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ENT practice

Disorders of the cervical spine in tinnitus

A. Reißhauer ^{1,6}, K. Mathiske-Schmidt ¹, I. Kuchler ², G. Umland ³, B. F. folding ⁴ and B. Mazurek ⁵

- (1) Department of Physical Medicine and Rehabilitation, University Medicine Berlin, Charité Campus Mitte,
- (2) Institute of Medical Biometry, University Medicine Berlin, Charité Campus Mitte,
- (3) Hospital and University Clinic of General Medicine, Naturopathy, Psychosomatics, University Medicine Berlin, Charité Campus Benjamin Franklin,
- (4) Medical Department, Division of Psychosomatic Medicine, University Medicine Berlin, Charité Campus Mitte,
- (5) Department of Oto-Rhino-Laryngology, University Medicine Berlin, Charité Campus Mitte,
- (6) Department of Physical Medicine and Rehabilitation, University Medicine Berlin, Charité Campus Mitte, Schumann Street 20/21, 10117 Berlin

A. Reißhauer

Email: anett.reisshauer @ charite.de

Summary

Background

The interdisciplinary concept of tinnitus day hospital and the care of hospitalized patients consiliary the ENT Clinic of the Charité were from April 2002 to March 2003 189 patients with tinnitus, hearing loss and Menière studied manual medicine.

Method

According to a uniform documentation form in all patients was the finding survey of global and segmental joint mobility of cervical spine (), zervikothorakalem transition, 1st Rib and kranio-mandibulärem system. The muscles were lengthening ability and trigger points of the Mm. sternocleidomastoid, trapezius pars descendens, levator scapulae and masseter evaluated and statistically analyzed.

Result

It contains specific, recurring finding constellations in the joints and paraspinal musculature of the cervical

spine in tinnitus patients. Here are global restrictions of the cervical spine mobility in the foreground, which are influenced in detail by segmental joint dysfunction of the head joints and the cervicothoracic junction and muscle imbalances in the shoulder and neck muscles.

Conclusion

The results confirm the relevance of the manual therapy study findings in the context of diagnosis tinnitus. Therefore, the development of a standardized test sequence is to be required and to integrate a corresponding physical treatment in the interdisciplinary tinnitus therapy.

Keywords Tinnitus – joint disorders of the cervical spine – muscular imbalance – blocking cervical – trigger points

Functional disturbances of the cervical spine in tinnitus

Abstract

Background

A total of 189 patients with tinnitus, Meniere's disease, and sudden hearing loss underwent manual therapeutic examination at the Department of Physical Medicine and Rehabilitation in the setting of an interdisciplinary program for the management of patients of the tinnitus daycare center and Inpatients of the ENT department of the Charité Medical School.

Method

In all patients, global and segmental joint mobility of the cervical spine, cervicothoracic junction, first rib, and Craniomandibular system was assessed using standardized documentation. Muscle extensibility and trigger points were determined for the sternocleidomastoid muscle, the descending part of the trapezius muscle, the levator muscle of the scapula, and the masseter muscle.

Results

Results of the statistical analysis show that patients with tinnitus have characteristic and specific patterns of abnormalities in the joints and paravertebral muscles. The dominant finding is an overall impairment of cervical spine mobility, various factors contribute to Which. These include disturbed function of segmental joints of the head and the cervicothoracic junction as well as muscular imbalances of the shoulder and neck muscles.

Conclusion

Our results corroborate the clinical significance of manual therapeutic findings as part of the diagnostic workup for tinnitus. They show that a uniform and standardized examination protocol is needed, and that Appropriate physical therapeutic measures should be incorporated into the interdisciplinary therapeutic management of patients with tinnitus.

Keywords Tinnitus – Functional Disorders – Cervical spine – paravertebral muscles – trigger points

Ten percent of all adults experience tinnitus during their lives, have the temporary character, at 0.5% of the adult population, the tinnitus developed but for independent tinnitus disease [5]. In recent decades, extensive studies have been conducted on the causes and effects of tinnitus.

Pathogenesis and diagnosis

It is now known that it is a Tinnitus is a ringing in the ears, which occurs in most cases due to faulty coding of acoustic information without adequate external physical stimuli and is perceived as a separate sound event. As a cause of tinnitus disturbance of the peripheral or central auditory pathway are discussed, which can also occur in combination. An increase in the severity is due to influences of the limbic system and the prefrontal cortex [8]. The auditory cortex is the limbic system and the prefrontal cortex linked as a center for behavior, which allows the enhancing effect of psychological stress on explaining the tinnitus.

A rational diagnosis is the most important foundation of therapy because of objective evidence of tinnitus takes over the load to legitimize the disease from the patient. In addition to a careful history and instrumental diagnostics, especially for the characterization of an accompanying hearing loss and to exclude organic causes for tinnitus, tinnitus, the characterization made by psycho-acoustic diagnostics [23]. Psychological assessment is useful is when the tinnitus described as painful or daytime perceived as unnerving or continuously available.

A detailed diagnostic environment used to identify factors influencing the tinnitus, which can be influenced therapeutically. Here, the Doppler sonography of the carotid arteries and the manual diagnosis of spinal function, including radiological imaging of the cervical spine [9 , 18] emphasized. Biesinger [1] described in 1989, the importance of functional disorders of the cervical spine for the ear, nose and throat medicine and demanded an exact functional diagnostics, especially the upper cervical spine. When a young patient tinnitus through contraction of the levator scapula M. was provoked.

Concomitant functional disturbances were reported in patients with sudden deafness Terrahe, in sudden blockage in the segment C1 / 2, an irregular OC segmentation and deformation of the right lateral atlantoaxial joint could be found [20]. The relationship between the cervical spine and the efferent part of the auditory system shows also in the clinically evident reflex caused cases of tinnitus after manipulation of the cervical spine [3].

Based on the previous observations [1 , 3 , 20], one can postulate a summary that the craniocervical region is prone to failure and can respond to noxious stimuli with symptoms from the ENT doctor's office. Described in the literature include dizziness, hearing loss, headaches, facial pain, otalgia, dysphagia and Karotisschmerz. Therefore it is necessary, in our view, that repeatedly discussed disorders of the cervical spine in these diseases are examined in more detail and described, although the exact pathophysiological context so far can be explained only hypothetical.

Disorders of the joints

Joint dysfunction are an aspect of this diverse Störmöglichkeiten movement system, they lead to a restriction of movement that impressed in the general clinical examination as different page motion, the manual therapy study as impairment of joint game [14]. As biomechanical basis of joint dysfunction limitation of joint movement is called, which are characterized by very discrete deficits of active and passive

joint play.

The joint play consists of a millimeter in size translational motions under separation of the articular surfaces [13]. These movements are disturbed, it is called a functional obstruction caused by a reversible hypomobile dysfunction [19 is characterized]. Lewit [11] in 1968 described the persistence of previously diagnosed with myorelaxation blocking findings under anesthesia, so you can assume that blockages are caused in the joint itself.

Emminger [6] presented in 1967 on the theory that an entrapment meniskoider structures is impeded the sliding of the articular surfaces and the substrate thus blocking. Because of the functional unit of a joint with his muscles and nerve structures occurs concomitantly with joint disorders to muscle tension in the corresponding myotomes, which are then referred to as reflex analgesic symptoms. These are accompanied by hyperalgesia of the skin, hypertension the segmental muscles, the tendons and tendinopathy sympathotone irritation.

Segmental joint dysfunction be considered as a functional disorder, when they occur, regardless of pathomorphological changes. Are the joint dysfunction not only functional in nature, the underlying structural problems or malocclusion are presented in radiological diagnostics, this is a prerequisite for any further manual therapeutic intervention (recommendation doctors seminar Berlin).

Under osteopathic approach is necessary for optimal function, that all 4 major systems of the body are in harmony. Including the parietal system muskulofaszialen and skeletal portions which envelops the majority of the human body, the visceral system of the internal organs, which can change in conditions, the function and mobility muskulofaszial-skeletal system, the craniosacral system as muskulofaszial-skeletal compound by sacrum to the cranium, which may result in changes in voltage to influence the temporal bone and vestibulokochleärem system and psyche. All 4 systems are inter-functional balance.

The diagnostic procedure of otolaryngologists in tinnitus disease as can the osteopathic survey findings fit into the investigation procedures, as they considering a holistic concept considers the patient as a patient and not as a disease, tinnitus.

Study Design

Materials and Methods

The aim of the present study was to demonstrate dysfunction of the cervical segmental joints and muscles in tinnitus patients, in order to create the basis for a systematic manual therapy diagnosis in patients with tinnitus.

From April 2002 to March 2003 189 patients were studied manual medicine, which is an outpatient under the tinnitus clinic (n = 74, 39.2%) or konsiliarisch during a hospital stay (n = 115, 60.8%) in the Department of Oto Nose and Throat Medicine, Charité Campus Mitte imagined.

There were 41.3% female (n = 78) and 58.7% male (n = 111) patients. The average age was 45.7 years for females (minimum 11 years, maximum 84 years), 46.9 years for males (minimum 22 years, maximum 78 years).

In addition to patients with tinnitus exclusive disease (n = 148, 78.3% of cases) were included in the

analysis, patients (n = 41, 21.7% of cases) included suffering from combined diseases, so tinnitus in Menière and sudden hearing loss, who presented at the time point mainly because of tinnitus.

Unilateral pathologies were at the forefront of clinical pictures: right 54 cases (28.6%), left 77 cases (40.7%), both sides 58 cases (30.7%).

Based on the duration of illness before data are from 148 patients, of which 87 (58.8%) acute and 61 (41.2%) were chronically ill.

Examination process

Using a common finding the questionnaire, which was developed in advance of the examination according to publications on cervicogenic symptoms in Otolaryngology [1 , 2 , 20], in all patients, the study of global mobility of the neck, the exploratory analysis of head joints, the cervicothoracic junction, the first Rib and the temporomandibular joints. Besides isometric tension tests to determine muscular imbalances that made the verification of the ability of extension of the Mm. sternocleidomastoidei trapezium, and partes descendentes levatores scapula and the exploration of trigger points in these muscles.

The manual therapy techniques investigation followed the training concept of doctors seminar Berlin. In all exploratory investigations, the patient was sitting, both feet were bent at right angles to hip and knee replacements on the floor or a hard surface. To stabilize and prevent thoracic kyphosis supported the examiner from the patients of the dorsal. For the global mobility of the neck of the movement, the maximum motion amplitudes and the so-called terminal voltage of the movement were recorded.

In limitations of the overall movement was followed by the targeted segmental analysis. The documentation of the test results were consistent with a diagnosis questionnaire (Table 1 performed).

Table 1 examination sheet

HWS orientating		
Inclination / reinclination (35-45/0/35-45)		
Lateral flexion left / right (45/0/45)		
Rotation right / left (60-80/0/60-80)		
Halsfaszien		
Cervical segmental	Right	Left
Rotation 0-C3 total		
0/C1 lateral flexion		

0/C1 anteflexion				
C1 / 2 rotation				
C1 / 2 lateral flexion				
C2 / 3 rotation				
CTUE				
First Rib				
TMJ	Right		Left	
Asymmetry by mouth				
Musculature	Right		Left	
	Ductility	Trigger Points	Ductility	Trigger Points
Suboccipital				
Sternokleidomastoideus				
Masseter				
Trapezius pars descendens				
Levator scapulae				

Statistical basis

These data were obtained in a clinical, non-randomized study. Statistical analysis was performed with SPSS, version 11. Dependent variables were the individual characteristics of tinnitus, such as the affected side and duration of disease, defined. The various ranges of motion and their limitations as well as the acquired muscular findings correspond to the question related factors. The relationships between target and influences between the individual and the influencing factors were examined bivariate. Since two variables is dichotomous variables, the analysis was performed using χ^2 test for independence. The significance level was set at $p \leq 0.05$. In the same way correlations were determined between the individual variables.

Results

Unilateral tinnitus

With unilateral tinnitus were compared with bilateral tinnitus significantly more global disturbances of the left rotation ($p < 0.01$) and right rotation ($p < 0.01$). When comparing the various parties concerned could this level of significance are shown again. In right-sided tinnitus significantly more often, there are limitations to the right rotation ($p < 0.05$) and significantly more often in left-sided tinnitus disorders left rotation ($p < 0.05$).

In right-sided tinnitus showed significantly more craniomandibular dysfunctions right with blockages of the right temporomandibular joint ($p < 0.05$).

In addition, we saw that the limited functions are influenced by various global and segmental functional limitations (Table 2). The restriction of the global legal cervical rotation correlated with the restriction of the global retroflexion ($p < 0.05$), the global Rechtsseitneige ($p < 0.05$), global Linksseitneige ($p < 0.01$) and global left rotation ($p < 0.001$). In addition, the global rotation is right segmental blockages anteflexion segment occiput on C1 ($p < 0.01$), right rotation segment C2 to C3 ($p = 0.05$) and a blocked first Rib on the left ($p < 0.01$) influenced.

Table 2 tinnitus, n = 189, manual therapy findings

	Rotation		Lateral flexion	TMJ
	Right	Left	Left	Right
Segmental mobility				
Anteflexion Okziput/C1	*	*		
Linksseitneige Okziput/C1			*	
Rotation C2 / 3 right	*		*	
Right rotation CTUE		*		
Left rotation CTUE		**		
First Left rib	**	*	*	
Mouth				***
Muscular imbalance				
Sternokleidomastoideus right	**		*	

Sternokleidomastoideus left	*		*	
Trapezius pars descending right	**		**	
Trapezius pars left descending			**	
Levator scapulae right		**		
Levator scapulae left		**	*	
Trigger Points				
Sternokleidomastoideus right		*		
Trapezius pars left descending		*		
Levator scapulae left		*		

* P <0.05, ** p <0.01, *** p <0.01.

Also muscular dysfunctions affect global right rotation. The extension capacity of Mm. sternocleidomastoid right (p <0.05) and left (p <0.05) and the trapezius pars descendens right (p <0.01) also have a significant impact on the global movement restriction right rotation.

The global left rotation is significantly by the global functional limitations Rechtsseitneige the cervical spine (p <0.01), the left rotation of the head joints of the occiput to C3 (p <0.05), the anteflexion segment occiput to C1 (p <0.05), the two-sided rotation in cervicothoracic junction (right p <0.05, left p <0.01) and the mobility of the 1st Rib on the left (p <0.05) influenced. The extension capacity of Mm. levator scapulae on both sides (right p <0.01, left p <0.01) as well as trigger points in the Mm. sternocleidomastoid right (p <0.05), levator scapulae left (n = 102, p = 0.025) significantly change the global left rotation, the trapezius pars descendens right (p = 0.051) tended to.

Sided tinnitus

Tinnitus can be found at both ends compared to unilateral tinnitus frequent disruptions of global Linksseitneige and reduced elongation ability of the masseter muscle on the right. The deviation from the equal behavior is significant in the comparison of one-sided (p <0.05) with bilateral tinnitus for global Linksseitneige.

Even if both ends tinnitus shows the influence of some global and segmental movement disorders and muscular disorders. Limitations of global anteflexion (p <0.05), global retroflexion (p <0.01), global Rechtsseitneige (p <0.01) and global right rotation (p <0.01) show a rectified, significant relationship. For the segmental joint dysfunction were significant influences show through the left rotation of the head joints (p <0.01), the Linksseitneige segment occiput on C1 (p <0.05), right rotation C2 to C3 (p <0.05) and the

first Rib on the left ($p < 0.05$).

A reduced ability of the extension Mm. sternocleidomastoid right ($p < 0.05$) and left ($p < 0.05$), trapezius pars descendens right ($p < 0.01$) and left ($p < 0.05$) and left levator scapulae ($p < 0.05$) influenced the limited Linksseitneige duplexed tinnitus also rectified.

Malfunction in dependence on the duration of the disease

The statistical analysis of the individual disorders, depending on the duration of illness that most restrictions of movement are to be found in chronic tinnitus, but not in an acute illness from tinnitus (Table 3).

Table 3 , depending on the malfunction disease duration

Tinnitus	Acute	Chronic
Global mobility		
Anteflexion		***
Rechtsseitneige		***
Linksseitneige		**
Left rotation	*	
Segmental joint mobility		
Right rotation CTUE		*
Muscular imbalance		
Right masseter		*
Left masseter		**
Trapezius pars left descending		**

* $P < 0.05$, ** $p < 0.01$, *** $p < 0.01$.

The deviation from the equal behavior in chronic tinnitus for the global movements of the cervical spine disorders anteflexion significantly ($p < 0.01$), the Rechtsseitneige ($p < 0.01$) and the Linksseitneige ($p < 0.01$). Left rotation tends to be more common in acute tinnitus ($p = 0.072$) as limited in chronic tinnitus.

In the investigation of the segmental mobility of the joint, we saw that blockages in the rotation right cervicothoracic junction often tend ($p = 0.059$) occurred in chronic tinnitus than in acute tinnitus.

Neuromuscular disorders are found for the Mm. left masseter ($p < 0.05$), trapezius pars descendens left ($p < 0.05$) in chronic tinnitus significantly more frequent in acute tinnitus.

For acute events we saw significantly more unilateral action significantly more often in patients with chronic bilateral tinnitus ($p < 0.01$).

Discussion

In the present work, the influence of cervical dysfunction in the global ranges of motion, segmental mobility and muscles are checked for tinnitus sufferers to develop a basis for the systematic manual medicine diagnosis and therapy in patients with tinnitus.

Of the 189 tinnitus patients who have been examined by us manual medicine, the majority were acutely ill. Besides pure tinnitus and patients with Menière's disease and hearing loss were included in the study. Unilateral tinnitus forms represented the largest proportion of the disease in the studied group of patients represents

Movement restrictions

There were restrictions on movement, differing in expression and localization in unilateral and bilateral tinnitus. In comparison to previously published findings in tinnitus patients we saw especially dysfunction of global cervical spine with limitation of motion volumes, not individual joint dysfunction [20].

With unilateral tinnitus were found depending on the affected side of tinnitus significantly more global restrictions on movement of the left and right rotation, with bilateral tinnitus significantly more restrictions on Linksseitneige.

In right-sided tinnitus, there were significantly more frequent craniomandibular dysfunctions right jaw with reduced joint mobility. This fact underscores the importance of recent publications on the relationships of temporomandibular disorders and tinnitus [12 , 16 , 22] that in the guidelines of the German Society of Oto-Rhino-Laryngology, Head and Neck Surgery [10 found] consideration. Perez could prove 2003 in a study of dysfunction of the masticatory system in tinnitus patients had a significantly higher prevalence of the tenderness of the jaw muscles in comparison to a control group [15]. Arthrogenic dysfunction of the temporomandibular joints were in tinnitus patients but not more frequently than in the control group.

Taking account of functional linkages, such as those described, inter alia as one of the founders of Lewitt manual therapy, we evaluated the influence of the global movements of the cervical spine by individual motion segments. In addition, muscular findings in terms of modified extension capability and trigger points are to be expected. This chaining pattern found in modern society due to the ever unphysiologischeren movement patterns in the workplace and in daily life becomes increasingly important.

We have shown that muscular imbalances of the Mm. sternocleidomastoid, trapezius and levator scapulae pars descendens a significant impact on global rotation disorders have. The altered muscular extension capability and trigger points in these muscles, which proved to be significant factors correspond in part with the previous manual therapeutic observations, inter alia by Travell and Simons [21 objects were classified]

as regards the trigger point areas. Here are the pain areas of the Mm. sternocleidomastoid and masseter ear and jaw joint assigned.

Blockages

Also have an influence on global segmental joint movements Funktionsseinschränkungen the cervical spine was demonstrated. In addition to that shown in previous publications context of segmental joint dysfunction of the cervical spine and tinnitus [1] it presents a much more complex interference pattern as previously described. The global law rotation is significant blockage of the head joints and the first Rib, limitations of global left rotation are significant first by blocking the head joints, the cervicothoracic junction and impaired mobility Rib influenced. In case of malfunction of Linksseitneige we saw as a significant determinant of the head joints and blockages of the 1st Rib.

Depending on the duration of disease blockages right rotation in the cervicothoracic junction were tended more often in chronic tinnitus than in acute tinnitus. Muscular dysfunction were observed in the Mm. masseter and left trapezius pars descendens left in chronic tinnitus significantly more frequent in acute tinnitus.

Acute tinnitus was associated significantly more often with unilateral chronic tinnitus significantly more common with bilateral tinnitus.

Based on the chronicity of the disease can therefore expect that in bilateral tinnitus forms a chronic course is more common than unilateral disease, especially if a bilateral tinnitus is accompanied by muscular imbalances in the masseter muscle.

Pathophysiological considerations

About the possible physiological interrelationships of presented disorders of the cervical spine with tinnitus, there may be only hypothetical explanations, since neither the pathophysiology of tinnitus [10 are shown] nor correlations between tinnitus and cervical spine. Assuming that the functional unit of the upper cervical joints is regarded as an intermediate sensory organ, which with vestibular and visual system regulates the adjustment of body position, oculomotor and spatial orientation [2], and that the sensory information from the head joints on the iliotibial spinoventibularis spinal cord in the brainstem and forwarded here with the vestibular nuclei interconnected [4], are offering the diagnostic manual therapy the possibility of detecting malfunctions in the beginning of the information chain.

By joint blockage occurs in the corresponding reflex myotomes an imbalance of tonic and phasic muscle activity, and muscle imbalances as well as the formation of trigger points in the muscles may be the result. Osteopathy also provides correlations of voltage increases in the Halsfaszien flying in connection with the Körperfaszien from caudal to cranial to dysfunctions of the craniosacral system. Tinnitus patients usually suffer from considerable interference with the muscle balance throughout the movement system. Any change in the mobility of the musculoskeletal system in the sense of hyper-or hypo mobility can lead to malfunction [17].

Critically discuss is whether the malfunction as a result of tinnitus occurred or existed prior to that as a triggering factor. For the hypothesis that joint blockages and muscular imbalance can be the cause for tinnitus case reports speak of the past few years, in the clinically evident reflex caused cases of tinnitus after manipulation of the cervical spine is a relationship between cervical spine and the efferent part of the

auditory system has been postulated [13 , 14].

As a result of ongoing study evaluating therapy for tinnitus patients is planned. Here are favored above all serial applications for muscle relaxation, trigger point deletion and mobilization of joint blockages. This will also confirm the previous findings ENT medical colleagues [would be 7] possible.

Conclusions

For various diseases from the otorhinolaryngological range correlations have been described with functional disorders of the cervical spine, especially noteworthy among these are cochlear and vestibular symptoms. Due to the close anatomical relationship between the bony spine and the proprioceptors of the facet joints, the upper neck joints regulate the vestibular and visual system, the interaction of oculomotor, spatial orientation and body position. With a functional disorder of the cervical spine motion, it may be a disturbance of this movement system.

By these data, which were determined in a retrospective clinical study, the influence of global movement disorders of the cervical spine and cervical dysfunction in segmental joints and muscles are shown in tinnitus patients.

The restriction of the global mobility of the neck had, unlike segmental dysfunction of the cervical spine. Significant impact on tinnitus Disorders of the head and jaw joints could be, unlike previously published [1 , 7 , 20], does not represent an independent pathognomonic image in tinnitus patients, but were nevertheless significant factors linked to the global mobility of the neck. It led to an identification of differences between single-sided and double-sided tinnitus and between acute and chronic tinnitus.

The results support the previous view that a thorough manual therapeutic examination, as already by Biesinger and Terrahe [1 , 20 was required], has meaning in the context diagnosis of tinnitus and confirm the previously subjective impression that disorders of the cervical spine a common finding are in tinnitus.

A case-control study, and a prospective randomized study to evaluate the results so far and effectiveness of potential therapies is to require the course.

Conclusion for practice

One can from the data of this retrospective clinical study concluded that there are characteristic limitations of the global mobility of the cervical spine in tinnitus. If any such malfunction, should be followed by a manual therapeutic investigation, as we were able to show that segmental joint dysfunction and muscular dysfunction in the cervical spine have a significant impact on the global restriction of movement in the cervical spine in tinnitus patients.

Conflict of Interest:

No details

Literature

- 13732
- Division of the Anatomical Institute, Leipzig
- First Biesinger E (1989) Functional disorders of the cervical spine in its importance for the ear, nose and throat medicine. ENT practice today 9: 130-147
- Second Biesinger E, et al. (1994) ear pain and functional disorders of the cervical spine. ENT 42: 207-213
[PubMed]
- Third Biesinger E, et al. (1998) Strategies in the outpatient treatment of tinnitus. ENT 46: 157-169
[CrossRef] [PubMed]
- 4th Brodal A (1974) Anatomy of the vestibular nuclei and their connections. In: Kornhuber HH (ed) Vestibular system, Springer, Berlin Heidelberg New York
- 5th Coles RRA (1984) Epidemiology of tinnitus: (1) Prevalance. J Laryngol Otol 98 [Suppl] 9: 7-15
- 6th Emminger E (1967) The anatomy and pathology of the blocked vertebral joint. In: Big D (eds) therapy on the nervous system Vol VII (chiropractic - Manual Therapy). Hippocrates, Stuttgart, S 117-140
- 7th M sleeve, Hölzl M (2004) Effectiveness of manual medicine in otolaryngology. A retrospective longitudinal study. ENT 52: 227-234
[CrossRef] [PubMed]
- 8th Lenarz T (1998) Diagnosis and treatment of tinnitus. Laryngorhinootologie 77: 54-60
[PubMed]
- 9th Lenarz T (1999) tinnitus. ENT 47: 14-18
[PubMed]
- 10th Lenarz T (1999) tinnitus. Guidelines of the German Society of Oto-Rhino-Laryngology, Head and Neck Surgery. ENT 47: 14-18
[PubMed]
- 11th Lewit K (1968) Contribution to joint reversible blockage. Z Orthop Grenzgeb 105: 150-158
- 12th Marx G (2000). On working with orthodontics and dentistry in manual medicine It Med 38: 342-345
[CrossRef]
- 13th JMcM Mennell (1964) joint pain. Little Brown Co, Boston
- 14th Neumann, HD (1999) Manual Medicine. An introduction to theory, diagnosis and treatment, 4th Ed
Springer, Berlin Heidelberg New York
- 15th Peroz I (2003) dysfunction of the masticatory system in tinnitus patients compared to a control group. ENT 51: 544-549
[CrossRef] [PubMed]
- 16th Peroz I (2001) otalgia and tinnitus in patients with temporomandibular dysfunction. ENT 49: 713-718
[CrossRef] [PubMed]
- 17th Philip E. Greenman (2005) Textbook of osteopathic medicine. Haug, Stuttgart

- 18th Prochno T (1997) from the viewpoint of tinnitus dentistry. Dtsch Ärztebl 94 B: 313-315
- 19th Axis J (2000) Impaired function of spinal block. In: Sachse J (eds) spine. Manual testing and mobilization treatment. Urban & Fischer, Munich, Jena, S 9-16
- 20th Terrahe (1985) The zervikokraniale syndrome in the practice of ENT specialist. Layngol Rhinol Otol 64: 292-299
- 21st Travell JG, Simons DG (1998) Handbook of muscle trigger points. Gustav Fischer, Jena, Stuttgart, Ulm, Lübeck
- 22nd Türp JC (1998). For relationship between craniomandibular disorders and ear symptoms (otalgia, tinnitus) ENT 46: 303-310
[CrossRef] [PubMed]
- 23rd Wilhelm T, et al. (1995) Standardization and quality assurance on the example tinnitus. Laryngorhinootologie 74: 300-306
[PubMed]

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