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Research

Evaluation of the Patient with Temporomandibular Dysfunction: What are the Steps to Arrive at a Correct Diagnosis?

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Abstract

Temporomandibular disorders are heterogeneous group of disorders involving the temporomandibular joint, masticatory muscles and associated structures. With a multifactorial origin, usually the patient with mandibular temporomandibular disorder reports multiple complaints, associated or not to comorbidities and non-repairing sleep. Anamnesis directed to the correct diagnosis is fundamental for the elaboration of a successful therapy. The diagnostic process should be able to categorize the pain as well as identify the involved tissues in addition to pointing out the specific source of pain within that tissue system. The steps to arrive at a correct diagnosis should cover: anamnesis, clinical evaluation for temporomandibular joint, the clinical examination through inspection of the cranial nerves, intra-oral evaluation and musculoskeletal examination, imaging tests, anesthetic block diagnosis, laboratory tests and evaluation of sleep pattern. This process begins in the clinical history, presence or not of associated comorbidities, sleep pattern and other factors that may somehow contribute to the patient's clinic. This information supports the correct diagnosis and is essential for adequate and successful therapy.

Introduction

The temporomandibular joint (TMJ) is a synovial type joint composed from the head of the mandible and the temporal bone covered by fibrocartilage. Among them, an oval and dense fibrocartilaginous articular disc divides the joint into upper and lower part. This disc has as main objective to prevent functional overload, a condition that can lead to temporomandibular dysfunction (TMD) [1].

The origin of TMD is multifactorial, and may be traumatic, psychosocial (anxiety and depression), systemic diseases, altered intra-articular pressure and genetic factors. Typical clinical signs of TMD are idiopathic and episodic orofacial musculoskeletal pain and/or TMJ sounds (click, crackling), as well as limited movement of the mandible. The cracks in the TMJ are a clinical sign of joint disc displacement, and although it is very frequent, it does not necessarily relates with pain, discomfort, or limitation of movement. TMD is a prevalent pathology that affects mainly women and can significantly limit the quality of life of their patients. Success in the treatment depends on an accurate diagnosis, which can often be difficult and challenging for even the most experienced professional. Patients often present multiple complaints, as well as reports of confusing signs and symptoms, which can result in a variety of diagnostic possibilities [1,2].

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The detailed and directed clinical examination, through which the information collected enables the formation of data that will be analyzed by the professional, identifying and classifying any abnormality responsible for the signs and symptoms of the patient, are fundamental for the correct diagnosis [3]. The diagnosis process should establish the category of pain (Somatic, Neuropathic or Psychogenic), determine the tissue system involved and identify the specific source of pain within that tissue system.

Content

Categories of Pain

The diagnosis process should establish the category of pain (somatic, neuropathic or psychogenic), determine the tissue system involved and identify the specific source of pain within that tissue system. Somatic pain results from nociceptive stimuli, as excessive pressure, heat, cold, and chemical irritants, of normal structures that innervate the affected area. These stimulus can sensitize nociceptors, transmitting impulses to the central nervous system in which the perception of pain occur. The pain is divided into superficial and deep pain [3,4].

Superficial somatic pain presents clear and stimulating quality, usually related to acute painful conditions, without difficulty for the diagnosis. Deep somatic pain has deaf, deep, depressive quality related to chronic pain. This type of pain often exhibits central excitatory effects that may confuse the clinician, which may include autonomic effects and make diagnosis difficult.

Neuropathic pain does not require noxious stimuli and can occur due to abnormalities or damage to the nervous system. It is divided into episodic (paroxysmal) and continuous. Episodic neuropathic pain is characterized by brief (paroxysmal) of intense pain, in short stabbing or shock, and of short duration. Occurs along the unilateral distribution of the involved nerve. (eg. trigeminal neuralgia). Continuous neuropathic pain is characterized by constant or burning pain, often accompanied by paresthesia or dysesthesia. (eg. atypical odontalgia). It should be noted that some continuous neuropathic pain may present involvement of the sympathetic autonomic nervous system [3,4].

Psychogenic pain is one that arises from psychological causes, is not caused by noxious stimuli or abnormalities of the nervous system and its psychological cause can't be determined. It presents outstanding characteristics: the absence of an anatomical relationship between the source and the localization of pain, the dramatization of the symptoms, the absence of consistent reports and the inadequate response to the treatment [3,4].

Diagnostic Groups

Once the category of pain is established, the next step in the diagnostic process is to determine which group the pain originates from. Tissue systems can be divided into the following groups: intracranial structures, extracranial structures, musculoskeletal disorders, neurovascular disorders and neuropathic disorders. The clinician should be able to identify, within these diagnostic groups, a specific pain syndrome based on the patient's history and clinical findings. It is important to point out that when a patient presents with an orofacial pain complaint, it should first be evaluated for a possible cause of odontogenic pain. If no dental etiology is found, a possible musculoskeletal pain should be considered. If both of the above categories are eliminated, the other systems should be evaluated [5,6].

Comprehensive Assessment

A comprehensive assessment should include: the patient's history, a complete physical examination, diagnostic tests and, if necessary, imaging and laboratory tests.

Patient History

Taking the patient's story is possibly the most important step in the evaluation process. Most cases of orofacial pain and temporomandibular disorder (TMD) can be diagnosed only on the basis of anamnesis, which is obtained through an appropriate interview and provides information about the problem. In order to do this, the clinician should be prepared to obtain a precise and complete history, and should use a previous questionnaire properly completed by the patient, which should be verified with the clinical findings. The American Academy of Orofacial Pain[7] recommends that a comprehensive story should contain: history of current illness, previous medical and dental history, review of systems, psychosocial history.

It is of fundamental importance that during anamnesis the patient is asked about the presence of some systemic pathology that may be affecting TMJ and triggering TMD, requiring a differential diagnosis prior to the establishment of an appropriate therapeutic course.

Among the main pathologies that may overlap the TMD is fibromyalgia. It is a chronic pain syndrome that causes fatigue and muscle weakness, characterized by generalized diffuse pain, present for at least 3 months, on both sides of the body and above and below the waist, affecting mainly women. Pain is often more intense after sleep disturbances. Studies have shown that the prevalence of fibromyalgia in patients with TMD is relatively small (18.4%) when compared to the prevalence of myofascial pain in fibromyalgic patients (75.0%) [8]. Individuals who present both fibromyalgia and TMD report common clinical features such as type, quality, intensity and description of pain. While they differ in self-report of functional capacity of work and general dissatisfaction with health [9].

Another important systemic change that deserves to be investigated is rheumatoid arthritis. Described as a chronic and relapsing inflammatory disease of unknown cause, it affects multiple systems and may result in

destruction or ankylosis of the affected joints. The main anatomical changes are observed in the joints of the hands, feet, wrists, elbows, ankles and knees, although the first clinical symptoms can be found in the TMJs bilaterally. The diagnosis can be confirmed with blood tests[10,11].

Physical Exam

At the end of history, the clinician must have a rational idea of the nature of the patient's problem and begin the exercise of differential diagnosis. Therefore, a comprehensive physical examination should be performed, seeking to locate the source of pain and identify a possible malfunction of the masticatory system. The examination should include a general examination of the face, head and neck: musculoskeletal examination, intraoral evaluation, evaluation of cranial nerves.

The inspection of the face, head and neck includes visualization and palpation, seeking to identify possible tumors, infections and/or other pathologies. One should also investigate scars indicative of trauma, signs of dermatological diseases that may suggest systemic disorders, look for areas with possible changes in sensitivity, and apply palpation of the lymph nodes chains (submentual, submandibular and superficial cervical). Examination of the ear canal through otoscopy should also be part of this stage. Musculoskeletal examination consists of evaluation of temporomandibular joints (TMJ), chewing muscles and cervical joints. Musculoskeletal pain is classified as deep somatic pain, usually described as constant and with periods of occasional exacerbations of well-defined pain. Challenge tests, functional activity and palpation of affected areas may increase pain [4].

Analysis of Dental Occlusion

Classically occlusion was considered an important risk factor for temporomandibular dysfunction and has been widely investigated in recent years. Occlusal treatments such as occlusal adjustment in natural dentition, orthodontic treatments and occlusal plaques were used, based on the principle that unfavorable occlusal contacts could lead to neuromuscular changes [12]. However, no conclusions were drawn regarding the type of occlusal interferences that are detrimental to the function; what are the best indications and the best way to perform an occlusal adjustment, and whether the TMD is correlated with orthodontic treatment. Although a stable occlusion is the goal of these treatments, the lack of an ideal occlusion does not result in signs and symptoms of TMD [12-15]. Due to its multifactorial etiology, occlusion can not be considered the most preponderant risk factor for TMD. Due to lack of scientific evidence, occlusal adjustment and orthodontic treatment should not be indicated to treat or prevent TMD. Currently, the relationship between occlusion and TMD is considered weak or non-existent, based on epidemiological data and systematic reviews [15].

Diagnostic and Imaging Tests

About 70% of the information needed to establish a diagnosis is obtained through physical examination and patient history. Sometimes a psychological evaluation can be important, allowing a better understanding of the complaints. Laboratory or imaging tests should only be indicated to confirm the diagnosis, since they constitute complementary tests. Furthermore, TMJ region is difficult to evaluate because of the large overlap of images. The three-dimensional images complement the clinical examination. The best techniques for visualizing TMJ structures are Magnetic Resonance Imaging (MRI) and Cone Bean Computed Tomography (CBCT) [5,6] (Figure 1). MRI has a good soft tissue contrast allowing good visualization of both the articular disc and the supporting structures and adjacent chewing muscles. It is a non-invasive, non-radiation examination with which it is possible to obtain several imaging planes through the water saturation and fat suppression features. It can provide high resolution images able to portray the physiological state of the articular disc with 95% accuracy in the sagittal and coronal sections. However, it´s a high-cost exam and requires sophisticated installations [5].

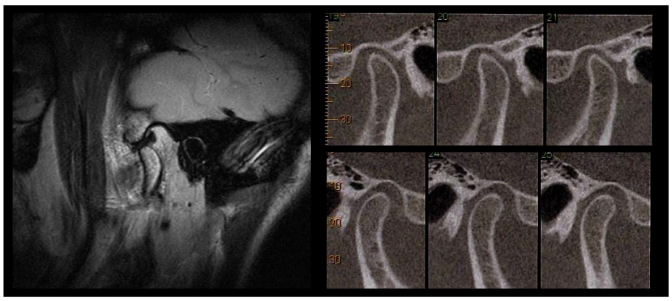

Figure 1: Magnetic Resonance Imaging (MRI) and Cone Bean Computed Tomography (CBCT)

CBCT provides accurate hard-tissue images that can be manipulated using specific software. It reproduces three-dimensional maxillofacial mineralized tissues, with little distortion and reduced radiation dose when compared to conventional computed tomography (CT). It should be used to evaluate the bone quality, quantity and morphology of the components and structures associated with TMJ [6].

Injections as a Method of Diagnosis or Treatment of TMD

Injections can be used in orofacial pains for both diagnostic (diagnostic) and therapeutic (therapeutic injections) purposes. This method allows us to inject medications allowing the control of pain. Currently, the most used solutions are local anesthetics, anti-inflammatory drugs (corticosteroids and some non-steroidal ones) and sodium hyaluronate for intra-articular TMJ conditions. In order to perform this procedure, the anatomy and neuroanatomy of the area to be infiltrated, as well as the therapeutic and adverse effects of the medication to be used should be adequately known.

Injections for diagnostic purposes consist of infiltration of anesthetics without vasoconstrictor, promoting the immediate relief of pain for a short period of time. So that it does not mask another area, possible pain source in a second complementary diagnostic injection. Therefore, one should inject the least amount of anesthetic in each area and as previously stated, without vasoconstrictor. With this method we can identify trigger points in musculoskeletal pain, as well as trigger zones in neuralgias, in addition to defining if the pain is primary or secondary. It is important to note that a solution based on 5% xylocaine can and should also be used as an anesthetic mouthpiece through mouthwash for the differential diagnosis in cases of pain of neuropathic origin, such as neuralgias in the glossopharyngeal nerve. Often, we need to establish a differential diagnosis between an Eagle syndrome, which is calcification and lengthening of the styloid process, which may promote symptoms compatible with glossopharyngeal neuralgia, confusing even an experienced examiner in the area.

The therapeutic injections promote pain relief. It is possible to use variable duration anesthetics, including high power (long duration) indicated for patients difficult to control, promoting comfort and pain relief for hours or days. It is recommended to infiltrate up to 1 tube of anesthetic allowing the performance of pain-free procedures [7].

Infiltration of Steroid Anti-Inflammatories as a Method of Treatment of TMD

The infiltration of steroid anti-inflammatory drugs locally has the main advantage of providing the action of the drug without the patient suffering the systemic effects of it. They can be used to treat muscles, ligaments, joints and tendons. The main anti-inflammatories suggested for these procedures are described in Table 1 [16].

Table 1: Suggestion of anti-inflammatory for local Injection

DRUG		TECHNICAL CHARACTERISTICS	CONCENTRATION
DEPO-MEDROL ®	METHYLPREDNISOLONE ACETATE	Crystalline, dissolves slowly, long lasting	40/80 mm por cc
CELESTONE SOLUSPAN ®	BETAMETHASONE ACETATE AND BETAMETHASONE DISODIUM PHOSPHATE	Crystalline and aqueous solution, fast anti-inflammatory action and long duration	6 mm por cc
DECADRON ®	DEXAMETHASONE	Short term	4 mm por cc
ARISTOSPAN ®	TRIANCINOLONE HEXACETONIDE	Two phases with more effective and long action when compared to celestone soluspan	20 mm por cc
CELESTONE ®	BETAMETHASONE	Aqueous solution, fast anti-inflammatory action and short duration	4 mm por cc

3.10 Pericapsular Infiltration of Steroidal Anti-Inflammatory as a Method of Treatment of TMD

It should be indicated in cases of adjunctive therapies of TMJ capsulitis, refractory to the conventional protocol. For this procedure, the celestone or celestone soluspan should be used as an election measurement. The medication should be injected externally into the subcutaneous capsule using an insulin needle and syringe (8 or 13mm in length and 30G), aiming to spread the product over a larger area in all directions (needle fan movement). Initially, between the first and third day the patient may present a slight worsening of the symptoms due to the trauma of the injection. If this happens, it is suggested to prescribe analgesic and / or NSAIDs for a short period of time, for immediate relief of symptoms. After the third day the patients begin to show improvement of the symptoms. The recommended dosage is 0.5 to 1 mL and can be reapplied at intervals of 30 to 60 days, in cases of very difficult control and extreme safety of the prescription. It is recommended to infiltrate this medication peri-capsular at least twice before opting for intra-capsular infiltrations. This fact is due to avoid the deleterious effects of corticosteroids on the synovial membranes of the TMJ, as well as in the degradation of the fibrocartilage coating of the articular surfaces. This avoids compromising the lubrication system of the joint and allows us to explore the anti-inflammatory and analgesic properties as a consequence of this medication [16].

The realization technique is simple and easy to perform. It is initiated by antisepsis and alcohol application in the region to be infiltrated, the ear region must be protected by means of a tamponade. An anesthetic spray is then applied to promote cryotherapy analgesia (fluoromethane or ethyl chloride), then follow the puncture, aspiration and injection sequence of the medication [7] (Figure 2).

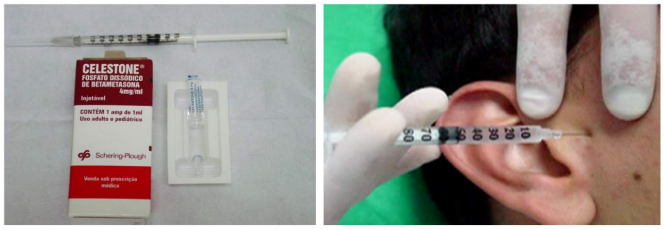

Figure 2: Pericapsular infiltration of steroidal anti-inflammatory

This procedure can generate as an adverse effect the dissolution of fats causing the patient to report a sensation of perceiving the TMJ more evident. Another important consideration is that the patient may present an allergy to the infiltrated drug and may manifest anaphylactic shock or intense allergic reaction. Do not forget to carry out an anamnesis of a broad and comprehensive past history.

Intracapsular Infiltration of SODIUM HYALURONATE AND/OR Steroidal Anti-Inflammatory as a Method of Treatment of TMD

The patient should be open-mouthed and wearing gauze, then palpate the posterior region of the jaw head. Use syringe and insulin needle, at a 45^0 angle to the skin. The needle should be inserted in the anterior-anterior direction, penetrating 1.0 to 1.5 cm, aspirate and then inject about 1 mL of anesthetic (Figure 3).

Figure 3: JANUZZI E - Intracapsular injection of steroidal anti-inflammatory

Sodium Hyaluronate may be infiltrated in the TMJ region to promote viscosity uptake of the joint [7] (Figure 4).

Figure 4: Viscosupplementation of the temporomandibular joint with Sodium Hyaluronate (HS).

Pain and inflammation should be avoided in order to prevent degenerative conditions. Although the conservative approach is always recommended, in more advanced cases intra - capsular corticoid infiltration will be necessary at a maximum quarterly frequency. The ideal is the minimum of this type of infiltration, or use it together with a viscosupplementation, seeking to minimize its deleterious effects as previously described (Figure 5) [7].

Figure 5: Viscosupplementation of ATM with Sodium Hyaluronate (HS), associated with intra-articular steroidal anti-inflammatory.

3.12 Muscle Injection as a Method of Diagnosis or Treatment of TMD

Hypersensitive nodules within a skeletal muscle are called myofascial trigger points, while trigger areas of neuropathic pain (eg, trigeminal neuralgia) are called trigger zones. The trigger point is said to be latent when it does not generate referred pain and is called active when it causes referred pain in situations of muscle stimulus or function (chronic skeletal muscle pain) [17].

The muscular injection in the regions of trigger points, also called muscular needle or myofascial trigger point injections, aims to promote mechanical rupture of the muscle nodule, improve local blood supply and tissue oxygenation, as well as avoid pain and discomfort during physiotherapy sessions [18].

The recommended anesthetic solution for this procedure is the anesthetic without vasoconstrictor. In cases of refractory or difficult to control it is possible to further recommend the infiltration of botulinum toxin, which reduces substance P, just as it seems to act in other excitatory peptides for pain [19].

For this procedure is very important the knowledge of anatomy neuroanatomy, and the main anatomical accidents present. Among them we can mention:

A. Masseter muscle: Parotid gland in which the facial nerve branch passes, responsible by muscles of facial expression. If it is reached during the procedure, the patient may be left without closing the

eyes until the anesthetic action completely passes (Figure 6).

B. Temporal muscle: The superficial temporal artery is present in the form of branches in a large part of this muscle.

C. Sternocleidomastoid muscle: we must pay attention to the internal jugular vein and external carotid artery. Avoid injecting bilaterally so as not to run the risk of an accident when injecting, it is reaching the interior of these blood vessels, which could lead to a lipothymia. It should be drawn externally in a tweezer palpation with the thumb and forefinger so as to isolate the muscle well and not to run the risk of reaching one of these blood vessels.

D. Trapezius muscle: traction it upwards, in order to isolate the muscle well, so as not to run the risk of reaching one of these blood vessels, besides not approaching the lung, avoiding a possible perforation of this, minimizing the risk of a possible pneumothorax.

Figure 6: Anatomy and the main anatomical accidents present - **A**.Muscle. Masseter - **B**. Muscle Temporal - **C.** Muscle Sternocleidomastoid - **D**. Muscle Trapézio.

The technique consists of identifying and demarcating the trigger point region, then promoting the asepsis and application of iodinated alcohol. The anesthetic is then sprayed with ethyl chloride or fluoromethane followed by puncture, aspiration, infiltration and then, muscle stretching is promoted [19].

Blockage of the Auricle Temporal and Masseter Nerves as a Method of Diagnosis or Treatment of TMD

The auriculotemporal nerve is responsible for about 80% of the innervation of TMJ and is therefore the main responsible for the sensation of pain in this region. The masseteric nerve is responsible for the secondary innervation of TMJ, about 20% of the innervation of this joint (Figure 7). Although less invasive, the blocks of these nerves are less effective than the intra-articular anesthetic injection. For this procedure, anesthetics of short or long duration can be used, depending on the objective that is wanted to reach (Table 2).

Table 2: Suggestion for local anesthetic

Anesthetic	Type of lock	Concentration	Dose	
			Ml	Mg
LIDOCAINE	Infiltration / Diagnosis	1% 2%	5 -10 2,5 - 5	
MEPIVACAINE	Infiltration / Diagnosis / Therapy	3%	2,5 - 5	
MARCAINE (with and without epinephrine)	Infiltration / Therapeutics	0,25 % 0,5 %	5 – 60 5 - 30	125 – 150 25 - 150

Figure 7: Blockage of the temporal and masseterinary atria respectively.

Technique: Antisepsis should be performed with disinfectant, then cleaning with 70% alcohol or iodine from the region to be injected. Use syringe with reflux, provided with a long needle. For the auriculotemporal nerve block the needle must be inserted completely between the tragus / lobe of the ear, in the postero / anterior direction, with medial path, passing behind the head of the mandible. For the masseterine nerve block, we must locate the mandibular notch with a patient with the mouth half open; the needle must be inserted completely anterior to posterior at a 45º angle in this region. The medication should be injected slowly and gradually, to generate the least discomfort possible for the patient [19].

It is important to consider that lidocaine has a half-life of 10 to 30 minutes, mepivacaine for 30 to 60 minutes, whereas marcaine promotes a half-life of 2 to 8 hours and also has a higher toxicity power.

Contraindications of Injections

Do not inject medications into infected regions or those individuals who are allergic to the medication being infiltrated. The antisepsis of the area should always be performed with the use of iodinated alcohol to avoid contamination and promote a safe procedure. Drug interactions are also an important factor in contraindications, especially in cases of patients who have suffered a stroke, present uncontrolled systemic arterial pressure (BP), or who may present an increase in BP due to anxiety prior to the procedure [19] (Figure 8).

Figure 8: Abscess in ATM due to an intra-articular fracture of the mandible head.

Laboratory Tests

When there are signs and symptoms suggestive of systemic disease, other tests such as blood count, urine test and synovial fluid may be indicated (Figure 9). Such diseases may include a variety of connective tissue disorders, metabolic disorders, infectious diseases, hematological disorders, nutritional deficiencies and even malignant tumors. Specific tests should be requested for selected patients, as long as the result can affect the diagnosis and treatment to be performed, making it necessary to refer to the appropriate specialist physician [4].

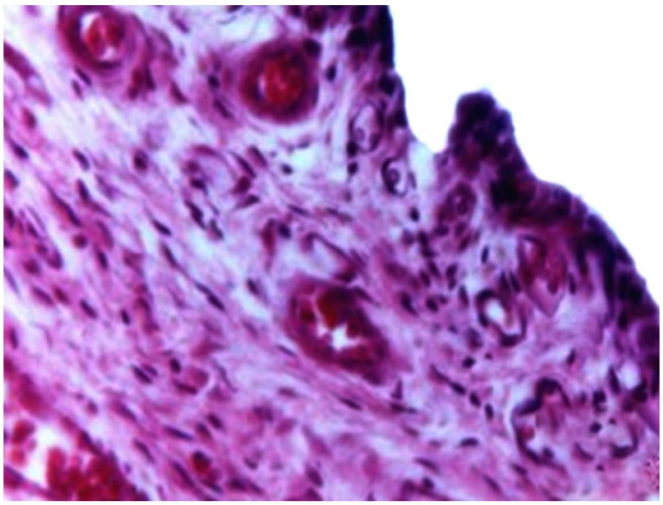

Figure 9: Histopathological analysis of TMJ (sagittal cut).

Sleep Evaluation

The relationship between pain and sleep is bidirectional, studies have shown that chronic pain leads to sleep fragmentation whereas poor sleep quality also influences the perception of pain. Thus, the investigation, recognition and treatment of a sleep disorder as a possible aggravating factor of patient's pain should be part of the diagnostic protocol for temporomandibular dysfunction [20,21]. Gold standard for evaluating patient sleep is the complete polysomnography (PSG) performed in a specialized sleep clinic. It is a highly complex examination in which the patient sleeps in a specialized clinic and, during the night, electroencephalographic markers, respiratory effort, oxyhemoglobin saturation levels, heart rate, as well as the level of relaxation muscular are measured. Through the polysomnographic record, a very detailed report of the quality of sleep of the patient is provided, as well as the presence or absence of possible sleep disorders. However, although extremely effective, it is a high-cost, difficult-to-access, and expensive exam [22].

Currently, some questionnaires can also be used in clinical practice in order to predict a possible change in the patient's normal sleep pattern and, if pertinent, to refer the individual for a more detailed analysis and treatment of this condition. Among the validated and most used questionnaires are the following: Epworth's sleepiness scale (evaluates excessive sleepiness during the day); Pittsburgh Questionnaire (assesses sleep quality); and, more recently, mobile apps. This assess the presence or absence of snoring, its intensity and percentage for a full night. Among them, *SnoreLab* and *NoSAS* stands out for its ease of access and simplicity of use, however still lack of a broad validity as a standalone diagnostic method.

Final Consideration

Temporomandibular dysfunction is a prevalent pathology that has an important impact on the quality of life of its patients. The anamnesis of the patient with clinical signs and symptoms should investigate intra-oral conditions, musculoskeletal structures, clinical metabolic condition, as well as their quality of sleep. The differential diagnosis defines the best therapy to be adopted, and it´s determinant for the ultimate success of the treatment adopted.

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