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LEARNING PACKAGE ABOUT TEMPOROMANDIBULAR JOINT FOR PHYSIOTHERAPY STUDENTS IN SATAKUNTA UNIVERSITY OF APPLIED SCIENCES

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This thesis is written in the purpose of creating a self-study material of temporomandibular joint disorders for the students of degree program of physiotherapy in Satakunta university of applied sciences. The aim of this thesis is to create evidence-based learning-package of the most important features related to temporomandibular joint physiotherapy. The material of the thesis was gathered trough literature review and this construct of the thesis report and the self-study material which was created with Microsoft PowerPoint.

Temporomandibular joint disorders (TMDs) are relatively common in health care which creates a need for future physiotherapists to be aware of the topic and be ready to treat clients suffering from temporomandibular joint disorders. Physiotherapeutic treatment approaches alongside with multi-professional co-operation with dentists and doctors have been shown good results on treating TMDs.

This thesis and learning package introduce reader to the anatomy of temporomandibular joint, temporomandibular joint disorders, classification of the disorders, physiotherapeutic assessment and physiotherapeutic treatments of temporomandibular joint disorders.

CONTENTS

1 / INTRODUCTION

Temporomandibular joint is really specific and small part of human body but still it a really important part and joint what people uses constantly. Temporomandibular joint disorders (TMDs) are relatively common in occurrence and even though typically doesn't need treatment, its high occurrence in health care creates a need for health care professionals to be aware of this important joint what we all use daily and create awareness in different physiotherapeutic treatment approaches related to it. This thesis and learning package are written because my personal interests in the topic and after discussions with the lecturers in the degree programme of physiotherapy in Satakunta university, that there appeared to be a need for this type of self-study material for the degree students included in the musculoskeletal studies to create more awareness and assist learning concerning this topic. This learning package consists of the aspects of anatomy, terminology, assessment and forms of treatment modalities that the literature supports that are important to the subject. Why I was personally interested in this topic is because in my close family and friends there is multiple people who are affected by TMDs and I have seen how it can have a negative effect on persons activities of daily living. I was interested to learn more about conservative treatment approaches on treating TMDs and in the subject as whole.

2 AIM AND OBJECTIVES OF THE THESIS

Aim of this thesis is to create an evidence-based learning-package about physiotherapy related to temporomandibular-joint disorders for physiotherapy students in SAMK (Satakunta-university of applied sciences).

The objectives of the learning package and self-study material are to provide to the physiotherapy student a base-level of knowledge about temporomandibular joint disorders (TMDs) and the conservative treatments related to it. This thesis teaches and introduces physiotherapy students to the unique features of temporomandibular joint and helps to create an understanding of how the client assessment and treatments are

done in TMDs based on the current evidence. The end-product of this thesis is a learning package which could be easily accessible for the students and efficient to use in the learning process.

3 ANATOMY OF TEMPOROMANDIBULAR JOINT

3.1 Joint anatomy and how it functions

The temporomandibular joint (Figure 1.) is the joint and articulation between the jawbone and head. It is a joint which is constantly under use and it allows us to do many life essential functions such as speaking, chewing, kissing, blowing etc. (Helland 1980.) The temporomandibular joint is constructed by the condylar process of mandible fitting in to the mandibular fossa of the temporal bone in the skull. Seen from outside superficially the temporomandibular joint is situated below the posterior end of zygomatic arch, anteriorly to the ear canal. (Agur, Dalley 2015, 648-651.) The intraarticular disc within the joint capsule is working between the mandible and fossa of temporal bone (Okeson 1996.) The temporomandibular joint has more fibrous cartilage and less hyaline cartilage. The fibrocartilage allows the joint to withstand the friction and pressure in a long-term use. (Shaffer, Brismée, Sizer, Courtney 2014.)

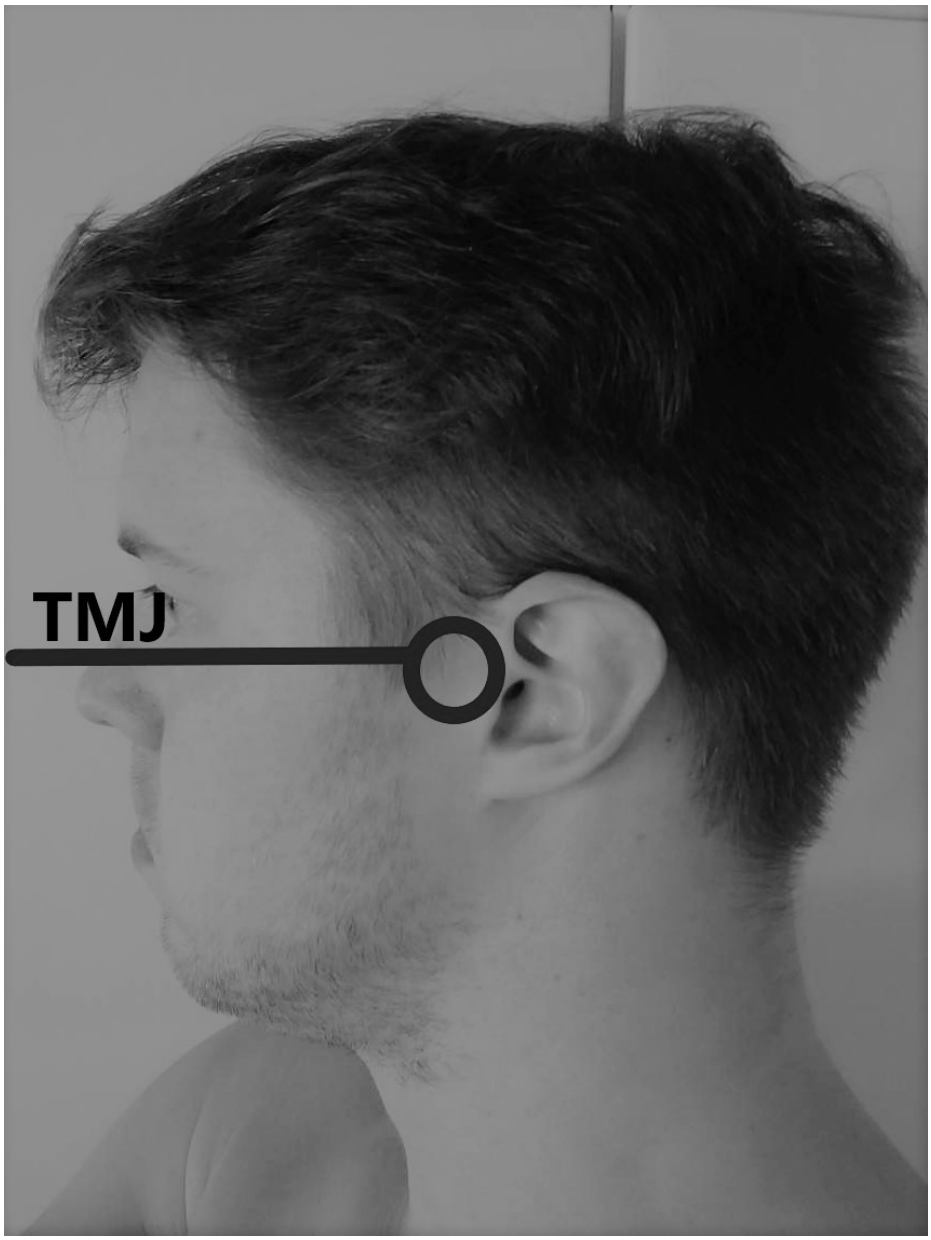

Figure 1. Location of temporomandibular joint. (c. Topi Kulmala)

Mandible, often called as the jawbone is the biggest and strongest bone of the face (Helland 1980). Mandible is attached to the temporal bone (Figure 2.) from both sides and those attachments (temporomandibular joints) creates it to be the only joint and attachment that moves freely in the head area (Walker 2014, 67-68). Mandible is curve-shaped, and its neck has two projections: the posterior and round one is called condylar head often referred as head of condyle, and the anterior projection with a sharper head which is called the coronoid process. The posterior condylar head of mandible articulates and forms the temporomandibular joint with the glenoid fossa. (Agur, Dalley 2015, 648-651.)

Temporal bone is the other joint forming bone which is anatomically anterior to the ear canal and posterior to the zygomatic arch. More specifically the glenoid fossa of temporal bone forms the temporomandibular joint with the head of mandible. (Agur, Dalley 2015, 648-651). The articular surface of the glenoid fossa is concave and has a smooth surface which contains meniscus or an articular disc. (Levangie, Norkin, 2011, 213-230.)

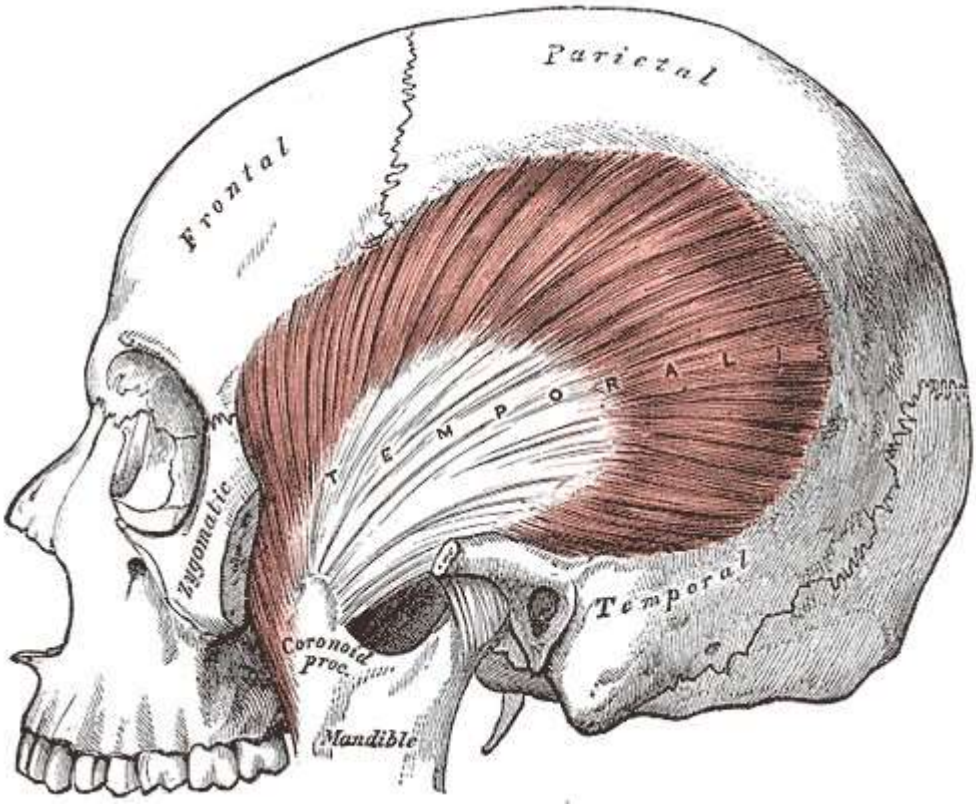

Figure 2. Bones of scull and the temporalis muscle. (Fig.382, Gray, 1918)

3.2 Ligaments

The temporomandibular joint has three different ligaments (Figure 3.). These three ligaments are lateral ligament, sphenomandibular ligament and stylomandibular ligament. (Agur, Dalley 2015, 648–651.)

Lateral ligament consists of two short bands on the surface of the articular capsule that originates from the inferior border and the tubercle of the zygomatic process of tem-

poral bone to the lateral and posterior side of neck of mandible. It strengthens the lateral aspects of the joint and prevents displacement of the mandible. (Agur, Dalley 2015, 648–651.) Parotid gland, which is a salivatory gland, covers the lateral ligament (Tortora, Derrickson 2014, 275).

Sphenomandibular ligament is a thin ligament between the spine of sphenoid bone and the ramus of the mandible (Helland, 1980). Sphenomandibular ligament does not produce significant strength on the function of temporomandibular joint (Agur, Dalley 2015, 648–651).

Stylomandibular ligament is a ligament between styloid and mandible which is formed of thickened band of fascia (Helland, 1980.) It originates from the styloid bone and attaches to the border of the ramus of mandible (Agur, Dalley 2015, 648–651). The ligament separates the salivatory glands, parotid and submandibular gland from each other and limits the movement of the temporomandibular joint (Tortora, Derrickson 2014, 275).

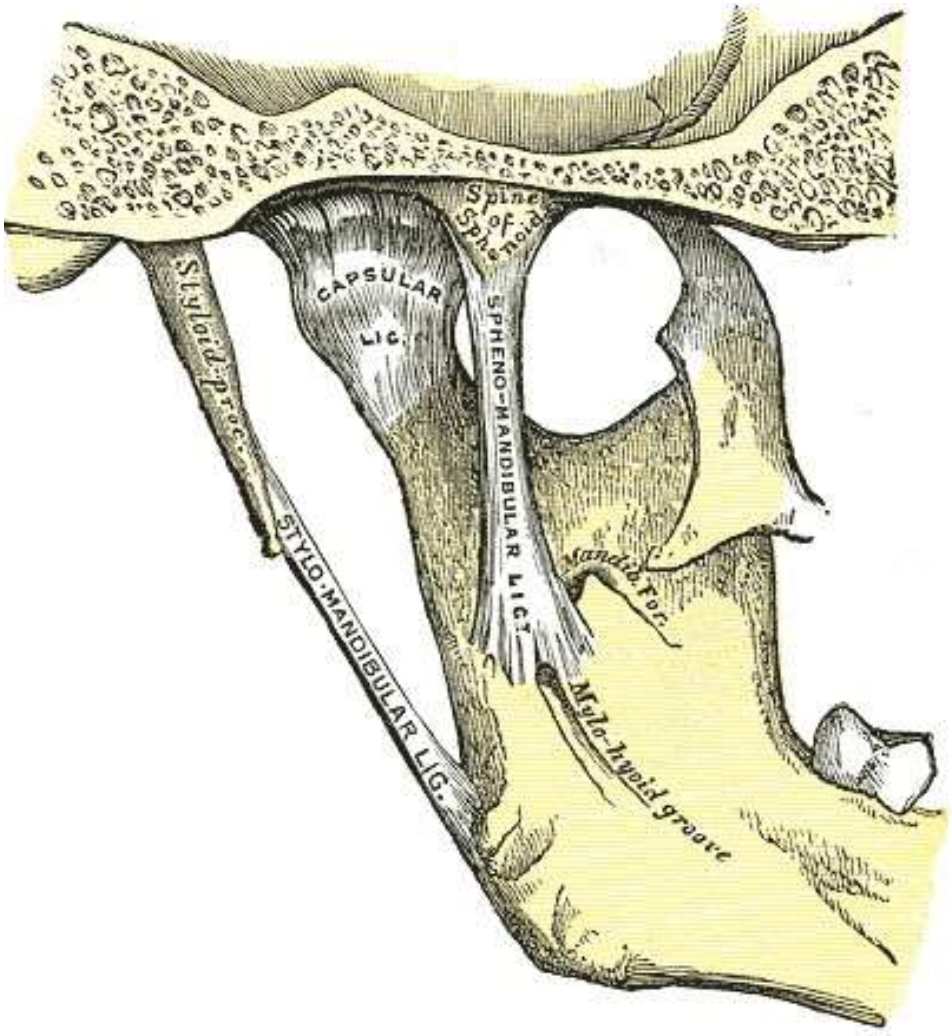

Figure 3. Ligaments of temporomandibular joint. (Fig.310, Gray, 1918)

3.3 Muscles

Muscles acting on temporomandibular-joint, which are also called muscles of mastication (chewing). Muscles of mastication are temporalis, masseter, pterygoid lateralis and pterygoid medialis. (Helland 1980.)

Temporalis is originated from the floor of temporal fossa and deep surface of temporal fascia and it is inserted to the tip and the medial surface of coronoid process and anterior border of ramus of mandible bone. Its action is to elevate the mandible and close the jaw. It also creates retrusion of the mandibular bone after protrusion. (Agur, Dalley 2015, 648-651.)

Masseter muscle originates from the inferior border and medial surface of the zygomatic arch. Its insertion is at the lateral surface of ramus of mandibular bone and coronoid process. Main action of masseter muscle is to elevate and protrude mandible and this way closing jaws. Masseter muscle also creates retrusion of the mandibular bone after protrusion. (Agur, Dalley 2015, 648-651.)

Lateral pterygoid (Figure 4.) has two heads called superior- and inferior head of lateral pterygoid. Origins of the superior head of lateral pterygoid are infratemporal surface and crest of the greater wing of sphenoid bone. Inferior head originates from lateral surface of lateral pterygoid plate. Insertion surfaces for both heads of pterygoid are the neck of mandible, articular disc and capsule of temporomandibular joint. The muscle acts bilaterally and unilaterally. While working bilaterally it protrudes mandible and depresses chin and while working unilaterally alternately, it produces side-to-side movements of mandible and jaw. (Agur, Dalley 2015, 648-651.)

Medial pterygoid (Figure 4.) also has two heads called deep – and superficial head of medial pterygoid. Deep head originates from medial surface of lateral pterygoid plate and pyramidal process of palatine bone. Superficial head originates from tuberosity of maxilla. Both heads are inserted to medial surface of ramus of mandible, inferior to mandibular foramen. Its action is to help to elevate mandible thus closing the jaw. It can act both bilaterally and unilaterally. Acting bilaterally, it protrudes mandible and working unilaterally it protrudes the side of jaw and acting alternately it produces a grinding motion in jaw. (Agur, Dalley 2015, 648-651.)

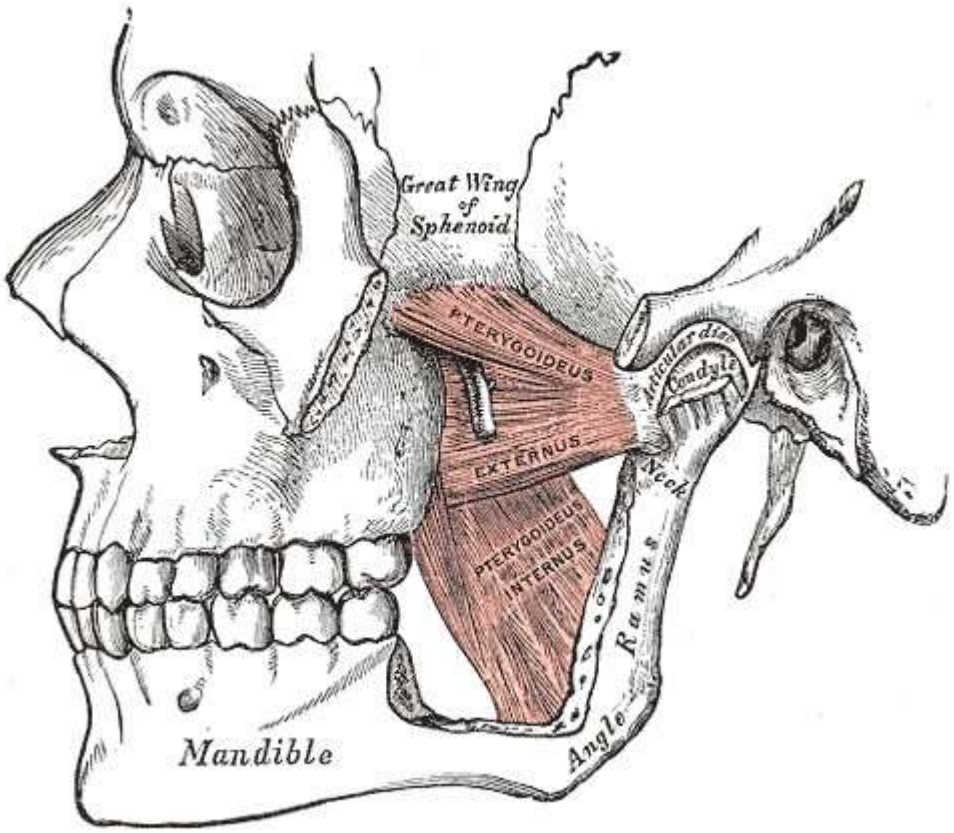

Figure 4. Lateral view of the temporomandibular joint and pterygoid muscles. (Fig.383, Gray, 1918)

There are also other muscles working on the head area and assisting the function of temporomandibular joint and the needed functions to living, such as swallowing. The muscles are categorized to already listed muscles of mastication (chewing) and to muscles of deglutition (swallowing). (Helland, 1980.) Following muscles have been noted that assist or are related the function of the temporomandibular joint and this way needs to be recognized and noted considering physiotherapy and anatomy knowledge of the head and neck area (Gross, Fetto, Rosen 2015, 81-93).

The suprahyoid muscle, which is an assisting muscle on deglutition, locates under the mandible, over the hyoid bone on the anterior side of neck and throat. The muscle constructs from four smaller muscles: digastric, stylohyoid, geniohyoid and mylohyoid. (Gray, 1918, 391-393.)

Also, the following muscles have shown relation to TMDs and must be noted when treating temporomandibular joint disorders. Those muscles or muscle groups are trapezius, suboccipital muscles, semispinalis cervicis and capitis, levator scapulae, sternocleidomastoid and the scaleni muscles. (Levangie, Norkin,2011 ,220-221.) These muscles have shown importance to the TMD and it is shown that there is a need to treat both temporomandibular joint and cervical spine disorders or postural problems alongside each other. (Gross, Fetto, Rosen 2015, 81-93.)

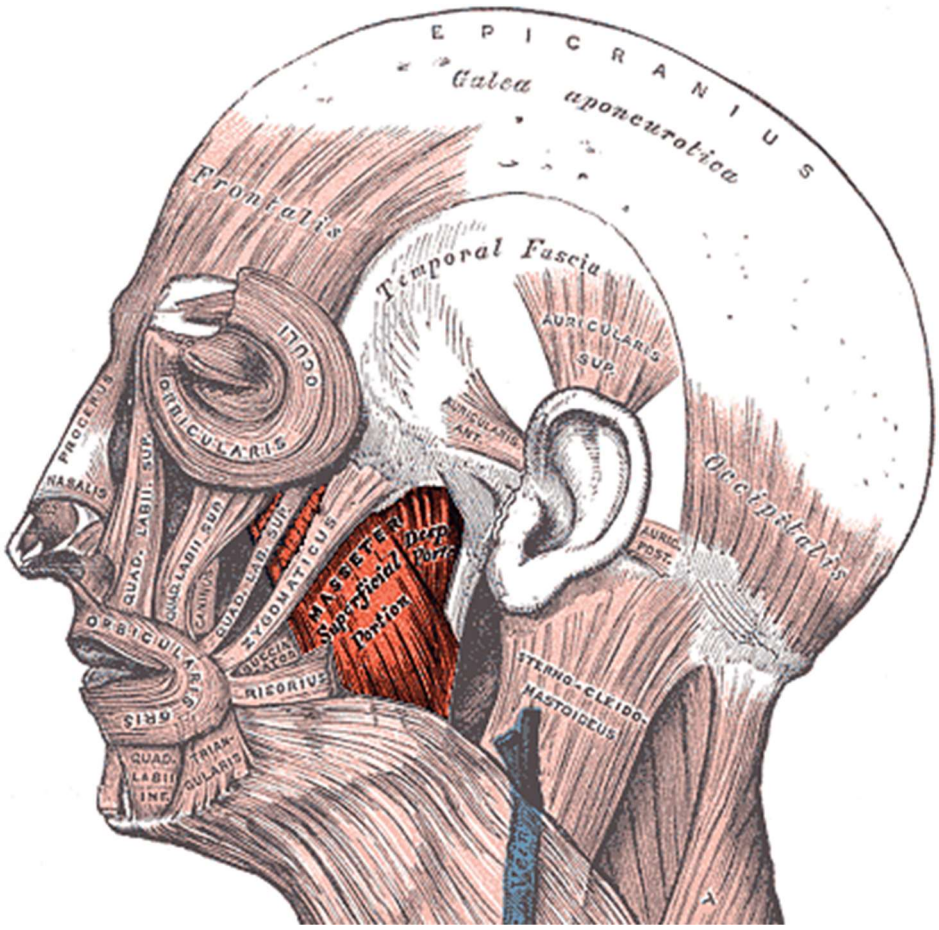

Figure 5. Lateral view of highlighted Masseter muscle and other muscles. (Fig.378, Gray, 1918)

3.4 Nerves and innervations

"The temporomandibular joints are innervated by branches of the auriculotemporal and masseteric branches of the mandibular nerve. The disc is innervated along its periphery but is a neural and avascular in its intermediate (force-bearing) zone (Magee, 2014, 224)." The mandibular nerve is a branch of the trigeminal nerve which is also referred as the cranial nerve V (Agur, Dalley 2015, 648-651). The facial nerves are a

complex system and the muscles of the temporomandibular joint are innervated by different facial nerves each (Levangie, Norkin, 2011). For additional information about nerve innervations, please go through the referred authors.

3.5 Joint kinematics

The process of mastication requires power and strength on the joint and muscles while speaking requires fine motor control. The muscles and the joint are designed to work efficiently and to do both for the human life span. To perform the normal function and actions on temporomandibular joint we need both osteo- and arthrokinematics movements. "Osteokinematic motions include mandibular depression, elevation, protrusion, retrusion, and left and right lateral excursions. Arthrokinematics movements involve rolling, anterior glide, distraction and lateral glide (Levangie, Norkin, 2011, 217)." (Levangie, Norkin, 2011, 213-230.)

Osteokinematics are the movements of bones at joints. The movements of the temporomandibular joint are mandibular depression and elevation, protrusion and retrusion and lateral deviations. In mandibular depression person opens its mouth and on elevation the mouth is closed. This is a needed action in chewing and on activities of daily living. Normal amount of mandibular depression is 40-50mm measured between the upper and lower front teeth. The process of mastication requires approximately 18mm of mandibular depression. (Reese, Bandy,2016, 259-300.)

In mandibular protrusion person "pushes" their lower jaw in front so that the lower front teeth become anterior to their upper contraries and this way creates an "overbite". On retrusion the lower jaw is moved backwards. Normal amounts of movement on protrusion is 7mm and on retrusion 3-4mm. In lateral deviation or excursion of the mandible persons teeth are slightly apart and then moving the mandible laterally from left to right. The normal range of deviation is approximately 10-15mm. (Magee, 2014, 236.)

In mandibular depression and elevation, the mandible must both roll and glide in the cavity to create the correct movement in the temporomandibular joint (Figure 6.). The

superior lateral pterygoid muscle pulls the articular disc between the mandible and mandibular fossa to help the disc to remain stable and to assist the movement of the temporomandibular joint in depression. (Shaffer, Brismée, Sizer, Courtney 2014.) The inferior head of lateral pterygoid assists the movement of mandible in depression and elevation (Reese, Bandy,2016, 259-300).

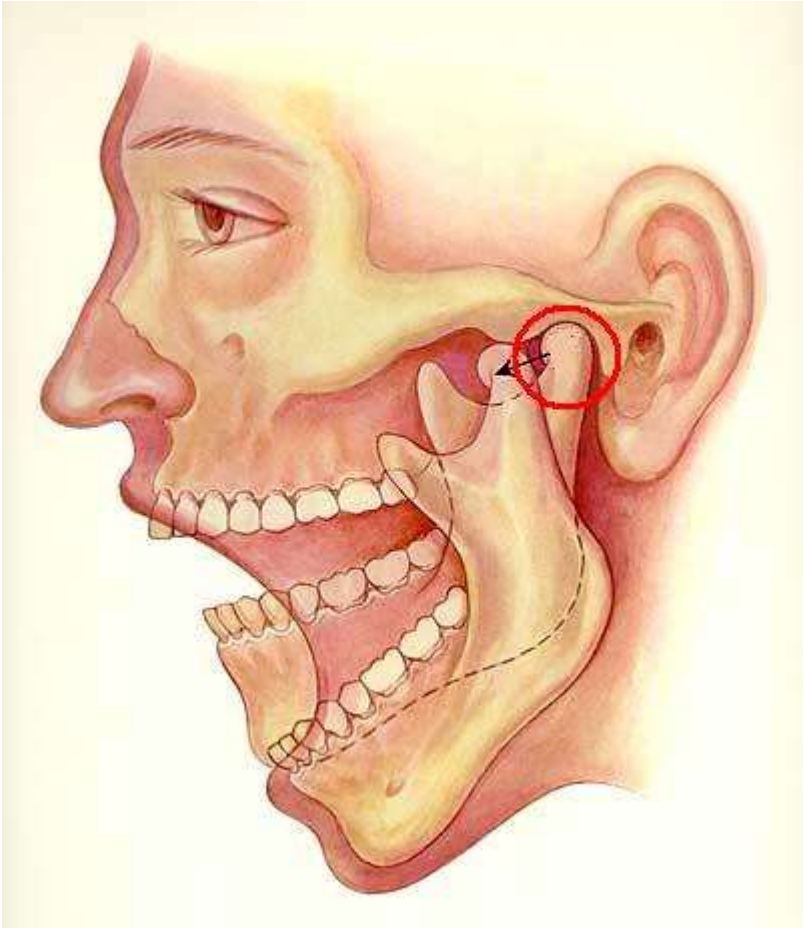

Figure 6. An illustration of how the mandible moves when opening and closing the mouth. (Thierry Canuel, Wikimedia Commons)

4 TEMPOROMANDIBULAR JOINT DISORDERS

4.1 Causal of temporomandibular joint disorders

Based on the Finnish Käypähoito-guidelines for temporomandibular disorders the TMD is relatively common in the population but usually the TMD-problems are mild

and do not always need extra care. The symptoms of TMD are most common at the ages of 35 to 50 and the symptoms are more common among females than men. Most common symptoms are temporomandibular joint noises or clicking, pain in the muscles of mastication, restricted opening of the mouth or a movement disorder in the lower jaw. The TMD is often associated with psychological problems such as depression and stress and the Käypähoito-guideline says that people who suffer from soft-tissue and muscle-based TMD-problems has been diagnosed more from ear, shoulder, neck and stress-related diseases, depression and somatic disorders and sleeping problems than their non-TMD-problematic counterpart. (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus,2016.)

Based on the Käypähoito-guideline and other sources the following characteristics or injuries may cause a higher risk of suffering from TMD: female gender, trauma or injury of the cervical spine such as whiplash-injury, bruxism or teeth grinding and this leading to dental problems, inflammatory diseases such as arthritis, hypermobility of joints, poor posture and control of the cervical spine, depression and other psychological factors, stress, genetical factors and problems with the teeth and biting. (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus,2016) (Levangie, Norkin, 2011, 213-230.) (Magee,2014,224-230.) Dental issues are often related to TMDs, but it is an expertise of dentists and other dental health care providers. It is important to be aware of this connection and to know when to guide the patient to other professional. The co-operation between physiotherapists and other health care professionals who take care of TMD patient is important to succeed in the treatment. (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus, 2016.)

4.2 Types of temporomandibular joint disorders

Creating a specific TMD diagnose is difficult and usually it is not one-dimensional. To create a specific diagnose it requires a thorough inspection both by professional of dental health or addition to that another expert of temporomandibular joint. (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus, 2016.) Based on findings, symptoms and subjective information the TMD: s can be mainly divided to three different groups: muscular based or myogenic TMD, articular based or arthrogenic

TMD and combination of both. (Jull, Moore, Falla, Lewis, McCarthy, Sterling, Khan, 2015, 433-435). The grouping is explained better in a flowchart on chapter about RCD/TMD where differentiative tool is presented (Figure 8.). The two different groups and main impairments within the group are presented in this chapter.

Most common TMD diagnoses based on the Finnish national guidelines for treating TMD: s are: Temporomandibular joint diseases, temporomandibular joint dysfunction-disorder, temporomandibular joint clicking or popping, temporomandibular joint pain, temporomandibular joint articular disc dislocation (locking of the jaw, non-returnable dislocation), temporomandibular joint degenerative diseases (such as osteoarthritis), temporomandibular joint dislocation, repetitive temporomandibular joint dislocation, stiffness of temporomandibular joint, temporomandibular joint strain or sprain, temporomandibular joint osteoarthritis or osteoarthrosis, temporomandibular joint traumatic joint disease, muscle pain (myalgia), bruxism, asymmetry of the jaw and inflammatory rheumatoid arthritis of the temporomandibular joint. (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus, 2016.)

4.3 Myogenic and Arthrogenic temporomandibular joint disorders

Myogenic or muscle based TMD: s is common dysfunction in the temporomandibular joint and it occurs during different movements of the mouth such as chewing and speaking and usually the feeling of myogenic pain is referred as dull pressure, uncomfortable sensation in the jaw area or stiffness. “Myofascial TMD pain is often described as pain around the TMJ without reference to a particular pathophysiological mechanism (Jull, Moore, Falla, Lewis, McCarthy, Sterling, Khan, 2015, 433).” (Jull, Moore, Falla, Lewis, McCarthy, Sterling, Khan, 2015, 433.)

Following reasons might lead to myogenic TMD: Dental occlusal factors can create altered motor activity and this way pain during the orofacial activities. Genetic factors and female hormones are growing the risk to suffer from myofascial pain in TMJ-area. Hormone estrogen has a strong effect on nerve growth factor and on the depolarization

of the nociceptors which may have an important role on generating TMJ-problems and increased muscular activity. Abnormal oral habits have been found that has a connection to headache and orofacial pain which may be associated with the poor cervical posture and forwarded head position. Increased muscle activity during daytime and rest can contribute to pain in the musculature of TMJ. Bruxism or "teeth grinding" can create masticatory stiffness and other symptoms. (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus,2016.) Bruxism has been often treated by night guard or bracing (Levangie, Norkin, 2011, 222-226).

Arthrogenic TMD includes impairments within the joint such as disc displacements, hypermobility, osteoarthritis and other joints degenerative changes. Physiotherapists often treats patients with non-specific arthrogenic disorders. More common disorders in the joint are disc displacements, hypermobility and dislocation and arthralgia. (Jull, Moore, Falla, Lewis, McCarthy, Sterling, Khan, 2015, 435.) Disc displacements are usually happening to anterior or anteromedial direction. Studies and anatomical research have shown that common reason of the disc displacements is that the supporting ligaments of the capsule and the disc are lengthened, and this creates the space looser and increases disc movement and allows the disc to displace and slip from its location. Normal behavior or character to disc displacements is clicking sound or crepitus during mouth opening or closing. (Magee, 2014, 224-230.)

Hypermobility and dislocation are a feature which source needs to be originated during the assessment of TMJ. When the TMJ dislocates the mandibular condyle subluxate out from the temporal fossa and restricts the mouth movements and jaw closure. (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus, 2016.) Contributing factors to dislocation can be overactivity of the pterygoid muscles, tightness in the different side of impaired TMJ, postural changes in cervical spine and a dental interference. (Gross, Fetto, Rosen 2015, 81-82). Also, the reason for dislocation can be a trauma or hit to the jawbone which forcefully dislocates the TMJ. Instability of the TMJ can be created also by inflammatory conditions which may lead to dislocation or subluxation. (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus, 2016.) Arthralgia or joint pain is not caused by a single pathological cause in the TMJ. Pain mapping is a used tool to identify this non-specific TMD and other clinical tests are used to specify this type of condition. Pain mapping is structural diagnosis of TMJ

pain by joint palpation and in combination with passive TMJ movements. (Jull, Moore, Falla, Lewis, McCarthy, Sterling, Khan, 2015, 435.)

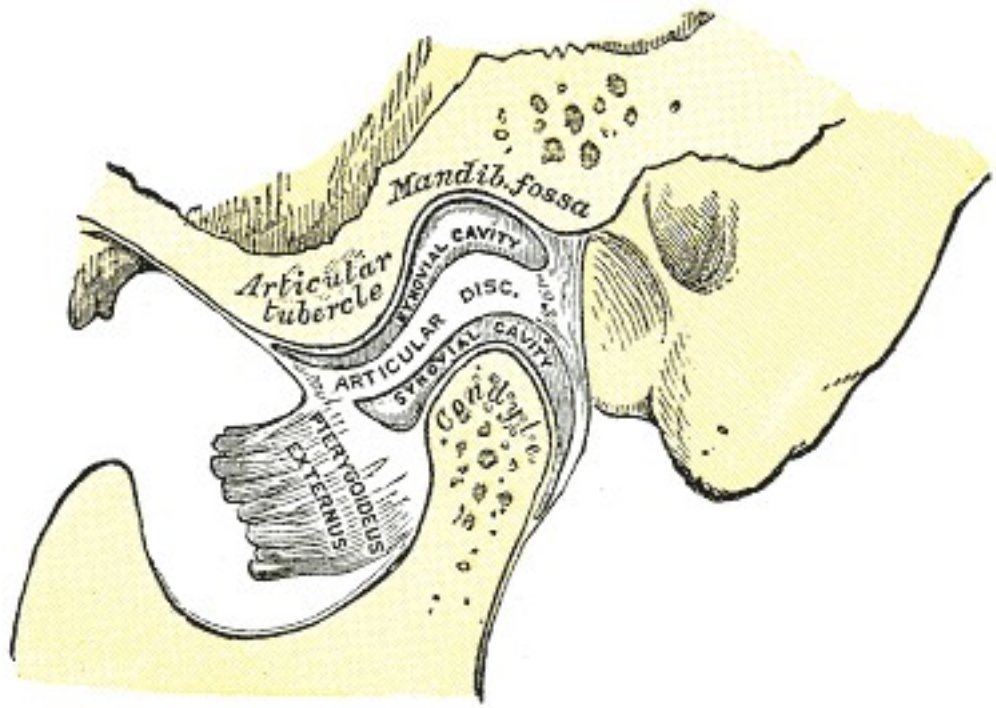

Figure 7. Lateral view of the inside of temporomandibular joint. (Fig.311, Gray,1918)

There has been found a connection between poor cervical posture and TMD problems. The muscles on the cervical area are connected both to the function of TMJ and to the cervical spine. (Levangie, Norkin, 2011, 213-230.) Poor posture can create in longer period, either shortening or lengthening of muscles both anteriorly and posteriorly of the neck and create disorders and pain in the TMJ and on its surrounding structures (Jull, Moore, Falla, Lewis, McCarthy, Sterling, Khan, 2015, 436-437). Compared to a faulty one, a correct posture decreases the forces produced by the cervical spine extensors and other cervical muscles needed to support the weight of the head. On the studies it has still been under debate, that is the head posture directly related to temporomandibular joint problems. Two reviews by authors: Armijo Olivo S, Magee D & Parfitt M and Manfredini D, Castroflorio T & Perinetti G have found head posture and stomatognathic system relationship supporting studies. On the studies the evidence was not so clear between the functional relationship of occlusion, jaw posture and head posture. (Manfredini, Castroflorio, Perinetti, 2012.) While studying the difference between clients with TMD and healthy subjects there was found a difference on the groups. Armijo-Olivo found a difference in a study, that when measuring an angle

between head and neck has been found a correlation between temporomandibular joint problems and poor posture of cervical spine. The study showed great reliability with the interclass correlation values varying between 0.996 to 0.998. (Armijo-Olivo, 2011.) On an illustration that can be found from Magee's Orthopaedic physical assessment book on page 226, there can be seen a mechanism that shows how poor posture of cervical spine and mouth breathing habit can create tightness of suprahyoid muscles and to sternocleidomastoid muscle. This mechanism can create pain in the temporomandibular joint and cause TMDs. (Magee, 2014, 224-231.)

5 TERMINOLOGY AND CLASSIFICATION OF TEMPOROMANDIBULAR JOINT DISORDERS

5.1 Classification and RCD/TMD

A tool has been created to classify and understand better the whole controversial concept of TMD. This tool is called RCD/TMD which stands for Research Diagnostic Criteria for Temporomandibular Disorders. (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus, 2016.) It had three different sub-classification which are presented in three different AXIS as they call them in the presented chart on (Figure 8.) Grieve's Modern Musculoskeletal Physiotherapy. "AXIS I represents the physical disorders and AXIS II represents psychosocial factors such as altered mood, context and beliefs, which are particularly important in the chronic situation. AXIS III represents clinical considerations or contributing factors, which may maintain the patient's complaints (Jull, Moore, Falla, Lewis, McCarthy, Sterling, Khan, 2015, 433)."

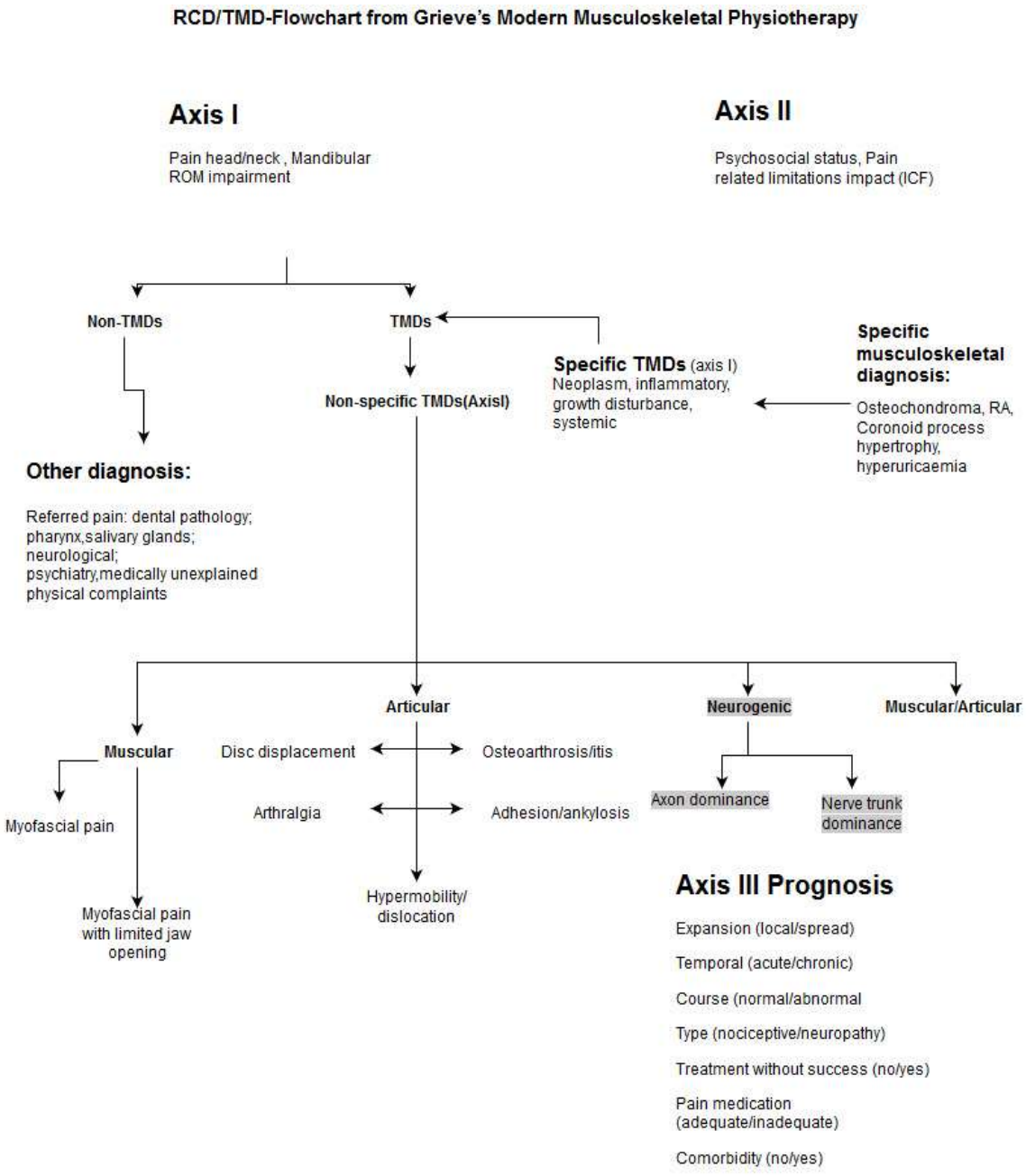

Figure 8. RCD/TMD-Flowchart from Grieve's Modern Musculoskeletal Physiotherapy. Created with draw.io by Topi Kulmala. (Figure 43-1, Jull, Moore, Falla, Lewis, McCarthy, Sterling, Khan, 2015, 434)

In 2013 the older version of screening and classification tool developed to DC/TMD which stands for Diagnostic Criteria for TMD. The new version has more short and simple screening instruments and tools for diagnosing and identifying TMD problems

more specifically. Both of these classification instruments need a validated professional to use them as a tool to treat clients with TMD. (Jull, Moore, Falla, Lewis, McCarthy, Sterling, Khan, 2015, 433-435.)

5.2 TMD-Clinical pattern

The RCD/TMD has few challenging sides to it. The RCD/TMD's is not diverse enough considering how TMD's occur and present in clinical life. Also, other downsides to the diagnostic tool are that it doesn't take cervical spine involvement in to consideration and doesn't include pain science involvement. Therefore, more helpful clinical diagnostic tool (Table 1.) has been created by the authors (Shaffer, Brismée, Sizer and Courtney, 2014.) "The table provides a schematic of primary recurrent TMD clinical patterns that may be more helpful to advanced clinicians than the RDC/TMD (Shaffer, Brismée, Sizer, Courtney, 2014)". The following table is referred from the article: Temporomandibular disorders. Part 1: anatomy and examination/diagnosis by Shaffer, Brismée, Sizer and Courtney.

Myogenic	Arthrogenic	Disk displacement with reduction	Disk displacement without reduction	Cervical spine involvement
Associated with stress, anxiety, clenching, bruxism; secondary component to all other forms of TMD	Associated with joint line pain, arthritis or arthrosis, arthralgia, hypermobility, and joint pain with movement	Associated with joint noises (popping/clicking) and blocked opening; may resolve spontaneously	Associated with blocked opening and possibly a history of displacement with reduction	Generally present across all patients with TMD
Palpable tenderness of musculature (temporalis, masseter, pterygoids)	Palpable joint line tenderness	Opening and/or reciprocal noise	May have a history of opening and/or reciprocal noise	Upper cervical spine and/or head pain
Palpable MTrPs of TMJ musculature	Crepitus (palpable or audible to the patient and/or clinician)	Generally, not associated with severe locking of the joint	Locking that does not permit functional range	Accessory movement restrictions
Provocation with activity (mastication, bruxing, etc.)	Positive joint compression test	Positive joint compression test	Positive joint compression test	Multiple levels may be involved
Often bilateral when the primary disorder	Accessory motion irregularities	Generally unilateral	Generally unilateral	Unilateral or bilateral
Confirmed through muscular management techniques and patient education to reduce contributing factors	Confirmed through joint techniques including joint mobilization when applicable, patient education for hypermobile joints	Confirmed through response to joint interventions; poor clinical differentiation of different disk displacements	Confirmed through response to joint interventions; poor clinical differentiation of different disk displacements	Confirmed through manual therapy and symptom reduction (high error rate with diagnostic imaging)

Table 1. Shortenings in the table stands for: TMD: temporomandibular disorders; MTrPs: myofascial trigger points; TMJ: temporomandibular joint. (Shaffer, Brismée, Sizer, Courtney, 2014)

6 SUBJECTIVE PHYSIOTHERAPEUTIC ASSESSMENT

6.1 Patient information and history

"A systematic subjective examination provides a hypothesis for the type of TMD, possible pain mechanisms, the patient's activity and participation level, as well as possible Yellow and Red flags (Jull, Moore, Falla, Lewis, McCarthy, Sterling, Khan,2015 ,436)".

Obtaining patient history is important part to define the characteristic of the TMD and it can help to determine the origins and causal of the disorder. The clinician should gather information for the type and location of the pain, how the symptoms behave and how the pain functions on different times of day. Pain ratings can be obtained by using numerical pain rating scaling or other similar. The pain type is an important factor to know that is the pain dull, tingling, sharp etc. to determine and classify more the TMD. PhD David Magee has developed a 20-question questionnaire which helps to obtain the most important factors contributing to TMD. The questions include topics of pain, limiting factors to jaw function and other features that affect client's activities of daily living. These are important information concerning the subjective examination. The questions for background information are fully presented in the learning package and can be read from Magee's Orthopaedical Physical Assessment-pages 226 – 231. (Magee D, 2014, 226-231.)

6.2 Use of ICF in temporomandibular joint disorders

The international classification tool for functioning disability and health (ICF) can be used as part of the assessment while trying to determine the effectiveness of the symptoms to the clients daily living. The ICF- classification tool constructs of four main categories of functioning or participation. The four main categories of the ICF-model introduced by WHO-World Health Organization are body functions, body structures, activities and participation and environmental factors. As said the four ICF-categories can be used in the assessment of TMDs and especially determine its effectiveness in

the activities of daily living. The body functions category could include limited jaw opening and pain included in the functioning. Body structures includes more specifically what can be involved, for example arthritis in the temporomandibular joint. Activities and participation focus more how the disorders effects daily living, such as painful jaw and limited jaw movements creates problems to eat and chew. Environmental factors include external factors such as the possibility to visit a professional of temporomandibular joint disorders to seek help for the matter. (Website of the World Health Organization, 2019.)

6.3 Red flags for temporomandibular joint disorders

Screening for red flags on TMD: s is important as any other musculoskeletal problem. "Important findings may include but are not limited to a history of emotional or psychological stress, medication usage, symptoms of vertebrobasilar insufficiency, upper cervical spine instability, cardiac dysfunction, central nervous system dysfunction, cranial nerve dysfunction, infection, and unexpected weight loss or gain (Shaffer, Brismée, Sizer, Courtney, 2014.)"

6.4 Imaging

When imaging the TMJ several techniques are used. The basic imaging consists of plain filming x-rays, tomography and orthopantogram which is an image from the mouth and lower jaw anteriorly taken. These imaging methods are easy and fast to take and the create the minimal amount of radiation that is necessary. Other techniques also used in imaging of TMJ are arthrography, computed tomography (CT-scan), and MRI (magnetic resonance imaging). Also bone scans can be done to the bones of temporomandibular joint. (Quinn, Granquist, 2015, 5-28.)

7 OBJECTIVE PHYSIOTHERAPEUTIC ASSESSMENT

7.1 Observation and palpation

Observation is an important tool for physical examiner while doing temporomandibular joint examination. Well lighted room and the working position of the examiner and examinee are important to not to get false diagnosis while observing and avoiding shadows. Observation is done throughout the whole physiotherapeutic session to get additional information and the following key features are important to note while the client arrives for appointment. How is client's appearance and posture? How is the facial symmetry or is asymmetry visible? Does the client have difficulty or discomfort while talking or moving the jaw? Does the client have a faulty bite (overbite, underbite, cross-bite or misalignment of the teeth)? Is there hypertrophy in the facial/neck muscles? How is the tongue "resting" in the client's mouth? (Gross, Fetto, Rosen 2015,82-83.)

Palpation should always be gentle and done with gloves on. The use of firm but gentle palpation is important as the patient may experience major discomfort and pain while palpation the tender muscles of the facial area and may not allow you to continue the process. The aspects that you are trying to search during palpation are to confirm things observed such as, alignment, color, muscular differences and symmetry. (Gross, Fetto, Rosen 2015,83.) Commonly the assessment and examination are convenient to do while the client is sitting (Magee,2014,248). Observation and palpation of facial structures can be challenging to physiotherapists and often may require familiarizing or refamiliarizing to the area and pathologies before treating (Shaffer, Brismée, Sizer, Courtney, 2014).

7.2 Testing and measurements of temporomandibular joint

According to David J Magee in Orthopedic physical assessment, the tested active movements concerning temporomandibular joint examination are either movements

of cervical spine or the temporomandibular joint. Tested active movements of cervical spine are, flexion, extension, side flexion's, rotation's and if necessary combined, repetitive or sustained positions of cervical spine. Active movements of temporomandibular joint done while examination is opening and closing the mouth, protrusion of the mandible and lateral deviations of mandible both right and left. Opening and closing the mouth is valuable and informative tool while assessing temporomandibular joint. Helpful tools can be used to help examiner to make the assessment more reliable. Easiest way to measure the active opening of the mouth is to use clients two fingers (commonly index and middle finger of the interphalangeal joints) to determine is the ROM enough in the opening. The normative value of opening of the mouth is between 35 to 55 mm. Usually 25 to 35mm of rom is needed for activities of daily living. It is also important to measure the mandible from its posterior end to the chin and compare if there is a length difference. (Magee, 2014, 234-235.)

Specific measuring tools can also be used, such as Therabite measuring device or a simple ruler to determine the opening of the mouth. A ruler is a useful tool of physiotherapist while doing various measurements of the temporomandibular joint. Average values of temporomandibular joint movements are following. Mean value of opening with adults is 51mm with females and 55 with males. Mean value of lateral deviation is approximately 10mm with both genders with normal range of 5mm to 16mm. Average protrusion of the mandible is 2.3mm with females and 3mm with males. (Shaffer, Brismée, Sizer, Courtney, 2014.)

7.3 Additional tests

Passive movements of temporomandibular joint are rarely done among the physiotherapists who are not specialized to the topic. End feel of the temporomandibular joint is the most common passive movement done while assessing. End feel should normally feel like tissue stretching while opening and bone to bone feel while closing the jaw. (Magee,2014,237.) Specialized professional can include anterior and medial glide, caudal anterior medial glide and distraction of mandible and mandibular heads. Also, palpation of the bony structures of mandible while testing is included. These measurements may require the tester to place their thumb to the clients mouth to enable all the

required movements. Gloves are worn by the tester as in other tests concerning temporomandibular joint assessment. (Shaffer, Brismée, Sizer, Courtney, 2014.) Resistive testing can be done, even though it is often challenging due to the movement directions of temporomandibular joint. Inability to do resistive testing is a sign of muscle weakness in facial region. (Gross, Fetto, Rosen, 2015,92.) Resisted movement testing is done by the tester carefully resisting the direction with hand. When starting the testing the jaw of the client should be in a relaxed resting position. The tested directions are opening of the jaw, closing of the jaw and deviations sideways of the mandible. Other tests such as Chvostek test, reflex testing, cranial nerve testing and joint play testing can also be done in the temporomandibular joint assessment. (Magee,2014, 237-243)

8 PHYSIOTHERAPEUTIC TREATMENTS FOR TEMPOROMANDIBULAR JOINT DISORDERS

Most recommended forms of treatments for TMD: s are non-invasive and cost-effective such as dental splinting and physiotherapy and combinations of different treatments. This creates a need for future physiotherapists to be aware of different physiotherapeutic modalities of treating TMD: s and to understand the role of physiotherapy in this controversial (lack of scientific evidence on treatments) and relatively common area of disorders. (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus, 2016.)

As said, treating TMDs is the most effective when the intervention is done with cooperation within different medical professionals such as dentists, doctors and physiotherapists. Physiotherapeutic treatment modalities may decrease the symptoms of temporomandibular joint disorders but there is not any reliable evidence that any single physiotherapeutic modality is superior in effectiveness. (McNeely, Armijo-Olivo, Magee,2006.) (Medlicott, Harris,2006.) There is some evidence that guiding and mo-

tivating clients to do home exercises reduces the symptoms of TMDs (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus, 2016). Focus of this chapter is on physiotherapeutic treatment modalities and approaches that are important to learn for a physiotherapy student.

Physiotherapeutic treatment modalities of TMDs are mobilization exercises of the lower jaw, manual mobilization, soft tissue mobilization of the facial muscles and stretching. Also, these modalities have been used on treating TMDs: ultrasound, transcutaneous nervous stimulation (TNS), acupuncture, laser treatments and voice massaging (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus, 2016). Based on the Finnish national guidelines the only treatment approach that has A-class evidence when treating TMDs is the use of Stabilization splinting when treating muscular or joint originated TMDs. (Le Bell, Raustia, Kemppainen, Könönen, Pöllänen, 2013).

8.1 Manual therapy and massaging

Manual therapy constructs of different soft tissue techniques which aim is to relieve tension in the facial muscles contributing to TMD and joint mobilization techniques to improve jaw ROM. Manual therapy to muscles in cervical spine area can be done to relieve the cervical spine's contributing factors to TMD. (Gil-Martínez, Paris-Alemany, López-de-Uralde-Villanueva, La Touche, 2018.) The main mechanism in joint mobilization is to relieve pain, muscles spasm and increase the ROM. The joint mobilization can be done by the physiotherapist or by the client as self-mobilization. Joint mobilization directions are distraction of the joint, anterior glide, lateral glides and caudal-antero-medial (CAM)glide. Self-mobilization can be included in the client's home exercise program. In the self-mobilization the client stabilizes the TMJ and does mouth opening exercises. If client has hypermobile TMJ, joint mobilization techniques are not recommended. (Shaffer, Brismée, Sizer, Courtney, 2014.) Joint mobilization techniques are advised to be done by trained experts and are not included in this learning package but only as their information of existing. Exception is the self-mobilization exercise by Shaffer, Brismée, Sizer, Courtney which is included in the learning package.

While doing the assessment and palpation the physiotherapist should check the tightness of the muscles: temporalis, masseter, lateral and medial pterygoid muscles. This gives information of possible muscle hypertrophy or atrophy. Also, possible myofascial trigger points of these muscles can be assessed and treated while massaging. Massage of facial muscles is done with gloves and should always be done with care and low pressure. Massage of cervical and other accessory muscles of TMD could also be included in the massage. (Shaffer, Brismée, Sizer, Courtney, 2014.)

8.2 Therapeutic exercises and an exercise program

Studies have shown that therapeutic jaw and cervical posture exercises have improved results comparison to control groups. The main improved categories with therapeutic exercises are pain and ROM but these exercises are also targeted to improve strength, coordination and mobility. (Armijo-Olivo, Pitance, Singh, Neto, Thie, Michelotti, 2015.) Masticatory muscle strength and endurance improvement has shown a relieving effect in the TMD symptoms. Compared to other treatment modalities, therapeutic exercises have not shown better results in pain relief. In studies that have reviewed the effectiveness of therapeutic exercises in TMD, one challenging factor has been the dosage such as intensity and duration which lowers the quality of the reviewed studies concerning exercises. (Gil-Martínez, Paris-Alemany, López-de-Uralde-Villanueva, La Touche, 2018.)

Different therapeutic exercise programs have been developed to treat TMDs. The programs share similarities and the main features of the programs are practising correct postures of the mouth, strengthening exercises such as isometric movements, postural awareness and jaw mobility increase. Two used programs are Rocabado's 6x6 exercise program and Kraus' temporomandibular joint exercises – program. (Shaffer, Brismée, Sizer, Courtney, 2014.)

Often the clients which gets treated by physiotherapists have myofascial problems related to their TMD's. It is important of physiotherapy students to be aware that the diagnosis is often done by either a medical doctor or a dentist which continues with

the referral to physiotherapist. The physiotherapists tools to treat other than muscle-originated TMD's is limited. Despite this factor is important for physiotherapists to be aware of other possible diagnosis and how to treat them. More from different treatment approaches to different types of TMD's can be read from Käypähoito-guidelines. The exercise program presented in the learning package which is referred from the Finnish national guidelines and recommended by them contains 9-step program of different exercises. These exercises allow client to relax, stretch and strengthen the jaw muscles. The program is recommended to repeat twice a day and they are recommended to keep the exercises light enough without excessive stress to jaw muscles. (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus, 2016.)

9 LEARNING MOTIVATION

9.1 Why to study this learning package?

The basic idea of this learning package is to increase awareness of temporomandibular joint disorders within physiotherapy students. TMDs relatively common occurrence and the scientific studies behind the topic supports that physiotherapeutic interventions and approaches can be beneficial on treating the subject and cause (Purentaelimistön toimintahäiriöt (TMD): Käypähoito-suositus, 2016). The basic level after studying this thesis and the self-study material is that a future physiotherapist (reader) is capable to recognize if a client has a temporomandibular joint related symptoms and problems and is able to guide the client to a professional who is able to continue with the correct approach if they are not able to treat the subject him/herself. Especially if a student is interested in working with musculoskeletal clients, the need for knowledge of temporomandibular joint disorders is relevant. Exercise program presented in this thesis and learning package is referred from Finnish Käypähoito-guidelines and is recommended to use by Finnish health care professionals. Cervical postural exercises and assessment is not included in this learning package because the topic is included in the physiotherapy studies and is at itself a large and important area of musculoskeletal studies in the degree programme of physiotherapy.

9.2 Different approaches on creating a learning package

When creating a well-designed learning package, it is important to find out what are the most important areas of the topic and which needs to be included in the material. Literature and references need to be gathered and reviewed first to seek out the most important parts that are introduced to students in the material. There are also multiple approaches on creating the platform on where the self-study material is created. Possible common tools such as Microsoft PowerPoint and Word may be used. Also, varieties of online learning platforms or tools are possible to use. A learning package can also include videos and other illustrative material on the topic which can be useful for the reader. The creator of the material needs to assess the targeting group and consider what would be the best option which could be done. Factors that are commonly important to students is that the material is easily accessible and quick to use and efficient to use with mobile devices and tablets.

10 DISCUSSION

The process of writing this thesis has been a wonderful learning experience with its ups and downs. When I started this whole process in spring 2018, the whole idea of writing a thesis from temporomandibular joint related physiotherapy came from experiences of personal life and both myself and family members being affected by jaw problems. The original idea was to dive into a fairly unknown subject and try to find help to the problems of my close people. The subject felt narrow enough to write thesis on and the timing was good because there was not written a same type of thesis recently. Majority of writing the theory background was done during summer of 2018. Most difficult part of reviewing and reading the literature and references was that most of the publications are directed either to dentists and doctors which meant that there was plenty of new terminology introduced and had to be learn. After the summer of 2018 and writing good portion of the thesis I had a break from the thesis process until March/April 2019. I feel like the break worked out well for me and I got reset well from the writing process and could focus on degree studies during the semester. When I started working with the thesis again in April, I found some new motivation towards

the process and felt that my writing and literature searching was more effective. Both the thesis and self-study material are ready in May 2019.

Biggest challenges during the writing was deciding what are the most important "parts" of topic that needs to present in the thesis and learning package. Even though the subject is fairly narrow, and we are only talking about one joint in human body, there is plenty of information concerning temporomandibular joint. As I'm not an expert of the field I found myself doubting that is the theory and information I wrote to the thesis broad enough and is it relevant for this work especially thinking about the target group of physiotherapy students. Also, one deficit in the learning package is that it could have had more illustrative material such as videos. Adding those would have been more time consuming that it couldn't be included in this thesis or learning package.

Still I think that the strongest part of this thesis is the self-study material which in my opinion contains the relevant aspects of temporomandibular joint physiotherapy that a student of the degree program needs to be aware of. The self-study material was done with Microsoft PowerPoint, which I believe is the easiest platform to use and is the most accessible by the students for independent studying with this BYOD (bring your own device) – era in Satakunta university. All the students have licensing for the software offered by the university. Adding videos and other illustrative material would have been so time consuming that it couldn't be included in this thesis or learning package.

An idea for future thesis writers would be an updated version of this type of package or re-review in 5 or 10 years and to seek if the literature and guidelines have changed the approach to the subject. The work could include videos and additional material that is left out from this work. Also, a case study or other where student could test the effectiveness of some presented treatment modalities in university setting and simultaneously create a wider presentation of different treatment approaches as in this thesis, they remain short.

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