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What is the best treatment for TMD comparing physiotherapy and other approaches?

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Thesis

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Preface

Temporo Mandibular Dysfunction is also known as cranio mandibular pain syndrome. It is a highly actual topic because more and more people are suffering from this problem.

There is an increase of people suffering from this condition and if one takes a look at the numbers of patients with the symptom groups of TMD such as Tinnitus and headaches, it can be concluded that the number of TMD patients must be quite high. There are different symptoms such as the inability to open the mouth completely, severe headaches and tension in the neck area. There are two types of TMD, primary and secondary. The difference between the two types is the cause. Primary TMD is caused by structural deformities such as Scoliosis, Arthritis of the mandibula, leg length discrepancy and others. Leg length discrepancy e.g. leads to the formation of a scoliotic curve in the lower back. As a compensation, the thoracic and cervical spine form a curve into the other direction, which affects the position of the head as well as the head and neck musculature, possibly resulting in a TMD.

Secondary TMD can be due to psychosocial stressors such as stress at work (external stressors), wrong posture, stress in the private life and within the person (internal stressors), pressure that affects the daily life and that causes muscle tightness in neck and head area resulting in pain and other signs and symptoms.

Signs and symptoms include tension headaches, cervico genic headaches, migraine, neck and shoulder pain, Tinnitus, Vertigo and even Trigeminus Neuralgy. Misinterpretation of the symptoms and non-identification of the actual cause often lead to a wrong diagnosis and therefore wrong treatment. Currently, there are different treatment options including different health care disciplines. These treatments are carried out by general practitioners, dentists, psychologists or physiotherapists.

This following Professional Assignment Project (PAP) deals with this topic. It consists of two parts, a theoretical part and a practical part. The theoretical part, which is the main part, is a literature research about the treatment approaches for patients with TMD. For the researchers the goal is to evaluate the different treatment approaches and to find the best treatment or best treatment combination in the short and in the long run. Based on this literature research, a systematic review is written that presents the results of the research, answering the research question. This work just involves literature, reading and judging of it.

The smaller second part is a case study that the research group conducted on three volunteers at the client's office. This is a practical part where the researchers had the opportunity to see patients who suffer from TMD, to observe different treatment methods like acupressure, circular friction, manual therapy as well as acupuncture. The research team had the chance to actively ask questions and to note the difference pre- and post treatment. After a time frame of four weeks, a reassessment of the effects of the therapy form was performed. The interesting resulting question of this practical part is to see if there are or if there are no similarities in the outcome of both parts, what the similarities are or what the differences are.

Table of contents

Abstract

Introduction

Temporo Mandibular Dysfunction (TMD) is a common condition leading to different symptoms in the head and neck area. In recent literature, there is no clear statement about the cause and the incidence of TMD. There are many treatment options discussed, but the most efficient one for the reduction of pain is not found yet. The aim of this research is to find the best treatment.

Methods and materials

A literature research with in the end 17 articles was conducted and a systematic review was written.

For this, different data bases such as Pubmed and Cochrane were searched. The articles were evaluated with a criteria list.

Results

All articles, which were included into the analysis, stated that physiotherapy was an effective approach, either as the only treatment or combined with other therapies.

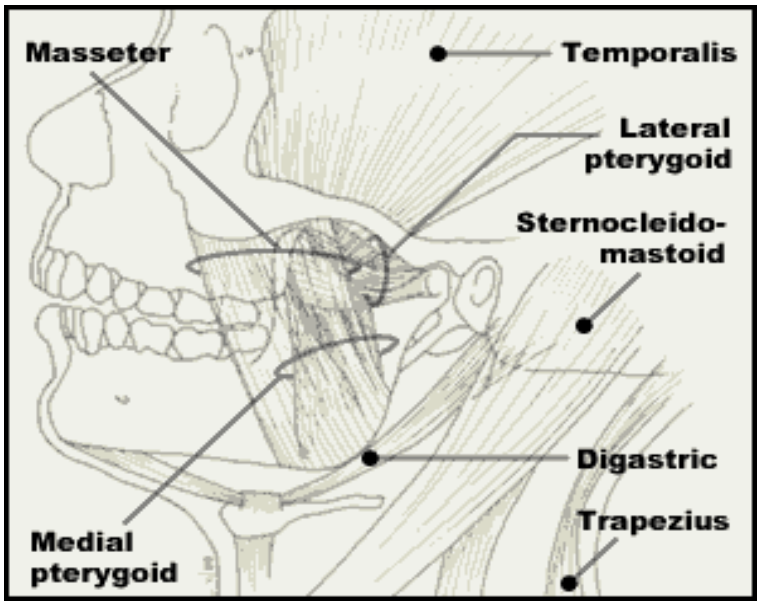
Conclusion

It can be concluded that physiotherapy is a very beneficial treatment by itself and in combination with others. Also other approaches show positive effects.

Keywords: TMD, best treatment, physiotherapy, pain

Introduction

Temporo Mandibular Dysfunction (TMD), which also has different synonyms such as orofacial pain syndrome and others, is the umbrella term for musculoskeletal complaints within the neck and head area including the chewing system. The muscles that are mainly affected by TMD are the muscles of the neck and the chewing system. As the drawing below shows, the Masseter as well as the medial and lateral Pterygoid, the Digastric and Temporalis and finally the Trapezius and Sternocleidomastoid could be involved.



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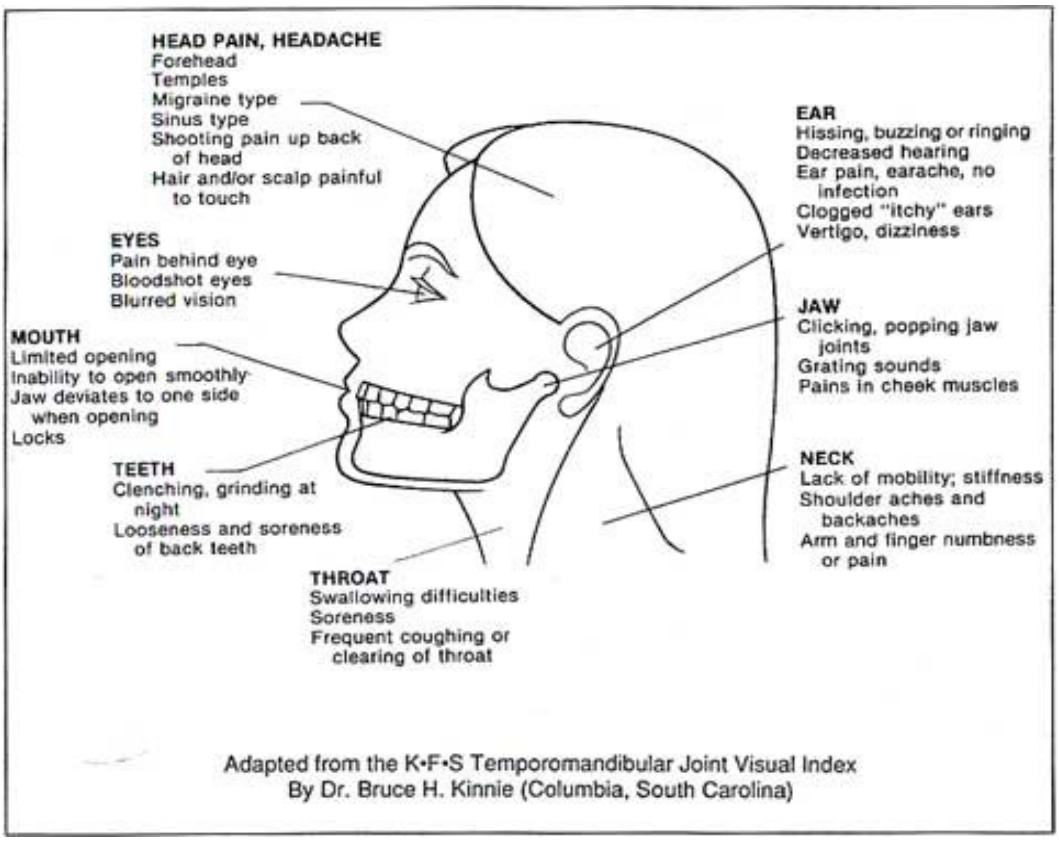
As Carmeli et al state in their research, there is no consensus about the etiology of TMD among researchers. This is also manifested by the differences in the articles which were found by the research team. Some articles (Ritenbaugh 2008, La Touche 2009) state that more women are affected than men while others state that there is no difference between genders (Smith et al 2006). Also about the numbers there are varying statements. According to one article (Ritenbaugh 2008) three percent of the population has livelong symptoms of TMD, while in another article (Wright 2000) 20 percent of the population is affected. The age of TMD patients varies, but it is mostly found from adolescence on (Isberg 1998).

It is a high actual topic and more and more people are suffering from this problem; especially in a time of socioeconomic and sociocultural pressure at the present time. Many people have a high level of stress due to different reasons such as the fear of losing their jobs, working hard financial problems and private stress. These stressors may lead to higher muscular activity and higher muscle tone. The higher muscle tone decreases the circulation which in turn

increases the muscle tone even more and finally leads to muscle tightness. This has a close relationship with the pain experienced by the patients. Muscle tightness increases the pain and the pain may increase the muscle tone even more.

There is a wide range of symptoms, by which TMD is characterized. These symptoms include pain in the jaw muscles when chewing, limitation in jaw mobility and opening of the mouth, crepitus or friction when opening and closing the mouth, radiation of the pain into mouth, face, head, neck, shoulder and back, Tinnitus, Vertigo, problems in neck, spine and shoulder, limited head rotation and side flexion, different types of headaches and ear pain. Even Trigeminus Neuralgy may be a result. To diagnose a patient with TMD, at least three symptoms have to be present (Sellmann 2009).



There are two types of TMD: Primary TMD is of structural origin and includes abnormalities like scoliosis, leg length discrepancy, not -leveled pelvis, osteoarthritis of the jaw and other structural deformities or abnormal developments.

Secondary TMD in contrast is of social and psychological origin, meaning wrong working position during the day (e.g. in front of the computer), posture, external and internal stress, tension, biting the teeth at night and others. It may be difficult to find THE cause. In most cases, the causes are multifactorial. This indicates the need for a thorough patient history and

assessment. Only if the right diagnosis is made, the treatment can be done efficiently and really help the patient as good as possible. Because of the multiplicity and variety of the causes, one treatment approach by one health discipline may not be sufficient as only a group of symptoms is treated. In contrast, a multidisciplinary approach is recommended as the best and most successful treatment by some sources (Sellmann 2009, Komiyama 1999, Abrahamsen 2009).

As the research group consists of future physiotherapists, the focus is on the physiotherapy approach. Therefore this systematic review is of much relevance for physiotherapists. Furthermore, it is relevant to other healthcare professionals because of the comparison to other approaches and the possible combination of different treatments.

There is already some literature (e.g. Ernst 1999, Mc Neele 2006, Medlicott 2006, Tuerp 2004) about the discussed topic available in form of articles and systematic reviews. The aim of the research group is to find the best treatment at this present time to reduce pain in TMD patients. Therefore a comparison between physiotherapeutic and other approaches was conducted and all the already existing literature needed to be evaluated in a systematic literature review. Since the current systematic reviews were written three to four years ago, there are new articles (e.g. Ismail 2007, La Touche 2009, Nilsson 2009, Ritenbaugh 2008) and new knowledge which had to be integrated to keep the "state of the art". This is why the research group decided to use systematic reviews as well as "normal" articles for the research. Furthermore, practical examples are included. Throughout the research, the project group intended to find out which treatment approach is the most beneficial one comparing physiotherapeutic approach and other approaches for adult patients with Temporo Mandibular Dysfunction with regards to the reduction of pain and muscle tightness in the short (one to two days) and long run of at least four weeks.

Therefore the research question is:

"What is the most efficient treatment comparing the physiotherapy approach and other approaches for adult patients with Temporo Mandibular Dysfunction with regards to the reduction of pain and muscle tightness in the short and long run?"

Methods

Literature research:

Three different electronic data bases, namely the Cochrane library, Google scholar and Pubmed, were searched for relevant literature throughout a time period of about four weeks. Within the databases the research group worked to find the most relevant results. The start was done with a more general search term combination which obviously led to a lot of hits. In order to reduce the number of hits and to filter the hits better matching the mentioned research question, the members of the group added an extra search term or combined the search terms differently. The key words used were the abbreviation TMD, therapy, pain and best treatment. The search terms consisted of different combinations of these keywords. The focus of the researchers was on pain as dependent variable. They did not use muscle tightness as a separate search term because of the earlier mentioned relationship between muscle tightness and pain and because the amount of muscle tightness is hard to evaluate, as it is best measured by ROM testing. (Simons 1998).

The team started to search Google scholar which showed a very high number of hits (10.700). Four of these results were of relevance regarding the research question. The search term combination was: “TMD and therapy”. A quick screening of the headings and abstract helped to get an impression if the article should be selected for further analysis. A lot of the articles obtained from Google Scholar were not of interest since a lot of articles had either interventions or control groups that did not fit into the provided definition of Physiotherapy or other treatments or only case studies were mentioned.

It was quite confusing and it was hard not to lose the overview because all different electronic data bases were included within this Google scholar search engine. That is why the team decided to go directly to the individual databases such as the Cochrane library and Pubmed. The number of hits was reduced a lot through this step.

In the Cochrane library the search term combination “TMD and therapy” led to 51 hits. By adding “and pain”, the number of hits was reduced to 32 hits. Out of those the team initially screened the titles and abstracts to determine the possible relevance and interest. Ten out of the 51 hits and two out of the 32 hits were of interest and therefore used for further research. The not used articles had different treatment approaches such as surgery, which were not considered; or the subjects were children which was one of the exclusion criteria.

Finally, the database Pubmed was searched. Entering three different search term combinations, nine results were found. Also in this database a decrease in the number of hits

was obvious after specifying twice the search term combination. That is why with the first search term combination “TMD and therapy” 1378 hits came up, out of which three results were of interest after taking a first look at the titles. The MeSH terms used by Pubmed were as follows: TMD [All Fields] AND ("therapy"[Subheading] OR "therapy"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]).

By adding “and pain” to “TMD and therapy”, only 458 hits were found. Five results were useful. The following MeSH-terms were used by Pubmed: TMD[All Fields] AND ("therapy"[Subheading] OR "therapy"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]) AND ("pain"[MeSH Terms] OR "pain"[All Fields]).

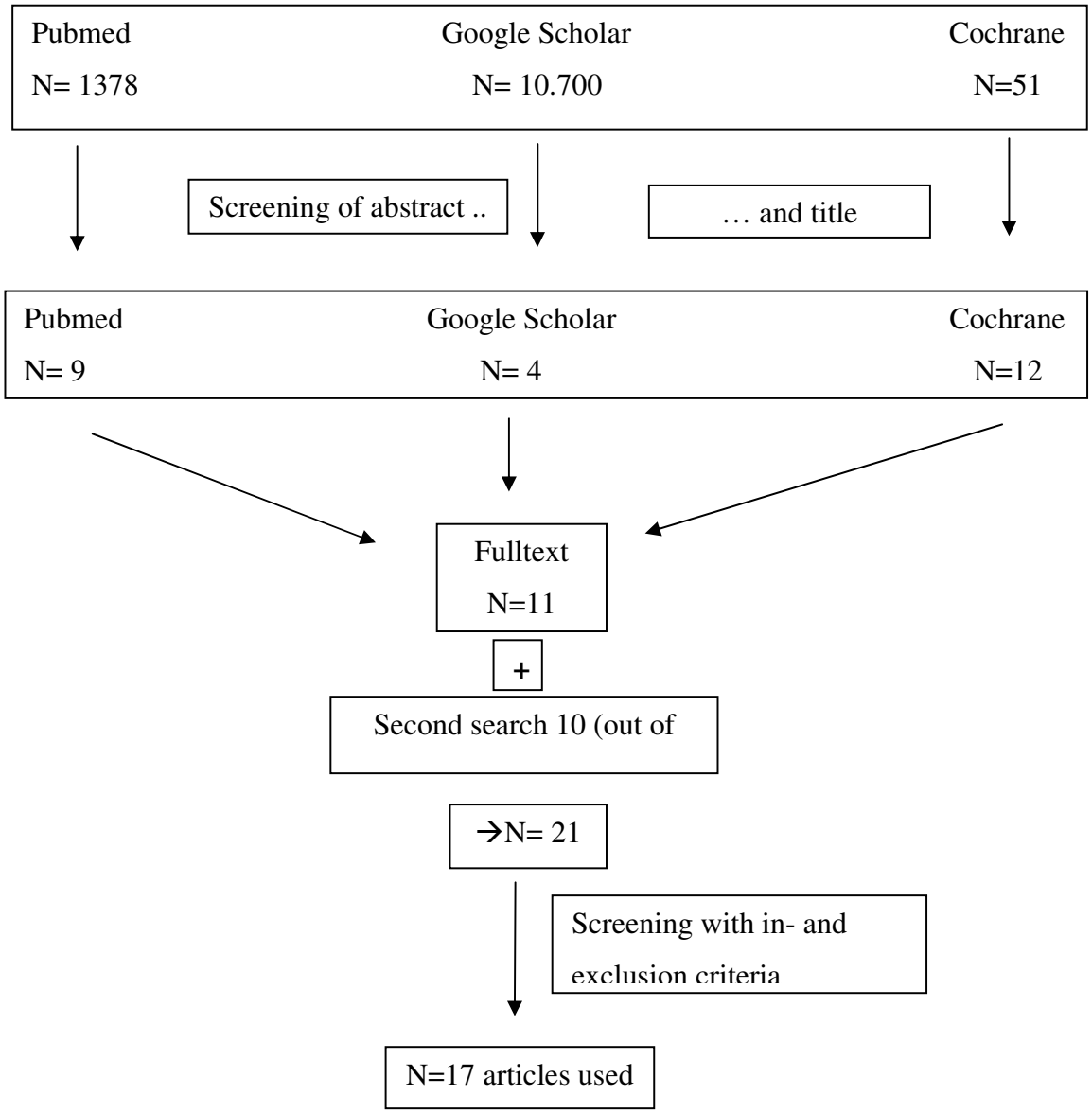
Finally, the number of hits was reduced to 29 hits with the search term combination “best treatment for TMD” leading to one relevant result.

Pubmed used the following MeSH terms: best[All Fields] AND ("therapy"[Subheading] OR "therapy"[All Fields] OR "treatment"[All Fields] OR "therapeutics"[MeSH Terms] OR "therapeutics"[All Fields]) AND TMD[All Fields].

A lot of these hits could not be used from the first view of the Pubmed database as the studies were case studies, the subjects were children or medication or surgery was the used intervention or that some of the hits did not meet others of the inclusion criteria. Therefore, overall nine relevant articles were selected from the Pubmed search engine.

This literature only included abstracts and not the full text articles. This first search yielded 25 articles. Eleven full text articles could be retrieved from these. In order to get the other fourteen articles, payment would have been needed. A second research was conducted to find more articles. The same search terms and combinations as mentioned before were used for this. Finally, the references of the retrieved articles were checked for relevant literature. Twelve articles seemed to be useful and were searched accordingly. This search gave another ten full text articles as a result. From these 21 full text articles, which seemed relevant for the research, four were excluded after screening the whole article with the help of the inclusion and exclusion criteria. In the end, the research group selected 17 articles including four systematic reviews, which were used in the study.

Pictogram search process



Definition of physiotherapy treatment:

Physiotherapy treatment can include different types such as mobilization and (homework-) exercises.

Definition of other treatments:

After revising existing literature about treatment of TMD, it became obvious to the research group that many articles focused on a comparison of the physiotherapy approach with one or combinations of the following approaches:

From the psychological area: hypnosis, cognitive behavioral therapy, relaxation therapy and patient education, in which the patient learns about the disorder and the corresponding treatment.
From the Traditional Chinese Medicine: Acupuncture.
Finally, there are the splints, also called appliances, of which there are different types and varying materials used.
Furthermore, combinations of physiotherapy with one or more of the mentioned approaches are compared to one or a combination of the different approaches.

Inclusion and exclusion of articles:
The full text articles were initially screened with the help of inclusion and exclusion criteria. An article was included if (1) it was written in English or German, (2) the words TMD or its synonyms were used, (3) the participants were adolescents or adults (at least 14 years of age) and (4) the study design was a randomized clinical trial or a retro- or prospective study.
An article was excluded if (1) it was a case study only, because these are of low scientific value (Moed 2009) or (2) if the study was completed with children.
All included articles were analyzed further by means of a detailed criteria list (appendix).

Evaluation and grading of the quality of an article with the criteria list:
For the evaluation of the articles, a criteria list, which can be found in the appendix, was used. This was designed by using the strong parts of several existing criteria lists (Beck et al 2009). The list consists of different elements and categories that characterize a scientific article of relevance for the research team. Each element gets a score, depending on if and how each particular element is fulfilled or not. A manual with instructions on the use of the criteria list and the scoring was added in order to clarify the list and to keep the inter-rater reliability of the researchers as high as possible. All the scores of the elements per category are added; after that, the sum of all category end-scores is calculated leading to a total score of the article. A number of maximally 100 points can be reached. The end score can be one of four quality classifications:

1. 90-100 points: the article is of high quality and relevant for our purpose
2. 60-89 points: the article is of good quality, relevant
3. 40-59 points: the article is of moderate quality, can still be used
4. <40 points: the article is of low quality, will not be included

It is possible to say that the higher the score, the higher is the quality of the article.

With the help of this literature review mainly, the research team hoped to answer the research question. Besides that, a few longitudinal case studies on patients with TMD were executed for the researchers' practical interest and to help finding an answer to the research question.

Grading of systematic reviews:

As systematic reviews can not be graded in the same way as the other articles, the research group followed the line of the criteria list but focused on the parts which are relevant for systematic reviews such as date of publication, the general format or the referencing style. Other points needed adjustment. For example the number of subjects was replaced by number of articles. In general, it can be said that systematic reviews have a higher value because they already summarize many articles. The criteria list for systematic reviews can be found in the appendix as well. Overall, the maximum score is 75 points, which implies the highest quality. As in the criteria list for the normal articles, there are four classifications according to which the quality of each systematic review can be determined.

Trial quality of literature:

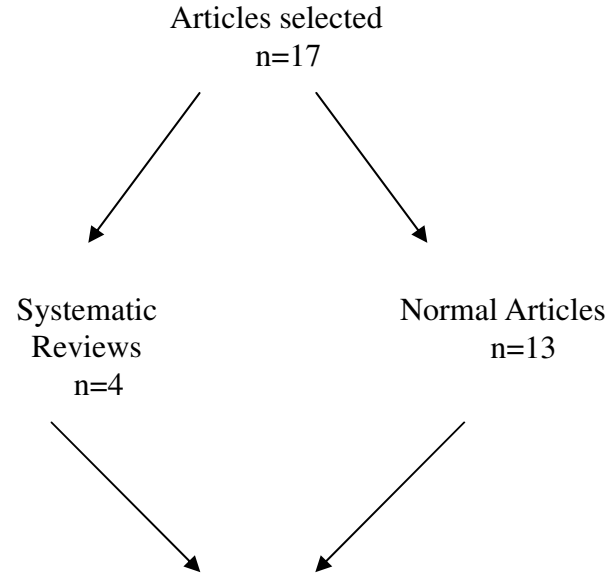
In order to keep the inter-rater reliability even higher (beside using a manual), a PILOT study on one of the articles was conducted. Both members had to evaluate and grade the same article and then the result of each member was compared. Only minor differences were found during the evaluation and then discussed and clarified.

Results

In total 17 articles were evaluated by the research group.

They all met the inclusion criteria and reached an acceptable score on the grading list. All of the articles were rated as good, meaning they are relevant for the researchers' study. Three out of the four systematic reviews were of high quality and one was of good quality. Nine articles dealt with the topic of physiotherapy in combination with other therapy types or physiotherapy only in comparison to one or several other therapy approaches. Four articles used acupuncture as an intervention compared to sham acupuncture or other treatments. Two articles focused on the psychological approach compared to or in combination with physiotherapy. Two articles compared two different types of splints with each other.

Distribution of the articles:



Physiotherapy (n=9):

Physiotherapy as a main intervention or as a supplement to another therapy does show a positive effect in the treatment on TMD.

Psychological therapy (n=2):

This approach has a positive effect, but there is only a small difference between different techniques.

Acupuncture (n=4):

Real acupuncture has a positive effect on TMD patients.

Physiotherapy:

The combination of home physiotherapy and patient education in comparison to patient education alone showed to be slightly more efficient than patient education only (Michellotti 2004). A Michigan splint in combination with physiotherapy is more effective than a Michigan splint only (Ismail 2007). Compared to a soft splint physiotherapy shows to be the better treatment in relation to pain and ROM (Carmeli 2001). According to La Touche (La Touche 2009), manual therapy and exercises at the cervical spine are helpful in the reduction

of the symptoms. Postural training combined with cognitive behavioral therapy compared to no treatments at all show a higher benefit in the pain-free mouth opening and pain than cognitive behavioral treatment only, as Komiyama (Komiyama 1999) stated. The combination of postural training and self management in comparison to self management only show to give significantly better results (Wright 2000).
The three analyzed systematic reviews (Medlicott 2006, Tuerp 2004, Mc Neele 2006) come to the result that physiotherapy is a useful approach in the treatment of TMD or a good supplement to other therapies.

Psychological treatment:
Stam (Stam 1984) stated that there is no difference in the treatments with hypnosis and cognitive coping compared to relaxation and cognitive coping. Both treatments show to be more effective than no treatment at all. According to Abrahamsen (Abrahamsen 2009), there is a slightly better result for hypnosis in the treatment of TMD versus relaxation therapy.

Acupuncture:
List (List 1992) stated that acupuncture is as efficient as occlusal splint therapy over a one year follow up. There is a significantly greater effect of acupuncture and naturopathic medicine compared to specialty care (splint therapy and pain management) (Ritenbaugh 2008). According to Smith (Smith 2006) real acupuncture has a better treatment outcome than sham acupuncture. Finally the systematic review of Ernst (Ernst 1999) comes to the conclusion that acupuncture is a helpful tool to treat TMD.

Splints:
There is no statistical significant difference between the resilient appliance and the non-occluding control appliance in reducing TMD pain from a short-term perspective (Nilsson 2009). According to Truelove (Truelove 2006), there is no significant difference between soft splint and hard splint, both combined with self care.

Table with outcome

Author & Year	Quality	Intervention	Control	Outcome	Conclusion
Physiotherapeutical approach (9 articles)					
Carmeli et al, 2001	Good	Passive mobilisation and active exercises	Treatment with a soft repositioning splint	Pain --	Intervention > control
Ismail et al, 2007	Good	Michigan splint	Michigan splint & supplementary physiotherapy	Pain --	Intervention < control
Komiyama et al, 1999	Good	• Posture correction +CB • CB only	No treatment at all	Pain --	Intervention 1 > intervention 2 > control
La Touche et al, 2009	Good	Manual therapy and exercises to the cervical spine	No control or comparison	Pain --	Short- and long term effects visible
Mc Neele et a,l 2006 (SR)	High	physiotherapy	Several other approaches		Intervention > control
Medlicott et al., 2006 (SR)	High	• Physiotherapy • Physiotherapy & others	Other therapy forms		Intervention 2 > Intervention 1 >

					control
Michellotti et al, 2004	Good	Patient education and home physiotherapy regimen	Patient education only	Pain --	Intervention > control
Tuerp et al, 2004 (SR)	High	Physiotherapy	Other therapy approaches		Intervention = control
Wright et al, 2000	Good	Posture training+ self management instructions	Self management only	Pain not directly measured	Intervention > control
Psychosocial approach (2 articles)					
Abrahamsen et al, 2009	Good	Hypnosis	Relaxation and visualization of a safe relaxing place	Pain -	Intervention > control
Stam et al, 1984	Good	1)Hypnosis&cognitive coping skills 2)Relaxation&cognitive coping skills	No intervention	Pain -	Intervention 1 > intervention 2 > control
Acupuncture (4 articles)					
Ernst et al, 1999	Good	acupuncture	Sham acupuncture		Acupuncture is

(SR)					effective
List et al, 1992	Good	acupuncture	occlusal splint therapy	Pain -	Intervention = control
Ritenbaugh et al, 2008	Good	1) TCM and NM	Specialty care (bite splints, pain management)	Pain --	Intervention > control
Smith et al, 2006	Good	Real Acupuncture	Sham acupuncture	Pain --	Acupuncture is effective
Splint therapy (2 articles)					
Nilsson et al, 2009	Good	treatment with a resilient appliance	treatment with a hard, palatal, non-occluding appliance	Pain ---	Intervention = control
Truelove et al, 2006	Good	1) Self care + high cost hard splints 2) Self care + low cost soft splints	Self care (exercises, hot packs, relaxation)	Pain --	Intervention 2 = intervention 2 = control
			→ positive effect of every approach for the reduction of pain as outcome		

SR: Systematic Review

-: Pain decreased by 0 – 20 mm on the VAS

--: Pain decreased by 21 – 40 mm on the VAS

---: Pain decreased by 41 – 60 mm on the VAS

>: better effect than; =: equal effect as; <: smaller effect than

In nine articles the intervention showed a greater decrease of pain than the control group

Only one article shows the better effect in the control group

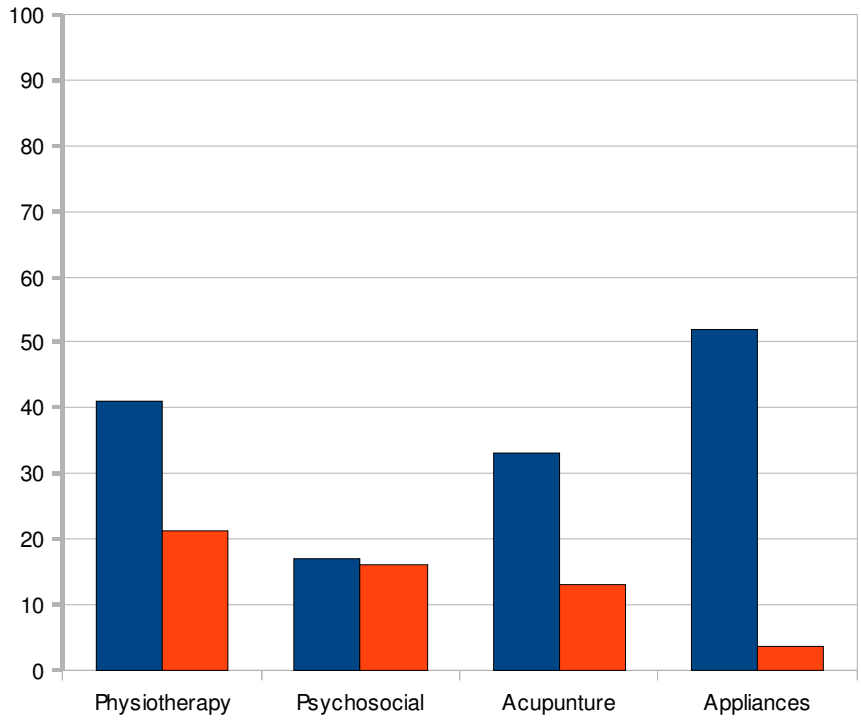
In four articles both groups show the same results

Three articles do not have a control group

The systematic reviews do not give specific numbers for pain

In all the evaluated articles a positive effect of every approach is reported for the reduction of pain as outcome. The article of Wright was excluded from this section because he did not state pain outcomes specifically. All the systematic reviews were not considered for this list either because there are no mean values given which were necessary.

Maximum and minimum pain decrease:



Blue maximum and red minimum decrease

The according table can be found in the appendix

Discussion

Physiotherapy alone seems to be a quite efficient treatment as it becomes obvious in three of the articles (Carmeli 2001, La Touche 2009, Mc Neele 2006). The reduction in pain on the VAS scale ranges from 21,2mm to 36,8mm which is a very significant outcome. Physiotherapy as a supplement to other approaches (splint and cognitive behavioral therapy) lead to drastically better treatment results than the other approaches alone (extra 10mm to 20mm). The combinations resulted in a decrease of pain up to 41mm on the VAS. This may be an indicator that physiotherapy is a good therapy as therapy alone or in combination with

other approaches. It shows that the use of physiotherapy added to another therapy is slightly more effective.

Acupuncture shows a smaller maximum decrease in pain than physiotherapy (23mm to 33mm on the VAS) which indicates that it is a less effective approach.

The psychosocial approach presents only a small improvement of pain with 16mm to 17mm on the VAS scale. This is a lot less than the other approaches which may imply the need for physical treatment, such as hands on physiotherapy or acupuncture needles. It can be guessed that the outcome of this type of treatment is strongly influenced by the individual's susceptibility to the treatment.

The results of splint treatment are varying in efficiency. As Nilsson (2009) states it decreases the pain by 52mm on the VAS scale, while Carmeli (2001) did not find a significant pain reduction. Even though Nilsson (2009) states a very good result for the treatment with appliances (52mm), which is even better than physiotherapy, it needs to be mentioned that two other articles state the additional value of physiotherapy to splint therapy. The differences between the multiple types of splints are quite insignificant so it does not matter which appliance is used (Truelove 2006).

Problems that occurred during the research were that a lot of the literature stated studies that were done with women only; that is why they are only partially generalizable. It has a high external validity when looking at studies in which is explained that the incidence of TMD is much higher in women than in men (La Touche 2009, Sellmann 2009).

Because the synonyms of TMD were not taken into account as search terms, there is a possibility that not the complete literature relevant for the study was found. In further research these should be added when conducting the literature research to gain better and maybe more specific results.

Looking at the inclusion and exclusion points as well as the criteria list itself, it must be said that the researchers first did not want to use systematic reviews; however, some of these types of articles were used as they do provide good overviews over the present situation regarding treatment. This is why an additional criteria list just for the systematic reviews was created.

During the literature research the group also realized that there are a lot of studies with young subjects in the adolescence years. For this reason articles with adolescents as subjects from the age of 14 on were also included and not just adult aged subjects. Some literature states that during the adolescence, the time of growing and development the jaw may change and develop, the teeth form differently and muscles develop more (Isberg 1998). This has to be taken into account as it may influence the development of TMD.

None of the articles actually discussed muscle tightness specifically. It can be assumed that the less the muscle tension, the lower the pain level. Therefore the outcomes discussed in the systematic review focus on pain level only and not as originally intended, on muscle tightness.

Many articles lost some points as no reliability and validity was stated or explained; only three articles actually stated some of these values. Some of the articles could have had "high quality" instead of "good quality" if the score would have been a bit higher. The researchers did not evaluate all articles together or compared the results after the individual judgments. This may lead to a lower inter-reliability despite the manual for the criteria list and the PILOT study that was performed in the beginning before any article was judged independently and therefore, influence the outcome of the article grading. As it became obvious, many articles scored high on the criteria list and therefore were rated as good or high quality articles it is a question if smaller ranges (e.g. 10 instead of 20 or 30 points) would have led to more distinct quality levels. This way a clearer link between the quality of the articles and their outcomes could possibly be drawn.

Another encountered problem with the literature review was that physiotherapy was very often combined with other treatments and then compared to more than one other treatment. It would be of great interest to see the effect of physiotherapy only compared to a control group that does not have any intervention at all, or that receives one type of treatment approach.

Even though the research group wanted to be objective, there was a chance that Physiotherapy was the favored approach as the members are future physiotherapists. The research group already had an expectation regarding the outcome before the research was conducted which was that the combination of different treatment approaches would lead to the best results in pain reduction (multi-disciplinary approach)

More articles, if possible, RCTs, in which physiotherapy as the only intervention is compared to one other approach (e.g. acupuncture) would be very helpful because it would lead to more specific results for this research question.

It is hard to find the best treatment for TMD patients as this disorder has multifactorial causes, which are different in each individual patient. This could explain why all the different approaches showed positive effects on TMD symptoms. Considering the results of this research, it is possible to say that physiotherapy seems to be a very effective approach as a single or additional treatment for TMD.

As literature states (Sellmann 2009, Komiyama 1999, Abrahamsen 2009) and based on the practical research, there is no unique therapy form because of the diversity of causes. It seems

that certain health disciplines are just able to focus on a group of symptoms, which can be helpful, but which does not cure the patient. In order to get a complete picture of the patient and the complaints, a holistic approach integrating different health disciplines could be beneficial.

Practical part:

The research group followed the treatments of three patients with TMD at the client's office in Guetersloh, Germany. The client is a general practitioner and is specialized in sports medicine, manual therapy, psychosomatic medicine and acupuncture, TCM. Included were three volunteers, two women and one man, who allowed the research team to observe a treatment session itself and then to let the research team ask questions of a self created questionnaire, which relates to a few general data of the patients, the TMD symptoms, influence of the TMD on the daily life, therapy and duration. Those questions included the following items:

- Mouth opening ability (pre and post treatment)
- Age
- VAS-scale score (pre and post treatment)
- Sex
- Profession
- Stress-level at work
- Influence of TMD on daily life
- Symptoms
- Onset of TMD
- Time since start of therapy
- What kind of effects
- How long do effects last
- Other tried therapy approaches
- Personal strategy
- Medication
- Dominant hand
- Mostly affected side

The questionnaire can be found in the appendix.

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The research team was able to see different approaches in the client's office. One of them consisted of slight pain point massage on the Masseter muscle and manual therapy on the thoracical spine on one young lady in the 30s. The other female patient in the 40s was treated with acupressure on the Trapezius and Sternocleidomastoid muscle, followed by a 20-minute acupuncture treatment**.** For her the points were LI 11 (Large Intestines), LR 3 (Liver), ST 6 (Stomach), SI 19 (Small Intestines), BL 10 (Bladder) as well as GB 20 and GB 21 (Gall Bladder). This case is very special to the researchers because the patient suffers from primary as well as secondary TMD. Some restrictions can not be cured by the treatment as there are structural changes in her jaw. The pain level and muscle tension can be significantly reduced, but the ability to open the mouth can only be improved slightly. The client reported that the patient tends to grind and bite the teeth regularly, especially during the night.

One man was treated with acupuncture only, a session of 20 minutes. For him the points were GB 20, GB 21 and GB 34 (Gall Bladder), BL 20 (Bladder), LI 4 (Large Intestines), LR 3 (Liver) and finally the "Parasympaticus Meridian".

The research team was able to ask the patients about the pain intensity on the Visual Analogue Scale (VAS) prior to the treatment and right after the treatment (short term effect). The patients have to give a number to the pain level, 0 being no pain and 10 being extreme pain. This scale is widely used in the assessment of pain intensity and shows a high reliability and validity (Medlicott 2006, Gallagher 2002, Gould 1990). At this time all the other questions from the questionnaire were discussed as well. A follow-up on these three cases was conducted after a four week interval (long term), in order to assess the pain intensity before the next treatment. In the second meeting, only VAS and mouth ROM was evaluated and not the whole questionnaire repeated.

Results of the follow up with the two patients on November 20th, 2009:

After a four-week time interval, two out of the three patients were interviewed again regarding pain, muscle tension and the effectiveness of the treatment. One of the patients did stop the treatment and was not available for further questions. This patient is a drop-out. The reevaluation showed the same results as the literature research.

Mrs. J. stated that her pain level (VAS) decreased from 50mm to 40mm pre-treatment compared to the pre-treatment four weeks ago. She sees a long-term effect and not only a short symptomatic relief. Since the beginning of the first manual/acupuncture therapy she

realizes a good progress and beneficial effect on symptoms and muscle tension and thinks the pre-treatment pain level is decreasing. It can be noted that the treatment with acupuncture and additionally low dosed muscle relaxants show a very good effect, short and long term relief of symptoms. According to the client, the use of muscles relaxants is essential in the management of chronic pain. This patient still report that relapses can occur in case of extreme stress.

Mr. S. showed a slight increase of symptoms (between 40 and 50 mm on the VAS) compared to the first measurement. He explains this with a high present stress level. In the meantime, he did experience a big relief of symptoms. Usually he has a longer lasting effect. He even reported that the treatment can lead to a two to three month-long, painfree episode. He therefore assumes it has a long term effect, but the effect of the treatment strongly correlates to his stress level.

Discussion:

With regard to the practical part it is to say that the sample size was very small and that the subjects could not be randomized. These patients volunteered as subjects for our study. If there was more time for the research, it would have been very interesting to have a bigger sample size, where a randomization could have been done; where stricter inclusion and exclusion criteria would be possible and therefore, obtain a more representative population. Also a stricter physiotherapy treatment protocol and a stricter medical or other approach would have been a better idea to have a more accurate comparison. The researchers dealt more or less with a holistic approach from the client, which, according to him, indicates the solution as the treatment of the TMD problem. For the case studies, acupuncture showed the best outcome in relation to pain reduction. The outcomes of the practical part show a good effect in the short run, directly after treatment and a few days after. Furthermore the participants stated pain reduction in the long run. In most of the articles only the long term effect was discussed. Because of this, the research question could only partially be answered with regards to long term effects. Short term effects can be concluded from the case studies, but due to the small sample size it is not generalizable. For a good practical research, a larger sample size, a stricter protocol and more influence on the actual treatments would be necessary. Furthermore a longer time period would be needed to conduct a RCT with a more representative value.

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Appendices

Questionnaire for the practical research part:

Pre-treatment:

- On a scale from 0-10, 0 being no pain and 10 being extreme pain, at what level is the pain right now at this point? (VAS scale)?

_____

_____

- Can you please open your mouth and describe how it feels.

_____

_____

Post treatment:

29. 1) On a scale from 0-10, 0 being no pain and 10 being extreme pain, at what level is the pain right now at this point? (VAS scale)?

_____

_____

30. Can you please open your mouth and describe how it feels.

_____

_____

General and specific questions:

1) How old are you?

_____

_____

2) What is your current profession?

_____

_____

3) Do you have a lot of stress at work and in your daily life?

_____

_____

4) How does the pain affect/influence your daily life? (at work, free time, eating and other ADL?)

_____

_____

5) Since when do you have that problem, the symptoms?

_____

_____

6) What other symptoms do you have except for pain?

_____

_____

7) How long have you been in therapy?

_____

_____

8) How long does the effect/relief of the treatment last?

_____

_____

9) How do you feel the effect? (relaxation, less pain etc)

_____

_____

10) Have you tried other therapies?

_____

_____

11) If so, which ones?

_____

_____

12) Do you have an own strategy that helps you to cope with the symptoms or leads to a reduction of the symptoms?

_____

_____

13) If so, which one?

_____

_____

14) Are you taking any medication like pain medication?

15) Which side is mainly affected?

16) What is your dominant hand?

Outcomes real patients

Age	Sex	Dom hand	Profession	Stress level	Symptoms	Time with TMD	Therapy	Effect	Coping	Medication	Vas pre	Vas post	Long term effect
33	F	R	Secretary	Very high: Job & daily live	Pain, Hypertension, Sleeping problems, Toothpain, Depression	13y.	Manipulation THS, CS, pain point massage (masseter) for the first time Other: Fango, massage, sports	Increased ROM CS, less pain,	Sport	Sleeping pills	70	35	Not stated
47	F	R	Translator	High at the Job okay in home situation	Headache, Hypertension, Pain, Sleeping problems	30y.	Acupunture, homeopathic injections, pain point massage	Less pain, More energy	Aikido Reki Warmth Gymnastics	Pain medication, Amitryptiline	60	0	45

							Other: Orthodontists treatment stopped after 5-7 times, because there was no effect						
38	M	R	Construction engenieer	High at job and Home situation	Back and shoulder pain	1y.	Acupuncture Only self tryout	Less pain, relaxed	Aikido Gymnastics Swimming	Pain medication if needed	30	0	45

Pain table:

Author	Baseline VAS (mean) in mm	Endpoint VAS (mean) in mm	Difference VAS (mean) in mm
Carmeli	Physiotherapy: 2,83 SD 16 Splint:3,0 SD 1,63Uses PPI	PT: 1,44 SD 12 S: 2,83 SD 1,78	Pt: -1,39 S: -0,17
Ismail	Physiotherapy & splint: 50 Splint: 38	PTs: 10 S: 18	PTs: -40 S: -20
Komiyama	IT 1(Cognitive Behavioral): 60 IT 2 (Cognitive Behavioral+ Posture): 61 Control Group: 68	12 months follow up: IT 1: 29 IT 2: 20 CG: 35	IT 1: -31 IT 2: -41 CG: -33
La Touche	Physiotherapy: 55,5; SD: 8,6	12 week follow up: 18,7; SD:7,1	-36,8
Michelotti	Physiotherapy: 29.3 SD 21.6 Education: 21.6 SD 19.5	Pt: 8.1 SD 14.4 E: 10.8 SD 13.1	Pt: -21,2 E: -10,8
Ritenbaugh	Specialty Care: 54 ;SD:20 TCM: 55; SD: 26 NM: 58; SD:27	(3 months) SC : 40 SD: 18 TCM: 32 SD:21 NM: 35 SD: 24	SC: -14 TCM: -23 NM: -23
Smith	Real Acupuncture: 62 Sham Acupuncture: 14	7-day follow up: RA: 29 SA: 13	RA: -33 SA: -1
List	Real acupuncture:21 Sham acupuncture: 22	RA: 8 SA: 10	RA: -13 SA -12

Stam	Hypnosis 61,8 relaxation 50,9 control 51,3	H: 44,8 R: 34,9 C: 55,9	H: -17 R: -16 C: +4,6
Abrahamsen	Hypnosis: 45; SD: 21 Control Group: 42; SD: 14	H: 29; SD: 24 CG: 39; SD: 15	H: -16 CG: -3
Nilsson	Resilient splint: 75 Palatal splint 69	RS: 23 PS: 26	RS: -52 PS: -43
Truelove	Hard splint: 52; SD: 22 Soft splint: 60; SD: 22 Usual Care: 54; SD: 22	12 months follow up: HS: 29; SD: 26 SS: 34; SD: 26 UC: 30; SD: 26	HS: -23 SS: -26 UC: -24

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