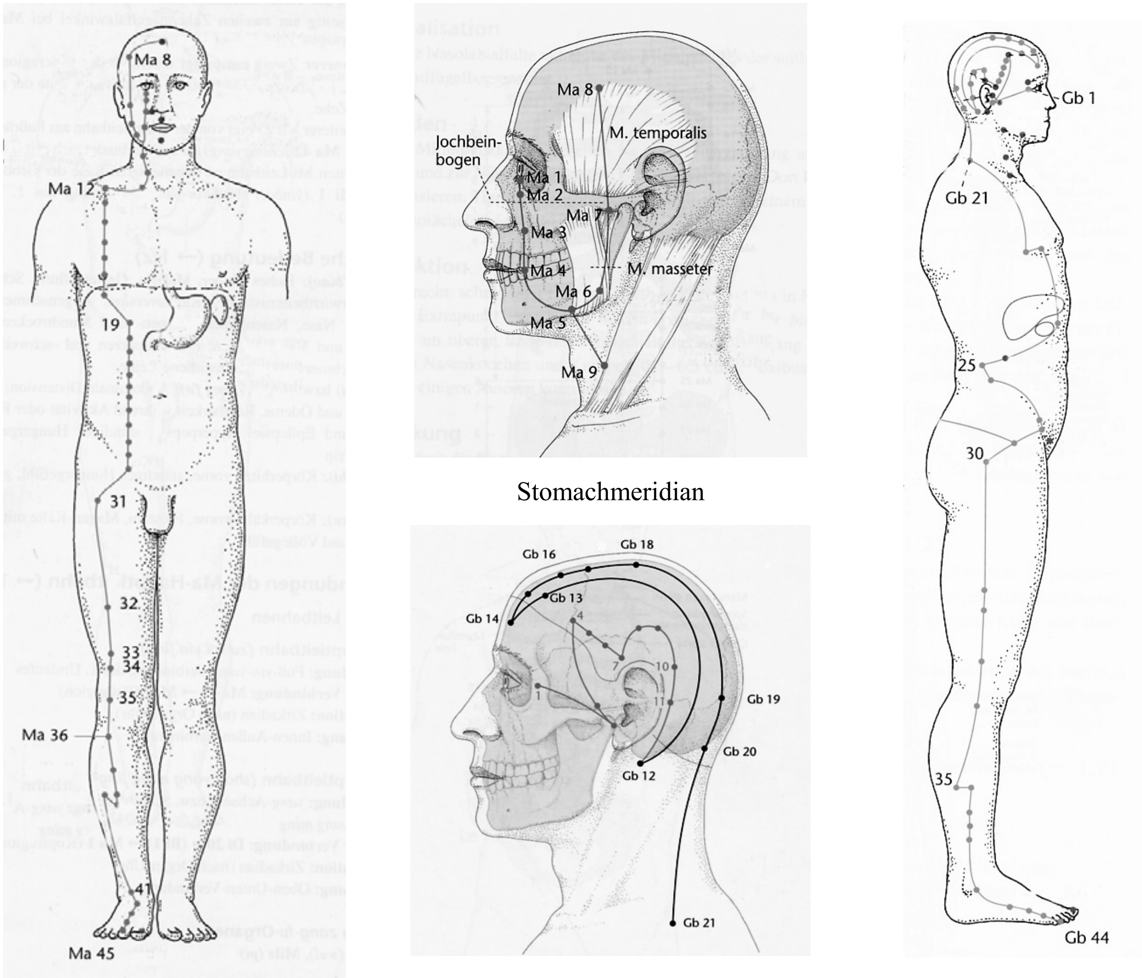
- Local points: GB 30; GB 29; Sp 12
- Distant points: GB 41; GB 40; Bl 62; Sp 3

3.4.3 Correlations between the temporomandibular and hip joint in TCM

The basic principles introduced in the chapters 3.4.1 and 3.4.2 are used as the basis for the following conclusions:

Comparing the twelve main meridians, it is noticeable, that two channels, the Gall bladder-meridian and the Stomach-meridian go through both the hip joint and the temporomandibular joint. From that, it is deducible, that if the qi-flow of this meridian is disturbed, each structure lying on the meridian can be influenced (thus the temporomandibular joint and the hip joint, as well as the knee or the ankle).

The acupuncture points GB 2-12, 20 and St 5-8 of these two meridians lie in the anatomical region of the temporomandibular joint (cf. chapter 3.4.2).
As it was also described in chapter 3.4.2, Focks and Hillenbrand (2003, 957, 1103) specify St 42 as the main point for the temporomandibular joint, and GB 29, 30 as the main point for the hip joint. Therefore, the temporomandibular and the hip joint do not seem to be lying on the same meridian.



Stomachmeridian

Gallbladdermeridian

Gallbladdermeridian

Stomachemeridian

Figure 15: Stomach- and Gallbladdermeridian (Focks, 2006, 121, 122, 391)

Focks (2006) however, describes St 7 as the local point of the temporomandibular joint in the Atlas for Acupuncture (126)[25], and St 31 in the case of paraesthesis and pains in the hip joint (158). As local points for the lateral head, GB 8 (396) and GB 2 are stated as the most

[25] (Focks (2006)

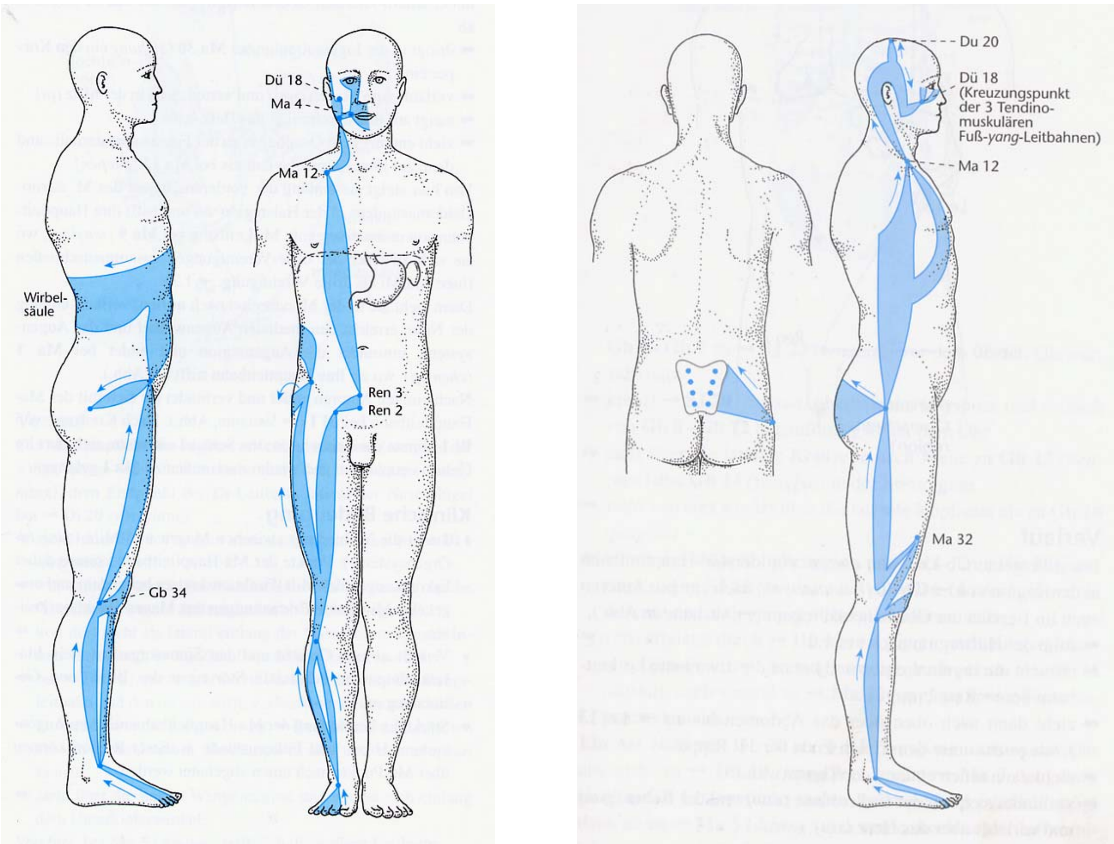
important local points in the case of auricular and temporomandibular disorders (400). GB 41 is given as distant point for the hip as well as for the head and the ears. Apart from that, there are four to seven crossing points between the St- and the GB-meridian (126, 395). This means, that there are points on both meridians that can be punctured either for the temporomandibular joint or for the hip joint. Moreover, there are points where a therapeutic effect can be achieved on each of the two, the hip joint and the temporomandibular joint. It should be pointed out however, that precisely St 29 to 30 are mentioned frequently for the urogenital tract while they seem to be less specific and important for the hip.

As described in chapter 3.4.1, the twelve primary meridians constitute from the three meridian cycles. The respective third of these three cycles goes from the face to the tip of the toes. This part is assigned to the yang-meridian and consists of the Bladder-, the Gall bladder- and the Stomach-meridian, which are also called the foot-yang channels (Focks, Hillenbrand, 2003, 49f). This could lead to the conclusion that those phenomena, which weaken or strengthen the yang-components, have an effect on the temporomandibular joint and the hip joint. This conclusion however, is true for all joints, which lie on this meridian e.g. the knee joint or the ankle.

In addition, these three, extremely long channels provide the characteristic attributes of the three vertical axes. The vertical axes form a meridian-connection that passes through from the upper to the lower extremities (Small intestine with Bladder; San-Jiao with Gall bladder; Large intestine with Stomach). Thus, both meridians that traverse the temporomandibular joint and the hip joint belong to the vertical axes. The axes are an important key for the treatment of chronic pain sufferers and have a considerable significance for the body’s posture (Gleditsch, 2005, 165ff). The relevance of the body’s postural position for the correlation of the temporomandibular joint and the hip joint in western medicine were treated in chapter 3.1. Gleditsch (2005, 165ff) interprets the vertical axes also phenomenologically with reference to pain and both the sensation and experience of pain. No palpable reference to the psychological factors of the craniomandibular dysfunction can be found in his work.

The tendinomuscular channels of the Gall bladder and the Stomach are also noteworthy. Their expansion is wider than the one of the primary meridians and therefore explains the working circle of some acupuncture points. Both tendinomuscular channels pass through from the head to toes.

The Gall bladder-meridian takes a lateral course and the Stomach-meridian runs on a medial course from it. They partly branch out and are interconnected. This way they meet on the level of point GB 34 at the head of the fibula and at the anterior side of the femur. One branch of the Stomach channel intertwines in the other anterior hip region, wherefrom a sector leads from the greater trochanter to GB 30. From this point, a part of the tendinomuscular Gall bladder channel runs widely to the sacral region beyond the buttocks (Focks, 2006, 394). This branch aligns with the anatomical course of the piriformis muscle. The stability of the hip joint in rotation could be explained via this anterior lateral dorsal chain, and the lateral stability of the hip joint via the tendinomuscular Gall bladder channel.



Tendino-muskulare Stomachmeridian

Tendino-muskulare Gallbladdermeridian

Figure 16: Tendino-muskulare Stomach- and Gallbladder-meridian (Focks, 2006, 124, 394)

Moreover, the tendinomuscular channels of the Gall bladder and the Stomach lead along the trunk and intertwine above the clavicle in the acupuncture point St 12. From there they run along the lateral neck region and branch out across the lateral cranium. It is noteworthy, that all three tendinomuscular foot-yang channels (Stomach, Gall bladder,

Bladder) meet at the lower zygomatic bone at the acupuncture point of the Small intestine 18 (Focks, 2006, 124, 246f, 394). The stabilization of the temporomandibular joint could be explained by these tendinomuscular channels. Anatomical structures can be recognized in this course (e.g. one branch of the tendinomuscular Gall bladder channel, which crosses from the temporal lobe across the cheek to the mandible, corresponds with the courses of the temporalis muscle and the masseter muscle).

An actual comparison with the muscle and fascia chains (cf. chapter 3.2), which are described in western medicine, is not possible because of the available literature, and would be too extensive for this paper. The tendinomuscular channels of TCM coincide with some references that are taught in osteopathy and are comprehensible for me as an osteopath; e.g. the segmental central zone of the sympathetic supply of the urinary bladder can be found from the twelfth thoracic vertebra to the second lumbar vertebra (T 12 to L 2) and the supply of the female genitals from the tenth thoracic vertebra to the third lumbar vertebra (T 10 to L 3) (Puylaert, 2005, 455, 487). According to the manual for visceral osteopathy (“Leitfaden Viszerale Osteopathie”), the second and third lumbar vertebrae are vertebral indicators for the urinary bladder and the twelfth thoracic and first lumbar vertebrae for the female genitals (Puylaert, 2005, 460, 495). This connection can also be recognized by the course of the tendinomuscular channel. The hypothesis of this paper, namely the possible connections between the hip joint and the temporomandibular joint, can be verified. Their exclusiveness however, cannot be justified.

In the organ system of TCM the Gall bladder channel is allocated as an organ to the Gall bladder and the Liver (wood). The stomach channel is assigned to the organs Stomach and Spleen (earth). Wood stands for growing activity; earth describes balance or neutrality. In accordance with the Five Elements in the Five Phases (Five Element Theory) wood controls the earth and pathologically leads to over-controlling. The earth resists the wood, which corresponds to a rebellion in the pathological relation (Gleditsch, 2005, 98).

Gall bladder / Liver and Stomach / Spleen are closely connected and are difficult to distinguish in their pathology. The relationship between Liver and Spleen is very close and often clinically disturbed. The Spleen produces blood, which is stored in the Liver. The Liver is responsible for the smooth flow of qi and gall, which enables the Spleen to transport and transform food. The Spleen produces the food-qi and thus forms the basis for the formation of qi and blood. The Spleen is the origin of the qi of the afterbirth (Focks, Hillenbrand, 2003, 47, 844). In addition to all the cardinal symptoms of the Liver and the

Spleen, which mostly correspond to the internistic disease patterns in western medicine, the Liver also controls the muscles and the sinews. It is responsible for the adequate nourishment of the sinews and controls the contractile part of the musculature (Focks, Hillenbrand, 2003, 863ff). States of exhaustion and muscle weakness are the results of a lack of Spleen-qi (Focks, Hillenbrand, 2003, 485f). The nourishment, the control and the realisable force of the muscles and therefore the active mobility of the joints depend on the harmony of the Liver and of the Spleen. All joints, which are situated on the respective channels of these organs (GB and St), are directly influenced e.g. the temporomandibular and the hip joint. Imbalances in the muscular area and in the enthesis of the sinew can occur in the case of hip joint or temporomandibular joint disorders. From the literature I used it is not deducible whether the function between Liver and Spleen in the case of hip joint or temporomandibular joint disorders is disturbed more frequently than in the case of other joints. The question, in how far an imbalance in the Liver and /or in the Spleen influences the metabolism or the digestion, cannot be clarified in this paper.

In conclusion, it has to be said that connections between the hip and the temporomandibular joint can be detected in Chinese medicine. TCM, however, does not recognize exclusive relations between the two joints, in its holistic view of the body. It always considers singular structures in correlation with the entire body and interprets them in terms of control cycles. It is the attempt of this paper to work out the control cycles between the hip joint and the temporomandibular joint. These cycles, however, do not only exist between the hip joint and the temporomandibular joint, but also in connection with other joints. Hereby a somatotopic relation between the hip joint and the temporomandibular joint cannot be confirmed.

4 Methods and Analysis

Data acquisition was carried out between 1st January 2006 and 30th June 2006 via the attached questionnaire. Investigation and measurement were carried out at the Department of Physical Medicine and Rehabilitation (PM&R), at the Vienna General Hospital, by courtesy of O. Univ. Prof. Dr. V. Fialka-Moser.

4.1 Sample of investigated patients

For the measurement, the sample of investigated patients was restricted to those subjects whose clinical picture complied with CMD and who had been admitted for manual therapy at the Hospital of Physical Medicine and Rehabilitation by a physical medicine and rehabilitation specialist.
Additional disqualifying criteria were:

- Lack of patient's consent
- Patients with a rheumatologic primary disease
- Patients with an acute infectious disease
- Patients with chronic digestive diseases and chronic diseases affecting the organs of the pelvis minor
- Patients with other diagnosed neurological problems (except herniated discs)
- Severely injured patients

4.2 Data collection

The subjects for the investigation were questioned and measured according to the questionnaire (cf. attachment) before commencing any of the manual therapy.

No individual-related data was collected apart from the participants' gender (male, female) and age (in years).

The *diagnosis* was taken from the physical medicine and rehabilitation specialist's referral. The following referral diagnoses were combined under the term of craniomandibular dysfunction (CMD): "dysfunction of temporomandibular joint", "anterior disc dislocation (ADD)" and "myofascial pain syndrome" (cf. chapter 1.1.3). Radiological diagnostics and magnetic resonance imaging verified all diagnoses of ADD.

4.2.1 Anamnestic Data

The investigation was conducted by questioning the patients, whereby the sequence of questions (according to the questionnaire) was always the same:
Where is the *mandibular joint problem* located (right, left, more right than left, more left than right or on both sides)?
How long has the mandibular joint problem been occurring (in years accurate to two decimal places)?
Are there *occlusion problems* according to your dentist?
Do or did you wear *braces*?
Do or did you use an *orthodontic retainer*, *brace* or *retainer at night*?
Do you have any spinal problems? If yes, in which areas: cervical spine (yes, no), thoracic spine (yes, no), lumbar spine (yes, no) and in which combination?
Do you have / or have had any hip problems? For how long (in years) have they been occurring? Was a hip dysplasia detected at birth (no, yes [right, left on both sides], don't know)?

4.2.2 Measured Data

In this paper, the ***active*[26] *and passive*[27] *range of movement in the hip*** was measured with the goniometer, using the neutral-0-method.

The neutral-0-method is a method measuring the mobility of a joint from a standardized initial position, ensuring standardisation from an optimal position (Pschyrembel, 1994, 1067). This initial position is called the neutral-0-position and is equal to the standing position of a person. It can also be used in different initial positions, e.g. in dorsal, lateral or prone position. The joint is always moved by the distal[28] part of the joint. The pivot point of the goniometer has to be applied at the level of the axis of motion and the two shanks have to be applied along the joint length axis (Trinkle, 2005, 39).

During the measurement, it was important to maintain the defined initial position correctly and to make sure that the movement only took place in the hip joint. Only the distal partner

[26] active motion: moved by the patient himself

[27] passive motion: moved by the therapist

[28] distal: part of the body furthest from the central trunk

of the joint changed its position, while the proximal should not dislocate. In the final position, the data was read from the goniometer. The following initial positions were chosen in order to conduct the measurement in one plane of movement without the patient's change of position:

Flexion and extension were performed in lateral position. The leg lying below was slightly bent. The therapist stood behind the test person.
In order to accomplish active mobility, the patient was first asked to move the above leg parallel to the bed as far towards the chest (flexion) as possible, and then to move it backward in an extended position (traction). Passive motion data was collected by the therapist moving the patient's leg into both the final flexion and extension position.

Abduction and adduction data were performed in supine position. The leg, which was not measured, was lifted so as not to interfere with the results of the adduction. The patient was instructed to first move a leg laterally away from the body (abduction) and then to move it to the other side (adduction). The result of this procedure was *active* mobility.
Passive range of motion was determined in the same way as active, with the difference, that the therapist moved the patient's leg.

Active rotation was ascertained in prone position with the knee flexed to 90°. The patient was instructed to move his feet and lower legs laterally outward (medial rotation) and inward (lateral rotation).
Passive joint movements were performed in supine position with the hip and the knee flexed 90°. The lower leg was rotated laterally outward (medial / internal rotation) and inward (lateral / external rotation).

Varying normal values in the literature made it necessary to chose diverse initial positions (Kolster et al., 1995, 662; Schünke et al., 2005, 386, cf. chapter 1.2.1.).
Mean values of the lower and the upper limits were verified in literature in order to determine the limits of normal ranges in movement, (with the exception of Cabri's flexion and extension values, which differ in the factor 2 from the otherwise stated necessary range of movement; cf. Cabri et al., 2001, 223). The values were rounded up to the next 5 degrees. As some literature references only contained typical mean values, these values were only taken into consideration for the calculation if they were within the average range

of the determined limits. This way, except for Capri's data, the limits correspond to the literature data to a large extent.
Due to the additional consideration of a measuring fault of 5°, it can be assumed, that the deviations from normal ranges of movement occur less frequently in the analysis than they do in reality.

The difficulty concerning the normal values was also discussed in chapter 1.2.1. For this paper, the following values for *active range of movement* were assumed:

- Flexion / Extension: 130-140 / 0 / 10-20
- Abduction / Adduction: 30-50 / 0 / 20-30
- External / internal rotation: 35-50 / 0 / 30-45

The following limits for passive range of movement were assumed:

- Flexion / Extension: 130-150 / 0 / 10-20
- Abduction / Adduction: 35-55 / 0 / 25-35
- External / internal rotation: 40-55 / 0 / 35-50

The Patrick-test is a clinical test with the aim of confirming a hip joint or sacroiliac joint disorder (Springorum et al., 1998, 190). In the Manual for Osteopathy (Dobler et al., 2002, 368ff) it is called ***Patrick-Kubis test*** (hyperabduction test), which is the denomination that will be used in this paper from now on.
The patient is placed in supine position with one leg stretched and the other leg bent at both the hip and knee joint until the outer ankle can be placed above the knee joint of the outstretched leg. The examiner now exerts pressure on the bent leg, which will cause inguinal pain in the case of numerous hip joint disorders e.g. activated coxarthrosis. In this hip abduction is clearly limited. The test is not exclusively used for the hip joint, because affections of the sacroiliac joint and various spinal disorders can also be the cause of radiating pain (Fabere-Patrick-test) (Springorum et al., 1998, 190). According to Dobler et al. (2002, 368ff) the findings are normal, if there is a bilaterally equal distance between the knee and the bed and if the leg is in an almost horizontal position.

The T**rendelenburg-Duchenne's test** investigates the insufficiency of the muscili glutaei medius and minimus. These muscles are also called the pelvitrochanteric musculature and contract in a one-leg stance in respect to the supported leg (Tschauner, 2004, 42). The

tilting of the pelvis towards the unaffected side is also called hip hitching and is the definition of the Trendelenburg's-sign (Springorum, et al., 1998, 252). The counterbalancing movement of the body towards the affected side in the case of positive hip hitching is called Duchenne's sign (Springorum, et al., 1998, 74).
The test clarified, if the patient's pelvis shifted in a one-leg stance, as described above, and if the shift was followed by the counterbalancing movement of the body.

4.3 Evaluation of the results

The results from the subjective medical history interview and the previously described tests were evaluated largely by descriptive methods (relative and absolute frequency, mean value, standard deviation, 95%-confidence intervals, minima, maxima, median and percentiles). χ^2-tests were conducted in the case of frequency comparisons. Cohen's kappa-index was used to calculate accordances of the results from different tests or approaches. Microsoft® Excel 2000 and Winstat® 3.1 softwares were employed to perform the data analysis blindly by Dipl.-Ing. Dr. Gebhard Woisetzschläger.
In the following chapters emphasis will be put on the definition of normal hip range of movement and on deciding which is the affected hip.

Definition of normal hip mobility for the results of the Neutral-0-method

As described earlier in chapter 2.2.2, there is not any consistent data about the normal range of movement for hip joints, which is the reason, why there are not any generally accepted definitions of mobility dysfunctions or normal mobility. On the one hand this corresponds with the osteopathic perception that every patient must be treated individually, but on the other hand it restricts exact scientific methods in their expressiveness. Deviations from normal ranges of movement (compare chapter 2.2.2, table 1) were classified differently in order to give consideration to both. When defining the deviations of normal mobility, two fundamental aspects were taken into account:

- *Asymmetries* in the mobility of the right and left hip joints
- *Extreme values of hypo and hyper mobility*

Apart from these two, the *frequency of deviation* was also used as a basis for further gradation.

Asymmetry

The sum of the internal and external rotation of both hip joints was compared in order to consider some possible torsion. The flexion, extension, abduction and adduction angles of the two hip joints were *individually* compared.

Deviations below 10°, corresponding double the amount of the measure fault given in the literature, were not considered (measurements both on the left and on the right), but deviations of 10° were separately disclosed. Theoretically, there is a possibility that deviations from the norm, which show no differences in the rotary mobility between the two hips, occur via measurement faults that neutralise each other. However, this case was disregarded. Secure deviations (of more than 10°) were marked as “d”, uncertain deviations (differences of exactly 10°) were marked as “u”, the rest as “n” for normal.

Extreme values of hypo- and hypermobility

From the calculation of the angles of flexion, extension, abduction, adduction and the total rotation (sum of internal and external rotation), measured on each of the 32 examined patients, both for the active and passive range of movements and negative and positive deviations from the literature values could be gained for the two hip joints. Thereby, in each case 20 values (5x2x2) were obtained, which provided a clue for hypo- and hypermobility.

The angle deviations above the fault limit (5°) of each patient were added up and divided through the total of the tests (20), which made up the mean *extent of hypo- and hypermobility per test*. Mean values, which exceeded 5°, were classified as definite deviations of the normal mobility and marked with “d” (for definite deviation) and values ranging between 0° and 5° of uncertain deviation were marked with “u” (for uncertain deviation).

Frequency of deviation

The probability, that the deviations are only based on measurement faults, decreased with the number of deviations. Those patients, who had been classified as “uncertain” before and where deviations had occurred more than twice, were marked with “p” (for probable deviation).

While “definite deviations” are characterized by their large extent of deviation, “probable deviations” are characterized by the frequency of deviation (more than two) and by an average extent of deviation. “Uncertain deviations” however, show deviations that occur in less than three of the measurements.

4.3.1 Determination of the affected hip joint from the results of the Neutral-0-method

For the evaluation of the mechanism of probable correlations between the mandibular joints and the hip joints, it must be clear which hip is affected. Various methods were used to determine this:

- Frequency of deviation

Those hip joints, where deviations occurred more frequently were regarded as affected.

- Extent of deviation

The sum of absolute contributions of hypomobility and hypermobility were compared in all tests for both hips.

- Deviation of rotation

The hips, which had little rotation mobility (the sum of internal and external rotation) were regarded as affected. Hypermobility was not taken into consideration.

- Other asymmetries

The hips, which had little mobility were regarded as affected as well. Hypermobility was not taken into consideration.

- Hip joint total

The affected side of the body is determined by the higher frequency of deviations with the above described variables. If the variables “other asymmetries“, “frequency of deviation“ and “extent of deviation“ lead to the result that the left body side is affected and only the variable “deviation of rotation“ indicates that it is the right side, the body side, which was more frequent – in this case the left one - will be assumed as affected.

In the case of equal amount and equal extent of deviation or restriction in the right and the left hip joint, both joints will be regarded as affected.

4.3.2 Variable definition

The considered variables consist of directly collected and defined data. Data that refer to the temporomandibular joint are viewed as independent variables, whereas data that refer to the spinal column and the hip joint are viewed as dependent.
The origin of the data that were consulted for the analysis is stated in italics. In cases where the data from the medical history were combined, the variables are marked with a star and their definitions are explicitly explained.

Considered variables:

Directly collected data:

- Temporomandibular joint diagnosis *(the referring physician's medical findings)*
  ("dysfunction of temporomandibular joint" / "anterior disc dislocation")
- Affected temporomandibular joint *(the referring physician's medical findings)*
  (right / left / both sides)
- Duration of the problem with the mandibular joint *(medical history)*
  (years)
- Occlusion *(medical history)*
  (yes / no)
- Spinal problems *(medical history)*
  (yes / no)
- Affected spinal section *(medical history)*
  (cervical / thoracic / lumbar spine)
- Hernia ion *(medical history)*
  (yes / no)
- Hip joint problems *(medical history)*
  (yes / no)
- Affected hip joints *(medical history)*
  (left / right / both sides)
- Hip dysplasia *(medical history)*
  (yes / no)
- Duration of hip joint problems *(medical history)*
  (years)
- Results of the Patrick-Kubis tests *(test)*
  (no reaction / right / left / both sides)
- Results of the Trendelenburg-Duchenne's tests *(test)*
  (no reaction / right / left)

Defined variable:

- Necessary or carried out corrective measures *(medical history)**
  (yes / no)

  *Patients with braces or orthodontic retainers
- Known spinal problems *(medical history)**
  (yes / no)
- Known hip joint problems *(medical history)**
  (yes / no)

  * Patients with hip joint disorders, therapies, pains, or dysplasia
- Reaction to Patrick-Kubis test *(test)**
  (yes / no)

  * without consideration of the displayed direction
- Reaction to Trendelenburg-Duchenne test *(test)**

  (yes / no)

  * without consideration of the displayed direction
- Mean significant mobility restriction in the Neutral-0-test *(test)**

  (°)

  * Mean value of the negative deviations of the normal mobility determined in the individual mobility tests (only deviations above the fault limit considered)
- Mean significant hypermobility in the Neutral-0-test *(test)**

  (°)

  * Mean value of positive deviations of the normal mobility determined in the individual mobility tests (only deviations above the fault limit considered)
- Mean significant deviation of the normal mobility in the Neutral-0-test *(test)**

  (°)

  * Mean value of the sum total of negative and positive deviation of normal mobility determined in the individual mobility tests (under consideration of the fault limit)
- Hip joint status / Range of movement from the results of the Neutral-0-test *(test)**

  (definite / probable / uncertain / no deviation)

  * definition see chapter 4.2.2 and 4.3
- Affected hip joints from the results of the Neutral-0-test *(test)**
  (left / right / both sides)

  * definition see chapter 4.3.1

5 Results

5.1 Results of the patient gathered data

The patients with problems in the mandibular joint were classified according to their sex. The investigated women's mean age was 36.1 years (median: 32 years) and the men's mean age was 45.24 (median: 43 years). On average, the women had suffered with the problem for 2.5 years and the men already for about 6.1 years.
As only five men were among the 32 patients with problems in the mandibular joint, the other data according to their sex was not analysed.

5.1.1 Dysfunctions in the temporomandibular joint

According to the referring doctors' diagnoses, 18 patients suffered from an "anterior disk dislocation", nine from "myofascial pain syndrome" and five from a "dysfunction of the mandibular joint".

The body sides in which the disorders occurred are summarized in table 3.

	Patients		
	n	%	Abbrev.[29]
Only right	3	9,4	1
Only left	11	34,4	2
Right >left	8	25,0	3
Left >right	2	6,3	4
Both sides equally	8	25,0	5

Table 3: Localisation of the dysfunctions in the temporomandibular joint

On interviewing, ten patients stated, that they had suffered from occlusion; eleven wore braces and thirteen a retaining splint. In 20 patients, a corrective measure had been necessary in their medical history.

[29] Abbrev. = Abbreviation

5.1.2 Cervical spine disorders

In the interview it was clarified in which segments of the spinal column the patients had problems additionally to the dysfunctions in the temporomandibular joint, whether they suffered from a prolapse and whether they had received treatment on their spinal column.
It was evident that 13 of the patients (40.6%) had received treatment of the spinal column, two of which had been due to a prolapse. In total, 19 patients (59.4%) were aware of problems with their vertebral column and 13 did not state any problems at all.
The affected segments of the spinal column are summarised in tables 4 and 5.

	Patients		
	N	%	Abbrev.
No problems	13	40,6	0
Cervical spine	5	15,6	1
Thoracic spine	1	3,1	2
Lumbar spine	1	3,1	3
Cervical spine + thoracic spine	3	9,4	4
Cervical spine + lumbar spine	5	15,6	5
Thoracic spine + lumbar spine	1	3,1	6
Cervical spine + thoracic spine + lumbar spine	3	9,4	7

Table 4: Localisation of cervical spine problems (Data basis: all patients)

At summarising the data for the diverse segments of the spinal column, it is clear that it is mainly the cervical spine, which is affected, followed by the lumbar spine. The frequent involvement of the cervical spine is confirmed by the repeated treatment of this topic in literature (cf. chapter 3.1.1).

	n	% of patients with cervical spine disorders (n = 19)	Abbrev.
Cervical spine	16	84,2	1
Thoracic spine	8	42,1	2
Lumbar spine	10	52,6	3

Table 5: Localisation of cervical spine problems (basis of data: patients with cervical spine problems, multiple counting possible)

5.1.3 Dysfunctions of the hip joint

On questioning in the interviews, only five patients were aware of problems in the hip joint (due to pain). Only one of them had received treatment. This patient was the one of those five, who knew of a hip dysplasia at birth. The other four patients, who had a hip dysplasia, mentioned neither problems, nor pains in their hip joints. Of these five patients, two did also not have spinal problems.

If the time during which the problems in the hip joint and the temporomandibular joint occurred is considered, it is clear, that the hip problems had been noticed at least three years before those in the temporomandibular joint. This indicates an increasing chain of lesions at least in the investigated cases. Only one patient noted a simultaneous start of the two disorders. Due to the small number of comparative figures, generalisations are not reasonable.

As shown in table 6, the hip dysplasia known to the patients solely occurred in both hip joints:

	n	%	Abbrev.
No dysplasia	21	65,6	0
Right hip joint	0	0,0	1
Left hip joint	0	0,0	2
Both hip joints	5	15,6	3
I do not know	6	18,8	4

Table 6: number and localisation of hip dysplasia

5.2 Results of the Neutral-0 test

From the presented data above (only 15.6% of the patients experienced hip problems), no compelling proof for a possible correlation between the temporomandibular joint and the hip joint is deducible.

In order to obtain a more exact dependent variable than the patients' subjective opinion with reference to their hips; the hip mobility was measured with the Neutral-0-method.

In table 7 some descriptive parameters of the results (minimum, maximum, mean value, SD = standard deviation and median) and the applied limits of normal mobility were opposed.

The median values marked in pale yellow show tests in which at least 50% of the patients have reduced range of movement.
The median values marked in light blue show tests in which approximately half of the patients had signs of hypomobility.

	Min	Max	Mean	SD	Median	Min (normal)	Max (normal)
Exterior rotation right passive [°]	25	55	41,5	6,6	45	40	55
Interior rotation right passive [°]	10	60	35	9,6	35	35	50
Exterior rotation left passive [°]	20	50	40,8	7,7	45	40	55
Interior rotation left passive [°]	15	50	34,8	7,9	35	35	50
Exterior rotation right active [°]	15	55	41,4	8,9	45	35	50
Interior rotation right active [°]	15	75	37,5	11,4	35	30	45
Exterior rotation left active [°]	15	60	40,5	10,3	42,5	35	50
Interior rotation left active [°]	18	110	40,4	17,2	40	30	45
Extension right passive [°]	5	25	15,9	4,0	15	10	20
Flexion right passive [°]	80	150	122,0	15,1	127,5	130	150
Extension left passive [°]	5	25	15,6	5,4	18	10	20
Flexion left passive [°]	80	140	122,5	15,2	130	130	150
Extension right active [°]	5	25	16,1	4,6	15	10	20
Flexion right active [°]	80	150	120,0	15,5	120	130	140
Extension left active [°]	0	25	14,9	5,4	15	10	20
Flexion left active [°]	15	145	115,3	28,8	125	130	140
Abduction right passive [°]	25	65	43,1	8,0	40	35	45
Adduction right passive [°]	10	55	25,1	10,5	20	25	35
Abduction left passive [°]	20	55	42,0	7,3	42,5	35	45
Adduction left passive [°]	15	50	24,3	9,2	20	25	35
Abduction right active [°]	18	50	41,3	6,4	40	30	50
Adduction right active [°]	5	50	23,9	8,7	20	20	30
Abduction left active [°]	18	50	40,3	6,8	40	30	50
Adduction left active [°]	12	40	23,1	7,1	20	20	30

Table 7: Descriptive summary of the results of the neutral-0 test and range of normal hip range of movement

As described in chapter 4.2.2, the measured range of movement was classified according to the symmetry of the extreme values and the number of occurring deviations from the norm. After these criteria, ten patients (the double amount of those who were aware of it) demonstrated secure deviation from the normal status of the hip range of movement.

Eleven further patients (34.4%) showed a probable deviation, while only six (18.8%) were inconspicuous in every respect. The other five patients (15.6%) could not be exactly classified. Deviations from normal range of movement were defined carefully due to the large distribution in literature. Thus, it can be assumed, that there is accordance in the same dimension as in spinal problems (approximately 60%). This would support the theory of chains of lesions. It is indicated, however, that this is no proof for this.

5.3 Results of the Patrick-Kubis tests

24 of the patients reacted positively to the Patrick-Kubis test. As this test also detects dysfunctions of the sacroiliac joint, a positive reaction to the test cannot directly be regarded as an indication for a restriction in hip function.

Table 8 summarises these results:

	N	%	Abbrev.
no indication	8	25,0	0
Right = left	2	6,3	1
Right > left	11	34,4	2
Left > right	11	34,4	3

Table 8: Results of the Patrick-Kubis test

Accordingly, 24 patients (75%) show a reaction to the Patrick-Kubis-test.

If *positive* tests in patients with problems in the lumbar spine are only ascribed to problems in the sacroiliac joint and if these are not considered in the evaluation of the hip function, 16 patients (50%) can be considered as having a restricted hip function.

5.4 Results of the Trendelenburg-Duchenne's test

The Trendelenburg-Duchenne test was only positive in four patients (12.5%, cf. table 9), of whom two stated as having hip problems. No correlation with other data can be established based on these data. For this reason, this test will not be considered in further chapters.

	n	%	Abbrev.
no indication	28	87,5	0
One-leg stance right: pelvis tilts left	2	6,25	1
One-leg stance left: pelvis tilts right	2	6,25	2

Table 9: Results of the Trendelenburg-Duchenne's test

5.5 Comparison of the test results with the interview data of the cervical spine

In this chapter, the data about the spinal column collected on interview and the measured results in the hip joint will be compared.
In this context, I would like to anticipate, that this comparison is limited due to the diverse emphasis in the data collection and the amount of data. Thus, only the patients' subjective evaluation of their spinal column health can be assessed.
The comparison is conducted nevertheless, because statements from the literature given in chapter 3.1.1 could probably be confirmed.

In this data collection, a direct comparison between collected and measured data of the hip joint is possible. Five patients stated problems in the hip joint (cf. chapter 5.1.3) and 21 patients deviate from the normal hip joint range of movement (cf. chapter 5.2). Those five patients, who were aware of problems in the hip joint, all showed a deviation from the normal mobility of the hip joint; two were counted as positive and three as probable deviation (for the definition cf. chapter 4.3).
Whether a corresponding clinical correlative can also be found in those five patients, who stated problems in the spinal column, cannot be deduced. As no cause and effect relations are developed in this paper and merely correlations should be established, a comparison between the data of the spinal column and the test results of the hip joint still seems possible.

In order to assure transparency, the data from the patient interviews and the tests from the compilation tables (cf. attachments) were summed up in table 10:

Patient	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
TMJ	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
CS	x	x	x	x			x		x				x		x	x					x		x		x	x	x		x			x
TS	x						x																x	x	x	x					x	x
LS									x							x					x		x	x	x	x	x	x	x			
N-0-t(p/d)	x	x	x			x	x	x	x		x				x	x		x	x		x	x	x		x	x		x	x	x		x
P-K-t	x	x	x		x							x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x

Table 10: Deviations of the normal values of the 32 patients' affected structures (TMJ… temporomandibular joint; c/t/l s… cervical/ thoracic/ lumbar spine; N-0-t… Neutral-0-test; p/d… probable/definite deviation; P-K-t…Patrick-Kubis Test)

In figure 17, the sums of the individual lines from table 10 are presented:

Problems in TMJ	yes n = 32 (100 %)	
Problems in CS	yes n = 16 (50 %)	no n = 16 (50 %)
Problem in TS	yes n = 8 (25 %)	no n = 24 (75 %)
Problems in LS	yes n = 10 (31, 2 %)	no n = 22 (68, 8 %)
Neutral-0-measurement	deviation n = 21 (65, 6 %)	norm n = 11 (34, 4 %)
Patrick-Kubis test	pos n = 24 (75 %)	neg n = 8 (25 %)

Figure 17: overview of the results of the temporomandibular joint problems, the cervical spine problems, the Neutral-0-measurement and the Patrick-Kubis-test

Of the 19 patients (59.4 %), who stated problems in at least one segment of the vertebral / spinal column, only one does not have any positive measurements nor test results (patient number 4 from table 10). This patient's cervical spine is affected. (The relationship between the individual spinal column segments has already been described in chapter 5.1.2).

Those three patients (9.4 %), who had problems in the entire spinal column, also showed a deviation from the norm in the Neutral-0 measurement (patients numbers 23, 25 and 26 from table 10).

In seven cases (21.9 %), a deviation from the norm can be detected in exactly *twice two adjoining structures*, whereby at the same time a deviation from the norm of the hip mobility can also be recognized from the results of the Neutral-0 test. (The following pairs are adjoining structures: hip and lumbar spine, lumbar and thoracic spine, thoracic and cervical spine, cervical spine and tempero-mandibular joint; in between these, structures without problems can also occur). This includes the following patients from table 10: patients numbers 1, 7, 9, 16, 21, 29 and 32.

Further congruencies between the simultaneous occurring of the deviation from the norm in hip mobility and the problems in *two adjoining structures* can be detected in four (12.5 %) other cases (patients 2, 3, 15 and 28 from table 10).

Thus, there are *multiple deviations from the norm* in both, the spinal column and the hip joint, in 43.8 % (n=14) of the present cases in dysfunctions of the temporomandibular joint.

This result refers to Nikolakis et al. (1998), who proved a significant correlation between postural asymmetries and an asymmetry of the masseter muscle tone. A correlation between the hip joint and posture is indicated; a direct connection between the temporomandibular joint and the hip joint however, cannot be confirmed.

The close functional correlation between lumbar and pelvic region (chapter 3.1.1; Klein, Sommerfeld, 2004, 140) is also comprehensible from this investigation. All of the ten patients, who noted problems in the lumbar spine (cf. figure 17) also had deviations from the normal hip joint range of movement and/or a positive Patrick-Kubis test (compare table 10). In six of these ten patients (numbers 16, 21, 23, 25, 28 and 29 from table 10) both tests were affected, and in two patients, only the Neutral-0 measurement (numbers 9 and 26 from table 10) or the Patrick-Kubis test (numbers 24 and 27 from table 10) were affected.

As it can be deduced from table 4 (chapter 5.1.2) and from table 10, 13 patients (40.6 %) did not state any problems in the spinal column. One of these patients only had problems in the temporomandibular joint (patient number 10 from table 10). In five patients only the Patrick-Kubis test was positive (patient numbers 5, 12, 14, 17 and 20 from table 10). With reference to Hülse and Losert-Bruggner (2002) it could be concluded, that six of the 32 patients do not show a connection to the body periphery.

Three patients only had deviations from the normal range of hip joint movement (patient numbers 6, 8 and 11 from table 10). In four patients both the measurement and the Patrick-Kubis test, results were positive (patient numbers 18, 19, 22 and 30 from table 10). This indicates a correlation to the hip joint in these seven patients. Moreover it could be concluded, that slightly more than half of the patients, who did not state any problems in the spinal column, showed deviations from the normal mobility. It is also possible, that there is a connection between the hip and temporomandibular joint without an involvement of the spinal column. Thus, there is still no evidence for this connection.

5.6 Comparison of the results of the Neutral-0-method with those of the Patrick-Kubis tests

Both, the results of the Patrick-Kubis test and those of the Neutral-0-measurement only represent indications for a deviation from the norm; the former due to possible interference from any possible sacroiliac joint dysfunction, the latter due to the wide range of hip movement.

In order to verify the accordance of the results, the tests were compared using Kappa-statistics. From the results of table 11 it is evident, that the affected hip side corresponds κ=0,28 (fair agreement) most frequently with the body side determined in the Patrick-Kubis test. If the side was determined with the variable "other asymmetries" (those being the asymmetries of extension, flexion, adduction and abduction excluding any rotation - for the variables cf. chapter 1.2.2.). The body sides determined with the other variables only randomly coincide with the body side determined in the Patrick-Kubis test.

"Deviation of rotation" is the body side determined via the higher degree of deviation of the rotation symmetry.
"Extent of deviation" is the body side determined via the sum of the 'degree of deviation' of normal 0 (with regard to the *sum* of rotations).
"No. of deviations" is the body side in which deviations from the normal mobility occur more frequently.
"Hip joint t." is the body side determined from the frequency of body sides in the above mentioned variables.

Cohen's κ	Hip joint [r/l/b]				
	Other asymm.	Deviation of rotation	Extent of deviation	No deviations	Hip joint t.
P-K test [l/r/b]	0,28	0,01	-0,11	0,09	0,11

Table 11: κ-indices for the comparison of the results (affected hip) of all considered aspects of the Neutral-0-test with those of the Patrick-Kubis test

5.7 Comparison of the affected body sides

Via the κ-indices, the degree of accordance between the affected sides of the mandibular joint and the affected hip joint are shown in table 13.

Patient	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
TMJ	r	b	l	b	l	b	b	l	b	r	b	l	l	r	r	r	l	r	r	r	l	b	r	l	r	l	b	l	r	l	l	l
P-K T	b	l	l		r							r	r	r	l	r	r	l	r	l	l	r	b	r	l		r	l	l	l	r	l
N-0 number of deviations	r	l	b			b	b	b	r	b	l		b		l	r		l	l		r	l	b	b	b	b	r	b	l	l	b	b
N-0 extent of deviation	r	r	b			b	b	b	l	b	b		b		r	l		b	l		r	b	l	l	l	r	l	l	l	l	l	b
N-0 deviation of rotation	r	l	b			b	b	b	b	l	b		r		l	l		b	b		l	r	l	l	b	l	b	b	l	r	b	b
N-0 other asymm.	l	l	l			b	b	b	r	b	b		r		l	r		r	b		l	r	b	l	l	r	l	l	l	l	r	l
N-0 Hip joint total	r	l	b			b	b	b	r	b	b		r		l	b		b	l		b	r	l	l	l	r	l	l	l	l	b	b

Table 12: overview of the body sides of the affected temporomandibular joint or of the test results (TMJ... Temporomandibular joint, P-K T Patrick-Kubis test, N-0...neutral-0-test, r...right, l...left, b... both sides)

Values below and equal to zero show an incidental accordance, while the κ-indices of one present the maximal accordance. This indicates the affection of both hip joint and temporomandibular joint of the same body side in only a few patients. The κ-values indicate an incidental accordance, which can also be ascribed to other mechanisms. The denominations of the variables in table 13 have already been explained in chapter 5.6.

		Hip joint [r/l/b]				
	P-K T	Other asymm.	Deviation of rotation	Extent of deviation	No of deviations	Hip joint t.
Temporomandibular joint [r/l/b]	-0,03	0,09	0,03	0,06	-0,14	-0,05

Table 13: κ-indices for the comparison of the side of the affected temporomandibular joint with the results (affected hips) of all aspects of the Neutral-0-test

5.8 Summary of the Results

According to the medical diagnoses, problems in the temporomandibular joint consist of an "anterior disc dislocation" in 18 patients, a "myofascial pain syndrome" in 9 patients and a "dysfunction of the temporomandibular joint" in five patients.

While 19 (59.4%) of these 32 patients were aware of *problems in the spinal column*, only five patients (15.6%) stated having problems in the hip joint (because of pains). Even of those five patients who had a hip dysplasia, only one stated that he had hip problems; two of these patients did not have problems in the spinal column.

Of those patients with problems in the spinal column, the pathology was localised to the cervical spine in 84.2% of the cases, lumbar spine in 52.6% of the cases and to the thoracic spine in 42.1% of the cases (several selections were possible).

The comparison of the subjectively gathered data of the spinal problems with the measured data of the deviation of the hip mobility from the norm seems acceptable only to a limited extent - particularly because the measurement of the deviation from the normal mobility of the hip joint yielded a much higher number of affected hip joints than of which the patients were conscious. Thus 19 patients with spinal problems face five patients with hip pain and 21 subjects with measured limitations in hip mobility. An involvement of the spinal column in connection with the hip joint can neither be confirmed from that, nor be denied. However, it does seem plausible (also with regard to references in literature).

From the five patients' data, who were aware of hip problems, it is deducible, that the hip problems occurred at least three years earlier than the problems in the temporomandibular joint; a fact, which could indicate an increasing/ ascending chain of lesions *in the present cases*. Due to the small amount of data, generalisation is not advisable.

Taking into consideration the deviations in the symmetries of the hip movements, in the extreme values and in the number of occurring deviations, ten patients (31.3%), thus being twice as much as patients who were aware of it, showed a *secure deviation* from the normal status of hip mobility. Further eleven patients (34.4%) showed a *probable deviation*, while only six patients (18.8%) were inconspicuous in every respect. The other five patients (15.6%) could not be exactly classified (*"uncertain deviations"*).

The classification into "secure", "probable" and "uncertain" deviations was realised due to the not exactly defined normal deviations in literature. Altogether, a probable deviation from the normal mobility of the hip joint could be anticipated in 66% of the patients.

24 patients (75%) reacted positively to the Patrick-Kubis test and excluding the patients with problems in the lumbar spine (patients' statements exclusively), who had to be considered because of mirroring of results due to sacroiliac joint problems, 16 patients (50%) remain, who probably reacted to the test because of hip problems.

The influence of the tooth position, of the temporomandibular joint and of the cervical spine on this test, identified by Hülse and Losert-Bruggner (2002), could not be considered.

No information from the Trendelenburg-Duchenne's test could be used.

As both, the results of the Patrick-Kubis test and those of the Neutral-0-measurement test represent only indications for a deviation from the norm (the former due to cross interference from sacroiliac joint dysfunctions, the latter because of the wide scope of hip motions) it can only *roughly be estimated,* that *approximately 50-60% of the patients with problems in the temporomandibular joint also have deviations in the hip joint*.

On considering the affected body sides, accordance between the affected side of the temporomandibular joint and the side of the affected hip joint (determined by means of the Normal-0-method) can be detected, which is just slightly above the probability of incidental accordance.

In summary, it can be assumed that 50-60% of patients with problems in the temporomandibular joint also show a deviation from normal hip mobility. Due to the small amount of data, the assumption, that the total of patients with problems in the temporomandibular joint show deficiencies and deviations in the hip joint is not valid. Moreover, a more exact definition of hip joint pathologies with more exact diagnoses would be necessary in order to analyse a clinically relevant correlation with dysfunctions in the temporomandibular joint.

6 Discussion and prospects

The task of this paper was to investigate a potential correlation between temporomandibular joint and hip joint and to find possible explanatory approaches for this theory.

In the empirical part of this paper 32 patients, diagnosed with craniomandibular dysfunction were examined. Occlusion disorders and their treatment, problems in the cervical spine and in the hip joint and a probable hip dysplasia were registered by means of a subjective examination. The patients' statements were considered but they were not verified by medical findings. The active and passive range of movement of both hip joints was measured by means of the Neutral-0-method. The Patrick-Kubis test and the Trendelenburg-Duchenne's test were also conducted. A positive results in these tests is neither the sole reason for an osteopathic treatment, nor sufficient for the diagnosis of a hip pathology. Thus, only a deviation of the norm and no disease can be determined with these tests.

The data of the Neutral-0-method was classified with respect to symmetry, extreme values and number of occurring deviations from the standard value. Differing statements about the upper and lower limits of the normal values can be found in literature. An approximate value was defined using the available spectrum of data (cf. chapter 2.2.2). The analysis of the data made clear, that 50-60% of the examined patients also showed a deviation from the normal range of hip mobility (cf. chapter 5.2). Due to the limited amount of data, it is not acceptable however, to generalise about the patients with CMD

The Trendelenburg-Duchenne's test was positive in only four patients of whom two disclosed hip problems. As a result, these data cannot be compared to the others.

No explicit comparison between temporomandibular joint and hip joint has been conducted in literature yet (cf. attechment 3 investigation protocol). References to the hip joint can be found within the scope of those papers which deal with the effects of temporomandibular disorders and/ or misaligned teeth on the rest of the body, (chapter 3.1.1). Ridder also surveyed, among other things, a considerable improvement in hip problems with the treatment of dysfunctions in the stomatognathic system via dental and osteopathic techniques. The improvement in hip problems was detected by means of patient interrogation and was not objectified by specific tests of the hip joint. The analysis of the

data collected by me (chapter 5.1.3 and 5.2) showed more than four times more patients with actual restrictions in their hip joint mobility (n=21) than with declared hip disorders (n=5). From this it can be concluded, that the improvements in hip joints, measured in Ridder's patients (Ridder, 1998), could also be confirmed with corresponding examinations.
Nikolakis et al. (1998) found increased tone in the masseter muscle and shortening in the hip adductors in up to 76.7% of patients and up to 96,7 % with a shortening in the iliopsoas muscle. Furthermore, Nikolakis et al. (2000) detected, that a static dysfunction can frequently be found in patients with a craniomandibular dysfunction. Nikolakis et al. (2000) reason this static dysfunction ("bad posture") with a shortening of the iliopsoas and the dorsal thigh musculature (cf. chapter 3.1.1). A restricted hip mobility could be interpreted from this shortening of the hip musculature, but it can in no case be diagnosed.

In chapter 5.5 the anamnestic cervical spine disorders that are shown in this paper and the measured restrictions in hip mobility are related. In total, a correlation appears in 43,8%. This result is not comparable to Nikolakis et al.'s results. A synchrony can be detected, however, which supports the hypothesis of a correlation between temporomandibular joint and hip joint via the cervical spine (chapter 3.1.1). This correlation can also be explained considering Littlejohn's (s.a.) model of gravity lines (chapter 3.1.2). All the three explanations regarding the correlation between the temporomandibular joint and the hip joint support an explanatory approach, but they do not verify it scientifically.

Nicolakis et al. (1998) also detected, that certain muscle groups act together and others antagonistically to the typertonicity of the masseter muscle. These can also be found in the straight and crossed fibres of the fascia link chains (chaper 3.2). In the comparison of temporomandibular joint and hip joint conducted by me, no accordance of the affected body side could be proven (chapter 5.7). This is no contradiction, because I merely compared the temporomandibular joint and the hip joint without the further use of parameters (like e.g. Nikolakis et al.'s asymmetry score, 1998). More specific investigations are necessary in order to substantiate the coincidental accordances I found through traceable develeopmental mechanisms.

Probably fascia chains are also responsible for the phenomenon, that functional orthopaedic tests of the lumbar spine, the pelvic and hip region only show varying values if the occlusion is modified. Fink et al. (2004), e.g. observed in healthy subjects, that the Forward flexion and spine-test (chapter 3.1.1) significantly changes with the use of an artificial occlusion problem. Hülse and Losert-Bruggner (2002) claim to be able to differentiate whether, a disorder in the craniomandibular region originates from the teeth and the temporomandibular joint or from the head/ cervical joints, with a modified Patrick-Kubis test (chapter 3.1.1 and 4.2.2). Whether this test is really significant will not be discussed here. It is essential however, that the Patrick-Kubis test generates different results with the tooth position altered than with normal bite. In 75% of the patients examined by me, the Patrick-Kubis test was positive. Whether the test indicates an imbalance in the tooth, temporomandibular and cervical spine region or in the lumbar, pelvic or hip region, is not deducible. A correlation between the temporomandibular joint and the pelvic region however, could be assumed and substantiated by the expressiveness of these tests.

For practice it seems important to determine, which degree of expressiveness the three above-mentioned and in clinical studies absolutely common test procedures have in reality. I therefore take the necessary steps to include the temporomandibular joint differential - diagnostically in the examination if the Forward Flexion test, spine-test and Patrick-Kubis tests are positive. For me the anamnestic question on the tooth position in patients with problems in the lower spinal column also gains importance.

The conjunct examination of the developmental stages of the temporomandibular joint and the hip joint shows only little accordance. Merely the vascularisation of the two joints happens at the same time of development (in the tenth gestation week). The two joints assume their final shape by means of strong external stimuli, which evolve from the utilisation of the joints. Thus, the temporomandibular joint does not assume its definite shape until the permanent teeth fully appear. The hip joint experiences major alterations during postural alterations into the erect position and has its last growth spurt in puberty. In both joints the development is directed by the corresponding loading, but these phases happen temporally apart in the toe joints.

Only five patients stated a known hip dysplasia after birth in the questionnaire (chapter 5.1.3). Six patients could not make any comments regarding that matter. Thus, a deviation from the norm of the two joints because of disturbances of growth seems to be merely incidental. It has however, not yet been investigated, whether patients with hip dysplasia suffer from temporomandibular disorders to a larger extent.

From the point of view of traditional Chinese medicine (TCM), a correlation between the temporomandibular joint and the hip joint can be detected (chapter 3.4). TCM considers the body in a holistic way and thus does not recognize an exclusive connection between the two joints. The Gall bladder and the Stomach meridian, however, run through both joints. Due to these meridians, they are assigned to the liver/ gall bladder and stomach/ spleen. The resulting function circles indicate a connection of the two joints, but do not provide sufficient proof for a causal correlation between them.

It can be concluded, that the development of the temporomandibular joint and the hip joint is neither temporally nor structurally connected.
Correlations are comprehensible considering the results that the explanatory approaches of spinal column, the fascia and traditional Chinese medicine provide. A causal connection of the disorders of the two joints however, cannot be deduced.
The terms ‘somatotopy’ and ‘somatotopic correlation’ cannot be defined unambiguously and thus are misleading in the medical discussion.
The conducted trials partly confirm the presented explanatory models and statements from literature. With reference to the correlation between the temporomandibular joint and the hip joint, neither a statistically significant statement can be made, nor can the clinical relevance be proven.
In this paper a scientific proof for the correlation between the temporomandibular joint and the hip joint cannot be given, this connection can however not be excluded.

What I personally conclude from this is to refer to special examples of patients or to literature directly in the future interdisciplinary exchange of experiences. In my practical occupation I am still going to consider a probable correlation of the two joints and in the case of relevant examination results I will also treat the hip joint in patients with craniomandibular dysfunctions.

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Attachment 3: Research protocol

Keywords / Terms

Kiefer	Hüfte
Kiefergelenk	Hüftgelenk
• Kraniomandibuläres Gelenk oder System • craniomandibuläres Gelenk oder System / CMS • Temporomandibuläres Gelenk/ Temporomandibulargelenk	Articulatio coxae
Kiefergelenk(s)störungen(en) oder –dysfunktion(en)	Funktionsstörung/Physiopathologie Hüfte/Hüftgelenk/Hüftbereich
• Kraniomandibuläre Dysfunktion(en) oder Störung(en) • craniomandibuläre Dysfunktion(en) oder Störung(en) / CMD • Temporomandibuläre Dysfunktion(en) oder Störung(en) / TMD	
Kieferstellung, Kieferfehlstellung	Hüftstellung, Hüftfehlstellung
jaw	Hip /coxa
• Craniomandibular joint / Craniomandibulary System	Hip joint
• Temporomandibular joint (TMJ)	
• Craniomandibular joint disorders / Craniomandibular disorders / Craniomandibular joint – physiopathology / Craniomandibular dysfunction / Craniomandibular joint dysfunction / CMD • Temporomandibular joint disorders / Temporomandibular disorders / Temporomandibular Dysfunction / Temporomandibular Joint Dysfunction (Syndrome)	Hip joint disorders / Hip joint dysfunction /.Hip joint - physiopathology / Hip joint - abnormalities
Jaw position / jaw malposition	Hip position
Kiefer* / Kiefergelenk* / Zahn* / kranioman* / cranioman* / mandibular*/ temporoman* / jaw*	Hüft* / Becken* / hip*

Grau = MeSH (Medical Subject Headings / kontrollierte Schlagwörter)

1) Initial article: Hülse, M./Losert-Bruggner, B. (2002): Der Einfluss der Kopfgelenke und/oder der Kiefergelenke auf die Hüftabduktion (Ein einfacher Test zur Frage, ob eine CMD durch eine HWS-Manipulation beeinflusst werden konnte). In: Manuelle Medizin, 40/2, S. 97-100; unter: http://www.springerlink.com/content/5kla8hde3td4brgp/

Search via: http://scholar.google.at/ for **similar Artikeln**
Treffer: 101 Artikel
Relevant: 4

2) Search via: http://scholar.google.at/ (for all terms: limites from 1996 except a)

Begriffe	Treffer	Relevant
Kiefergelenk + Hüftgelenk	30	3
Kiefergelenk + Hüftgelenk + Zusammenhang	7	1
Kraniomandibuläres + Gelenk OR System	15	4
craniomandibuläres + Gelenk OR System	1	0
„Temporomandibuläres Gelenk“	1	0
Temporomandibulargelenk	25	1
Kieferstellung OR Kieferfehlstellung	21	4
Kiefer + Hüfte OR Hüftgelenk	100	3
Kiefergelenk + Dysfunktionen + (Hüfte OR Hüftbereich) OR Hüftgelenk	18	2
Kraniomandibuläre + dysfunktionen OR störungen	59	8
craniomandibuläre + dysfunktionen OR störungen	22	0
temporomandibuläre + Dysfunktionen OR störungen OR TMJ	26	2
Kiefergelenk + Becken	49	6
Zahn + Hüft*	46	3
Kranioman* + Hüft*	5	1
Kranioman* + Becken*	6	2
Cranioman* + hüft*	0	0
Cranioman* + Becken*	2	2
Temporoman* + hüft*	2	1
Temporoman* + Becken*	4	3
Cranioman* + hip*	0	0
Temporoman* + hip*	93	0
„jaw position“ + hip*	18	2
TMJ + „hip joint“	142	0
craniomandibular + "hip joint"	23	0
"temporomandibular joint" + "hip joint" / ohne die Wörter: rabbit, dog, pig / Einschränkung ab 2000	73	0

3) Search via PubMed: http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?DB=pubmed

(Limits: Human)

Begriffe	Treffer	Relevant
"Temporomandibular Joint"[MeSH] AND "Hip"[MeSH]	2	0
"Temporomandibular Joint"[MeSH] AND "Hip Joint"[MeSH]	7	1
"Temporomandibular Joint"[MeSH] AND "Hip/physiopathology"[MeSH]	0	0
"Temporomandibular Joint"[MeSH] AND "Hip/abnormalities"[MeSH]	0	0
"Temporomandibular Joint Disorders"[MeSH] AND "Hip"[MeSH]	0	0
"Temporomandibular Joint Disorders"[MeSH] AND "Hip Joint"[MeSH]	3	2
Begriffe	**Treffer**	**Relevant**
"Temporomandibular Joint Disorders"[MeSH] AND "Hip/physiopathology"[MeSH]	0	0
"Temporomandibular Joint Disorders"[MeSH] AND "Hip/abnormalities"[MeSH]	0	0
"Temporomandibular Joint Dysfunction Syndrome"[MeSH] AND "Hip"[MeSH]	0	0
"Temporomandibular Joint Dysfunction Syndrome"[MeSH] AND "Hip Joint"[MeSH]	0	0
"Craniomandibular Disorders"[MeSH] AND "Hip"[MeSH]	1	1
"Craniomandibular Disorders"[MeSH] AND "Hip Joint"[MeSH]	3	2
"Craniomandibular Disorders"[MeSH] AND "Hip/physiopathology"[MeSH]	0	0
"Craniomandibular Disorders"[MeSH] AND "Hip/abnormalities"[MeSH]	0	0
Diverse Begriffskombinationen (ohne MeSH)		0

4) Search via British Medical Journals: http://bmj.bmjjournals.com/

Alle Begriffskombinationen = keine relevanten Treffer

5) Search via Health on the Net: http://www.hon.ch/MedHunt/

Alle Begriffskombinationen = keine relevanten Treffer

6) Search via healthline: http://www.healthline.com/

Alle Begriffskombinationen = keine relevanten Treffer

7) Search via Gateway: http://gateway.nlm.nih.gov/gw/Cmd

gleiche Ergebnisse wie pubmed, 1 Treffer mehr

8) Search via Dimdi: http://www.dimdi.de/dynamic/de/index.html

Ähnliche Ergebnisse wie scholar google

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Attachment 4: *Erhebungsbogen* / Data entry form

Geschlecht *(sex):* männlich *(male)* / weiblich *(female)* Alter *(age)*: JJ in Jahren *(year)*

Diagnose *(diagnosis)*: 1 = Kiefergelenks Dysfunktion *(jaw-dysfunction)*
2 = Antoriore Diskusverlagerung *(anterior disc dislocation)*
3 = myofasziales Schmerzsyndrom *(myofascial pain syndrome)*

Seite des TMG-Problems *(side of TMA problem)* : 1 = rechts *(right);* 2 = links *(left)*;
3 = rechts > links *(right > left)*; 4 = links > rechts *(left > right)*; 5 = beidseits*(both sides equally)*;
seit wann *(since)*: JJ,xx in Jahren, auf zwei Kommastellen *(year, two decimal points)*

Okklusionsprobleme *(occlusion problems)*: y = ja *(yes)* n = nein *(no)*

Zahnspange *(brace)*: y = ja *(yes)* n = nein *(no)*

Lagerungsschiene *(bedding splint)* : y = ja *(yes)* n = nein *(no)*

Probleme mit der Wirbelsäule *(spine problem)*: 0 = kein Problem *(no problem);*
1 = Halswirbelsäule (HWS) *(cervical spine);* 2 = Brustwirbelsäule (BWS) *(thoracic spine)*;
3 = Lendenwirbelsäule (LWS) *(lumba spine);* 4 = HWS + BWS; 5 = HWS + LWS;
6 = BWS + LWS; 7 = HWS + BWS + LWS;
Therapie für die Wirbelsäule *(therapy for the spine)*: y = ja *(yes)* n = nein *(no)*

Diagnostizierter Prolaps *(diagnosed disc prolapse)*: y = ja *(yes)* n = nein *(no)*

Hüftprobleme *(problems in the hipjoint)*: y = ja *(yes)* n = nein *(no)*

Therapie für das Hüftgelenk *(therapy for the hipjoint)*: y = ja *(yes)* n = nein *(no)*

Schmerzen in der Hüfte *(hip pain)*: y = ja *(yes)* n = nein *(no)*

seit wann *(since)*: JJ in Jahren *(year)*

Hüftdysplasie *(dysplasia)*: 0 = nein *(no)* 1 = rechts *(right)* 2 = links *(left)*
3 = beidseits *(both sides equally)* 4 = weiß nicht *(I do not know);*

Hüftbeweglichkeit mit der Neutral-Null-Methode in Grad gemessen - *(hip-mobility, measured with neutral-0-method, in degrees)*:

		Passiv *(passive)*			Aktiv *(active)*	
		rechts *(right)*	links *(left)*		rechts *(right)*	links *(left)*
AR / IR	RL	xx / 0 / xx	xx / 0 / xx	BL	xx / 0 / xx	xx / 0 / xx
EXT / FLEX	SL	xx / 0 / xx	xx / 0 / xx	SL	xx / 0 / xx	xx / 0 / xx
ABD / ADD	RL	xx / 0 / xx	xx / 0 / xx	RL	xx / 0 / xx	xx / 0 / xx

AR / IR = Außen- / Innenrotation *(external / internal rotation)*
EXT / FLEX = Extention / Flexion *(extention / flexion)*
ABD / ADD = Abduktion / Adduktion *(abduction / adduction)*
RL = Rückenlage *(supine position);* SL = Seitlage *(lateral position);* BL = Bauchlage *(prone position)*

Patrick-Kubis-Test: 0 = kein Zeichen *(no indication)*
1 = positive: rechts = links *(positive: right = left)*
2 = positive: rechts > links *(positive: right > left)*
3 = positive: links > rechts *(left > right)*

Trendelenburg-Duchenne-Zeichen 0 = kein Zeichen *(no indication)*
1 = Einbeinstand rechts: Becken kippt links *(one-leg stance right: pelvis tilts to the left)*
2 = Einbeinstand links: Becken kippt rechts *(one-leg stance left: pelvis tilts to the right)*

Attachment 5: Statistic-tabels

ID	General data		Mandibula						Spine			Coxafemural joint				Tests			Summary				
Patient	Sex [m/f]	Age [y]	Diagnosis	Side of TMA Problem	since [y]	Occlusion problem [y/n]	Brace [y/n]	Bedding splint [y/n]	Spine problem [y/n]	Therapy [y/n]	Prolapse [y/n]	Problems [y/n]	Therapy [y/n]	Pain [y/n]	Pain since [y]	Dysplasia [0-4]	Patrik-Kubis test [0-3]	Trendelenburg-Duchenne [0-2]	Correction of mandibula	Known spine problems	Known coxa problems	Patrik-Kubis Test [y/n]	Trendelenburg-Duchenne [y/n]
1	f	25	3	3	5	y	y	n	4	n	n	n	n	n		3	1	0	y	y	n	y	n
2	f	24	2	5	3	y	y	n	1	n	n	n	n	n		0	3	0	y	y	n	y	n
3	f	36	2	4	4	y	y	y	1	y	n	n	n	n		3	3	0	y	y	n	y	n
4	m	30	1	5	11	n	n	y	1	n	n	n	n	n		0	0	0	y	y	n	n	n
5	m	43	1	2	0,25	y	y	n	0	n	n	n	n	n		0	2	0	y	n	n	y	n
6	f	22	2	5	0,1	n	n	y	0	n	n	n	n	n		4	0	0	y	n	n	n	n
7	f	66	3	5	3	y	n	y	4	n	n	n	n	n		0	0	0	y	y	n	n	n
8	f	16	2	2	1,5	n	y	y	0	n	n	n	n	n		0	0	0	y	n	n	n	n
9	m	36	2	5	3	n	y	n	5	y	n	n	n	n		0	0	0	n	y	n	n	n
10	f	19	2	3	0,5	n	y	n	0	n	n	n	n	n		3	0	0	n	n	n	n	n
11	f	19	2	5	4	n	n	y	0	n	n	n	n	n		0	0	0	y	n	n	n	n
12	f	31	3	2	1	n	n	y	0	n	n	n	n	n		4	2	0	y	n	n	y	n
13	f	34	3	2	0,5	n	n	y	1	y	n	n	n	n		0	2	0	y	y	n	y	n
14	f	23	1	3	1,5	n	y	n	0	n	n	n	n	n		0	2	0	n	n	n	y	n
15	f	46	3	3	1	y	n	y	1	y	n	n	n	n		0	3	2	y	y	n	y	y
16	m	48	3	3	15	n	n	n	5	y	n	y	y	y	18	3	2	2	n	y	y	y	y
17	f	33	2	4	2	n	y	n	0	n	n	n	n	n		4	2	0	n	n	n	y	n
18	f	32	2	1	1,5	n	n	y	0	n	n	n	n	n		0	3	0	y	n	n	y	n
19	f	56	1	3	1,5	y	n	n	0	n	n	y	n	y	10	4	2	0	y	n	y	y	n
20	f	31	2	1	0,5	n	y	y	0	n	n	n	n	n		0	3	0	y	n	n	y	n
21	f	48	1	2	5	y	n	n	5	y	y	n	n	n		0	3	0	y	y	n	y	n
22	f	26	2	5	4	n	n	n	0	n	n	n	n	n		3	2	0	n	n	n	y	n
23	f	50	2	3	1	y	n	n	7	y	n	y	n	y	20	4	1	0	y	y	y	y	n
24	f	29	2	2	1	n	n	n	6	y	n	n	n	n		4	2	0	n	y	n	y	n
25	f	26	2	3	20	n	n	n	7	y	n	y	n	y	20	0	3	1	n	y	y	y	y
26	f	63	3	2	1,5	n	n	y	7	y	n	n	n	n		0	0	0	y	y	n	n	n
27	f	41	2	5	0,25	n	n	n	5	n	y	n	n	n		0	2	1	n	y	n	y	y
28	f	66	2	2	0,33	n	n	y	3	y	n	n	n	n		0	3	0	y	y	n	y	n
29	f	47	3	1	0,5	y	n	n	5	y	n	y	n	y	7	0	3	0	y	y	y	y	n
30	f	15	2	2	1	n	y	n	0	n	n	n	n	n		0	3	0	n	n	n	y	n
31	m	69	3	2	1	n	n	n	2	n	n	n	n	n		0	2	0	n	y	n	y	n
32	f	50	2	2	1	n	n	n	4	y	n	n	n	n		0	3	0	n	y	n	y	n
Min					0,1										7								
Max					20										20								
Mean					3,0										15,0								
SD					4,4										6,1								
SE					0,0										0,0								
+/-95%CI					0,0										0,0								
lo 95%CI					0,0										0,0								
up 95%CI					0,0										0,0								
Median					1,5										18								

Deviation from norm   Calculated values

ID	Mobility tests (Neutral-null method)																							
	Passive Rotations				Active Rotations				Passive Extensions/ Flexions				Active Extensions/ Flexions				Passive Abduction/ Adduction				Active Abduction/ Adduction			
Patient	Exterior rotation right passive [°]	Interior rotation right passive [°]	Exterior rotation left passive [°]	Interior rotation left passive [°]	Exterior rotation right active [°]	Interior rotation right active [°]	Exterior rotation left active [°]	Interior rotation left active [°]	Extension right passive [°]	Flexion right passive [°]	Extension left passive [°]	Flexion left passive [°]	Extension right active [°]	Flexion right active [°]	Extension left active [°]	Flexion left active [°]	Abduction right passive [°]	Adduction right passive [°]	Abduction left passive [°]	Adduction left passive [°]	Abduction right active [°]	Adduction right active [°]	Abduction left active [°]	Adduction left active [°]
1	45	25	45	30	50	30	60	45	18	115	22	100	18	95	15	90	40	30	40	25	38	25	35	20
2	45	40	40	30	48	45	45	35	15	130	15	130	15	130	15	130	30	20	30	18	30	20	30	18
3	45	40	40	35	50	45	45	40	18	120	15	120	18	120	15	120	40	20	40	20	40	20	40	20
4	45	40	45	40	50	45	50	45	15	130	15	130	15	130	15	130	45	25	45	25	45	25	45	25
5	45	40	45	40	45	40	45	40	10	125	10	125	10	125	10	125	40	30	40	30	40	30	40	30
6	40	40	40	40	35	35	35	35	10	100	10	100	10	100	10	100	45	20	45	20	45	20	45	20
7	40	40	45	40	30	35	35	35	5	80	5	80	5	80	5	80	40	20	40	20	40	20	40	20
8	45	55	45	40	40	40	40	40	10	90	10	90	10	90	10	90	40	20	40	20	40	20	40	20
9	40	20	40	20	40	30	40	25	15	115	20	125	15	115	20	125	40	20	35	20	40	20	35	20
10	55	45	50	40	55	45	50	40	20	140	20	140	20	140	20	140	40	20	40	20	40	20	40	20
11	45	40	50	40	30	60	30	60	15	120	15	120	15	120	15	120	40	18	40	18	40	18	40	18
12	45	35	45	30	50	40	50	35	15	130	18	130	15	130	18	130	45	20	50	20	45	20	50	20
13	30	40	30	45	35	45	35	50	18	140	20	140	18	140	20	140	45	25	45	25	45	25	45	35
14	45	40	45	45	40	35	40	40	20	130	20	130	20	130	20	130	40	30	40	30	40	30	40	30
15	45	30	45	25	45	25	45	25	15	95	10	94	15	95	10	95	40	30	40	30	40	30	35	25
16	25	10	20	15	15	20	15	18	10	130	5	140	8	120	0	135	25	10	20	15	18	5	18	12
17	40	35	35	35	40	35	40	35	18	130	18	130	18	130	18	130	45	20	50	20	45	20	50	20
18	45	35	40	35	50	40	45	35	15	130	18	130	15	130	18	130	30	15	30	15	30	15	30	15
19	45	35	45	35	45	35	45	35	15	110	10	120	15	110	10	120	40	20	40	15	40	20	40	15
20	45	40	45	40	45	40	40	40	18	130	18	130	18	130	18	130	45	30	45	30	45	30	45	30
21	40	25	25	35	25	15	15	25	15	130	10	120	10	120	10	125	45	25	45	25	40	25	45	25
22	40	30	45	30	40	30	45	30	15	130	10	130	15	130	10	130	40	18	50	18	40	18	50	18
23	35	20	30	20	35	20	30	20	18	120	18	120	18	120	18	120	40	20	40	20	40	20	40	20
24	33	35	35	25	33	35	35	25	20	130	20	130	20	130	20	130	40	20	30	20	40	20	30	20
25	50	30	40	50	45	40	40	45	15	110	20	115	20	110	15	110	45	30	45	20	40	30	45	20
26	35	30	40	35	35	35	20	30	20	110	22	110	20	110	25	115	50	15	50	15	50	15	50	15
27	30	30	30	30	35	30	35	30	20	150	20	140	25	150	20	145	50	40	45	40	45	35	40	35
28	30	30	30	30	45	40	45	40	25	125	25	130	25	120	20	125	60	55	50	50	50	50	40	40
29	40	60	50	40	55	75	55	65	18	140	18	140	20	130	18	130	65	50	55	50	50	40	40	40
30	50	40	50	40	50	50	50	70	20	120	22	130	20	110	20	120	60	50	50	40	50	40	40	30
31	45	35	50	40	45	35	50	40	13	130	10	130	13	130	10	130	45	18	45	22	45	18	45	22
32	45	30	45	40	45	30	45	40	15	120	10	120	15	120	10	120	45	20	45	20	45	20	40	20
Min	40	35	40	35	35	30	35	30	10	130	10	130	10	130	10	130	35	25	35	25	30	20	30	20
Max	55	50	55	50	50	45	50	45	20	150	20	150	20	140	20	140	55	35	55	35	50	30	50	30
Mean	41,5	35,0	40,8	34,8	41,4	37,5	40,5	37,9	15,9	122,0	15,6	122,5	16,1	120,0	14,9	121,6	43,1	25,1	42,0	24,3	41,3	23,9	40,3	23,1
SD	6,6	9,6	7,7	7,9	8,9	11,4	10,3	11,7	4,0	15,1	5,4	15,2	4,6	15,5	5,4	15,4	8,0	10,5	7,3	9,2	6,4	8,7	6,8	7,1
SE	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
+/-95%CI	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
lo 95%CI	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
up 95%CI	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Median	45	35	45	35	45	35	42,5	37,5	15	127,5	18	130	15	120	15	125	40	20	42,5	20	40	20	40	20

Literature data | Calculated values | Hypomobility | Hypermobility

ID	Rotation asymmetries**				Hip status rotation			Other asymmetries												
	Total rotation passive		Total rotation active					Difference Right - Left												
Patient	Total rotation right passive [°]	Total rotation left passive [°]	Total rotation right active [°]	Total rotation left active [°]	Hip status (total rotation active)**	Hip status (total rotation passive)**	Deviation of rotation active+passive**	Exterior rotation passive [°]	Interior rotation passive [°]	Exterior rotation active [°]	Interior rotation active [°]	Extension passive [°]	Flexion passive [°]	Extension active [°]	Flexion active [°]	Abduction passive [°]	Adduction passive [°]	Abduction active [°]	Adduction active [°]	"Other assymmetries"
1	70	75	80	105	d	n	d	0	-5	-10	-15	-4	15	3	5	0	5	3	5	d
2	85	70	93	80	d	d	d	5	10	3	10	0	0	0	0	0	2	0	2	n
3	85	75	95	85	u	u	u	5	5	5	5	3	0	3	0	0	0	0	0	n
4	85	85	95	95	n	n	n	0	0	0	0	0	0	0	0	0	0	0	0	n
5	85	85	85	85	n	n	n	0	0	0	0	0	0	0	0	0	0	0	0	n
6	80	80	70	70	n	n	n	0	0	0	0	0	0	0	0	0	0	0	0	n
7	80	85	65	70	n	n	n	-5	0	-5	0	0	0	0	0	0	0	0	0	n
8	100	85	80	80	n	d	d	0	15	0	0	0	0	0	0	0	0	0	0	n
9	60	60	70	65	n	n	n	0	0	0	5	-5	-10	-5	-10	5	0	5	0	u
10	100	90	100	90	u	u	u	5	5	5	5	0	0	0	0	0	0	0	0	n
11	85	90	90	90	n	n	n	-5	0	0	0	0	0	0	0	0	0	0	0	n
12	80	75	90	85	n	n	n	0	5	0	5	-3	0	-3	0	-5	0	-5	0	n
13	70	75	80	85	n	n	n	0	-5	0	-5	-2	0	-2	0	0	0	0	-10	u
14	85	90	75	80	n	n	n	0	-5	0	-5	0	0	0	0	0	0	0	0	n
15	75	70	70	70	n	n	n	0	5	0	0	5	1	5	0	0	0	5	5	n
16	35	35	35	33	n	n	n	5	-5	0	2	5	-10	8	-15	5	-5	0	-7	d
17	75	70	75	75	n	n	n	5	0	0	0	0	0	0	0	-5	0	-5	0	n
18	80	75	90	80	u	n	u	5	0	5	5	-3	0	-3	0	0	0	0	0	n
19	80	80	80	80	n	n	n	0	0	0	0	5	-10	5	-10	0	5	0	5	u
20	85	85	85	80	n	n	n	0	0	5	0	0	0	0	0	0	0	0	0	n
21	65	60	40	40	n	n	n	15	-10	10	-10	5	10	0	-5	0	0	-5	0	u
22	70	75	70	75	n	n	n	-5	0	-5	0	5	0	5	0	-10	0	-10	0	u
23	55	50	55	50	n	n	n	5	0	5	0	0	0	0	0	0	0	0	0	n
24	68	60	68	60	n	n	n	-2	10	-2	10	0	0	0	0	10	0	10	0	u
25	80	90	85	85	n	u	u	10	-20	5	-5	-5	-5	5	0	0	10	-5	10	u
26	65	75	70	50	d	u	d	-5	-5	15	5	-2	0	-5	-5	0	0	0	0	n
27	60	60	65	65	n	n	n	0	0	0	0	0	10	5	5	5	0	5	0	u
28	60	60	85	85	n	n	n	0	0	0	0	0	-5	5	-5	10	5	10	10	u
29	100	90	130	120	u	u	u	-10	20	0	10	0	0	2	0	10	0	10	0	u
30	90	90	100	120	d	n	d	0	0	0	-20	-2	-10	0	-10	10	10	10	10	u
31	80	90	80	90	u	u	u	-5	-5	-5	-5	3	0	3	0	0	-4	0	-4	n
32	75	85	75	85	u	u	u	0	-10	0	-10	5	0	5	0	0	0	5	0	n
Min	75	75	65	65				-10	-20	-10	-20	-5	-10	-5	-15	-10	-5	-10	-10	
Max	105	105	95	95				15	20	15	10	5	15	8	5	10	10	10	10	
Mean	76,5	75,6	78,9	78,4				0,7	0,2	1,0	-0,4	0,3	-0,4	1,1	-1,6	1,1	0,9	1,0	0,8	
SD	13,8	13,5	17,7	19,0				4,8	7,3	4,5	6,7	2,9	5,3	3,1	4,3	4,4	3,1	4,7	4,1	
SE	2,4	2,4	3,1	3,4				0,8	1,3	0,8	1,2	0,5	0,9	0,6	0,8	0,8	0,5	0,8	0,7	
+/-95%CI	5,0	4,9	6,4	6,9				1,7	2,6	1,6	2,4	1,0	1,9	1,1	1,5	1,6	1,1	1,7	1,5	
lo 95%CI	71,5	70,8	72,6	71,5				-1,0	-2,5	-0,7	-2,8	-0,7	-2,3	0,0	-3,1	-0,5	-0,2	-0,7	-0,7	
up 95%CI	81,5	80,5	85,3	85,2				2,4	2,8	2,6	2,0	1,4	1,5	2,2	0,0	2,7	2,0	2,7	2,3	
Median	80	75	80	80				0	0	0	0	0	0	0	0	0	0	0	0	
				d	4	2	5												d	2
				u	6	7	7	Calcul ated values		Hypomobility		Hypermobility							u	11
				n	22	23	20												n	19

ID	Measured deviation from neutral-null*																											
	Passive Rotations				Active Rotations				Passive Extensions/ Flexions				Active Extensions/ Flexions				Passive Abduction/ Adduction				Active Abduction/ Adduction				Total rotations			
Patient	Exterior rotation right passive [°]	Interior rotation right passive [°]	Exterior rotation left passive [°]	Interior rotation left passive [°]	Exterior rotation right active [°]	Interior rotation right active [°]	Exterior rotation left active [°]	Interior rotation left active [°]	Extension right passive [°]	Flexion right passive [°]	Extension left passive [°]	Flexion left passive [°]	Extension right active [°]	Flexion right active [°]	Extension left active [°]	Flexion left active [°]	Abduction right passive [°]	Adduction right passive [°]	Abduction left passive [°]	Adduction left passive [°]	Abduction right active [°]	Adduction right active [°]	Abduction left active [°]	Adduction left active [°]	Total rotation passive left [°]	Total rotation passive right [°]	Total rotation active left [°]	Total rotation active right [°]
1	0	-10	0	-5	0	0	10	0	0	-15	2	-30	0	-35	0	-40	0	0	0	0	0	0	0	0	-5	0	0	10
2	0	0	0	-5	0	0	0	0	0	0	0	0	0	0	0	0	-5	-5	-5	-7	0	0	0	-2	0	-5	0	0
3	0	0	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10	0	-5	0	-5	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	-5	0	-5	0	-5	0	-5	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	-30	0	-30	0	-30	0	-30	0	-5	0	-5	0	0	0	0	0	0	0	0
7	0	0	0	0	-5	0	0	0	-5	-50	-5	-50	-5	-50	-5	-50	0	-5	0	-5	0	0	0	0	0	0	0	0
8	0	5	0	0	0	0	0	0	0	-40	0	-40	0	-40	0	-40	0	-5	0	-5	0	0	0	0	0	0	0	0
9	0	-15	0	-15	0	0	0	-5	0	-15	0	-5	0	-15	0	-5	0	-5	0	-5	0	0	0	0	-15	-15	0	0
10	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	-5	0	-5	0	0	0	0	0	0	5	0
11	0	0	0	0	-5	15	-5	15	0	-10	0	-10	0	-10	0	-10	0	-7	0	-7	0	-2	0	-2	0	0	0	0
12	0	0	0	-5	0	0	0	0	0	0	0	0	0	0	0	0	0	-5	0	-5	0	0	0	0	0	0	0	0
13	-10	0	-10	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	-5	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	-5	0	-10	0	-5	0	-5	0	-35	0	-36	0	-35	0	-35	0	0	0	0	0	0	0	0	0	-5	0	0
16	-15	-25	-20	-20	-20	-10	-20	-12	0	0	-5	0	-2	-10	-10	0	-10	-15	-15	-10	-12	-15	-12	-8	-40	-40	-30	-32
17	0	0	-5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-5	0	-5	0	0	0	0	0	-5	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-5	-10	-5	-10	0	-5	0	-5	0	0	0	0
19	0	0	0	0	0	0	0	0	0	-20	0	-10	0	-20	0	-10	0	-5	0	-10	0	0	0	-5	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	-10	-15	0	-10	-15	-20	-5	0	0	0	-10	0	-10	0	-5	0	0	0	0	0	0	0	0	-10	-15	-25	-25
22	0	-5	0	-5	0	0	0	0	0	0	0	0	0	0	0	0	0	-7	0	-7	0	-2	0	-2	-5	0	0	0
23	-5	-15	-10	-15	0	-10	-5	-10	0	-10	0	-10	0	-10	0	-10	0	-5	0	-5	0	0	0	0	-20	-25	-10	-15
24	-7	0	-5	-10	-2	0	0	-5	0	0	0	0	0	0	0	0	0	-5	-5	-5	0	0	0	0	-7	-15	0	-5
25	0	-5	0	0	0	0	0	0	0	-20	0	-15	0	-20	0	-20	0	0	0	-5	0	0	0	0	0	0	0	0
26	-5	-5	0	0	0	0	-15	0	0	-20	2	-20	0	-20	5	-15	0	-10	0	-10	0	-5	0	-5	-10	0	0	-15
27	-10	-5	-10	-5	0	0	0	0	0	0	0	0	5	10	0	5	0	5	0	5	0	5	0	5	-15	-15	0	0
28	-10	-5	-10	-5	0	0	0	0	5	-5	5	0	5	-10	0	-5	5	20	0	15	0	20	0	10	-15	-15	0	0
29	0	10	0	0	5	30	5	20	0	0	0	0	0	0	0	0	10	15	0	15	0	10	0	10	0	0	35	25
30	0	0	0	0	0	5	0	25	0	-10	2	0	0	-20	0	-10	5	15	0	5	0	10	0	0	0	0	5	25
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-7	0	-3	0	-2	0	0	0	0	0	0
32	0	-5	0	0	0	0	0	0	0	-10	0	-10	0	-10	0	-10	0	-5	0	-5	0	0	0	0	0	0	0	0
Min	-15	-25	-20	-20	-20	-15	-20	-12	-5	-50	-5	-50	-5	-50	-10	-50	-10	-15	-15	-10	-12	-15	-12	-8	-40	-40	-30	-32
Max	0	10	0	0	5	30	10	25	5	0	5	0	5	10	5	5	10	20	0	15	0	20	0	10	0	0	35	25
Mean	-1,9	-3,0	-2,7	-3,1	-1,0	0,3	-1,6	0,7	0,0	-9,5	0,0	-9,1	0,1	-10,9	-0,3	-9,5	0,0	-2,1	-0,9	-2,6	-0,4	0,4	-0,4	0,0	-4,6	-4,8	-0,6	-1,0
SD	4,0	6,5	5,2	5,4	4,3	7,2	6,0	7,2	1,3	13,3	1,7	13,7	1,6	14,2	2,2	14,2	3,1	7,3	3,0	6,1	2,1	5,4	2,1	3,6	8,7	9,3	9,7	10,5
SE	0,7	1,1	0,9	0,9	0,8	1,3	1,1	1,3	0,2	2,4	0,3	2,4	0,3	2,5	0,4	2,5	0,5	1,3	0,5	1,1	0,4	1,0	0,4	0,6	1,5	1,6	1,7	1,9
+/-95%CI	1,5	2,3	1,9	1,9	1,5	2,6	2,2	2,6	0,5	4,8	0,6	4,9	0,6	5,1	0,8	5,1	1,1	2,6	1,1	2,2	0,8	1,9	0,8	1,3	3,1	3,3	3,5	3,8
lo 95%CI	-3,4	-5,3	-4,5	-5,1	-2,5	-2,3	-3,7	-1,9	-0,5	-14,3	-0,6	-14,0	-0,5	-16,1	-1,1	-14,7	-1,1	-4,7	-2,0	-4,8	-1,1	-1,5	-1,1	-1,3	-7,7	-8,2	-4,1	-4,8
up 95%CI	-0,5	-0,6	-0,8	-1,2	0,5	2,9	0,6	3,3	0,5	-4,7	0,6	-4,2	0,7	-5,8	0,5	-4,4	1,1	0,6	0,1	-0,4	0,4	2,4	0,4	1,3	-1,5	-1,5	2,9	2,8
Median	0	0	0	0	0	0	0	0	0	-2,5	0	0	0	-10	0	-5	0	-5	0	-5	0	0	0	0	0	0	0	0

Calculated values | Hypomobility | Hypermobility

ID	Considered deviation of neutral-null* (Hypomobility)																													Summary
	Passive Rotations				Active Rotations				Passive Extensions/ Flexions				Active Extensions/ Flexions				Passive Abduction/ Adduction				Active Abduction/ Adduction				Total rotations**					
Patient	Exterior rotation right passive [°]	Interior rotation right passive [°]	Exterior rotation left passive [°]	Interior rotation left passive [°]	Exterior rotation right active [°]	Interior rotation right active [°]	Exterior rotation left active [°]	Interior rotation left active [°]	Extension right passive [°]	Flexion right passive [°]	Extension left passive [°]	Flexion left passive [°]	Extension right active [°]	Flexion right active [°]	Extension left active [°]	Flexion left active [°]	Abduction right passive [°]	Adduction right passive [°]	Abduction left passive [°]	Adduction left passive [°]	Abduction right active [°]	Adduction right active [°]	Abduction left active [°]	Adduction left active [°]	Total rotation passive left [°]	Total rotation passive right [°]	Total rotation active left [°]	Total rotation active right [°]	Hypomobility [°](>Error)*	**Mean hypomobility**
1		-10								-15		-30		-35		-40													120	6
2																				-7									7	0,35
3										-10		-10		-10		-10													40	2
4																													0	0
5																													0	0
6										-30		-30		-30		-30													120	6
7										-50		-50		-50		-50													200	10
8										-40		-40		-40		-40													160	8
9		-15		-15						-15				-15											-15	-15			60	3
10																													0	0
11										-10		-10		-10		-10		-7		-7									54	2,7
12																													0	0
13	-10		-10																										0	0
14																													0	0
15				-10						-35		-36		-35		-35													141	7,05
16	-15	-25	-20	-20	-20	-10	-20	-12						-10	-10		-10	-15	-15	-10	-12	-15	-12	-8	-40	-40	-30	-32	259	12,95
17																													0	0
18																		-10		-10									20	1
19										-20		-10		-20		-10				-10									70	3,5
20																													0	0
21		-10	-15		-10	-15	-20					-10		-10												-15	-25	-25	85	4,25
22																		-7		-7									14	0,7
23		-15	-10	-15		-10		-10		-10		-10		-10		-10									-20	-25		-15	100	5
24	-7			-10																						-15			15	0,75
25										-20		-15		-20		-20													75	3,75
26							-15			-20		-20		-20		-15		-10		-10								-15	110	5,5
27	-10		-10																						-15	-15			30	1,5
28	-10		-10											-10											-15	-15			40	2
29																													0	0
30										-10				-20		-10													40	2
31																		-7											7	0,35
32										-10		-10		-10		-10													40	2
Min	-15	-25	-20	-20	-20	-15	-20	-12	0	-50	0	-50	0	-50	-10	-50	-10	-15	-15	-10	-12	-15	-12	-8	-40	-40	-30	-32	0	0
Max	-7	-10	-10	-10	-10	-10	-15	-10	0	-10	0	-10	0	-10	-10	-10	-10	-7	-15	-7	-12	-15	-12	-8	-15	-15	-25	-15	259	12,95
Mean	-10,4	-15,0	-12,5	-14,0	-15,0	-11,7	-18,3	-11,0		-21,1		-21,6		-20,9	-10,0	-22,3	-10,0	-9,3	-15,0	-8,7	-12,0	-15,0	-12,0	-8,0	-21,0	-20,0	-27,5	-21,8	56,5	2,8
SD	2,9	6,1	4,2	4,2	7,1	2,9	2,9	1,4		12,9		14,0		12,7		14,7		3,1		1,6					10,8	9,6	3,5	8,3	65,7	3,3
SE	1,3	2,7	1,7	1,9	5,0	1,7	1,7	1,0	******	3,4	******	3,9	******	3,1	******	4,1	******	1,3	******	0,6	******	******	******	******	4,8	3,6	2,5	4,2	11,6	0,6
+/-95%CI	3,6	7,6	4,4	5,2	50,0	7,2	7,2	10,0	******	7,4	******	8,5	******	6,5	******	8,9	******	3,3	******	1,5	******	******	******	******	13,5	8,9	25,0	13,2	23,7	1,2
lo 95%CI	-14,0	-22,6	-16,9	-19,2	-65,0	-18,8	-25,5	-21,0	******	-28,5	******	-30,1	******	-27,4	******	-31,2	******	-12,6	******	-10,2	******	******	******	******	-34,5	-28,9	-52,5	-35,0	32,8	1,6
up 95%CI	-6,8	-7,4	-8,1	-8,8	35,0	-4,5	-11,2	-1,0	******	-13,6	******	-13,2	******	-14,4	******	-13,4	******	-6,0	******	-7,2	******	******	******	******	-7,5	-11,1	-2,5	-8,5	80,2	4,0
Median	-10	-15	-10	-15	-15	-10	-20	-11		-17,5		-15		-20	-10	-15	-10	-8,5	-15	-10	-12	-15	-12	-8	-15	-15	-27,5	-20	40	2
																												d	23	
																												n	9	

ID	Summary of the results															Total										
	Hip status										Body sides															
Patient	Hip status Hypomobility	Hip status Hypermobility	Hip status Hyper- and Hypomobility	Rotation asymmetry	Other asymmetry	Hip status total Asymmetries + Hyper + Hypom.	Number of deviations right	Number of deviations left	Total number of Hyp- mob	Final hip status	Hip joint [r/l/b] (No of Deviation)	Sum of deviations from NN right	Sum of deviations from NN left	Total(Right - Left)	Hip joint [r/l/b](Extent of Deviation)	Total rotation a + p right	Total rotation a + p left	Hip joint [r/l/b] (Deviation of Rotation)	Sum (°re - °li)	Hip joint [r/l/b]Other asymm	NN Hip joint total [r/l/b]	Temporomandibular joint [r/l/b]	PK [l/r/b]	T/D [l/r]	total mobility range	Diff from mean total mob range
1	d	n	d	d	d	d	3	2	5	d	r	70	50	20	r	-5	10	r	32	l	r	r	b		1056	-247
2	u	n	u	d	n	d	0	1	1	d	l	7	0	7	r	0	-5	l	4	l	l	b	l		1104	-295
3	u	n	u	u	n	u	2	2	4	p	b	20	20	0	b	0	0	b	6	l	b	l	l		1126	-317
4	n	n	n	n	n	n	0	0	0	n		0	0	0		0	0		0			b			1220	-411
5	n	n	n	n	n	n	0	0	0	n		0	0	0		0	0		0			l	r		1160	-351
6	d	n	d	n	n	d	2	2	4	d	b	60	60	0	b	0	0	b	0	b	b	b			1000	-191
7	d	n	d	n	n	d	2	2	4	d	b	100	100	0	b	0	0	b	0	b	b	b			880	-71
8	d	n	d	d	n	d	2	2	4	d	b	80	80	0	b	0	0	b	0	b	b	l			985	-176
9	u	n	u	n	u	u	3	1	4	p	r	0	60	-60	l	-15	-15	b	-20	r	r	b			1035	-226
10	n	n	n	u	n	u	0	0	0	u	b	0	0	0	b	5	0	l	0	b	b	r			1260	-451
11	u	n	u	n	n	u	4	5	9	p	l	27	27	0	b	0	0	b	0	b	b	b			1127	-318
12	n	n	n	n	n	n	0	0	0	n		0	0	0		0	0		-16			l	r		1186	-377
13	n	n	n	n	u	u	0	0	0	u	b	0	0	0	b	-5	0	r	-14	r	r	l	r		1236	-427
14	n	n	n	n	n	n	0	0	0	n		0	0	0		0	0		0			r	r		1210	-401
15	d	n	d	n	n	d	2	3	5	d	l	71	70	1	r	0	-5	l	21	l	l	r	l	r	984	-175
16	d	n	d	n	d	d	7	6	13	d	r	117	142	-25	l	-70	-72	l	-19	r	b	r	r	r	809	0
17	n	n	n	n	n	n	0	0	0	n		0	0	0		0	-5		-10			l	r		1157	-348
18	u	n	u	u	n	u	1	2	3	p	l	10	10	0	b	0	0	b	-6	r	b	r	l		1091	-282
19	u	n	u	n	u	u	2	3	5	p	l	30	40	-10	l	0	0	b	0	b	l	r	r		1060	-251
20	n	n	n	n	n	n	0	0	0	n		0	0	0		0	0		0			r	l		1227	-418
21	u	n	u	n	u	u	3	2	5	p	r	60	25	35	r	-35	-40	l	5	l	b	l	l		1020	-211
22	u	n	u	n	u	u	1	2	3	p	l	7	7	0	b	-5	0	r	-10	r	r	b	r		1112	-303
23	u	n	u	n	n	u	4	4	8	p	b	35	65	-30	l	-30	-40	l	0	b	l	r	b		1002	-193
24	u	n	u	n	u	u	1	1	2	u	b	0	15	-15	l	-7	-20	l	20	l	l	l	r		1076	-267
25	u	n	u	u	u	u	2	2	4	p	b	35	40	-5	l	0	0	b	10	l	l	r	l	l	1130	-321
26	d	n	d	d	n	d	4	4	8	d	b	60	50	10	r	-10	-15	l	-12	r	r	l			1052	-243
27	u	u	u	n	u	u	2	0	2	u	r	0	40	-40	l	-15	-15	b	30	l	l	b	r	l	1250	-441
28	u	u	u	n	u	u	2	2	4	p	b	25	80	-55	l	-15	-15	b	30	l	l	l	l		1280	-471
29	n	d	d	u	u	d	2	4	6	d	l	50	70	-20	l	35	25	l	22	l	l	r	l		1444	-635
30	u	u	u	d	u	d	2	3	5	d	l	35	55	-20	l	5	25	r	18	l	l	l	l		1322	-513
31	u	n	u	u	n	u	1	1	2	u	b	0	7	-7	l	0	0	b	-2	r	b	l	r		1166	-357
32	u	n	u	u	n	u	2	2	4	p	b	20	20	0	b	0	0	b	15	l	b	l	l		1105	-296
Min							0	0	0			0	0	-60											809	-635
Max							7	6	13			117	142	35											1444	0
Mean							1,8	1,8	3,6			28,7	35,4	-6,7											1121	-312
SD							1,6	1,6	3,1			33,1	35,7	19,1											129	129
SE							0,3	0,3	0,5			5,8	6,3	3,4											23	23
+/-95%CI							0,6	0,6	1,1			11,9	12,9	6,9											46	46
lo 95%CI							1,2	1,2	2,5			16,8	22,5	-13,6											1075	-358
up 95%CI							2,3	2,4	4,7			40,6	48,3	0,2											1167	-266
Median							2	2	4			20	26	0											1119	-310
d	7	1	8	5	2	10			d	10																
u	16	3	16	7	11	16			p	11																
n	9	28	8	20	19	6			u	5																
									n	6																