Treatment in Primary Raynaud's Syndrome with Osteopathy

Master Thesis zur Erlangung des Grades

Master of Science in Osteopathie

an der **Donau Universität Krems**

niedergelegt

an der **Wiener Schule für Osteopathie**

von ***Dipl. Phys. Tamara Kalcakosz-Takacs***

Wien, Dezember 2006

EIDESSTATTLICHE ERKLÄRUNG

Hiermit versichere ich, die vorgelegte Masterthese selbständig verfasst zu haben.

Alle Stellen, die wörtlich oder sinngemäß aus veröffentlichten oder nicht veröffentlichten Arbeiten anderer übernommen wurden, wurden als solche gekennzeichnet. Sämtliche Quellen und Hilfsmittel, die ich für die Arbeit genützt habe, sind angegeben. Die Arbeit hat mit gleichem Inhalt noch keiner anderen Prüfungsbehörde vorgelegen.

Datum

Unterschrift

Treatment in Primary Raynaud's Syndrome with Osteopathy

Table of contents:

Acknowledgement

When I was sitting at home, thinking of beginning a research project and searching for an interesting topic, my fingers suddenly turned white, became painful, numb and finally became livid. I have experienced these disturbing symptoms since my youth and know that they are harmless although painful. It often hinders me while swimming and can be quite frequent and painful especially in the winter. I was checked by my doctor, assured that it was harmless, but he was unable to do very much in my case. It was recomended as a prevention that exposure to the cold should be avoided. There is no good clinical help available. Suddenly it came in my mind, "why not making an osteopathic study on Raynaud`s Syndrome?" If I can help others, maybe there will be some help for myself. That is briefly how everything started. Often you do not have to look so far, but simply keep an eye on things around you.

I want to thank my teachers, who opened my mind and showed me a new principal in life and human nature, not only therapeutic tools. Among all of them, who did their best, I am especially thankful to my teacher and friend Bernard Ligner, who tought me the osteopathic way of thinking, and who shared with me the „gold coins" of his wide experience, Tom Shaver, who encouraged me to look behind the crude structure and feel the stream of the vital force no matter, which therapeutic concept one follows, Sarah Wallace, who showed me with her preciseness, and her attitude how to reevaluate ones own therapeutic approach and who demonstrated over and over again, how to become a professional, and Jean Pierre Barral, who demonstrated the complexity of lesions in his workshops and books.

Next I want to thank Prof. Dr. W. Jurecka, head of the dermatologic department of the Wilhelminenspital, Vienna, who made this study possible and Dr. Takacs Michael, who did the clinical measures, who believed in my work and who was a great support during this entire study process.

I would like to acknowledge several special people for their assistance and inspiration. Peter Sommerfeld, who's excellent introduction to the study of methodology and his dedication to scientific research in osteopathy was not only a great help, but also an inspiration for my work. Kathie Schroll, the pragmatic supervisor, who always had good advice during the entire process of this thesis and last but not least a special thanks to the WSO, which prepared this Mastercourse despite all difficult circumstances from outside.
Many Thanks to all of them.

1. Introduction

Raynaud`s Syndrome is a vascular disorder characterized by recurrent transient vasospasm of the fingers and toes on exposure to cold or with emotional stress. The digits first turn white, then blue and finally red and can be accompanied by severe pain. During the attack any manual activity with the hands is difficult for the patient.The pathogenesis is not fully understood. There are different mechanisms which singly or in combination, may contribute. A key point is that Raynaud's Syndrome can be either primary (idiopathic), and starts normally in puberty, or secondary to a number of underlying conditions, which start later in life, and that the pathogenesis and pathophysiology vary between these conditions. Although primary Raynaud's Syndrome is a harmless disease, it leads to a reduction in life quality, because the attacks are frequent in winter and lead to pain. Outdoor sports or work is extremely difficult and even swimming during the summer months is painful if the water is cold. In primary Raynaud's disease the vasospasms are supposed to be due to a hyperactivity of sympathetic autonomous nerve fibers surrounding the digital arteries. The therapy of primary Raynaud's Syndrome is symptomatic and focused on individual preventive strategies such as stress reduction, avoiding exposure to cold and smoking as recomended by the scottish intercollegiate guidelines network SIGN 1998 (www.sign.ac.uk). In very severe cases with severe pains there are some vasodilaters available, which improve the arterial flow in the periphery, such as nitroglycerin, alpha-receptor blockers, calcium channel antagonists and prostaglandins. If this medication fails, there is the possibility of thoraco sympathectomy. The use of all these drugs is limited due to the side effect of decreasing the arterial blood pressure and leading to vertigo, headaches, nausea and collapse. Many patients with primary Raynaud's Syndrome already show a marked hypotonus and therefore cannot be treated as mentioned above. Osteopathic treatment could be a good alternative for those patients.

Osteopathy is a holistic therapeutic method, which has become more and more popular for treating functional diseases. Our study could show a new indication as well as the efficacy of osteopathic treatment in a functional problem. With osteopathic treatment we expect a marked rise in the hand temperature, due to an improved arterial supply in the periphery, and a decreased frequency and severity of ischemic attacks.

12 patients with primary Raynauds Syndrome, randomized by choice were treated with Osteopathy 4 - 6 times by me additional to standard treatment as recomended by SIGN (www.sign.ac.uk). All patients are evaluated with a questionaire about the frequency, intensity and duration of their attacks. Pains are evaluated with VAS 1-10. Raynaud's Syndrome is clinically evaluated with hand thermography before and after cold exposure and acral plethysmography with nitro provocation. Exclusion of secondary Raynaud's Syndrome by means of autoimmune serology, x-rays of thorax and the cervical spine if needed, and nerve-conduction-velocity. After the treatment they are reevaluated with a questionaire, hand thermography and photopletysmography. These patients are afterwards compared with a control group treated without osteopathy.

2. Raynaud's Syndrome

Raynaud's Syndrome is defined as reversible vasospastic attacks of the digital arteries due to cold and stress. Effected are fingers and/or toes, which show initial blanching, in worse cases pains, followed by red-livid discolouration (Alexander 1993).

1862 the disease was first described by Maurice Raynaud, who reported about cold induced ischemic attacks of the fingers and toes, which follow a characteristic pattern and is today called Raynaud's Syndrome or Raynaud's phenomenon. Allen and Brown (1972) critically reviewed the published literature and precisely defined the disease within the following clinical criterias:

- *typical tricolor phenomenon with initial acral blanching followed by cyanosis and at last reactive hyperemia (erythema).*
- *attacks are induced by cold and stress*
- *paroxysmal attacks*
- *symmetrical acral pathologic changes, especially of fingers and toes*
- *persistence of the attacks over a two years period*

(Allen et Brown, 1932 s.p.)

The incidence of Raynaud's Syndrome is 3-16% in the average population, 5 - 10 times more prevalent in women than in men. 70% suffer primary Raynaud's Syndrome, which is the benign form without underlying systemic disease, for example collagenosis (Belch, 1990).

Secondary Raynaud's Syndrome is a heterogenic group of diseases, with the same clinical entity (Table 1). Primary Raynaud's Syndrome is therefore an exclusion and the diagnosis is complex and includes several tests.

Diseases associated with secondary Raynaud's Syndrome	
Collagenosis	Scleroderma, CREST Syndrome Lupus Erythematodes Chronic Polyarthritis Dermatomyositis Mixed connective tissue disease Sjögren Syndrome Morbus Wegener Panarteriitis nodosa
Arterial Diseases	Arterial Sclerosis Thrombangitis obliterans Embolia (cardiac, arterio arterial, f.e. neurovascular Shoulder girdle compression Syndrome, Tumors- mostly Pancoast tumor)
Trauma	Local injuries Hypothenar Hammer Syndrome
Haematologic diseases	Cold agglutinins, Cryofibrinogen Polycythemia Paraproteinemia Thrombocytosis

Chronic intoxication	Heavy Metals (Arsen, Pb) Ergotamine Intoxication by mushrooms PVC (Polyvinyl chloride) Serotonin Cyanide
Medications	Sympathico mimetics Beta receptor inhibitors Seco alkaloids Hormonal Anticontraceptives Clonidine Zytostatics (Bleomycin, Vinca alcaloid)
Neurologic Diseases	Multiple Sclerosis Neuritis Poliomyelitis Syringomyelia Spinal tumors Apoplectic stroke Carpel tunnel syndrome
Diseases of the spine	Scoliosis Arthrosis of the cervical spine
Liver Diseases	Cirrhosis of the liver Hepatitis C
Arterial-Venous Shunts	AV Fistulas with Secondary Steel Phenomenon Cimino Shunts
Paraneoplastic Syndromes	

Fig. 1 : Alexander (1993, p. 612)

2.1. Pathophysiology

The pathogenesis of Raynaud's Syndrome is not yet fully understood. There are many different mechanisms which may contribute singly or in combination.

The clinical syndrome of Raynaud's phenomenon probably represents the final common pathway of various pathological triggers. The specific pathophysiological abnormalities that induce the disorder may differ for each of the underlying conditions of secondary and primary forms of the disease. (Block, 2001, p. 2044)

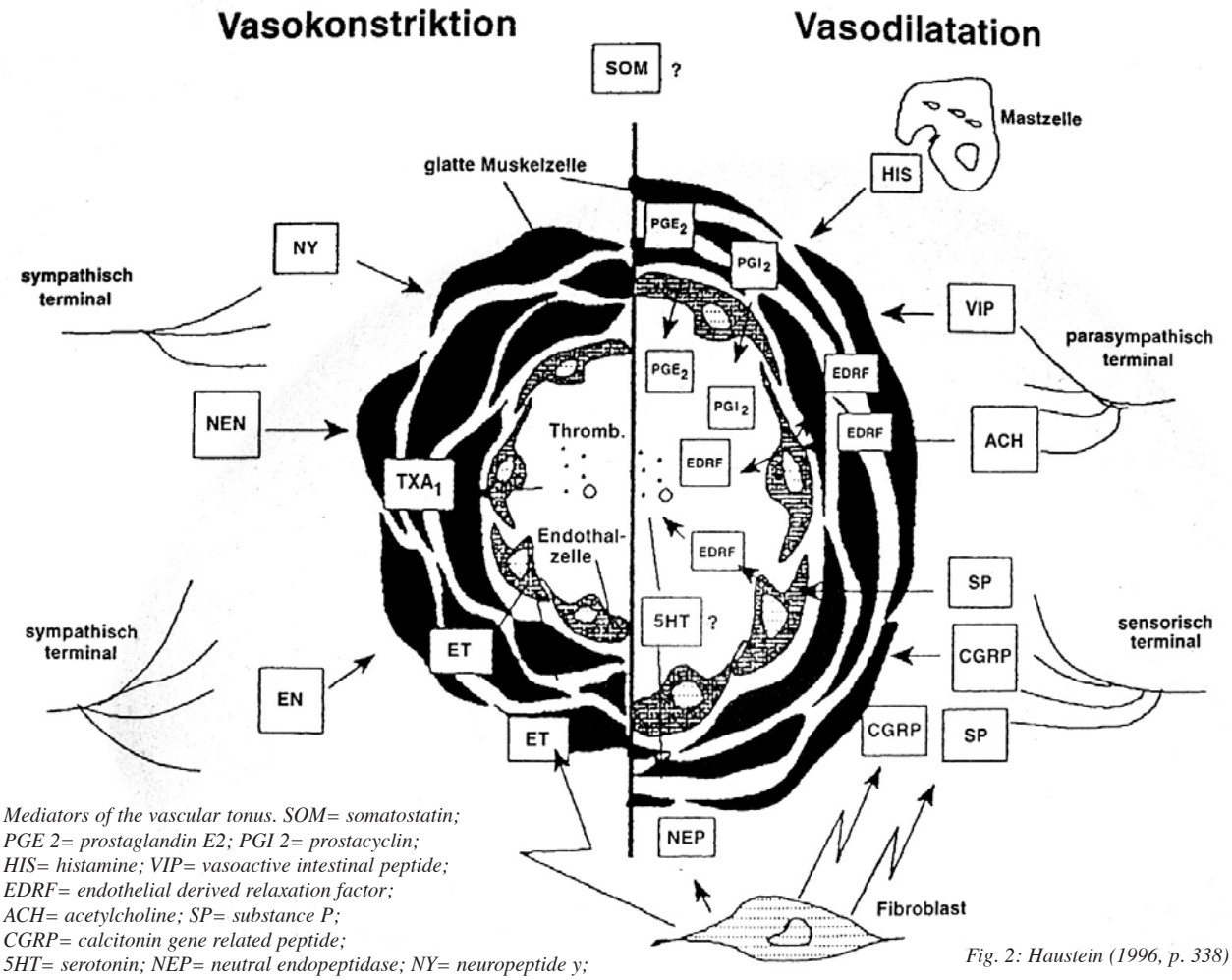
These different pathological triggers and hypothesis are described as followed.

Especially important in primary Raynaud's phenomenon is the vasoconstriction in peripheral vessels mediated by the sympathetic nervous system via the alpha adrenergic receptors of the vascular smooth muscle. Several factors are discussed as to why there is a hyperreaction of vascular smooth muscle to stimuli of the sympathetic nervous system:

- increased release of noradrenalin in sympathetic innervation
- decreased removal of catecholamines
- increased number or affinity of alpha adrenergic receptors
- decreased number or affinity of beta-2-adrenergic receptors
- changes in the balance of the activity and concentration of secondary messengers such as cAMP, cGMP and calcium iones

Freedmann (1989) could show in his work, that patients with primary Raynaud's Syndrome have an increased sensitivity and/or increased number of peripheral alpha adrenergic receptors. (Freedmann 1989 quoted by Alexander ,1993). Much attention has been paid to the role of the alpha-2 adrenergic system in Raynaud's phenomenon because of observations that physiological cold induced vasoconstriction of the cutaneous vessels is mediated through the alpha-2 and not the alpha-1 receptors (Alexander, 1993).

In secondary forms of Raynaud's Syndrome, especially in collagenosis, the major pathological factor is supposed to be due to endothelial damage, leading to high concentrations of endothelin 1 and thromboxan A2. Both substances are responsible for vasoconstriction in the peripheral blood vessels and are endothelium dependent (Haustein, 1996). All these mediators of the vascular tonus can be seen in Figure 2.



Mediators of the vascular tonus. SOM= somatostatin; PGE 2= prostaglandin E2; PGI 2= prostacyclin; HIS= histamine; VIP= vasoactive intestinal peptide; EDRF= endothelial derived relaxation factor; ACH= acetylcholine; SP= substance P; CGRP= calcitonin gene related peptide; 5HT= serotonin; NEP= neutral endopeptidase; NY= neuropeptide y; NEN= norepinephrine(noradrenaline); TXA2= thromboxane A2; EN= epinephrine (adrenaline); ET= endotheline

Fig. 2: Haustein (1996, p. 338)

Raynaud's Syndrome of the feet is less common and is supposed to be due to a higher orthostatic blood pressure than in the hands. Some clinical studies could show a lesser blood pressure in patients with Raynaud's Syndrome in comparison to the average population (Alexander 1993), which explains, why the hands are more often effected.

A higher blood viscosity and higher concentrations of fibrinogen are only found in patients with

haematologic disorders and thus may contribute there, but do not play a major role in patients with the primary form (Alexander, 1993).

Another pathological factor is chronic vibration trauma, which leads to hypertrophy of blood vessel wall within the smooth muscle, and reduction of the blood vessel lumen, which diminishes the peripheral blood flow. Thus a normal vasoconstriction can clinically lead to a vasospastic attack because of the reduced blood flow. In consequence chronic vibration trauma results in recurrent microembolism in the peripheral arteries and leads to irreversible ischemic attacks for example in hypothenar hammer syndrome (Alexander, 1993), which is considered as a secondary form, as seen in figure 1.

Regarding all these possible pathological factors the most improtant one in primary Raynaud's Syndrome is the hyperactivity of the sympathetic nervous system. Therfore the problem is a dysfunction in the autoregulation of the autonomous nervous system, as seen in other „functional" or psychovegetative problems. We suppose, that primary Raynaud's Syndrome is just another entity of these complex disorders and it should be possible to see a positive effect after osteopathic treatment, such as seen for example in gastrointestinal problems and headaches. My osteopathic approach is mainly focused on the autonomic nervous system, the blood supply and the anatomical structures, which may contribute.

3. Anatomy

For this chapter compare: Corning (1946), Kahle et Frotscher (2005), Pernkopf (1944 et 1952), Gray's Anatomy (2005).

3.1. Region of the neck and shoulder girdle

3.1.1. Fascia of the neck

Usually we can distuinguish between three cervical fascia:
- 1. superficial colli fascia
- 2. middle colli fascia
- 3. deep colli fascia seu prevertebral fascia

The middle colli fascia is as mentioned by Merkel F. S. (1913) exceptional, because it has a structure like an aponeurosis and therefore can be distinguished from the other connective tissue structures in this region. As it has a connection with the omohyoid , sternohyoid and sternothyroid muscles it has an important mechanical role. Its inferior insertion is on the upper border of the scapula (the origin of the omohyoid), posterior edge of the clavicle, scalene tubercle, cartilage of the first rib and posterior sternum. At the top it inserts on the hyoid bone. It has a continuity with the subclavius muscle and exchanges fibres with the pleura. Restrictions here have an adverse effect on the circulatory system, as mentioned by Barral (1991). Nevertheless the superficial and deep colli fascia serve as borders to differentiate certain regions in this area.
The superficial cervical fascia surrounds anterior the m. sternocleidomastoideus and together with the middle colli fascia it reaches the medial plane. Posterially it covers the lateral triangle, caudally it inserts on the upper border of the clavicle, the acromion, the spine of the scapule and the sterno jugular notch. According to Barral (1991) it also functions as an active aponeurosis, which enlarges the neck and dilates the vessels by it's contraction.
The deep colli fascia forms certain well-defined fibrous sheets. The praevertebral fascia covers the anterior vertebrae until the third thoracic vertebra, sometimes exchanging fibers with the dura mater, extending laterally on the anterior and middle scalene and on the levator scapula muscle as a fascial floor of the posterior triangle. The subclavian artery and brachial nerves carry prevertebral fascia infero-laterally behind the clavicle as the axillary sheet. Other parts of the fascia is loosely arranged but condensed around blood vessels and enclose arteries and accompanying veins. Some parts of the fascia insert on rib 1 and have an expansion to the anterior edge of the pleural dome. This expansion is part of the suspensory apparatus of the pleura and is sometimes called the scaleno-pleural ligament. Some fibers of the sheet reinforce the aponeurosis of the subclavius muscle.
The subclavian aponeurosis is continous with the middle cervical aponeurosis and the clavipectoral

fascia. Therefore Barral (1991) states, it also plays a role in venolymphatic circulation.
Finally, the pleural dome is connected with the endothoracic fascia and together they form the cervical thoracic diaphragm. It has suspensory ligaments such as seen in Figure 3, of Paoletti's book (2001), the costo-pleural, transverse-pleural and vertebro-pleural ligaments, through which the spinal nerves of C8 and Th1 pass.

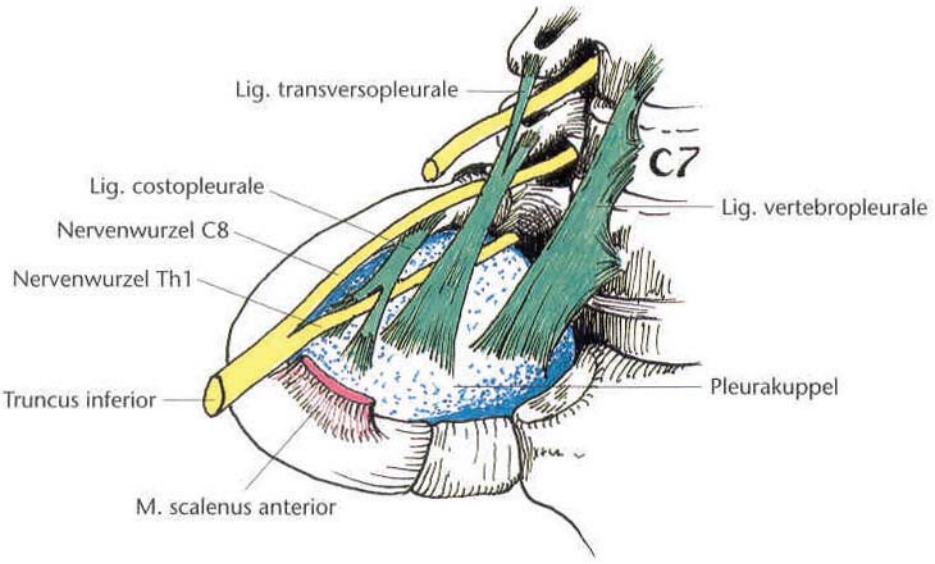


Abb. 2.36: Aufhängungsapparat der Pleura.

Figure 3: Paoletti (2001, p 85)

3.1.2. Muscles of the neck

When treating Raynaud's Syndrome the smaller muscles in this region are of far greater interest than the large muscels, because the large muscles are very rarely responsible for primary restrictions according to Barral (1991).
The most important ones will be described and are well seen in Figure 4:

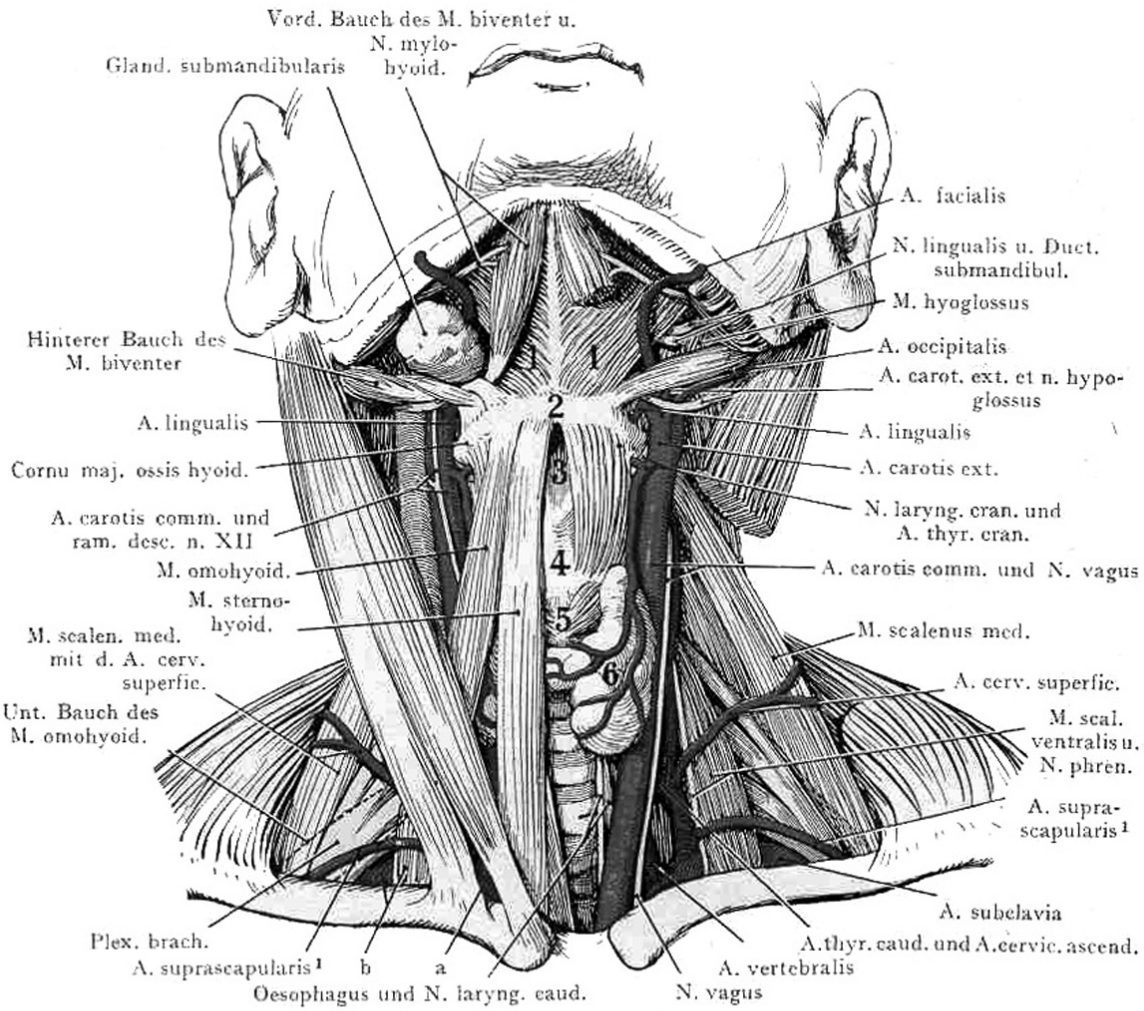


Abb. 176. Topographie des Halses von vorne, nach Entfernung der oberflächlichen Schichten sowie linkerseits des M. sternocleidomastoideus.

1 M. mylohyoideus. 2 Corpus ossis hyoidis. 3 Membrana hyothyreoidea. 4 Cartilago thyreoides. 5 Cart. cricoides. 6 Lobus sinister gland. thyreoideae. a' A. subclavia in der Lücke zwischen den beiden Portionen des M. sternocleidomastoideus freigelegt. b A. subclavia nach dem Austritte aus der hinteren Scalenuslücke mit dem M. scalenus ventralis.

Fig. 4: Corning (1946, p. 214)

Omohyoid Muscle:

The Omohyoid muscle consists of two bellies. The inferior belly is flat. It arises from the upper border of the scapula, near the scapular notch. It then passes behind the m. sternocleidomastoideus and ends in the intermediate tendon. Here the superior belly begins, which passes almost vertically upwards and is attached to the lower border of the hyoid body, lateral to the insertion of sternohyoid muscle.

Sternohyoid Muscle:

The sternohyoid muscle is a thin muscle, that arises from the posterior surface of the medial end of the clavicle and from the costoclavicular ligament and sternum, and is attached to the inferior border of the body of the hyoid bone.

Sternothyroid Muscle:

The sternothyroid muscle arises from the posterior surface of the manubrium and the first costal cartilage and attaches on the lateral thyroid cartilage.

Thyrohyoid Muscle:

The thyrohyoid muscle is a small muscle, that may be regarded as an uppward continuation of the sternothyroid running from the thyroid cartilage to the thyroid bone.

Contraction of these muscles lowers the hyoid bone. Barral (1991) mentions, that they also have a fascial role in tensing the middle cervical aponeurosis, which allows the dampening of large changes in pressure levels, which could have an effect on the cervico-thoracic vessel system.

Anterior Scalene Muscle:

The anterior scalene is attached to the anterior tubercles of the transverse processes of C3-C6 and runs to the scalene tubercle on the superior edge of rib 1, and to a ridge on the upper surface of the rib anterior to the groove for the subclavian artery. The anterior scalene forms an important landmark in the root of the neck, because the phrenic nerve passes above it, the subclavian artery below it and the brachial plexus lies at its lateral border, as seen in Figure 5 below.

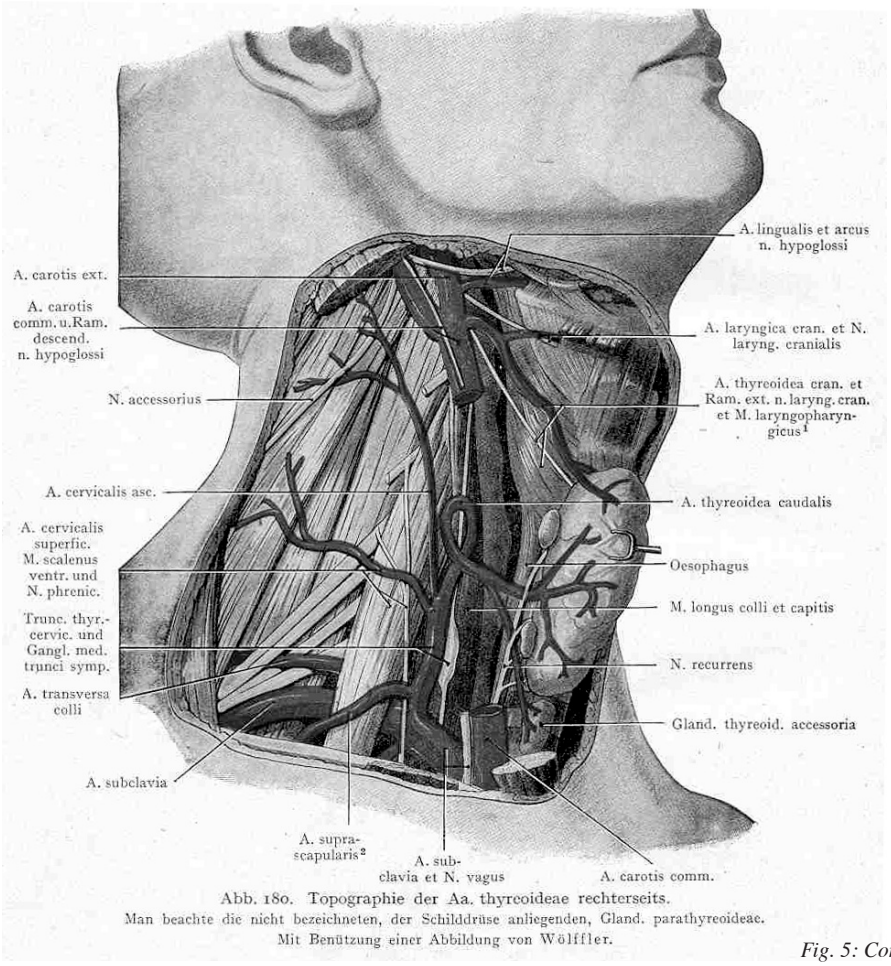


Abb. 180. Topographie der Aa. thyreoideae rechterseits.
Man beachte die nicht bezeichneten, der Schilddrüse anliegenden, Gland. parathyreoideae.
Mit Benützung einer Abbildung von Wölffler.

Fig. 5: Corning, (1946, p. 218)

Middle Scalene Muscle:

The middle scalene muscle runs from the transverse processes of C2-C7 to the upper surface of the first rib and is separated from the anterior scalene by the subclavian artery.

Posterior Scalene muscle

The posterior scalene muscle passes from the transverse processes of C4-C6 to the superior edge of the second rib.

Subclavius Muscle

The subclavius is a small, but very important muscle, tucked between the clavicle and the first rib. It arises from the junction of the first rib and its costal cartilage. It passes upwards and laterally to a groove on the undersurface of the middle third of the clavicle. The lateral fibers also insert via a strong tendon between the conoid and trapeziod ligament. The muscle is innervated by cervical nerves 5 and 6 via the brachial plexus and has fibers, which anastomose with the phrenic nerve. The consequences of contracture or fibroses here are considerable, because the thoracic inlet is naturally very narrow. Disturbance of the surrounding muscular system including the subclavius muscle may further narrow this opening and interfere with normal blood flow. (Barral, 1991, p. 18)

3.1.3. Nerve bundles of the neck

As the upper extremity is mainly innervated by the brachial plexus, there is a focus on this structure. The brachial plexus arises from C5-T1 and divides in the supra and infra clavicular fossae. Figure 6 shows us the brachial plexus as a union of the ventral rami of the lower 4 cervical nerves and the greater part of the first thoracic ventral ramus, which frequently receives a branch from the second. Inside the medial angle of the supraclavicular fossa, closely related to the pleural dome the nerves coming from the brachial plexus are found above and behind the subclavian artery. *Therefore [....] abnormal tensions of the anterior soft tissues frequently have major neurovascular effects* (Barral, 1991, p. 48). In the axilla, the lateral and posterior cords of the brachial plexus are lateral to the first part of the axillary artery, and the medial cord is behind it. In the lower axilla the cords divide into the nerves, which supply the upper limb.

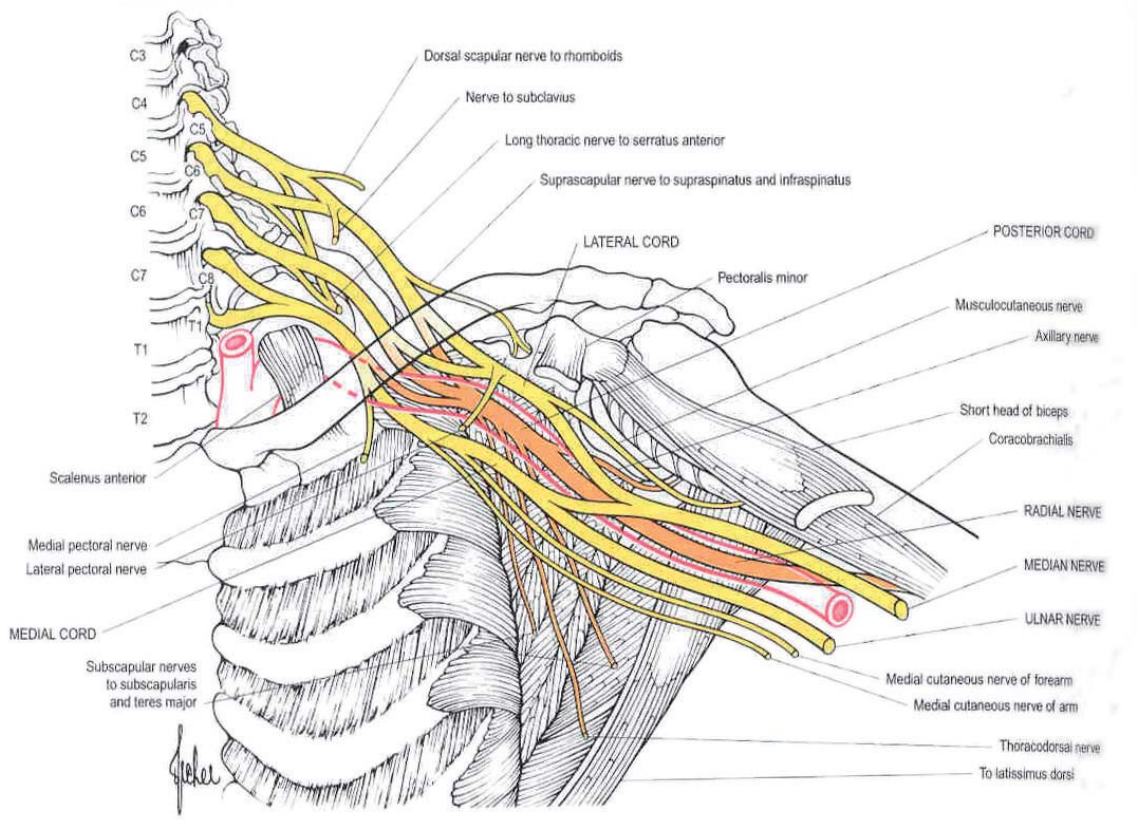


Fig. 49.30 Diagram of the brachial plexus, its branches and the muscles which they supply. The axillary artery, shown in red outline, runs anterior to the radial nerve. (By permission from Aids to the Examination of the Peripheral Nervous System. 2000. 4th edition. London: Saunders.)

846

Fig. 6: Gray's Anatomy (2005, p. 846)

3.1.4. Posterior cervical triangle (Trigonum colli laterale)

The posterior cervical triangle (Figure 7) plays a major role in the therapeutic approach, because it contains the cervical and brachial plexes, the subclavian artery and the spinal accessory nerve.

It is deliniated anteriorly by the m. sternocleidomastoideus, posteriorly by the anterior edge of the m. trapezius and inferiorly by the middle third of the clavicle. The roof is formed by the investing layer of the deep cervical fascia and the floor of the triangle is formed by the prevertebral fascia. It is crossed about 2.5 cm above the clavicle, by the inferior belly of the omohyoid, which divides it into occipital and supraclavicular triangles. The uppermost part of the brachial plexus crosses in the occipital triangle. The supraclavicular triangle corresponds with the supraclavicular fossa, where it is accessible to osteopathic techniques but also vulnerable to trauma. It's floor contains the first rib, the middle scalene and the first slip of the serratus anterior. It's size varies with the extent of the clavicular attachments of the m. sternocleidomastoideus and m. trapezius and also the level of the inferior belly of the omohyoid muscle. The triangle is covered by the superficial and deep fascia. Just above the clavicular level, the third part of the subclavian artery curves inferolaterally from the lateral margin of the anterior scalene, across the first rib to the axilla. The brachial plexus is partly above and partly behind the artery and closely related to it.

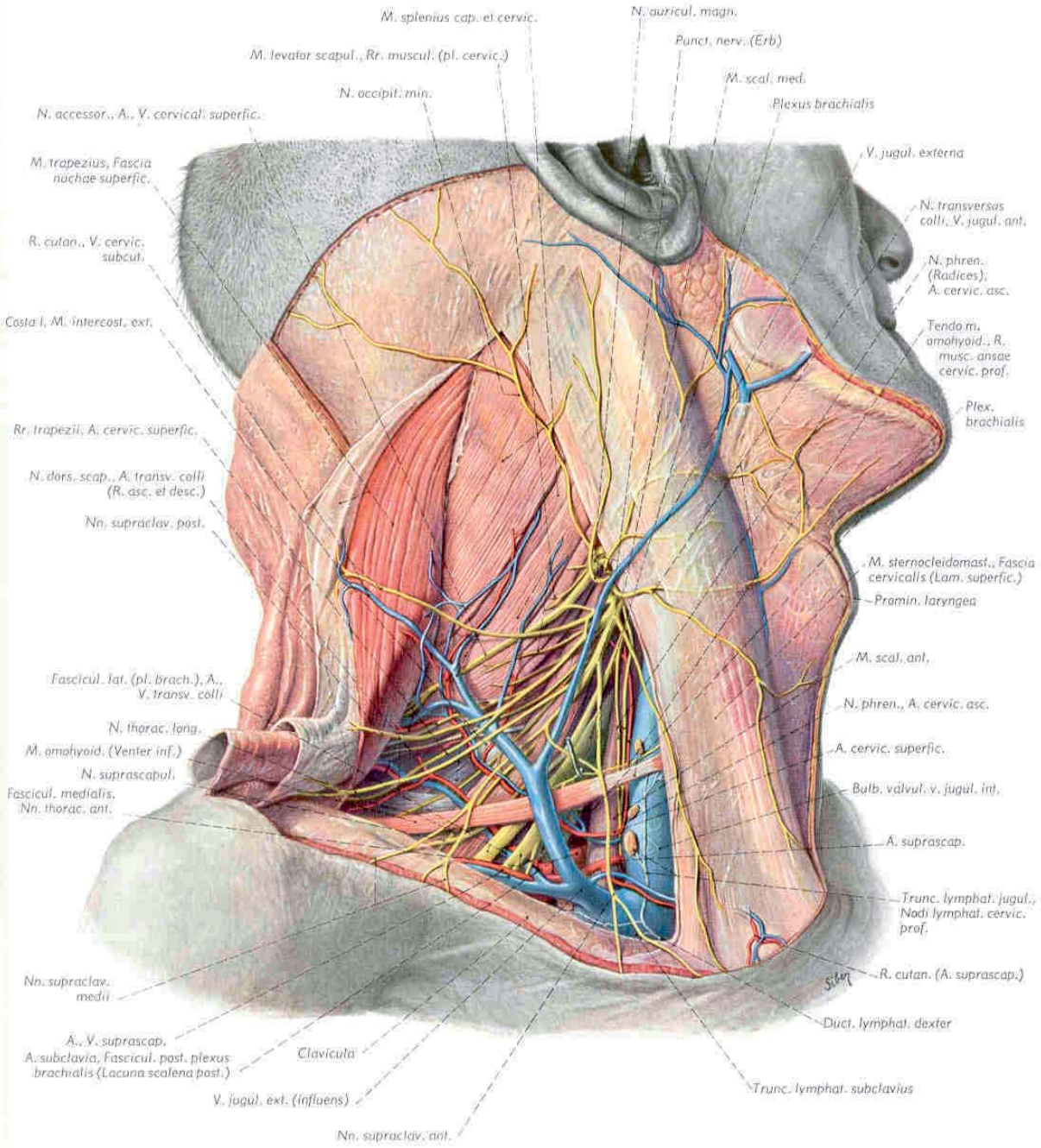


Abb. 276. Präparation der Blutgefäße, Nerven und Muskeln im Bereiche des lateralen Halsdreiecks. Plexus brachialis und Arteria subclavia in der hinteren Scalenuslücke.

Fig. 7: Pernkopf (1944, p. 269)

3.2. Important arteries

3.2.1. Subclavian Artery

The main artery of the upper limb is single as far as the ellbow, but its name changes in the regions traversed. From its origin to the outer border of the first rib, it is called subclavian artery. From there to the tendon of the teres major it is called the axillary artery, and from this to its division at the ellbow it is called brachial artery. The subclavian artery is divided into three parts. The first part lies medial to the posterior groove of the anterior scalene, the second part lies in the posterior groove behind the anterior scalene, the third part, after passing the space between the anterior and middle scalene, lies in the supraclavicular fossa until it reaches the inferior margin of the first rib and enters the axilla. As the subclavian artery seperates the anterior scalene from the middle scalene, the proximity of these structures can give rise to compression Syndromes, either arterial or nervous.

The right subclavian artery, demonstrated in Figure 8, arises from the brachiocephalic trunk, behind the upper border of the right sternoclavicular joint and passes to the medial margin of the anterior scalene. It has relations to the superficial and deep cervical fascia, to the anterior supraclavicular nerves, the clavicular attachment of the sternocleidomastoid, sternohyoid and sternothyroid muscles. Below and behind the artery are the pleura and pulmonary apex, separated by the suprapleural membrane. The left subclavian artery arises from the aortic arch, ascends into the neck, then arches laterally to the medial border of the anterior scalene and has the same relations as the right subclavian artery.

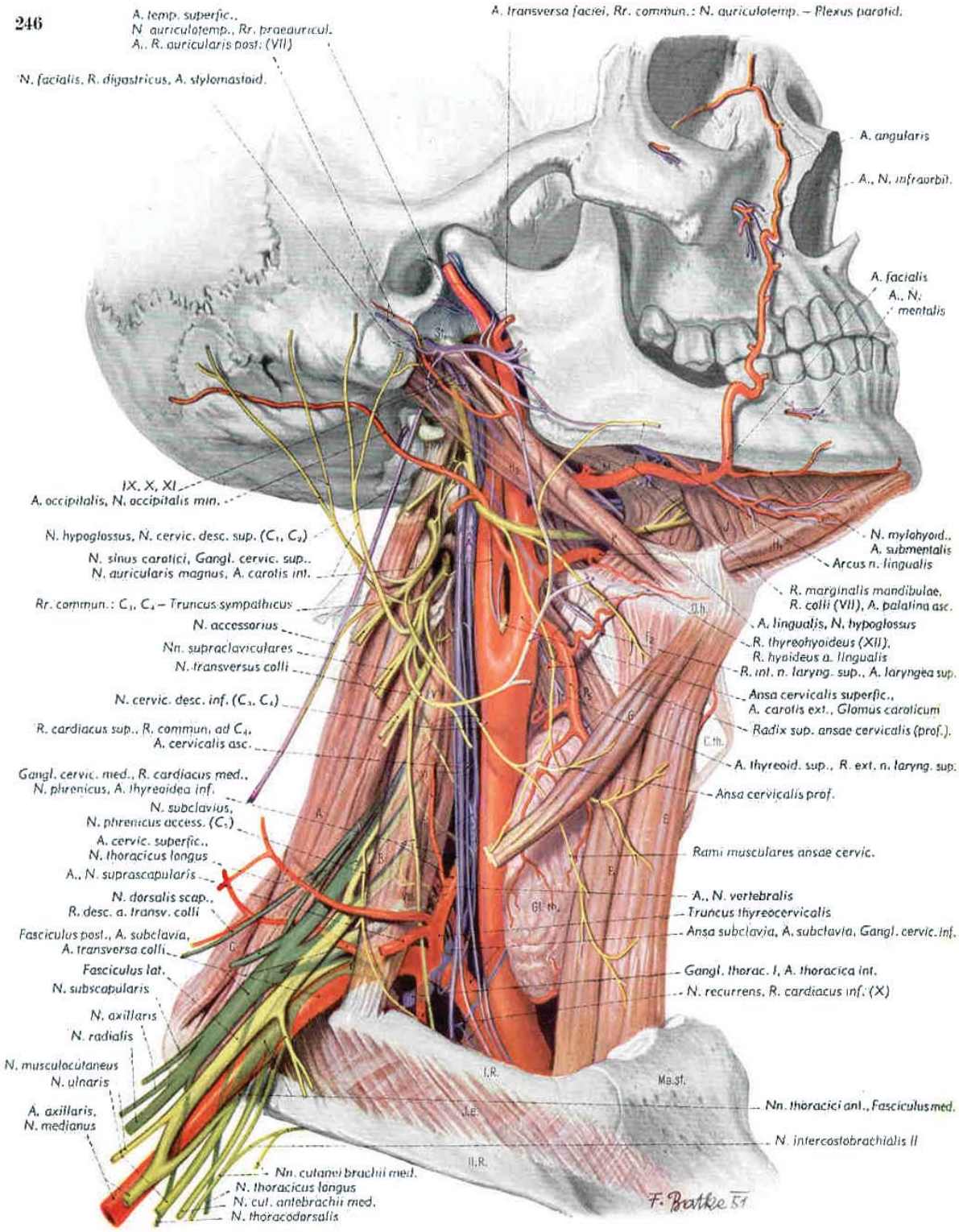


Abb. 260. Die Topik der Arterien und Nerven des Halses, von rechts her dargestellt unter Entfernung des Schultergürtels, des M. sternocleido mastoideus und der Nackenmuskulatur.

A	= M. scalenus medius	Gl. th.	= Glandula thyreoidea	Ma. st.	= Manubrium sterni
B	= M. scalenus ant.	H_1	= M. digastricus (Venter ant.)	O. h.	= Os hyoideum
C	= M. scalenus post.	H_2	= M. digastricus (Venter post.)	P_2	= M. thyreopharyngeus
C. th.	= Cartilago thyreoidea	J	= M. mylohyoideus	St.	= Processus styloideus
E	= M. sternohyoideus	J. e.	= M. intercostalis ext.	I–VIII	= Ramus ventralis des 1. bis 8. Cervicalnerven
F_1	= M. sternothyreoideus	K	= M. stylohyoideus	I	= Ramus ventralis des 1. Thoracalnerven
F_2	= M. thyreohyoideus	L	= M. hyoglossus	I., II. R.	= 1. und 2. Rippe
E	= M. omohyoideus (Venter sup.)	M	= M. styloglossus		

Fig. 8: Pernkopf (1944,p 246)

The second part of the subclavian artery is behind the anterior scalene muscle and is the highest part of the vessel. Here it has relations anterior to the superficial and deep cervical fascia, the sternocleidomastoid and anterior scalene muscles. Posteroinferior are the suprapleural membrane, pleura and lung and the lower trunk of the brachial plexus.
The third part of the subclavian artery descends laterally from the lateral margin of the anterior scalene to the outer border of the first rib, where it becomes the axillary artery. It lies partly in the supraclavicular triangle. Here the anterior relations are the superficial and deep cervical fascia and supraclavicular nerves. Superolateral are the upper and middle trunks of the brachial plexus and the inferior belly of the omohyoid. Inferior is the first rib.

3.2.2 Axillary Artery

The axillary artery is the continuation of the subclavian artery. It begins at the outer border of the first rib and ends at the inferior border of the teres major muscle, where it is called the brachial artery. Anteriorly it has relations to the superficial and deep cervical fascia, clavicular fibers of the major pectoral muscle and the clavicular pectoral fascia. Posteriorly are the first intercostal space and the medial cord of the brachial plexus and laterally is the posterior cord of the brachial plexus.

3.3. Thoracic Spine and Sympathetic Trunk

3.3.1. Thoracic Spine

The importance of the upper thoracic spine in Raynaud's Syndrome is obvious as you can see in figure 9. The ganglions of the sympathetic trunk, which supply the upper extremity with sympathetic fibres, are located just in front of the heads of the ribs.

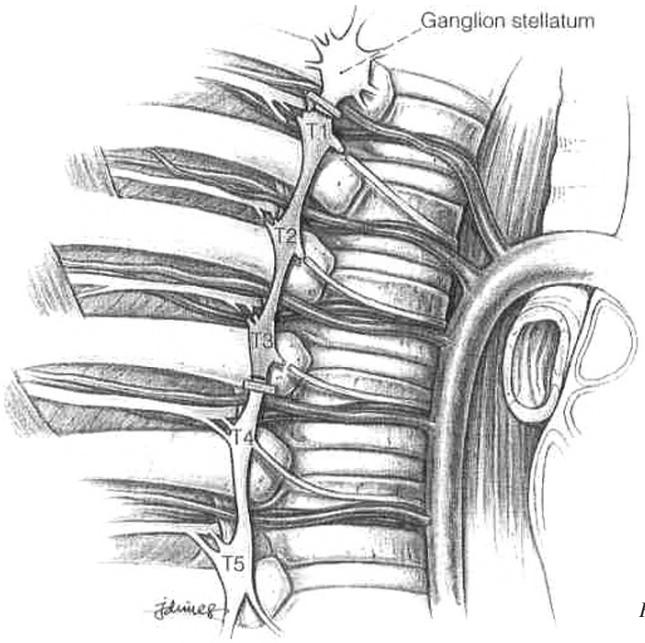


Fig.9: Breitner (1996, Vol.13, p. 263)

Therefore any little dislocation of the ribs or hypertension of the small muscles in the thoracic spine could disturb the normal function of the sympathetic fibres. Especially the deep intrinsic muscles such as the erector spinae muscles, semispinal, multifidus, rotatores brevis and longus muscles which play a major role in keeping the vertebrae in their correct position and their correct junction with the ribs. Furthermore the short and long levator costarum muscles, which run from the transverse processes of C7 and T1-11 to the twelve ribs, should be considered.

3.3.2. The Sympathetic Trunk

The sympathetic trunks are two ganglionated nerve cords which extend from the cranial base to the coccyx. The ganglia are joined to spinal nerves by short connecting nerves called white and grey rami communicantes. Figure 10 shows these rami communicantes, leaving the ganglion stellatum and the first thoracic ganglion, joining the brachial plexus.

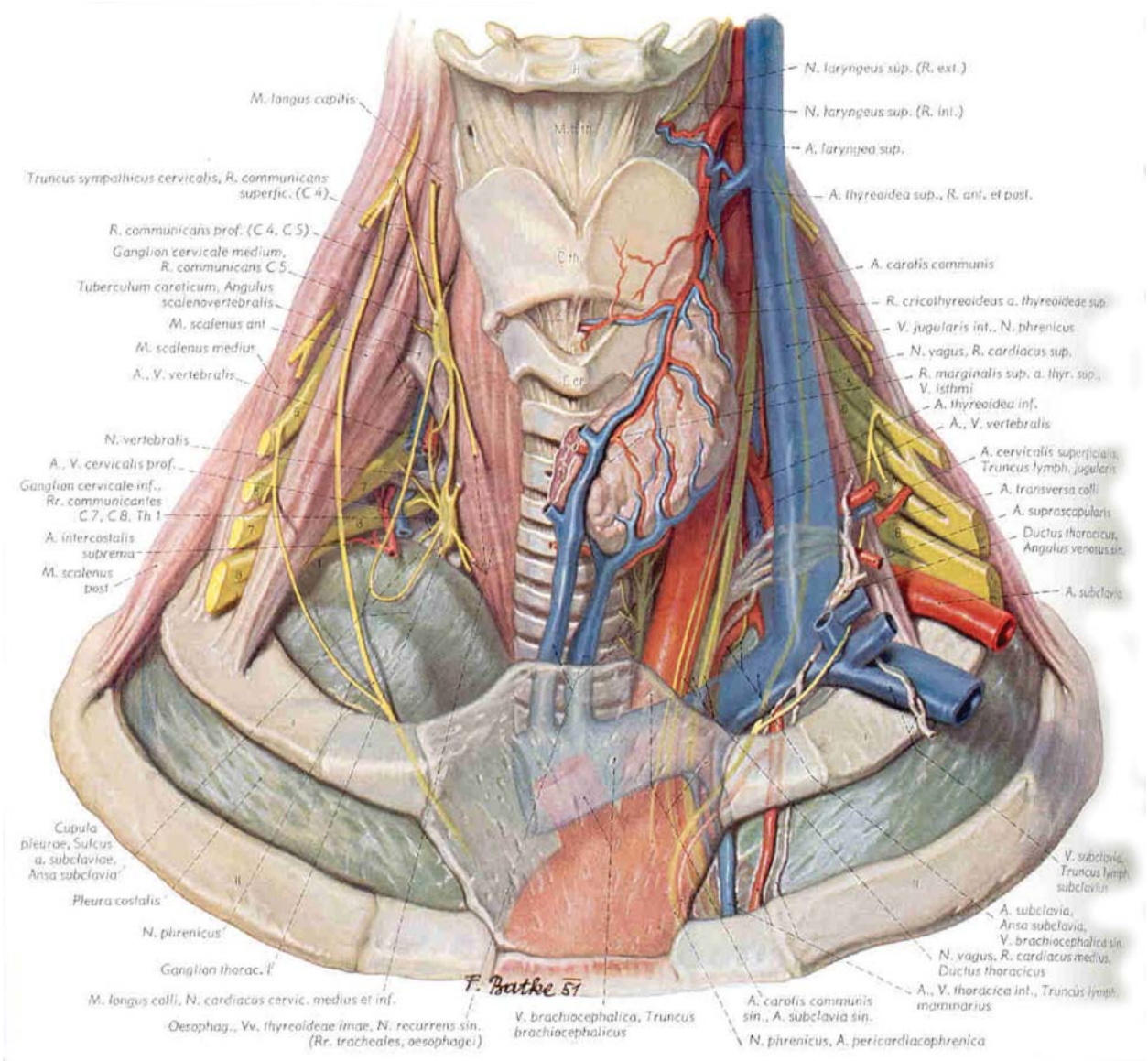


Figure 10: Pernkopf (1944, p.200)

In the neck each sympathetic trunk lies posterior to the carotid sheath and anterior to the transverse processes of the cervical vertebrae. In the thorax the trunks are anterior to the heads of the ribs. Postganglionic sympathetic fibers, which join the spinal nerves, are vasoconstrictor to blood vessels and secretomotor to sweat glands as you can see in figure 11.

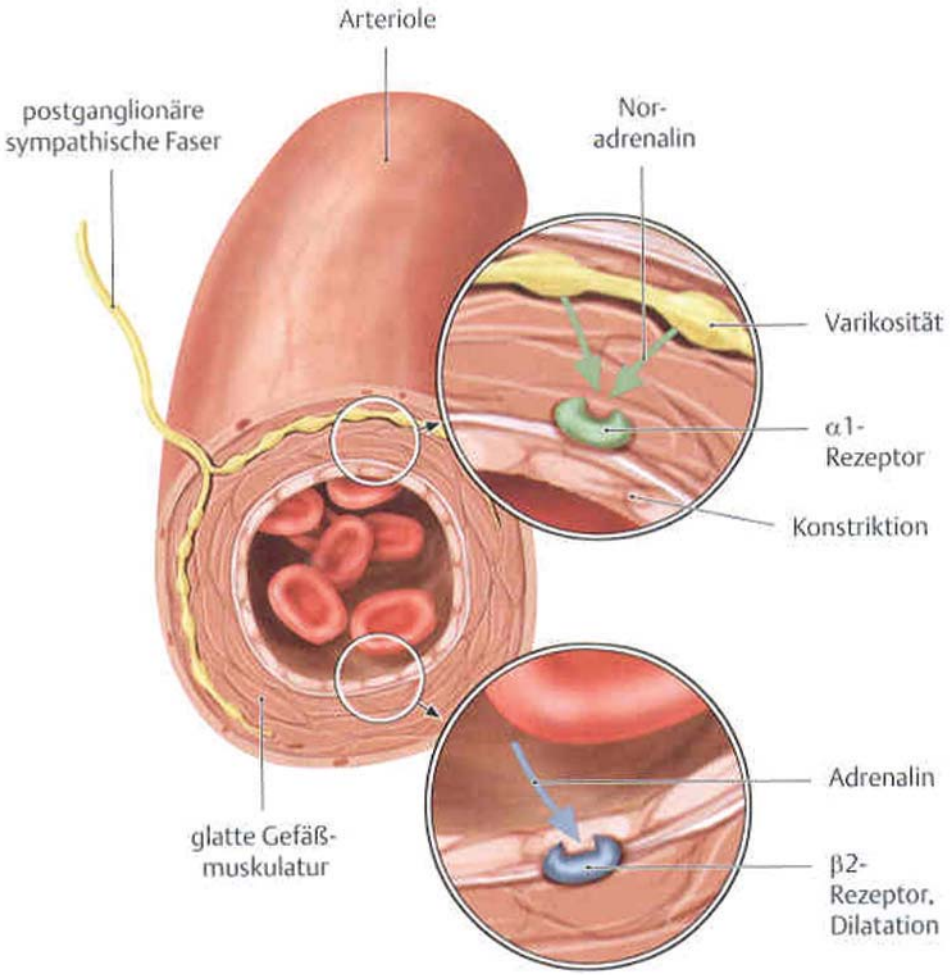


Figure 11: Prometheus (2006, p. 325)

Most, if not all, peripheral nerves contain postganglionic sympathetic fibers. These postganglionic fibers may also innervate adjacent blood vessels, or pass along them externally to their peripheral distribution.

The stellate ganglion or cervicothoracic ganglion located on the anterior side of the transverse process of C7, represents the fusion of four or five cervical ganglia and one or two thoracic ganglia, as you can see in figure 9 and figure 12. *Vascular branches from the ganglion stellatum as well as the thoracic roots of the thoracic sympathetic nerves supply the vertebral and subclavian arteries and vertebrobasilar plexus* (Barral, 1991, p.105).

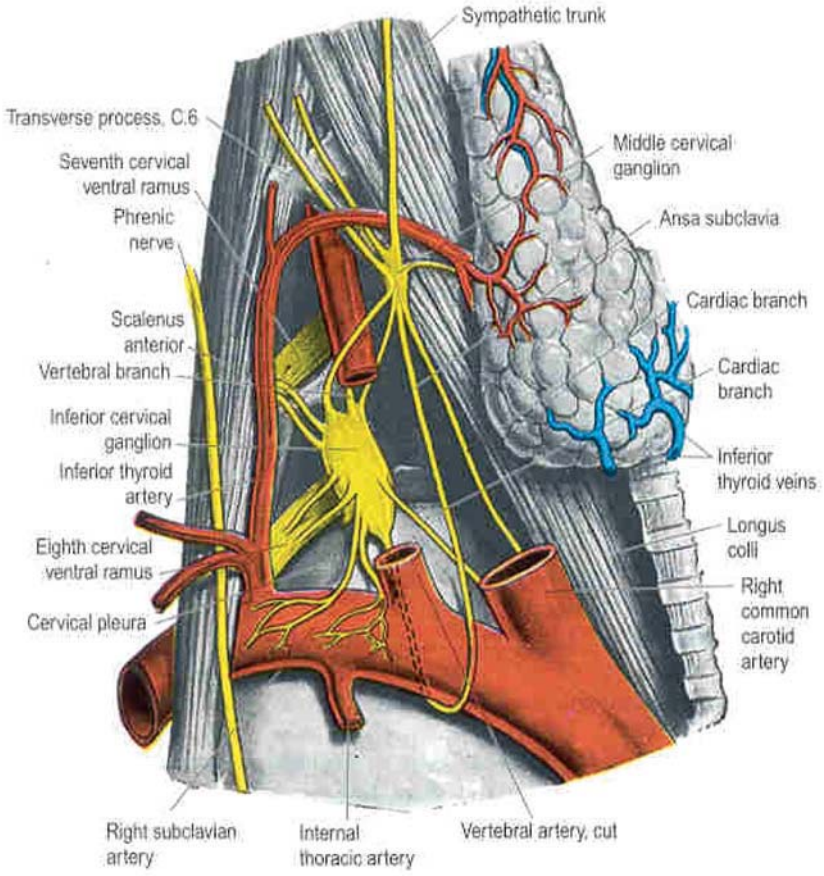


Fig. 31.25 The middle and inferior cervical ganglia of the right side, anterior view. Part of the vertebral artery has been excised to show the inferior cervical ganglion.

Fig. 12: Gray's Anatomy (2005, p. 560)

The thoracic sympathetic trunk contains ganglia almost equal in number to those of the thoracic spinal nerves. The first thoracic ganglion is usually fused with the inferior cervical ganglion, forming the cervico-thoracic ganglion. The first thoracic ventral ramus divides unequally. A large brunch ascends across the neck of the first rib lateral to the superior intercostal artery and enters the brachial plexus. It often receives a connecting ramus from the second, which ascends in front of the neck of the second rib. The anatomical variations seem to be larger as expected. Cho et al. (2005) could demonstrate by dissection carried out in 42 adult Korean cadavers, that there are also ascending rami from the third and fourth thoracic sympathetic ganglia to the brachial plexus. Except for the lowest two or three, the thoracic ganglia lie against the costal heads, posterior to the costal pleura and are therefore indirectly accessible for osteopathic treatment via the costal heads. Endoscopic thoracic sympathicotomy is used for severe vasospastic diseases and hyperhidrosis. As demonstrated in Fig. 8 the ganglias from T1 - T3 are blocked by different surgical procedures. As examined by Matsumoto et al. (2002), the recurrence of symptoms, although milder, was in 26 of 28 patients and Claes (2003) observed severe side effects, especially compensatory sweating. It is of great interest, that Panhofer et al. (2006) could show in their study, although they treated hyperhidrosis and not Raynaud's Phenomenon, good results with a very low rate of side effects in blocking only the sympathetic ganglion of T4!! Neumayer and Bischof et al (2005)

further mention in their study, that blocking T4 improves plantar hyperhidrosis in 50 % of their patients, which cannot be explained by our current neuroanatomical and neurophysiologic knowledge. So it seems that there are still many questions left regarding the sympathetic innervation of the upper limb and lower limb.

4. Osteopathic Approach

As we can see primary Raynaud's Syndrome is mainly a functional disease with poor possibilities of medical treatment. We deal with a hyperactivity of the sympathetic nervous system, which is induced by cold and stress. The fact, that the symptoms are stress induced leads us to the conclusion, that for some people primary Raynaud's Syndrome is a specific form of stress pattern. It is well known, that stress can cause hypertension of muscles and soft tissues. So we deal with two major problems: the hyperactivity of the sympathetic nervous system and hypertension of soft tissues, which are good indicators for osteopathic treatment. As already discussed, all the vessels and nerves,which supply the upper extremity, have to pass through the region of the thoracic inlet, where a lot of muscles and soft tissues can lead to an entrapment, if they are in hypertension and decrease the blood supply. Still says in his book The Philosophy and Mechanical Principles of Osteopathy: *„If you find all things normal at the shoulder, then go to the neck, from which all the nerves of the arm are derived. [.....] As the neck has much to do with the arm, we should keep with us a living picture of the forms of each vertebra, how and where it articulates with others, how it is joined by ligaments, and what blood vessels, nerves, and muscles cross or range with it lengthwise..."* (Still, 1902, p. 88)

Therefore, osteopathic examination and treatment was mainly focused on the following structures, while never loosing sight of the patient in his entirety:

- Fascia of the neck and arm
- Muscles of the neck
- Clavicle and its ligaments
- Pleural dome and its suspensory apparatus
- Cervical and thoracal spine and its muscles
- Upper ribs and head of the ribs
- Posterior cervical triangle

The reason, why these structures and regions are of special importance, has already been described in the anatomy chapter. Barral (1991) mentions in his book The Thorax, that the subclavian arteries are frequently compressed by bony or firm neighbouring structures of the thoracic inlet, with a variety of resulting clinical symptoms. Further he states, that the subclavian aponeurosis, which is continous with the middle cervical aponeurosis above and the clavipectoral fascia below, plays an important role in venolymphatic circulation, and in arterial blood supply as well. As the thoracic inlet is naturally very narrow, disturbances of the surrounding muscular system may further narrow this opening and interfere with normal blood flow. Here the treatment focus is mainly on the smaller muscles, because they are more likely to be pathogenic and primary. Treating the small muscles for example subclavian muscle may have a greater overall effect on the body. Any spasm, adhesion, or fibrosis of the subclavius muscle leads to a compression of the thoracic inlet by bringing the clavicle closer to the first rib. Whereas problems affecting the large muscles are almost always secondary arrising from dysfunctions elswhere in the body. Large muscles are very rarely responsible for primary restrictions, like for example the trapezius

muscle. If we treat these larger muscles it gives a transient response and leads to a satisfactory relaxation, but it will have little general affect and does not last long.
That the treatment nevertheless must be complex and individual, can be shown with the example of the subclavian muscle: this muscle is mostly innervated by the phrenic nerve, which also contributes to abdominal, peritoneal, thoracic visceral innervation and the diaphragm. Due to reflex activity, visceral irritations in these regions could cause spasms of this muscle and side effects could be circulatory problems of the upper limb. From this we can expect, that working on the diaphragm, proper breathing and ameliorating gastrointestinal disturbances can affect a better blood supply of the upper limb.
According to Paoletti (2001) all the internal and external fascias come together at the shoulder girdle. Therefore the shoulder girdle has to compensate all the fascial dysfunctions and has to adapt their influence not only to the lower „immobile“ part of the body but also to the upper „hypermobile“ region. He also states, that the hyoid bone serves as a shock absorber for the central fascial chain. The mechanical distribution is performed either anterolateral to the superficial cervical fascia or backwards to the temporal bone through the digastric muscle. This demonstrates the importance of treating the fascia as a whole chain and the hyoid bone with all its structures around.
Also interesting is Paolettis description (2001) of descending chains of lesions. If there is a fixation at the galea aponeurotica we can follow such a descending chain of lesions through the superficial cervical fascia to the shoulder girdle and from there to the arm or to the upper thorax. If the origin is at the cranial base or intracranial, the chain could run through the deep cervical fascia and the fascia of the scalene muscles and then go on to the arm or upper thorax. Likewise we can find ascending chains of lesions,too, beginning from the lower extremities or the pelvis, going through the thoracolumbar fascia or the latissimus dorsi muscle to the shoulder and the neck. Another example of an ascending chain would be disturbances of the perineum, which can be transferred to the viscera or the transversalis fascia, further to the diaphragm and from there through the pleura or the endothoracic fascia to the shoulder girdle and the neck.
At last I would like to mention the dura mater. Covering the brain and running down the spinal canal, it also covers the spinal nerves at their exit off the spinal canal, as demonstrated in figure 13.

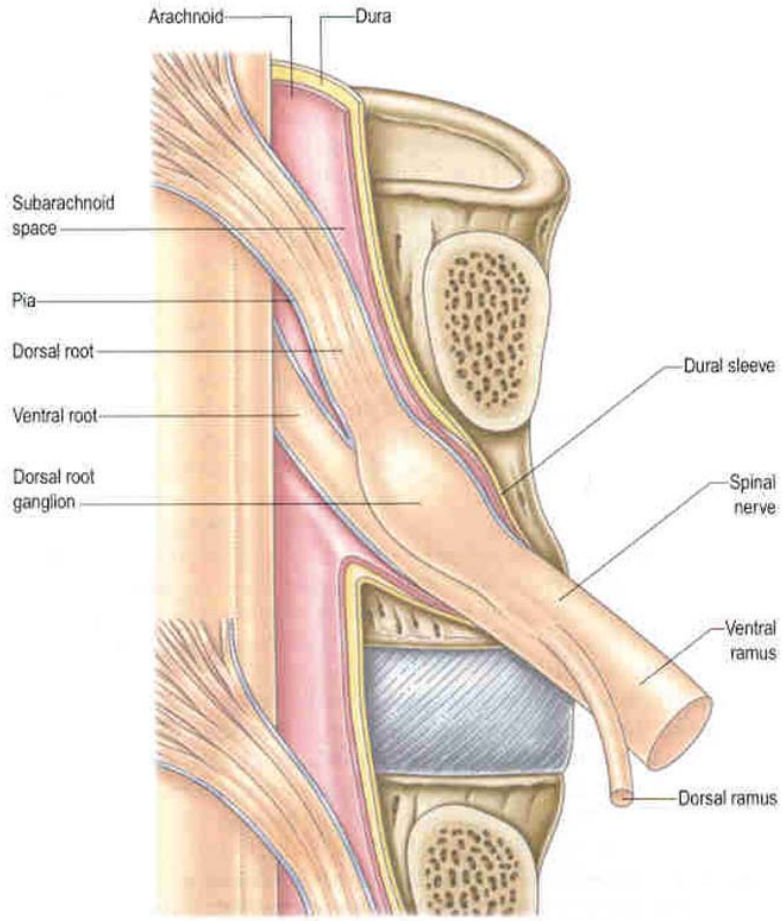


Fig. 46.13 A lumbar spinal nerve and its roots and meningeal coverings.

Figure 13: Grays Anatomy (2005, p.)

Although I do not think, that strains in the dura mater are a major problem in the case of primary Raynaud's Syndrome, it should be nevertheless taken into consideration. Therefore it is necessary to check the cranial system, too and the effect of a craniosacral therapy should not be underestimated. If a pathologic pattern can be found for example in the sphenobasilar symphysis, it is obvious, that this will have a negative effect further down as well and could influence the brachial plexus.

All these examples show, that the osteopathic approach in treating primary Raynaud's Syndrome must take into consideration all kinds of lesions in the body, not simply local influences, otherwise we are not following the osteopathic principles, as postulated by Still (2002) which continue to retain their validity today.

„Not only look at the pictures in Gray, Morris, Gerrish, or some finely illustrated work on anatomy, but we must apply a searching hand and know to a certainty that the constrictors of neck, or other muscles or ligaments do not pull cervical and hyoid bones so close as to bruise pneumogastric or any other nerves or fibres that would cause spasmodic contraction of digastric, stylohyoid or the whole remaining group of neck muscles and ligaments, with which you are or should be very familiar" (Still 1899, p.43)

5. Study Design

5.1. Hypothesis

Osteopathic treatment can improve the arterial supply in the periphery and decrease the frequency of ischemic attacks. We expect a clinical amelioration in the severity, frequency, duration and pain of the attacks. Additionally we expect a general rise in hand temperature.
As osteopathy is a holistic method, general and global improvements of other problems within the patient may result from the treatments administered.

5.2. Planned Magnitude of Sample Size

We took 20 patients suffering from primary Raynaud's Syndrome, who fullfilled the inclusion criterias and were randomized by choice. They were recruited from the angiologic ambulance of the dermatologic department, Wilhelminenspital, Vienna.

Group A: 10 Patients treated with osteopathy, and first line standard therapy as described below.

Group B: 10 Patients control group treated with first line standard therapy, which is no smoking, withdrawl of drugs associated with Raynaud's Syndrome (e.g. betablockers, ergot preparations), hand warmers, gloves and socks, avoidance of cold exposure, stress reduction and the local application of nitro ointments (Isoket Salbe) during attacks.

The ethic comission is not required in this case, because both groups receive the standard treatment, as already described.

5.3. Inclusion Criteria:

Patients with primary Raynaud's Syndrome.

5.4. Exclusion Criteria:

Patients with secondary Raynaud'Syndrome, thoracic outlet Syndrome and chronic problems of the cervical spine, pancoast tumor, carpal tunnel Syndrome. Further patients with drug induced or drug aggravated Raynaud's Syndrome.

5.5. Planned Procedure:

All patients are evaluated with a questionaire about the frequency, intensity and duration of their attacks. Pains are evaluated with VAS 1-10. Raynaud's Syndrome is clinically evaluated with hand thermography before and after cold exposure and acral plethysmography with nitro provocation. Exclusion of secondary Raynaud's Syndrome by means of autoimmune serology, x-rays of thorax and the cervical spine if needed, and nerve-conduction-velocity.
12 patients , randomized by choice will be treated with Osteopathy 4-6 times by me and reevaluated after treatment with questionaire, hand thermography and acral pletysmography.

5.6. Additional Information:

Questionaire:

To evaluate the patients clinical symptoms two questionaires were used, which were created, prior to and following treatments as seen in appendix. Of great interest was the frequency and duration of attacks and intensity of pain, which was evaluated by VAS. In the follow up questionaire consideration was given to additional general changes in the patients well-being and health situation, since osteopathy is a holistic method as previously described in the chapter: osteopathic approach.

Acral Plethysmography:

Acral plethysmography is used to register the volume pulse of the digits. Diagnostic criterias are changes in the pulse- curves and in the amplitude. In primary Raynaud's Syndrome typicaly we find spastic deformed curves with reduced amplitude from the second to the fifth digit. Criterias are: flattened course, prolonged duration of rise, flattened peak, absence of the dicrotic notch. The deformities of the pulse wave are reversible after application of warmth or nitro. In our study the height of the amplitude is measured and compared. All other criterias are only descriptive and therefore cannot be considered due to lack of validity (Alexander 1993).

Hand Thermography: (contact free infrared thermography- IRT)

Each physical body, whose temperature is above the absolute zero, is emitting infrared waves according to its temperature. These electromagnetic waves can be made visible by a special detecting equipment, and in particular for the acral parts of the extremities exists a direct correlation between skin perfusion and heat emission (Alexander 1993, Kistler et al 1998). Based on this, IRT can be applied for detection of perfusion changes simultaneously in all fingers, e.g. after cold exposure, without external manipulation. Temperature differences of as low as 0.1 grade Celsius can be registered as a "temperature map". The examinations are performed at constant room temperature after an equilibration period of at least 20 minutes. The cold provocation is performed by immersing both hands into an 18 degrees celsius cold water bath for 5 minutes. The volar sides of both hands are scanned by the camera before and 15 minutes following cold exposure. IRT demonstrates that there is a more intense cooling reaction and a

significantly delayed rewarming after cold provocation in primary Raynaud's Syndrome. Changes of acral skin blood flow are a commonly used indicator for sympathetic reflex responses to various stimuli. In a study by Kistler et al. (1998) IRT could demonstrate, that various stimuli triggering the sympathetic nervous system induced decreases in cutaneous microcirculation, most prominently in fingertip skin. In our study we compare the pictures before and after treatment of group A and B evaluating the temperature differences.

5.7. Variables

5.7.1. Dependent (target behaviour):

Questionaire: Frequency of vasospastic attacks before and after treatments
Duration of vasospastic attacks before and after treatments

Visual analoge scale (VAS): intensity of pain during attacks before and after treatments on a 10 point visual scale.

Hand thermography before and after treatments with cold exposure described above in grade celsius.

Acral plethysmography before and after treatments compared and evaluated by the height of the amplitude.

5.7.2. Independent:

Group A: 4-6 osteopathic treatments of 50- 60 minutes every 2-4 weeks and first line standard treatment.

Group B: First line standard treatment, which is no smoking, withdrawl of drugs associated with Raynaud's Syndrome (e.g.betablockers, ergot preparations), hand warmers, gloves and socks, avoidance of cold exposure, stress reduction and the local application of nitro ointments (Isoket Salbe) during attacks.

5.8. Validity and Reliability of Variables (Gold standards)

Hand thermography, acral plethysmography, capillary microscopy and digital subtraction angiography (DAS) are seen as the gold standard in evaluation of Raynaud's Syndrome. Most clinics use two of these methods. DAS is an invasive and expensive method, which is not routinely used, only in special indications.

5.9. Patients and Methods

From the angiologic ambulance of the dermatologic department Wilhelminenspital, Vienna we recruited 20 patients between the ages of 18 and 62 years with primary Raynaud's syndrome according to the criteria of Allen and Brown (1932), intermittent vasospastic attacks triggered by cold or emotions, duration of the disease at least two years, symmetrical symptoms, no trophic lesions, no organic manifestations. Additionally a pathologic pattern of hand thermography after cold provocation and of acral plethysmography. Secondary manifestations of Raynaud's Syndrome were excluded by normal blood count, no anticentromere or antinuclear antibodies, no cryoglobulins, cryofibrinogens, no anticoagulative therapy, no use of systemic vasoactive drugs during the study, normal morphology of nailfold capillaries, no pathologic radiologic criterias of the cervical spine and thoracic outlet, no pathologic nerve velocity conduction. The fact, that all patients were female is due to epidemiology. The patients were randomly assigned by choice into two groups. Only 8 patients were in the control group and got first line treatment, as described above, because of the high drop out rate. Many patients did not come to the reevaluation, which was performed by questionaire, hand thermography and acral pletysmography after three months. I assume, that this happened due to the fact, that secondary forms of Raynaud's phenomenon were excluded at the beginning of the study and the prognosis of primary Raynaud's Syndrome is not considered as severe. 12 patients were treated osteopathically additional to first line therapy. The osteopathic treatments consisted of 5 to 6 single sessions of 50 minutes in an intervall of two to three weeks. Osteopathic principles were followed, which ensured individualisation of approach to each patient.The treatment included structural, myofascial, visceral and cranial techniques. The reevaluation was performed by a physician of the dermatologic clinic in the same way as the control group.

Patients in the treatment group also presented other clinical symptoms:

- 6 Patients suffered from problems of the intestines (4 of them liver troubles, 4 gastric problems),
- 4 headaches or migraine,
- 3 hyperperspiration (hyperhidrosis),
- 4 gynaecological problems (2 menses, 2 uterine troubles),
- 3 bladder- and urinary tract problems,
- 1 varicosity and haemorrhoids,
- 1 hypothyroidism.

Remarkable was the high number of patients (7!), who were clearly underweight.

The osteopathic examination revealed:

- All patients had problems of the thoracic spine and head of the ribs (most of them T2-6), 3 showed additionally a diminished kyphosis.
- All of them had problems in the shoulder girdle and thoracic inlet. (9 subclavius muscle, 9 clavicle, 8 pleural dome and ligaments, 5 pectoralis minor and major muscles). Interestingly in most of the cases I did not find an isolated problems of only one of these structures was not

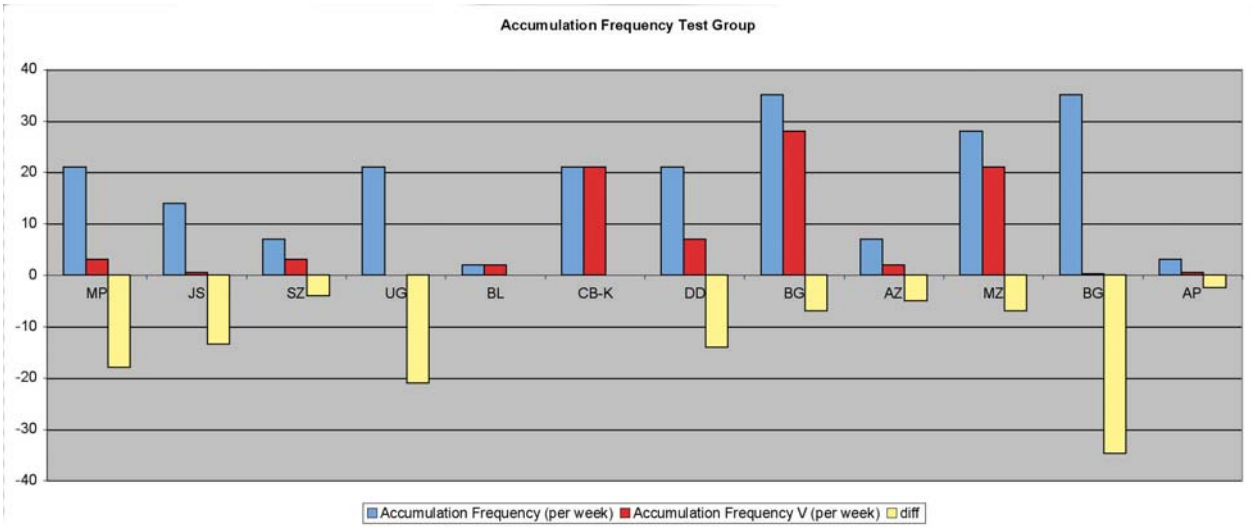
found, but a combination of at least two.

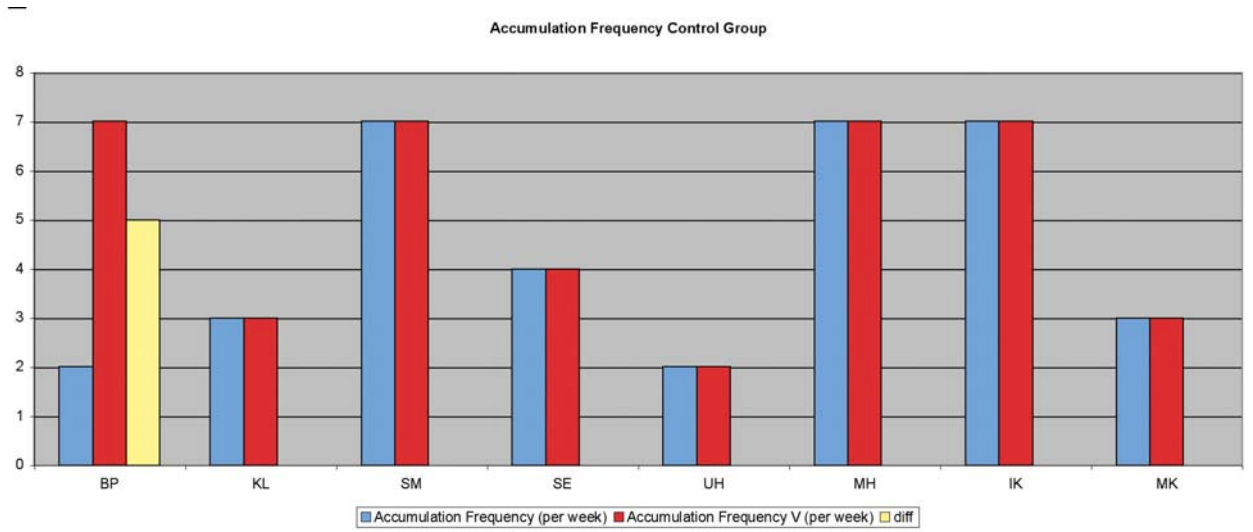
- Fascial problems:
  6 cervical fascia (middle cervical fascia and profunda), 5 fascia of the arm.
- 7 patients with liver problems,
- 3 had superior first ribs
- 1 problems of the ellbow.

6. Results:

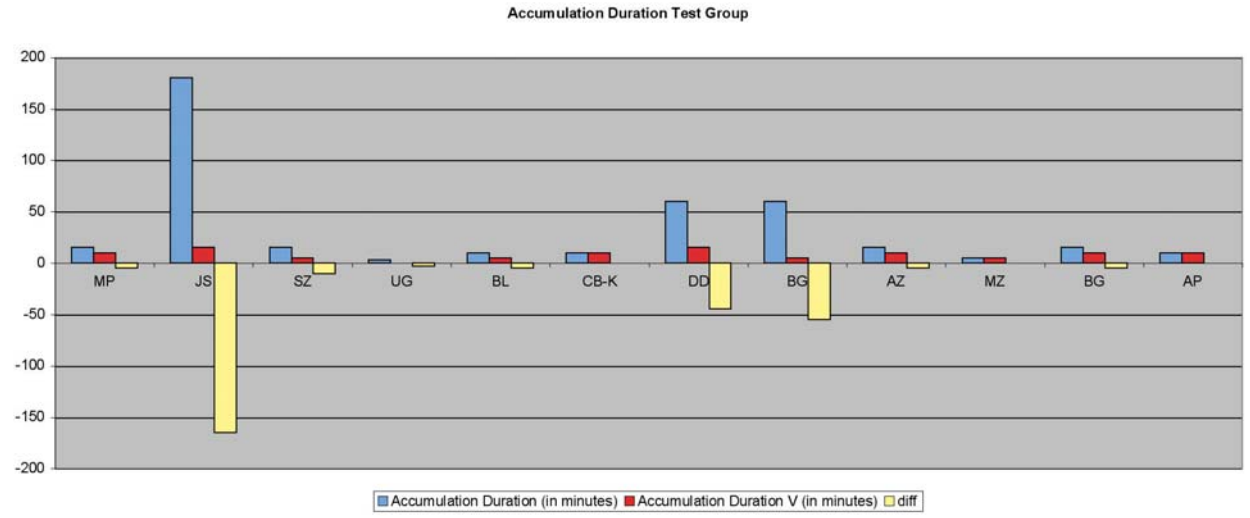
It is obvious, that the number of patients gathered is not enough for statistical relevance. This is why the results are not presented in percentage. Therefore results are presented in the tables below, showing each patient of the treatment and control group.
Ten out of twelve treated patients reported a subjective improvement of their Raynaud's Syndrome concerning the frequency of their attacks.Three showed minimal attacks, and one had no attacks as proven in the questionaire. The average improvement in the treatment group was from 17,92 (standard error 3,32) attacks per week to 7,35 (standard error 2,88).

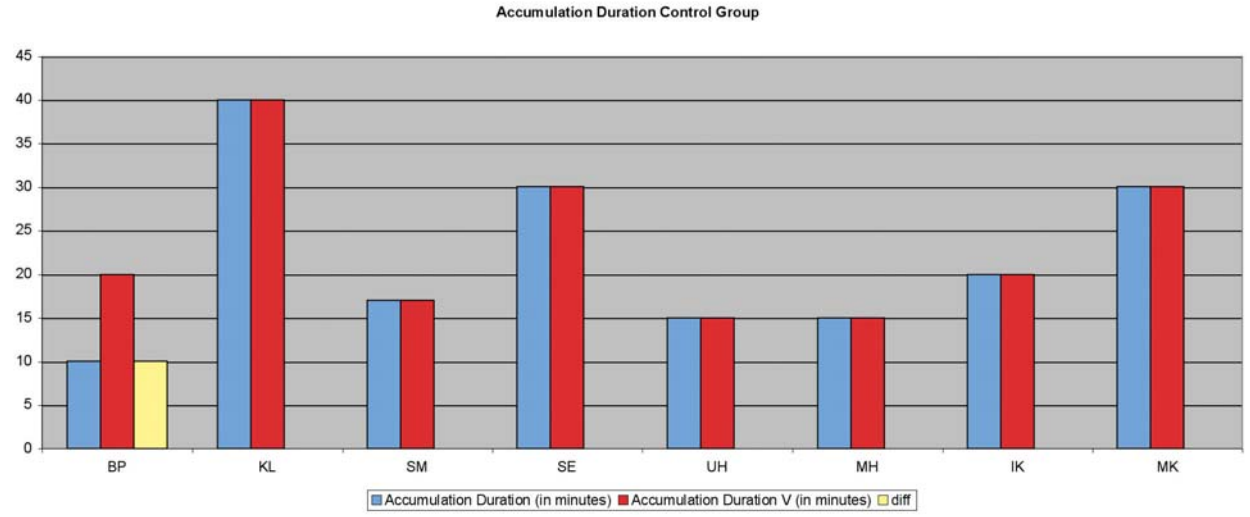
The tables below show the change in each patient of the treatment group and the control group.



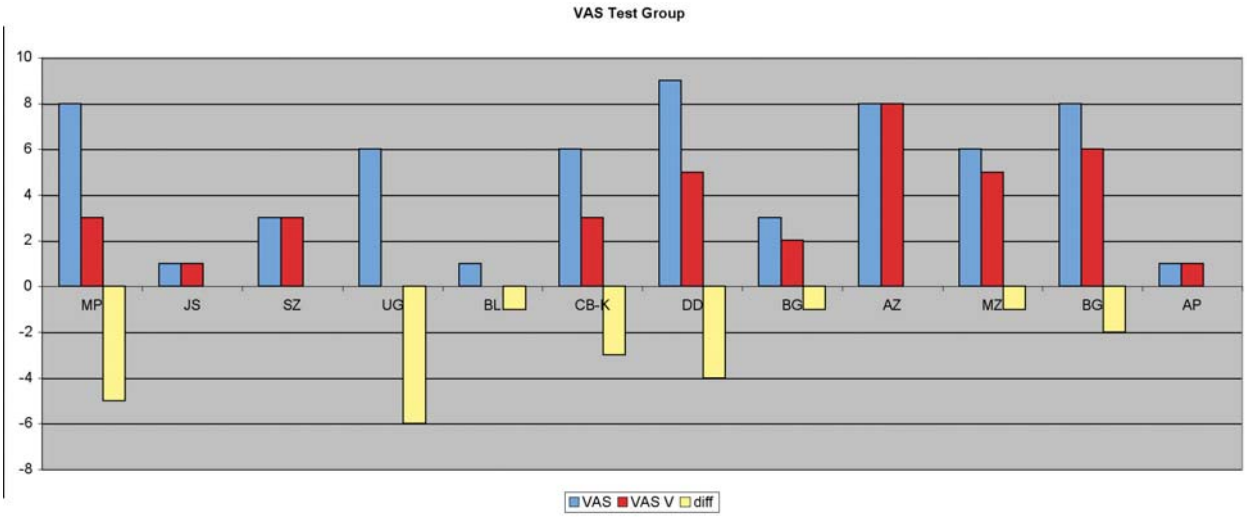


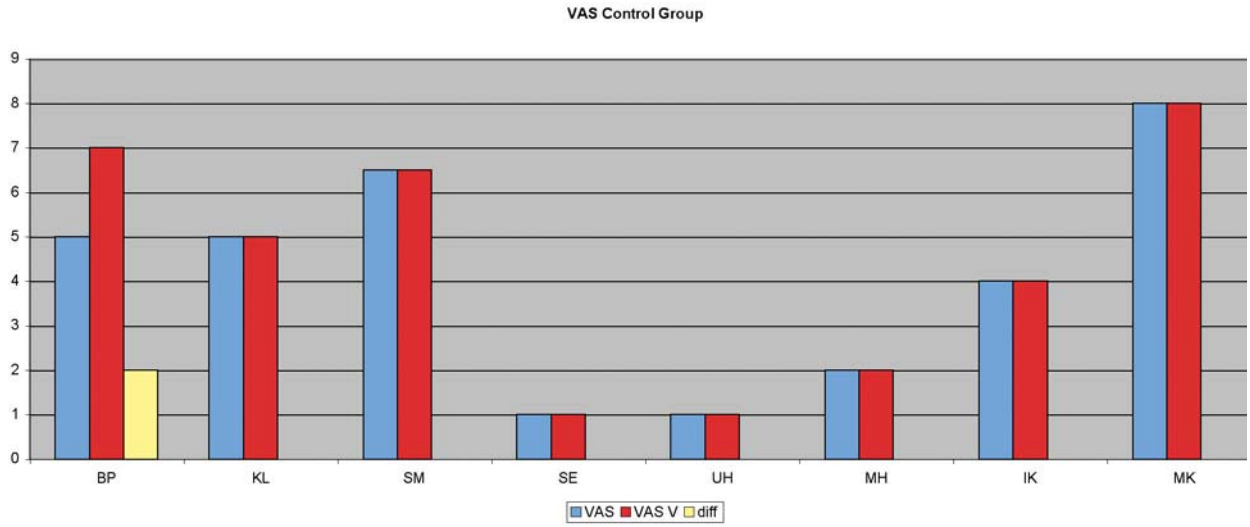
Nine patients of the treatment group had an improvement concerning duration and pain. Duration diminished from an average of 33,17 (standard error 14,47) minutes to 8,33 (standard error 1,28) minutes (compare table below).



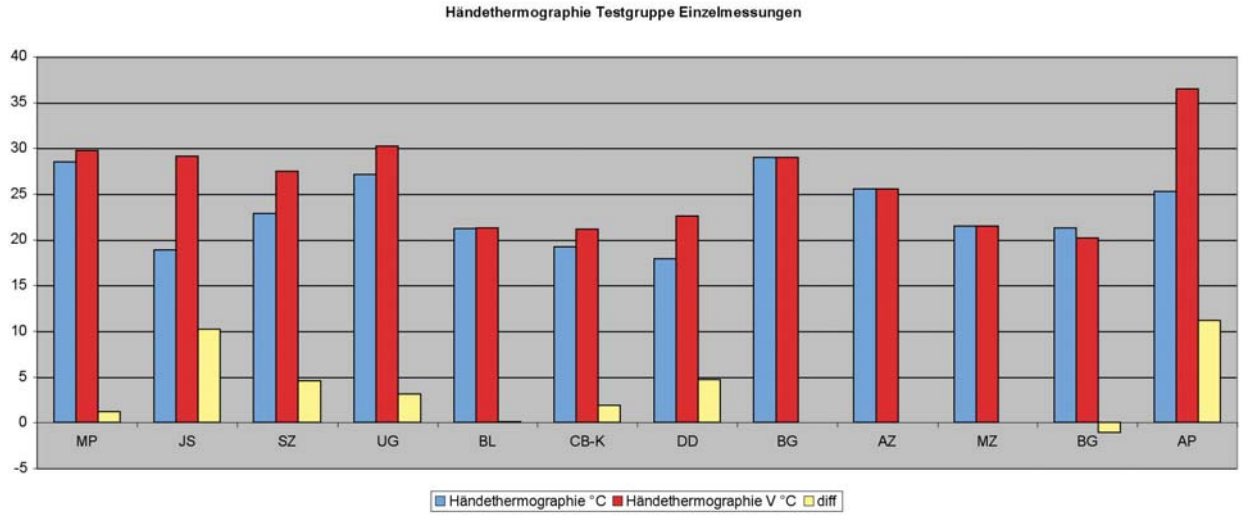


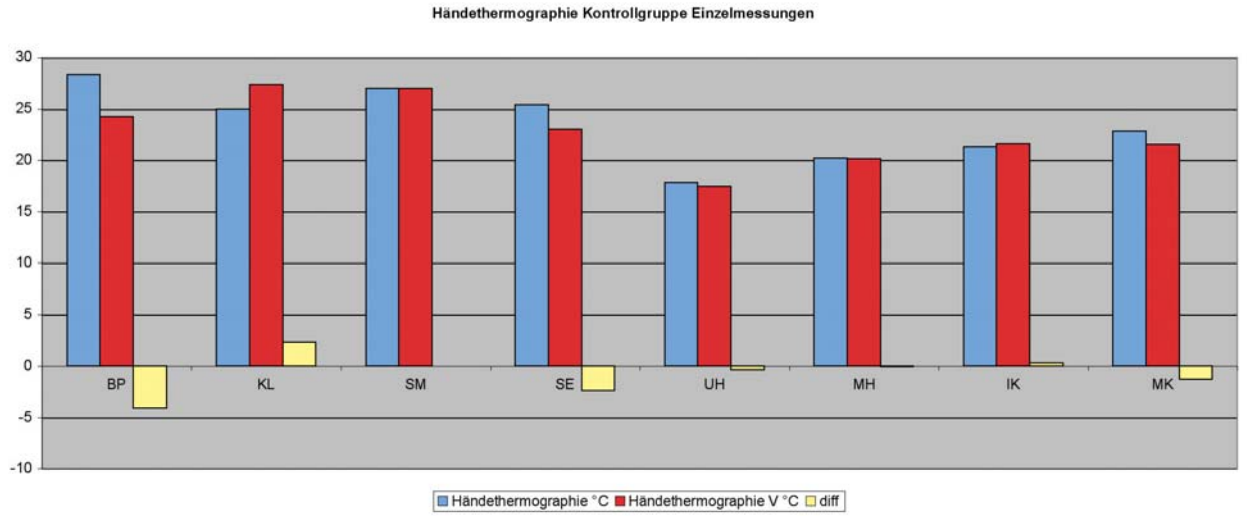
Similar evaluation of pain in each patient as seen below. This changed from an average of VAS 5 (standard error 0,88) to VAS 3,08 (standard error 0,72).



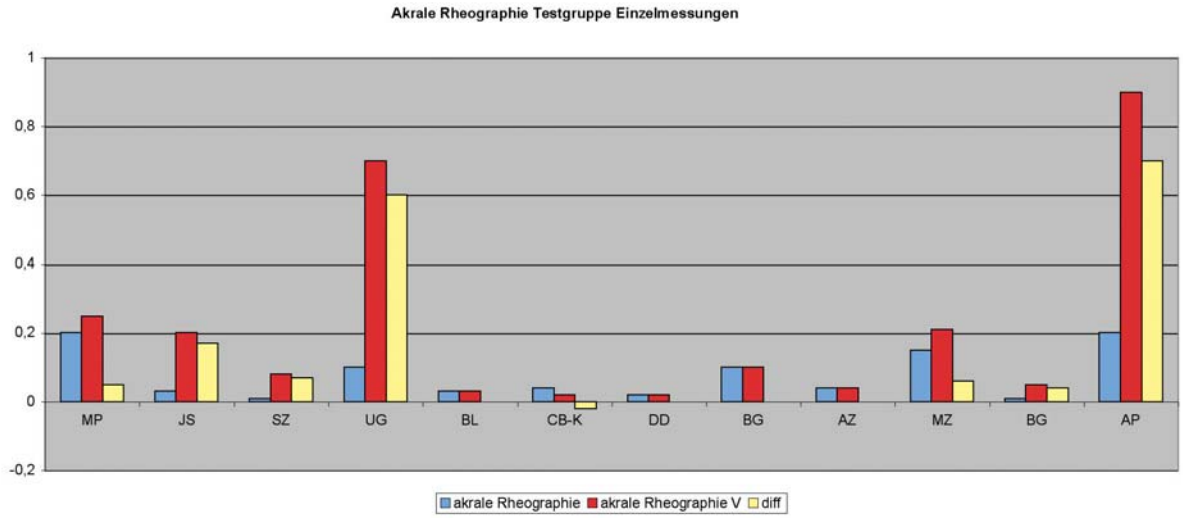


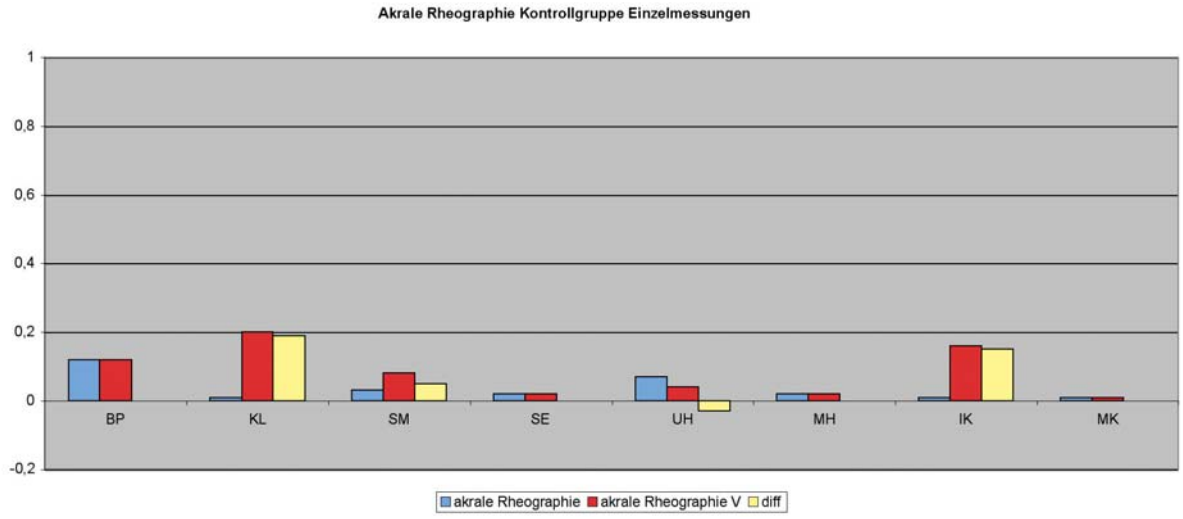
In eveluating the hand thermography, there was a marked rise in hand temperature, as well as a rise of the amplitude in acral plethysmography. The average hand temperature raised from 23,17° C (standard error 1,10) to 26,18° C (standard error 1,44). Interestingly only seven patients showed an improvement, which is opposite to the results of the questionaire. In three of these patients no Raynaud`s phenomenon could be provoked by cold application! In the control group we found a worsening from an average of 23,48° C (standarderror 1,27) to 22,76° C (standard error 1,19).





The result of the acral plethysmography, also showed that seven patients improved. The circulation of the small vessels of the digits raised from 0,08 vp (standard error 0,02) to 0,22 vp (standard error 0,08). Two patients had a normal blood flow. As seen in the table the control group showed a slight improvement of 0,04 vp (standard error 0,03).





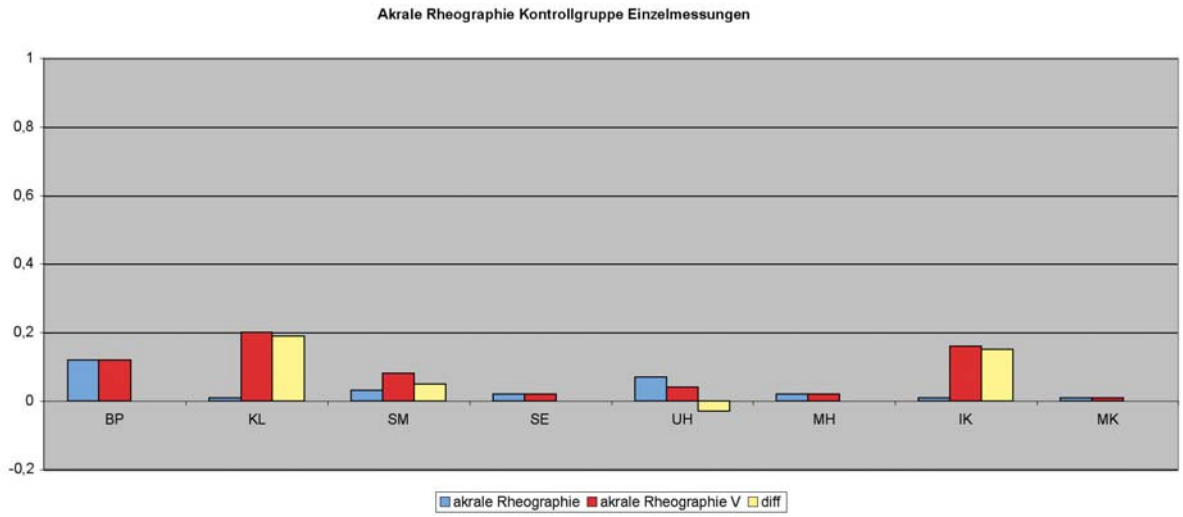
7. Discussion:

The fact, that so many patients were clearly underweight is remarkable. This result could be either due to a high metabolism, which can be a result of a hyperactivity of the sympathetic nervous system, or due to bad assimilation and therefore lack of energy. The high number of gastrointestinal disturbances, headaches and hyperhidrosis support this theory. More than five treatments would be necessary for patients suffering Raynaud's Syndrome coupled with being underweight or having gastrointestinal problems, because it is necessary to regulate the metabolism first, in order to increase energy levels. An amelioration of the microcirculation can be expected following this regulation. This was the case with one patient in the treatment group, in which no positive change was observed. Further treatment was proposed to address the underlying factors but was rejected by the patient.

Another interesting result of the patients examination were the problems found in the thoracic spine. On the one hand this is due to the exclusion criterias, problems of the cervical spine are listed by several authors (Alexander 1993) among secondary Raynaud's Syndrome. On the other hand the majority of the patients in this study had lesions in the region of T3 - T5, which was not expected. More of the sympathetic supply of the brachial plexus is provided from the ganglia at the level of T1-T3 of the sympathetic trunk, as described in the anatomic literature. These results as well as the results of Pannhofer and Neumayer et.al (2005, 2006) show, that the lower ganglia of the sympathetic trunk in the thoracic spine could also play an important role for the sympathetic innervation of the brachial plexus, which cannot be explained by our current neuroanatomical and neurophysiologic knowledge.

Three patients suffered from marked hyperhidrosis. All of them reported a clear amelioration or even disappearance of this at the same time that their Raynaud`s Syndrome improved. This supports the theory, that Raynaud's Syndrome is due to a disorder of the autonomous nervous system.

The hallmark of the results in this study is the frequency of the attacks, because this is the clinical parameter, which is the most important for the patients wellbeing and contributes to the patients life quality. As the graph below shows, ten patients out of twelve responded well to osteopathic treatment. Among them four patients reported an amelioration of almost 100%, one of them had a total remission. Altogether eight patients had a decrease of their attacks by more than 50%. The results of the control group show little change, which is not surprising, since the standard care only treats the symptoms and therefore only influenced the severity of the attacks.



The results in duration and pain show a similar picture, although they are not as good. This can be explained by the fact, that regardless of frequency, the vessel wall always reacts to the nerve stimulus in the same way, with a full contraction according to the law of all or nothing. Nevertheless, osteopathic treatment seems to have a modulating effect.

The measurements using various apparatus show the same trend, although not with the same clarity. This demonstrates the dependance of measurements by apparatus on certain circumstances such as daily disposition of the patient, nervous tension of the patient during the examination and interview and the clinical surroundings, which are different than those in daily life. They show only a momentary picture of the patient and can even differ in their results, due to inaccuracy and variance in the methods of measurement. This was the case in one patient. She reported a great improvement in the Raynaud's Syndrome and also in quality of her life and general health, while the results of the hand thermography and acral plethysmographie showed no improvement. The physician observed,that the patient was extremly nervous and tense during the clinical tests. As already described, Raynaud's Syndrome is also a stress induced disease, which is caused by the sympathetic nervous system. Its control is integrated with emotional, cognitive and neuroendocrine functions and therefore evaluation of treatment should also add quality of life measures. This should be taken into consideration for future studies.

The hand thermography demonstrated a marked rise in hand temperature in seven patients, and in three patients vasospasm could no longer be provoked. In the control group we see a worsening of 1° C. Even if we take this as the inacurracy of the methods of measurement, osteopathic results still show a clear warming of the hands on an average of 2° C. From this result the conclusion can be drawn, that due to the osteopathic treatment, the basic metabolic rate increased, appart from the effects described above, and had a positive effect on the hand temperature, as well.

The results of the acral plethysmography diverge from the results in hand thermography. Here we see four patients, who did not respond and one patient who worsened. It is interesting, that three of these patients nevertheless had an increase in hand temperature. This shows that both methods do not correlate, as shown by Clark et al (2003). One explanation for this is, that acral plethysmography and laser doppler imaging are more sensitive to blood flow changes while thermography

measures surface temperature.

8. Conclusion:

The sample size of this study was not large enough, however the results show that patients, who suffer from primary Raynaud's Syndrome have a significant reduction in the severity of their disease with osteopathic treatment.

The experiences during this study lead to some reflections, which should be taken into consideration for further research:

- It should be discussed if problems of the cervical spine should be an exclusion criteria. The number of patients in the treatment group was reduced by this circumstance and mainly patients with problems of the thoracic spine were included. For the osteopathic approach this exclusion criteria seems to be irrelevant.
- As already discussed, the measurements using various apparatus are not that precise, as considered, and diverging. Moreover they are only a snapshot. This problem leads to look for other possibilities measuring the therapeutic effect more precisely. One possibility would be useing standardised quality of life questionaires, to assess the quality of treatment as well.
- Patients diaries could offer a continous observation of the therapeutic progress. It enables us to acquire more information about the individual triggers and circumstances, which lead to ischemic attacks.

To show the significance of this study a t-test was made as well although due to the small sample size only trends can be shown. The result of this test regarding the frequency of attacks reached 2,40530059. This means that this result of the study is accurate with a probability of 97,5%. This is done with all parameters of measurment as seen in the appendix.
All these results show that osteopathic treatment could be a therapeutic option in primary Raynaud's Syndrome in the future, when more data is available and more extensive studies are done on this subject. The results of this study are quite promising and deserve further attention and research.

9. References

Allen E. et Brown G.E., 1932 , Raynaud's disease: a critical review of minimal requisites for diagnosis. Am J Med Sci 138: 187-200

Alexander K.: Gefäßkrankheiten, München:Urban und Schwarzenberg 1993

Barral J.P.: The Thorax, Seattle: Eastland Press 1991

Belch J.J. ,1990, Raynaud's Phenomenon. Curr opin Rheumatol 2: 937-941

Block J.A, Sequeira W.: Raynaud's Phenomenon; The Lancet Vol 357 June 2001: 2042-2048

Breitner B.: Chirurgische Operationslehre Band 13, 2. Auflage, Wien-München: Urban und Schwarzenberg 1996

Clark S., Dunn G., Moore T., Jayson M.4th, King T.A., Herrick A.L.: Comparison of thermography and laser doppler imaging in the assessment of Raynaud's phenomenon; Microvasc Res. 2003 Jul; 66 (1): 73-6

Corning H.K.: Lehrbuch der topographischen Anatomie, Berlin:Springer Verlag 1946

Cho M.M., Lee D.Y., Sung S.W.: Anatomical variations of rami communicantes in the upper thoracic sympathetic trunk; Eur J Cardiothorac Surg. 2005 Feb; 27 (2): 320-324

Claes G.: Indications for endoscopic thoracic sympthectomy; Clin Auton Res. 2003 Dec; 13 Suppl 1:116-119

Freedmann R.R., Sabharwal S.C., Desal N., Wening P., Mayes M.: Increased alpha adrenergic responsiveness in idiopathic Raynaud's disease; Arthr. and Rheum. 32 (1989) 61.

Haustein U.F.: Raynaud Phänomen und Sclerodermie; Hautarzt (1996) 47: 336-340

Kahle W., Frotscher M.: Taschenatlas Anatomie, Nervensystem und Sinnesorgane, Stuttgard: Thieme 2005

Kistler W., Mariauzouls C., von Berlepsch K.: Int J Psychophysiol., 1998 Jun; 29 (1): 35-41

Matsumoto Y., Ueyama T., Endo M., Sasaki H., Kasashima F., Abe Y., Kosugi I.: Endoscopic thoracic sympathicotomy for Raynaud's Phenomenon; J Vasc Surg. 2002 Jul; 36 (1): 57-61p.

Merkel F. S.: Die Anatomie des Menschen, Wiesbaden: J.F.Bergmann 1913

Neumayer C., Panhofer P., Zacherl J., Bischof G.: Effect of endoscopic thoracic sympathetic block on plantar hyperhidrosis; Arch Surg 2005; 140: 676-680

Panhofer P., Zacherl J., Jakesz R., Bischof G., Neumayer C.: Improved quality of life after sympathetic block for upper limb hyperhidrosis; Br J Surg. 2006 May; 93 (5): 582-586p.

Paoletti S.: Faszien, München:Urban und Fischer Verlag 2001

Pernkopf E.: Topographische Anatomie des Menschen, Band 3, München: Urban und Schwarzenberg 1952

Pernkopf E.: Atlas der topographischen Anatomie, München:Urban und Schwarzenberg 1944

SIGN publication no.27: Drug therapy for peripheral vascular disease, Glasgow 1998, www.sign.ac.uk, Oct. 2005

Standring S.: Grays Anatomy 39th edition 2005

Still A.T.: Philosophy of Osteopathy, Kirksville MO. 1899

Still A.T.: The Philosophy and Mechanical Principles of Osteopathy, Hudson-Kimberly PUB.CO, Kansas City, Mo 1902

9.1. Recomended Reading:

Appiah R., Hiller S., Caspari L., Alexander K., Creutzig A.: Treatment of primary Raynaud's Syndrome with traditional chinese accupuncture; J of Internal medicine 1997; 241: 119-124

Bollinger A.: Klinische Angiologie 1979, Stuttgard:Thieme Verlag.

Bollinger A., Butti P.: primary and secondary Raynaud's Syndrome; Schweizer Med Wochenschr. 1976 Mar 20; 106(12): 415-21

Rieger H., Schoop W.: Klinische Angiologie, Berlin:Springer Verlag 1998

Still A.T.: Osteopathy research and practice, Seattle:Eastland press 1992

9.2. Index of figures:

10. Appendix:

10.1. Questionaire:

Anamneseblatt Raynaud Syndrom

Name: . . . . . .

Geburtsdatum: . . . . . Größe: . . . . . Gewicht: . . . . . .

Haben Sie anfallsweise kalte Finger oder Zehen? O ja O nein

Sind diese Anfälle verstärkt wenn es kalt ist? O ja O nein

Verfärben sich dabei die Finger zuerst weiß, und dann bläulich? O ja O nein

Wann traten die Beschwerden erstmals auf?

Wie häufig treten die Beschwerden auf?

Wie lange halten die Beschwerden an?

Wie stark sind die Schmerzen während eines Anfalls? (Skala von 1-10)

Welche Körperseite ist stärker betroffen?

Nikotin:

Wirbelsäulenbeschwerden (Halswirbelsäule) :

Beschwerden der Handgelenke:

Kribbeln der Arme bei Tätigkeiten, bei denen man die Arme längere Zeit über den Kopf halten muß:

Medikamente:

Danke für Ihre Mitarbeit

Anamneseblatt Raynaud Syndrom Follow up

Name: . . . . . .

Geburtsdatum: . . . . . Größe: . . . . . Gewicht: . . . . . .

Haben Sie anfallsweise kalte Finger oder Zehen? O ja O nein

Sind diese Anfälle verstärkt wenn es kalt ist? O ja O nein

Verfärben sich dabei die Finger zuerst weiß, und dann bläulich? O ja O nein

Wann traten die Beschwerden erstmals auf?

Wie häufig treten die Beschwerden auf?

Wie lange halten die Beschwerden an?

Wie stark sind die Schmerzen während eines Anfalls? (Skala von 1-10)

Hat sich für Sie durch die osteopathischen Behandlungen auch anderes verändert?
(Allgemeinsymptome, Wohlbefinden, sonstige Beschwerden.....)

Danke für Ihre Mitarbeit

10.2. Patients Information:

Lieber Patient!

Osteopathie ist eine ganzheitliche, also Körper, Seele und Geist umfassende Behandlungsform, die in der USA am Ende des 19. Jh. begründet wurde und heute ein Universitätsstudium ist. In Europa hat sie sich nun langsam etabliert, wobei Arzt und Physiotherapeut eine 6-jährige Ausbildung mit anschließendem Diplom und Diplomarbeit absolvieren müssen.

Im Zentrum steht die Unterstützung der Selbstheilungskräfte durch Lösung von Blockaden, die in allen Geweben des Körpers (Knochen, Muskel, innere Organe, Bindegewebe, Nervensystem) auftreten können. Osteopathen bedienen sich zur osteopathischen Diagnose und Therapie nur ihrer Hände und Sinnesorgane. Als Informationsergänzung dienen osteopathische Anamnese, sowie schulmedizinische Befunde.

Beim primären Raynaud Syndrom besteht eine funktionelle Störung des autonomen Nervensystems, die zu Gefäßkrämpfen in den Fingern und/ oder Zehen führt. Diese Störung kann durch osteopathische Behandlungen verbessert oder ganz geheilt werden. Deshalb habe ich mich entschlossen eine Diplomarbeit zu diesem Thema zu schreiben.

Dazu benötige ich eine komplette schulmedizinische Abklärung, die bereits durchgeführt wurde. Danach erfolgen 5 bis 6 osteopathische Behandlungen zu je 50 Minuten in je 3-5 wöchigen Abständen in meiner Praxis. Danach werden Ihre Beschwerden neuerlich mittels Fragebogen und apparativen Mitteln (Händethermographie mit Kälteprovokation und akraler Rheographie) erhoben. In diesem Zeitraum sind die osteopathischen Behandlungen gratis.

Ich würde mich über Ihre Teilnahme freuen und verbleibe mit freundlichen Grüßen.

Meine Adresse und Telefonnummer:

Kalcakosz-Takacs Tamara

Hamiltongasse 3/1/3
1140 Wien
Tel.: 069919571046

10.3. Data of the study and statistically significance see the next pages

Name	Alter	Geschlecht	Accumulation Frequency (per week)	Accumulation Frequency V (per week)	diff
MP	41	w	21	3	-18
JS	31	w	14	0,5	-13,5
SZ	36	w	7	3	-4
UG	25	w	21	0	-21
BL	24	w	2	2	0
CB-K	38	w	21	21	0
DD	38	w	21	7	-14
BG	24	w	35	28	-7
AZ	44	w	7	2	-5
MZ	22	w	28	21	-7
BG	29	w	35	0,25	-34,75
AP	31	w	3	0,5	-2,5
Test Group	12				
Test Group (average)	31,92		17,92	7,35	-10,56
Standardabweichung	7,39		11,49	9,97	10,26
Standardfehler	2,13		3,32	2,88	2,96

Accumulation Duration (in minutes)	Accumulation Duration V (in minutes)	diff	VAS	VAS V	diff	akrale Rheographie	akrale Rheographie V	diff
15	10	-5	8	3	-5	0,2	0,25	0,05
180	15	-165	1	1	0	0,03	0,2	0,17
15	5	-10	3	3	0	0,01	0,08	0,07
3	0	-3	6	0	-6	0,1	0,7	0,6
10	5	-5	1	0	-1	0,03	0,03	0
10	10	0	6	3	-3	0,04	0,02	-0,02
60	15	-45	9	5	-4	0,02	0,02	0
60	5	-55	3	2	-1	0,1	0,1	0
15	10	-5	8	8	0	0,04	0,04	0
5	5	0	6	5	-1	0,15	0,21	0,06
15	10	-5	8	6	-2	0,01	0,05	0,04
10	10	0	1	1	0	0,2	0,9	0,7
33,17	8,33	-24,83	5,00	3,08	-1,92	0,08	0,22	0,14
50,12	4,44	47,75	3,05	2,50	2,11	0,07	0,29	0,24
14,47	1,28	13,79	0,88	0,72	0,61	0,02	0,08	0,07

Händethermo-graphie °C	Händethermo-graphie V °C	diff	sonstiges	Größe in cm	Gewicht in kg	RR
28,5	29,7	1,2	Kein Raynaud ausgelöst, AZ besser, Rücken, Schulter lockerer	175	73	
18,9	29,1	10,2	Kein Raynaud ausgelöst, Kreutzschmerzen und Migräne weg	177	70	120/90
22,9	27,5	4,6	Schwitzen reduziert			122/ 60
27,1	30,2	3,1	Rückenschmerzen weg	176	58	118/83
21,2	21,3	0,1	Nachtschweiß reduziert	160	47	
19,2	21,1	1,9	generell wärmer, Streßadaptoion besser	167	60	
17,9	22,6	4,7	schnellere Wiedererwärmung, Magenschmerzen weg	175	55	
29	29	0	bessere Streßadaption, mehr Schlafbedürfniss	170	59	
25,5	25,5	0		170	63	
21,5	21,5	0		174	52	81/57
21,3	20,2	-1,1				
25,3	36,5	11,2	Kein Raynaud ausgelöst			100/75
23,19	26,18	2,99		171,56	59,67	
3,81	4,99	4,06		5,46	8,22	
1,10	1,44	1,17		1,58	2,37	

Kontrollgruppe:

Name	Alter	Geschlecht	Accumulation Frequency (per week)	Accumulation Frequency V (per week)	diff
BP	18	w	2	7	5
KL	43	w	3	3	0
SM	35	w	7	7	0
SE	38	w	4	4	0
UH	23	w	2	2	0
MH	62	w	7	7	0
IK	30	w	7	7	0
MK	36	w	3	3	0
Control Group	8				
Control Group (average)	35,63		4,38	5,00	0,63
Standardabweichung	13,41		2,26	2,20	1,77
Standardfehler	4,74		0,80	0,78	0,63

Accumulation Duration (in minutes)	Accumulation Duration V (in minutes)	diff	VAS	VAS V	diff	akrale Rheographie	akrale Rheographie V	diff
10	20	10	5	7	2	0,12	0,12	0
40	40	0	5	5	0	0,01	0,2	0,19
17	17	0	6,5	6,5	0	0,03	0,08	0,05
30	30	0	1	1	0	0,02	0,02	0
15	15	0	1	1	0	0,07	0,04	-0,03
15	15	0	2	2	0	0,02	0,02	0
20	20	0	4	4	0	0,01	0,16	0,15
30	30	0	8	8	0	0,01	0,01	0
22,13	23,38	1,25	4,06	4,31	0,25	0,04	0,08	0,05
10,16	9,01	3,54	2,57	2,76	0,71	0,04	0,07	0,08
3,59	3,18	1,25	0,91	0,98	0,25	0,01	0,03	0,03

Händethermo-graphie °C	Händethermo-graphie V °C	diff	sonstiges	Größe in cm	Gewicht in kg	RR
28,3	24,2	-4,1				
25	27,3	2,3		165	50	
27	27	0		166	55	
25,4	23	-2,4		171	74	98/45
17,8	17,4	-0,4		169		109/70
20,2	20,1	-0,1		161	48	129/82
21,3	21,6	0,3		175	56	110/70
22,8	21,5	-1,3		167	63	118/ 38
23,48	22,76	-0,71		167,71	57,67	
3,58	3,37	1,92		4,50	9,56	
1,27	1,19	0,68		1,59	3,38	

Gut angeschlagen (MP, JS, SZ, UG):

Test Group ++	4							
Test Group ++ (average)	33,25	15,75	1,63	-14,13	53,25	7,50	-45,75	4,50
Standardabweichung	6,85	6,70	1,60	7,42	84,69	6,45	79,55	3,11
Standardfehler	3,42	3,35	0,80	3,71	42,34	3,23	39,78	1,55

1,75	-2,75	0,09	0,31	0,22	24,35	29,13	4,78
1,50	3,20	0,09	0,27	0,26	4,34	1,17	3,88
0,75	1,60	0,04	0,14	0,13	2,17	0,59	1,94

Mittel angeschlagen:

Test Group 00	6							
Test Group 00 (average)	31,33	21,50	9,79	-11,71	27,50	9,17	-18,33	5,83
Standardabweichung	8,38	13,85	11,86	11,92	25,45	3,76	24,83	3,19
Standardfehler	3,42	5,66	4,84	4,87	10,39	1,54	10,14	1,30

4,50	-1,33	0,09	0,22	0,13	23,42	25,88	2,47	172,25	57,25
2,59	1,51	0,08	0,34	0,28	3,94	6,08	4,74	2,63	4,79
1,06	0,61	0,03	0,14	0,11	1,61	2,48	1,93	1,07	1,95

Schlecht angeschlagen (BL, CB-K):

Test Group --	2							
Test Group -- (average)	31,00	11,50	11,50	0,00	10,00	7,50	-2,50	3,50
Standardabweichung	9,90	13,44	13,44	0,00	0,00	3,54	3,54	3,54
Standardfehler	7,00	9,50	9,50	0,00	0,00	2,50	2,50	2,50

1,50	-2,00	0,04	0,03	-0,01	20,20	21,20	1,00	163,50	53,50
2,12	1,41	0,01	0,01	0,01	1,41	0,14	1,27	4,95	9,19
1,50	1,00	0,01	0,01	0,01	1,00	0,10	0,90	3,50	6,50

Aussage 1): The accumulation frequency is significantly better after applying the therapy

t =	2,405300593	n1 =	12	T(0,25) =	0,686
		n2 =	12	T(0,1)=	1,323
		mean(1) =	17,91666667	T(0,05)=	1,721
		mean(2) =	7,354166667	T(0,025) =	2,074
		varianz(1) =	132,0833333	T(0,01) =	2,508
		varainz(2) =	99,32339015	T(0,005) =	2,819

--> Mit 97,5% Wahrscheinlichkeit stimmt die Aussage

Aussage 2):The accumulation duration is significantly better after applying the therapy

t =	1,709648324	n1 =	12
		n2 =	12
		mean(1) =	33,16666667
		mean(2) =	8,333333333
		varianz(1) =	2512,151515
		varainz(2) =	19,6969697

--> Mit 90% Wahrscheinlichkeit stimmt die Aussage

Aussage 3): The VAS is significantly better after applying the therapy

t =	1,684384935	n1 =	12
		n2 =	12
		mean(1) =	5
		mean(2) =	3,083333333
		varianz(1) =	9,272727273
		varainz(2) =	6,265151515

--> Mit 90% Wahrscheinlichkeit stimmt die Aussage

Aussage 4): The acreal rhetrography is significantly better after applying the therapy

t =	-1,630607473	n1 =	12
		n2 =	12
		mean(1) =	0,0775
		mean(2) =	0,216666667
		varianz(1) =	0,005093182
		varainz(2) =	0,082315152

--> Mit 90% Wahrscheinlichkeit stimmt die Aussage

Aussage 5): The Händethermographie is significantly better after applying the therapy

t =	-1,6505648	n1 =	12
		n2 =	12
		mean(1) =	23,19166667
		mean(2) =	26,18333333
		varianz(1) =	14,52810606
		varainz(2) =	24,89424242

--> Mit 90% Wahrscheinlichkeit stimmt die Aussage