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Bruxism – self study material

An overview for future physiotherapists

DEGREE PROGRAMME IN PHYSIOTHERAPY
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ABSTRACT

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Bruxism, characterized by the involuntary grinding or clenching of teeth, gnashing or thrusting of the mandible presents significant challenges to individuals' health and overall well-being.

This thesis aims to enhance the understanding of bruxism to future physiotherapists, by examining and presenting through a self study material its nature, etiology, diagnosis, consequences, and the evolving role of physiotherapy in management of this phenomenon, and other possible treatment options available at the moment. Utilizing a thorough analysis of literature and clinical evidence, this study aims to present the complexities of in order to emphasize the potential benefits of physiotherapy interventions in relieving symptoms and enhancing patients' quality of life. Also by putting together existing knowledge about bruxism, it highlights the importance of interdisciplinary collaboration in addressing the diverse needs of individuals affected by bruxism.

CONTENTS

1 INTRODUCTION

Bruxism, parafunctional activity of the masticatory muscles, characterised by teeth grinding and clenching, or by bracing and gnashing of the mandible. 85-90% of people will suffer from some form of bruxism to a certain degree during their life. (Manfredini & Lobbezoo,2010) It is associated with temporomandibular disorder (TMD) and can occur during sleep or while awake. This common phenomenon often comes unnoticed until symptoms such as incisal and occlusal tooth wear, jaw pain, masticatory muscle stiffness, headache, toothache or chips and cracks on teeth occur. (Bulanda et al., 2021; Goldstein & Auclair Clark, 2017a; Murali et al., 2015a)

This condition calls for a multi-professional team of dentists, psychotherapists, medical doctors and physiotherapists to work together, where physiotherapy plays its role primarily in symptomatic treatment and management of pain caused by this disorder.

Physiotherapy is a health care profession which uses wide range of approaches such as exercise, manual therapy, relaxation techniques, body awareness and patient education in which the objective is to relieve symptoms, treat the cause and overall improve quality of life. When treating patients with TMJ pain and TMD, bruxism is an important topic to be acknowledged and considered by physiotherapists when making physiotherapy examination and assessment, as it may help set an adequate conclusion and treatment plan. (Hynynen et al., 2016; Shaffer et al., 2014a)

In this thesis the questions such as “what is bruxism?”, “what should a physiotherapist know about bruxism”, “what are the causes of bruxism, its effects and what are the treatment and/or management options?” are answered.

Collection of scientific literature material for this thesis was done in English. Inclusion criteria for the process of researching are articles published on PubMed database using the search terms “bruxism”, “temporomandibular disorder”, “physiotherapy”, “awake OR diurnal bruxism”, “sleep OR nocturnal bruxism”, “temporomandibular joint”, “masticatory muscular pain”, “stress”, “anxiety”, “teeth clenching” and “teeth grinding”.

2 AIM AND OBJECTIVE

Aim of the thesis is to increase knowledge of physiotherapy students about bruxism, to learn what are the options of treatment a physiotherapist can offer and what other TMJ problems may be related to this topic.

The objective of the thesis is to create a quality self-study video material which would help physiotherapy students better understand the issue of bruxism and its impact on the temporomandibular joint.

3 ANATOMY OF THE JAW

The anatomical structures relevant for this thesis, which will provide comprehensive understanding of the impact of bruxism on patients’ health, are as follows – musculoskeletal structures from head and maxilla, the mandible and temporomandibular joint, the only joint in the facial area, which consists of four masticatory muscles, next periodontal tissues, and shortly neurological structures – relevant information about CNS and innervation of the jaw.

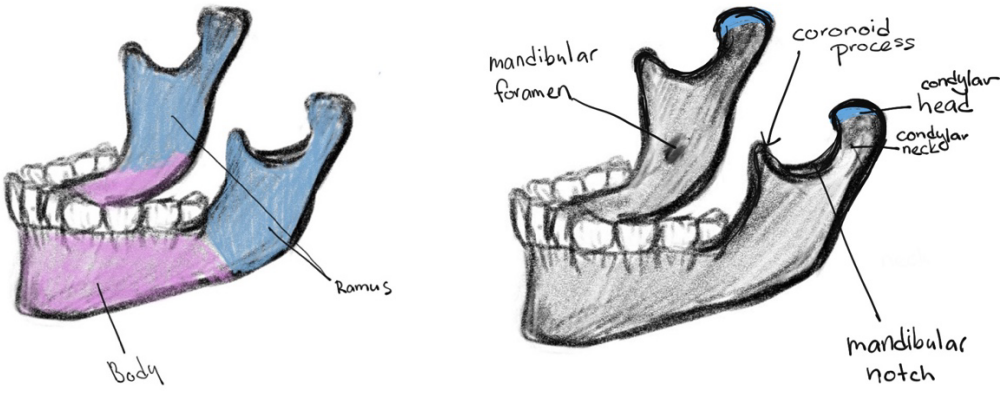
Muscles of the face, head and cervical spine are participating in stability of the temporomandibular joint. Muscles of mastication are often divided into openers and closers, although they contribute to bigger variety of movements. (Bordoni

& Varacallo, 2023; Manfredini et al., 2011; Melo et al., 2019; Shaffer et al., 2014a)

Teeth are hard structures attached to maxillae and mandible, with the purpose of chewing food and preparing it for easier digestion. Humans have two sets of teeth during lifetime, deciduous – primary teeth (20 count), and after that permanent teeth (usually 32). A tooth can be divided into crown, neck and root. When speaking of bruxism – teeth grinding most usually affects the structure of the crown, causing dental attrition, which means its destroying the protective part of the tooth – the enamel and exposing the inner part - dentine. Bruxism makes permanent damage to the teeth, because enamel is unable to heal or grow back, despite it being the hardest material in the body. (A. Agur & Dalley, 2017; Norton, 2016; Schmidt, 2021)

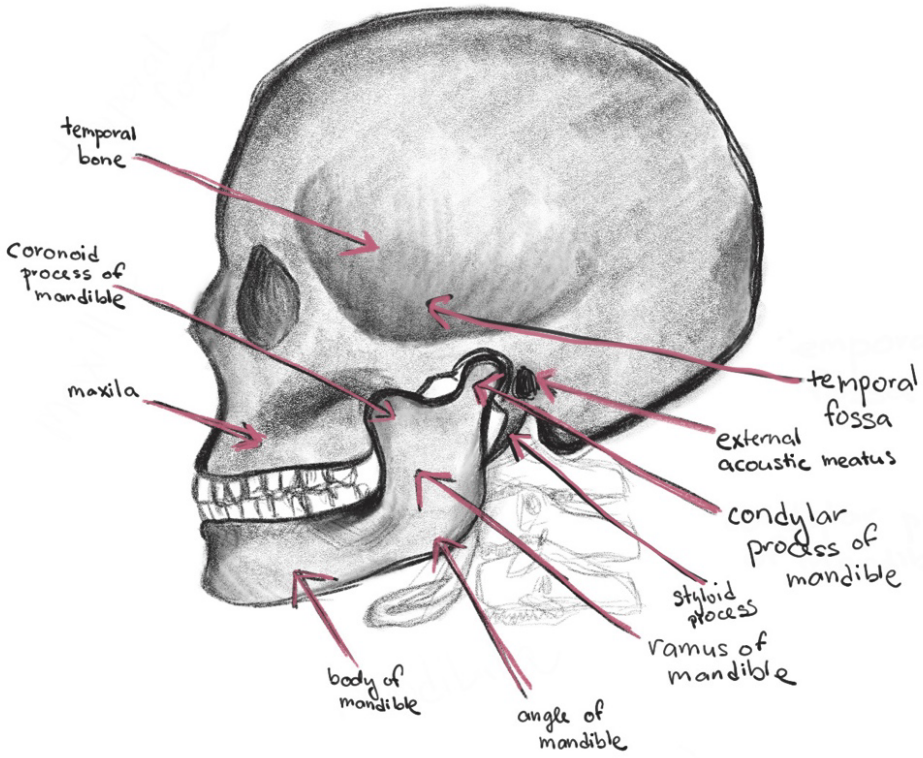
3.1 Bones of the jaw

The **mandible** is the largest bone of the viscerocranium (facial skeleton). It is attached to the rest of the scull through synovial joint, known as the temporo-mandibular joint (TMJ) which makes it the only bone of the scull that moves, allowing it to produce many motions like opening and closing the mouth, see picture 2. Mandible is bilaterally symmetrical, has a shape often referred to as a horse shoe and consists of three parts, the corpus (body) and two rami on each sides, see picture 1 below. (A. Agur & Dalley, 2017; Atkinson & Johnson, 2020; Bordoni & Varacallo, 2023; Helland, 1980; Shaffer et al., 2014a)



Picture 1.: mandible anatomy, Katrin Hrbacova 2024

Maxillae is the upper jawbone and is the structural support of viscerocranium. It is formed by two pyramid-shaped maxillary bones fused together in the mid-line. It separates the oral and nasal cavity and carries the upper set of teeth. (Norton, 2016; Soriano & Das, 2022)



Picture 2.: Bone anatomy of the head and jaw, author Katrin Hrbacova 2024, adapted from A. Agur & Dalley, 2017

3.2 Temporomandibular joint (TMJ)

Temporomandibular joint (TMJ) facilitates movement of the jaw and is the meeting point of the mandibular condyle and temporal bone. Located bilaterally, anteriorly to the external acoustic meatus. Briefly described its unique structure, TMJ consists of several parts as presented in the Netter's Head and Neck Anatomy Norton, (2016) - Superior part is the squamous area of temporal bone, the mandibular fossa, the next is Inferior part is the condylar head of mandible covered with fibrocartilage. In between them is the intra-articular disc

which serves as a cushion. Ligaments, muscles and tendons all assist in guiding the joint movement or hold the joint in place.(Bordoni & Varacallo, 2023; Helland, 1980; Norton, 2016)

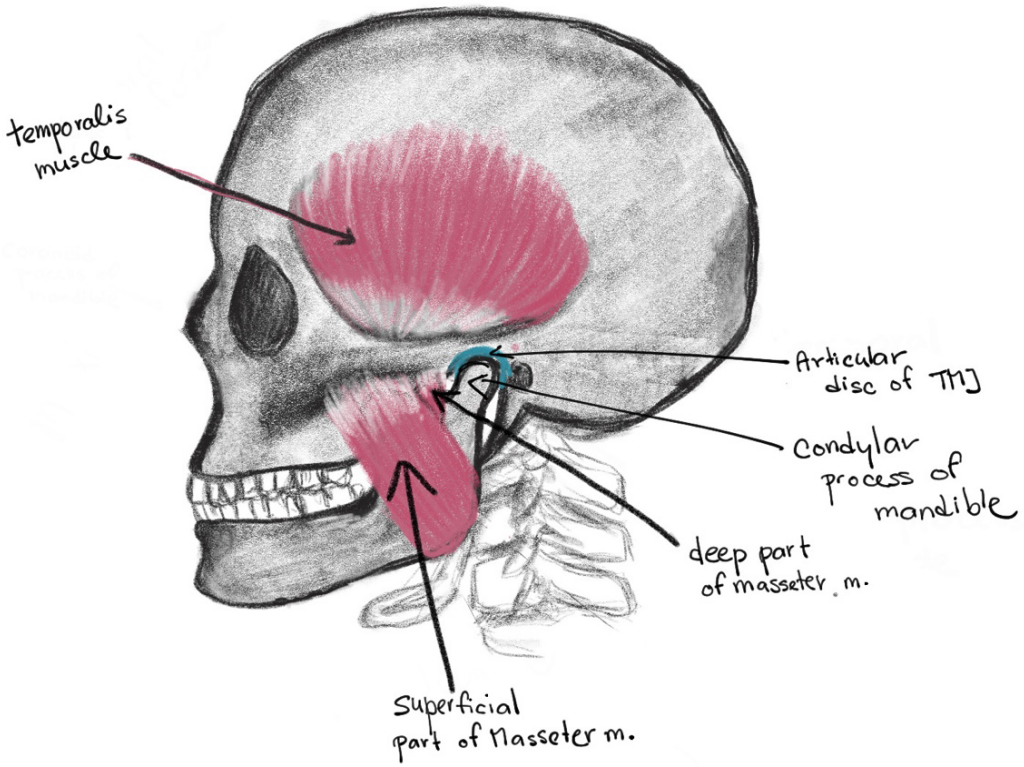
The TMJ is highly dynamic joint, allowing mandible to perform hinge-like actions, rotation and translation movements. Temporomandibular joint works in synergy with the surrounding structures of head and neck (A. M. R. Agur & Dalley, 2017; Atkinson & Johnson, 2020; Bordoni & Varacallo, 2023)

The squamous area of temporal bone is formed by articular eminence, articular tubercle, glenoid fossa, tympanic plate and postglenoid tubercle. Glenoid fossa is the same thing as mandibular fossa and is a concave structure which the condylar head of mandible fits into. The condylar head is the inferior part of TMJ and is the top part of the mandible bone. The internal surface of both of these structures (superior and inferior) is covered in synovial lining, producing synovial fluid, which supplies lubrication and nourishment. In between glenoid fossa and condylar head lies the **intra-articular disk**, meniscus of the TMJ, flexible and elastic cartilage, which serves as a cushion, allowing smooth movements during jaw opening/closing. It is attached anteriorly to the lateral pterygoid muscle. (A. Agur & Dalley, 2017; Norton, 2016) One third of the population reportedly suffers from some kind of temporomandibular joint disfunction, often this is related to problems with the articular disc, and one of the causes can be the effects of bruxism (Norton, 2016).

3.3 Muscles of mastication

Mastication, or the process of chewing food and preparing it for deglutition, is not only about opening and closing the mouth, it involves movements of the muscles in different combinations of movement in the frontal, sagittal and transversal plane in order to move the mandible. (Bordoni & Varacallo, 2023; Corcoran & Goldman, 2022; Norton, 2016)

Movements of the jaw, in the temporomandibular joint to be precise, are produced mainly by the four muscles of mastication (Agur & Dalley, 2017). Primary masticatory muscles consist of masseter, temporalis, lateral pterygoid and medial pterygoid, are all bilateral and have direct contact with the temporomandibular joint (Bordoni & Varacallo, 2023; Neumann, 2010). To properly understand their function and anatomy, it is important to discuss each muscle individually.(Bordoni & Varacallo, 2023)



Picture 3.: sketch of anatomy of jaw and head, muscular structures, Katrin Hrbacova 2024, adapted from A. Agur & Dalley, 2017

Masseter muscle (picture 3) consists of two heads, deep and superficial head, they both essentially contribute to the same movement which is elevation of the mandible. Masseter origin is the zygomatic arch and insertion is the lateral surface of ramus of mandible and coronoid process of mandible.(A. Agur & Dalley, 2017; Bordoni & Varacallo, 2023; Corcoran & Goldman, 2022)

Masseter has direct contact with the articular disc. Closing the mouth and bringing teeth together requires bilateral contraction of this muscle. Another function of both masseter muscles activation at the same time is protrusion of

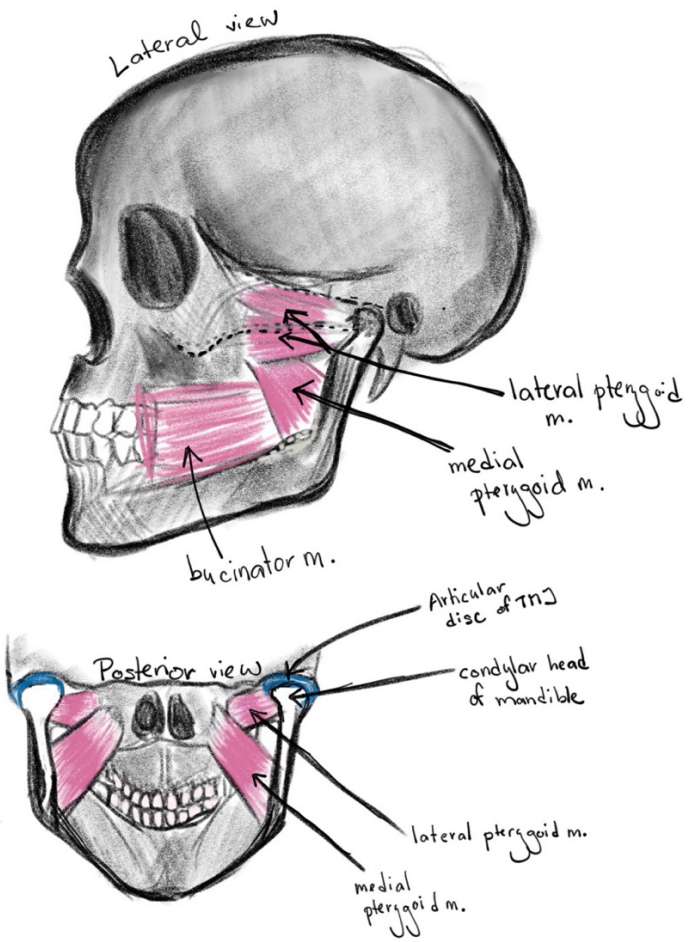
the mandible, and when the masseter muscle contracts unilaterally, it creates ipsilateral excursion of the mandible, movement which happens during lateral grinding. The origin of masseter muscle is the zygomatic arch of zygomatic bone and insertion is the lateral surface of ramus of the mandible. (Helland, 1980; Neumann, 2010; Shaffer et al., 2014a)

Temporalis muscle (picture 3) origin is the temporal fossa and insertion is in coronoid process of mandible, and its function is to elevate the mandible. It's a flat muscle which fills big part of the temporal fossa and is the main muscle which keeps the mandible in resting position(Norton, 2016) . It's function is to elevate the jaw (mandible), and protrusion of mandible. (A. Agur & Dalley, 2017; Bordoni & Varacallo, 2023)

Lateral pterygoid (picture 4) is the main opener of the mouth, strongest muscle generating protrusion, pulling the mandibular condyle anteriorly during jaw opening when activated bilaterally, and when activated unilaterally produces medial/lateral deviation of mandible, creating side to side movement of the jaw. Lateral pterygoid muscle has superior and inferior head. The superior head origins on crest and infratemporal surface of sphenoid bone, inferior head origins on lateral pterygoid plate and both heads insert on neck of mandible, articular disc and capsule the of TMJ. (A. Agur & Dalley, 2017)

Medial pterygoid (picture 4) assists in elevating of mandible, closing movement of jaw. Equally as lateral pterygoid, when activated bilaterally it protrudes the mandible, and when activated unilaterally produces grinding motion, side to side protrusion. Medial pterygoid consists of two heads – deep and superficial. Both heads of the medial pterygoid muscle insert on the medial part of ramus of mandible, deep head origins on medial side of lateral pterygoid plate and superficial head origins on the tuberosity of maxilla. (A. Agur & Dalley, 2017)

All of the muscles of mastication are innervated by the branches of trigeminal nerve, which is classified as the fifth cranial nerve (CN V) (Norton, 2016).



Picture 4.: lateral and posterior view of anatomical musculoskeletal structures of jaw and head, Katrin Hrbacova 2024 adapted from Norton, 2016

3.4 Ligaments of the jaw

Ligaments of the temporomandibular joint play an important role in guiding the condyle during jaw movements, especially opening and closing (Koolstra & Van Eijden, 1995). They also have proprioceptive function, detecting tension is important for the TMJ function (Bordoni & Varacallo, 2023).

The **stylomandibular ligament** connecting the styloid process of temporal bone to the mandible, it stabilizes and limits excessive protrusion of mandible (Bordoni & Varacallo, 2023; Norton, 2016).

Sphenomandibular ligament, located on the medial part, going from the spine of the sphenoid bone towards lingula of the mandible. Has stabilizing function and limits anterior protrusion of mandible. (Norton, 2016)

There are two **collateral ligament** located on each side of the articular disc to the mandible (medial and lateral), to the condyle and they restrict the movement of the disc away from the condylar head (Bordoni & Varacallo, 2023; Helland, 1980; Norton, 2016)

Temporomandibular ligament is made out of two separate bands, outer which is oblique and inner which is horizontal. The outer band is much larger, covers and stabilizes the TMJ, head of the condyle in the joint capsule, limiting opening of jaw. Temporomandibular ligament is going from the articular tubercle of zygomatic arch attaching on the lateral part of mandibular neck. (Norton, 2016)

The joint **capsule** is completely enclosing the articular surface of the temporal bone and condyle, providing support and nutrition to the joint, taughtened around by ligaments, it provides proprioceptive and nociceptive feedback. (Norton, 2016)

3.5 Movements of the jaw

The movements of the jaw are divided into 3 antagonistic pairs of movements of the mandible - **depression and elevation, protrusion and retrusion and side to side excursion (medial/lateral deviation)**. These movements are important to address in this thesis, because they also happen during the manifestation of bruxism. (Norton, 2016)

On the basic movement of jaw – opening and closing, we will be able to understand some of the principles of the movement of TMJ, muscle engagement and we will get to the review of the functional anatomy, which will assist in understanding the topic of bruxism. For bruxism masticatory muscles are

relevant to study, because from the definition, it is the non-functional activity of masticatory muscles, and there the closing muscles are important to mention (masseter, temporalis and medial pterygoid), because bruxism happens during the activation of those muscles. (Lavigne et al., 2003a)

3.6 The biomechanics of jaw opening

During the process of jaw opening (picture 5), there are two main movements happening in the temporomandibular joint, rotation and translation, and it moves the jaw forward and downward (Koolstra & Van Eijden, 1995). Both opening and closing movements require bilateral movement at the same time. Muscles involved in the jaw opening movement are lateral and medial pterygoid, geniohyoideus, mylohyoideus, and digastric, but the movement happens mainly due to gravity and relaxation of the muscles holding the mandible in closed position (Bordoni & Varacallo, 2023; Norton, 2016; Pinheiro et al., 2021). Firstly a rotational movement of the mandibular condyle inside the mandibular fossa, which is about 20mm of the initial movement, and secondly translation of the mandibular condyle and articular disc which move anteriorly and inferiorly from the joint cavity of mandibular fossa. Protrusion and depression movements are both necessary for the jaw to open. When the mouth opens, both condylar heads of mandible move out of the mandibular fossa into the articular tubercle. (Bordoni & Varacallo, 2023; Corcoran & Goldman, 2022; Norton, 2016)

Picture 5.: sketch of jaw opening and closing, Katrin Hrbacova 2024

3.7 The biomechanics of jaw closing

The mechanics of jaw closing are in principle the opposite to jaw opening, the condyle moves backward and upward back into the fossa (Koolstra & Van Eijden, 1995). Muscles involved in jaw closing are masseter, temporalis and medial pterygoid, and these muscles are engaged also during bruxism (Koolstra & Van Eijden, 1995; L. T. Thayer & Ali, 2022; Lobbezoo, 2017; Murali et al., 2015a; Shaffer et al., 2014a). The eccentric activation of lateral pterygoid muscle slows down the movement and allows the mandible to return back into the glenoid fossa (Murray et al., 2001).The movement of closing and placement of the final position of mandible is guided by the skeletal shape, ligaments, muscles and by the shape of the teeth (Ingawalé & Goswami, 2009; Koolstra & Van Eijden, 1995).

4 INTRODUCTION TO BRUXISM

Bruxism, defined by the Glossary of Prosthodontic Terms as the “parafunctional grinding of teeth and/or oral habit consisting of involuntary rhythmic or spasmodic nonfunctional gnashing, grinding, or clenching of teeth in other than chewing movements of the mandible, which may lead to occlusal trauma.” And although this glossary has been updated, the term is used since 1940. (Ferro et al., 2017). Recent studies point out that there are numerous and sometimes various definitions, and many professionals suggest redefinition of the term, to eliminate drawbacks and specify it correctly. And in the paper made by Lobbezzo et al. (2013) international consensus was made, which simplified the definition of bruxism to “*repetitive masticatory muscle activity that is characterized by clenching or grinding of the teeth and/or by bracing or thrusting of the mandible, has two circadian phenotypes which are specified as either sleep bruxism or awake bruxism.*”.

Nevertheless, bruxism is considered to be a critical risk factor for developing masticatory dysfunction and has been generally believed to be one of the major risk factors for developing TMD (Bulanda et al., 2021; Poveda Roda et al., 2007). Some studies referred to awake bruxism as a disorder, but more recent studies suggest referring to it as a possible risk factor in otherwise healthy individuals (Lobbezoo et al., 2018a).

As mentioned above, we identify two different types of bruxism based on the circadian manifestation, **nocturnal/sleep bruxism** – present during sleep, and **diurnal/awake bruxism-** present during wakeful state (Lobbezoo et al., 2013). These two types of bruxism have reported different prevalence, classification and accordingly also different diagnostic criteria and management options. Although the general definition of bruxism is similar, there are various opinions between professionals on the distinguishment of sleep and awake bruxism due to the differences in etiology, and it remains unclear whether sleep and awake bruxism have different pathophysiology after all. (Castrillon et al., 2016; Lavigne et al., 2008; Minakuchi et al., 2022; Pandya & Kushida, 2013)

Some studies may differentiate types of bruxism into idiopathic (primary), and iatrogenic (secondary). Idiopathic bruxism is quite common, and the cause isn't fully understood, current scientific studies mention combination of genetic, psychological and environmental factors. As for iatrogenic bruxism, the etiology is connected to manifestation of neurological diseases, autism, muscle-related issues, and autoimmune degenerative diseases, psychiatric sleep disorders, drugs (methamphetamine, cocaine, ecstasy) or medication (cardioactive, antipsychotic). (Castrillon et al., 2016; Goldstein & Auclair Clark, 2017b; Murali et al., 2015b).

For the purpose of this thesis the author mainly focuses on relating the topic of bruxism into sleep and awake.

4.1 Mechanism of bruxism

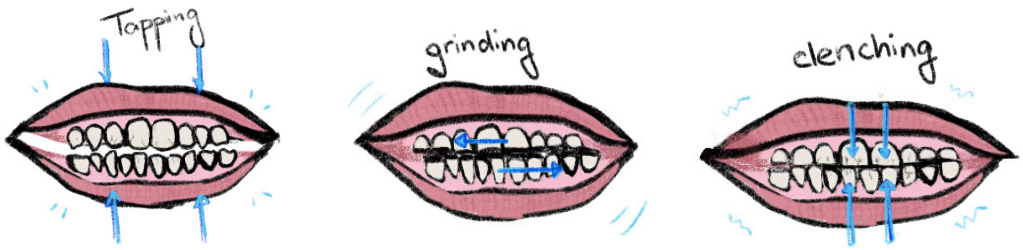
To further understand bruxism, it is important to explain what kind of non-functional movement is happening during this parafunction. Oral parafunction is a non-functional movement which is not associated with natural movements such as mastication, respiration, mimicking, verbal communication, sucking and swallowing (Mehta et al., 2008).

The movements considered to be bruxism are: teeth **grinding** - jaw movements when maxillar and mandibular teeth are in tight contact which can be latero-medial or proximo-distal (protrusive-retrusive), **clenching** – sustained jaw closing movement with teeth contact, or **bracing** and **thrusting** of mandible, not necessarily with tooth contact (Lobbezoo et al., 2013). The movements are based on the masticatory muscle activity, and in sleep bruxism which is associated with rhythmic masticatory muscle activity, movements are differentiated, among other, into 'phasic' and 'tonic', which can manifest as grinding, sustained clenching or even teeth chatter/tapping (Lavigne et al., 2003a; Yoshimi et al., 2009). All the movements differ from typical chewing motions of the mandible, yet for bruxism to manifest closing muscles of the jaw must be used – masseter, temporalis and medial pterygoid (Castrillon et al.,2015; Wieckiewicz et al., 2014). The forces used during sleep bruxism contact of the teeth are exceeding normal masticatory forces (Mehta et al., 2008).

As reported, bruxism, especially sleep bruxism can manifest in various forms, and in study made by Yoshimi et al., (2009) is presented that grinding patter is the most predominant during sleep bruxism in patients. Based on the length of events, almost 60% of the bruxing time patients presented grinding movement, second most common with over 1/3 of time was sustained clenching, and the least manifested was teeth tapping (Yoshimi et al., 2009).

Grinding movement pattern in jaw during bruxism can be bilateral or unilateral, meaning, that a person can grind both sides at a time or only one side of the jaw (Akamatsu et al., 1996).

Because grinding is a very complex set of movements, see picture 6 for visual presentation, it requires activation of muscles at different points and can be a combination of lateral deviation and protrusion/retrusion. The exact impact and movement pattern is individual to each patient, bruxism can manifest as a combination of all the different types of movement or patient may present only one type. Lateral grinding movement happens during unilateral activation of lateral pterygoid muscle causing mandibular deviation to the opposite side. Protrusive-retrusive grinding requires lateral pterygoid with masseter muscle activation in mandibular protrusion motion and lateral fibers of temporalis to generate retrusion, masseter with anterior fibers of temporalis to generate elevation causing the mandible to grind forward and backwards – during bruxing the activation is bigger and creates great force on the teeth structures. (Castrillon et al., 2016; Kang & Yi, 2000; Koolstra & Van Eijden, 1995; Manfredini & Lobbezoo, 2021; Murray, 2015; Norton, 2016; Shaffer et al., 2014a)



Picture 6: visual demonstration of bruxism movements tapping, grinding, clenching, Katrin Hrbacova 2024

4.2 Sleep bruxism

Sleep bruxism (SB) or nocturnal bruxism is a “masticatory muscle activity during sleep that is characterized as rhythmic (phasic) or non-rhythmic (tonic) and is not a movement disorder or a sleep disorder in otherwise healthy individuals.”(Lobbezoo et al., 2018a). It is an involuntary, unconscious movement of the jaw and according to several different sources it could be also referred to as parafunction (Barbosa et al., 2008; Ferro et al., 2017; Mehta et al., 2013). Although recent studies suggest that sleep bruxism in otherwise healthy individuals is not a sleep movement disorder, it is included in the International

Classification of Sleep Disorders (ICSD) under sleep-related movement disorders, and it is the third most common sleep disorder, after sleep talking and snoring (Castrillon et al., 2016; Murali et al., 2015a; Sateia, 2014a).

Rhythmic masticatory muscle activity, further referred to as RMMA, is often associated with sleep bruxism and is similar to chewing motion, typically occurs unconsciously and often in the minutes before or during REM phase of sleep and studies show that it is related to autonomic activation (Abe S. et al., 2013; Lavigne et al., 2001, 2008). RMMA occurs also in healthy individuals, however without the grinding sound, and the amplitude of muscle contractions is lower, the frequency is three times lower than in individuals with bruxism. The frequency of RMMA in patients with bruxism is 5.4-5.8 episodes/hour of sleep. (Lavigne et al., 2001, 2003b)

The prevalence of sleep bruxism is globally from 8%-90% among population, due to various studies having different assessment tools, different population being surveyed, and different classification methods were applied, but it is adequate to say that most people will experience sleep bruxism at some point during their life (Koyano et al., 2008; Murali et al., 2015a; Sateia, 2014b; Svensson & Lavigne, 2013). It is more prevalent in children and least prevalent in elderly population. There is no difference in the prevalence of sleep bruxism based on gender. (Castrillon et al., 2016; Lavigne et al., 2008)

Sleep bruxism manifests in various forms, from sustained clenching, tapping, RMMA to teeth grinding (TG) which is commonly detected based on self-report, or a report of patients' bed partners due to its very specific and unpleasant noise causing great sleep disturbance. Additionally research shows that over 74% of studied patients were simultaneously aware of TG and teeth clenching. (Lavigne et al., 2008; Rompré et al., 2007) Great difference between sleep and awake bruxism, apart from the etiology, is that sleep bruxism often manifests with higher maximum occlusal forces than normal clenching forces during consciousness/waking state (Minakuchi et al., 2022).

4.3 Awake bruxism

Awake bruxism (AB), as the title indicates, is a type of bruxism which is present during wakeful state, although that doesn't mean it is a conscious movement. Actually most of the patients are completely unaware of this masticatory muscle activity, and when patients are made aware of this, they can then very easily reduce its manifestation. Awake bruxism is characterised by sustained or repetitive tooth clenching or by bracing and/or thrusting of the mandible, and it can occur alone or concomitantly with sleep bruxism. (Lavigne et al., 2003a; Manfredini et al., 2024; Matusz et al., 2022; Wieckiewicz et al., 2014)

The prevalence of awake bruxism in adult population is 22.1%-31% (Manfredini et al., 2013). Main complication related to AB is that there is lack of awareness among patients as well as clinicians about its prevalence and effects on quality of life.(Goldstein & Auclair Clark, 2017a)

5 ETIOLOGY AND PATHOPHYSIOLOGY OF BRUXISM

Etiology of bruxism has been a very popular topic of study over the years, yet we still don't have enough reliable high-level evidence to be able to determine it with certainty. Primary bruxism is considered to have multifactorial etiology from psychosocial factors, central nervous system influence to autonomic nervous system activation, and is affected by risk factors. Secondary bruxism is considered to be connected to medication/drug use or certain neurological diseases. (Bulanda et al., 2021; L. T. Thayer & Ali, 2022; Lobbezoo et al., 2013, 2018a; Shetty et al., 2010; Svensson & Lavigne, 2013)

From a study made by Wieckiewicz et al.(2014) it showed that bruxism is influenced by societal advancements and modern lifestyles, and consequently there has been a rise in the number of individuals affected by bruxism.

It was believed that malocclusions and local dental factors such as tooth contact patterns could be one of the causes for bruxism, but recent clinical studies provide strong evidence that there is no association between them (Castrillon et al., 2016; Castrillon & Exposto, 2018).

Sleep bruxism is believed to have origins connected to psychosocial factors, such as stress and anxiety, there is now strong evidence that bruxism pathophysiology is induced and regulated within the central nervous system (CNS), there has been connection with the sympathetic autonomic nervous system, neural pathways related to control jaw closing and also high sleep arousal response (Firmani et al., 2015; Lavigne et al., 2005; Lobbezoo et al., 2017; Manfredini et al., 2015; Matusz et al., 2022; Svensson & Lavigne, 2013). There is a speculation if psychological factors like stress and anxiety are not initiating factors for bruxism, rather than the cause(L. T. Thayer & Ali, 2022).

Castrillon et al. (2015) mention in their study that a phenomenon known as the 'central pattern generator' may hold responsibility for RMMA and sleep bruxism episodes. The hypothesis speaks about several factors in the central nervous system which may have an affect on activation of the central pattern generator such as changes in sleep pattern, microarousals or autonomous regulation of heart rhythm (Castrillon et al., 2016).

Studies on sleep bruxism with anxiety and depression also showed association with vitamin D deficiency and low calcium intake, however those studies didn't include whether supplementing those deficiencies would decrease bruxism episodes (Alkhatatbeh et al., 2021).

Awake bruxism it is considered to be mainly related to psychological factors, type A personality type, psychological stress and anxiety (Goldstein & Auclair Clark, 2017b). Awake bruxism is more related to a stress-habit behaviour, similar to lip or nail biting.

During COVID-19 pandemic, there has been globally an increase of people experiencing bruxism, and professionals explain this with the most commonly

used explanation, psychological stress. Due to higher difficulty to access to medical professionals, people started to search online for explanations and public awareness about this topic increased. (Matusz et al., 2022)

Some studies which reported low evidence level with a need of a further research suggest that there are some genetic and environment factors influencing the manifestation of bruxism, possibly genetic predispositions to stress coping often in type A personality type (Lobbezoo et al., 2014; Matusz et al., 2022).

5.1 Primary risk factors

Alcohol, tobacco, excessive caffeine intake and psychological stress are all mentioned to be primary risk factors for bruxism episodes (Lavigne et al., 2008). Drugs like cocaine and amphetamines are linked to bruxism manifestation, but those are considered as causes of secondary bruxism (Beddis et al., 2018; Matusz et al., 2022).

5.2 Sleep disorders

Sleep disorders such as snoring, sleep apnea or PLMS (Periodic Limb Movement Disorder) are considered to be a risk factors for developing sleep bruxism (Lavigne et al., 2008). Children with astma and sleep apnea are reported to be more likely to also suffer from bruxism, yet from the studies it isn’t defined which one influences the other (Matusz et al., 2022)

6 DIAGNOSING AND ASSESSMENT OF BRUXISM

The golden standard for diagnosing sleep bruxism is full PSG study with audio-visual assessment (Castrillon et al., 2016). Recognizing the need for diagnostic classification of bruxism Lobbezoo et al., formulated a diagnostic grading

system in their study in 2013, and then proposed new perfected system in 2018. This system helps professionals in determining the proper diagnosis, the presence of bruxism, and mainly aids in fostering clarity in research endeavours, thereby enhancing its reliability. There are three groups – Possible sleep/awake bruxism, probable sleep/awake bruxism and definite sleep/awake bruxism, based on the level of evidence available for diagnosis. If the diagnose is only based on self-report/bed partner report only, then it is *possible bruxism*, if the diagnosis is made based on positive self-report with or without positive clinical signs then we refer to it as *probable bruxism*, and lastly if the diagnosis is made based on positive instrumental assessment such as PSG, with or without positive self-report and/or the patient has positive clinical inspection, then we refer to it as *definite bruxism*. See figure 1. (Lobbezoo et al., 2018a)

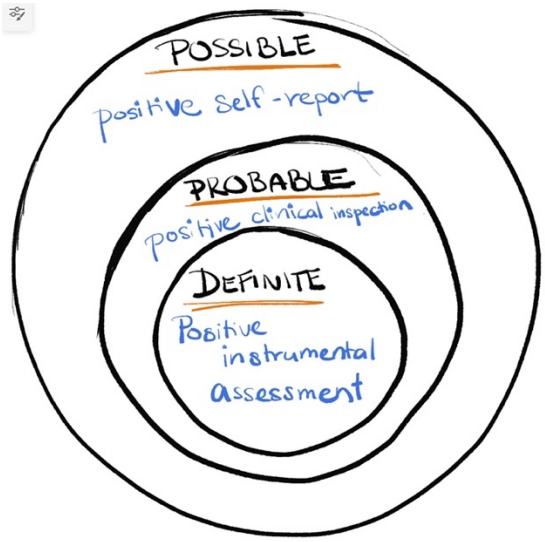


Figure 1.: visual description of grading system of bruxism adapted from Lobbezoo et al. (2018)

Additionally, Lobbezoo's et al. (2018) work in progress about bruxism mentions that bruxism could be classified as all of the following options when it comes to medical consequences: as a risk factor, harmless behavior and a protective factor, depending on the individual and whether it is associated with any positive or negative health outcomes. Which was quite revolutionary, opened more suggestions for studies, and in early 2024, the view on bruxism has shifted to that extent, where professionals show that it also has some positive impact, or protective aspects such as oroesophageal lubrication after increased mechanoreceptors in periodontal membrane and increasing saliva production, and

positive effect airway patency, although these positive health outcomes can be accompanied with severe negative ones (Manfredini et al., 2024).

The golden standard for diagnosing sleep bruxism is full polysomnography study, including audio-visual assessment. Polysomnography (PSG) is the most reliable tool to assess sleep bruxism, due to its exclusive assessment of muscle activity which is characteristic to bruxism and can be differentiated from masticatory muscle activity which is not related to sleep bruxism. Unfortunately this tool is expensive and requires appropriate space, highly trained professionals to operate it and additionally it could create a burden for the patients, hence the high quality research is lacking. (Castrillon et al., 2016; Minakuchi et al., 2022)

Interview, is one of the key tools especially for physiotherapist, used for assessment of both sleep and awake bruxism, and later used as a part of treatment. For sleep bruxism, patients often report restless sleep, waking up with limited ROM in the jaw, headache, facial pain and neck pain and the progression is that stiffness usually improves during the day. If patient reports stiffness and pain during the day, one should suspect AB (Mehta et al., 2008). During the interview it is important to ask for a report from patient's bed partner about sleep bruxism, the sound of the grinding is usually one of the first and major reasons why people seek medical help (Lavigne et al., 2005; Svensson & Lavigne, 2013). Important to mention that about 80% of people reported with bruxism do not produce sound during bruxism episodes, such as during clenching (Koyano et al., 2008).

If a professional suspects that patient is suffering from awake bruxism, before getting a diagnosis based on a self-report, it is highly recommended that the patients are made aware of bruxism, what it is and that they might be bruxers, and on the second visit to ask them again, to confirm this suspicion, after the patients have had the chance to self-evaluate and focus on it during their day-to-day life. Chances are that during the first session, patients might deny their possible bruxism, might even get offended, and during the next session the

self-report may change into a confirmation of experiencing bruxism. (Goldstein & Auclair Clark, 2017)

The use of questionnaires during interview is one of the most commonly used tool (Koyano et al., 2008). An example of clinically tested questionnaire from a study done by Pintado et al., (1997) asked questions such as ‘has anyone heard you grind your teeth at night?’, or ‘ is your jaw fatigued upon awakening in the morning?’. There is a risk of bias and inaccuracy in the method of interview and questionnaires related to patient’s response, because patient who’s dentist believes they have bruxism or patients who have been told so even without adequate assessment, might answer ‘yes – I have bruxism’ on the self-report assessment (Koyano et al., 2008). And also during self-report patients usually cannot with certainty say what is the intensity, duration and frequency of bruxism episodes, especially in sleep bruxers (Lobbezoo et al., 2018a). Since the use of tabaco, alcohol and other drugs are a risk factor for developing bruxism, and certain medication, it should be mentioned in the questionnaire as well. Asking about sleep habits, sleep hygiene, anxiety, stress and nervousness should be a part of the interview. (Beddis et al., 2018; Koyano et al., 2008; Lobbezoo et al., 2008)

Clinical examination involves assessment of pain sensitivity, observation of bruxism related features which include: masseter muscle hypertrophy during voluntary contraction, masticatory muscle fatigue, visible moderate-to-severe hyperkeratosis or mucosal ridging of inner cheeks, lips and tongue, and visible evidence of advanced tooth wear such as chips, fractures or dental attrition, and teeth mobility, which is primarily assessed by dentists, hence why multi-professional approach is highly recommended (Castrillon et al., 2016; Lobbezoo et al., 2017; Sateia, 2014b; Svensson & Lavigne, 2013). Dental attrition or tooth wear is often a visible sign but is not a key element, it does not provide evidence for current bruxism, due to inaccuracy and often lack of evidence from patients history to compare the time relevance (Lavigne et al., 2005). Use of oral splints and then evaluating the wear and tear is listed as one of the methods used by dentists as well, reported to be more reliable, because

existing tooth wear is not considered as current evidence (Koyano et al., 2008). These clinical signs of bruxism are also the consequences of bruxism.

Portable electromyography (EMG) is often used to assess the level of jaw muscle activity, although less reliable than PSG, it is cheaper and easier to use. Portable devices under the names BiteStrip® and Grindcare ® are used to detect force applied during bruxism episodes.(Koyano et al., 2008; Lobbezoo et al., 2018a)

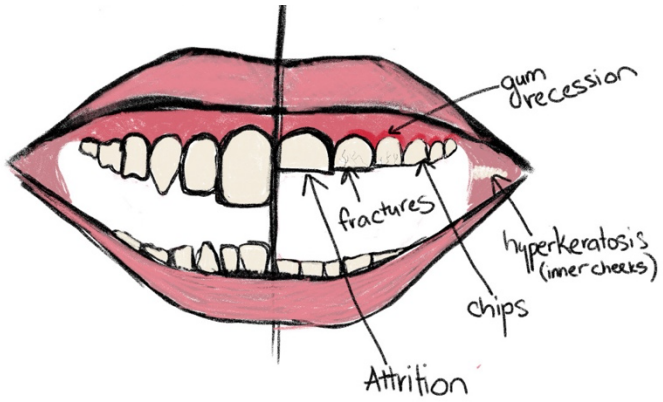
Newest study published in early 2024, done by Manfredini et al., (2024) presents a multidimensional system for assessment and evaluation of bruxism called ‘Standardised Tool for the Assessment of Bruxism’ (STAB), this tools has been designed to use mainly for the purpose of further research in the topic of bruxism, it is being tested in an on-field environment. For the purpose of this thesis, it seems only necessary to mention that STAB has two axes, Axis A dedicated to the evaluation of bruxism status and its consequences, and the second is Axis B, dedicated to the evaluation of bruxism risk, etiological factors, and comorbid conditions.(Manfredini et al., 2024)

During assessment, professionals should also take into consideration not only differentiation of the likelihood of bruxism (possible, probable, definite), whether it is awake or sleep, and if it is primary or secondary bruxism we are speaking about, one should also carefully assess what kind of bruxism movement is manifesting, because different management strategies may apply.

7 CONSEQUENCES OF BRUXISM

Bruxism affects many structures - teeth, jaw muscles, intraoral area, TMJ, yet in most cases is detected by dentists only after visibly grinded teeth occur. The consequences associated with bruxism are fractured teeth and restorations, abfraction lesions, tooth mobility, and can even lead to tooth loss (picture 7).

Next are listed pain in the masticatory muscles, myalgia, muscle spasms, temporal headaches and signs of TMD, jaw locking and clicking. For intraoral signs, they include indentations on the tongue and cheeks. (Goldstein & Auclair Clark, 2017a)



Picture 7: dental bruxism consequence, Katrin Hrbacova 2024

Medical observations showed that bruxism generates joint pain and occasionally headache due to overloading the temporomandibular joint, and in the study made by Commisso et al. (2014) it has been proven that bruxism, especially teeth clenching, which is most prevalent in awake bruxers, is damaging to the temporomandibular joint, specifically the articular disc. Although higher activity level of the masticatory muscles increase the risk for oral problems such as masticatory muscle pain, TMJ pain and occasional headache, Raphael et al. (2016) proposed that bruxism should be considered a risk factor rather than a disorder in otherwise healthy individuals. Even though it is still not clear if bruxism causes some TMD, but there is evidence that awake bruxism exacerbates TMD symptoms (Goldstein & Auclair Clark, 2017a).

Lobbezoo's et al. (2018) work in progress about bruxism mentions that bruxism can be classified as all of the following options when it comes to medical consequences: as a risk factor, harmless behavior and a protective factor, depending on the individual and whether it is associated with any positive or negative health outcomes. From this we can see that there are many conflicting theories about bruxism and the connection to TMD and it needs to be properly studied further more. Minakuchi et al., (2022) again in their study confirmed

that excessive stress, which is produced especially during sleep bruxism is a critical risk factor for developing dental complications, masticatory muscle problems and temporomandibular joint disorders.

Zieliński et al., (2019) suggested that sleep bruxism could cause primary headaches. Up to 65% of sleep bruxism patients report headache in temporal area, which according to Lavigne et al., (2008) suggests a link between stress and SB. In some chronic SB patients substantial muscle tension during sleep bruxism occurs, which can cause muscle tears and myosis with swelling in the masticatory muscles, and they can also experience pain in the cervical muscles (Mehta et al., 2008).

Sleep disturbance due to sleep bruxism is very common issue and majority of patients who come to the clinic based on self-reported sleep bruxism come based on bed-partners complains. The sound of teeth grinding during sleep is very specific and very sleep disturbing, and mouth guards often reduce this noise, but not bruxism episodes itself. (Lavigne et al., 2008)

8 NON-PHYSIOTHERAPEUTIC TREATMENT OPTIONS

Since bruxism, sleep and awake, has unspecified and multifactorial etiology, it is impossible to cure this pathology with the resources and knowledge currently available, but there are several management options (Matusz et al., 2022; Minakuchi et al., 2022). Due to its nature, bruxers develop high mechanical stress on the involved structures, and it is necessary to reduce this impact in order to maintain their morphological and physiological functions (Minakuchi et al., 2022). There are multiple management options available to reduce the harmful effects of bruxism, the following list is focused on presenting up-to-date evidence based tools, used for symptomatic management of negative effects of sleep and awake bruxism, calling for multi-professional approach. (Goldstein & Auclair Clark, 2017a; Manfredini et al., 2015; Matusz et al., 2022)

Manfredini et al., (2015) presented the “triple P” in management of sleep bruxism, plates, pep-talk and pills. By plates they refer to oral appliance and splints. Pep-talk refers to counselling, cognitive behavioural strategies and stress management. And lastly, ‘pills’ refer to centrally acting drugs. (Manfredini et al., 2015)

8.1 Dental care

Dental professionals - dentists, orthodontists and dental hygienists, diagnose and treat patients suffering from bruxism. People are often unaware of bruxism until some form of dental problem occurs and diagnosis is commonly made exclusively by observation of the oral cavity, of the consequences of bruxism – dental attrition, hyperkeratosis etc., and followed by short interview and possibly assessment of splint damage.(Lobbezoo et al., 2008; Manfredini et al., 2004; Matusz et al., 2022; Soares-Silva et al., 2024)

Management of bruxism from dental professionals is aiming to protect teeth/oral structures, and it is solely symptomatic management. Mostly it is focusing on management of the effects of sleep bruxism. Hard acrylic splints have proven to be the most effective tool to protect the teeth, but did prove to be effective in reducing bruxism episodes or their intensity.(Beddis et al., 2018; Goldstein & Auclair Clark, 2017b; Lobbezoo et al., 2008; Shetty et al., 2010) There are also occlusal splints based on biofeedback which release bad taste when patient is clenching or grinding, but those are not that common to use (Beddis et al., 2018). Advanced mandibular repositioning splint is another type used (Minakuchi et al., 2022). There are conflicting opinions about the use of occlusal appliances like hard stabilisation splints, some professionals claim that they have positive effect on reduction of bruxism episodes and reduction of load on TMJ, more than palatal splints (Matusz et al., 2022). But there is evidence showing that these stabilisation splints aggravate sleep apnea (Beddis et al., 2018). Nevertheless, intermittent use showed to be more effective in reducing sleep bruxism episodes over continuous use of stabilisation splints,

based on the hypothesis of a ‘novelty effect’.(Manfredini et al., 2015; Minakuchi et al., 2022)

Botulinum toxin is peripherally used drug to reduce the intensity of sleep bruxism episodes, but it hasn’t proven to be very effective on the reduction of the frequency of these episodes.(Manfredini et al., 2015; Minakuchi et al., 2022) It is worth mentioning that professionals recommend reaching for this method in high-risk patients or after previous, less invasive methods have failed to help, due to the fact that botulinum toxin is invasive and can cause muscle pain, does not solve the problem and lasts only for couple of months (Goldstein & Auclair Clark, 2017b; Lang et al., 2009).

8.2 Psychological, psychiatric care

Cognitive behavioural therapy (CBT), hypnosis and stress management are often effective tools mostly used by psychologists in order to reduce psychopathological factors which could be the cause or trigger of bruxism in patients (Manfredini et al., 2004; Matusz et al., 2022).

Pharmacotherapy is used more in severe cases of bruxism or in clinical trials, short term medication such as antidepressants, muscle relaxants, sedatives are sometimes used (Matusz et al., 2022). Centrally acting drugs tested to reduce sleep bruxism frequency which showed to be effective were benzodiazepine clonazepam, acting as sedative, and antihypertension clonidine, for that the theory of effectiveness is based on hypothesis that it interrupts chain reaction leading to activation of sympathetic nervous system which precedes bruxism.(Manfredini et al., 2015)

Reducing the use of bruxism aggravating drugs, such as dopamine antagonist, dopamine agonist and tricyclic antidepressants visibly reduces its symptoms (Beddis et al., 2018; Matusz et al., 2022). Implementing avoidance management of risk factors aggravating bruxism is used in the behavioural therapy (Minakuchi et al., 2022).

A vital part, implemented in the treatment not only by psychologists/psychiatrists but also physiotherapists is to understand the possible reason for why could patient be experiencing bruxism, primarily awake bruxism since that is more of a parafunctional habit, understanding their psychological portfolio and paying attention to their personality type (Goldstein & Auclair Clark, 2017a; Mehta et al., 2008). Bruxism tends to be more common among people with type A personality (stressed, work-obsessed, impatient etc.), patients who have anxious, depressive or even manic symptoms (Manfredini et al., 2004).

9 PHYSIOTHERAPY INTERVENTIONS FOR BRUXISM

Matusz et al., (2022) presented in their paper well made overview of common therapeutic approaches for management of bruxism, which listed patient education, biofeedback, muscle relaxation and posture exercises, biostimulation and several other approached not used by physiotherapists listed in the previous chapter. Since bruxism is tightly linked to TMD, physiotherapists working with patients presented with both TMD and bruxism should work towards creating appropriate rehabilitation plan to reduce the masticatory muscle hyperactivity. (Xu et al., 2021)

9.1 Patient education

Patient education, is one, or should be the one, of the most important tools used by professionals in the medical field. Making patients who are suspected or diagnosed with bruxism aware of this parafunctional activity and its possible negative consequences, is one of the key tools used for reducing bruxism, especially awake bruxism. Recommending to avoid gum chewing, to consciously stop clenching teeth, focus on nasal breathing with relaxed position of the tongue, when mouth is closed, it should remain relaxed and teeth should be slightly apart, and lastly it was mentioned that explaining and reminding

patients to maintain good posture and general healthy living habits is important. Lifestyle changes or often recommended in support of management of bruxism. (Goldstein & Auclair Clark, 2017a; Matusz et al., 2022)

Another recommendation professionals could use to help patients with sleep bruxism is to introduce sleep hygiene. Avoiding caffeine close to bed time, reducing blue light exposure, maintaining clean and ventilated bedroom space and practicing relaxation techniques. These tips are based on the hypotheses that the cause of bruxism is psychological stress, which is one of the most commonly used explanations for bruxism.(Beddis et al., 2018)

9.2 Manual therapy

Studies show that manual therapy (MT) has proven to be an effective tool for symptomatic management of bruxism consequences like TMJ pain, muscle pain and tension, jaw stiffness and bruxism related TMD. Primarily focusing on relaxation and myofascial release with intra- and extraoral manual therapy of the masseter muscle, and extraoral MT for pterygoid and temporalis muscles. Stretching and relaxation exercises for the TMJ such as setting mandible in relaxed position, opening and closing mouth into “têtê-à- têtê” position, which in dentistry refers to bottom and top teeth contact in one line, protrusive movement and returning jaw to starting position. Teaching clients to consciously relax jaw muscles and reminding them to keep nasal breathing and resting position of the tongue (Matusz et al., 2022; Minakuchi et al., 2022; Volkan-Yazici et al., 2021; Yazici et al., 2023).

Volkan-Yazici et al., (2021) study shows that the use of kinesiotaping showed to decrease pain bilaterally in the temporalis, right occipital region and in trapezius muscles. Kinesiotaping combined with manual therapy however showed to be even more effective on reducing muscle stiffness, pain threshold, sleep quality and overall reported positive effect on the quality of life of patients. They explained that the use of KT concomitantly with manual therapy should be implemented into the therapy plan if the primary complain is pain.

(Volkan-Yazici et al., 2021; Yazici et al., 2023) The location of kinesiotaping is used depending on the patients main complain, often in the masseter muscle the epidermis-dermis-fascia technique is used(Yazici et al., 2023).

9.3 Biofeedback

Biofeedback is another tool commonly used by physiotherapists, in the case of bruxism, EMG with auditory, vibratory or electric stimulation feedback is applied on the masticatory muscles – masseter or temporalis. This tool is used for both, sleep and awake bruxers and gives patients instant feedback about the muscle activation/parafunctional behaviour, allowing them to realize it and focus on its elimination. (Beddis et al., 2018; Lobbezoo et al., 2008) There is smart phone application called BruxApp connected to a biofeedback device designed to help people track the occurrence of awake bruxism. (Matusz et al., 2022)

10 THESIS METHOD

The method of this thesis is an action research for SAMK Pori physiotherapy degree students. An action research is an approach which aims to address a real-world issue using creative methods, such as improving the knowledge of future physiotherapists regarding bruxism through creative self-learning material. This approach includes a thorough research process, involving the collection and selection of information, followed by action which is targeted presentation. Importantly, there is a strong emphasis on reflection and evaluation throughout the process, ensuring deeper understanding and gaining valuable insights about the topic.(Oosthuizen, 2002)

A self-study material is done in the form of a Doodle video presented online on the Moodle platform. Doodle video is a whiteboard animation video which can

be used to illustrate discussed topic. It is a great tool to retain interest in visual and auditory learners and keep their attention for needed time.

The thesis includes theoretical part, researching and gathering all the necessary information for creating the product of this thesis. Followed by practical part which will be describing the process of creating, piloting and presenting this product.

The author of the thesis has noticed that the topic of bruxism and problems connected to TMD have not been discussed much in depth in the musculoskeletal course in the degree programme of physiotherapy despite its high prevalence in the population, hence why it seemed to be appropriate to provide this information as a self-study material for future physical therapists.

After making a questionnaire research from physiotherapy students of 3rd and 4th year, 22 students answered to the following questions:
“Do you know what is bruxism?” Almost 61% of students answered “yes”.

“Do you or someone you know suffer or has suffered in past from bruxism?” To this question, 15 students answered positively, and only 31.8% of students didn’t know of anyone nor suffered of bruxism themselves see figure 2.

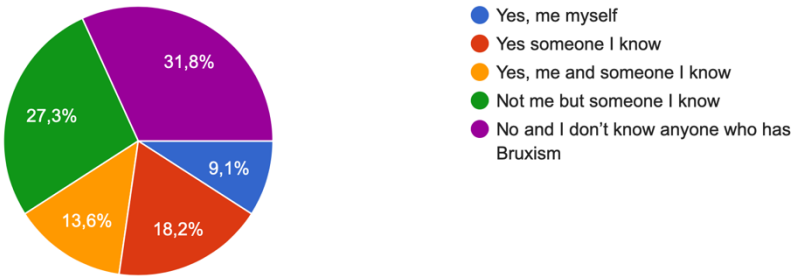


Figure 2 – graph of answers to question “Do you or someone you know suffer or has suffered in past from bruxism?”

“Have you or someone you know ever suffered of Temporomandibular disorder, jaw pain, masticatory muscle pain or other musculoskeletal problems related to the jaw?” To this question (figure 3), majority of students knew of

someone who suffered of the problems listed, and only 13.6% answered that they haven't or didn't know of anyone.

Figure 3.: graph of answers to the question "Have you or someone you know ever suffered of Temporomandibular disorder, jaw pain, masticatory muscle pain or other musculoskeletal problems related to the jaw?"

To the questions "As a student of physiotherapy and future professional, do you think that having some knowledge about the temporomandibular joint and Bruxism should be a part of your general knowledge?" and "Would you like to know more information about Bruxism and why is it important for physiotherapists to be aware of this topic?" students answered in both of them 100% "Yes".

11 THESIS PROCESS

In figure 4. Is a visual representation of the thesis timeline plan. As described, thesis was planned to be finished by November 2023, however due to various circumstances, that was not possible and the duration of the writing process increased. Finally this thesis and was finished by May 2024. The steps were followed as indicated in timeline (figure 4).

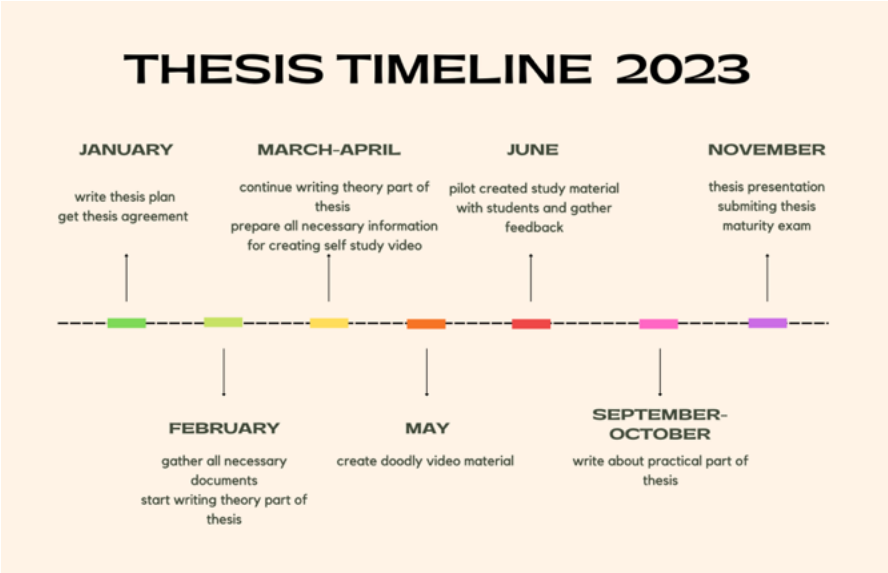
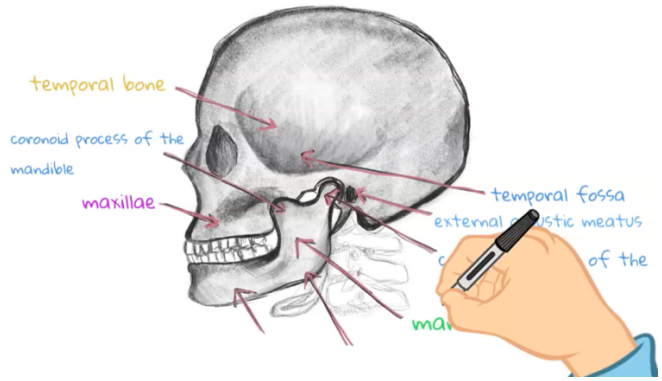


Figure 4.:timeline for thesis planning

As mentioned in the introduction, the practical part of this thesis was to use the collected information and create informational video for physiotherapy students, future physiotherapists and physiotherapists who would be interested in increasing their knowledge about bruxism. The goal was to make the video simple and short, yet informative– like attention catcher, to avoid overloading the watcher with information and refer them if interested to the theoretical part of this thesis. It is aimed for students who don't have previous knowledge about this topic or much knowledge about TMD treatment, jaw anatomy and biomechanics. The video was created using Doodly program (picture 8), which assists in creating it visually attractive. Written text, pictures and illustrations is useful for visual learners, and voiceover explanation is great for audio learners. Combining it with both creates a material which is targeting variety of students. The video is 10 minutes long and includes introduction, anatomy and biomechanics, insights to bruxism, description of sleep and awake bruxism, diagnosis and management options. Therefore it is a product useful for any student to have at least basic information related this growing issue. The video is shared on youtube with access for anyone who has the link, shared with MSK teachers of SAMK Physiotherapy degree and in this thesis as well. https://youtu.be/Z8enjE5i5d0



Picture 8. Screenshot of video illustration, Katrin Hrbacova 2024

The students of 2nd and 3rd, also some 4th year students who are still studying, and freshly graduated physios from the PH20 group of SAMK Physiotherapy degree were sent the link for this video and also a feedback questionnaire.
All of the students who watched the video and answered the questionnaire said that they believe it is important for every professional to watch it and increase their knowledge in this topic. They have all also found the video as a good learning tool and the information shared as useful and sufficient for someone who has no previous knowledge about bruxism.

12 DISCUSSION

During the preparatory stages of this thesis, the author has faced several obstacles related to gathering resources. Because the topic of bruxism is still in the beginning stages of understanding –aetiology and best options of treatment are unclear. The highest quality articles mention themselves that there is no definitive consensus which would specify the etiology, no reliable methods of assessing bruxism, there are ongoing studies happening which are trying to address the problem of lack of information related to bruxism treatment. In many of the studies there is a risk of bias due to lack of randomization. Some of the management options or connections are based on hypotheses which recent studies are still trying to prove and the research is still in process.

Also when making research about bruxism, author has faced that many articles have led the author to related topics about TMJ, TMD etc, which did not contribute to the research, however it was connected to the topic of bruxism. After thorough research, about in the middle of the process, the author realized that it would've been much easier to have more narrow topic so that the gathering of information wouldn't be so confusing, broad and time consuming. Therefor the author would recommend future students writing their thesis who are interested in the topic of bruxism and physiotherapy to narrow down the topic, such as choosing only one circadian manifestation "physiotherapy and sleep bruxism", or "biofeedback in treatment of bruxism", or "latest evidence on the effects oof exercise therapy in management of bruxism". However it would be useful if the students would wait a couple of years until the research in this topic is more available and reliable.

Even though there have been so far many attempts to make international consensus on this topic, the evidence is still low since it requires multi-professional approach of dentists, medical doctors, scientists and physiotherapists and the research required is very resource demanding (Svensson et al., 2008).

Due to the fact that this thesis has taken longer than expected the author faced several obstacles with newer studies being published in early 2024 which on one hand increased the valuable information shared in this thesis but created additional burden on constant re-doing certain parts of the thesis, especially about redefining bruxism and its etiology, and since the latest studies suggest that bruxism as a parafunctional activity may be beneficial for some patients, not harmful as well as harmful for others. Overall to sum it up, its safe to say that there is a lot of uncertainties.

Either way, the author is confident that in the end the choice of the topic was correct, that it was needed and necessary to increase the knowledge of physiotherapy students in this area. According to Shaffer et al. (2014) physical therapy is the recommended conservative approach for many temporomandibular joint disorders (TMD) **including bruxism**. Physiotherapists are encouraged to develop appropriate plan which focuses on the TMJ and muscular structure

affected by bruxism using therapeutic tools such as joint and soft tissue mobilization, therapeutic exercise, patient education and biofeedback.(Shaffer et al., 2014a, 2014b) Goldstein & Auclair Clark, (2017) in their study clearly state that “any patient who self-reports TMD, morning masticatory muscle pain or stiffness, or joint noises should be considered a *possible* bruxer, and then it should be specified if sleep or awake”, which only proves the severity of this problem. Therefore it is crucial for healthcare professionals to prioritize detection of bruxism to ensure timely intervention.(Wieckiewicz et al., 2014)

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