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**Temporomandibular Disorders and
its relationship with upper cervical
spine: workshop for physiotherapy
students in Satakunta University of
Applied Sciences**

DEGREE PROGRAMME IN PHYSIOTHERAPY
2024

ABSTRACT

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Temporomandibular disorder it's relationship with upper cervical spine: workshop and lecture review for physiotherapy students in Satakunta University of Applied Sciences.

Bachelor's Thesis

Degree programme in physiotherapy 2024

May 2024

Number of pages: 39

This thesis has been written to explore the management of Temporomandibular Joint Disorders (TMD) and its relationship with the upper cervical spine, with a particular emphasis on educating physiotherapy students at the Satakunta University of Applied Sciences. Through the development of a comprehensive workshop and lecture review, the aim was to enhance understanding and awareness of TMD among students, equipping them with the necessary knowledge and skills to effectively address these issues in their future practice.

The link between TMD and the upper cervical spine has received a lot of attention over the years, highlighting the complexity of both disorders and the need for a comprehensive management approach. The authors examined the link and the efficacy of combined manual therapy, cervical spine exercises, and therapeutic pain education in TMD management, building on recent study findings.

The authors found the importance of a holistic treatment paradigm that addresses the interconnectedness of the temporomandibular joint and cervical spine, offering a promising direction for improving patient outcomes in TMD management.

Keywords: Temporomandibular joint, Temporomandibular disorder, Physiotherapy, upper cervical spine.

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1 INTRODUCTION

Temporomandibular joint disorder (TMD) is a common condition that affects the jaw joint and its surrounding muscles, resulting in pain, discomfort, and restricted movement. The link between TMD and the cervical spine has received a lot of attention in recent years. Understanding the relationship between these two complex systems is important for proper diagnosis and therapy.

The primary objective of this thesis is to enhance our understanding of the details involved in the management of temporomandibular joint disorders, commonly referred to as Temporomandibular Disorders (TMD), as well as its relationship with upper cervical spine. The overall goal is to improve the knowledge and awareness of TMJ/TMD for physiotherapists, particularly for the Satakunta University of Applied Science physiotherapy (SAMK) program.

A comprehensive lecture review and workshop were created to serve as instructional tools for Samk physiotherapy students. This educational objective is to equip students with an in-depth understanding of the various aspects related to the management of TMJ/TMD, ranging from theoretical foundations to practical applications.

The workshop was not only tailored for specific individuals; rather, it is inclusive and open to all physiotherapy students. By a collaborative learning environment, the workshop aimed to create a platform where student can engage in meaningful discussions, share experiences, and collectively enhance their knowledge and skills in the field of TMJ/TMD management.

Furthermore, the learning material from the workshop was made accessible to students in the form of a detailed PowerPoint presentation. This resource

served as a comprehensive guide, allowing students to revisit and reinforce their understanding of key concepts covered during the workshop. The availability of the presentation confirms that the learning materials remain a valuable reference for students, aiding them in their ongoing studies and future professional careers. This plan had not only advanced the knowledge base of TMJ/TMD management, but also provided a dynamic and interactive educational experience for Samk physiotherapy students.

In addition to the workshop, the thesis includes a detailed lecture review that dives into the theoretical foundations and practical applications of managing temporomandibular joint disorders (TMJ/TMD). The lecture review is structured to provide a thorough exploration of key concepts related to TMJ/TMD.

The review covers the role of a Physiotherapist, the anatomy and biomechanics of the temporomandibular joint, temporomandibular disorders, symptoms and causes, treatment, relationship with the upper cervical spine, and more. The temporomandibular joint and upper cervical spine have a close biomechanical and neuroanatomical interaction. Both regions contribute to the complex movements of the head and neck, and their activities are intricately linked. This connection implies that failure in one region may trigger compensatory changes and symptoms in the other. The lecture review served as a valuable resource for self-directed learning, enabling students to deepen their knowledge beyond the limitations of the workshop. It was designed to be an accessible and engaging educational tool that raises continuous learning and development in the field of physiotherapy.

In conclusion, the combined efforts of the workshop and lecture review aim to elevate the educational experience for Samk physiotherapy students. This approach ensures that students are not only equipped with theoretical knowledge, but are also prepared to apply their skills in real-world clinical scenarios.

2 AIM AND OBJECTIVES

The aim of this thesis was to investigate research, aiming to uncover why TMD happens, how it affects the neck, and most importantly, how we can improve it. With this analysis of TMD and the upper cervical spine relation, the authors anticipate improving the knowledge of those dealing with TMD issues.

The objective of this thesis was to plan and implement a hands-on workshop for physiotherapy students of Samk. In the workshop, students learned how to identify and treat jaw joint problems (TMD) related to the neck. They practised hands-on techniques to assess these issues and learn simple ways to ameliorate patients. By participating, students have gained important skills to support patients with jaw joint and neck issues in their future career.

The other objective of this thesis was to make a wide literature review on the management of temporomandibular joint disorders (TMD) and their relationship with the upper cervical spine. For this review the objective is to cover the role of a physiotherapist, the anatomy, and biomechanics of the temporomandibular joint, TMD symptoms and causes, treatment options, and the connection between TMD and the upper cervical spine. It serves as a valuable resource for self-directed learning, enabling students to deepen their knowledge after the workshop.

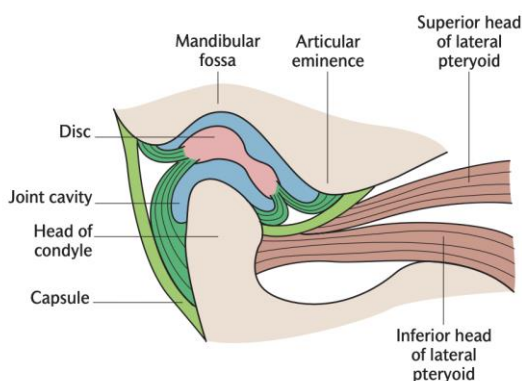
3 UNDERSTANDING ANATOMY OF TEMPOROMANDIBULAR JOINT

The temporomandibular joint (TMJ) is the joint that connects the jaw to the skull. Positioned on each side of the face. In front of each ear, these joints enable essential movements for speaking, eating, and facial expression (Helland, 1980.) Functionally, the temporomandibular joint, or jaw joint, is a synovial joint that enables complex movements crucial for daily activities. It serves

as the connection between the condylar head of the mandible and the mandibular fossa of the temporal bone. Comprising the TMJ, teeth, and soft tissue, this system actively contributes to vital functions such as breathing, eating, and speech (Wilkie & Al-ani, 2022.)

3.1 Temporomandibular joint

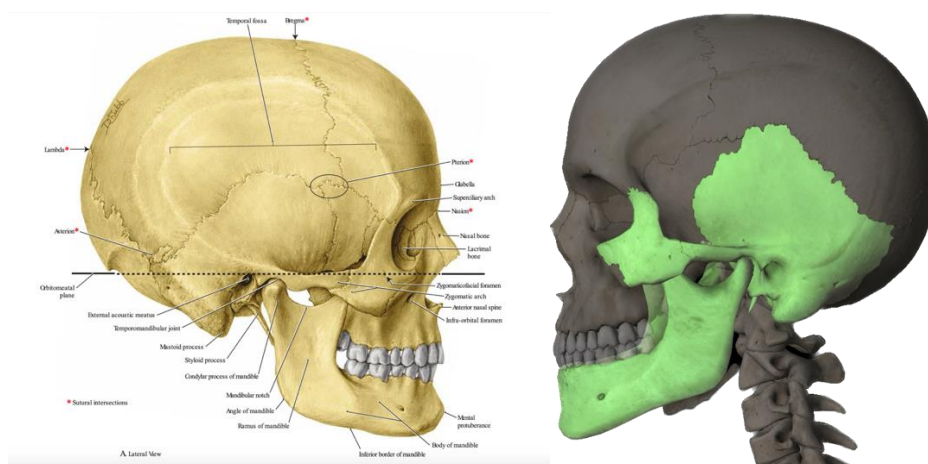
The temporomandibular joints (TMJ) are the only joints in the skull that move freely. They are located between the ears on both sides of the face. The masticatory muscles help to move these joints, which are categorized as synovial joints. Made up of the joint between the mandibular condylar head and the squamous temporal bone, each TMJ has different articular surface covered in fibrocartilage as opposed to the hyaline cartilage that is typically present in other synovial joints (Picture 1.) The TMJ has an articular disc that separates the top and lower compartments of the joint. This disc, which is made of dense fibrous tissue, attaches to the mandibular neck and the anterior surface while blending in smoothly with the joint capsule. The articular discs' roles are yet unknown; however it has been shown to improve joint function (Martin E. Atkinson, 2011, p. 242).



Picture 1. The Temporomandibular Joint (Martin E. Atkinson, 2011, p. 242).

3.2 Bones

The temporomandibular joint (TMJ) is a key component of the craniofacial anatomy, located at the point where the mandible (lower jaw) attaches with the temporal bone of the skull. This joint is surrounded by several bones (Picture 2.); the mandible, which forms the lower part of the joint, and the temporal bone, which creates the upper part. The zygomatic bone, commonly known as the cheekbone, plays a role in the structural support of the TMJ. Together, these bones create a joint that enables the movements necessary for activities such as chewing, speaking, and facial expressions (Agur & Dalley II, 2019, p. 586).

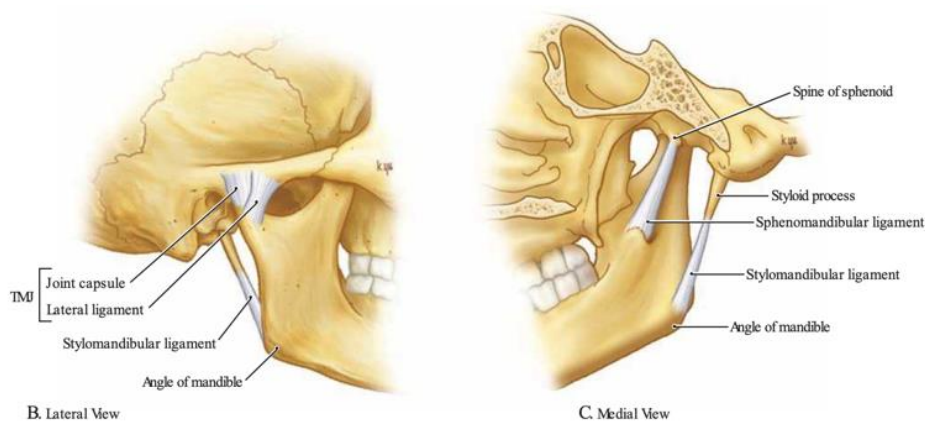


Picture 2. Bones of skull (Agur & Dalley, 2012, p. 586; 3D4Medical, 2017).

3.3 Ligaments

The Temporomandibular ligament (TML) is made of the sphenomandibular ligament, the stylomandibular ligament, and the capsular ligament (Picture 3.) A network of ligaments playing a unique role in maintain the joints structural integrity and promoting easy mobility. These ligaments are essential for maintaining correct alignment of the TMJ components throughout different jaw motions and preventing excessive displacement of the mandible (Agur & Dalley II, 2019, p. 650).

The Temporomandibular Ligament (TML) is a stabilizing component that is different from the other ligaments attached to the temporomandibular joint. Often referred to as the Temporal Ligament, it provides support and restricts excessive anterior movement of the mandible by attaching to the temporal bone and the mandibular condyle. Restricting inferior movement of the mandible, the sphenomandibular ligament- which originates from the sphenoid bones spine and attaches to the mandibles lingula- contributes to the stability of the temporomandibular joint. The stylomandibular ligament, which runs from the mandibular angle to the styloid process of the temporal bone, aids in limiting the mandibles lateral movement. The capsular ligament, which encircles the whole TMJ joint capsule, is essential for preserving joint integrity and offering proprioceptive feedback while moving the jaw. (Agur & Dalley II, 2019, p. 650).



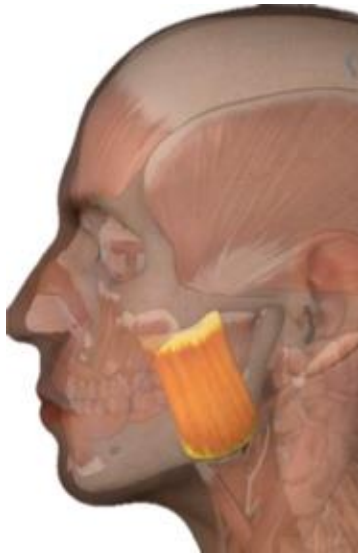
Picture 3. Ligaments around TMJ (Agur & Dalley II, 2019, p. 650).

3.4 Muscles

The small and required movements of the temporomandibular joint (TMJ) are made possible by a network of supporting muscles. It is important to know the functions and roles of these muscles to understand the mechanics of mandibular movement and the job of the TMJ. Each muscle has its own unique origins, insertions, and activities. They are important to the function of the TMJ. The

muscles that attach to the coronoid process of the mandible and out of the temporal fossa of the skull, are important for raising and lowering the jaw. The involvement is most noticeable while the jaw is shutting, which occurs when chewing (Agur & Dalley II, 2019, p. 648-651).

The masseter muscle (Picture 4.) is well-known for its ability to raise the jaw. It originates from the zygomatic arch and inserts onto the lateral surface of the mandibular angle. It is used for efficient chewing because of its strong contractions that help close the jaw. The lateral pterygoid muscles (Picture 5.) insert onto the condyle of the mandible and the articular capsule of the TMJ. It has beginnings on the greater wing of the sphenoid bone and the lateral surface of the lateral pterygoid plate. This muscle greatly expands the jaws range of motion by supporting a variety of actions such as protrusion, lateral excursion, and jaw opening (Agur & Dalley II, 2019, p. 648-651).



Picture 4. Masseter muscle (3D 4MEDICAL Ess. anatomy 5.)



Picture 5. Lateral pterygoid (3D 4MEDICAL Ess. anatomy 5.)

The medial pterygoid muscle (Picture 6.) inserts into the medial surface of the mandibular angle and ramus, after emerging from the maxillary tuberosity and the medial side of the lateral pterygoid plate. It functions with the masseter to elevate the jaw, support the jaw closed, and enable the grinding motion that occurs during chewing. The muscles known as the digastric (Picture 7.), stylohyoid (Picture 8.), mylohyoid (Picture 9.), and geniohyoid (Picture 10.) work together to produce the different movements that the hyoid bone and mandible perform. Together, they depress the jaw, raise the hyoid bone during swallowing, and support the preservation of the oral cavity's structural integrity. (Agur & Dalley II, 2019, p. 648-651).



Picture 6. Medial pterygoid (3D 4MEDICAL Ess. anatomy 5.)



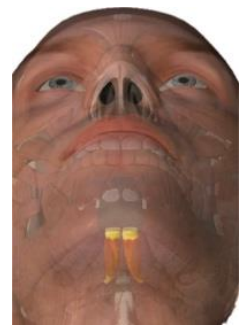
Picture 7. Digastric (3D 4MEDICAL Ess. anatomy 5.)



Picture 8. Stylohyoid (3D 4MEDICAL Ess. anatomy 5.)



Picture 9. Mylohyoid (3D 4MEDICAL Ess. anatomy 5.)



Picture 10. Geniohyoid (3D 4MEDICAL Ess. anatomy 5.)

The platysma muscle (Picture 11.) inserts onto the bottom border of the mandible as well as the skin of the lower face and neck. It originates from the fascia covering the top portions of the pectoralis major and deltoid muscles. It helps create facial expressions by tightening the skin around the neck, especially when grimacing and depressing the lower lip and corners of the mouth (Agur & Dalley II, 2019, p. 606-610).



Picture 11. Platysma muscle (3D 4MEDICAL Ess. anatomy 5.)

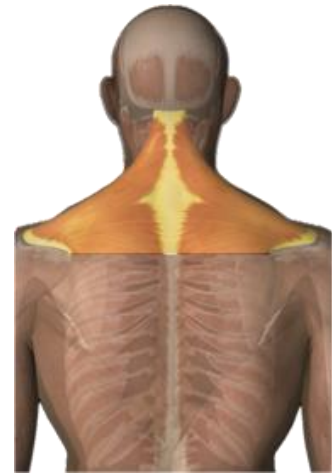
The muscles known as splenius capitis (Picture 12.), sternocleidomastoid (Picture 13.), and upper trapezius (Picture 14.) are crucial for maintaining posture, stabilizing the cervical spine, and enabling movement of the head and shoulder girdle. These muscles originate from different bony landmarks and insert onto various structures of the head, neck, and shoulder region. The origins, insertions, and actions of the muscles involved in TMJ function are crucial for understanding the complex mechanics of mandibular movements. These details and the Table 1. below offers a short overview of each muscle's role (Agur & Dalley II, 2019, p. 648-651).



Picture 12. Splenius capitis (3D 4MEDICAL Ess. anatomy 5.)



Picture 13. Sternocleidomastoid (3D 4MEDICAL Ess. anatomy 5.)



Picture 14. Upper trapezius (3D 4MEDICAL Ess. anatomy 5.)

Table 1. Muscle anatomy overview: origin, insertion, and action. (Agur & Dalley II, 2019, p. 648-651, p.606-610).

Muscle	Origin	Insertion	Action
Temporalis	Temporal fossa of the skull.	Coronoid process of the mandible.	Elevates and retracts the mandible. It is a key muscle involved in the closing of the jaw during chewing.
Masseter	Zygomatic arch (specifically the zygomatic process of the maxilla and the zygomatic bone).	Lateral surface of the mandibular angle.	Elevates the mandible, contributing to jaw closure. It is a powerful muscle used in chewing.
Lateral Pterygoid	Greater wing of the sphenoid bone and the lateral surface of	Condyle of the mandible and the articular	Assists in opening the jaw, protruding the jaw, and moving the jaw from

	the lateral pterygoid plate.	capsule of the temporomandibular joint.	side to side. It is crucial for jaw movements.
Medial Pterygoid	Medial surface of the lateral pterygoid plate and maxillary tuberosity. Insertion: Medial surface of the mandibular angle and ramus.	Medial surface of the mandibular angle and ramus.	Works with the masseter in elevating the mandible. It also plays a role in jaw closure and the grinding motion during chewing
Digastric	Anterior belly: Digastric fossa of the mandible.	Intermediate tendon attached to the body of the hyoid bone.	Elevates the hyoid bone during swallowing and depresses the mandible.
Stylohyoid	styloid process of the temporal bone.	Body of the hyoid bone.	Elevates and retracts the hyoid bone.
Mylohyoid	Mylohyoid line of the mandible.	Midline raphe and body of the hyoid bone.	Forms the floor of the mouth and assists in swallowing.
Geniohyoid	Inferior mental spine of the mandible.	Body of the hyoid bone.	Elevates and brings the hyoid bone forward.

Digastric posterior belly	Mastoid notch of the temporal bone.	Intermediate tendon on the minor cornu of the hyoid bone	Elevates the hyoid bone and depresses the mandible.
Platysma	Fascia overlying the upper parts of the pectoralis major and deltoid muscles.	Lower border of the mandible and skin of the lower face and neck.	Depresses the lower lip and corners of the mouth, as well as tenses the skin of the neck. It is involved in facial expressions, especially during actions like grimacing.
Splenius Capitis	Ligamentum nuchae and the spinous processes of the vertebrae C3-T3	Mastoid process and the lateral end of the superior nuchal line.	Same side rotation of the head; extension and lateral flexion of the cervical spine and head.
Sternocleidomastoid	Sternal head: the anterior surface of the manubrium; clavicular head: the medial third of the clavicle.	Mastoid process and the lateral part of the superior nuchal line.	Involved in flexing the head and neck laterally.
Upper Trapezius	Descending: the external occipital protuberance, ligamentum nuchae and spinous process of the C1-C7 vertebrae	Descending: the lateral one-third of the clavicle, acromion, and spine of scapula	Elevation and depression of the shoulder blade.

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3.5 Nerves

The table 2. below provides an informative summary of the numerous muscles linked with the temporomandibular joint (TMJ), and their nerve and artery supply. The mandibular division(V3) of the trigeminal nerve innervates key muscles such as the temporalis, masseter, lateral pterygoid, and medial pterygoid, which are primarily supplied by branches of the maxillary artery. Other muscles, such as the Digastric, Stylohyoid, and platysma, get their nerve supply from facial nerves (VII) and have several artery origins. These include facial, submental, and occipital arteries. (Agur & Dalley II, 2019, p. 609-615).

Tabel 2. Nerve and arterial supply overview for temporomandibular joint (Tortora & Derrickson, 2018, pp. 511-517 & Agur & Dalley II, 2019, p. 609-615).

Muscles	Nerve Supply	Arterial Supply
Temporalis	Trigeminal nerve (V3-Mandibular)	Deep temporal arteries, Maxillary artery
Masseter	Trigeminal nerve (V3-Mandibular)	Masseteric branch of the maxillary artery
Lateral Pterygoid	Trigeminal nerve (V3-Mandibular)	Branches of the maxillary artery, including the lateral pterygoid artery
Medial Pterygoid	Trigeminal nerve (V3-Mandibular)	Branches of the maxillary artery, including the pterygoid branches
Digastric (Anterior)	Facial Nerve (VII)	Submental branch of the facial artery, mylohyoid branch of the inferior alveolar artery
Digastric (Posterior)	Facial nerve (VII)	Occipital artery, posterior auricular artery

Stylohyoid	Facial nerve (VII)	Stylohyoid artery
Mylohyoid	Trigeminal nerve (V3-Mandibular)	Submental artery, Mylohyoid branch of the inferior alveolar artery
Geniohyoid	Hypoglossal nerve (XII)	Geniohyoid branch of the lingual artery
Platysma	Facial nerve (VII)	Submental artery, branches of the facial artery

4 TEMPOROMANDIBULAR DISORDERS

A range of disorders affecting the temporomandibular joint (TMJ) and muscles are collectively referred to as temporomandibular disorders (TMDs). These disorders can cause a wide range of symptoms, from localized jaw pain to widespread discomfort throughout the head, neck, and face. This section clarifies the problems in diagnosing and treating TMD by examining its symptoms, causes, assessment, examination, and warning signs (Merck Manuals, 2023).

4.1 Symptoms

The symptoms of temporomandibular disorders (TMD) are complex and involve many different areas of the face, neck, and head. They go far beyond the limitations of the localized jaw pain. Face-specific symptoms that people with TMD may experience include recurrent headaches, increased facial tenderness, tingling, numbness, burning, visual disturbances and pain behind and/or under eyes. TMD's effects can also be felt in the throat, a persistent cough, hoarseness that sounds rough to the voice, and difficulty swallowing (National Institute of Dental and Craniofacial Research, n.d.).

The complex effect of TMD also extend to the auditory area. Patients may experience ringing in the ears, continuous buzzing, ear blockage, water in the ear, ear pain, or strange noises that sound like cracks inside the ear (Suomalainen Lääkäriseura Duodecim, 2021.)

TMD has an effect on jaw function, resulting in restrictions on mouth opening, trouble speaking, pain in the jaw joint and chewing muscles, visible bite marks or impressions on the cheeks, increased sensitivity to teeth, vertigo attacks, swelling, and trouble speaking. (Suomalainen Lääkäriseura Duodecim, 2021.) Neck muscle pain is common in people with jaw joint issues (TMD), and the more severe the jaw problems, the worse the neck pain. Different neck muscles are affected. Neck pain can be an early sign of jaw joint issues, and checking the neck muscles can help identify problems early for better treatment and improved quality of life. (Basri et al., 2024)

4.2 Causes

The term temporomandibular disorder (TMD) refers to a group of disorders that commonly cause pain and discomfort in the jaw joint and surrounding muscles. These disorders have a variety of origins; trauma injuries like whiplash, vehicle accidents, sports incidents, abrupt movements, and persistent teeth grinding or clenching. Furthermore, hits to the head or jaw, such as those sustained during kickboxing, extensive dental treatment, misaligned bite alignment, and stress, can cause TMD. The incidence of TMD is significant, as it is currently the second most frequent condition, following lower back pain. (Suomalainen Lääkäriseura Duodecim, 2021.)

Temporomandibular disorders affect between 5% and 12% of the adult population, highlighting how common this issue is. In addition, TMD is more common in women than in males, occurring around four times as often in the former group. It should be noted that TMD symptoms can also appear in children, although they usually go away with time. Even though TMD is common, diagnosis and treatment of these conditions greatly benefit from the involvement of

healthcare experts, especially dentists and physiotherapists. By treating the many features of TMD, this can help improve the patient's quality of life (Kuč et al., 2021).

4.3 Assessment & Examination

A thorough patient history is the first step in any comprehensive evaluation of temporomandibular disorder (TMD) and offers important information about the patient's past experiences with jaw-related problems. Part of this process involves asking specific questions such as, "where do you feel the pain?", "when did it start?", "was there was an injury?", "how did it start?", "how bad is the pain?" (VAS), "how easily does the pain get worse or improve?" "Do you hear any noises like clicks or locks when you move your jaw?", "have you had any previous injuries or dental problems?", "when do you usually feel the symptoms?", "are there any other issues like neck pain, dizziness, headaches, or other (nerve-related) symptoms?". An understanding of the condition is made clearer by asking these specific questions. You will learn more about the patient's location and onset of pain, potential injuries, pain intensity, fluctuation in pain, noises during movement of the jaw and the existence of other related issues such as headaches, dizziness, neck pain, or nerve-related symptoms (Nishiyama et al., 2014).

When examining temporomandibular disorder (TMD), several critical elements are carefully monitored to obtain a thorough picture of the patient's state. To achieve uniformity, closely examine both sides of the face, with facial symmetry standing out as a crucial area of examination. Variations in facial symmetry might provide important information for the diagnosis process by suggesting potential temporomandibular joint problems. Looking closely for any indications of edema or deformity in the jaw region is another important component of the evaluation. Changes in the jaw shape or puffiness can reveal important information about the physical signs of TMD (TMJ Examination - Physiopedia. (n.d.).

Examining occlusion, the position of the teeth when the jaw is closed, is another aspect of the examination procedure. Abnormalities or misalignments can be detected, that may be causing the patients jaw related problems by closely inspecting how the teeth fit together. The examination also includes an auditory evaluation, in which listening for any audible joint noises made when moving jaw, such as clicks or locks. The examinations auditory component improves knowledge of the kind and severity of TMD overall. Evaluating the patient's posture is an important aspect of the examination as well (cervical spine, neck, and spine position/posture). This part of the exam provides additional information about the patient's general musculoskeletal health by recognizing the connection between the temporomandibular joint and cervical spine (TMJ Examination - Physiopedia. (n.d.)).

To summarise, the examination phase is a thorough and meticulous process that combines functional, visual, and auditory examinations to help clarify the diagnosis and guide customized interventions for people with temporomandibular disorders (TMJ Examination - Physiopedia. (n.d.)).

4.4 Red Flags

When performing a temporomandibular disorder (TMD) assessment, it is important to carefully evaluate any red flags that may indicate underlying complications that need to be further investigated and treated with customized interventions. Notable symptoms include intense, persistent pain that does not improve with conservative therapy, which calls for a thorough investigation of aggravating and possible causative factors (Günther et al., 2020).

Furthermore, the existence of headaches along with neurological symptoms like vertigo, light-headedness, or altered sensation prompts questions about the wider neurological effects of TMD and calls for a thorough assessment. Unexpected weight loss, fever, and night sweats, as well as breathing or swallowing difficulties, call for a comprehensive examination to rule out these

problems, highlighting the significance of comprehensive patient evaluation. (American Headache Society, 2021) A thorough examination that is customized to meet each patients' needs is guided by several critical indicators, including unilateral symptoms that deviate from typical TMD patterns, persistent and worsening symptoms despite appropriate physiotherapy, joint noises accompanied by jaw locking, recent trauma or injury to the head, neck, or jaw, and progressive limitation in mouth opening (Günther et al., 2020).

5 TREATMENT

The management of temporomandibular disorder (TMD) involves various treatment methods, with a preference for nonsurgical approaches initially. Among these, physical therapy interventions play an important role, focusing on both manual therapy and therapeutic exercises. Manual therapy involves manipulation, mobilization, and soft tissue techniques, attempting to improve mandibular movements and reduce pain. Recent evidence suggests that combining manual therapy techniques with exercises will increase the chances of a positive outcome for TMD patients (Fernández-de-las-Peñas & Mesa-Jiménez, 2020, pp. 139-141).

Exercise therapy aims to enhance muscular coordination, range of motion, and strength. Postural and oral exercises are implemented in treating TMD patients to reduce pain and improve mouth opening in TMD patients. Moreover, recent randomized controlled trials have expanded research in this area, exploring the efficacy of manual therapy and exercise interventions. The importance of evidence-based approaches in managing TMD-related pain and dysfunction, providing insights into the potential mechanisms and clinical significance of these interventions. (Fernández-de-las-Peñas & Mesa-Jiménez, 2020, pp. 139-141).

Temporomandibular joint disorder (TMD) treatment, emphasizing conservative approaches like physiotherapy and manual therapy. The research investigated the effects of post-isometric muscle relaxation (PIR) and myofascial release (MR) on TMD-related pain and muscle tension. Results showed significant decreases in muscle electrical activity and pain intensity after both treatments, with no significant differences between the two methods. The study highlighted the scarcity of comparative research on these techniques in TMD treatment, underscoring the need for further investigation. Additionally, it referenced previous studies supporting the efficacy of PIR and MR in reducing pain and improving musculoskeletal function. However, the study acknowledged limitations including a small sample size and challenges in standardizing electrode placement for electromyographic assessment. Overall, the findings corroborated existing literature on the positive effects of PIR and MR in TMD management, suggesting potential avenues for future research to address limitations and expand understanding in this area (Urbáński et al., 2021).

The temporomandibular joint (TMJ) is impacted by temporomandibular disorders (TMD), which are complex conditions that can be uncomfortable and impair jaw function. This section we will explore a comprehensive and scientifically supported treatment strategy for TMJ/TMD that combines medication, focused exercises, manual therapy, and preventive care (Miernik et al., 2012).

With the goal of improving muscular strength, flexibility, and joint mobility, therapeutic exercises are essential to the management of TMJ/TMD. Use of exercise therapies in the treatment of TMDs by highlighting their beneficial effects on pain relief and enhanced jaw function. Tailored exercise, such as weight training and jaw stretches, which emphasize the utility of exercise in mitigating muscles soreness and improving joint function overall (Lee & Kim, 2023) (Fernández-de-las-Peñas & Von Piekartz, 2020).

When TMJ/TMD is characterized by ongoing pain and inflammation, pharmaceutical therapies become essential. The usefulness of analgesics, muscle relaxants, and nonsteroidal anti-inflammatory medications (NSAIDs) in reducing symptoms and enhancing treatment efficacy. When recommended

carefully, medication can be a useful addition to manual treatment and exercise programs (Ouanounou et al., 2017).

To reduce the likelihood of symptom recurrence, preventive interventions are an essential part of long-term TMJ/TMD management. Sustained relief is facilitated by modifying one's lifestyle, managing stress, and avoiding bad habits. Patients get education on appropriate oral hygiene practise, such as keeping a straight posture and minimizing actives that put undue pressure on the jaw (Fernández-de-las-Peñas & Von Piekartz, 2020).

A thorough and scientifically supported treatment plan for TMJ/TMD includes medication, focused exercises, manual therapy, and preventive care. Each modality, which is based on scientific research, advances our knowledge of the ability to treat TMD by offering patients individualized, highly effective therapies. Combining these evidence-based elements guarantees both the resolution of present symptoms and the establishment of basis long-term joint health and functionality. The treatment of TMJ/TMD is changing, and this comprehensive approach reflects this change by fusing conventional knowledge with new scientific discoveries (Fernández-de-las-Peñas & Von Piekartz, 2020).

6 THE ROLE OF THE PHYSIOTHERAPIST IN THE TREATMENT OF TEMPOROMANDIBULAR DISORDERS

The terms “temporomandibular disorder” (TMD) and “temporomandibular joint” (TMJ) refer to a group of disorders that affect the jaw joint and the structures that surround it. A full approach is necessary for the successful management of these disorders, and physiotherapists play an important role in correcting musculoskeletal irregularities, reducing discomfort, and restoring optimal functionality (Brighenti et al., 2023.) Physiotherapists do comprehensive, individualized assessments and are qualified to handle TMJ disorders. These evaluations consider the patient's posture, muscle strength, joint mobility, medical

history, and other relevant variables (McNeely et al., 2006.) Physical treatment for TMJ/TMD, adopts a non-invasive approach and consists of exercise, manual therapy, and patient education. This can frequently eliminate the need for surgical therapies, providing the patient with less invasive options, and more effective options (Brighenti et al., 2023.)

Important elements of a physiotherapy intervention consist of pain management, posture control, customized exercise program, education and self-management, and cooperation with other medical professionals (Smekal et al., 2008.) In pain management, physiotherapists use a range of techniques; including manual therapy and modalities, to successfully treat pain associated with TMJ/TMD. Additionally, patients will receive methods for managing their pain at home, guaranteeing a thorough and long-lasting relief plan (Herrera-Valencia et al., 2020).

In posture correction, physiotherapists will carefully assess and adjust posture, especially in the upper cervical spine, showing awareness of the negative consequences that posture can have on TMJ/TMD. By reducing stress on the jaw joint and related muscles, this corrective action promotes a better healing environment (Lee & Kim, 2023.) In a customized exercise program, developing personalized programs is essential to improving the flexibility, strength, and coordination of the jaw and neck muscles. These customized workout plans provide patients the freedom to take an active role in their recovery from the comfort of their own homes, encouraging a sense of agency in the healing process (McNeely et al., 2006).

In education and self-management, physiotherapists educate patients on TMJ structure, causes of TMD, and necessary lifestyle changes in addition to physical therapies. The ability of patients to self-manage their illnesses is improved by this all-inclusive approach. Encouragement of healthy sleeping habits, advice on soft food diet during acute stages, and a combination of relaxation and stress-reduction technique into everyday routines are all recommended (Armijo-Olivo et al., 2016). In cooperation with other medical professionals, physiotherapists who adopt a multidisciplinary approach work in harmony with

orthodontists, dentists, and other medical professionals. By working together, we can guarantee a well-rounded and efficient treatment plan that maximizes the overall efficacy of therapeutic procedures (Cebola et al., 2021).

The complete care for TMJ/TMD includes a variety of therapeutic techniques in addition to the previously listed parts. Specialized manual therapy techniques and focused interventions for managing the conditions related to headaches and neck pain may be among them (La Touche et al., 2020). Physiotherapists are quite important and have a variety of roles in the treatment of TMJ/TMD. Treatment and rehabilitation are greatly aided by their dedication to careful assessment and the application of tailored therapies. Physiotherapists support patients with TMJ/TMD by harmoniously conjoining the treatment of the musculoskeletal issues, patient education, and working in conjunction with other medical experts to improve the patient's overall quality of life (McNeely et al., 2006).

7 TEMPOROMANDIBULAR JOINT /TEMPOROMANDIBULAR DISORDERS AND ITS RELATIONSHIP WITH UPPER CERVICAL SPINE

Temporomandibular disorders (TMD) are a set of ailments affecting the temporomandibular joint (TMJ), Masticatory muscles, and surrounding structures. TMD is a common source of orofacial pain, and it can have a substantial influence on an individual's quality of life. The link between TMD and the upper cervical spine has received a lot of attention over the years, highlighting the complexity of both disorders and the need for a comprehensive management approach. This section examines this link and the efficacy of combined manual therapy, cervical spine exercises, and therapeutic pain education in TMD management, building on recent study findings (Lee & Kim's, 2023).

The temporomandibular joint and upper cervical spine have a close biomechanical and neuroanatomical interaction. Both regions contribute to the

complex movements of the head and neck, and their activities are intricately linked. This connection implies that failure in one region may trigger compensatory changes and symptoms in the other (Lee & Kim's 2023) study, medicine, and rehabilitation shows that manual therapy combined with myofascial TMD and headaches. This study emphasizes the interconnected nature of TMD and cervical spine disease, demonstrating how treatment approaches targeting the cervical spine can result in considerable reduction in TMD symptoms.

In the setting of TMD and its relationship to the upper cervical spine, manual therapy and therapeutic exercises emerge as critical component of a comprehensive treatment approach (Gabriella de Almeida Tolentino et al. 2021), investigate the effect of combining manual therapy, neck muscle exercises, and therapeutic pain neuroscience education on migraine sufferers. Although primarily focused on migraines, this approach holds promise for TMD management, given the overlapping symptomatology and underlying mechanisms between these conditions. The study underscores the potential of a multidisciplinary approach in addressing the complex interplay between the cervical spine and TMD.

Further supporting the connection between TMD and the cervical spine, (La Touche et al. 2020), in their systematic review and meta-analysis, examine the effect of manual therapy and therapeutic exercises applied to the cervical region on pain and pressure pain sensitivity in patients with TMD. The findings from this comprehensive review affirm that interventions focusing on the cervical spine can yield significant benefits for individuals suffering from TMD, reinforcing the concept that the management of TMD requires attention beyond the temporomandibular joint itself.

The relationship between temporomandibular joint disorders and the upper cervical spine is complex and multifaceted, involving biomechanical and neuroanatomical connections that play a crucial role in the manifestation and perpetuation of symptoms. The body of research, including the studies by Lee & Kim (2023), Gabriella de Almeida Tolentino et al. (2021), La Touche et al.

(2020), provides compelling evidence supporting the effectiveness of a multi-disciplinary approach that includes manual therapy, cervical spine exercises, and therapeutic pain education in managing TMD. These findings underscore the importance of a holistic treatment paradigm that addresses the interconnectedness of the temporomandibular joint and cervical spine, offering a promising direction for improving patient outcomes in TMD management.

8 THESIS PROCESS AND METHODS

Below is the table 3 of the thesis schedule and process. The authors decided to collaborate on the writing process of the thesis. The authors had a few topics in mind, but eventually settled with the topic of Temporomandibular joint /Temporomandibular Disorders and its relationship with upper cervical spine. The authors split the workload of this thesis with the first one in charge of preparing and organizing the workshop, the second one with the responsibility of putting together the lecture review. The topic and planning of the thesis were according to the schedule. The authors came up with the topic of this thesis, including a hands-on workshop. The writing process started a month earlier than planned, which was a mutual decision. During the writing process, then the authors began to write and plan the workshop, which was three weeks later than planned. The authors wanted to explore the topic more in depth and have an extended time frame to plan a beneficial workshop. Finally, the workshop was held on February 19th. After the workshop, the authors had already completed most of the thesis report and decided to present it earlier than planned. Due to these changes, the piloting and feedback part was delayed by one month, but luckily, the authors completed it in a timely manner to hold a presentation on May 27th, 2024.

Table 3. Thesis process plan

Task	Date
Starting thesis process	March 2023
Choosing the topic	20.03.2023
Researching about the topic	March 2023 – May 2024
Thesis plan unofficial approval	May 2023
Official thesis plan presentation	December 2023
Writing process	January – March 2024
Preparing the workshop	December 2023 – January 2024
Workshop presentation	January - February 2024
Piloting and feedback	February 2024
Finalizing the thesis	September 2024 – November 2024

9 WORKSHOP AND STUDY MATERIAL

The workshop was held in Samk University on February 19th, 2024, open and limited of 12, 3rd year physiotherapy students. An invitation was sent by email two weeks earlier. Eleven students enrolled to participate. Nine students showed up on the workshop day. Data collection was gathered from a feedback questionnaire in paper format, where students had to answer seven questions concerning the workshop.

For the presentation, a PowerPoint had been created and shared to students on the morning of workshop day. The workshop involved the theory and role of physiotherapy in treating TMJ, including anatomy such as bones, ligaments, and main muscles that effect TMJ, including neck muscles, palpation, and soft tissue manual massage therapy of those muscles.

Participants were required to respond to six out of seven questions using a rating scale ranging from 1 to 5. A rating of 1, labelled as "Not at all," signified

the absence or very minimal impact. A score of 2, designated as "Slightly," indicated a small or subtle amount, though still not considered significant. The middle ground was represented by 3, labelled as "Moderately," suggesting a moderate level of presence or impact falling between low and high magnitudes. Moving towards higher impact, 4 denoted "Quite a bit," indicating a substantial amount surpassing moderation but not reaching extremes. The highest rating, 5, labelled as "A lot," represented a noteworthy and substantial presence or impact. This scale facilitated a nuanced assessment of the varying degrees of influence in participants' responses.

At the beginning of the workshop, participants were asked to assess their current level of knowledge about TMJ (Temporomandibular Joint). The responses revealed diverse perspectives. 1 out of 9 participants (~11.1%) indicated a very low or minimal level of familiarity. In contrast, 4 out of 9 (~44.4%) of participants indicated a slight or small amount of pre-existing knowledge, suggesting a level of familiarity that, while present, may not be considered significant. Another 4 out of 9 (~44.4%) expressed a moderate level of understanding, signifying a considerable but not overwhelming amount of knowledge.

After the workshop, the authors wanted to understand the impact on everyone's knowledge about TMJ (Temporomandibular Joint). They gathered insights through additional questions/survey. The goal was to ensure that everyone, regardless of their initial knowledge, gained valuable insights from the workshop. This information helped guide in recognizing what aspects were effective and how the workshop can be improved in the future.

After the workshop, during the feedback session, the first question participants were asked to answer was, 'How much do you feel you have benefited from the workshop?' The responses revealing varying degrees of perceived impact. 1 out of 9 (~11.1%) participants felt they benefited slightly, suggesting a small or subtle positive impact. In contrast, a substantial 2 out of 9 (~22.2%) participants expressed that they gained quite a bit from the workshop, indicating a more significant and noteworthy impact that exceeded a moderate level. The majority, comprising 6 out of 9 (~66.7%) of participants, felt that they benefited

a lot, signifying a substantial and substantial presence or impact. These responses underscore the overall positive perception of the workshop's effectiveness, with a significant portion of participants recognizing substantial benefits. The feedback obtained from these questions serves as valuable input for gauging the success of the workshop and understanding the varying levels of impact experienced by participants.

The next question was, 'Rate the clarity of the instructions provided during hands-on activities?' The results indicated that 2 out of 9 (~22.2%) of participants perceived the clarity of instructions as moderate, suggesting a satisfactory but not overwhelming level of understanding. On the other hand, a significant majority, comprising 7 out of 9 (~77.8%) participants respondents, found the instructions to have a substantial and significant impact, signifying a high level of clarity. These findings highlight a positive overall assessment of the clarity of instructions during hands-on activities, with a notable majority expressing a strong understanding. This feedback is valuable in recognizing the effectiveness of instructional delivery and provides insights for potential enhancements in future workshops, ensuring continued positive participant experiences.

The next question 4 and 5 asked participants to reflect on their experience after attending the workshop: 'After attending the workshop, please share your overall satisfaction with the usefulness of the information provided and indicate if the workshop enhanced your understanding of the subject matter?' The responses yielded insightful feedback. A notable 1 out of 9 (~15,3%) of participants indicated a minimal impact, signifying that the workshop had little or no presence in enhancing their understanding. In contrast, 1 out of 9 (~15,3%) participants expressed a moderate level of impact for this group. Furthermore, 2 out of 9 (~23,1%) participants indicated a substantial amount of impact. The majority, a significant 5 out of 9 (~46,3%) of respondents, rated the workshop the highest, representing a significant and substantial impact. These responses demonstrate an overall positive sentiment, with a large majority expressing that the workshop had a significant presence and positively influenced their understanding of the subject matter.

Reflecting on the participants' pre-workshop knowledge, the question sought insights into the impact of the workshop in deepening their understanding of TMJ-related topics. The responses revealed a varied spectrum of experiences. 1 out of 9 (~11,1%) of participants indicated that the workshop had minimal impact, suggesting that it did not significantly contribute to their understanding. In contrast, 2 out of 9 (~22.2%) felt that the workshop had a moderate impact, implying a satisfactory but not overwhelming level of deepening. Another 1 out of 9 (~11,1%) expressed that the workshop had a substantial impact, surpassing a moderate level but not reaching an extreme level. The majority, comprising 5 out of 9 (~55.6%) of respondents, noted that the workshop had a significant and substantial impact, signifying a deepening of understanding. These findings highlight a generally positive influence of the workshop on participants' knowledge, with a substantial proportion experiencing a notable enhancement in their understanding of TMJ-related topics. This feedback is valuable for recognizing the effectiveness of the workshop in achieving its educational goals.

The seventh question was an open-ended prompt, 'What key information will you take away from this workshop?' Most participants answered that the introduction to TMD, muscle palpation, and manual techniques were beneficial.

In conclusion, the workshop proved to be a valuable learning experience. Despite a slight disparity in pre-existing knowledge levels among participants, the workshop effectively deepened understanding of TMJ-related topics for the majority of attendees. Feedback from the post-workshop questionnaire revealed a positive perception of the workshop's effectiveness, with participants acknowledging substantial benefits and enhanced clarity of instructions during hands-on activities. The majority expressed satisfaction with the usefulness of the information provided and noted a significant improvement in their understanding of the subject matter. Overall, the workshop successfully achieved its educational goals and provided valuable insights for potential future enhancements.

10 DISCUSSION

The primary focus of this thesis has been to explore the management of Temporomandibular Joint Disorders (TMD) and its relationship with the upper cervical spine, with a focus on educating physiotherapy students at the Satakunta University of Applied Sciences. The entire thesis process went very well, there definitely were struggles finding well-fitting articles, and studies. But as the two authors worked as a team everything worked out well. Good communication and always helping each other made the process of the thesis follow smoothly. Now thinking back on the ethical side of this theses, the many things that were taken into consideration were making sure the questionnaire was anonymous. The way this was performed was by not collecting any names and making sure there were no question that with the answers you would be able to tell who it was. As well and looking into each referenced that was used and made sure it was not bias and had good evidence grading, both authors researched and looked into every reference used.

Through the development of a workshop and lecture review, the aim was to enhance understanding and awareness of TMD among students, giving them an introduction to the necessary knowledge and skills that it takes to effectively address these issues in their future practice.

The workshop and lecture review were designed to cover various aspects of TMD management, ranging from theoretical foundations to practical applications. The inclusion of hands-on techniques and detailed educational material aimed to provide students with a holistic understanding of TMD, enabling them to identify and treat jaw joint problems related to the neck. By participating in these activities, students developed valuable skills that will support their future work in assisting patients with TMD issues.

The role of physiotherapists in the treatment of TMD is important, as highlighted in the literature review. Physiotherapists play a crucial role in conducting assessments, developing personalized treatment plans, and implementing

non-invasive interventions to reduce pain and restore optimal functionality. Through techniques such as manual therapy, customized exercise programs, and patient education, physiotherapists can effectively manage TMD, often without the need for surgical interventions. Collaboration with other healthcare professionals further enhances the efficacy of treatment, emphasizing the importance of a multidisciplinary approach in addressing TMD.

Understanding the anatomy of the temporomandibular joint is essential for effective TMD management. The complex interaction between bones, ligaments, muscles, and nerves highlights the intricate nature of this joint and its susceptibility to dysfunction. By examining the anatomy and biomechanics of the TMJ,

Symptoms and causes of TMD are multifaceted, cover a wide range of issues that extend beyond localized jaw pain. The link between TMD and neck muscle pain show the interconnectedness of these systems, highlighting the need for a holistic approach to assessment and treatment. Early identification of TMD symptoms, along with thorough patient history and examination, is crucial for timely intervention and improved patient outcomes.

Treatment strategies for TMD involve a combination of manual therapy, exercises, medication, and preventive care. Manual therapy techniques, such as massage and mobilization, can help ease muscle tension and improve joint function. Therapeutic exercises aim to improve muscular strength and flexibility, while medication may be prescribed for pain and inflammation management. Prevention strategies focus on lifestyle modifications and stress management techniques to reduce the risk of symptom recurrence.

In conclusion, the management of TMD requires a comprehensive and multidisciplinary approach, with physiotherapists playing a central role in assessment, treatment, and rehabilitation. By equipping students with the necessary knowledge and skills through educational initiatives like workshops and lecture reviews, we can enhance the quality of care provided to patients with TMD, ultimately improving their overall quality of life. The overall thesis went well and the teamwork between the two authors went smoothly. A lot of knowledge was

gained during the whole thesis process. For future thesis, and to continue the study of this subject it would be really good to expand more on manual therapy and mobilization of the cervical spine and how it can benefit temporomandibular disorder or how neck injuries can trigger or effect temporomandibular disorders.

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