Osteopathy applied on Children with Secretory Otitis Media

Dissertation

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Preface

Conducting a study of a pathology that is of great interest from an osteopathic point of view and presenting its results in written form represented a great challenge and an important step in my training and further development as an osteopathic practitioner.

I would like to thank all my friends and all of those who supported me in my work in many ways.

Eric GERY, D.O., my tutor

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1. Introduction

The function of hearing is of vital importance for a healthy development of the child, particularly during the early years. Any impairment of hearing, especially if it persists over an extended period of time, can not only interfere with language acquisition, but also with motor development as well as with emotional and cognitive functions.

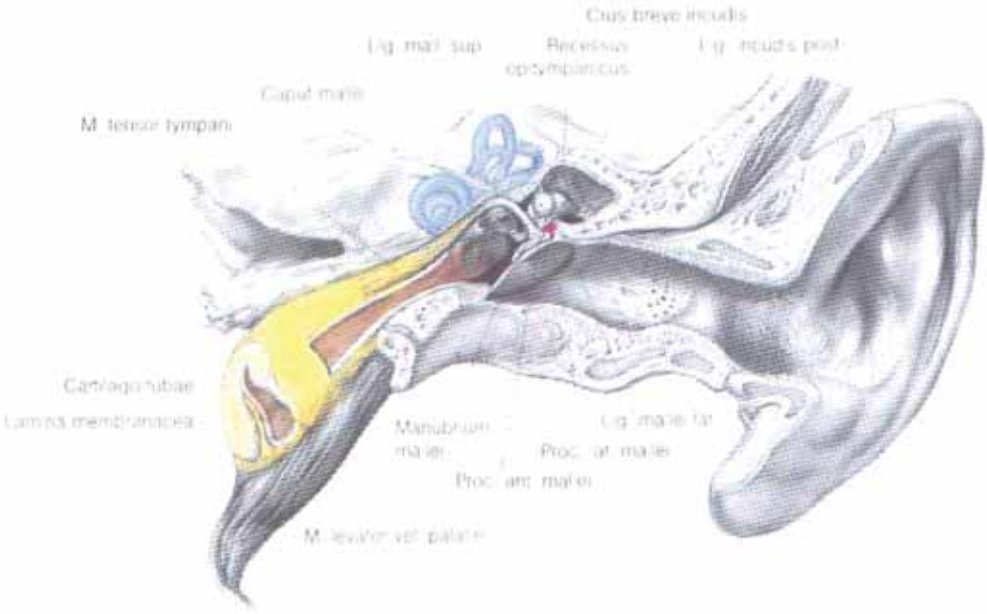
During my training at the Wiener Schule für Osteopathie my interest in the subject was stimulated by several lecturers (Arlot J., Carreiro J., Ratio A., Shaver T., Turner S., Van der Helden P.) who discussed ear problems among children, their causes and possibilities of osteopathic treatment. From my husband, who is an ENT specialist, I learned that the approach of traditional medicine and the success rate of conventional medical treatment of SOM is often unsatisfactory and that many parents wish for alternative treatment as they are concerned over the administration of antibiotics.

Chronic SOM is often preceded by a generally weak condition of the immune system, frequently expressed in recurring infections of the upper respiratory tract. These characteristics of SOM therefore suggest a form of treatment which applies a **holistic** approach to the functional integrity of the body. **Osteopathic treatment** is based on such an approach and is therefore indicated for the treatment of SOM.

All this led me to choose SOM as the subject for my dissertation and to expand my knowledge and my abilities as an osteopathic practitioner in the framework of this project.

2. Basics

2. 1. Anatomy of the Hearing Organ



Ill.1: Benninghoff, Anatomie Vol. 2, 1994 p.754

The hearing organ consists of a **peripheral apparatus,** which can be divided into an **external**, **middle** and **inner part**, a part responsible for the central procession of stimuli in cortical and subcortical auditory centres and the central vestibular apparatus.

- The main function of **the external ear** and the middle ear is to transmit sonic waves to the inner ear, which contains the labyrinth with the sensory organs for balance and auditory perception. The external ear consists of the auricle (pinna), the external acoustic meatus and the eardrum, which forms the boundary to the inner ear.

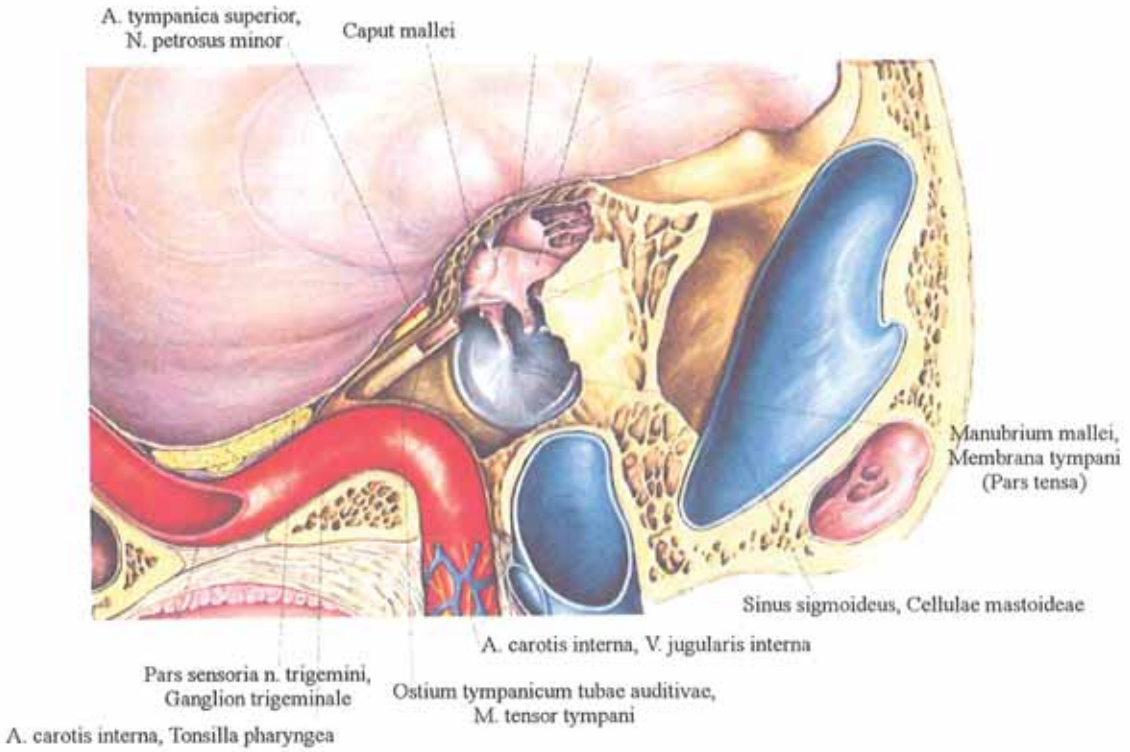
- The **middle ear** consists of the tympanic cavity (Cavum tympani) with the auditory ossicles, the auditory tube (Tuba auditiva, Tuba Eustachii) and the pneumatic cavities in the mastoid process (Cellulae mastoideae).

- The **inner ear** consists of the membranous and the osseous labyrinth. It is located in the petrous part of the temporal bone.

2. 1. 1. Anatomy of the Middle Ear

2.1.1.1. The Tympanic Membrane

The **eardrum** (Membrana tympani) separates the tympanic cavity from the external acoustic meatus. The largest part of the eardrum, the Pars tensa, is attached to the Anulus tympanicus of the Pars tympanica of the temporal bone. The smaller and thinner Pars flaccida is attached to the temporal squama in the Incisura tympanica. It consists of joined cuticular and mucous layers. The handle of the malleus is attached to the tympanic membrane and the membrane's inner surface is convex. Tension of the tympanic membrane is controlled by the tensor tympani muscle, which is attached to the malleus.



Ill.2: Pernkopf, Anatomie 1994, p.128

- **Arterial supply** - by an internal and an external capillary network.
- **Venous drainage** - external and internal surface of the tympanic membrane are connected through Vv. profantes.
- **Lymphatic drainage** - to parotid lymph nodes and deep cervical lymph nodes.
- **Innervation** - exteriorly by the auriculotemporal nerve (from the mandibular nerve of trigeminal nerve) and the vagus nerve, interiorly by the tympanic plexus of the tympanic cavity.

2.1.1.2. The Tympanic Cavity

The **tympanic cavity** (Cavum tympani) is located in the petrous part of the temporal bone. It forms the largest space of the auditory organ and is lined with mucoperiosteum. It contains the auditory ossicles, **hammer** (malleus), **anvil** (incus) and **stirrup** (stapes), which transmit sound waves to the inner ear.

The boundaries of the tympanic cavity - anteriorly it is bounded by the **carotid canal** of the internal carotid artery, which is joined by the **Semicanalis m. tensoris tympani.** The latter is continuous with the **Semicanalis tubae auditivae**. The roof of the tympanic cavity (Tegmen tympani), a thin plate of compact bone, separates the cranial and tympanic cavities.
The floor of the tympanic cavity consists of a thin convex plate of bone which separates the cavity from the superior bulb of the internal jugular vein. The posterior wall, with the entrance to the mastoid antrum, is bounded by the mastoid process. The tympanic cavity is laterally bounded by the eardrum, and medially by the labyrinth.

The **tympanic mucosa** (Membrana propria) is continuous with the endosteum, it is rich in blood-vessels and nerves and lined by a low squamous epithelium that rises towards the tube.

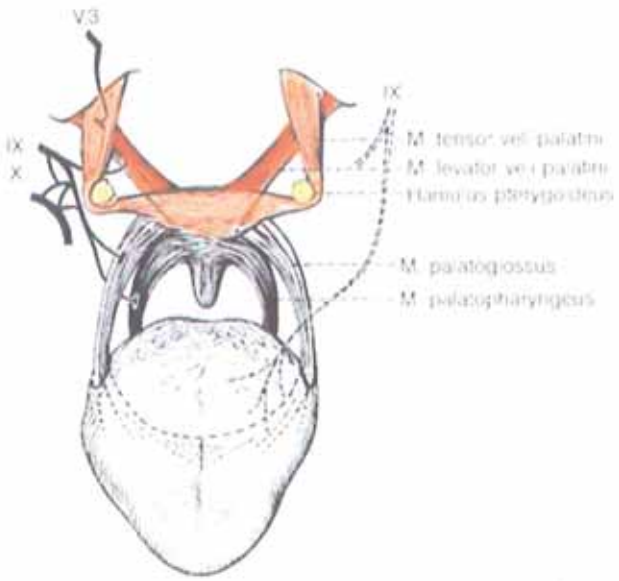
- **Arterial supply** – maxillary artery with its branches tympanic artery and sphenopalatine artery, further the stylomastoid artery, middle meningeal artery, internal carotid artery, ascending pharyngeal artery.
- **Venous drainage** - pharyngeal plexus, middle meningeal artery and petrous sinus.

- **Lymphatic drainage** - connections with drainage of the external ear and the eardrum into lymph nodes anterior to the auditory canal, below the pinna, the parotid gland, into submandibular, superficial and deep cervical lymph nodes.
- **Innervation** - the mucous membrane is innervated by the tympanic plexus (formed by the tympanic nerve of the glossopharyngeal nerve, which is connected to a branch of N. facialis-intermedius and fibres from the external carotid plexus.
  Stapedial muscle - facial nerve
  Tensor tympani muscle - trigeminal nerve/3
  The tympanic chord and the facial nerve pass through the tympanic cavity but do not fulfil specific functions in it.

2.1.1.3. The Auditory Tube

The auditory tube (Tuba auditiva) passes from its opening (Ostium pharyngeum) in Pars nasalis of the pharynx **laterally**, **posteriorly** and **upwards** to the anterior wall of the tympanic cavity. The opening (Ostium tympanicum) is close to the roof of the tympanic cavity so that the drainage of secretion into the tuba auditiva can be impaired.
The lateral third is osseous, located ventrolaterally of the carotid canal and is termed **Semicanalis tubae auditivae.**
The medial two thirds are cartilaginous. A hook-shaped plate of cartilage forms the medial wall, the roof and a part of the lateral wall. The lateral end is firmly attached to the osseous part while the rest of the lateral wall and the floor are membranous and expandable.
The transition from the osseous to the cartilaginous part is formed by a narrow part termed the **Isthmus tubae auditivae**. The cartilaginous part of the tube passes at the cranial base in the **Sulcus tubae auditivae** along the **Fissura petrosphenoidale** (between the petrous bone and Ala major of the sphenoid bone) and is firmly attached to the bone. Towards the pharynx, the opening of the tube widens and can be influenced by the following muscles.

- **Tensor veli palatini muscle** - originates ventrolaterally of the tube at the cranial base, at the root of the pterygoid process and to the spina spenoidalis and from the tubal cartilage and runs down to Hamulus pterygoideus, turns to median, widens to form the palatine aponeurosis and is attached to the posterior palatine crest.
  Innervation - N. pterygoideus medialis (trigeminal nerve/3)
  Action - tightens the soft palate during swallowing and opens the tube.



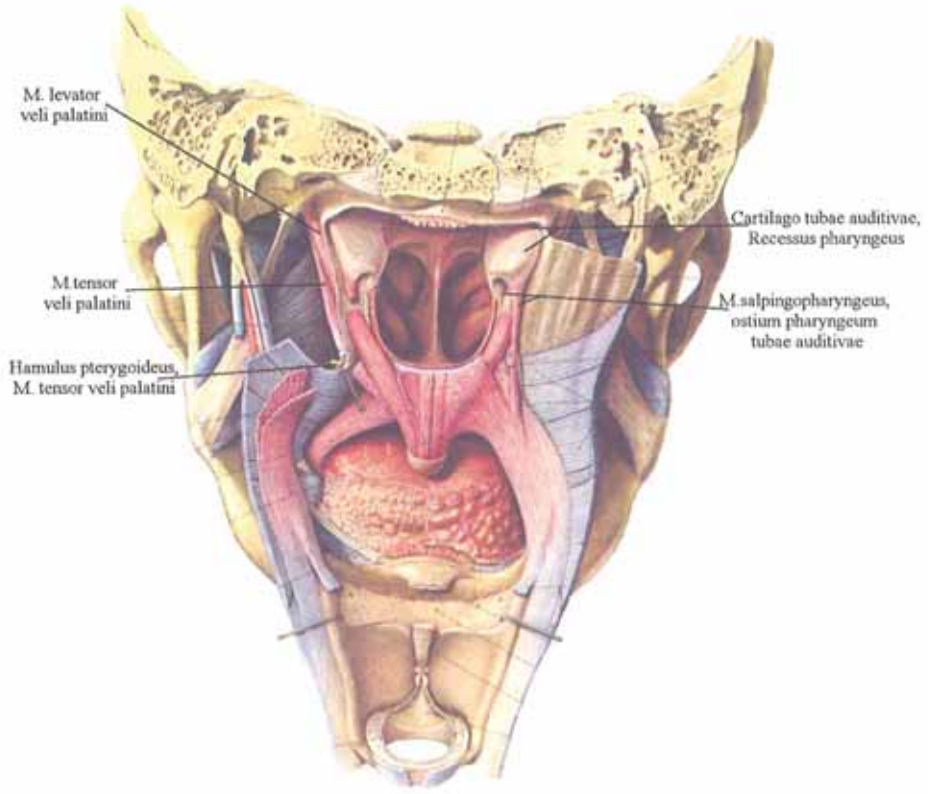
Ill.3: Benninghoff, Anatomie,1994, p.781

- **Tensor veli palatini muscle** - arises from the inferior surface of the petrous temporal bone and from the cartilaginous part of the tube and already spreads out in the soft palate above the hamulus pterygoideus.
  Innervation – glossopharyngeal nerve
  Action – elevates the soft palate and helps opening the tube.

- **Medial pterygoid muscle** – arises from the Fossa pterygoidea of the pterygoid process and passes posteriorly and caudally to the Tuberositas pterygoidea at the inside of the submaxillary angle. This muscle is mentioned here because some of its fibres blend with Tensor veli palatini muscle. Additionally, this strong muscle strongly influences the position of the sphenoid through its insertions at the entire pterygoid process and thus the function of the above mentioned muscles.
- **Salpingopharyngeus muscle** - (also known as a part of the palatopharyngeus muscle) its fibres arise from the Tuba auditiva and the Hamulus pterygoideus and insert into the lateral pharynx wall.

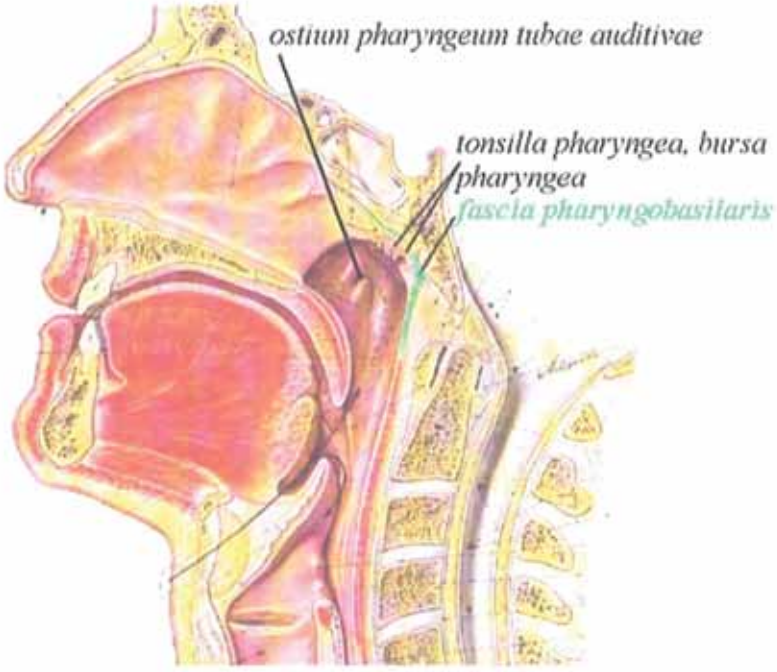
Innervation - pharyngeal plexus (from glossopharyngeal nerve, vagus nerve and accessory nerve)

- **Arterial supply of the auditory tube** - internal carotid artery, middle meningeal artery, ascending pharyngeal artery, descending palatine artery, sphenopalatine artery
- **Venous drain** - mainly into the pterygoid plexus, the pharyngeal veins, the veins of the tympanic cavity and into the Plexus venosus caroticus internus.
- **Lymphatic drainage** - through retropharyngeal lymph nodes or directly into the deep cervical lymph nodes and parotid lymph nodes.
- **Nerves of the mucous membrane** - tympanic plexus, pharyngeal plexus. For the Ostium pharyngeum glossopharyngeal nerve and Ramus pharyngeus from the Ganglion pterygopalatinum.



Ill.4: Pernkopf, Anatomie, 1994, p.310

2. 2. Anatomy of the Pharynx

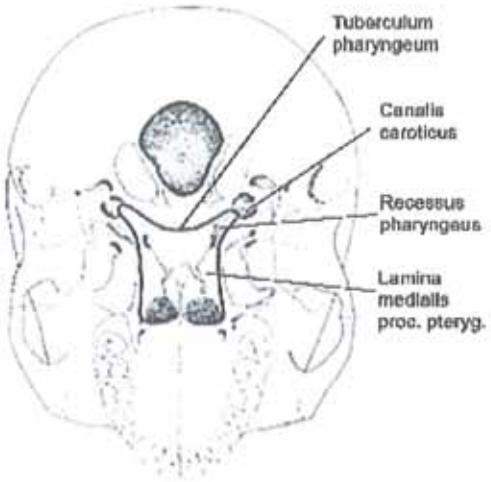


Ill.5: Sobotta, Atlas der Anatomie des Menschen,1, 1982, p.189

The **Pharynx** is a musculomembraneous tube that extends from the basal surface of the skull to the entrance of the esophagus. It is connected ventrally to the nasal chamber and the oral cavity and laterally with the middle ear through the Tuba auditiva. The pharyngeal opening of the auditory tube (Ostium tubae auditivae) is located approximately 1-1.5 cm behind the end of the Concha inferior in the lateral wall of the Pharynx and is bounded above and behind by the tubal elevation (Torus tubarius), a prominence which is provided by the tubal cartilage. Below the pharyngeal opening of the tube, the levator veli palatini muscle produces a less pronounced elevation, the Torus levatorius. In the roof (Fornix pharyngis) lies the pharyngeal tonsil.

In this nasal part of the pharynx, which serves purely the purpose of an air passage, the **mucous membrane** consists of **columnar ciliated epithelium** while in the remaining oral and laryngeal part it consists of stratified squamous epithelium with mucous glands.

In its upper part, where muscle fibres are absent, the wall of the pharynx tube is attached to the cranial base with a membrane of connective tissue, the **Faszia pharyngobasilaris**. It is important that the area of attachment of this fascia also reaches the tubular cartilage. The fascia is continuous with the **constrictors** (Mm. constrictores pharynges), which are attached to the fascia through the **pharyngeal raphe**.



Ill.6: Benninghoff, Anatomie Bd.1, 1994, p.819

To the outside, the pharyngeal wall is connected to its surroundings by loose layer of connective tissue that is able to **glide and shift** on the underlying layer of tissue. The space between pharynx and Lamina praevertebralis of the cervical fascia continues caudally into the posterior mediastinum. The lateral space, in which the tuba auditiva is located, is also connected to the mediastinum.

Lymphoid Ring (Waldeyer's Ring)

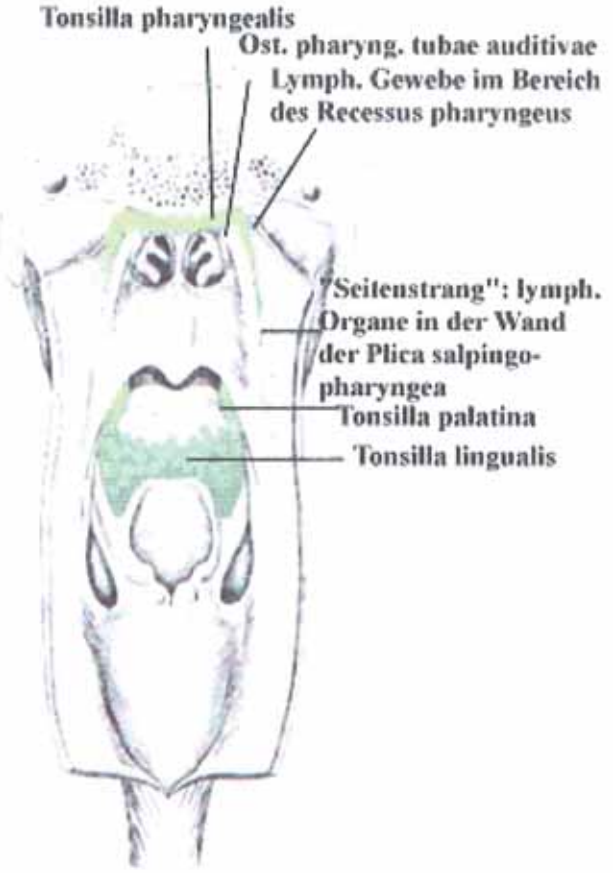
At the entrance of the pharynx there are several lymphoid collections, a kind of early warning system that can induce first immunological reactions to pathogens intruding from the air or from food. In addition to the smaller collections of lymphoid tissue directly under the mucous membrane, there are also larger masses with mucous folds, the **tonsils**.

The azygous **pharyngeal tonsil** (Tonsilla pharyngea) lies at the roof of the pharynx. It is particularly large during childhood and later atrophies until puberty.

The two **palatine tonsils** (Tonsillae palatinae) are situated between the palatine arches in Rosenmüller's fossae.

The azygous **lingual tonsil** (Tonsilla lingualis) is situated at the root of the tongue.

The **eustachian tonsils** extend caudally from the auditory tube.



Ill.7: Benninghoff,Anatomie Bd.1, 1994, p.822

2. 3. Embryology of the Ear

2.3.1. The Inner Ear

The inner ear forms (Week 4) from **ectodermal thickenings** on both sides of the hindbrain. Both the lens placode and the **auditory placode** are induced by the developing **CNS**. By Week 5, a **cochlear** and a **vestibular** division can be recognised.

By Weeks 20-22, the ear has reached its final shape. **"Inner ear, eardrum and ossicles are the only structures that reach their adult size in the foetus after only half of the pregnancy is completed... Histologically speaking, the ossicles are the only parts of the foetal skull whose properties are the same as in the adult skull."** (Tomatis A, Der Klang des Lebens, p. 271ff).

By approximately **Weeks 20-22**, the growing foetus is capable of intrauterine acoustic perception!

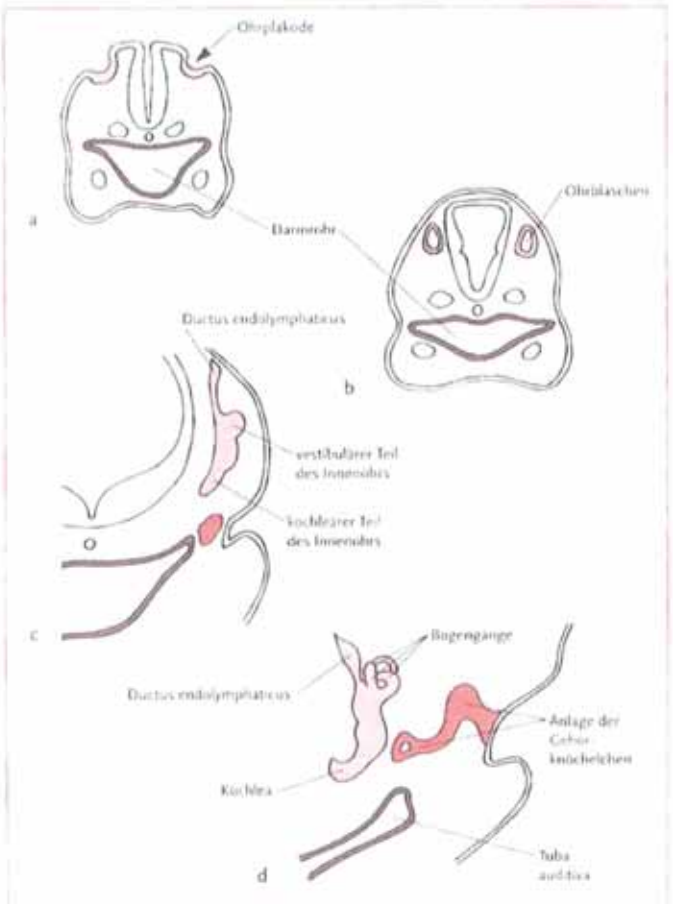


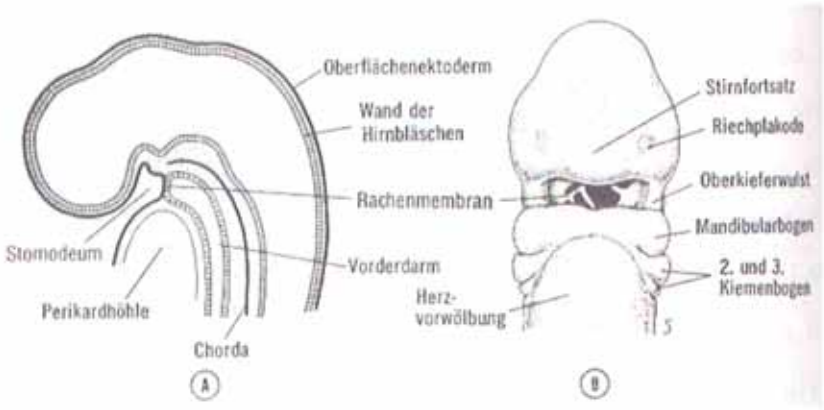
Abb. 27 a-d: Entwicklung des Innen- und Mittelohres. **a** Ende der dritten Woche, **b** Ende der vierten Woche, **c** fünfte Woche, **d** siebte Woche

Ill. 8 Christ B., Wachtler F., Med. Embryologie, 1998, p. 102

2.3.2. The Tympanic Cavity and The Auditory Tube

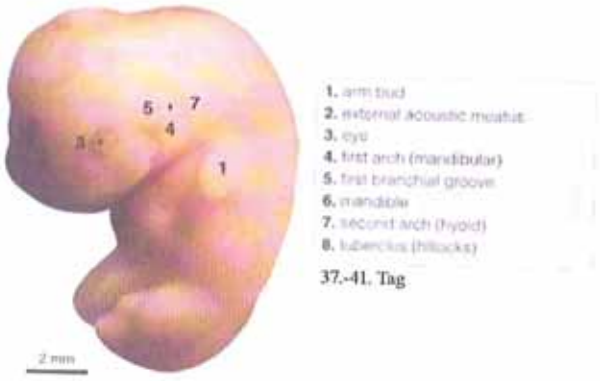
In **Week 4**, the gut tube forms from the **endoderm** of the trilaminar blastodisk by lateral folding and bending of the embryonic body. The gut tube is divided into **foregut, midgut and hind gut**. The foregut is cranially closed by the buccopharyngeal membrane. When this membrane ruptures, the **stomodeum** communicates with the endodermal **foregut.**

The foregut, which lies dorsally to the cardiogenic plate gives rise to **pharynx, esophagus, stomach, superior part of the duodenum including liver and pancreas.**



Ill.9: Langmann J. Medizinische Embryologie,1989, p.248

During Weeks 4 and 5, the pharyngeal gut (the superior part of the foregut) forms the **pharyngeal pouches**, which protrude into the surrounding mesenchymal tissue. On the embryo's surface, ectodermal clefts appear which reach almost up to the pharyngeal pouches. The mesenchyma that surrounds the pharyngeal gut is pushed aside and thus the pharyngeal or branchial arches are formed. In this phase of development, the approximately four to six-weeks-old embryo acquires its typical appearance.

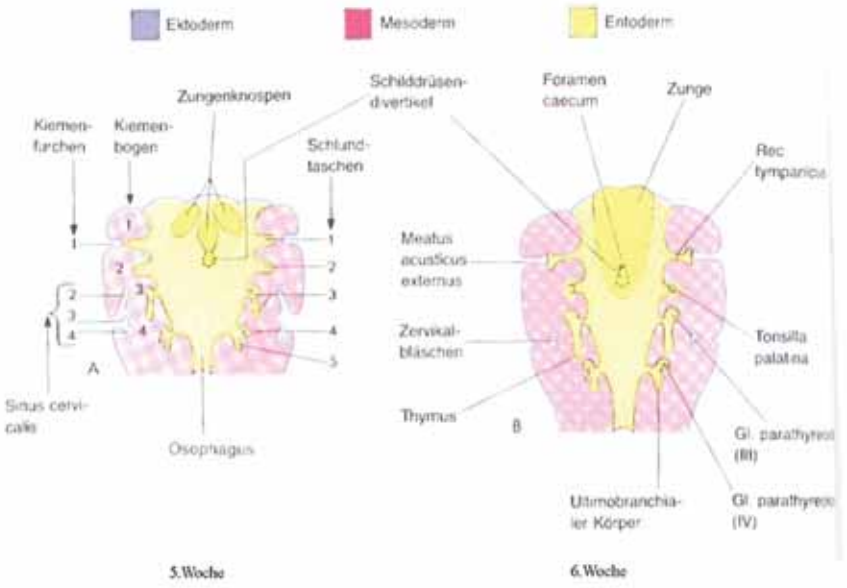


Ill.10: England M. A., Life before Birth, 1996, p.91.

- **The first pouch** forms the **tubotympanic recess**, whose distal part extends to form the **tympanic cavity**. The ossicles are embedded in mesenchyma until Week 8. After the dissolution of the mesenchyma, they are covered with a mucous membrane from the endodermal epithelium lining of the tympanic cavity and thus united with the latter. The proximal part of the tubotympanic recess remains narrow, extends towards the pharynx and forms the auditory tube. Lymphoid tissue forms in the area where the auditory tube enters the pharynx. In the late foetus, shortly before birth, the tympanic cavity expands dorsally and gives rise to the tympanic or mastoid antrum (Antrum mastoideum). After birth, the mastoid antrum continues to grow and forms the mastoid process (Processus mastoideus).

  The **eardrum** develops from the ectoderm of the first **branchial groove**, the **endoderm of the first branchial pouch** and an intermediate layer of **mesenchyma** of the **first** and **second branchial arches.**

- The **second pouch** forms the epithelial parts of the **palatine tonsils.** Migrating mesnchymal tissue differentiates in Week 20 to form lymphoid tissue.



Ill.11: Moore K., Embryologie,1990, p. 208

- The **first branchial arch** (mandibular arch) gives rise to the **trigeminal nerve** (Ramus mandibularis), the masticatory muscles and the following muscles that are important for the middle ear and the auditory tube: **tensor tympani muscle, tensor veli palatini muscle**. The **malleus** and **incus** are the bony structures that originate from the fist arch.

- The **second branchial arch** (hyoid arch) forms, among other structures, the **stapes**.

- The **third branchial arch** gives rise to the **glossopharyngeal nerve** and, among other structures, the **levator veli palatini muscle,** which is important for the auditory tube.

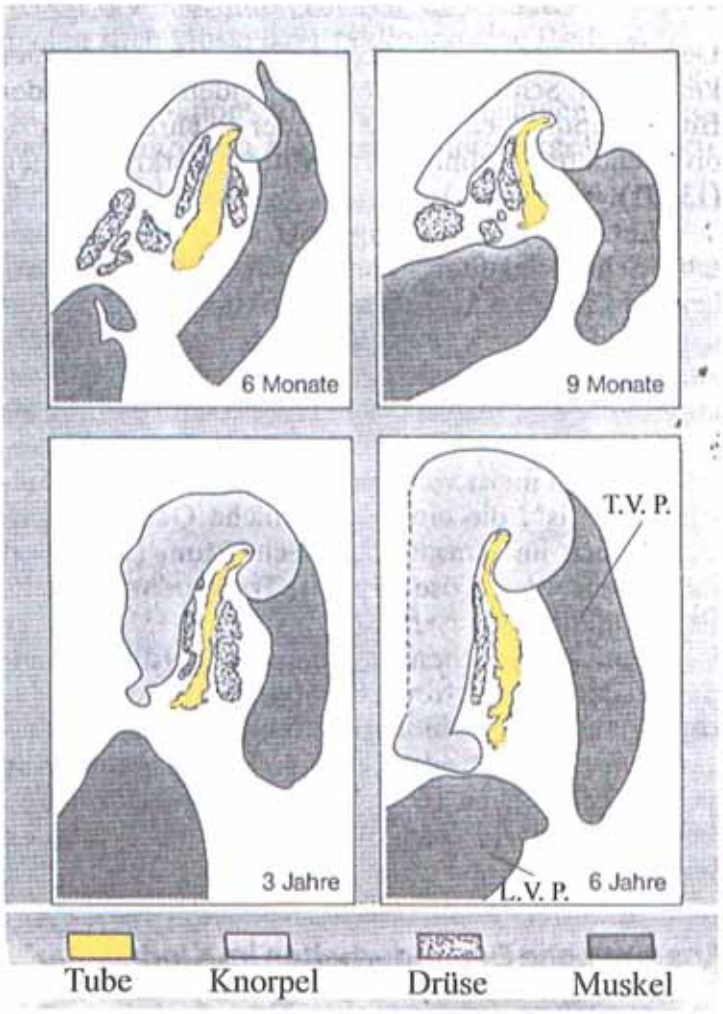
28 Tage, 3: Schlundbögen

Ill.12: Larsen W., Essentials of human Embryology, 1998, p.262

2. 4. Anatomical Peculiarities of the Child

In the infant and young child, the pharyngeal opening of the tube lies deeper in the flat naso-pharyngeal space, the tube is shorter and oriented more horizontally.

The **levator veli palatini muscle** is more distant from the tubular cartilage and the **neuromuscular system** does not mature until the age of **seven** (Koch U., Pau H., in Oto-Rhino-Laryngologie in Klinik und Praxis, Vol.1 Ohr, p.565-566).



Ill.13: Koch U., Pau H.,Oto-Rhino-Laryngologie in Klinik und Praxis, Band 1, p. 566

The development of the epithelium-lined cavities (mastoid air cells) in the **Pars mastoidea** of the temporal bone continues until **puberty**.

2. 5. Physiology of the Hearing Organ

The ear is the human sensory organ for acoustic perception and sense of balance.
Sound waves (vibrations) are funnelled by the auricle into the external auditory apparatus and transmitted to the eardrum. The sound waves from the air must be transformed into a **stationary wave** in the **endolymph** of the cochlea. The **acoustic impedance** thus created is neutralised by the amplifying action of the middle ear. This is achieved firstly by the **difference in the surface of the eardrum** and the **oval window** of a ratio of **55 : 3.6 mm²** and secondly by the **leverage of the ossicles** of the factor 1.3. This permits an amplification by a factor of approximately **20**.
The **vibration** created in the perilymph of the **cochlea** is transmitted to the **endolymph** and stimulates the **external** and **internal haircells**. The action potential of this sensory epithelium is transmitted by the **cochlear nerve (N. cochlearis)** into the hearing centres in the brain and processed in the auditory cortex.

A precondition for the unobstructed transmission of sound to the inner ear is the ability of the eardrum to vibrate freely and an equal amount of air pressure in the external auditory canal and in the middle ear. The auditory tube is therefore required to regulate air pressure.

The slot-shaped lumen (opening) of the tube is **at rest** kept close **from the outside** by the elasticity of the curved cartilage and by tissue pressure which is important due to **the inner ear's high sensitivity**. Only during yawning, speaking and swallowing, a number of muscles (cf. relevant chapter on anatomy) pull the walls apart to **equalize pressure.**

3. Pathology of Secretory Otitis Media (Glue Ear)

3. 1. Terminology

Secretory Otitis Media (SOM) is characterised by effusion behind the eardrum, in the tympanic cavity.
There are variations in European and Anglo-American terminology with reference to the various causes of effusion in the tympanic cavity.

In the case of **chronic effusion,** the term **seromucotympanon** is used in German-speaking areas, regardless of the cause of effusion. This term has become established due to the fact that when examining the eardrum with an otoscope, it cannot be determined whether the effusion is of **serous** or **mucous** consistency. American authors speak of **serous** or **mucous otitis media** because an inflammation can never be excluded as a possible cause. Other expressions such as **"Otitis media with effusion"** or **"glue ear"** are also used in English medical texts.

3. 2. Pathological Mechanisms

For various reasons, particularly as a result of **pathological negative pressure**, a kind of immunological reaction can lead to metaplasia of the mucous membrane (transformation of one kind of tissue into another). Epithelial tissue with mucous-producing cells (respiratory epithelium) is formed as a result and this tissue produces a serous secretion. If the accompanying impairment of tubular ventilation prevails over an extended period of time, this secretion can acquire a mucous or glue-like consistency and lead to chronic SOM.

„Abnormal function of the ET (eustachian tube) appears to be the most important factor in the pathogenesis of OM (otitis media)" (Bluestone CD, Doyle WJ, Eustachian tube function: Physiology and role in OM, Ann.Otol.94, Suppl. 120, S48).

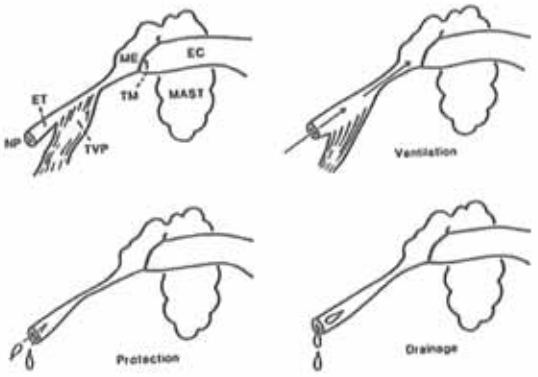


Fig 30. Three physiologic functions of ET in relation to ME.

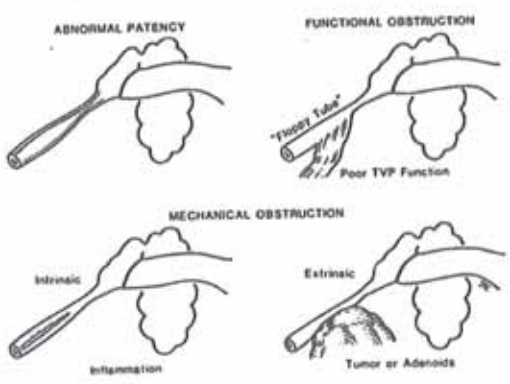


Fig 31. Pathophysiology of ET.

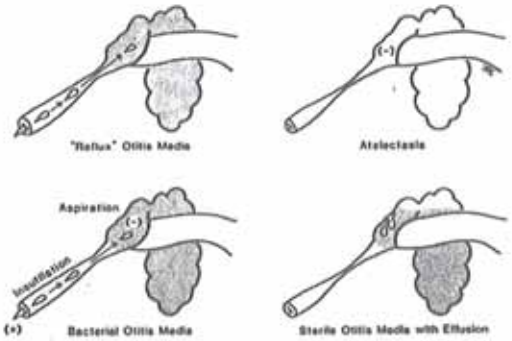


Fig 32. Pathogenesis of OM caused by abnormal function of ET.

Ill.14: Bluestone C. D.,Doyle W. J., Eustachian tube function, Ann. Otol. 94, Suppl. 120, S 48-49

A tubular ventilation dysfunction can be a possible **cause** for middle ear pathologies in the case of children due to the above mentioned anatomical peculiarities. But also infections of the upper respiratory apparatus with increased mucous production and swelling of the nasopharynx can constrict or obstruct the tubular orifice and thus cause **secondary** tubular ventilation dysfunction and, in consequence, SOM. Other possible causes include enlarged pharyngeal tonsils, muscular dysfunction and allergic reactions.

The three main functions of the auditory tube are the following:

- **Ventilating** the tympanic cavity to equalize air pressure
- **Protecting** the tympanic cavity from secretion from the nasopharynx
- **Draining** secretions from the tympanic cavity into the pharynx by the tube's ciliated epithelium, that is oriented towards the pharynx.

3. 3. Clinical Presentation of SOM

Numerous studies and statistics confirm that SOM is one of the most frequent pathologies in childhood.

"According to an extensive collection of epidemiological data, 90 % of all individuals suffered from SOM one or several times during childhood. Tos observed a large group of children from their birth until the age of six and detected SOM in 80% of the children during this time: 15 % a single time and for a short period, 25% repeatedly and for a short period, 15 % repeatedly and over an extended period (3-6 months), 10 % gravely and protractedly. However, the percentage of children with SOM was reduced to 4% by the age of six." (Helms J, Oto-Rhino-Laryngologie in Klinik und Praxis, Vol. 1Ohr, p.571)

The main symptoms of SOM are **impaired hearing**, and a **sense of pressure and fullness** in the ear.

Protracted SOM (longer than two months) with impaired hearing represents a major problem in the development of language and articulated speech. An American study conducted by Jerome O. Klein proved that very early hearing impairment led to a **generally slower development** of the child. According to this study, not only articulated speech, vocabulary and the ability of self expression are affected but also **motor development** as well as the development of **social behaviour and intelligence** are clearly reduced compared to children without hearing problems. (Klein JO, Otitis media with effusion and development of speech and language, Ann Otol 1985,Vol 94, Suppl.120, p.53)

3. 4. Diagnosis of SOM

Typical anamnestic indicators are the following

- Recurring infections of the upper respiratory apparatus and otitis media
- impaired hearing
- anomalies in language development
- frequent nocturnal snoring
- adenoid facies due to oral breathing

Examination

- **clinical examination** - frequently enlarged adenoid tonsil and lymph nodes of the neck
- **otoscopic examination** - typical appearance of SOM with waxy coloured eardrum, sometimes increased vascularisation
- **audiometry** - conductive hearing loss of approximately 40 dB, particularly affecting the middle and low ranges
- **tympanometry** - particularly flat or entirely flat tympanogram (for more detailed explanations see chapter on method and materials)

Traditional Medical Treatment

- administration of antibiotics over a period of two weeks
- administration of nasal decongestants
- adenotomy if there is no improvement
- myringotomy (surgical incision of the eardrum) and
  optionally the insertion of tubes for better drainage

4. Osteopathic Causes and Considerations

A healthy organism is the result of harmonic cooperation of the various structures of the body. The osteopathic approach is to treat these **fascial, biomechanical, muscular, nervous, liquid** and **endocrinal** structures in a suitable manner in order to stimulate the organism's regenerative abilities and provide the basis for a healthy condition. On this basis, the possible osteopathic causes of SOM will be examined in the following chapter.

4. 1. Arterial Vascularisation

"The blood must be able to come and go without interference. The business of the osteopath is to know that the blood has an unobstructed flow through the arteries, capillaries and veins." (Still A., Osteopathy, Research and Practice, 1992, p. 50)

The following arteries for the pharyngeal area and the area of the ear facing the pharynx arise from the **external carotid artery** and must not be obstructed on their passage to their "final organ":

- The **ascending palatine artery**, a branch from the facial artery, rises between styloglossus muscle and stylopharyngeus muscle laterally at the pharynx wall and reaches the soft palate, the palatine tonsils and the anterior pharynx wall up to the auditory tube.
- The **inferior tympanic artery** enters the tympanic cavity with the tympanic nerve through the Canaliculus tympanicus (between carotid canal and jugular foramen).
- The **posterior tympanic artery** originates from the stylomastoid artery, which passes through the foramen of the same name and sends this branch from the Canalis facialis into the tympanic cavity to the mastoid air cells.
- The **maxillary artery**, the strongest final branch of the external carotid artery, passes through the masticatory muscles and from the Fossa infratemporalis to the Fossa pterygopalatina. It is surrounded by a strong venous plexus, the Plexus pterygoideus.
- The **anterior tympanic artery** is a small branch of the maxilliary artery and passes through the Fissura petrotympanica to the tympanic cavity.
- The **artery of the pterygoid canal**, a very fine blood vessel, passes through the canalis pterygoideus to the pharynx, the tube and to the tympanic cavity.

Osteopathic Consequences

From the topography of these vessels it is obvious that particularly lesions of the temporal bone and the surrounding structures can interfere with optimum blood supply.
But also fascial, muscular and biomechanical restrictions of the arteries on their passage away from the heart must be recognised and treated, particularly at the **superior thoracic aperture** and the spine from the **OAA down to the fourth thoracic vertebrae.**

A. T. Still compares the heart with a barrel, and the holes that are to be penetrated with a barrel's bung-holes. (Still A., Osteopathy, Research and Practice, p.46, 1992). The bung-holes must be open so that the blood can flow unrestrictedly to its destination.

4. 2. Venous Vascularisation

"Should the venous system be obstructed, congestion, inflammation, pusformation would be the result. This same law extends to the deep and superficial glands, the tonsils, the auditory and nasal memranes. The blood must come and go without interference." (Still A. Osteopathy, Research and Praxis, p.50, 1992)

Venous stasis can lead to **inflammations** and **changes in the tissue**. A modified mucous membrane in the pharynx cannot properly fulfil its task of **drainage and immunological defence** (destroyed ciliated epithelium). A vicious circle of **excessive mucous production** and **reduced drainage** of this secretion sets in and prepares the ground for **recurrent infections**, particularly in childhood. Swelling of the mucous membrane and the accumulation of mucus can obstruct the tubal orifice and cause tubal dysfunction with SOM. Mucus can also be sucked into the tympanic cavity due to the resulting negative pressure and, similarly to an **antigen,** provoke an **immunological reaction** in the mucous membrane of the tympanic cavity and cause the destruction of tissue, increased secretion and SOM.

- The **internal jugular vein** drains 98 % of the venous blood from the head. It begins in the jugular foramen. At its origin is a dilatation, the superior bulb (Bulbus superius venae jugularis), in which blood from the **sigmoid sinus**, the **inferior petrous sinus** and various minor veins converges. The internal jugular vein continues its course together with the internal carotid artery, then with the common carotid artery and meets the subclavian vein behind the sternoclavicular joint in the **venous angle.** Lymphatic drainage from the head and neck also enters to the left as the Truncus jugularis sinister either through the thoracic duct or directly into the **venous angle** or into one of the **two large veins**. The Ductus lymphaticus dexter enters the right **venous angle**.
- The **pharyngeal veins** form the pharyngeal plexus that surrounds the pharynx laterally and posteriorly and drains the venous blood from the pharynx, the hyoid, and the anterior cervical fascia. These veins communicate with the veins of the nasal mucosa, the tube, the palate, the pterygoid plexus and vertebral plexus.

- The **pterygoid plexus**, a dense cavernous network located cranially, surrounds the maxillary artery and fulfils important functions for the tube, the nasal mucosa and the palate. This venous plexus opens into the internal jugular vein through the retromandibular vein.
- The **inferior petrous sinus** receives among others the tympanic veins from the tympanic cavity and opens into the internal jugular vein through the sigmoid sinus.

Osteopathic Consequences

In observing the topography of the venous drainage from **caudal to cranial,** we can draw the following diagnostic and therapeutic conclusions:
The superior **thoracic aperture,** the **cervico-thoracic junction,** the **muscles** of the **pharynx,** the **cervical spine** and the **OAA area** are of therapeutic importance. Fully functional pterygoid muscles (medial and lateral pterygoid muscle) are a precondition for adequate drainage of the **pterygoid plexus.**
Kuchera writes that relaxing the **medial pterygoid muscle** opens the tube because this muscle is connected to the **tensor veli palatini muscle**. A.T. Still and other authors describe the **mandibular traction technique**. (Kuchera M., Kuchera W. Osteopathic Considerations in Systemic Function, p.17, 1994).

Particularly important for uninhibited venous drainage is the **jugular foramen**. This foramen can be restricted due to **intraosseous lesions** caused by birth trauma, particularly at the **Pars basilaris** and the **Partes condylares** of the not yet ossified **occipital bone**. Other reasons for venous stasis include **interosseous lesions** between **temporal bone** and **occipital bone** such as at the **Sutura occipito-mastoidea,** leading to stasis of the **sigmoid sinus** or at the **Sutura petro-basilaris,** causing stasis of the **inferior petrous sinus**, or at the Sutura petro-jugularis (Arlot J., Kurs Wien 1994).
Furthermore, the **dural membranes** with their **duplications** for the **venous sinuses** and their intracranial and extracranial areas of attachment at the **Foramen occipitale**, the **second** and **third cervical vertebrae**, the body of the **second sacral vertebrae** and finally at the **coccyx,** must not be under abnormal tension in order not to interfere with venous drainage from the skull. The sacrum and the cranio-sacral rhythm must always be examined

4. 3. Lymphatic System

The function of the lymphatic system of **defence** and for the drainage of **interstitial liquid** into the venous system must not be inhibited by any kind of stasis. An accumulation of metabolic products in the **extracellular milieu** leads to **metabolic dysfunction**.
Lymphatic drainage from the tympanic cavity, from the tube and the nasopharynx is mainly into the **retropharyngeal lymphatic nodes** and through the **right** and the **left lymphatic duct** into the **venous angles**, or the **subclavian vein** or the **internal jugular vein** respectively. In this context we will consider other aspects of the defence system.
The high number of **cervical lymph nodes** (approximately **70**, between 20 and 30 in the axillary and the inguinal region) and of **lymphoid organs** (Waldeyer's Ring) it is evident, that first immunological reactions are vital considering the amount of microbial pathogens absorbed with respiratory air and food intake.

Strengthening the child's defence system can represent a very efficient osteopathic approach to the therapeutic and preventive treatment of ENT pathologies and resulting SOM.

A certain number of infections during childhood is necessary for the **development of the defence system** but when the infant's organism cannot cope with the amount of intruding pathogens, an **overreaction** of the **tonsils** of **Waldeyer's ring** can be the consequence. Particularly the **palatine tonsil** is subject to **hypertrophy**, which can lead to a blocking of the naso-pharyngeal space and to **oral breathing**. Consequently, the ciliated epithelium of the mucous membrane **cannot properly fulfil** its function of **cleansing** and **moistening respiratory air** which will lead to further infections. Studies conducted by Linder-Aronson (1970) prove that enlarged pharyngeal tonsils reduce nasal airflow. (in Scott-Brown´s Otolaryngology, p.164).

The **mucosa-associated lymphoid tissue (MALT)** in the **respiratory tract** (bronchus-associated lymphoid tissue) and in the **gastrointestinal canal** (gut-associated lymphoid tissue) are the main sources of the immunocompetent **precursor B lymphocytes**. Whenever these precursors "recognise" an antigen, lymph cells are activated. However, these cells can also **proliferate** in other areas of the mucous membrane. Investigations have revealed that during SOM the mucous membrane of the tympanic cavity appears and

reacts similarly to an extension of the mucosal immune system in the upper respiratory tract (Bluestone C., Recent Advances in Otitis Media with Effusion, p.326,1979).

A normal mucous membrane of the middle ear is similar to the gastrointestinal mucous membrane of a new born baby. (c.f. embryology – formation of the tympanic cavity and the auditory tube from the first pharyngeal pouch, i.e. from endodermal tissue, similar to the gastrointestinal tract)

Osteopathic Consequences

The **immune system** can be regulated by stimulating the **endocrinal mechanism** by improving **CSF fluctuation** and **CSF-lymphatic fluid exchange** (fourth ventricle, CV 4 technique).

The child's **intestinal and pulmonary functions** must be diagnosed and treated if necessary, e.g. in the case of problems with regard to the position of the intestine, tension in the navel area or diaphragm lesions. Accompanying measures such as dietetic treatment, stress reduction and avoiding cigarette smoke in the child's environment can also prove beneficial.

4. 4. Myofascial and Osseous Aspects

Since SOM is always accompanied by **tubal dysfunction**, the patient's **muscular** and **osseous** condition must also be taken into consideration. In an American study, a coloured liquid was introduced into the auditory tube and observed to move into the direction of the pharynx after electrical stimulation of the **tensor veli palatini muscle**. Obviously, the changing pressure in the tube and the tympanic cavity caused by contraction and relaxation of the tensor veli palatini muscle in deglutition creates a **pumping action**. **Liquid is drawn from the tympanic cavity first into the tube and then transported into the pharynx** (Honjo, I. in Ann. Otol. Vol. 94, Suppl.120, p.29).

Osteopathic causes that can upset the sensitive balance include the following:
Lesions of the **SSB** with its areas of attachment of the **superior pharyngeal muscles** at the **Tuberculum pharyngeum** and abnormal tension of theses muscles which in turn can cause lesions of the SSB. Particularly abnormal tension of the **superior constrictor**, which is continuous with the Fascia pharyngobasilaris and forms a small gap termed the **Sinus Morgagni** immediately below its area of attachment, can restrict the **levator veli palatini muscle** and the **Tube** in their passage through it. (Van den Heeden, P., Kurs Wien, Feb.97).

Torsion or **sidebending** of the SSB can twist the Fascia pharyngobasolaris and lead to impaired drainage and swelling of the tubal tissue (Magoun H., Osteopathy in the Cranial Field, p.114-115, 1976).

A drag on the **anterior cervical fascia** (particularly Lamina praetrachealis in the middle, that envelopes the **omohyoid muscle**) can bring the tubal orifices closer to each other resulting in obstruction by the palatine tonsils and intrusion of pathogens from the tonsils into the tympanic cavity (Collangolo, G., Paediatrics course Vienna, 2000).

The course of the cartilaginous portion of the tube in the **Fissura petrosphenoidale** and finally into the soft pharyngeal wall leads W. G Sutherland to the conclusion that **external and internal rotation** of the temporal bone are of great importance for **opening and closing** the tube. In **external rotation** of the temporal bone the tube **opens**, in **internal rotation** it **closes**. Therefore, the tube can **remain** closed or opened in the case of lesions. Furthermore, it must be remembered that the temporal bone follows the movements of the

Occiput and is therefore affected by any kind of Occiput lesion (Sutherland W., Teachings in the Science of Osteopathy, p.78, p.86-87, 1990).

Apart from the before mentioned connections with the superior cervical muscles, the physiological function of the **levator veli palatini muscle** is dependent on the correct position of the **temporal bone**. The tension of the **tensor veli palatini muscle is** affects by loss of symmetry of the **pterygoid processes of the sphenoid bone.** (c.f. Anatomy, p...). Excessive tension of the very strong **lateral pterygoid muscle** with its insertions over the entire **pterygoid process** can bring the sphenoid bone into external rotation and cause problems at the auditory tube.

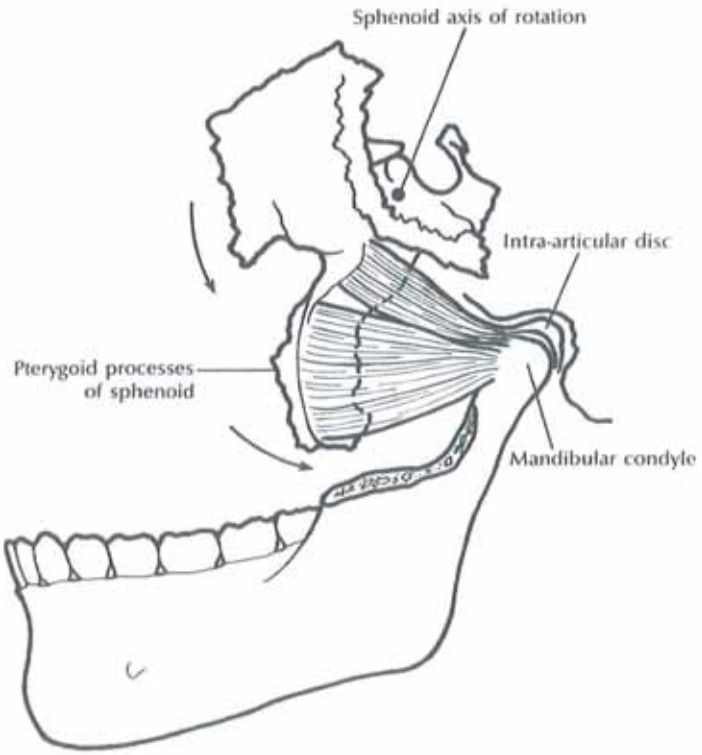


Illustration 1-53
Mechanical Effect of Lateral Pterygoid Muscle Upon the Sphenoid

Ill.15: Upledger J. D., Craniosacral Therapy II, Beyond the Dura, 1998 p. 79

4. 5. Osteopathic Aspects of Innervation

4. 5. 1. Sensory Innervation

The most important nerve for the area of the pharynx, the tube and the tympanic cavity is the **glosso-pharyngeal nerve** (IX). It is **sensory** to the pharyngeal mucous membrane and motor to the stylopharyngeus muscle. This nerve arises from several nuclei of the medulla and exits the skull through the **jugular foramen**. Since this nerve carries its own **sleeve of dura mater** into the jugular foramen it is particularly affected by dural restriction. (Upledger J., Craniosacral Therapy II, Beyond the Dura, p.97, 1987).

Therefore, particular attention must be given to the **Tentorium** with its areas of attachment at the **Occiput** and the **temporal bone,** and to an unrestricted passage of the cranial nerves IX and X through the jugular foramen. It is a good idea to apply the CV 4 technique to activate CSF fluctuation around these two cranial nerves already in their areas of origin in the **medulla,** anterior to the **fourth ventricle**.

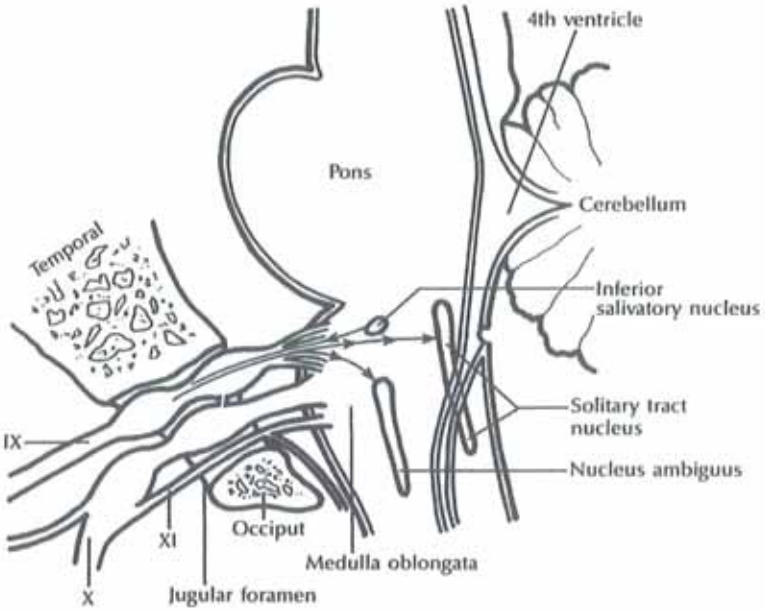


Illustration 1-63
Central Connections of the
Glossopharyngeal Nerve (IX)

Ill.16: Upledger J. D. CS Therapy II Beyond the Dura, 1998, p. 93

At the **inferior vagal ganglion**, immediately after the point of exit in the skull, the vagus nerve communicates with the **glossopharyngeal nerve**, the **accessory nerve**, the **sympathetic cervical chain** and the roots of **the first and second cervical vertebrae** (Plexus pharyngealis).
Birth traumata and abnormal intrauterine position can lead to **compression at the cranial base**, at the **Partes condylares** with restriction of the **Foramen magnum**, the **jugular foramen** and to shifting in the **OAA area**.
Therapeutic intervention is naturally the release of OAA, the Partes condylares and the sutures between Occiput and temporal bone.
A good balance between **sympathetic** and **parasympathetic** functions is important for the viscosity of the liquid film of the mucous membranes.

The sympathetic nervous system is responsible for vasoconstriction, thickening of the secretion and reduced drainage. The area of the cervical ganglia (in the deep cervical fascia) and the sympathetic chain from the **first to the fourth thoracic vertebrae** (in the area of the costovertebral joints) must be free of lesions. **The parasympathetic nervous system is responsible for vasodilatation and thinning the secretion.** Again, the jugular foramen must be considered in this context.

The remaining branches, the **tympanic nerve** and the **lesser petrosal nerve** with connections to **sympathetic fibres** and to the **vagus nerve**, have already been described in detail in the chapter on anatomy.

4. 5. 2. Motor Innervation

The **mandibular nerve** is the caudalmost branch of the **trigeminal ganglion** of the **Trigeminal nerve.** It leaves the skull through the **Foramen ovale,** reaches the outer cranial base and supplies motor innervation to the **muscles of mastication,** and consequently to a series of muscles which are important for tubal function:

- Tensor veli palatini muscle
- Superior constrictor muscle
- Medial pterygoid muscle

From the osteopathic point of view, the **trigeminal ganglion** is very important. It lies at the anterior part of the petrous bone in a **dural sheath** which it pierces near the apex of the petrous part of the temporal bone, then forms three main branches that reach their areas of supply through the various **foramina in the sphenoid bone**. Dural tension and dysfunction of the temporal bone and the sphenoid bone can lead to irritation and must be considered from an osteopathic point of view.

The **levator veli palatini muscle** and the **salpingopharyngeus muscle**, supplied by the **glossopharyngeal nerve**, must be examined considering the course of this nerve through the jugular foramen.

5. Method of Procedure and Material

5.1. Selection of Patients

After I had informed doctors and parents about my osteopathic work and how I intended to conduct my study, children who fulfilled my requirements were transferred to me from various practices.

GROUP A

The **test group** included 10 children, among them four girls, six boys with an average age of four years.

Criteria for Inclusion

- All patients were older than 19 month and younger than six years
- male and female
- All patients showed particularly flat tympanograms in the preceding tests

Criteria for Exclusion

- patients younger than 19 months and older than six years
- prior surgery (adenotomy, myringotomy, grommets)
- medication (antibiotics, corticosteroids...) during osteopathic treatment
- other (additional medical) treatment during osteopathic therapy
- known allergies of the nasopharynx
- ceilognatho-uranoschisis (cleft palate)
- other malformations of the skull

GROUP B

The control group was selected from patients of the same ENT specialist who conducted tympanometry before and after osteopathic treatment. Therefore, the conditions of examination were the same for the test group as well as for the control group. The same number of test persons was selected randomly from patients who fulfilled the same criteria for inclusion and exclusion as the test group. The control group consisted of seven boys and three girls. Their average age was three years and five months. These children had received traditional medical treatment with the administration of antibiotics and nasal decongestants over a period of two weeks.

Criteria for Inclusion

- patients older than 19 months and younger than six years
- male and female
- bilaterally flat

Criteria for exclusion

- patients younger than 19 months or older than six years
- prior surgery (as in group A)
- known allergies of the nasopharynx
- ceilognatho-uranoschisis (cleft palate)
- other malformations of the skull

5.2. Experimental Set-up

GROUP A

Each child was treated six times in intervals of one week.

1. APPOINTMENT: medical examination and tympanometry, carried out by an assistant of the ENT specialst in his practice.

2. APPOINTMENT:
   - taking the patient's history with the help of the children's parents in my osteopathic practice. Collecting data in questionnaires (enclosed in the annex).
   - General osteopathic examination and treatment.
   - Application of the selected techniques.

3. APPOINTMENT:: Osteopathic treatment with application of the selected techniques.

4. APPOINTMENT: Osteopathic treatment with application of the selected techniques.

5. APPOINTMENT: Osteopathic treatment with application of the selected techniques, final interview with the parents.

6. APPOINTMENT: final tympanometry carried out by an assistant of the ENT specialist in his practice (as on first appointment).

GROUP B

The children from the control group were selected from patients of the cooperating ENT specialist according to the criteria established for the test group. Members of the control group had therefore all been diagnosed with SOM and showed bilaterally flat tympanograms in the medical examination preceding treatment. After traditional medical treatment with antibiotics and nasal decongestants, a final medical check-up including tympanometry was carried out.

5. 3. The Questionnaires

The **case history sheet** and the sheet for the **initial osteopathic examination** are based on the questionnaires of the OCC (Osteopathic Centre for Children in London) and on the conventional osteopathic parameters used by the WSO (Wiener Schule für Osteopathie). The questionnaires were modified and extended to suit the requirements with regards to SOM (questionnaires included in the annex).

5. 4. Tests and Instruments used for Testing

Tympanometry was selected as a suitable method for the objective detection of SOM. SOM is characterised by an impaired transmission of sound waves from the auditory canal to the inner ear due to the presence of serous or mucous effusion or high negative pressure that interferes with the ability of the eardrum and the ossicular chain to vibrate. The severity of this condition can be measured objectively with the aid of tympanometry.

Tympanometry measures the compliance or freedom of movement of the eardrum in response to variations in pressure. A known quantity of sound energy is introduced into the auditory canal and reflected by the eardrum. The intensity of these reflected sound waves indicates the amount of sound absorbed by the eardrum and the middle ear. The quantity of absorbed sound energy is measured under changing pressure in the auditory canal and at the eardrum and recorded in form of a tympanogram. Positive and negative pressures in the auditory canal both produce a low value (a low amount of sound energy is absorbed, a high amount is reflected and registered in the tympanogram). Equal pressure in the external auditory canal and the tympanic cavity allows free movement of the eardrum and optimum transmission of sound waves to the inner ear via the ossicular chain. The presence of liquid in the middle ear interferes with the eardrum's ability to vibrate and neither positive nor negative pressure in the external ear canal change the absorption of sound waves in the eardrum - middle ear system, the transmission of sound is blocked and the patient suffers from **conductive hearing loss.**

Tympanometry therefore reveals:

- whether the eardrum is intact
- the air pressure in the middle ear and thus
- the ability of the eardrum and the middle ear to absorb sound under normal ambient pressure

The **tympanogram of a healthy middle ear** shows minimum absorption of sound waves under positive pressure at the eardrum. Sound absorption can be increased to a peak value under normal ambient pressure by reducing air pressure in the ear canal. By introducing negative pressure, sound absorption is reduced to a minimum value. The tympanogram shows a tent shape and a line indicating maximum sound absorption.

A **pathological** variation of the above mentioned parameters produces the following result: Negative pressure in the middle ear produces a lower peak and therefore a flatter tympanogram. If the middle ear is completely filled with liquid and the eardrum is unable to vibrate, it does not respond to variations in pressure. The resulting tympanogram shows only minor oscillations or produces an entirely flat line..

Procedure:

The ear canal of the test person is sealed with the probe while the auricle is gently pulled backwards in order to stretch the auditory canal. The tympanometer then automatically commences testing procedures and records the results in form of a tympanogram. The probe first introduces a pressure of + 200 daPa (decapascals) to the ear canal, then the pressure is varied in the negative direction and continually reduced to values as low as – 300 daPa. The reflected sound is continually measured and registered in form of a tympanogram.

The test is painless and non obtrusive. Tympanometry is an objective means of assessing middle ear function since it does not require subjective feedback from the patient and produces the same results independently of the assistant who conducts the test.

Ill. 17: Tympanometer

Ill. 18: Measurement with Tympanometer

5. 5. Techniques

5. 5. 1. Preliminary Notes

Before treatment can begin, the patient must be thoroughly **examined** and the **case history** must be taken. Osteopathic treatment can never be given by following a **standard procedure**, instead it must be individually designed to suit the needs of the patient.
The technique of **listening** was used to establish initial contact with the child. This technique gives the practitioner an insight into the condition of the tissue, the fascia and the primary respiratory mechanism (PRM). The objective of the first, general osteopathic treatment was to release the **cranio-sacral system** and to treat the diagnosed lesions which were found primarily in the **sacrum-pelvis area,** at the **thoracic diaphragm**, at the **upper thoracic aperture,** in the area of the **upper cervical spine**, at the **sternum**, in the **OAA area** and at the **occiput**. Depending on diagnosis, treatment also included the release of **abdominal tension** and dysfunction at the **cranium.**

In the following three treatments the same set of five techniques was applied while the individual requirements of the organism were observed at the same time:

Thoracal Diaphragm
Relaxing the OAA Region
Mandibular Traction Technique
Pumping Technique for the Auditory Tube
CV-4 Technique

5. 5. 2. Thoracal Diaphragm

POSITION: the therapist is sitting or standing beside the patient and puts both hands on the lower rib cage.

TECHNIQUE: the therapist now gently follows the movement of the tissue to a point of tension, waits until a release can be felt and does not return to the original direction but allows the tissue to find a new direction.

The treatment has been successful when a harmonisation of the tissues on both sides of the thorax, greater tissue permeability and more freedom of movement of the diaphragm have been reached.

Ill 19. Thoracal Diaphragm

5. 5. 3. Relaxing the OAA Region

POSITION: The therapist is seated behind the patient's head, the forearms rest on the table. The child's head rests in the practitioner's hands, the fingertips establish contact with the soft tissue between the occiput and the second cervical vertebrae.

TECHNIQUE: The gentle flexion of the head and the warmth of the therapist's hands already induce a relaxation of the tissue. When a light traction can be felt, the fingers gently push into an anterior direction until a further release of the OAA region is achieved. Slower breathing and general relaxation are indicators of successful treatment.

Ill. 20: Relaxing the OAA Region

5. 5. 4. Mandibular Traction Technique

(Magoun)

POSITION: The therapist sits beside the patient, keeping the patient's head in position with the cranial hand. The caudal hand is placed on the mandible of the opposite side.

TECHNIQUE: While the cranial hand keeps the head in position, the caudal hand applies gentle traction to the mandible into an anterior, medial and caudal direction and runs the fingers slowly along the mandible to the chin. This process is repeated several times. The other side is treated in the same manner.

Ill. 21: Mandibular Traction Technique

5. 5. 5. Pumping Technique for the Auditory Tube

(Magoun)

POSITION: The therapist sits behind the patient's head, the forearms are placed on the treatment table. The child's head rests in the practitioner's hands, the tips of the thumbs are placed on the mastoid processes.

TECHNIQUE: The mastoid processes are now gently pushed into a posteromedial direction. This position is retained while the therapist uses the right shoulder to alternately apply and remove pressure on the glabella in order to create a pumping action in the auditory tube.

Ill. 21: Pumping Technique for the Auditory Tube

5. 5. 6. CV-4 Technique

POSITION: The therapist sits behind the patient's head, forearms resting on the treatment table, hands crossed with both thenars parallel and establishes contact at the occiput **within** the Sutura occipito-mastoidea.

TECHNIQUE: The therapist senses the tissue's PRM and the thenars perceive the narrowing of the lower occiput area during the exhalation phase. This position is retained very gently until deep relaxation, often accompanied by a deep breath, occurs. The practitioner now carefully removes both hands and examines the condition of the SSB.

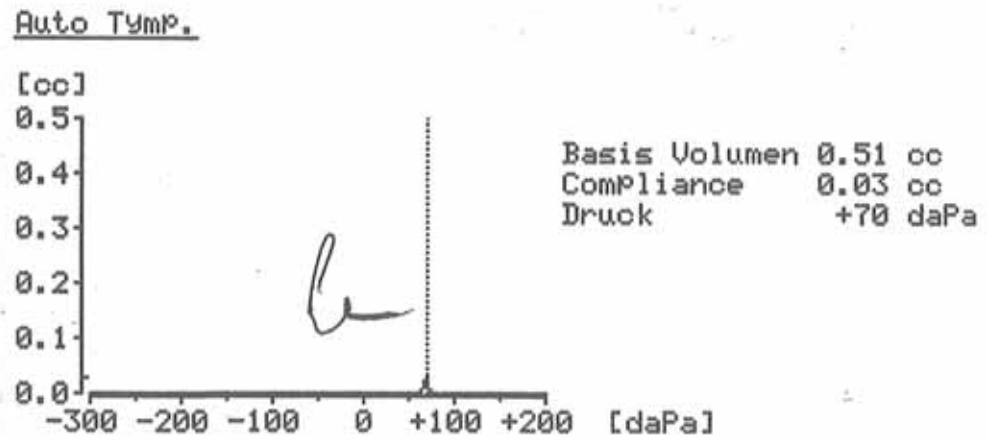
Ill. 22: CV-4 Technique

6. Results and Interpretation

The tympanograms of the final examination were assessed in four levels and the results were recorded in tabular form. The results of both groups are presented in graphs (EXCEL) that allow easy comparison of the data.

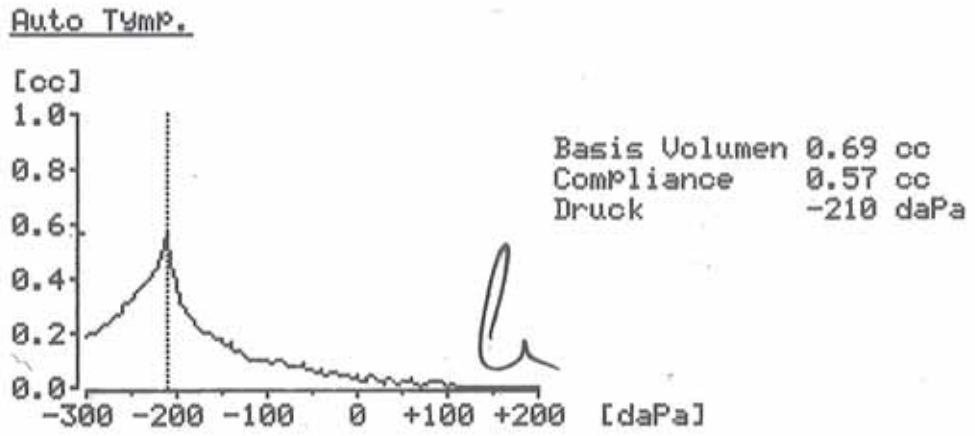
The following parameters were used for assessing improvement:

Improvement 0 - minor oscillation or flat tympanogram

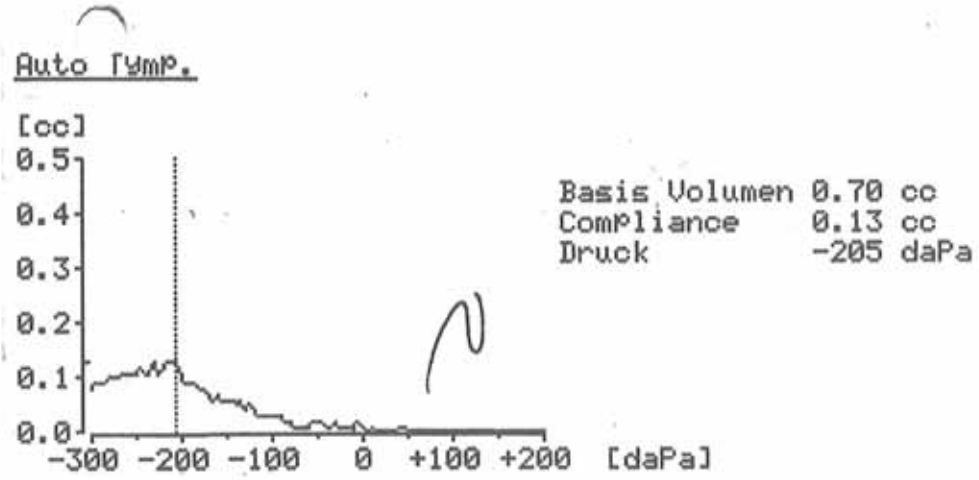


Graph 1: Improvement 0

Improvement 1 - flattened curve or showing a peak at < -150 daPa

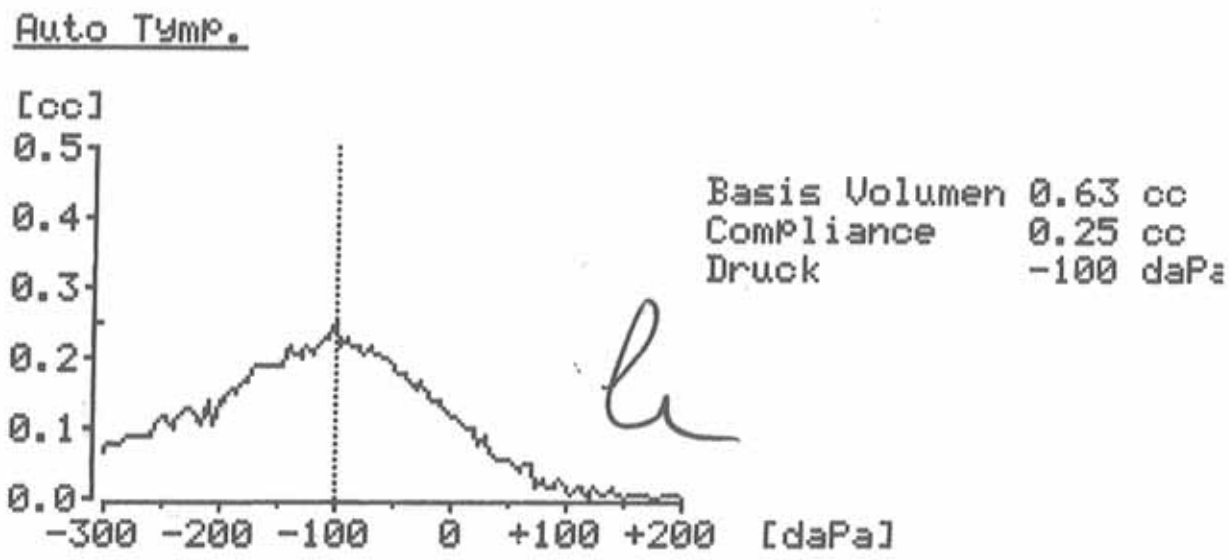


Graph 2: Improvement 1

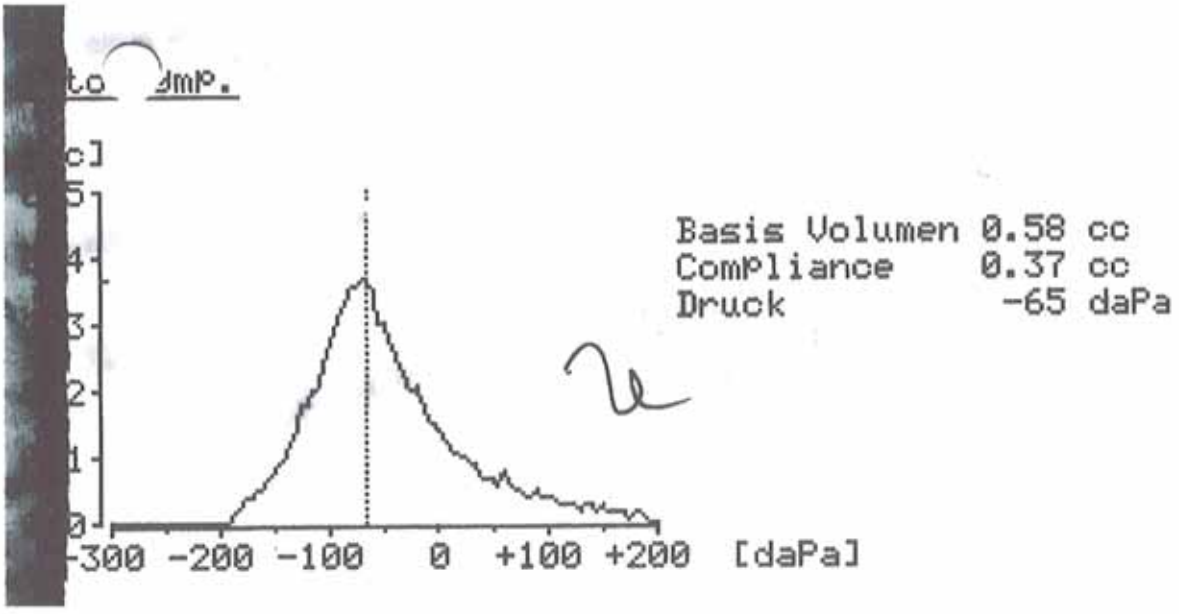


Graph 3: Improvement 1

Improvement 2: - flattened curve or showing a peak between -50 and -150 daPA or > +50 daPA

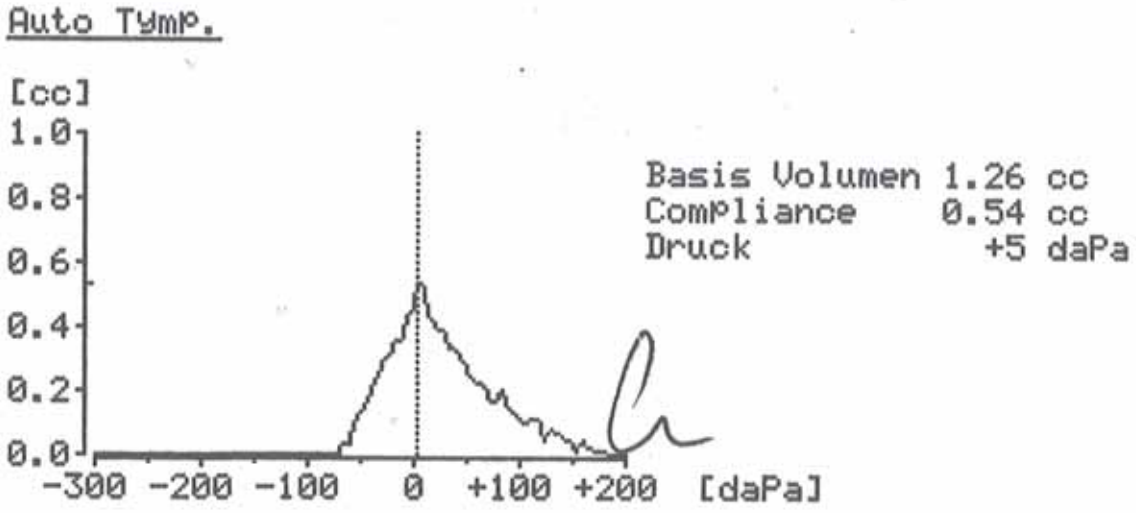


Graph 4: Improvement 2



Graph 5: Improvement 2

Improvement 3: curve showing a peak between -50 and +50 daPA



Graph 6: Improvement 3

Tables 1 and 2 show the data of the control group and the test group with the patient's number, age in months and gender. The tables also contain tympanometry results in daPA, a code for the form of the tympanogram with s standing for a peak and a for a flat tympanogram, and the values of improvement from 0 to 3, given for the right and for the left ear.

CONTROL GROUP:

patient nr.	m/f	age [months]	control group left		class.	control group right		class.
1	m	42	-170	s	1	-130	s	2
2	w	40	-120	a	2	-70	a	2
3	m	35	-100	s	2	-70	s	2
4	m	21	0		0	0		0
5	m	67	-30	s	3	-90	s	2
6	w	37	-190	a	1	-100	s	2
7	m	60	0		0	0		0
8	m	24	80	s	2	105	s	2
9	m	36	-130	a	2	-40	s	3
10	w	53	-190	s	1	0		0

table 1

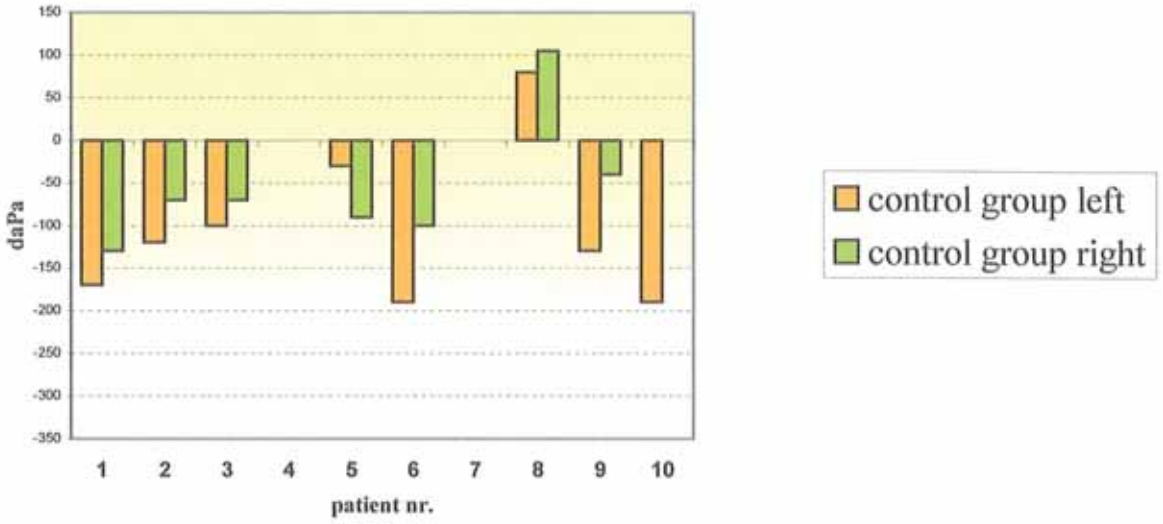
TEST GROUP:

patient nr	m/f	age [months]	test group left		class.	test group right		class.
1	m	39	0		0	0		0
2	m	19	0		0	0		0
3	m	58	-130	s	2	-60	s	2
4	m	50	-220	s	1	-300	s	1
5	m	63	-200	s	1	-160	s	1
6	m	53	-60	a	2	-50	a	2
7	w	71	-230	s	1	-220	s	1
8	w	31	-50	s	2	-100	s	2
9	w	41	0		0	-190	a	1
10	w	49	0		0	0		0

table 2

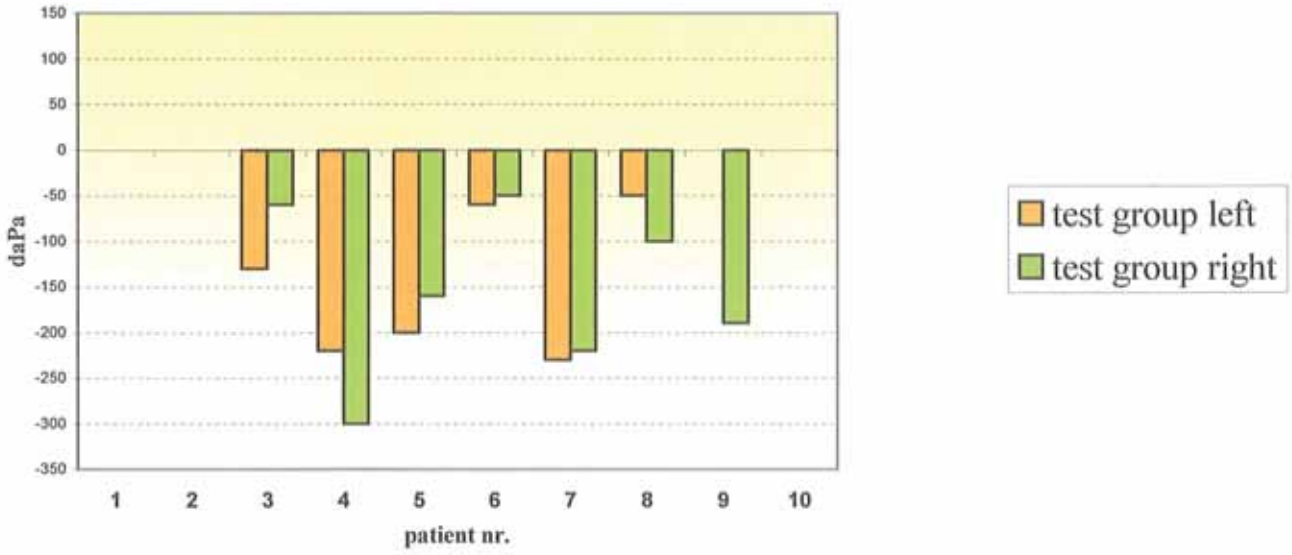
The results for the left and the right ear in daPA values of both the test group and the control group are presented in a graph that allows comparison between the two groups.

Results Control Group



Graph 7: control group

Results Test Group



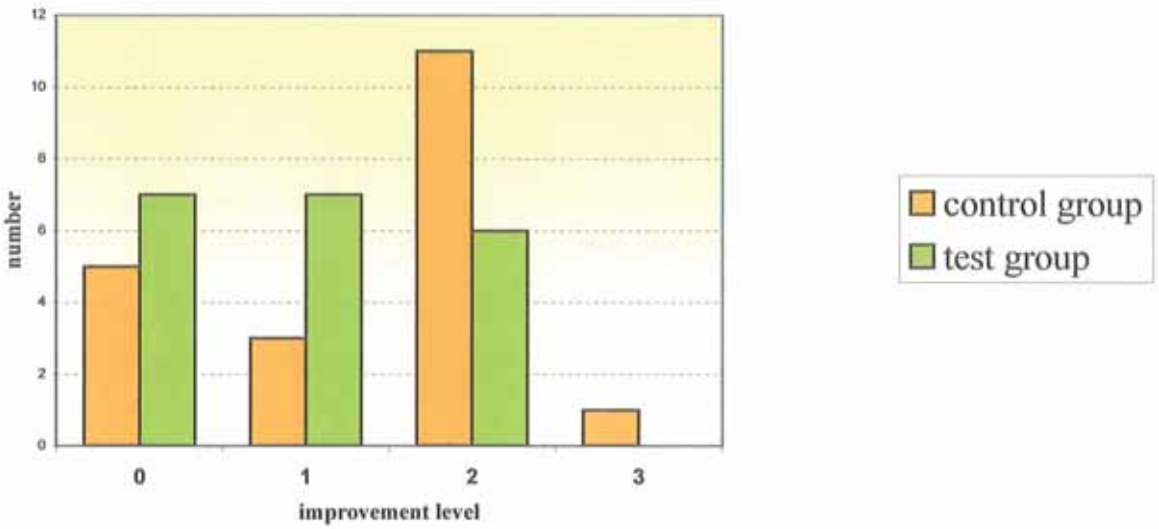
Graph 8: test group

Table 3 shows the distribution of improvement levels and the number of patients from each group who reached the individual levels. The data of both groups is again presented in form of a graph for better comparison.

	number	number
class	control group	test group
improvement level 0	5	7
improvement level 1	3	7
improvement level 2	11	6
improvement level 3	1	0

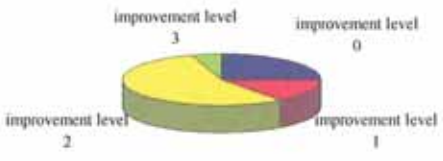
table 3

Distribution of Improvement Level



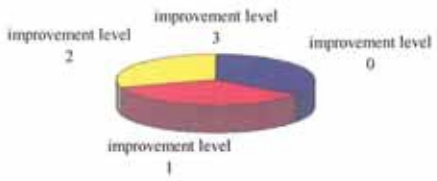
Graph 9: improvement level

Control Group



Graph 10: improvement level

Test Group



Graph 11: improvement level

7. Discussion

7. 1. Discussion of the Results

The study shows an improvement of both the osteopathically treated group (test group) as well as of the group that received conventional treatment with antibiotics. Statistical significance cannot be detected due to the small size of the test groups. It would be very interesting of course to compare the osteopathically treated group with a control group of patients who do not receive any treatment but due to the severity of the condition (bilaterally serious impairment of conductive hearing caused by SOM) this is not possible for medical and ethical reasons.
The improvement obtained by osteopathic treatment despite the severity of the condition justifies a holistic approach to treatment as it is exemplified by osteopathic therapy.

Cooperation and acceptance of osteopathic treatment on behalf of the parents and the children was very good. All parents noticed that the children's hearing and general health improved which was expressed in increased vitality and a more balanced mental condition.

Considering and treating the organism as a functional unit is certainly one of the key factors responsible for the success of osteopathic therapy.

- The patient's histories revealed difficult pregnancies and/or deliveries in all cases.

- Eight out of ten children suffered from several infections of the upper respiratory apparatus per year, all of which were treated with antibiotics.

- Seven out of ten children suffered from indigestion.

From the obvious aetiological similarities I draw the conclusion that in the case of many children with SOM **intrauterine** or **birth related traumata** caused lesions which led to dysfunction of the **CNS** and the **autonomic nervous system** and consequently to a weakening of the **immune system**. The frequent early infections, often accompanied by bronchitis, lead to **myofascial restrictions** in the **thorax area, adhesions** in the tissues of the entire **respiratory tract** and finally to muscular tension and posture problems causing

impaired lymphatic drainage, venous stasis and **reduced oxygen supply** of the tissue. A **holistic** form of therapy that considers the **entire organism** with its **functional integrity** can be more effective in breaking the resulting **vicious circle** than the conventional, purely symptomatic treatment with the administration of antibiotics which might be locally effective but puts further strain on the already weakened immune system and the organism as a whole.

Summarizing the results of the study it can be said that osteopathic therapy is indicated to complement conventional medical treatment of SOM or to substitute it in the case of concerns about the administration of antibiotics on behalf of the parents. Good cooperation between **allopathic** and **holistic** medicine with the common goal of **helping** the patient in the best possible way should become the norm.

7. 2. Outlook

- A larger number of test persons would be required in order to give a more accurate percentage of improvement and for better statistical comparisons between the two groups.

- The analysis of the case history and examination sheets in the framework of a more extensive study could allow interesting conclusions about the aetiology of SOM.

- Both groups should return for a medical check-up after a longer period of time.

- Children who suffer from SOM should receive extended osteopathic treatment over a longer period than four weeks and their condition should be monitored during that period.

- Children could be treated very individually according to their momentary condition and the results compared with those obtained by specific osteopathic treatment.

8. Bibliography

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9. Index of Illustrations

10. Tables

11. Graphs

12. Appendix

PATIENT HISTORY SHEET

Date of appointment: _____

Name: _____

Mothers name: _____

Adress: _____

_____

Phone: _____

Date of birth: _____ age: _____ m / f

Present illness: _____

Pregnancy:

mother's age: _____

number of pregnancies: _____

miscarriages: _____

amniocentesis: y / n

medication: y / n

haemorrhage y / n

other: _____

Delivery:

duration of pregnancy: _____

spontaneous birth: y / n

induced: y / n

duration of delivery: _____

anaesthetic: _____

forceps: y / n

vacuum extraction: y / n

caesarean section: y / n

APGAR 1min:

APGAR 5 min:

weight: _____

Neonatal Phase:

Respiration/crying: immediately/delayed

attentiveness: good/poor

shape of skull/bruises: _____

_____

feeding:

vomiting: y / n

breast feeding: y / n

difficulty in swallowing: y / n

bottle: y / n

Development and Growth:

walking: _____

teeth: _____

speech: _____

nutrition: _____

Prior Illnesses:

accidents: y / n

details: _____

_____

illnesses: y / n

details: _____

_____

_____

_____

surgery: y / n

details: _____

_____

Present State:

medication y / n

details: _____

dental malalignment: y / n

details: _____

fixed appliances (braces): y / n

logopaedic therapy: y / n

snoring: y / n

oral breathing: y / n

vitality:

EXAMINATION:

Inspection:

Spine in erect position:

from the side:

head: _____

shoulder posture: _____

thoracic spine: _____

vertebral column: _____

pelvis: _____

knees: _____

from behind:

shoulders: _____

pelvis: _____

spinal column: _____

Manual Examination:

seated:

cervical spine: _____

thoracic column: _____

diaphragm: _____

mandibular joint: _____

lying position:

length of legs: _____

pelvis: _____

abdomen: _____

first rib: _____

collar bone: _____

OAA: _____

Cranio-sacral System:

cranio-sacral rhythm: _____

sacrum: _____

OCC-condyles: _____

SSB: _____

Remarks: _____

_____

_____

_____

_____

13. Abstract

13. 1. Background

Reasons that led to my decision to conduct a study on the treatment of SOM include the wish of many parents to obtain alternative treatment for their children and the possibility to cooperate with an ENT specialist for carrying out tympanometry.

13. 2. Patients

Ten children of a defined age group with bilaterally flat tympanograms were treated four times applying osteopathic methods while a control group of children with the same pathology received conventional treatment with antibiotics. In the final examination, tympanometry was used to objectively assess improvement of the patient's condition and to compare the results of the two groups.

13. 3. Results

The results obtained from both groups are presented in form of a graph for better comparison. The condition of both groups improved. A statistically relevant result cannot be expected due to the small number of test persons.

13. 4. Conclusion

Osteopathic treatment did not only improve hearing but also had a positive effect on the children's general health. This allows the conclusion that osteopathic therapy with its holistic approach is indicated for the treatment of SOM and represents a viable alternative for parents who are concerned over the administration of antibiotics.