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Current Concepts About Temporomandibular joint disorders: A Review Article

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ABSTRACT

Temporomandibular joint is formed by the mandibular condyle inserting into the mandibular fossa of temporal bone. It's considered as ginglymoarthroidal joint which mean that is capable of both hinge type and gliding movements. TMD affects up to 15% of adults, with a peak incidence at 20 to 40 years of age. However, it can be classified as intra-articular or extra- articular. The incidence varies from 21.5% to 50.5%. The prevalence of TMD is about 3.7-12% greater in women than men. There are two types of treatment: conservative and surgical.

We all believe that the valid diagnosis is the key to successful treatment on account of TMD multifactorial nature and often of patients suffering from other disorder simultaneously that can make the correct diagnosis difficult.

Manual TMJ inspection was and remain self-evident manner used to detect joint dysfunction related to clinical findings. The primary study should be plain radiography (transcranial, trans maxillary views) or panoramic radiography, the optimal radiography for comprehensive joint evaluation in patients with signs and symptoms is magnetic resonance imaging (MRI), if MRI is not available ultrasonography can be an alternative ,ultrasonography(US) is noninvasive dynamic low cost technique that can use to diagnose internal derangement of TMJ(2).US is also one of the diagnosis methods for DDWR, in comparison with MRI, US revealed a sensitivity of 78.6%, specificity of 66.7% and accuracy of 73.0%. A range between 5% to 10% of patients seeking treatment whereas the others around 40% of patients are spontaneously free of symptoms. In addition, Initial treatment goals should focus on resolving pain and dysfunction.

Keywords: Temporomandibular joint, Disorders, Photobiomodulation, Mandibular fossa

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INTRODUCTION

Temporomandibular joint is formed by the mandibular condyle inserting into the mandibular fossa of temporal bone. It's considered as ginglymoarthroidal joint which mean that is capable of both hinge type and gliding movements [1]. Muscles of mastication have primary role in joint movement [2]. Temporomandibular disorders (TMD) are discrepant group of musculoskeletal and neuromuscular conditions which effect the temporomandibular joint complex and the muscles and bony structures that surrounding it. TMD affects up to 15% of adults, with a peak incidence at 20 to 40 years of age. However, it can be classified as intra-articular or extra- articular [2]. Pain related conditions and intra-articular disorders are the most common TMD conditions, and internal derangement is the most common form [3]. There is range of symptoms for TMD such as pain. joint noise, restricted movements

[4]. It affects the jaw joint and related structure causing internal derangement of joint space, bone alterations and degenerative pathologies [2]. Many patients are tolerating the symptoms like debilitating pain which is over the time will affect their life quality, such a thing is due to improper understanding of the etiology or pathogenesis of disease or absence of actual diagnosis or therapeutic approaches [5]. The incidence varies from 21.5% to 50.5%. The prevalence of TMD is about 3.7-12% greater in women than men [6]. There are two types of treatment: conservative and surgical [7]. However as far as we know vast of majority of physicians favored the conservative management rather than surgical procedures [8]. Nowadays, there is still no agreement about the most effective management of arthrogenous TMD.

The aim of this study is to explore literature for the current concepts about TMD etiology, pathophysiology, and epidemiology, with special focus on current concepts and advances in diagnosis, and treatment.

METHODOLOGY

An electronic search of the literature was conducted on PubMed of articles within five to ten years back publication time. The key words of this search were "Temporomandibular joint disorders", "TMD", "etiology", "pathophysiology", "risk factors"," epidemiology", "diagnosis", ''management and" treatment". The Boolean operators "AND", "OR" was used to merge these keywords. The inclusion criteria were clinical studies performed on humans and systematic reviews on the subject published in the last 5 years. Studies performed on animals or published in a language other than English were excluded. Articles were selected after reading of the titles and abstracts that appeared in the search results and only those articles that appeared relevant and fulfil the inclusion and exclusion criteria were selected.

Etiology

There is many factors for TMD such as (biological, emotional, social, environmental, cognitive) that's why TMD is consider multifactorial disease, Robert L.gauer et al. in 2015 suggested that there are factors associated with TMD such as fibromyalgia, sleep apnea, autoimmune disorders, and psychiatric illness [2], the prospective cohort study with more than 6,000 participants showed a twofold increase in TMD in persons with depression (rate ratio=2.1; 95% confidence interval, 1.5 to 3; P<0.001) and a 1.8-fold increase in myofascial pain in persons with anxiety (rate ratio=1.8; 95% confidence interval, 1.2 to 2.6; P<0.001) [2]. Most patients with TMD are seeking medical help because of pain [4]. Also, One of the etiological factors that lead to disk displacement with reduction (DDWR) are slightly referred to abnormal biomechanical forces directed to the mandibular condyle, which change the shape as well as function of the articular tissue [9]. Bruxism, clenching, stress, and malocclusion are related to TMD [10], however, the etiological factors of this disorder are still ambiguous [4].

Epidemiology

The prevalence of TMD is still unclear [11]. It is considered to have high prevalence among population, between 40% to 60% [12]. One study had reported that 87% of a sample of 1040 subjects had one or more positive symptoms or clinical signs of TMD [12]. TMD symptoms are more prevalent in women than men. Women tend to develop TMD during their premenopausal years [13]. A study indicates that most of the cases are related to effect of the increasing psychological pressure on nowadays community [14]. While myofascial pain has been reported by many studies that it is contributing to most TMD patients [15]. It has been reported that around 75% of patients suffer from chronic symptoms, and anxiety symptoms directly influence physical symptoms of TMD [16].

CLASSIFICATION

TMD is categorized as intra-articular (within the joint) or extra- articular (involving the surrounding musculature) [16]. At least half of the cases are musculoskeletal conditions [17] while articular disk displacement involving the condyle–disk relationship is the most common intra-articular cause of TMD [18]. The International Research Diagnostic Criteria for Temporomandibular Dysfunction Consortium Network published an updated classification structure for TMD in 2013 (Table 1) [18].

DIAGNOSIS

The history taking and clinical examination

Table 1: Classification of temporomandibular disorders articular disorders (Intra-articular).

Classification
Congenital or developmental disorders Condylar hyperplasia
First and second branchial arch disorders Idiopathic condylar resorption Degenerative joint disorders
Inflammatory: capsulitis, synovitis, polyarthritides (rheumatoid arthritis, psoriatic arthritis, ankylosing spondylitis, Reiter syndrome, gout)
Noninflammatory: osteoarthritis Disk derangement disorders Displacement with reduction
Displacement without reduction (closed lock) Perforation
Infection
Neoplasia
Temporomandibular hypermobility
Dislocation
Joint laxity
Subluxation
Temporomandibular hypomobility
Ankylosis: true ankylosis (bony or fibrous) or pseudoankylosis
Post radiation fibrosis
Trismus
Trauma Contusion Fracture
Intracapsular hemorrhage

findings are essential for TMD diagnosis [2]. We all believe that the valid diagnosis is the key to successful treatment on account of TMD multifactorial nature and often of patients suffering from other disorder simultaneously that can make the correct diagnosis difficult [19]. The symptoms of TMD are often associated with jaw movement (e.g., opening and closing the mouth, chewing) and pain in the preauricular, masseter, or temple region. Another source of orofacial pain should be suspected if pain is not affected by jaw movement. Adventitious sounds of the jaw (e.g., clicking, popping, grating, crepitus) may occur with TMD, but also occur in up to 50% of asymptomatic patients [20]. Abnormal mandibular movement, decreased range of motion, tenderness masticatory muscles, pain with dynamic loading, signs of bruxism, and neck or shoulder muscle tenderness are some of the clinical findings that may help in TMD diagnosis [2]. TMJ clicking corresponds to 26.2% of clinical signs of TMD and one of the most common complains of patients [10]. Single click during opening of the mouth may be associated with an anterior disk displacement, second click during closure of the mouth results in recapture of the displaced disk; this condition is referred to as disk displacement with reduction. Disc displacement with reduction corresponds to 41% of TMD clinical diagnosis, also can occur in 33% of asymptomatic individuals. When disk displacement progresses and the patient is unable to fully open the mouth (i.e., the disk is blocking translation of the condyle), this condition is referred to as closed lock. Disc can be displaced in any direction, but it is rarely displaced to posterior direction, whereas anterior displacement appears the most common [10]. Crepitus is related to articular surface disruption, which often occurs in patients with osteoarthritis [21]. Reproducible tenderness to palpation of the TMJ is suggestive of intra-articular derangement. Tenderness of the masseter, temporalis, and surrounding neck muscles may distinguish myalgia, myofascial trigger points, or referred pain syndrome. Deviation of the mandible toward the affected side during mouth opening may indicate anterior articular disk displacement [22]. Suddenly observed occlusal changes may reflect TMJ or muscle disorder due to obvious connection between these structures and dental occlusion [23]. The delay in correct diagnosis often leads patients to suffering deep-seated symptoms [19]. TMD diagnosis has been standardized based on research diagnostic criteria for temporomandibular disorders (RDC/TMD) that constitute a multidimensional diagnostic research tool adopted worldwide this standardization has improved reproducibility among clinicians and has facilitated the comparison of results among researchers [4]. There are different diagnostic modalities that can help in diagnosis of TMD.

Physical examination

Manual TMJ inspection was and remain self-evident manner used to detect joint dysfunction related to clinical findings [9]. At this point, the clinician should have a reasonable idea of the nature of patient's problem. A comprehensive

physical examination will help to determine the source of pain as well as the severity of the dysfunction. This part of assessment includes TMJ evaluation (joint range of motion, inspection of joint sounds and pain on palpation), and muscle palpation. Additional diagnostic tests can be necessary for some patients. Dental and occlusal evaluations are also performed [24].

Imaging

The primary study should be plain radiography (transcranial, trans maxillary views) or panoramic radiography, the optimal radiography for comprehensive joint evaluation in patients with signs and symptoms is magnetic resonance imaging (MRI), if MRI is not available ultrasonography can be an alternative ,ultrasonography (US) is noninvasive dynamic low cost technique that can use to diagnose internal derangement of TMJ [2]. US is also one of the diagnosis methods for DDWR, in comparison with MRI, US revealed a sensitivity of 78.6%, specificity of 66.7% and accuracy of 73.0% [9]. However, Magnetic resonance imaging (MRI) showed a specificity range 88-90% and sensitivity range 78-83.3%, and it allows evaluation of soft tissue and bone altogether [9,25], in addition to assessment of dynamic connection between the condyle, articular disc, mandibular fossa, and articular eminence, and hence considered as a gold standard exam of TMD [9]. A meta- analysis on the effectiveness of ultrasonography in the diagnosis of temporomandibular disorders indicated that there is still no evidence to recommend using ultrasonography in TMD diagnosis and more research is needed to verify its effectiveness [14]. Bone details detection in (Cone Beam CT) is better than MRI [25]. CT scan is considered an excellent option to disclose bone surface deformation [9,25]. A systematic review study about the use of diagnostic imaging in temporomandibular joint rheumatoid arthritis showed that MRI gives maximum contrast resolution in addition to dynamic imaging of the joint while CT offers the bony component of the TMJ. Positron emission Tomography (PET) scans that had been superimposed with MRI or CT scan allowed for optimum results [26].

Diagnostic injections

Muscles of mastication can be injected at trigger point by local anesthetic to figure out the origin of jaw pain. This procedure can be only performed by physicians and dentists with experience in anesthetizing the auriculotemporal nerve region. When performed correctly, complication rates are low. If pain persisted after appropriate nerve blockade, this should alert the clinician to reevaluate TMD symptoms and consider an alternative diagnosis [2].

TREATMENT

A range between 5% to 10% of patients seeking treatment whereas the others around 40% of patients are spontaneously free of symptoms. In addition, Initial treatment goals should focus on resolving pain and dysfunction [2]. Entire treatment modalities aim to improve symptoms accompanied with TMD, however, there is no gold standard treatment [19].

Non-invasive treatment

The initial treatment for TMD is supportive patient education (Table 2) [23] by the side of Home exercise and relaxation technique (opening and closing over 15mm distance, Moving the jaw

Table 2: Counselling and home self-care guidelines for the TMD patient.

Counselling
1. Modify your diet
Try eating soft foods like soup, yogurt, mashed potatoes etc. Avoid eating hard foods or chewing for a long time. Do not chew gum!
2. Avoid opening the mouth wide
Avoid yawning, screaming, singing, and long sessions at the dentist.
3. Use hot compresses
Apply moist heat to the painful area for 20 minutes, two to four times a day.
4. Relax your jaw muscles
Try not clenching your teeth. Practice keeping your tongue on the roof of your mouth behind your front teeth. The rule is “lips together and teeth apart.”
5. Keep good posture
Maintaining good posture of head, neck, and back will help relax your jaw muscles.
6. Improve your sleep
Try to have a resting sleep. Avoid sleeping on your back or in other positions that stretch your jaw and neck muscles.
7. Practice aerobic exercises
Walking and water aerobics are excellent ways to help improve your pain and your overall health.

to right and left side over 5mm to both side) aid to relieve 82% of clicking [2,9]. Ultrasound, iontophoresis, electrotherapy, or low-level laser therapy are an example of specialized physical therapy in the management of TMD [2].

Photobiomodulation (PBM) OR low-level laser therapy (LLLT)

Low-level laser therapy is one of the physical therapies that has been recently add due to its easy application, short duration, and less contraindications [4]. Laser or red and infrared light waves rely on activation of respiratory chain and oxidation of the nicotinamide adenine dinucleotide hydrogen pool, which lead the stimulation of normal cell function, Enhance local blood circulation, Tissue healing as well as analgesic and myorelaxant effect, delineated by depth of penetration into musculoskeletal tissue [8,19]. Most popular figures of wavelength that have been used in therapeutic purposes hovering between 810-830 [8]. It is applied at 12 points (5 on TMJ region, 7 on temporalis /masseter muscle and insertion of medial pterygoid muscle) [19].

In 2018, A review study of Gang-zhu xu et al in 2018 that compared the effect of LLLT with placebo in treatment of TMD, as a result, LLLT showed more effective than placebo in reducing the pain. Moreover, it enhances the functional outcome of TMD, however, along the treatment phase of TMD with LLLT if there is an alteration of laser type, frequency, dosage, exposure time, application area, number of sessions, and duration of therapy. Hence, this may increase heterogeneity in effects [4]. In 2015, a randomized controlled trial displayed better results related to pain intensity when laser is applied on greatest points of pain rather than on predetermined points [8]. One of the studies that recently published in 2018 reveals that there is a diminished depression in symptoms among participants who received an isolated PBM or united with manual therapy in addition to pain associated with muscle, joint and enhanced jaw functions [19]. Due to its analgesic, anti-inflammatory and regenerative effects without an even adverse outcomes besides it has a good acceptance by patients so, the use of LLLT has been an integral option for treatment of TMD [4].

Occlusal splint and adjustments

Occlusal splints are the first choice among dentist [19]. Degenerative force on TMJ dentition, abd articular disk can be prevented by using occlusal splints. They are effective to be used in patients with severe bruxism and nocturnal clenching. To choose the optimal occlusal device, consultations should be taken before [2]. Regarding the index score, other studies recommended that soft splints could decrease the severity of symptoms in a duration of 4 to11 weeks in patient with masticatory muscle pain. Recently, it has been proved in a study that, initiating the treatment with occlusal splint in combination with an adjuvant nonsteroidal anti-inflammatory for a 10-day duration could be amazingly effective for a chronic masticatory muscle pain [5]. There were no beneficial outcomes from occlusal adjustment in the management or prevention of TMD [2]. Another meta-analysis study concluded that using of splints for patients with a maximum mouth opening (MMO) that accounts for less than 45mm will result in increasing their MMO and decreased pain intensity calculated by the visual analogue scale (VAS) for those with TMD without specific description (TMDSD). Patients with TMJ clicking, it can be helpful for them as it is shows to lower the intensity of pain, therefore using of splints was suggested for the treatment and control of TMDs in adults [27]. Splint therapy may be used post arthrocentesis to decrease the joint overloading however, still there's not enough studies to prove its effectiveness [28].

Biofeedback

In comparison with conventional management, biofeedback, and cognitive behavior therapy in both short and long terms showed to be favorable in the management of pain for patients with symptomatic TMD [2].

Patient should be advised concerning some behavioral modifications, such as stress reduction, sleep hygiene and elimination of parafunctional habits such as teeth clenching or grinding, pencil or ice chewing, also patient should avoid extreme mandibular movement (excessive opening, yawning, brushing or flossing) [2].

Botulinum toxin

The definition of Botulinum toxin (BTX) is a potent neurotoxin synthesized by the Gram-negative, anaerobic, spore-forming bacterium Clostridium botulinum. It blocks the presynaptic release of acetylcholine into the endplate of the

neural junction, thus leading to reduced activity of the muscles or glands. They are commercially available with different formulations, thus Its stable crystalline, lyophilized substances associated with human albumin in the laboratory, which can be used after dilution in normal saline [29]. A systematic review and meta-analysis study by Machado et al found that BTX-A is more effective than placebo in reduction of pain in a period of only one month, also it was found that it's more effective than LLLT at one month. BTX-A is safe intervention for painful TMDs since none of the studies reported any adverse effects [30]. Nowadays still there is not enough number of studies investigating the effectiveness of Botox in TMD management [2].

Acupuncture therapy

A PRISMA compliant meta-analysis assessed the use of conventional acupuncture therapy for temporomandibular disorders (TMD) in adults compared to sham nonpenetrating acupuncture and sham laser therapy. Their results revealed that acupuncture therapy had superior efficacy in reducing the episode of pain specifically myofascial pain symptoms [15].

Analgesic gel phonophoresis and ultrasound

Phonophoresis with analgesic gel as a coupling agent gives good results in the treatment of TMDs. Treatment of TMDs using short-term phonophoresis with the help of ultrasound promote the transmission of such topical medicaments. Analgesic gel containing aceclofenac is applied then ultrasound is done to facilitate delivery of topical medications. Phonophoresis has been useful for those who unable to tolerate oral drugs and elderly people as well [31].

Short term transcutaneous electrical nerve stimulation (TENS) transcutaneous

Electrical Nerve Stimulation (TENS) has been used to control pain in patients with chronic temporomandibular disorders (TMD). It is well established that TENS can reduce patient-reported pain intensity in acute pain conditions, but its efficacy is controversial in chronic pain.

It was found that short term TENS provide superior reliability in relation to masticatory myofascial pain reduction, while long term TENS need more research to prove its efficacy [32].

Pharmacological management

Many types of medications are used to treat the pain associated with TMD, Initially in acute pain NSAIDs act as first-line agents which are used for 10 to 14 days, even though that there's multiple choices of NSAIDs available, naproxen is the only one that prove benefit in pain reduction, in case of muscular component involvement the muscle relaxants can be prescribed in combination with NSAIDs however, in chronic pain, tricyclic antidepressants can be used. It's not recommended to use opioids unless patients had ineffective non opioids treatment and it should be for short period and with caution because of the risk of dependence [2].

A systematic review by Davoudi et al compared the arthrocentesis using corticosteroids with arthrocentesis using other medications (Hyaluronic acid, ringer lactate, normal saline, Vitamin B12+physiological salt water) and it was concluded that there is no significant differences between corticosteroid groups and other groups [10].

Minimally invasive treatment with injections

Minimally invasive procedures include intraarticular injection (IAI) of pharmacologic, (hyaluronic acid (HA), corticosteroid (CS), morphine, and/or growth factors as found in platelet-rich plasma, (PRP) arthrocentesis with or without occlusal splint therapy or arthroscopy either alone or in combination with IAI of HA or CS or PRP, etc. A recent meta-analysis by Al-Moraissi et al. support a paradigm shift in arthrogenous TMJ disorder (internal derangements, arthralgias, osteoarthritis, and osteoarthrosis) treatment. There is a new evidence (though on a very low to moderate quality level) that minimally invasive procedures, particularly in combination with IAI of adjuvant pharmacological agents (PRP, HA or CS), are significantly more effective than conservative treatments for both pain reduction and improvement of MMO in both short (≤ 5 months) and intermediate term (6 months to 4 years) periods. It was suggested that minimally invasive procedures deserve to be implemented as efficient first-line treatments (e.g. IAIs and/or Arthrocentesis) or should be considered rather early, i.e. as soon as patients do not show a clear benefit from an initial conservative treatment [33].

Invasive management

Arthroplasty

TMJ arthroplasty involves the reshaping of the articular surface to remove osteophytes, erosions, and irregularities found in osteoarthritis refractory to other treatment modalities. The articular disk degeneration or displacement can be repositioned, repaired, or entirely removed. This is done using an open surgical approach through a periauricular skin incision. Complications are rare but can include wound infection, facial nerve injury, and permanent occlusal

changes, relapsing joint pain, and life-threatening vascular injuries [34]. Early postoperative physical therapy and range-of-motion exercises are vital to achieving long-term functional improvements.

Disk repositioning

Disk is repositioned back to its normal anatomic position in patients with internal derangement. This procedure is most effective in disks that are normal appearing (white, firm, shiny) with minimal displacement.

Disk repair

Repair is done with a tension-free primary closure for small disk perforations.

Discectomy alone

Removal of the articular disk is performed in patients with severe disk perforation, loss of disk elasticity, and in patients with unresolved symptoms after disk repositioning. Although patients may have improvement in pain and maximal mouth opening following the surgical removal of the disk, patients also exhibited signs of fibrous adhesions, narrowing of joint space, and osteophyte formation on MRI [35].

Discectomy with graft replacement

The placement of a graft aims to protect the joint from further degeneration and prevent fibrous adhesions. The use of autogenous sources, such as temporalis flaps, auricular cartilage, and dermal grafts, results in superior clinical outcomes compared with alloplastic grafts [34].

Total joint replacement

The primary goal for TMJ replacement is restoration of form and function. It is indicated in severely damaged joints with end-stage disease in case all other more conservative treatment modalities have failed. Autogenous costochondral bone grafts have been frequently used in TMJ reconstruction in the past because of its gross anatomic similarity to the mandibular condyle, ease of adaptation to the recipient site, and its demonstrated growth potential in juveniles [36]. However, the use of alloplastic materials has become increasingly more popular in the adult population [34] because of potential harvest-site morbidity and failure during the transplantation process or from functional loading. A variety of custom and stock titanium joint designs are currently available, which consist of both a fossa and a condylar component held in place by screw fixation. Studies have shown that TMJ replacements resulted in statistically significant improvement in pain level, jaw function, and incisal opening [37,38].

TMJ Tissue engineering

With the development of tissue engineering, intra-articular grafting of autologous bone marrow-derived stem cells (MSCs) has been proposed as biological therapy for patients with knee osteoarthritis, because the procedure is safe, reduces pain, and improves function [39]. However, culture expansion of MSCs is still a complex and uncertain process, which involves technical expertise and sophisticated laboratory logistics, so its widespread application is limited. A recent randomized clinical trial on a human model published in 2019 aimed to test the hypothesis that office based TMJ arthrocentesis with intra-articular injection of BMNc has a better clinical outcome compared with arthrocentesis with intraarticular injection of hyaluronic acid (HA) in patients with degenerative TMDs. It was concluded that intra-articular TMJ BMNc injection improved clinical outcomes in TMD treatment. However, further studies are needed to determine whether BMNc can represent the best treatment for TMDs. However, there are still no human-model reports that have investigated the use of BMNc in the treatment of TMDs [40].

CONCLUSION

The literature suggests evolving incidence and prevalence of TMD that can be attributed to many factors. Diagnosis is the key to successful treatment on account of TMD multifactorial nature. The superiority of MRI over other imaging modalities has been reflected upon in

the current literature. Moreover, new treatment modalities have been suggested recently but their use still need validation by strong scientific evidence. However, there are recent management protocol changes supported by moderate quality level evidence that encourage the use of minimally invasive procedures as efficient first-line treatments or as as soon as patients do not show a clear benefit from an initial conservative treatment.

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