Giorgi Dugashvili was born in Tbilisi, Georgia on July 25, 1987. In 2001 he finished the secondary school with highest distinction. In 2004 he graduated from Ivane Javakhishvili Tbilisi State University Medical College Summa Cum Laude and became Certified Dental Technician (CDT). In 2009, Giorgi Dugashvili graduated from the same University Summa Cum Laude where he was a presidential scholar and obtained the degree of Doctor of Dental Medicine (DMD). Soon afterwards, he began his residency program in Conservative Dentistry, which he completed in 2010. His PhD project started in 2011 at Ilia State University in Tbilisi, Georgia. At the time, soon after gaining some experience as a Junior doctor, he started working as a DMD at N1 Dental Clinic of Tbilisi State Medical University where he allowed students to attend clinical cases to build their skills by teaching them history taking, communication techniques, aspects of medical ethics and competence as practitioners (2011-2019). In 2012 he completed a residency program in Oral Surgery. Since 2013, Giorgi Dugashvili has been a certified clinical director and representative of "Special Olympics" (the world's largest sports organization for children and adults with intellectual disabilities and physical disabilities) in Georgia. Throughout the field, he has trained doctors, has organized and taken participation in many local and international events dedicated to the field of disabilities.

In 2014-2016, within the scope of Erasmus Mundus program, Giorgi Dugashvili was a PhD researcher at Ghent University under the supervision of Prof. Dr. Luc Marks in Belgium. In 2017, he was an assistant to the Vice-Speaker of the Parliament of Georgia in the field of international relations. In 2018 he became the holder of the national award "Doctor of the Year 2018".

Since 2018 Giorgi Dugashvili has been a lecturer at the Medical School of Georgian American University (GAU).

In 2020 Giorgi Dugashvili successfully completed a course of study in Justice offered by HarvardX, an online learning initiative of Harvard University and was awarded with a certificate of achievement.

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Aspects of TMD diagnostics in vulnerable patients Giorgi Dugashvili

2020

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Statement

As an author of this doctoral thesis, I confirm that this thesis is my original work and does not include the materials of other authors that have already been published, accepted for publication or submitted for a degree, which have not been cited in an accepted manner. Due references have been provided on all supporting literatures and resources.

_____

Giorgi Dugashvili

აბსტრაქტი

საფეთქელ-ქვედა ყბის სახსრის დისფუნქციის ეტიოპათოგენეზი და კლინიკური მართვა აერთიანებს რამდენიმე სამედიცინო დისციპლინას: სტომატოლოგიას, ყბა-სახის ქირურგიას, რევმატოლოგიას, ნევროლოგიას და ფსიქოლოგიას.

დღესდღეობით არ არსებობს ერთიანი სტრატეგია ამ მდგომარეობის მენეჯმენტის საკითხებში. ხშირ შემთხვევაში საფეთქელ-ქვედა ყბის სახსრის პათოლოგიები ადვილად ექვემდებარება მარტივ მკურნალობას და პროგნოზი, შესაბამისად, დადებითია.

აუცილებელია პაციენტის განათლება და მასთან პათოლოგიით გამოწვეული ტკივილისა და ფუნქციის მოშლის განხილვა. რთულ შემთხვევებში აუცილებელია მულტიდისციპლინური გუნდის ერთობლივი კონსულტაცია.

ამ პროექტის მიზანს წარმოადგენდა დადგენა, შეიძლება თუ არა გამოყენებული იქნას ტკივილის უნივერსალური შეფასების ინსტრუმენტი, როგორც დამატებითი საზომი სადიაგნოსტიკო ერთეული.
კვლევა ჩატარდა საფეთქელ-ქვედა ყბის სახსრის ფუნქიური ტკივილის შესახებ მონაცემების შეგროვების მიზნით და სახისა და პირის ღრუს მიდამოში არსებული ტკივილის დონის შესაფასებლად, რომელიც დაკავშირებულია საფეთქელ-ქვედა ყბის სახსრის დისფუნქციასთან, პაციენტებში, რომლებსაც აქვთ შეზღუდული სამედიცინო კომუნიკაციის უნარი, როგორც მოზარდებში, ასევე გონებრივად შეზღუდული შესაძლებლობების მქონე პირებში.

არსებულ პროექტში, ყბის სახსრის შესაძლო ფუნქციური ტკივილის კლინიკური ქულები შეგროვდა მიზნობრივად მომზადებული სტომატოლოგების მიერ ტკივილის უნივერსალური შეფასების ინსტრუმენტის გამოყენებით, რათა მიუთითონ ტკივილის

სიმძიმე ვიზუალურ სკალაზე ყბის სხვადასხვა მოძრაობის დროს (გახსნა, დახურვა და გვერდითი) მოწყვლად, მათ შორის შეზღუდული კომუნიკაციის უნარის მქონე პაციენტებში, იმისათვის, რომ კლინიცისტებს საშუალება მიეცეთ უფრო ხშირად გაიარონ კონსულტაცია სპეციალიზირებულ - ტკივილის მართვის ჯგუფთან.

ზემოთ აღნიშნული იძლევა ადრეული ჩარევის და რაც მთავარია, მდგომარეობის განვითარების პრევენციის საშუალებას.

კვლევის შედეგების თანახმად, ტკივილის უნივერსალური შეფასების ინსტრუმენტმა აჩვენა, რომ ის შეიძლება იყოს სასარგებლო, დამატებითი ინსტრუმენტი, რათა გამოავლინოს ყბის სახსრის ფუნქციური ტკივილის არსებობა, რომელიც შესაძლოა ასოცირდებოდეს საფეთქელ-ქვედა ყბის სახსრის დისფუნქციასთან, ასევე, წარმოადგენდეს ეფექტურ ინსტრუმენტს, რათა მოხდეს ტკივილის ინტენსივობის შეფასება მოწყვლად პაციენტებში.

ძირითადი საძიებო სიტყვები: ტკივილის უნივერსალური შეფასების ინსტრუმენტი, საფეთქელ-ქვედა ყბის სახსრის დისფუნქცია მოზარდებში, საფეთქელ-ქვედა ყბის სახსრის დისფუნქცია გონებრივად შეზღუდული შესაძლებლობების მქონე პირებში.

Abstract

The cause, subsequent development and clinical management of temporomandibular disorder (TMD) can include a number of medical disciplines such as dentistry, oral and maxillofacial surgery (OMFS), neurology, rheumatology and psychology. No unified strategy for the management of this condition seems available at this moment. In some cases, TMD responds to simple treatment, symptoms usually remit with simple care and the prognosis is good. A comprehensive medical history and physical examination of the patient is crucial and essential for an early diagnosis of the specific condition to decide further investigations, if any, and to provide specific treatment and early intervention. In more severe cases, a multidisciplinary teams (MDTs) approach is needed.

The aim and scope of the present project was to determine, whether the Universal Pain Assessment Tool (UPAT) could be used as an extra measuring diagnostic instrument to collect data on functional temporomandibular joint (TMJ) pain and to assess orofacial pain levels related to temporomandibular disorder(s) (TMD) in patients with limited medical communication skills as youngsters and people with intellectual disabilities (ID).

In the current project the clinical scores of possible functional jaw pain were collected by callibrated dentists using the UPAT, to indicate pain severity on a visual scale during different jaw movements (opening, closing and lateral) in vulnerable patients, including people with limited communication skills in order to enable clinicians to consult a specialized pain management team more often. This could lead to earlier interventions and, most importantly, prevention of the development of the condition.

According to the results of the present study, the UPAT demonstrated that it could be a useful, additional tool to detect the existence of functional jaw pain presumably associated with TMD and also a valid instrument to score pain intensity associated with TMD in vulnerable patients.

Key words: Universal pain assessment tool - TMD in ID - TMD in youngsters.

Overzicht

Bij deoorzaak, ontwikkeling en behandeling van kaakgewrichtproblemen (TMD) zijn een aantal disciplines zoals tandheelkunde, maxillofaciale chirurgie, neurologie, reumatologie en psychologie betrokken. Voor deze aandoening blijkt momenteel geen eenduidige behandelstrategie voorhanden. In sommige gevallen, reageert TMD op een eenvoudige aanpak waarbijde symptomen verdwijnen bij eenvoudige behandeling en waarbij een goede prognose bestaat.Kennis van de medische achtergrond en een volledig medisch onderzoek lijkt onontbeerlijk. Daarenboven isdeze essentieelom een vroegtijdige diagnose van het specifieke probleem mogelijk te maken om zodoende in een vroeg stadium te kunnen ingrijpen. Bij de meer ernstige vormen is een aanpak binnen een multidisciplinaire teamnoodzakelijk.

Het doel van het voorgestelde project was te bepalen of de Universal Pain Assessment Tool (UPAT) kan gebruikt worden alseen bijkomend extra diagnostisch instrument. Doelstelling is, om bij patiënten met beperkte communicatie en jongeren met een verstandelijke beperking, data te verzamelen bij functionele kaakgewrichtsklachten en pijnklachten die in verband gebracht worden met deze kaakgewrichten.

Binnen het huidige project werden klinische scores van mogelijke kaakgewrichtspijn verzameld door gekalibreerde tandartsen, gebruikt makend van de UPAT schaal, waarbij door de simulatie van de diverse bewegingen van de kaak (openen, sluiten en laterale bewegingen) de pijnscore op een visuele schaal werd overgebracht. Deze test werd toegepast bij kwetsbare patiënten, inclusief personen met beperkte mogelijkheden wat betreft communicatie. Deze beperkte communicatie vormt een drempel tot de toegankelijkheid van clinici gespecialiseerd in pijnbehandeling. Snellere en verbeterde toegankelijkheid van de behandelaar zou kunnen leiden naar meer mogelijkheden wat betreft preventie en , misschien nog belangrijker,voorkomen van de verdere ontwikkeling van de aandoening.

Verwijzend naar de resultaten van de voorgestelde studies blijkt het gebruik van UPAT een nuttig en aanvullend instrument te zijn in de detectie van functionele kaakgewrichtsproblemen of van problemen die waarschijnlijk in verband kunnen worden gebracht met TMD. Daarenboven blijkt het specifiek een nuttig instrument om pijn te scoren die in verband kan gebracht worden met TMD.

This PhD is based on the following peer reviewed and published papers:

Dugashvili, G, G Menabde, M Janelidze, Z Chichua, and I Amiranashvili. 2013. "Temporomandibular Joint Disorder (Review)." *Georgian Med News* (215): 17–21.

Dugashvili, G, L Van den Berghe, G Menabde, M Janelidze, and L Marks. 2016. "Use of the Universal Pain Assessment Tool for Evaluating Pain Associated with TMD in Youngsters with an Intellectual Disability." *Medicina Oral Patología Oral y Cirugia Bucal* 22 (1): 88–94. https://doi.org/10.4317/medoral.21584.

Dugashvili, Giorgi, Tamar Kotchlashvili, Giorgi Menabde, Marina Janelidze, and Luc Marks. 2019. "Use of the Universal Pain Assessment Tool for Evaluating Pain Associated with TMD in Youngsters." *European Journal of Paediatric Dentistry* 20 (4): 315–19.

Conference Paper from this PhD:

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Abbreviations

AAOP: American Academy of Orofacial Pain

ADDR: Articular Disc Displacement with Reduction

Beta-EP: Beta-Endorphine

CBC: Complete Blood Count

CH: Cluster Headache

CNS: Central Nervous System

CPH: Chronic Paroxysmal Hemicranias

CT: Computed Tomography

DC/TMD: Diagnostic Criteria for Temporomandibular Disorders

EMG: Electromyography

IASP: International Association for the Study of Pain

ID: Intellectual Disability

IL-1ra: Interleukin 1 Receptor Antagonist

IPEM: Institute for Psychoacoustics and Electronic Music

LEM: Loud Electronic Music

LETM: Loud Electronic Techno-Music

MDTs: Multidisciplinary Teams

MH: Migraine Headache

MPDS: Myofascial pain dysfunction syndrome

MRI: Magnetic Resonance Imaging

NIDCR: National Institute of Dental and Craniofacial Research

NRS: Numeric Rating Scale

NSAIDs: Nonsteroidal Anti-Inflammatory Analgesics

OFP: Orofacial Pain

OMFS: Oral and Maxillofacial Surgery

PhD: Doctor of Philosophy

RDC/TMD: Research Diagnostic Criteria for Temporomandibular Disorders

SIL-1RII: Soluble IL-1 Receptor II

TMD: Temporomandibular Disorder

TMJ: Temporomandibular Joint

TMJD: Temporomandibular Joint Disorder

TN: Trigeminal Neuralgia

UPAT: Universal Pain Assessment Tool

WHO: World Health Organization

YLDs : Years Lived with Disabilities

Chapter I Introduction

Parts of this introduction are published in:

Dugashvili, G, G Menabde, M Janelidze, Z Chichua, and I Amiranashvili. 2013. "Temporomandibular Joint Disorder (Review)." *Georgian Med News* (215): 17–21.

The temporomandibular joint (TMJ) is the synovial joint that connects the jaw to the skull. It is formed by the articulation of the mandible and the temporal bone of the cranium. TMJ is located anteriorly to the tragus of the ear, on both lateral aspects of the face. Each joint is made out of the condyle of the mandible, an articulating disk, and the articular tubercle of the temporal bone.

This unique and complicated joint along with its attached muscles, is capable of ginglymos and gliding type of movements such as side to side, up and down, as well as protrusion and retrusion, movements, needed for speaking, chewing, and making facial expressions. Movements at this joint are produced by the muscles of mastication, and the hyoid muscles. The two divisions of TMJ have different functions. The upper part of the joint allows protrusion and retraction of the mandible – the anterior and posterior movements of the jaw. The lateral pterygoid muscle is responsible for protrusion (assisted by the medial pterygoid), on the other hand the posterior fibres of the temporalis perform retraction. A lateral movement such as chewing and grinding is achieved by alternately protruding and retracting the mandible on each side. The lower part of the joint permits elevation and depression of the mandible - opening and closing the mouth. Depression is mostly caused by gravity. During the presence of resistance, the digastric, geniohyoid, and mylohyoid muscles assist. Elevation is very strong movement, achieved by the contraction of the temporalis, masseter, and medial pterygoid muscles.

The arterial supply to the TMJ is provided by the branches of the external carotid, principally the superficial temporal branch. Other contributing branches include the deep auricular, ascending pharyngeal and maxillary arteries. The TMJ is innervated by the auriculotemporal and masseteric branches of the mandibular nerve (CN V3).

I.1. Aetiopathogenesis of TMD and aspects of pain

Aetiology, diagnosis and treatment, this is the rational chronological order that needs to be taken into consideration in regards of Etiopathogenesis and clinical management of TMD.
In order to comprehend the aspects of diagnostics of temporomandibular disorder (TMD), first, it is essential to start from the fundamental details.
In case the temporomandibular region is affected, a variety of diagnostic terms have been presented in the literature over the years, reflecting the different theories of aetiology.

In the past, TMD used to be called TMJ disease or TMJ syndrome by many physicians. Formerly, TMD was also known under the eponymous title of Costen syndrome, after Dr. James Costen. In the early 1930s, James Costen, an otolaryngologist, described a group of signs and symptoms of jaw and ear disturbances and published an article in which he argued that symptoms of pain and dysfunction within the region of the temporomandibular joint were attributed to the loss of vertical dimension of occlusion, leading to compression of the joint structures (Costen 1934).

Until today, this process is still known by some as the "Costen syndrome". However, as time progressed, numerous other terms were proposed to describe, somewhat interchangeably, the various disorders in the temporomandibular region. These include, amongst others, temporomandibular joint dysfunction syndrome (Noble 1965), pain dysfunction syndrome (Marbach and Lipton 1987), and facial arthromyalgia (Madland, Feinmann, and Newman 2000).

Interestingly, the National Institute of Dental and Craniofacial Research (NIDCR) assembles the two terms TMJ and TMD and refers to them as temporomandibular joint disorder (TMJD).
Currently, according to the American Academy of Orofacial Pain (AAOP) and most other groups who sponsor studies into its origins and treatment, temporomandibular disorders (TMDs) is a common and preferred collective term embracing a number of clinical problems that involve the temporomandibular joint, the masticatory musculature and the associated structures. (de Leeuw and Klasser 2013). There are many different pathologies, both articular and muscular that can be added to this group.

The cause, subsequent development and clinical management of temporomandibular disorder can unite a number of medical disciplines such as dentistry, oral and maxillofacial surgery (OMFS), neurology, rheumatology and psychology.

The patient's comprehensive medical history and physical examination are necessary for the initial diagnosis of a given condition, to determine further investigations if necessary and to provide specific treatment and early intervention. In severe cases, a multidisciplinary teams (MDTs) approach is needed.

The different modalities include patient education and self-care practices, medication, physical therapy, splints, psychological counseling, relaxation techniques, biofeedback, hypnotherapy, acupuncture, and arthrocentesis (Medlicott and Harris 2006).

TMD affects 5 to 12 percent of the population, with an annual cost estimated at 4 billion $. One half to two-thirds of people with TMDs will seek treatment. Among this group, approximately 15% will develop chronic TMD (Basi et al. 2012).

A measure called Years Lived with Disabilities (YLDs), which measures incidence, is how the World Health Organization (WHO) quantifies the impact of personal and socioeconomic effects on concomitant persistent pain and disability (Basi et al. 2012).

In 2002, the most recent year for which data are globally available, more YLDs were lost to variety of conditions that can affect the muscles, bones, and joints, collectively termed musculoskeletal disorders than to cardiovascular diseases, respiratory diseases or malignant neoplasms (Manfredini et al. 2012).

Following chronic back pain, TMD has been shown to be the second most prevalent musculoskeletal condition resulting in pain and disability, and is one of the most common causes of orofacial pain after dental pain (Manfredini et al. 2011). It is considered one of the four main features of chronic orofacial pain complexes, along with burning mouth syndrome, atypical facial pain and atypical odontalgia (Aggarwal et al. 2011).

Uyanik and Murphy identify three distinct causes of pain related to TMJ, which collectively fall under the broader term of TMJ syndrome (Uyanik and Murphy 2003):

- Myofascial pain dysfunction syndrome (MPDS), pain at the TMJ due to various causes of increased muscle tension and spasm. Frequently, the masticatory muscles are involved in the origination of TMD pain (Okeson and de Leeuw 2011; Zakrzewska 2013). Muscle disorders classified by Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) are predominantly chronic or fluctuating pain conditions, with a modest probability (31%) of remission (Rammelsberg et al. 2003).

In addition to functional limitations, pain associated with TMD can cause physical and mental distress in adults (Barros Vde et al. 2009; Rodrigues et al. 2015), which may lead patients to take vacations or to be unable to perform their normal activities (Macfarlane et al. 2002).

It is generally believed that a variety of biological, psychological, and social factors may reduce the adaptive capacity of the masticatory system, thus resulting in TMDs (Suvinen et al. 2005; de Leeuw and Klasser 2013).

MPDS is believed to be a physical manifestation of psychological stress. There is no primary disorder of the joint itself. Pain is secondary to events such as nighttime jaw clenching and teeth grinding. Treatment is focused on behavioral modification.

Aetiology of myogenic TMD is multifactorial and includes malocclusion, (Janson et al. 2008) jaw clenching, bruxism, where daytime clenching has a stronger association with TMD than nighttime bruxism (Camparis et al. 2006). Other Aetiological factors may be increased pain sensitivity, personality disorders, stress and anxiety. Patients may have a history of heavy computer use as this has been found to be associated with development of TMD (Perri et al. 2008). About one third of patients have a history of psychiatric problems (Reissmann et al. 2008). In most patients more than one factor may be present and significance of psychological factors during the past few years needs to be recognized.

Women under the age of 30 may have a positive association between smoking and the incidence of TMD, but this association can be explained by other factors (such as stress levels) (Sanders et al. 2012).

- Internal derangements (ID) of the temporomandibular joint (TMJ) are described as deviations in the anatomical position or form of the tissues within the capsule of the joint (The glossary of prosthodontic terms 2005). The clinical manifestations of IDs are interferences with smooth TMJ movements and TMJ sounds, with or without the presence of pain (McNeill 1993). The problem lies within the joint itself, most commonly with the position of the articulating disc (Annino and Goguen 2003).
- Other diseases such as degenerative joint disease, polyarthritides such as rheumatoid arthritis, ankylosis, dislocation, infection, neoplasia, and congenital abnormalities may contribute to arthritic changes leading to degeneration of the articulating surfaces and pain (Scutellari, Orzincolo, and Ceruti 1993).

According to the separate study, interleukin 1 receptor antagonist (IL-1ra) and soluble IL-1 receptor II (sIL-1RII) in the synovial fluid and blood plasma of patients with TMJ involvement of polyarthritis appeared to influence the TMJ inflammation (Alstergren, Benavente, and Kopp 2003a).

Symptomatically the patient may complain about having pain periauricularly, which might be associated with chewing, and may radiate to the head but is different from headache (Gonçalves et al. 2011).

Myofascial pain dysfunction syndrome may be unilateral or bilateral. Whereas, pain associated with TMD of articular origin is usually unilateral, except for rheumatoid arthritis.

The TMD related pain is often described as a variable deep ache with intermittent sharp pain with jaw movement.

Click, pop, and snap sounds may be associated with pain related to TMD. The click accompanied with pain in anterior disk displacement is due to sudden reduction of the posterior band to normal position. On the other hand an isolated click is very common in the general population and is not a risk factor for development of TMD.

I.2. Pain related issues in people with intellectual disabilities

Intelectual disability (ID) is a term used to define impairment in the areas of development or cognitive activities. It is characterized by significant limitations both in intellectual functioning and in adaptive behaviour, which covers many everyday social and practical skills. This disability originates before the age of 18 (Kankkunen, Jänis, and Vehviläinen-Julkunen 2010).

In people with ID, typical indicators, such as crying, grimacing, elevated blood pressure, or tachycardia, may be absent due to central nervous system (CNS) damage accompanying the ID. As a result, it is difficult to ascertain, if the person is in pain. In addition, some people with IDs exhibit self-injurious behaviours (Symons and Thompson 1997), which some professionals may mistakenly interpret as insensitivity to pain. In fact, these improper behaviours may be a response to pain.

Pain assessment is essential among non-communicating ID people. According to Stallard et al., people with intellectual disabilities suffer from pain often on a daily basis but their pain is not actively managed (Stallard et al. 2001). Pain is mostly chronic (Breau et al. 2003) and, according to Hadden and Baeyer pain duration is between one to five hours with a mean intensity of 2.4 (scale 1-5) (Hadden and von Baeyer 2002).

People with intellectual disabilities have a higher risk of painful medical conditions partly because of the impaired ability to communicate about it, therefore pain is often undertreated.

Early assessment and appropriate intervention for pain enhances quality of life. Unfortunately, people with ID are less likely to see healthcare practitioners regularly or have their pain recognized and treated promptly (McGuire, Daly, and Smyth 2010).
For physicians, the challenge has been in how to obtain a valid and reliable assessment of pain from persons who are unable to provide a self-report. Given the fact, that non-communicating

ID people are not usually able to use any self-rating scales, FLACC scales are used by nurses and doctors.

The healthcare provider should be able to use pain assessment tools and to evaluate how effective the method used in pain management was.
Documentation of pain assessment and management is necessary in order to provide the basis for continuity of care too (M Haapio, E Reen, A Salonen 2000, 149–63). For the evaluation of the effectiveness of pain management and continuity of care, use of pain measurement instruments is essential, and, therefore it is important to teach the healthcare providers to use the instruments for assessment of pain in patients with intellectual disabilities.

Assessing pain in people who have complex communication needs can be challenging and as people with intellectual disability live within the community and/or remain in the family home, the opinions and experiences of the person's family and others who know the person well should be included and taken into consideration.

Individuals with intellectual disability may experience the similar chronic diseases and conditions as the general population, but are more likely to have physical and psychological co-morbidities, resulting in a higher risk of pain experience and more frequent or severe pain.

The majority of people with IDs are able to give some account of pain they are experiencing, but the descriptions of localization of pain and the potential origins of it can be difficult for some to articulate (Hennequin, Morin, and Feine 2000; Findlay, Williams, and Scior 2013).

Bottos and Chambers report that both children and adults with intellectual disabilities have higher tolerance for pain experiences in comparison with healthy individuals. This may be associated with challenges in recognizing and communicating pain to others (S. Bottos and C.T Chambers 2006).

People with IDs have been observed carrying out normal daily activities even when they have been seriously injured. Children and adults with intellectual disabilities often have medical conditions that require ongoing treatment or regular procedures and investigations that are related to pain.

Caregivers, family members, and healthcare team need to regularly assess for the presence of pain, its location and severity. Once pain is identified, it needs to be treated and comfort measures should be provided.

I.3. Communication issues in vulnerable people regarding pain

According to McCaffrey, pain is whatever the experiencing individual says it is and exists whenever he or she says it does. But a problem arises when person cannot report what is happening to them (Mccaffery 1968).

The ethical pillars of beneficence (the duty to benefit another) and non-maleficence (the duty to do no harm) oblige healthcare professionals, caregivers, and direct support staff to provide medical care for health issues and pain management and to provide comfort to all individuals, including those who are unable to speak for themselves (Herr et al. 2011). The principle of justice (fair and equal treatment of individuals) and respect for human dignity require medical workers to do the best for individuals in their care.

More than a century ago William Osler urged students he taught: "Listen to the patient, he is telling you the diagnosis" (Osler 1914). Osler knew that the patient's story could be often critical to an accurate diagnosis. Like many of his contemporaries, Osler saw diagnosis as a key to the medical profession's foundational skill. Indeed, the right treatment, after all, depends on the right diagnosis.

Generations later, skill of identifying the correct diagnosis remains a source of professional pride for many physicians, while the spectre of a misdiagnosis or missed diagnosis can provoke sleepless nights and can have a negative influence on quality of life. (Mulley, Trimble, and Elwyn 2012)

Medicine has changed since Osler's day, in that there are now more diagnostic technologies and more treatment options available. Although the rising accuracy of diagnostic tests has allowed doctors to rely less on listening when determining the cause of symptoms (Marvel et al. 1999), listening is growing in importance when deciding which of the many treatment options best fits each patient's priorities and individual needs.

The International Association for the Study of Pain (IASP) identifies most vulnerable populations by focusing on four patient groups as particularly high risk for inadequate assessment and management: children and babies, older adults, individuals with intellectual and development disabilities, and survivors of torture and war.

Although the above-mentioned populations may communicate pain differently, they share a concerning trait: the frequent inability to effectively articulate their pain related issues to healthcare providers. This communication challenge often means clinicians and others struggle to provide an appropriate diagnosis, resulting in a lack of treatment, undermedication, or overprescription, which may lead to undesirable prognosis.

People who lack expressive language and have limited comprehension of language can usually only articulate their distress through changes in behaviour and facial expression. In this case pain must be assessed using a combination of behavioural cues and proxy information (information provided by others) (Davies and Evans 2001).

Sometimes it is difficult for clinicians to understand patients with limited expressive communication, limited time may increase the frustration of physicians and they may not take thorough histories leading to premature, ill-thought-out treatment plans.

Pain in non-communicating people can be assessed by observing physiological changes, such as breathing, skin colour, sweating, urinating, blood pressure and heart rate (Donovan 2002; Carter, McArthur, and Cunliffe 2002; Breau et al. 2003; Zwakhalen et al. 2004).

Additionally, pain can be assessed by observing behavioural changes (Kyrkou 2005). Facial expressions and aggressive behaviour are common indicators of pain (Collis et al. 2008). Vocal expressions and body posture may be the indicators of pain as well.

Sometimes it is difficult for clinicians to know who is “in charge”, who has the legal authority to represent the patient. Therefore treating the patients according to individual approach is crucial.

In 1969, the term ‘patient-centred medicine’ was introduced by Enid Balint as ‘understanding the patient as a unique human being’, thus opposing a general apprehension of medicine as being ‘disease-centred’ (Balint 1969).

Research in the 1970s and 1980s developed and expanded these ideas (Byrne & Long 1976; Levenstein et al. 1986). The concept of patient-centred medicine has had an impact in the development of care during the last decades. It has also been criticized for being too wide a concept but the label ‘patient-centred medicine’ has a wide recognition (Bensing 2000; Roter 2000; Mead & Bower 2002).

Patient-centred communication is helpful in building a working alliance with the patient and a tool of mediating doctor’s professional competence to the patient–doctor relationship.

The advantage of using patient-centred communication in the patient–doctor encounter is supported by a large body of research (Simpson et al. 1991; Stewart et al. 2000).

Chapter II Aspects of TMD diagnostics

II.1 Physical Examination

During the physical examination of the patient, forward head posture can be observed that can be the cause of the displacement of the condyles posteriorly. Jaw malocclusion, abnormal dental wear, and poor dentition can be identified. While examining the patient, a visible clenching or spasm of the ipsilateral neck musculature can be noticed as well.

II.2 Joint range of motion

Jaw opening and closure as well as lateral deviation bilaterally should be evaluated by the examiner. An acceptable range of motion for opening is 5 cm, whereas for lateral mandibular movement it is normally 1 cm. Notably, patients with TMD tend to have restricted mouth opening.

II.3 Palpation

The TMJ is palpated both laterally and posteriorly in open and closed positions. Laterally, the joint is palpated as a depression below the zygomatic arch and 1-2 cm anterior to the tragus. Posteriorly, the joint is palpated through the external auditory canal.

While palpating, it is essential that the examiner feels for muscle spasm, as well as muscle or joint tenderness. The examiner should also listen to the joint sound.
As a part of thorough TMJ examination the muscles palpated are masseter, temporalis, medial pterygoid, lateral pterygoid, and sternocleidomastoid.
In isolated myofascial pain and dysfunction, joint tenderness and joint click are generally absent.

II.4 Laboratory Studies

No laboratory studies are specifically indicated to be used with TMD, however, appropriate laboratory samples may be drawn to help rule out other disorders.

In the suspicion of infection, Complete blood count (CBC) can be done:

- Calcium or alkaline phosphatase, for possible bone disease;
- Serum levels of creatine phosphokinase, indicators of muscle disease;
- Erythrocyte sedimentation rate if temporal arteritis is suspected and rheumatoid factor during rheumatoid arthritis suspicion;
- Uric acid test done when suspecting gout;

II.5 Imaging Studies (Granat et al. 1989)*:*

- Arthroscopy can be considered for internal disc derangement and visualization of deviations in the anatomical position or form of the tissues within the capsule of the joint (Rigon et al. 2011).
- For the evaluation of disorders within the temporomandibular joint, such as articular disc displacement with reduction (ADDR), which is one of the most common internal derangement within the TMJ complex encountered in adults, and also frequently detected in younger populations - magnetic resonance imaging (MRI) is considered the gold standard. However, due to costs, MRI is not feasible to be used broadly. This type of imaging is considered the imaging modality of choice for ADDR (Larheim 2005).

  Magnetic resonance imaging should be used as the study of choice if articular or meniscal pathology is suspected and an endoscopic or surgical procedure is contemplated, or in the case of traumatic TMD (Tallents et al. 1996).
- For exploration of bony structures and muscular soft tissues (Tsiklakis 2010), computed tomography (CT) scan is carried out.
- Visualization of the morphological elements and the functions of the TMJ, articular disk,

mandibular condyle, and lateral pterygoid muscle are possible by dynamic high-resolution ultrasonography (Emshoff et al. 2002).

II.6 Differential Diagnoses

There are many types of conditions correlated with pain that is felt in the orofacial region. While majority of conditions treated by dentists are related with teeth, periodontal structures, and associated mucosal tissues, it is a responsibility of the dentist to identify and manage common TMD as well.

Even though dentists might not be primary care providers of certain orofacial pain conditions they might face, such as neuropathic pain disorders, and common headaches, they should be able to recognize and perform differential diagnosis between TMD and other conditions which may have similar signs or symptoms, conditions such as chronic paroxysmal hemicranias (CPH), cluster headache (CH), migraine headache (MH), trigeminal neuralgia (TN), coital cephalalgia (sexual headache).

II.7 Universal pain assessment tool

Universal pain screening with a 0-10 pain intensity numeric rating scale (NRS) has been widely implemented in primary care medicine. Various pain assessment tools, such as Wong-Baker Faces Pain Rating Scale (Wong and Baker 1988) the Poker Chip Tool (Cheng et al. 2003), the Eland Colour Scale (Eland 1985) and FLACC scale (Merkel, Voepel-Lewis, and Malviya 2002) have been used or adapted by clinicians.

Since pain is a highly subjective and individualized, self-report is frequently cited as the gold standard of pain assessment and it should always be initially attempted, as it is the most reliable report of pain (Herr et al. 2006).

According to the results of the present PhD study, the Universal Pain Assessment Tool (UPAT) (Gupta, Dhiman, and Sharma 2012; Dugashvili et al. 2017) (Figure 1). demonstrated that it might be an additional tool to detect the existence of functional jaw pain possibly related with TMD and also an additional instrument to score pain intensity related with TMD in people with internal derangement.

In the present PhD study, the above-mentioned tool was used in order to identify if TMD can originate in ASA 1 youngsters. The tool was also used among Special Olympics Athletes, people with ID. The positive feedback could enable clinicians in the early recognition of pain-related behaviour to avoid undertreatment of TMD related problems in vulnerable patients.

As the Tool is an adapted version of the Wong- Baker Faces Pain Rating Scale, it would help assess pain according to the individual needs of the patients.

The tool was believed to provide the opportunity to assess pain levels when athletes are unable to communicate the intensity of their pain. Moreover, it would give the opportunity for earlier consultation of a special care management team in case of suspected pain (Baldridge and Andrasik 2010).

The purpose of this PhD study was to: 1) determine, whether the UPAT could be used as an additional tool and a valid instrument to collect data on functional TMJ pain and to assess orofacial pain levels related to TMD in people with ID and ASA 1 youngsters, and 2) identify if the TMD issue can originate from an early age.

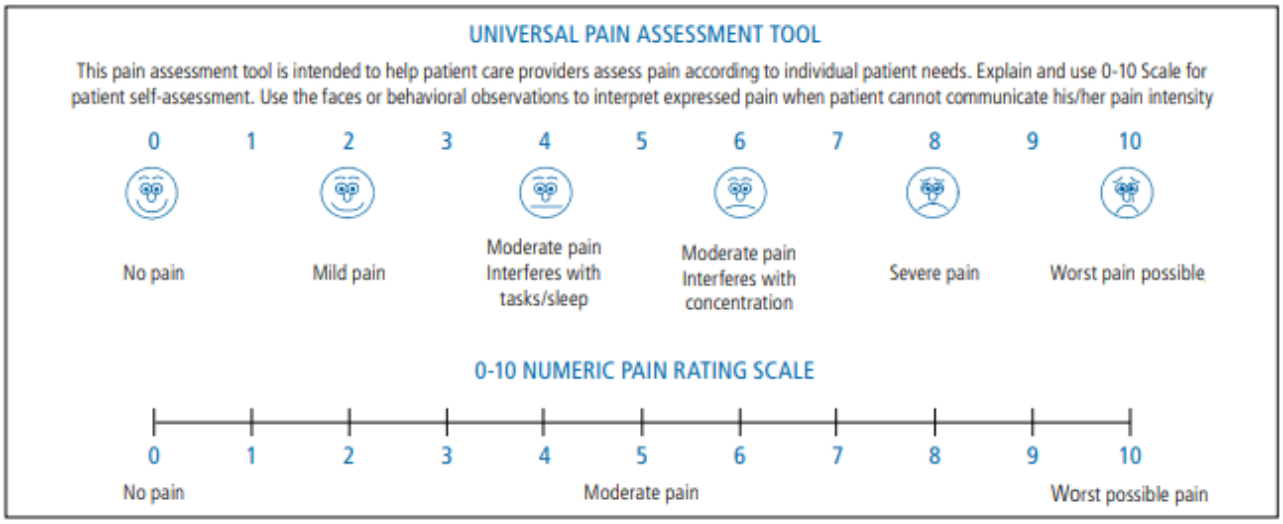


Figure 1. The Universal Pain Assessment Tool (UPAT), that has been used to identify functional TMJ pain.

CHAPTER III.

III.1 Use of the universal pain assessment tool for evaluating pain associated with TMD in people with an intellectual disability

This chapter is based on :

Dugashvili, G, L Van den Berghe, G Menabde, M Janelidze, and L Marks. 2016. "Use of the Universal Pain Assessment Tool for Evaluating Pain Associated with TMD in Youngsters with an Intellectual Disability." *Medicina Oral Patología Oral y Cirugia Bucal* 22 (1): 88–94. https://doi.org/10.4317/medoral.21584.

III.1.1 Introduction

Non-down syndrome athletes were screened during the Special Olympics 2014 European games. The athletes were invited to the "Special Olympics Special Smiles" (Perlman, Waldman, and Wong 2012) site on a voluntary basis. Written consent was obtained from the athlete and a parent or guardian.

In full accordance of the World Medical Association Declaration of Helsinki, the Joint Ethical Committee of the Ghent University Hospital approved the study as 2013/816. Identification of functional jaw pain was measured using the UPAT (Ohrbach et al. 2013).

Five jaw movements were assessed (Schiffman et al. 2014): opening, maximum unassisted opening, maximum assisted opening (when moderate digital pressure was used to increase the degree of opening, if possible), left lateral excursion and right lateral excursion.

The TMJ was palpated at 3 locations: lateral pole, posterior attachment (via the external acoustic meatus), and dorsal aspect (with 25-30 mm of jaw opening) (Ohrbach et al. 2013).

For right and left excursive movements, athletes were directed to open slightly and move their jaws as far as possible towards the right and left, even if it was painful, and then move their jaw back to a comfortable state and position their posterior teeth completely together each time. If the subject was confused about which direction they should move their jaw, they would be told to move their jaw towards the hand touched on the side of the desired movement.

The subject was asked to repeat the movement three times for all excursive movements. If pain was reported during any of those movements, athletes were asked to indicate the severity of their pain on the UPAT.

At no time during the screening, was a suggestion made nor was the subject led to respond about the presence of pain. Joint noises (click, crepitus) were detected while placing fingers over the TMJ on either the right or the left side during opening and closing movements.

III.1.2 Statistical analysis

All of the data were recorded using the UPAT and processed by SPSS software (IBM® SPSS® Statistics 22 Version 22.0.0.1). The level of significance was set at 0.05.

III.1.3 Results

Two hundred and four ID athletes were evaluated. The majority (65%) of participants were male (133 male and 71 female patients); age distribution ranged from 15 to 23 years (mean 19.25 ± 2.53) (Figure III.1.1).

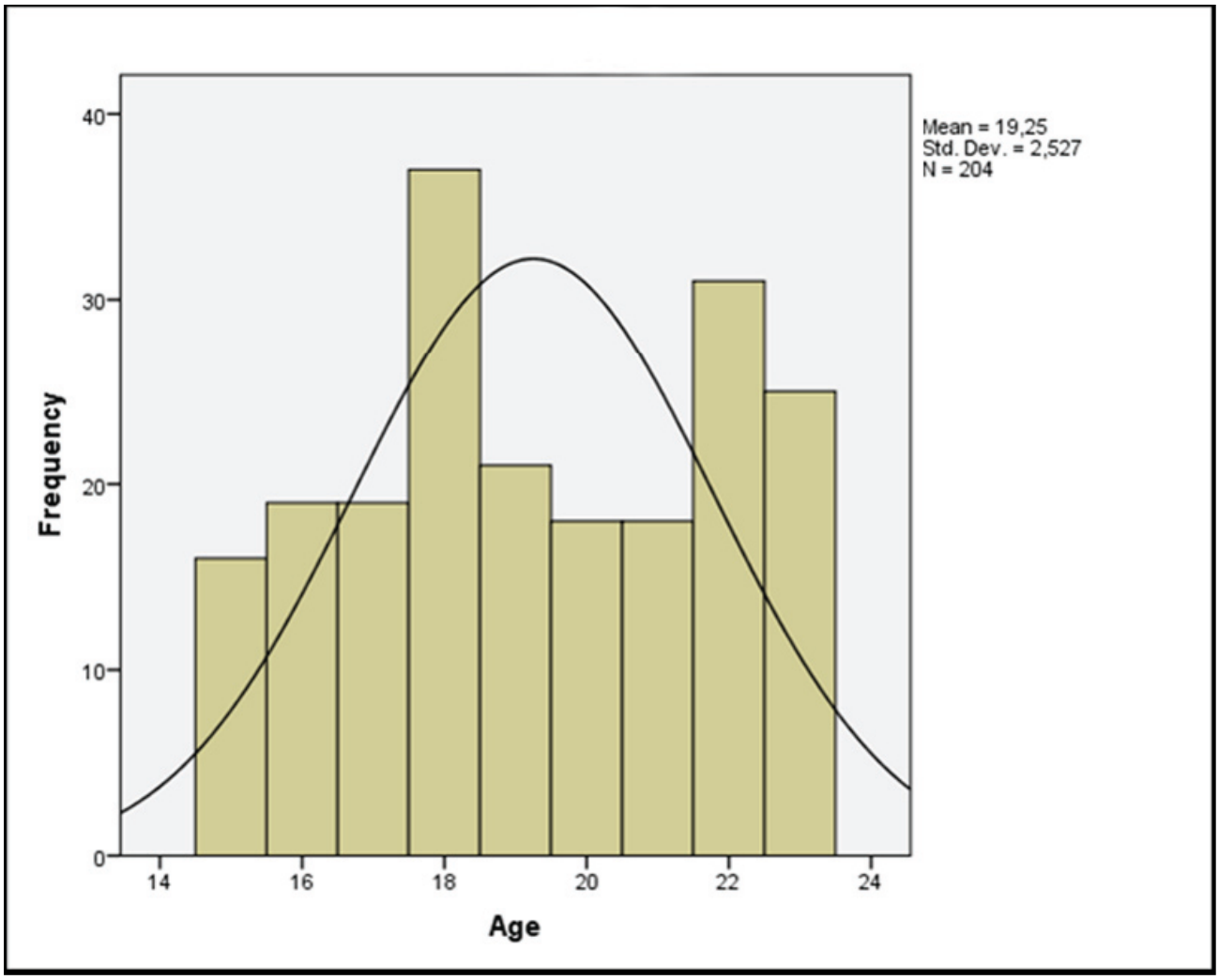
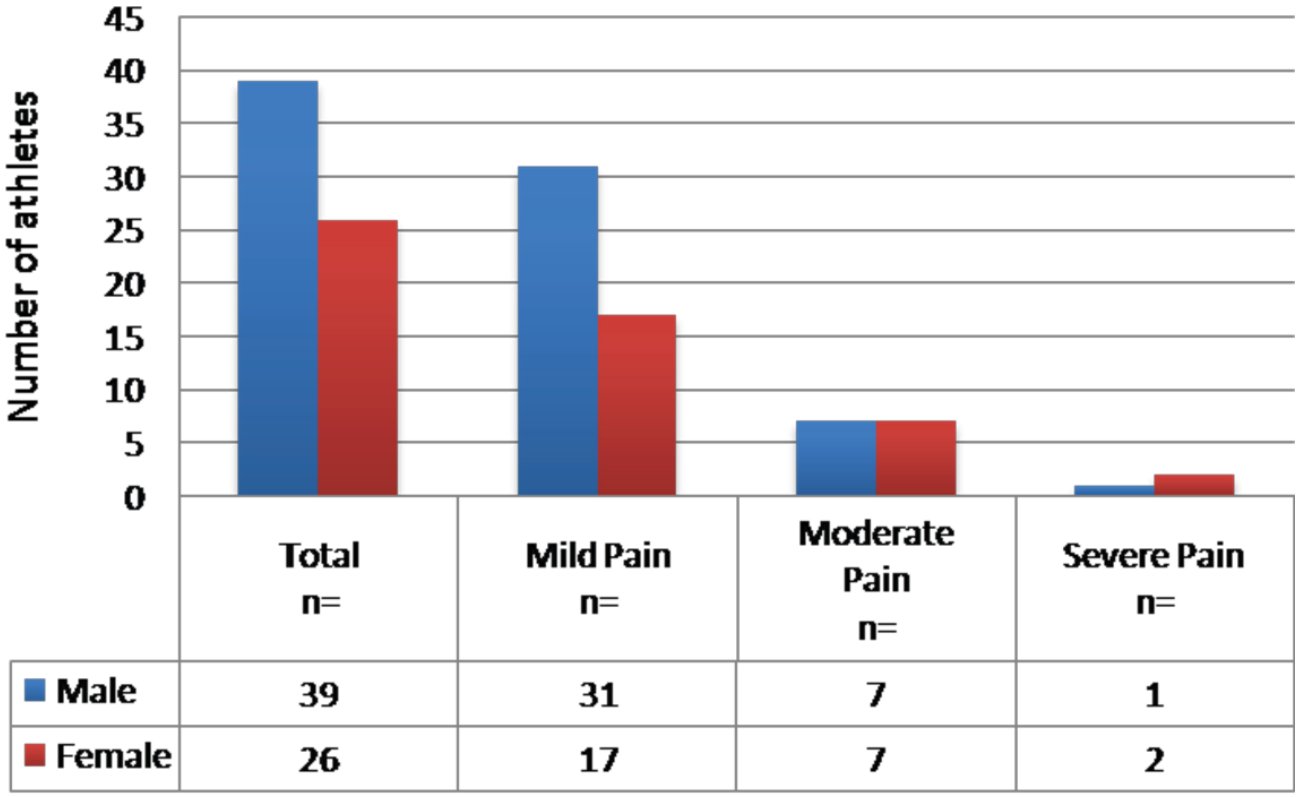


Figure III.1.1. Age distribution of screened athletes.

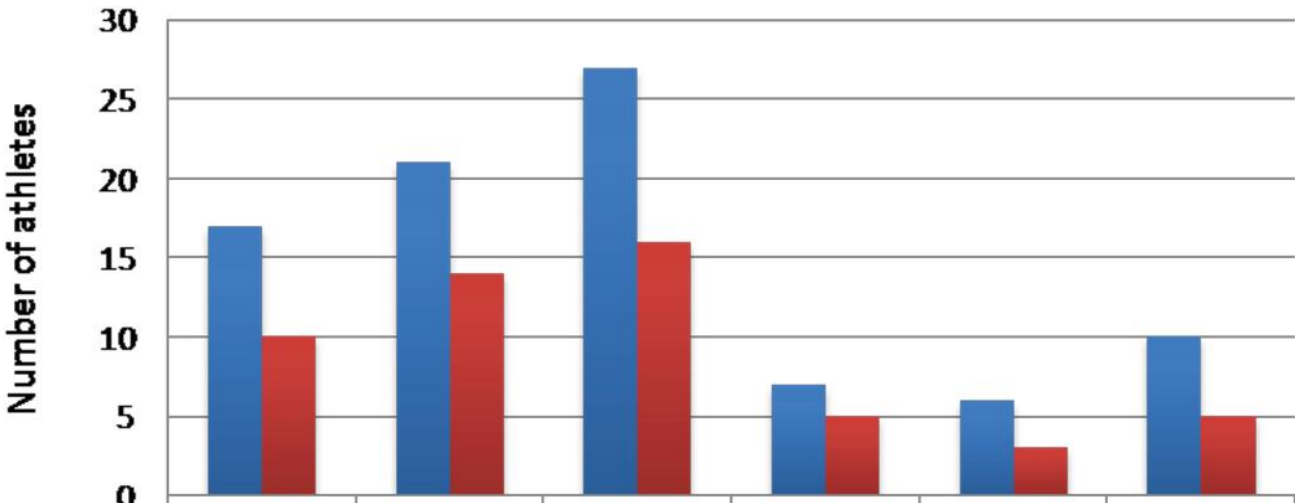
The results of the UPAT demonstrated the existence of functional TMJ pain in 32% (n=65) of the athletes without significant prevalence ($P > 0.05$) in the survey group. Seventy four percent of pain associated with TMD, was reported as mild. As the severity of pain level increased, the distribution of pain decreased, this can be markedly seen on figure III.1.2.



	Total n=	Mild Pain n=	Moderate Pain n=	Severe Pain n=
Male	39	31	7	1
Female	26	17	7	2

Figure III.1.2. Distribution of pain levels among male and female athletes.

Considering different jaw movements, the subjects reported far more pain on maximum opening without significant difference between assisted or unassisted opening ($P > 0.05$) (Figure III.1.3).



	Opening n=	Maximum Unassisted Opening n=	Maximum Assisted Opening n=	Left Lateral Excursion n=	Right Lateral Excursion n=	Both Sides n=
Male	17	21	27	7	6	10
Female	10	14	16	5	3	5

Figure III.1.3. Distribution of functional jaw pain according to the different jaw movements.

Joint sounds were found in 38% of subjects, 65% of these athletes also reported functional pain (Figure III.1.4).

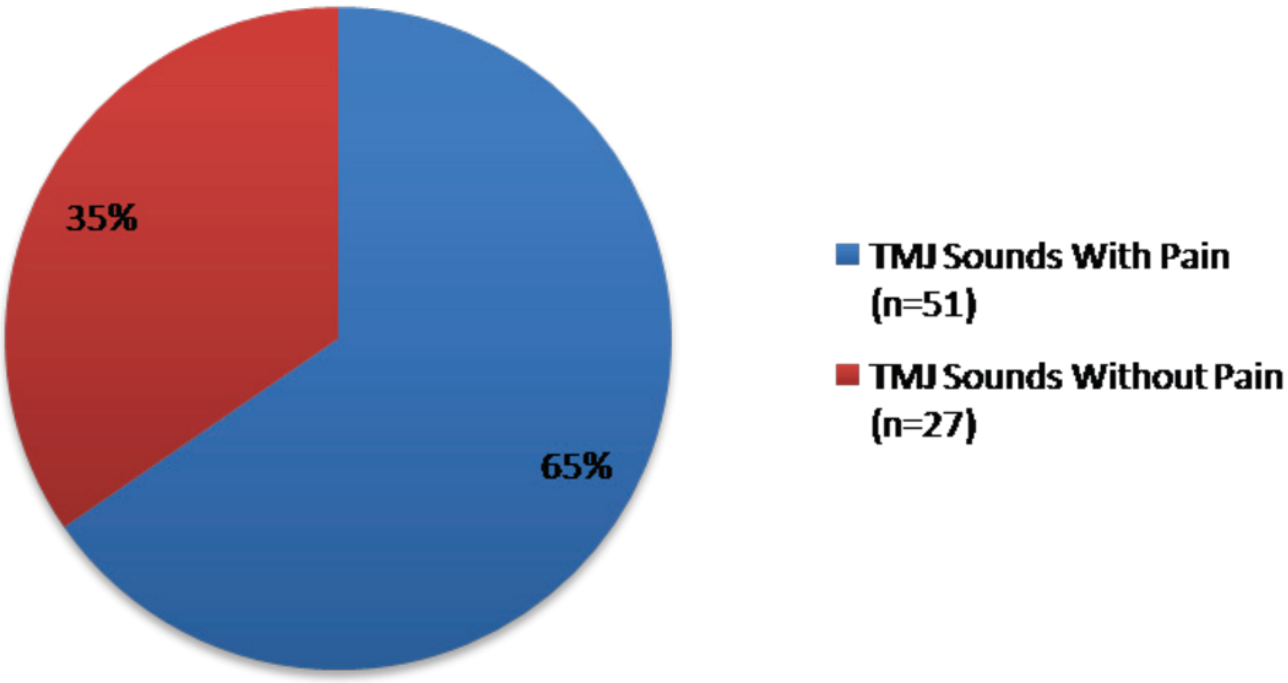


Figure III.1.4. Distribution of TMJ sounds with and without functional pain report.

III.2 Use of the universal pain assessment tool for evaluating pain associated with TMD in ASA 1 youngsters

This chapter is based on:

Dugashvili, Giorgi, Tamar Kotchlashvili, Giorgi Menabde, Marina Janelidze, and Luc Marks. 2019. "Use of the Universal Pain Assessment Tool for Evaluating Pain Associated with TMD in Youngsters." *European Journal of Paediatric Dentistry* 20 (4): 315–19.

III.2.1 Introduction

Youngster patients were screened at the N1 Dental Clinic of Tbilisi State Medical University in Tbilisi, Georgia.

The youngsters, who addressed the dental clinic because of dental issues, were undergoing different dental treatments. Prior to the treatment, patients were invited for the screening of TMD on a voluntary basis. Written consent was obtained from the patient and a parent or guardian.

In full accordance of the World Medical Association Declaration of Helsinki, the Joint Ethical Committee of Khechinashvili University Hospital approved the study as 2016/13.

Identification of functional jaw pain was measured using the UPAT (Ohrbach et al., 2011) (Figure 1). Five jaw movements were assessed (Schiffman et al., 2014): opening, maximum unassisted opening, maximum assisted opening (when moderate digital pressure was used to increase the degree of opening, if possible), left lateral excursion and right lateral excursion. The TMJ was palpated at 3 locations: lateral pole, posterior attachment (via the external acoustic meatus), and dorsal aspect (with 25-30 mm of jaw opening) (Ohrbach et al., 2011).

Additionally, the superficial masticatory muscles (masseter and temporalis) were palpated. By means of mechanical stimuli caused by digital pressure, nociceptive neurons located in the

muscular and myofascial structures were stimulated to detect and transmit pain messages to the central nerve system (Conti et al. 2007).

The palpation was done as follows: the masseter at its attachments to the zygomatic arch and angle of the mandible, the temporalis both in the temporal fossa and intraorally along the ascending ramus of the mandible, and the medial pterygoid bimanually, placing one finger externally at the medial aspect of the angle of the mandible and the other finger orally in the lingual vestibule in the retromolar region (Meyer 1990).

For right and left excursive movements, patients were directed to open slightly and move their jaws as far as possible towards the right and left, even if it was painful, and then move their jaw back to a comfortable state and position their posterior teeth completely together each time. If the subject was confused about which direction they should move their jaw, they would be told to move their jaw towards the hand touched on the side of the desired movement.

The subject was asked to repeat the movement three times for all excursive movements.

If pain was reported during any of those movements, patients were asked to indicate the severity of their pain on the UPAT.

At no time during the screening, was a suggestion made nor was the subject led to respond about the presence of pain. Joint noises (click, crepitus) were detected during the screening while placing fingers over the TMJ on either the right or the left side during opening and closing movements.

Both trained examiners were calibrated for the UPAT exams included in the tests. Inter-and intra-examiner scores were higher than 80%.

III.2.2 Data analysis

All of the data were recorded using the UPAT and processed by SPSS software (IBM® SPSS® Statistics 22 Version 22.0.0.1). The level of significance was set at 0.05. Comparisons of categorised data have been performed by chi-square test and Fisher's Exact test (where expected values were less than 5). A P value less than 0.05 was considered as statistically significant.

III.2.3 Results

Two hundred and ninety-one patients were evaluated. The majority (59%) of participants were male (172 male and 119 female patients); age distribution ranged from 8 to 15 years (mean 11.46±2.11) (Figure III.2.1).

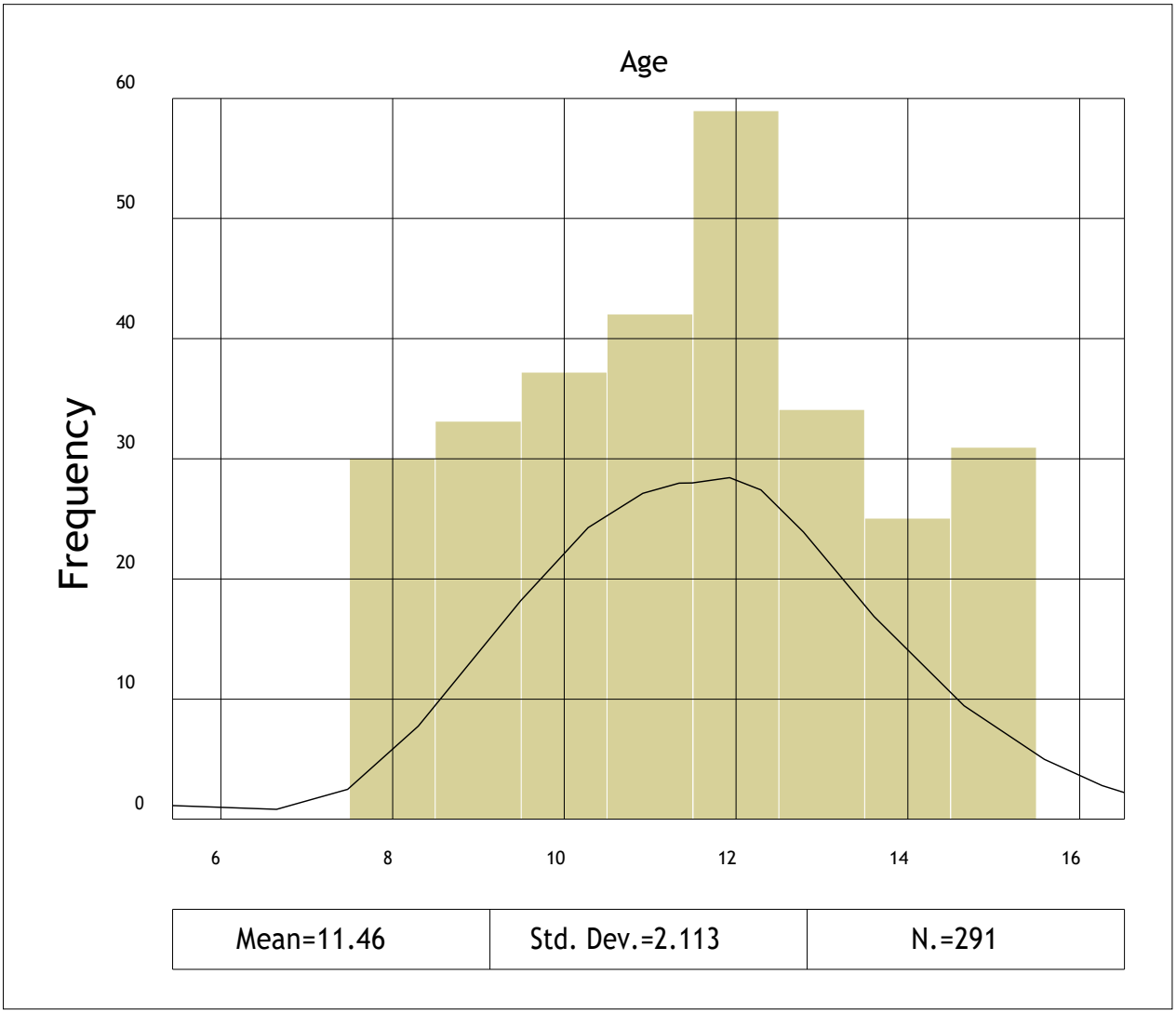


Figure III.2.1. Age distribution of screened patients.

The results of the UPAT demonstrated the existence of functional TMJ pain in 15.46% (n=45) of the youngster patients without significant prevalence ($P > 0.05$) in the survey group. Seventy eight percent of pain associated with TMD was reported as mild. As the severity of pain level increased, the distribution of pain decreased, this can be markedly seen on figure III.2.2.

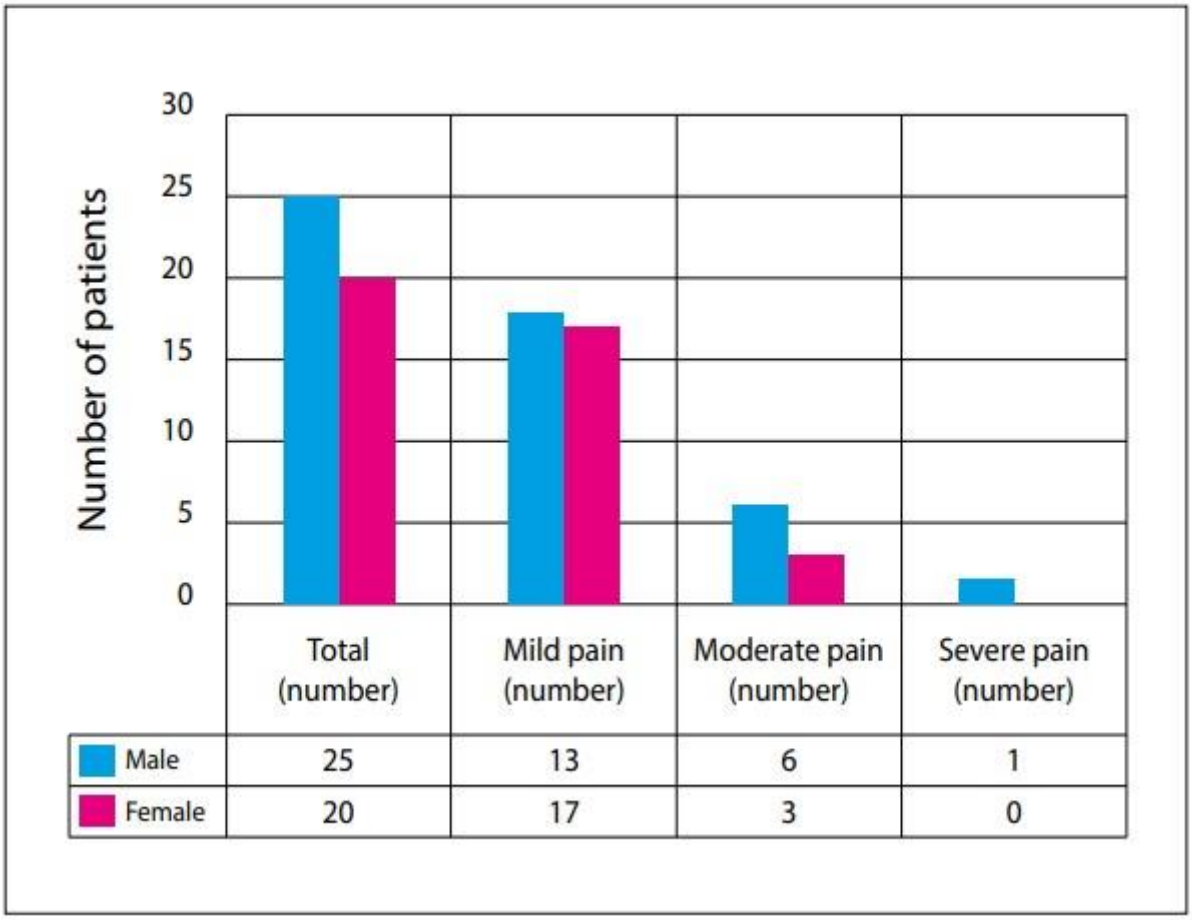


Figure III.2.2. Distribution of pain levels among male and female patients.

Considering different jaw movements, the subjects reported far more pain on maximum opening without significant difference between assisted or unassisted opening ($P > 0.05$) (Figure III.2.3).

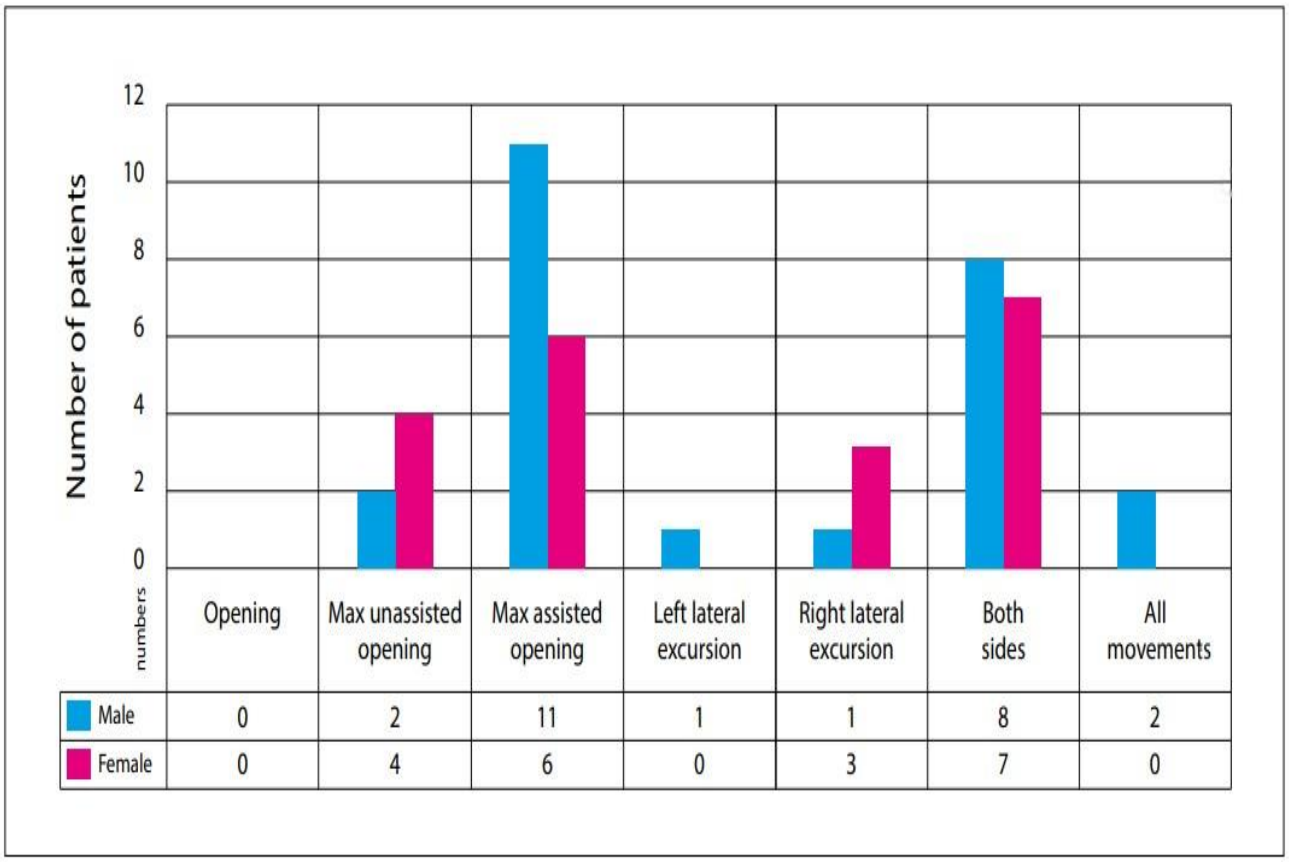


Figure III.2.3. Distribution of functional jaw pain according to the different jaw movements.

Joint sounds were found in 25.43% of subjects, 49% of these subjects also reported functional pain (Figure III.2.4).

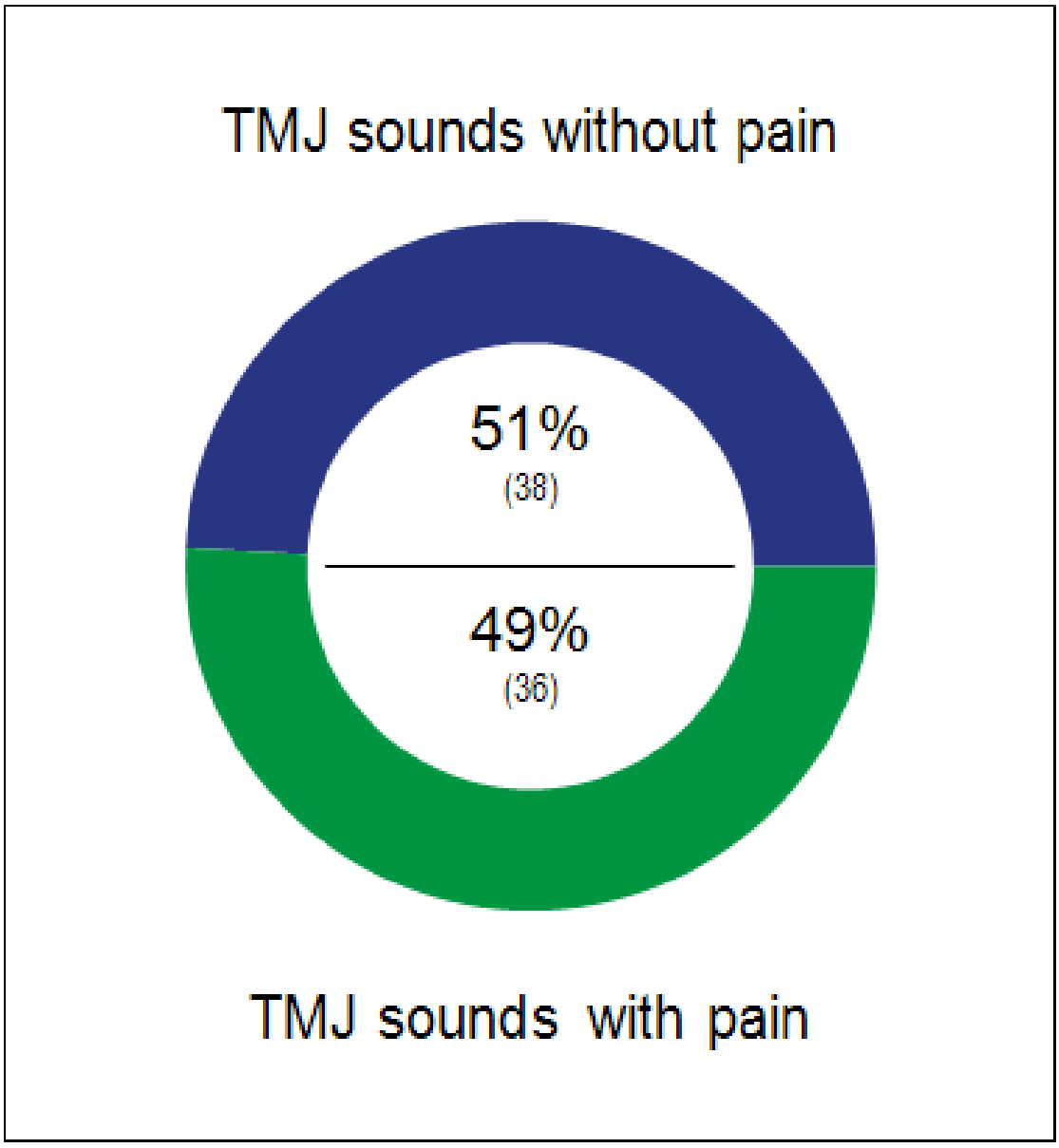


Figure III.2.4. Distribution of TMJ sounds with and without functional pain report.

The radiographic images of the eight ear old patient with explicit joint sounds can be seen on figure III.2.5 A&B.

Figure III.2.5A.

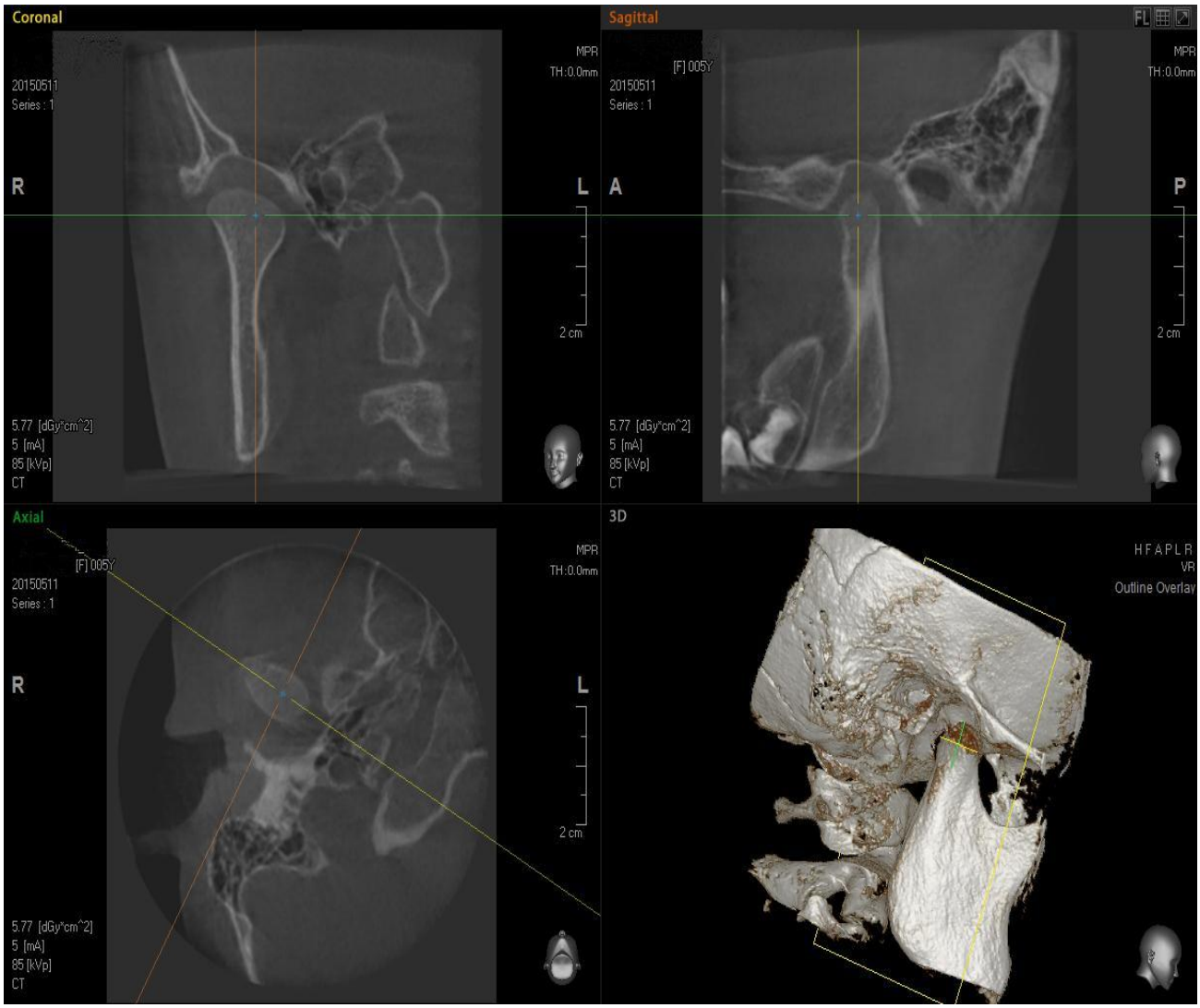


Figure III.2.5B. The radiographic images of the eight year old patient with explicit joint sounds.

Chapter IV General Discussion

There are several studies in the literature regarding TMD in youngsters reporting that the TMD issue can originate from an early age with similar signs and symptoms to those seen in adults (Grosfeld and Czarnecka 1977; Gazit et al. 1984; Magnusson et al. 1985; Casanova-Rosado et al. 2005).

Early assessment and appropriate intervention for pain associated with TMD seems important in order to eliminate the problem at an early stage, as later the symptoms can become chronic and more difficult to manage.

Additionally studies by Minghelli et al. and Al-Khotani et al. revealed a significant association between TMD and the levels of emotional stress. (Minghelli et al. 2014; Al-Khotani et al. 2016).

There have been very limited studies and little information reported regarding TMD in people with ID (Tanboga et al. 2014). The selection of the study sample was defective as it included all "non-Down Syndrome ID athletes".

There are a many types of IDs with many different clinical presentations that may cause a distortion in the validity of the results. The present study has been conducted, in order to collect data on functional TMJ pain and to assess pain levels in people with ID, using the UPAT.

In addition, the present method for evaluating pain, would give opportunities to an earlier intervention in case of suspected pain.

Certain aspects can be considered to be the limitations of the present study. There is an unequal female/male ratio. This ratio is considered to be an important factor, because studies have demonstrated, that starting from late adolescence, prevalence of temporomandibular symptoms is higher in females than in males (Bonjardim et al. 2005; Barbosa et al. 2008).

Secondly, as far as only a particular group of people with ID has been studied, the results of the present research cannot be generalized. The outcomes have shown, that the issue is problematic and needs further study.

According to Kim et al. TMD can occur at any age (Kim et al. 2012). They investigated different age groups and showed that patients younger than 40 years of age have demonstrated high proposition (74%), of which 38% is the youngest group (under 25 years).

The study also suggested the tendency in younger patients needs to be continuously investigated.

On the contrary to the above-mentioned study, present research has shown a non-significant prevalence ($P > 0.05$) of pain associated with TMD in people with ID, within the ages of 15 to 23 years.

According to the same study (Kim et al. 2012), there is a tendency of female patients to be predisposed to TMD more than male patients. A possible explanation of this has been associated with the female sex hormone estrogen (CAIRNS 2010). In animal models estrogen has been shown to modulate inflammation in the TMJ (Guan et al. 2005; Flake, Hermanstyne, and Gold 2006). Moreover, Flake et al. (Flake, Hermanstyne, and Gold 2006) suggest, that testosterone and estrogen have opposing actions on TMJ. This could also account for the higher prevalence and severity of pain associated with TMD in females by suggesting that testosterone may mitigate, while estrogen exacerbates TMJ damage, particularly in the presence of overt inflammation.

The purpose of the present study was not to consider gender differences in pain prevalence, but a tendency towards absence of this differentiation could be observed. A possible explanation for this is the fact, that a population was screened rather than a patient group.

Authors in the present study palpated only the TMJ but not the superficial masticatory muscles (Masseter & Temporalis), which are the main source of extra-oral pain. Besides, palpation was performed without any objective measurement of the force applied.

Another limitation of the present study is that it analyzed TMJ signs and not real articular or muscular disorders according to the diagnostic criteria of the AAOP (Schiffman et al. 2014). A single sign from the masticatory system is not sinonymous with a TMD, nor does it

automatically lead to the diagnosis of a TMD. Pain on palpation, joint noises and others are clinical signs that are frequently found in the examination of normal population without leading to a diagnosis of TMD.

Consistent implementation of the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) in future studies will enable a more reliable definition of TMD cases for comparison of their findings. A questionnaire, in which the subjects are asked about pain during mastication would give additional benefits although the outcome could be questioned in this ID group.

It is generally acknowledged that, depending on the study, differences in diagnostic criteria and the method of data collection, the prevalence of pain related TMD in children and adolescents varies widely (Toscano and Defabianis 2009).

In 2007, a large-scale study was published that focused on pain associated with TMD among adolescents aged 12-19 (Nilsson 2007). Of the 28,899 adolescents that participated, 4.2% reported pain related to TMD during their annual routine examination in Public Dental Service (PDS) clinics. In another Swedish study, 7% of the 862 adolescents from a public dental clinic were diagnosed to have pain associated with TMD (List et al. 1999). Similar rate was also found in a recent study on Norwegian adolescents (Ostensjo et al. 2017).

The present study has outlined, that when pain associated with TMJ noises is present, TMD can be present.

Similar findings can be found in the study of Ohrbach et al. (Ohrbach et al. 2013). However, noises alone are no longer considered to be diagnostic for TMD, since they can be detected in a high proportion in general populations (Wright and North 2009).

It is generally believed that a variety of biological, psychological, and social factors may reduce the adaptive capacity of the masticatory system, as a consequence resulting in TMDs (de Leeuw and Klasser 2013; Suvinen et al. 2005). However, many previous studies either focused only on one category of TMDs, namely pain-related TMDs or TMJ sounds (Könönen, Waltimo, and Nyström 1996; Nilsson 2007; Fernandes et al. 2015), or merged the signs and symptoms into one

overall TMD diagnosis (Pereira et al. 2009; Karibe et al. 2015; Sermet Elbay et al. 2016). As it is generally agreed that TMDs incorporate a nonspecific umbrella term, it is essential to differentiate pain-related TMDs from TMJ sounds. By differentiating between the two, one can also learn if there are any common risk indicators for both types of TMDs.

As with other pain conditions, TMD pain is a subjective experience that involves biopsychosocial components in the etiopathogenesis. For example, age, gender, living area, and socioeconomic status have been reported to be associated with the presence of pain associated TMD in the general population (Fillingim et al. 2011; Maixner et al. 2011b; Fernandes et al. 2015).

According to Glaros et al. (GLAROS, WILLIAMS, and LAUSTEN 2005) the existence of stress and emotional distress, together with oral parafunctional behaviours can be predictive for TMD. They suggest that treatment focussing on coping with psycho-emotional problems could be effective by diminishing excessive masticatory muscle tension.

Myogenous TMD is frequently considered to be the most common type of TMD and is generally caused by increased muscle activity triggered by emotional stress (Lauriti et al. 2013).

Since the TMJ screening was performed during the Special Olympics event, when the athletes were taking part in the sports competition, the stress factor should be taken into consideration while interpreting the results.

According to Chisnoiu et al. (Chisnoiu et al. 2015), stress and anxiety issues can influence on the person's psyche and may lead to pain, due to spasms of the internal, external pterygoid and masseter muscles caused by bruxism (grinding, clenching, bracing).

In conformity with the abovementioned, TMD in ID athletes could be considered as stress related. However, the issue needs to be further researched and cannot be generalized in people with ID.

Health studies on children are important, because in many cases a health condition that occurs during childhood sets the stage for adult health (National Academy of Sciences 2004). For instance, children who experience pain in early life often show long-term changes in terms of pain perception and related behaviors (McGrath and Frager 1996). Studies on pain and related disorders conducted in the young population are thus deemed necessary to learn more about the course of such disorders. In addition, an early detection and possible intervention might reduce future problems (da Silva et al. 2017).

Chapter V General Conclusions

Although TMD is not considered to be life-threatening, it can be deleterious to the quality of life (Shi, Guo, and Awad 2013) for people with ID, as their symptoms could become chronic and difficult to manage if they are not detected and eliminated at an early stage.

According to the results found in this study, the UPAT demonstrated to be an additional tool to detect the existence of functional jaw pain possibly associated with TMD.

If UPAT could be implemented in general practice of dentistry for evaluating pain related to TMD in people with special needs, further research will be needed to determine whether screening for pain will improve patient outcomes.

As far as there are very limited studies reported in the literature regarding TMD in people with ID, the present study could be the initiative for future research in this field.

Chapter VI Medical Care

There is currently no unified strategy for the management of TMD. In most cases, the condition responds to simple treatment, symptoms usually remit with simple care and the prognosis is good.

Mostly, TMDs are self-limiting and do not aggravate. Simple treatment, involving self-care practices, rehabilitation geared toward eliminating muscle spasms, and restoring proper coordination, is all that is required. Nonsteroidal anti-inflammatory analgesics (NSAIDs) should be used on a temporary, regular basis and not on an as needed basis (Gauer and Semidey 2015).

On the other hand, treatment of chronic TMD can be strenuous and the condition may be best managed by a team approach. The team consists of a primary care physician, a dentist, a physiotherapist, a psychologist, a pharmacologist, and in a few number of cases, a surgeon.

The different methods include patient education and self-care practices, psychological counseling, physical therapy, splints, relaxation techniques, hypnotherapy, biofeedback, acupuncture, arthrocentesis, and medication (Medlicott and Harris 2006).

Frequently used medications include NSAIDs, muscle relaxants, and tricyclic antidepressants (Dionne 1997).

Surgical intervention includes injecting medications including steroids into the joint.

Relaxation training using electromyographic (EMG) biofeedback: The patient initially is educated about the contribution of stress and muscular hyperactivity to pain.

Occlusal splints: The use of occlusal splints is thought to alleviate or prevent degenerative forces placed on the TMJ, dentition and articular disk (Klasser and Greene 2009). Dental consultation should be obtained in order to determine the optimal, preferred occlusal device.

Friction massage: The hypothesis is that short-term ischemia and resultant hyperemia, produced by firm cutaneous pressure during massage, helps inactivate trigger points. Friction massage also may help disrupt small fibrous adhesions in the muscle formed as a result of surgery, injury, or prolonged limited motion.

Ultrasonic treatment: Ultrasonic waves may produce tissue heating at a deeper level than moist heat. The elevated local tissue temperature leads to increase in blood flow and removal of metabolic byproducts responsible for pain. It also may help decrease intra-articular inflammation. To be effective, ultrasonic treatment should be done every other day, utilizing about 1 watt/cm2 for approximately 10 minutes over the affected muscles and joints.

Transcutaneous electronic nerve stimulation: Electronic stimulation of superficial nerve fiber overrides the pain input from mastication muscles and temporomandibular joint, causing release of endogenous endorphins. In certain patients it provides longer duration of pain relief than the time during which the stimulation is actually applied.

Acupuncture: Acupuncture is used increasingly in the treatment of myogenous TMD and is a reasonable adjunctive treatment method for short-term analgesia in patients with painful TMD symptoms (Cho and Whang 2010; La Touche et al. 2010).

Chapter VII The future perspective and rationale for conducting the clinical trial

This clinical trial is intended to be conducted to assess the treatment efficacy and safety of loud electronic techno-music (LETM) against pain associated with temporomandibular disorders (TMD). Generally, relax music sounds are used in order to treat pain during the sound therapy (Baker, Tamplin, and Kennelly 2006).

According to the clinician's manual by Baker et al. (Baker, Tamplin, and Kennelly 2006) 'chill out' electronic music can be effective for pain management when the patient is in a relaxed position (may lie prone on a bed or sit up), however the loudness and the genre of the electronic music have not been mentioned and it is unclear what effect can loud electronic music sounds have in a positive or negative way on the individuals who are not obliged to lie or sit during the music therapy session.

According to the clinical trial by Alicia Howard (Howard 2015), music and rhythmic vibrations can substitute the processes related to sensation of pain in the brain and can block the neurological pathways that transmit pain sensations and thereby reduce pain. In compliance with the same clinical trial, the self-select music of the participants will be applied for managing the painful symptoms of TMD.

On the contrary to the above-mentioned clinical trial, in the present study, music preference will be limited and loud electronic music in the genre of techno will be the only type of music equally selected for every participant in the clinical trial.

According to Sprouse-Blum et al. neuropeptide called beta-endorphine (beta-EP) plays a crucial role in pain management by processing morphine like effects (Blum et al. 2010).

The study by Gerra et al. suggests that a significant increase was observed in beta-EP after listening to techno-music on the contrary to the classical music (Gerra et al. 1998).

Recommendations

The purpose of the present clinical trial is to determine the effectiveness of sound therapy with loud electronic music in the genre of techno for managing TMD related pain.

As a method of treatment, this tactic might be useful for people with pain associated with TMD.

Hypotheses

LETM has a positive effect on pain associated with TMD.

Participant Selection

Type, Source and Number of Participants

Overall thirty female participants aged eighteen to thirty-five years, suffering from pain associated with TMD will be recruited at the unit of orofacial pain and temporomandibular disorders (OFP/TMD unit).

Potential study participants will be provided with a study information sheet and asked to sign an Informed Consent Form.

Inclusion Criteria

1. Female participants
2. Aged eighteen to thirty-five years
3. Hearing able as listening to music is required as part of treatment

4. Present with clinical evidence of pain due to pain related temporomandibular disorders, according to the Diagnostic Criteria for Temporomandibular Disorders (DC-TMD, 2014) (Eric Schiffman et al. 2014):

Myalgia: local myalgia, myofascial pain or myofascial pain with referral

5. Able to give Informed Consent

6. Able to understand and comply with the requirements of the trial

Exclusion Criteria

Study participants who meet any of the following criteria will not be eligible for participation in this study:

1. Presence of pain associated with TMD that includes one or more of the following factors confirmed by the clinical assessment according to the Diagnostic Criteria for Temporomandibular Disorders (DC-TMD, 2014): arthralgia, pain in temporomandibular joint(s) and/or headache associated with temporomandibular disorders

2. Presence of the most common intra-articular temporomandibular disorders according to the Diagnostic Criteria for Temporomandibular Disorders (DC-TMD, 2014): disk displacement with and without reduction, degenerative joint disease or subluxations

3. Any significant condition that may preclude the participant from the study

4. Unable or unwilling to attend the treatment

Participant Consent

Before recruitment and enrolment into the study, each prospective participant will be given a full explanation of the nature and purposes of the study.

Criteria for Participant Withdrawal

Participants may withdraw from the study at any time, for any reason, or if necessary, the Investigator may withdraw a study participant to protect their health. The reasons for withdrawal will be fully documented in the study.

Methodology for conducting the trial

The duration of the clinical trial will be 17 days. The study will consist of 3 visits, 1 treatment session and 5 assessments.

The participants are obliged to terminate any sort of treatment they are receiving 3 days prior to every visit in order to exclude their impact on the results.

According to Cronin et al. (Cronin et al. 2016) a long-acting corticosteroid has a half-life of 36 to 72 hours. Therefore, it can be assumed that 3 day treatment free time period should be enough for pain recurrence.

On the first visit the participants will enter specially designed IPEM music studio for 30 minutes without receiving any musical therapy.

During the second visit they will enter the same studio and listen to the loud electronic techno-music for 30 minutes (Gerra et al. 1998; Baker, Tamplin, and Kennelly 2006; Howard 2016).
The upper limit of the volume level should be 85 dB (Fink 2017), considering the fact, that it should be harmless for the participants.
The third visit is a check-up visit and is considered just for an assessment.
Pre/post assessments among the visits will be utilized as a means to examine change in pain at the level of each participant.

The assessment will include clinical examination and identification of functional jaw pain level.

Clinical examination will be done according to the Diagnostic Criteria for Temporomandibular Disorders (DC-TMD, 2014). Moreover, the functional jaw pain level will be scored on the Universal Pain Assessment Tool (UPAT) after the physical examination (Ohrbach et al. 2011).

Five jaw movements will be assessed during the examination (Eric Schiffman et al. 2014): opening; maximum unassisted opening; maximum assisted opening (when moderate digital pressure is used to increase the degree of opening, if possible); left lateral excursion; right lateral excursion.

The TMJ will be palpated at 3 locations: lateral pole, posterior attachment (via the external acoustic meatus), and dorsal aspect (with 25-30 mm of jaw opening) (Ohrbach et al. 2011).
For right and left excursive movements, participants will be asked to open slightly and move their jaws as far as possible towards the right and left, even if it is painful, and move their jaw back to a comfortable position and put their posterior teeth completely together every time.

When pain is reported during any of these movements, participants will be asked to indicate the pain severity on the UPAT.
Joint noises (click, crepitus) will be detected while placing fingers over the TMJ on the right and the left side during opening and closing movements.

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Curriculum Vitae

Giorgi Dugashvili was born in Tbilisi, Georgia on July 25, 1987. In 2001 he finished the secondary school with highest distinction. In 2004 he graduated from Ivane Javakhishvili Tbilisi State University Medical College Summa Cum Laude and became Certified Dental Technician (CDT). In 2009, Giorgi Dugashvili graduated from the same University Summa Cum Laude where he was a presidential scholar and obtained the degree of Doctor of Dental Medicine (DMD). Soon afterwards, he began his residency program in Conservative Dentistry, which he completed in 2010. His PhD project started in 2011 at Ilia State University in Tbilisi, Georgia. At the time, soon after gaining some experience as a Junior doctor, he started working as a DMD at N1 Dental Clinic of Tbilisi State Medical University where he allowed students to attend clinical cases to build their skills by teaching them history taking, communication techniques, aspects of medical ethics and competence as practitioners (2011-2019). In 2012 he completed a residency program in Oral Surgery. Since 2013, Giorgi Dugashvili has been a certified clinical director and representative of "Special Olympics" (the world's largest sports organization for children and adults with intellectual disabilities and physical disabilities) in Georgia. Throughout the field, he has trained doctors, has organized and taken participation in many local and international events dedicated to the field of disabilities.

In 2014-2016, within the scope of Erasmus Mundus program, Giorgi Dugashvili was a PhD researcher at Ghent University under the supervision of Prof. Dr. Luc Marks in Belgium. In 2017, he was an assistant to the Vice-Speaker of the Parliament of Georgia in the field of international relations. In 2018 he became the holder of the national award "Doctor of the Year 2018".

Since 2018 Giorgi Dugashvili has been a lecturer at the Medical School of Georgian American University (GAU).

In 2020 Giorgi Dugashvili successfully completed a course of study in Justice offered by HarvardX, an online learning initiative of Harvard University and was awarded with a certificate of achievement.

Addendum

GEORGIAN MEDICAL NEWS
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TEMPOROMANDIBULAR JOINT DISORDER (REVIEW)

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Etiopathogenesis and clinical management of TMJD integrates a number of medical disciplines. In particular, dentistry, oral - facial surgery, neurology, rheumatology and so on. Nowadays there is no unified strategy for the management of this disease.

The temporal mandibular joint (TMJ) is the synovial joint that connects the jaw to the skull. These two joints are located just in front of each ear. Each joint is composed of the condyle of the mandible, an articulating disk, and the articular tubercle of the temporal bone. The movements allowed are side to side, up and down, as well as protrusion and retrusion. This complicated joint along with its attached muscles, allows movements needed for speaking, chewing, and making facial expressions. Temporomandibular disorder(s) (TMD), or temporomandibular joint syndrome, is the most common cause of facial pain after toothache. In the past, many physicians called this condition TMJ disease or TMJ syndrome. TMD was previously known under the eponymous title of Costen syndrome, after Dr. James Costen, who elucidated many aspects of the syndrome as it relates to dental malocclusion. Today, a much more comprehensive view of this condition exists, and the term temporomandibular disorder (TMD) is the preferred term according to the American Academy of Orofacial Pain (AAOP) and most other groups who sponsor studies into its origins and treatment. Interestingly, the National Institute of Dental and Craniofacial Research (NIDCR) puts TMJ and TMD together and refers to them as temporomandibular joint disorder (TMJD).

Uyanik et al identifies 3 distinct causes of pain at the TMJ, which collectively fall under the broader term of TMJ syndrome [1]:
- Myofascial pain dysfunction (MPD) syndrome, pain at the TMJ due to various causes of increased muscle tension and spasm. It is believed that MPD syndrome is a physical manifestation of psychological stress. No primary disorder of the joint itself is present. Pain is secondary to events such as nocturnal jaw clenching and teeth grinding. Treatment is focused on behavioral modification as opposed to joint repair.
- Internal derangement (ID), where the problem lies within the joint itself, most commonly with the position of the articulating disc [2].
- Degenerative joint disease, where arthritic changes result in degeneration of the articulating surfaces..

In a separate study, interleukin 1 receptor antagonist (IL-1ra) and soluble IL-1 receptor II (sIL-1RII) in the synovial fluid and blood plasma of patients with TMJ involvement of polyarthritis appeared to influence the TMJ inflammation [1].

Material and methods. In a recent study of young women aged 19-23 years, facial pain and jaw symptoms related to TMD were noted more frequently in Caucasians than in African Americans. Such symptoms also had an earlier onset in Caucasians. Temporomandibular disorder primarily affects women with a male-to-female ratio of 1:4. Highest incidence is among young adults, especially women aged 20-40 years.

Myogenous TMD (myofascial pain and dysfunction):
- Etiology is multifactorial and includes malocclusion. [9] jaw clenching, bruxism, personality disorders, increased pain sensitivity, and stress and anxiety; in most patients more than one factor is present.
- Significance of psychological factors has been recognized during the past few years.
- Many patients also tend to score high on obsessive-compulsive scale and have increased levels of disease conviction arthrogenous TMD
- Of the causes of arthrogenous TMD, disk displacement is the most common.
- Other diseases such as degenerative joint disease, polyarthritides such as rheumatoid arthritis, ankylosis, dislocation, infection, neoplasia, and congenital anomalies may contribute to pain [16].

A comprehensive, chronological history and physical examination of the patient, including dental history and examination, is essential to diagnose the specific

condition to decide further investigations, if any, and to provide specific treatment:
- Patients may have a history of facial trauma, poor dental care, and/or emotional stress.
- Patients with chronic eating disorders have a high prevalence of TMD.
- Many patients with TMD also have neck and/or shoulder pain.
- The practitioner should inquire about daytime or nighttime clenching. Daytime clenching has a stronger association with TMD than night time bruxism [3].
- Patients may have a history of heavy computer use as this has been found to be associated with development of TMD [11].
- About one third of patients have a history of psychiatric problems [13].
- A positive association may be observed between smoking and the occurrence of TMD in women younger than 30 years, although this association may be explainable by other factors (eg, stress levels) [15].

The patient may complain of any of the following symptoms:
- Pain: Pain is usually periauricular, associated with chewing, and may radiate to the head but is not like a headache [6]. It may be unilateral or bilateral in myofascial pain and dysfunction, and usually is unilateral in TMD of articular origin, except in rheumatoid arthritis. The pain is often described as a variable deep ache with intermittent sharp pain with jaw movement.
- Click, pop, and snap: These sounds usually are associated with pain in TMD. The click with pain in anterior disk displacement is due to sudden reduction of the posterior band to normal position. An isolated click is very common in the general population and is not a risk factor for development of TMD.

Physical
- Observation;
- Forward head posture (this has been shown to displace the condyles posteriorly);
- Jaw malocclusion, abnormal dental wear, and poor dentition;
- Visible clenching or spasm of the ipsilateral neck musculature.

Examination.
- Joint range of motion: The examiner should evaluate jaw opening and closure as well as lateral deviation bilaterally. Normal range of motion for opening is 5 cm and lateral mandibular movement is normally 1 cm. Patients with TMD usually have reduced opening (Pic. 1).

Pic. 1. Patient with reduced mouth opening

Palpation: the TMJ is best palpated laterally as a depression below the zygomatic arch and 1-2 cm anterior to the tragus. The posterior aspect of the joint is palpated through the external auditory canal (Pic. 2).

Pic. 2. Diagnosing TMJ

The joint should be palpated in both open and closed positions and also both laterally and posteriorly. While palpating, the examiner should feel for muscle spasm, muscle or joint tenderness, and joint sound. The muscles palpated as a part of complete TMJ examination are masseter, temporalis, medial pterygoid, lateral pterygoid, and sternocleidomastoid. In isolated myofascial pain and dysfunction, joint tenderness and joint click are usually absent.

Laboratory Studies:
- No laboratory studies are specifically indicated to rule in temporomandibular joint (TMJ) syndrome; however, appropriate laboratory samples may be drawn to help rule out other disorders.
- Complete blood count (CBC), if infection is suspected;

- Calcium, phosphate, or alkaline phosphatase, for possible bone disease;
- Uric acid if gout is suspected;
- Serum creatine and creatine phosphokinase, indicators of muscle disease;
- Erythrocyte sedimentation rate if temporal arteritis is suspected and rheumatoid factor if rheumatoid arthritis is suspected;

Imaging Studies [7]:
- Arthroscopy – good for internal disc derangement visualization [14].
- Dynamic high-resolution ultrasonography allows for visualization of the morphological elements and the functions of the TMJ, articular disk, mandibular condyle, and lateral pterygoid muscle [5].
- CT scans can explore both bony structures and muscular soft tissues [18].
- MRI should be used as the study of choice if an articular or meniscal pathology is suspected and an endoscopic or surgical procedure is contemplated, or in the case of traumatic TMD [17].

Differential Diagnoses:
- Chronic Paroxysmal Hemicrania
- Cluster Headache
- Migraine Headache
- Migraine Headache: Neuro-Opthalmic Perspective
- Trigeminal Neuralgia

Medical Care [8]. Most temporomandibular disorders (TMDs) are self-limiting and do not get worse. Simple treatment, involving self-care practices, rehabilitation aimed at eliminating muscle spasms, and restoring correct coordination, is all that is required. Nonsteroidal anti-inflammatory analgesics (NSAIDs) should be used on a short-term, regular basis and not on an as needed basis.

On the other hand, treatment of chronic TMD can be difficult and the condition is best managed by a team approach; the team consists of a primary care physician, a dentist, a physiotherapist, a psychologist, a pharmacologist, and in small number of cases, a surgeon. The different modalities include patient education and self-care practices, medication, physical therapy, splints, psychological counseling, relaxation techniques, biofeedback, hypnotherapy, acupuncture, and arthrocentesis [10].

Commonly used medications include NSAIDs, muscle relaxants, and tricyclic antidepressants [4].

Surgical intervention includes injecting medications including steroids into the joint.

Relaxation training using electromyographic (EMG) biofeedback: The patient first is educated about the contribution of stress and muscular hyperactivity to pain.

Friction massage: The hypothesis is that temporary ischemia and resultant hyperemia, produced by firm cutaneous pressure during massage, helps inactivate trigger points. Friction massage also may help disrupt small fibrous adhesions in the muscle formed as a result of surgery, injury, or prolonged restricted motion.

Ultrasonic treatment: ultrasonic waves produce tissue heating at a deeper level than moist heat; this increase in local tissue temperature leads to increase in blood flow and removal of metabolic byproducts responsible for pain and may help decrease adhesions by disrupting collagen cross-linkage. It also may help decrease intra-articular inflammation. To be effective, ultrasonic treatment should be done every other day, using about 1 watt/cm^2 for approximately 10 minutes over the affected muscles and joints.

Transcutaneous electronic nerve stimulation: Electronic stimulation of superficial nerve fiber overrides the pain input from mastication muscles and TMJ, causing release of endogenous endorphins. In some patients it provides longer duration of pain relief than the time during which the stimulation is actually applied.

Conclusion.
Most cases of temporomandibular disorder (TMD) respond to simple treatment and the prognosis is good. Symptoms usually remit with simple care. In cases of secondary involvement of temporomandibular joint (TMJ), the prognosis depends on the primary disease. A second opinion should be obtained in cases in which irreversible treatment is being considered.

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SUMMARY

TEMPOROMANDIBULAR JOINT DISORDER (REVIEW)

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Etiopathogenesis and clinical management of TMJD integrates a number of medical disciplines. In particular, dentistry, oral - facial surgery, neurology, rheumatology and so on. Nowadays there is no unified strategy for the management of this disease. Most cases of temporomandibular disorder (TMD) respond to simple treatment and the prognosis is good. Symptoms usually remit with simple care. In cases of secondary involvement of temporomandibular joint (TMJ), the prognosis depends on the primary disease. A comprehensive, chronological history and physical examination of the patient, including dental history and examination, is essential to diagnose the specific condition to decide further investigations, if any, and to provide specific treatment. In severe cases, a joint consultation of a dentist, neurologist and rheumatologist is needed.

Keywords: temporomandibular dysfunction, myofascial pain, Costen's syndrome, TMJD.

РЕЗЮМЕ

ЗАБОЛЕВАНИЯ ВИСОЧНО-НИЖНЕЧЕЛЮСТНОГО СУСТАВА (ОБЗОР)

Дугашвили Г.И., Менабде Г.Т., Джанелидзе М.Т., Чичуа З.Дж., Амиранашвили И.Дж.

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Этиопатогенез расстройств височно-нижнечелюстного сустава (ВНЧС) и их клиническое управление объединяет ряд медицинских дисциплин, в частности, стоматологию, челюстно-лицевую хирургию, неврологию, ревматологию. В настоящее время не существует единой стратегии управления этой болезнью. В большинстве случаев расстройства ВНЧС подлежат простому лечению и соответственно прогноз положительный. Необходимо информирование пациентов и разбор с ними болей и нарушений функций, вызванных патологией. В сложных случаях необходима совместная консультация стоматолога, невролога и ревматолога. Детальный хронологический опрос пациента, включая стоматологический анамнез и обследование, имеют важное значение для диагностики.

რეზიუმე

საფეთქელ-ქვედა ყბის სახსრის პათოლოგიები (მიმოხილვა)

გ. დულაშვილი, გ. მენაბდე, მ ჯანელიძე, ზ. ჩიჩუა, ი. ამირანაშვილი

ილიას სახელმწიფო უნივერსიტეტი, მედიცინის სამეცნიერო-კვლევითი ინსტიტუტი, თბილისი; ს. ხეჩინაშვილის სახ. საუნივერსიტეტო კლინიკა, თბილისი, საქართველო

საფეთქელ-ქვედა ყბის სახსრის დაავადებათა ეტიოპათოგენეზი და კლინიკური მართვა აერთიანებს რამდენიმე სამედიცინო დისციპლინას: სტომატოლოგიას, ყბა-სახის ქირურგიას, ნევროლოგიას, რევმატოლოგიას და ა.შ. დღესდღეობით არ არსებობს ერთიანი სტრატეგია ამ დაავადებათა მენეჯმენტის საკითხებში. ხშირ შემთხვევაში საფეთქელ-ქვედა ყბის სახსრის პათოლოგიები ადვილად ექვემდებარება მარტივ მკურნალობას და პროგნოზი, შესაბამისად, დადებითია. აუცილებელია პაციენტის განათლება და მასთან პათოლოგიით გამოწვეული ტკივილისა და ფუნქციის მოშლის განხილვა. რთულ შემთხვევებში აუცილებელია სტომატოლოგის, ნევროლოგის და რევმატოლოგის ერთობლივი კონსულტაცია.

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Use of the universal pain assessment tool for evaluating pain associated with TMD in youngsters with an intellectual disability

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Abstract

Background: The Universal Pain Assessment Tool (UPAT) was used to assess the level of pain in people with limited communication skills. The UPAT enables clinicians to consult a specialized pain management team more often and lead to earlier interventions. The purpose of this study was to determine, whether the UPAT could be used as an extra tool to collect data on functional TMJ pain and to assess orofacial pain levels related to temporomandibular disorder(s) (TMD) in people with intellectual disabilities (ID).

Material and Methods: Non-down syndrome ID Athletes were screened during the Special Olympics European games in 2014. The clinical scores of possible functional jaw pain were collected using the UPAT, to indicate pain severity on a visual scale during different jaw movements (opening, closing and lateral).

Results: Two hundred and four youngsters were screened by calibrated dentists. The majority (65%) of participants were male (133 male and 71 female athletes); age distribution ranged from 15 to 23 years (mean 19.25 ± 2.53). The results of the UPAT have shown the existence of functional TMJ pain in 32% (n=65) of the athletes without significant prevalence ($P > 0.05$) in this survey group.

Conclusions: According to the results of the present study, the UPAT demonstrated that it could be a useful tool to detect the existence of functional jaw pain possibly associated with TMD and also a valid instrument to score pain intensity associated with TMD in people with ID.

Key words: *Universal pain assessment tool - TMD in ID - TMD in youngsters.*

Introduction

Temporomandibular disorder(s) (TMD) is a general term that includes a group of clinical entities that affect the Temporomandibular Joint, the Masticatory Musculature and the Associated Structures. There are many different pathologies, both articular and muscular that can be included in this group. TMD are one of the most common causes of orofacial pain after dental pain (1). It is considered to be one of the 4 major symptom complexes in chronic orofacial pain, along with burning mouth syndrome, atypical facial pain and atypical odontalgia (2).

Intelectual disability (ID) is defined as an impairment in the areas of development or cognitive activities. It is characterized by significant limitations both in intellectual functioning and in adaptive behaviour, which covers many everyday social and practical skills. This disability originates before the age of 18 (3). In people with ID, typical indicators, such as crying, grimacing, elevated blood pressure, or tachycardia, may be absent due to central nervous system (CNS) damage accompanying the ID. As a result, it is difficult to ascertain, if the person is in pain. In addition, some people with IDs exhibit self-injurious behaviours (4), which some professionals may mistakenly interpret as insensitivity to pain. In fact, these inappropriate behaviours may be a response to pain. Early assessment and appropriate intervention for pain enhances quality of life. Unfortunately, people with ID are less likely to see healthcare practitioners regularly or have their pain recognized and treated promptly (5).

Universal pain screening with a 0-10 pain intensity numeric rating scale (NRS) has been widely implemented in primary care medicine. Various pain assessment tools, such as Wong-Baker Faces Pain Rating Scale (6) the Poker Chip Tool (7), the Eland Colour Scale (8) and FLACC scale (9) have been used or adapted by clinicians.

As pain is a highly subjective and individualized, self-report is frequently cited as the gold standard of pain assessment and it should always be initially attempted, as it is the most reliable report of pain (10).

For clinicians, the challenge has been in how to obtain a valid and reliable assessment of pain from persons who are unable to provide a self-report. Given the fact, that non-communicating ID people are not usually able to use any self-rating scales, FLACC scales are used by nurses and physicians.

In the present study the Universal Pain Assessment Tool (UPAT) (11) was used among Special Olympics Athletes. As the Tool is an adapted version of the Wong-Baker Faces Pain Rating Scale, it would help assess pain according to their individual needs. The UPAT was believed to provide the opportunity to assess pain levels using faces or behavioural observations to interpret pain, when athletes are unable to communicate the intensity of their pain.

The positive feedback of this tool could enable clinicians in the early recognition of pain-related behaviour to avoid undertreatment in people with intellectual disabilities (12). Moreover, it would give the opportunity for earlier consultation of a special care management team in case of suspected pain (13).

The purpose of this study was to determine, whether the UPAT could be used as a valid instrument to assess orofacial pain levels related to TMD in people with ID.

Material and Methods

Non-down syndrome athletes were screened during the Special Olympics 2014 European games. The athletes were invited to the "Special Olympics Special Smiles" site on a voluntary basis. Written consent was obtained from the athlete and a parent or guardian. In full accordance of the World Medical Association Declaration of Helsinki, the Joint Ethical Committee of the Ghent University Hospital approved the study as 2013/816.

Identification of functional jaw pain was measured using the UPAT (14) (Fig. 1). Five jaw movements were assessed (15): opening, maximum unassisted opening, maximum assisted opening (when moderate digital pressure was used to increase the degree of opening, if possible), left lateral excursion and right lateral excursion. The TMJ was palpated at 3 locations: lateral pole, posterior attachment (via the external acoustic meatus), and dorsal aspect (with 25-30 mm of jaw opening) (14). For right and left excursive movements, athletes were directed to open slightly and move their jaws as far as possible towards the right and left, even if it was painful, and then move their jaw back to a comfortable position and position their posterior teeth completely together each time. If the subject was confused about which direction they should move their jaw, they would be told to move their jaw towards the hand touched on the side of the desired movement. For all excursive movements, the subject was asked to repeat the movement three times.

If pain was reported during any of those movements, athletes were asked to indicate the severity of their pain on the UPAT. At no time during the screening, was a suggestion made nor was the subject led to respond about the presence of pain.

Joint noises (click, crepitus) were detected while placing fingers over the TMJ on either the right or the left side during opening and closing movements.

- Statistical analysis

All of the data were recorded using the UPAT and processed by SPSS software (IBM® SPSS® Statistics 22 Version 22.0.0.1). The level of significance was set at 0.05.

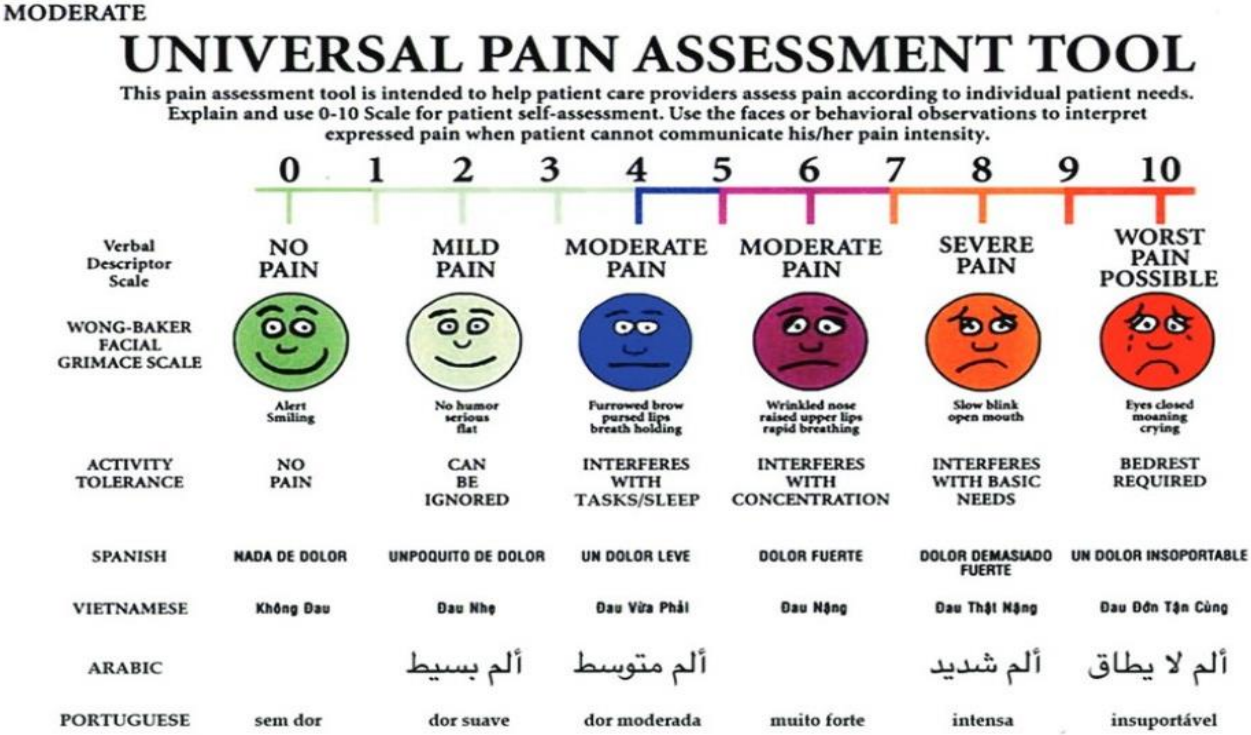


Fig. 1. The Universal Pain Assessment Tool (UPAT), that has been used to identify functional TMJ pain.

Results

Two hundred and four ID athletes were evaluated. The majority (65%) of participants were male (133 male and 71 female patients); age distribution ranged from 15 to 23 years (mean 19.25 ± 2.53) (Fig. 2). The results of the UPAT demonstrated the existence of functional TMJ pain in 32% (n=65) of the athletes without significant prevalence ($P > 0.05$) in the survey group.

Seventy four percent of pain associated with TMD, was reported as mild. As the severity of pain level increased, the distribution of pain decreased, this can be markedly seen on figure 3.

Considering different jaw movements, the subjects reported far more pain on maximum opening without significant difference between assisted or unassisted opening ($P > 0.05$) (Fig. 4).

Joint sounds were found in 38% of subjects, 65% of these athletes also reported functional pain (Fig. 5).

Discussion

There have been very limited studies and little information reported regarding TMD in people with ID (16). The selection of the study sample was defective as it included all "non-Down Syndrome ID athletes". There are a great variety of IDs with many different clinical presentations that may cause a distortion in the validity of the results.

The present study has been conducted, in order to collect data on functional TMJ pain and to assess pain levels in people with ID, using the UPAT. Moreover, the present method for evaluating pain, would give opportunities to an earlier intervention in case of suspected pain.

Certain aspects can be considered to be the limitations of the present study. There is an unequal female/male ratio. This ratio is considered to be an important factor, because studies have demonstrated, that starting from late adolescence, prevalence of temporomandibular symptoms is higher in females than in males (17,18). Secondly, as far as only a particular group of people with ID has been studied, the results of the present research cannot be generalized. The outcomes have shown, that the issue is problematic and needs further study.

According to Kim *et al.* (19), TMD can occur at any age. They investigated various age groups and demonstrated that patients younger than 40 years of age have shown high proposition (74%), of which 38% is the youngest group (under 25 years). The study also suggested the tendency in younger patients needs to be continuously investigated.

On the contrary to the above-mentioned study, present research has shown a non-significant prevalence ($P > 0.05$) of pain associated with TMD in people with ID, within the ages of 15 to 23 years.

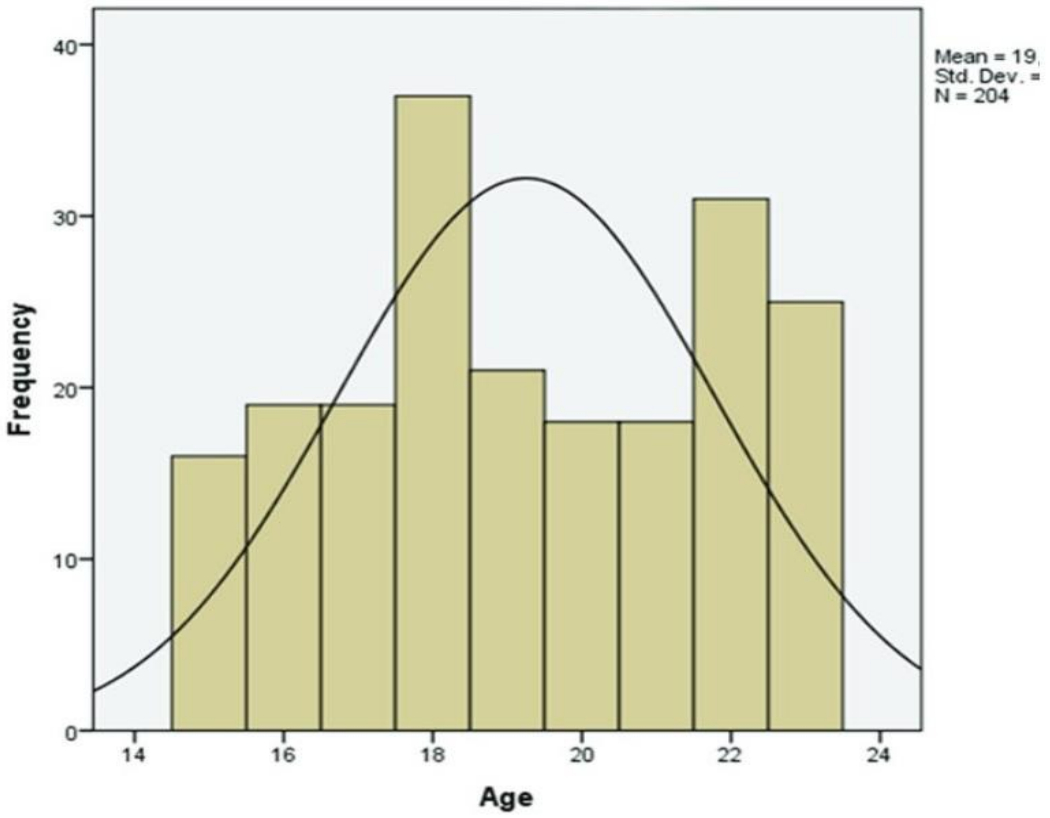
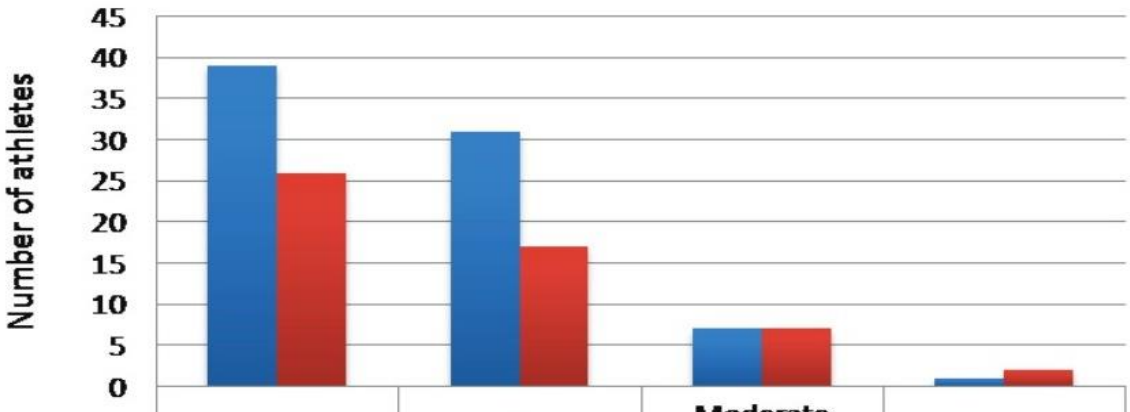
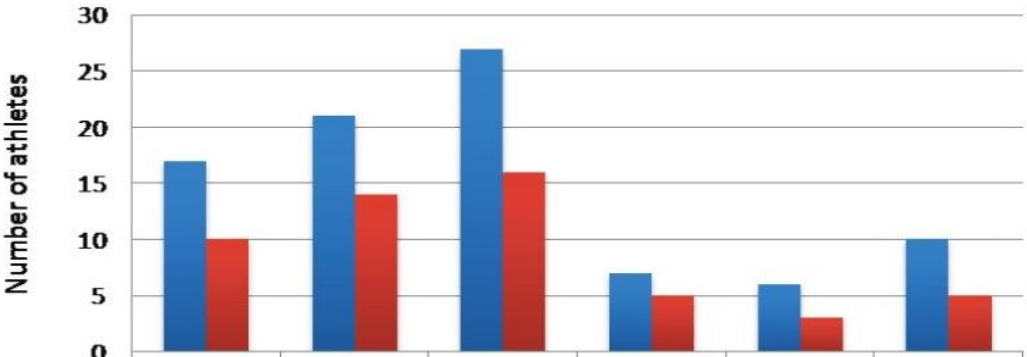


Fig. 2. Age distribution of screened athletes.



	Total n=	Mild Pain n=	Moderate Pain n=	Severe Pain n=
Male	39	31	7	1
Female	26	17	7	2

Fig. 3. Distribution of pain levels among male and female athletes.



	Opening n=	Maximum Unassisted Opening n=	Maximum Assisted Opening n=	Left Lateral Excursion n=	Right Lateral Excursion n=	Both Sides n=
Male	17	21	27	7	6	10
Female	10	14	16	5	3	5

Fig. 4. Distribution of functional jaw pain according to the different jaw movements.

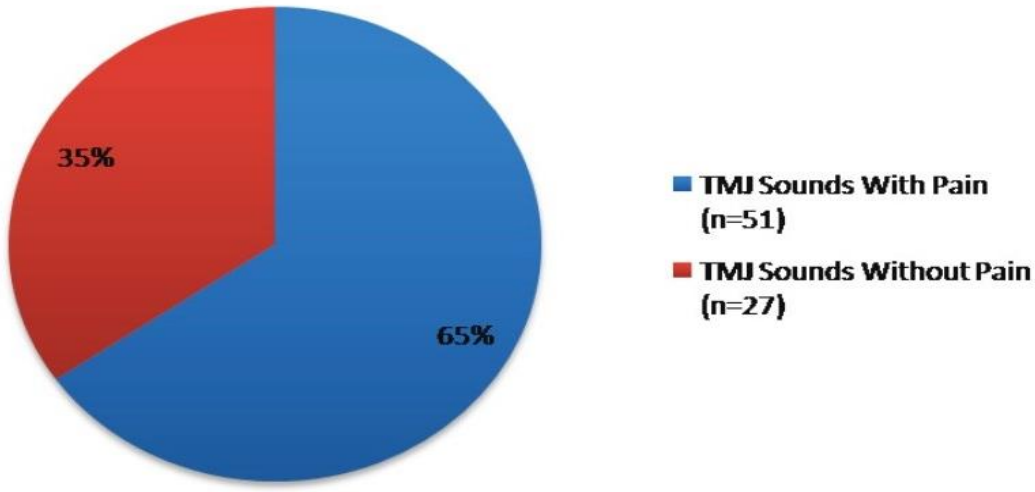


Fig. 5. Distribution of TMJ sounds with and without functional pain report.

According to the same study (19), there is a tendency of female patients to be predisposed to TMD more than male patients. A possible explanation of this has been associated with thefemale sex hormone estrogen (20). In animal models estrogen has been shown to modulate inflammation in the TMJ (21,22). Moreover, Flake *et al.* (22) suggest, that testosterone and estrogen have opposing actions on TMJ. This could also account for the higher prevalence and severity of pain associated with TMD in females by suggesting that testosterone may mitigate, while estrogen exacerbates TMJ damage, particularly in the presence of overt inflammation.

The purpose of the present study was not to consider gender differences in pain prevalence, but a tendency towards absence of this differentiation could be observed. A possible explanation for this is the fact, that a population was screened rather than a patient group.

Authors in the present study palpated only the TMJ but not the superficial masticatory muscles (Masseter & Temporalis), which are the main source of extra-oral

pain. Besides, palpation was done without any objective measurement of the force applied. Another limitation of the current study is that it analyzed TMJ signs and not real articular or muscular disorders according to the diagnostic criteria of the AAOP (15). A single sign from the masticatory system is not sinonymous with a TMD, nor does it automatically lead to the diagnosis of a TMD. Pain on palpation, joint noises and others are clinical signs that are frequently found in the examination of normal population without leading to a diagnosis of TMD. Consistent implementation of the DC/TMD in future studies will enable a more reliable definition of TMD cases for comparison of their findings. A questionnaire, in which the subjects are asked about pain during mastication would give additional benefits although the outcome could be questioned in this ID group.

The present study has outlined, that when pain associated with TMJ noises is present, TMD can be present. Similar findings can be found in the study of Ohrbach *et al.* (14). However, noises alone are no longer considered to be diagnostic for TMD, since they can be detected in a high proportion in general populations (23).

According to Glaros *et al.* (24) the existence of stress and emotional distress, together with oral parafunctional behaviours can be predictive for TMD. They suggest that treatment focussing on coping with psycho-emotional problems could be effective by diminishing excessive masticatory muscle tension. Myogenous TMD is frequently considered to be the most common type of TMD and is generally caused by increased muscle activity triggered by emotional stress (25). As far as the TMJ screening was performed during the Special Olympics event, when the athletes were taking part in the sports competition, the stress factor should be taken into consideration while interpreting the results.

According to Chisnoiu *et al.* (26), stress and anxiety issues can influence on the person's psyche and may lead to pain, due to spasms of the internal, external pterygoid and masseter muscles caused by bruxism (grinding, clenching, bracing). In conformity with the abovementioned, TMD in ID athletes could be considered as stress related. However, the issue needs to be further researched and cannot be generalized in people with ID.

Conclusions

Although TMD is not considered to be life-threatening, it can be deleterious to the quality of life (27) for people with ID, as their symptoms could become chronic and difficult to manage if they are not detected and eliminated at an early stage.

According to the results found in this study, the UPAT demonstrated to be a an additional tool to detect the existence of functional jaw pain possibly associated with TMD.

If UPAT could be implemented in general practice of dentistry for evaluating pain associated with TMD in people with special needs, further research will be needed to determine whether screening for pain will improve patient outcomes.

As far as there are very limited studies reported in the literature regarding TMD in people with ID, the present study could be the initiative for future research in this field.

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Conflict of Interest
The authors have declared that no conflict of interest exist.

Use of the universal pain assessment tool for evaluating pain associated with temporomandibular disorders in youngsters

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Abstract

Aim Determine, whether the UPAT could be used as an extra tool to collect data on functional TMJ pain and to assess orofacial pain levels related to temporomandibular disorder(s) (TMD) in youngsters.

Methods Patients were screened at the N1 Dental Clinic of Tbilisi State Medical University. The clinical scores of possible functional jaw pain were collected using the UPAT, to indicate pain severity on a visual scale during different jaw movements (opening, closing and lateral). Statistics: Comparisons of categorised data have been performed by chi-square test and Fisher's Exact test (where expected values were less than 5). The P value less than 0.05 was considered as statistically significant.

Results Two hundred and ninety-one youngsters were screened by calibrated dentists. The majority (59%) of participants were male; age distribution ranged from 8 to 15 years (mean 11.46 ± 2.11). The results of the UPAT demonstrated the existence of functional TMJ pain in 15.46% (n=45) of the patients without significant prevalence (P > 0.05) in this survey group.

Conclusion According to the results of the present study, the UPAT demonstrated that it could be an additional tool to detect the existence of functional jaw pain possibly associated with TMD and also a valid instrument to score pain intensity associated with TMD in youngster patients.

KEYWORDS Universal pain assessment tool, TMD in youngsters, Georgia.

Introduction

The metric termed, "Years lived with disability" (YLDs), which measures a disease's morbidity is how the World Health Organization (WHO) quantifies the effect of personal and socioeconomic impact experienced in terms of associated persistent pain and disability [Basi et al., 2012].

In 2002, the most recent year for which data are globally available, more YLDs were lost to musculoskeletal diseases than to cardiovascular diseases, respiratory diseases or malignant neoplasms [Manfredini et al., 2012]. Temporomandibular disorders (TMD) are the second most common occurring musculoskeletal conditions resulting in pain and disability, subsequent to chronic low back pain. TMD affects 5 to 12% of the population, with an annual cost estimated at 4 billion $. One half to two-thirds of people with TMD disorders will seek treatment. Among this group, approximately 15% will develop chronic TMD [Basi et al., 2012].

According to the results of the study by Dugashvili et al. [2017] the Universal Pain Assessment Tool (UPAT) [Dugashvili et al., 2017; Gupta et al., 2012] demonstrated that it might be an additional tool to detect the existence of functional jaw pain possibly associated with TMD and also an additional instrument to score pain intensity associated with TMD in people with internal derangement (ID). In the present study, the above-mentioned tool was used in order to identify if TMD can originate in ASA 1 youngsters.

The feedback could enable clinicians in the early recognition of pain-related behaviour to avoid undertreatment of TMD related problems in youngster patients.

The purpose of this study was to: 1) determine, whether the UPAT could be used as an additional tool to collect data on functional TMJ pain and to assess orofacial pain levels related to TMD in youngsters, and 2) identify if the TMD issue can originate from an early age.

Materials and methods

Youngster patients were screened at the N1 Dental Clinic of Tbilisi State Medical University in Tbilisi, Georgia.The

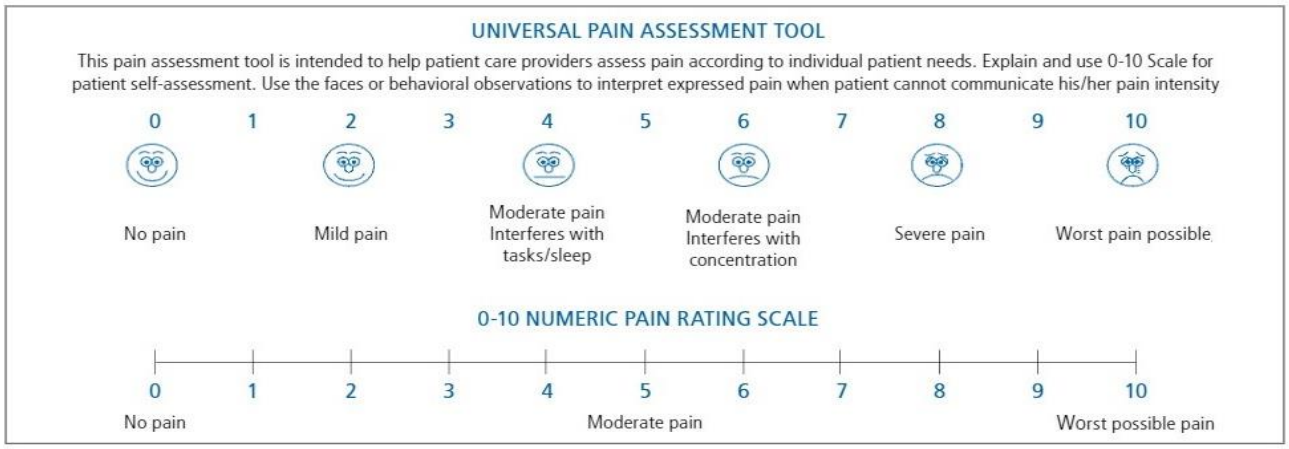

FIG. 1 The Universal Pain Assessment Tool (UPAT), that has been used to identify functional TMJ pain.

youngsters, who addressed the dental clinic because of dental issues, were undergoing different dental treatments.

Prior to the treatment, patients were invited for the screening of TMD on a voluntary basis. Written consent was obtained from the patient and a parent or guardian. In full accordance of the World Medical Association Declaration of Helsinki, the Joint Ethical Committee of Khechinashvili University Hospital approved the study as 2016/13.

Identification of functional jaw pain was measured using the UPAT [Ohrbach et al., 2011] (Fig. 1). Five jaw movements were assessed [Schiffman et al., 2014]: opening, maximum unassisted opening, maximum assisted opening (when moderate digital pressure was used to increase the degree of opening, if possible), left lateral excursion and right lateral excursion. The TMJ was palpated at 3 locations: lateral pole, posterior attachment (via the external acoustic meatus), and dorsal aspect (with 25-30 mm of jaw opening) [Ohrbach et al., 2011].

Additionally, the superficial masticatory muscles (masseter and temporalis) were palpated. By means of mechanical stimuli caused by digital pressure, nociceptive neurons located in the muscular and myofascial structures were stimulated to detect and transmit pain messages to the central nerve system [Conti et al., 2007].

The palpation was done as follows: the masseter at its attachments to the zygomatic arch and angle of the mandible, the temporalis both in the temporal fossa and intraorally along the ascending ramus of the mandible, and the medial pterygoid bimanually, placing one finger externally at the medial aspect of the angle of the mandible and the other finger orally in the lingual vestibule in the retromolar region [Meyer, 1990].

For right and left excursive movements, patients were directed to open slightly and move their jaws as far as possible towards the right and left, even if it was painful, and then move their jaw back to a comfortable position and position their posterior teeth completely together each time. If the subject was confused about which direction they should move their jaw, they would be told to move their jaw towards the hand touched on the side of the desired movement. For all excursive movements, the subject was asked to repeat the movement three times. If pain was reported during any of those movements, patients were asked to indicate the severity of their pain on the UPAT. At no time during the screening, was a suggestion made nor was the subject led to respond about the presence of pain.

Joint noises (click, crepitus) were detected during the screening while placing fingers over the TMJ on either the right or the left side during opening and closing movements. Both trained examiners were calibrated for the UPAT exams included in the tests. Inter-and intra-examiner scores were higher than 80%.

Data analysis

All of the data were recorded using the UPAT and processed by SPSS software (IBM® SPSS® Statistics 22 Version 22.0.0.1). The level of significance was set at 0.05. Comparisons of categorised data have been performed by chi-square test and Fisher's Exact test (where expected values were less than 5). A P value less than 0.05 was considered as statistically significant.

Results

Two hundred and ninety-one patients were evaluated. The majority (59%) of participants were male (172 male and 119 female patients); age distribution ranged from 8 to 15 years (mean 11.46±2.11) (Fig. 2). The results of the UPAT demonstrated the existence of functional TMJ pain in 15.46% (n=45) of the youngster patients without significant prevalence ($P > 0.05$) in the survey group.

Seventy eight percent of pain associated with TMD was reported as mild. As the severity of pain level increased, the distribution of pain decreased, this can be markedly seen on figure 3. Considering different jaw movements, the subjects reported far more pain on maximum opening without significant difference between assisted or unassisted opening ($P > 0.05$) (Fig. 4). Joint sounds were found in 25.43% of subjects, 49% of these subjects also reported functional pain (Fig. 5). The radiographic images of the eight ear old patient with explicit joint sounds can be seen on figure 6.

Discussion and conclusion

There are several studies in the literature regarding TMD in

youngsters reporting that the TMD issue can originate from an early age with similar signs and symptoms to those seen in adults [Casanova-Rosado et al., 2006; Gazitetal., 1984; Grosfeld and Czarnecka, 1977; Magnusson et al., 1985]. Early assessment and appropriate intervention for pain associated with TMD seems important in order to eliminate the problem at an early stage, as later the symptoms can become chronic and more difficult to manage. Additionally studies by Minghelli et al. and Al-Khotani et al. revealed a significant association between TMD and the levels of emotional stress. [Al-Khotani et al., 2016; Minghelli et al., 2014].

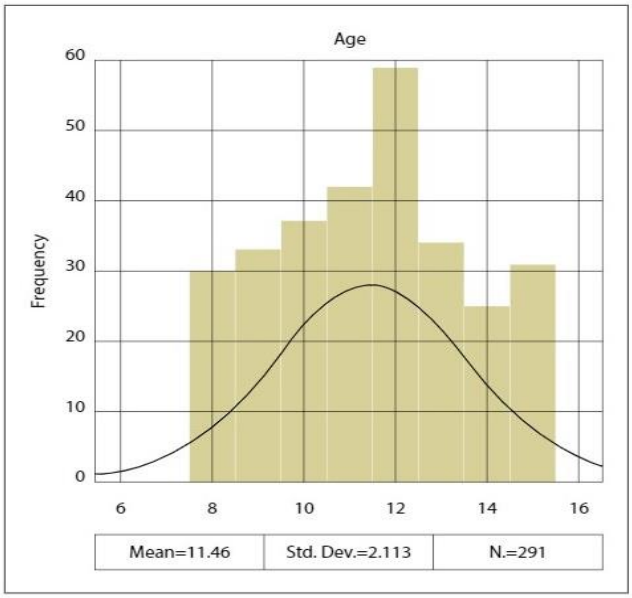

FIG. 2 Age distribution of screened patients.

The present study has been conducted, in order to collect data on functional TMJ pain and to assess pain levels in youngster patients, using the UPAT. Moreover, the present method for evaluating pain, would give an extra opportunity to an earlier intervention in case of suspected pain.

Certain aspects can be considered to be the limitations of the present study. There is an unequal female/male ratio. This ratio is considered to be an important factor, because studies have demonstrated, that starting from adolescence, prevalence of temporomandibular symptoms is higher in females than in males [Barbosa et al., 2008; Bonjardim et al., 2005]. Secondly, as far as only a particular group of patients has been studied, the result sof the present research cannot be generalised. The outcomes have shown that the issue is problematic and needs further study.

According to Kim et al. [2012], TMD can occur at any age. They investigated various age groups and demonstrated that patients younger than 40 years of age have shown high incidence (74%), of which 38% is the youngest group (under

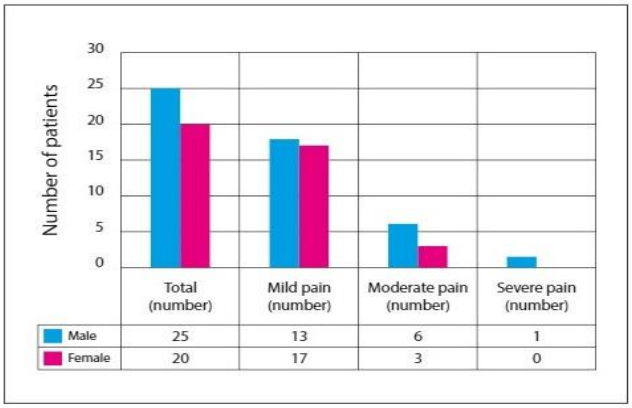

FIG. 3 Distribution of pain levels among male and female patients.

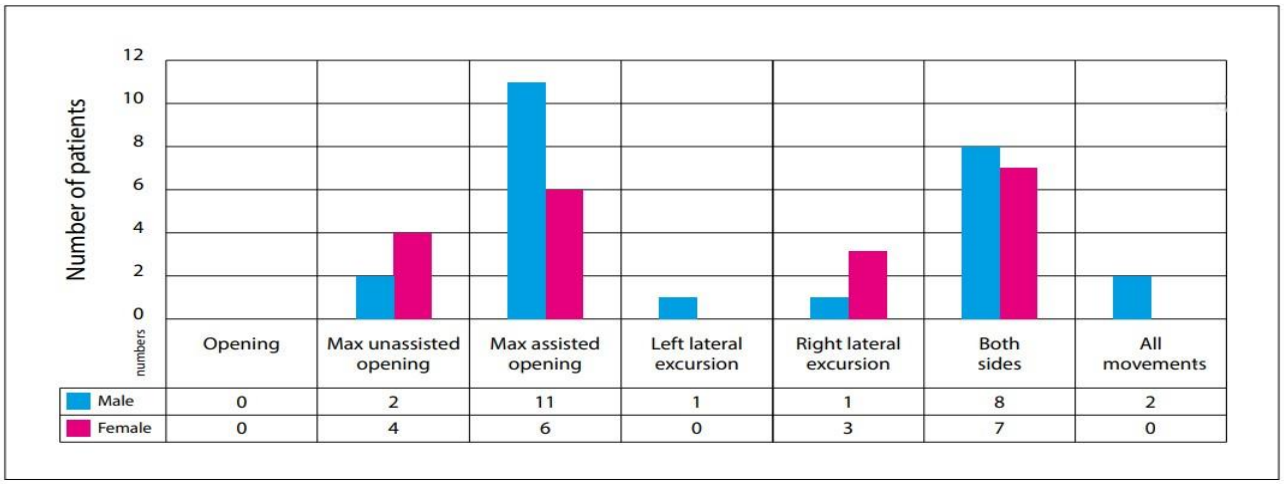

FIG. 4. Distribution of functional jaw pain according to the different jaw movements.

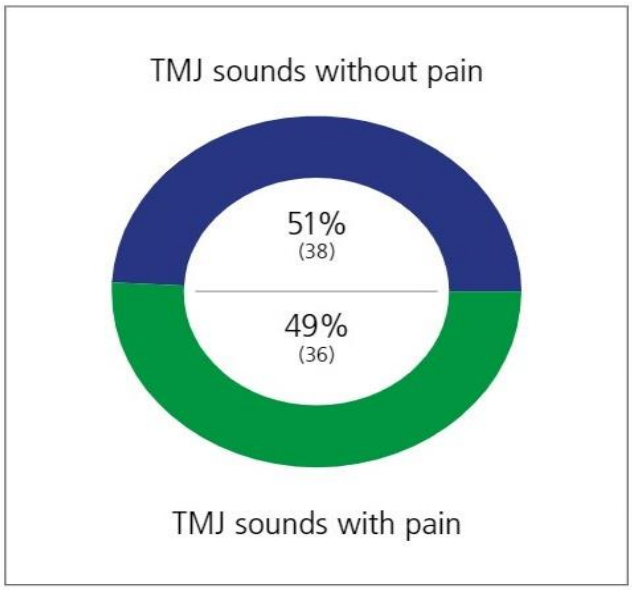

FIG. 5. Distribution of TMJ sounds with and without functional pain report.

25 years). The study also suggested the tendency in younger patients needs to be continuously screened.

Unlike the above-mentioned study, the present research has shown a non-significant prevalence ($P > 0.05$) of pain associated with TMD in youngsters, within the ages of 8 to 15 years.

According to the same study [Kim et al., 2012], there is a tendency of female patients to be predisposed to TMD more than male patients. A possible explanation of this has been associated with the female sex hormone estrogen [Cairns,

FIG. 6A

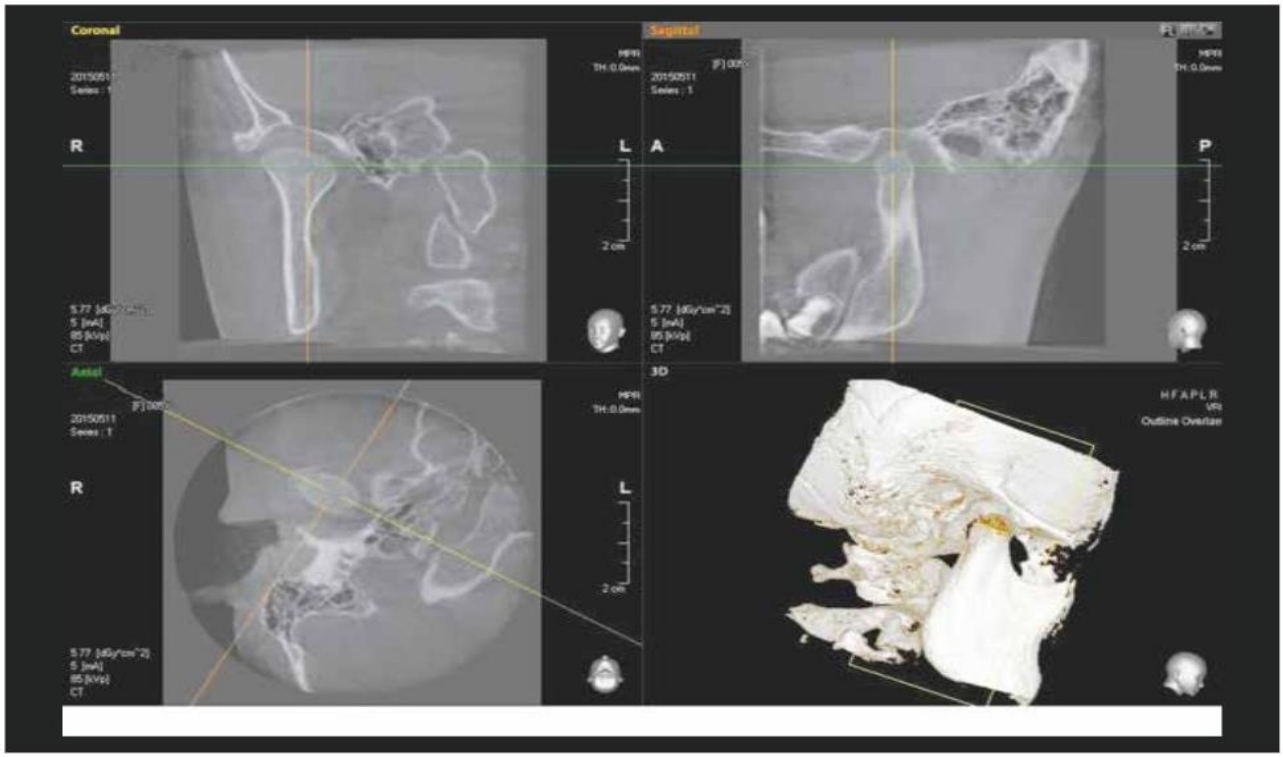

FIG. 6B

FIG. 6. The radiographic images of the eight year old patient with explicit joint sounds.

2010]. In animal models estrogen has been shown to modulate inflammation in the TMJ [Guan et al., 2005; Flake et al., 2006]. Moreover, Flake et al. [2006] suggest that testosterone and estrogen have opposing actions on TMJ. This could also account for the higher prevalence and severity of pain associated with TMD in females by suggesting that testosterone may mitigate, while estrogen exacerbates TMJ damage, particularly in the presence of overt inflammation. As the subjects in this group were youngsters the impact of the hormones is unclear.

Another limitation of the current study is that the palpation was done with limited objective measurement of the force applied. Calibration of the practitioners with an adequate inter- and intra-examiner score tried to standardise these screenings.

Signs such as pain on palpation, joint noises are clinical signs that are frequently found in the examination of normal population without leading to a diagnosis of TMD. Consistent implementation of the DC/TMD in future studies will enable a more reliable definition of TMD cases for comparison of their findings.

The present study has outlined, that when pain associated with TMJ noises is present, TMD can be present. Similar findings can be found in the study of Ohrbach et al. [2011]. However, noises alone are no longer considered to be diagnostic for TMD, since they can be detected in a high proportion in general populations [Wright and North, 2009].

According to Glaros et al. [2005], the existence of stress and emotional distress, together with oral parafunctional behaviours can be predictive for TMD. They suggest that treatment focusing on coping with psycho-emotional problems could be effective by diminishing excessive masticatory muscle tension. Myogenous TMD is frequently considered to be the most common type of TMD and is generally caused by increased muscle activity triggered by emotional stress [Lauriti et al., 2013]. As far as the TMJ screening was performed at the dental clinic, before the patients would undergo different dental treatments, the stress factor should be taken into consideration while interpreting the results. According to Chisnoiu et al. [2015], stress and anxiety issues can influence on the person's psyche and may lead to pain, due to spasms of the internal, external pterygoid and masseter muscles caused by bruxism (grinding, clenching, bracing).

In conformity with the above-mentioned, TMD in dental patients could be considered as stress related. However, the issue needs to be further researched and cannot be generalised.

Although TMD is not considered to be life-threatening, it can be deleterious to the quality of life [Shietal., 2003], as symptoms could become chronic and difficult to manage if they are not detected and eliminated at an early stage.

According to the results found in this study, the UPAT demonstrated to be an additional and useful tool to detect the existence of functional jaw pain possibly associated with TMD in youngsters and it could be suggested to be included in the standard 6 months dental check-up.

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