

The importance of differential diagnosis in specific internal derangements of the temporomandibular joints: Review and update.

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Abstract

Introduction: Internal derangements of the temporomandibular joints is a recent orthopaedic concept used to describe a number of inflammatory, degenerative and or biomechanical disorders involving the joint disk. The differential diagnosis of such disorders has not been comprehensive explained in the dental and medical literature. **Goal:** Discuss most frequent internal derangements of the temporomandibular joints and propose their differential diagnosis.

Material and Methods: We entered a number of internal derangements related terms into Google Academics so as to gather scientific articles in order to elaborate this study. **Outcome:** Thirty-three scientific papers were considered adequate containing sufficient material in different areas in the domain of Internal Derangements of the Temporomandibular joints and were used to prepare the current study.

Conclusion: In a small and delicate joint such as the temporomandibular joint, many internal joint derangements have been described. Careful study and observations of different disorders demonstrate that they present their own characteristics and thus, the specialist in orofacial pain, may establish their differential diagnosis.

Keywords: Temporomandibular joints. Internal Derangements. Differential Diagnosis.

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I. Introduction

Craniomandibular Disorders or CMDs is a collective term introduced recently in the dental and medical literature with the connotation of signs and symptoms of pain and dysfunction occurring frequently in the masticatory muscles, temporomandibular joints (TMJs) and adjacent anatomic structures, usually of musculoskeletal origin^[1]. Such set of disorders is characterized by a complain of pain, different types of joint noises, tenderness to palpation of joint and muscles, difficulties to perform normal jaw movements and headache referred from masticatory and/or cervical muscles and TMJs^[2] Internal Derangements of the TMJs (TMJ-IDs) is another collective term used currently to describe an abnormal functional and anatomical relationship between the articular disc, head of the mandible, mandibular fossa and articular eminence^[3]. Disk position and shape are considered of paramount importance in the conceptualization of TMJ-IDs.

Researchers consider that in TMJ-IDs, there is a displacement of the joint disc from its normal functional relationship with the mandibular condyle and the articular portion of the temporal bone in which the intra-articular components may be deranged, displaced, inflamed or degenerated^[4]. TMJ-IDs are considered by some researchers as forms of progressive, degenerative diseases characterized by morphological and structural changes in the TMJs and adjacent anatomic structures^[5] in which the normal shape and position of the intra-articular components are significantly altered and inflammation, deformation and displacement occur frequently. However, these pathological changes and anatomical deformations and position changes do not occur in all individuals and thus, do not progress to the next stage.

Even though TMJs-IDs are usually described in terms of an intra-articular disc displacement that may cause various types of joint sounds^[6], there are some cases or situations of TMJs-IDs for instance in capsulitis/synovitis and the stuck disk phenomenon, that the disk is normal in position and shape. Because the concept of TMJ-IDs is wide and comprise a number of different disorders, but there is paucity of studies about their differential diagnosis, this study was designed to:

1. Discuss some clinical characteristics of specific TMJ-IDs
2. Compare some clinical characteristics unique to each specific disorders and how such characteristics can be used to establish the differential diagnosis with other TMJ-IDs.

II. Methods

In the current study we used terms such as Temporomandibular joints, Internal Derangements of the Temporomandibular Joint, Diagnosis, Differential Diagnosis, capsulitis/synovitis, retrodiscitis, disk-attachment pain, disk displacement without reduction, arthralgia and osteoarthritis in order to get sufficient material to discuss and define characteristics of each disorder which would be useful to establish the differential diagnosis. Such terms were entered into The Google Academics. Only papers written in the English language were searched in the Google Academics database. A primary goal of this search was to get about 50 papers from which those considered most complete and comprehensive would be retrieved and printed.

III. Outcome

Fifty papers were identified, retrieved, printed and analyzed in the first stage of this investigation. In a second step, we identified the most relevant papers to carry out the current investigation. Thus, thirty-three papers were identified and considered relevant to carry out the current study.

IV. Literature review

1. Capsulitis/Synovitis of the TMJs

Capsulitis and synovitis of the TMJ is inflammation and pain in the joint capsule which surrounds the mandibular condyle and in the synovial membrane which protects and nourishes both the TMJ capsule and the articular disc. Capsulitis/synovitis is the commonest functional disorder in TMJ-IDs and is associated with a low grade local inflammation in the external layer of the capsule usually associated with synovial inflammation^[7]. One investigation^[8] asserts that inflammation of the capsular ligament may manifest with swelling and continuous pain localized to the joint. Capsulitis and synovitis have a number of etiological factors but the most common one is strain, pressure and or parafunctional habits related jaw movements that stretch the joint capsule causing the release of pain and inflammatory mediators. In the classification of TMJ-IDs, stage I is a badly defined stage of TMJ –IDs in which disc displacement with reduction is the main characteristics. However, many patients presenting with TMJ capsulitis / synovitis do not necessarily demonstrate the presence of disk displacement during careful clinical examination or do not report such clinical characteristics. This is probably so as capsulitis synovitis is the first stage of a TMJ-ID characterized by low grade inflammation and mild or moderate pain. It may be that anterior displacement with reduction can exist without joint noises as stated by Barkin and Weinberg^[9]. Poluha and Grossman^[10] contends that a TMJ-ID takes the name from the affected anatomic structure in which occurs. They assert that synovitis, capsulitis, retrodiscitis, ligamentitis, and arthritis, are the commonest TMJ-IDs. The inflammation of the synovial membrane results in changes in the composition of the synovial fluid^[10].

According to one recent investigation^[11], clinical characteristics of TMJ capsulitis/synovitis which facilitates its differential diagnosis are described as follows:

1. The patient reports pain on gentle palpation of the joint capsule externally during opening and closing;
2. Pain may be elicited in seconds by experimental border jaw movements that stretch the joint capsule, for instance during maximal jaw opening and or during a border lateral movement to the opposite side.
3. Pain elicited using such maneuvers disappears immediately when the patient closes the jaw in the maximal intercuspal position;
4. Pain is also induced when the patient is instructed to perform a border lateral movement to the opposite side.
5. Clicking may or may not be present
6. Periods of locking do not occur.

2. Retrodiscitis of the TMJs

Retrodiscitis of the TMJ is pain, discomfort, inflammation occurring in highly innervated and vascularized structures of the TMJ which by definition are anatomically located posterior to the posterior band of the joint disk^[7]. Retrodiscitis usually occurs together with inflammation and pain in the synovial membrane. There are two reasons for TMJ retrodiscitis to be a common TMJ-ID. One reason is that the region is profusely innervated and vascularized and the second is that such area is very susceptible to repeated low or high grade

microtrauma associated with parafunctional habits. Thus, pressure, distension, a posterior condylar position and compression of some anatomic components including pain receptors and blood vessels in the retrodiscal pad, cause pain and inflammation^[7]. Macro trauma when the joint capsule is stretched and the retrodiscal pad is compressed may also cause an inflammatory reaction which leads to both synovitis and retrodiscitis.

Several inflammatory mediators play an important role in the pathogenesis of retrodiscitis and other inflammatory states in the TMJ including tumor necrosis factor alpha, IL-1 beta, prostaglandin E2, leukotriene B4 and serotonin^[12]. Recent studies^[11] indicate that retrodiscitis may be recognized using palpation and biomechanical tests to induce some responses from the retrodiscal tissues:

1. Pain may be induced instructing the patient to clench the teeth in the maximal intercuspal position (MIP);
2. Pain is immediately abolished when we place cotton rolls on the posterior teeth to inhibit tooth contact;
3. Pain may also be induced when repetitively manipulate the mandible in the centric relation position (CRP).
4. Pain may be elicited immediately by instructing the patient to move the mandible to the affected side. This is so, as the movement to the ipsilateral side will compress part of the retrodiscal tissues. Once the mandible is moved to the rest position, the pain is abolished immediately.

3. Disk-attachment pain

Because disk-attachment pain (DAP) is characterized by joint pain and intermittent locking such characteristics are only observed in Wilkes stage II patients. Disk-attachment pain constitutes a more advanced and chronic TMJ-ID characterized by severe inflammation, a gradual decrease in jaw opening, unilateral or bilateral reciprocal clicking, intermittent pain only during function and refractoriness to conventional modes of therapy, mostly analgesics. Further, reciprocal clicking in DAP patients may be unilateral or bilateral. Eversole and Machado^[13] contends that the characteristic of transitory closed lock, the observation that pain is usually present most frequently during jaw function and self-report of periods of lockings, are used to classify patients in Wilkes stage II of TMJ-ID. Further, locking may be overcome by jaw exercises carried out by the patient and by a prolonged rest period of the jaw.

Molina and associates^[11] contends that the differential diagnosis characteristics of disk-attachment pain are the following:

1. Patient reports periods of intermittent locking
2. Pain is directly associated with jaw function
3. Reciprocal clicking is observed during gentle palpation and jaw manipulation
4. Pain is described as shooting or stabbing, dull, aching
5. Patient reports that jaw opening is progressively decreasing.

4. Disk-displacement without reduction

In some cases TMJ disk displacement may progress slowly as a result of previous stages of TMJ-IDs. However, in others cases, disk displacement without reduction (DDW_oR) may be the result of a macro traumatic event (a blow to the face, car accident, third molar extraction, orthognathic surgery), leading to permanent, incapacitating and painful disk displacement without reduction or DDW_oR. Chronic DDW_oR occurs when the loss of elasticity is so great, that the disk is unable to return to normal position within the articular fossa. Chronic DDW_oR may lead to a perforated disk and the perforation usually occurs in the bilaminar zona or occasionally in the disk^[14]. Further, because the condyle is displaced posteriorly and the disk anteriorly, normal opening is severely hampered and is not likely to occur. A posterior condylar position may cause severe pain and degeneration in the posterior area of the TMJ. Symptoms in DDW_oR usually includes severe pain, severe limitation of jaw opening, deviation of the mandible to the affected side^[15], speech difficulties and worry or anxiety about the cause of DDW_oR more frequently in females.

In chronic DDW_oR the patient usually reports a history consistent with acute and very painful closed lock. If function is recovered with time this is due to stretching of some components of the retrodiscal tissues usually during months. Thus, restoring translational movements^[8]. The differential diagnosis of DDW_oR may be established based on the history of the chief complain, comprehensive clinical examination and MRI. Toameh and colleagues^[15] state that the following characteristics of this TMJ-ID may assist the clinician in the recognition and potential treatment:

1. Severe limitation of jaw opening. Jaw opening is limited to +29mm
2. Patient reports severe pain in the affected joint and adjacent masticatory muscles
3. On RMN examination, the disk is anteriorly and/or medially displaced
4. Severe difficulties to eat
5. Severe pain if the patient moves the mandible to the opposite side
6. Gentle manipulation of the jaw may increase jaw opening.

5.Arthralgia

As stated previously, in some individuals TMJ-IDs may progress and reach a stage of severe inflammation combined with early signs of degeneration. This is particularly true if the disk is severely displaced and deformed. Arthralgia is probably a more advanced of permanently displaced disk and a previous stage of TMJ-Osteoarthritis. One investigation in TMJ-IDs individuals indicate that arthralgia is a rarely describe TMJ-ID characterized by inflammation and initial tissue degeneration which precedes osteoarthritis in the internal derangement process^[16]. Molina and associates^[17] evaluated a subgroup of subjects presenting with CMDs and reported that with the exception of subjects demonstrating signs and symptoms of OA, arthralgia subjects were usually older as compared to those with capsulitis, synovitis, disk-attachment pain and disk-displacement without reduction. The also reported that 100% of those 25 subjects with arthralgia described their pain as burning, 48% reported bilateral reciprocal clicking, 8% reported unilateral crepitus indicating osteoarthritic changes and 28% reported no joint noises. Further, 80% of the subjects reported severe pain indicating severe inflammation.

With some exceptions, the differential diagnosis of arthralgia of the TM can be established using the observations described as follows:

- 1.The patient is usually around forty years of age
- 2.Pain is usually described as severe and burning, although descriptions of dull and aching can also be used by patients to describe their pain.
- 3.Usually the patient describes a long history of TMJ-IDs
- 4.Approximately one third of the patients do no report joint noises likely related to a history of disk displacement without reduction.

6.TMJ osteoarthritis (TMJ-OA)

TMJ-OA is usually described as a TMJ-ID characterized by both inflammation and degeneration of the articular surfaces usually associated with a long-standing local inflammatory process^[18]. Both the inflammatory and degenerative process occur as the result of excessive loading, disc displacement and a combination of parafunctional behaviors^[18]. Chronic overload of the articular surfaces, is the most common etiological factor in TMJ-IDs. Once the joint disc is permanently displaced, anatomic contact during jaw movements may occur on surfaces not adapted to withstand friction and compression thus resulting in bone and cartilage degradation. Continuous cartilage degradation results in significant osteoarthritic changes and can ultimately result in disc perforation^[19].

Creptitation of one or both TMJs is the cardinal sign of chronic TMJ-OA. The noise is associated with roughness of the articular surfaces as a result of remodeling, progressive destruction and deformation. This disorder is more frequently found in patients with a history of unilateral or bilateral disk displacement^[20]. Chronic DDW_{OR} may result in a perforated disk which usually occurs most frequently in the bilaminar zone or occasionally in the joint disk^[14]. In TMJ-OA, osteoarthritic signs present in the head of the condyle includes osteophytes formation, flattening, surface erosion, formation of cortical cysts and/or sclerosis^[3]

Clinical and radiographic observations indicate that degenerative arthritis of the TMJ (osteoarthritis), is a natural consequence of derangement of the joint disk and condyle. Reduced joint space is usually associated with a progression of both inflammatory and degenerative disorders or events resulting in condylar flattening, irregularity of the joint surfaces, peripheral exostosis, sclerosis of the condyle and neck of the mandible^[21]. Follows some clinical and imaging characteristics which may assist the clinician in the diagnosis of TMJ-OA^[22]:

- 1.With rare exceptions, the patient is usually in the fifth or sixth decade of life
- 2.He or she reports a history of long-standing TMJ-IDs
- 3.Pain is usually described as aching, dull and constant
- 4.Pain occurs most frequently late in the evening
- 5.Clinical examination reveals the presence of creptitation in one joint and single or reciprocal clicking in the opposite joint

7. The “stuck disk” phenomenon

In the last three decades, there has been increased interest in the study and definition of clinical characteristics of the “stuck disk” phenomenon. The anchorage of the joint disc to the mandibular fossa or eminence has been defined as “the sudden and persistent severely limited mouth opening associated with a total lack of disc sliding along the mandibular fossa during jaw opening”^[23]. The “stuck disc” is a pathologic condition characterized by an immobile disc in relation to the mandibular fossa and the articular eminence that may also be related to the presence of adhesions^[24]. Inflammatory processes affecting the upper joint compartment such as arthritis or trauma may cause disc immobility associated with a lower intensity signal in

the upper joint space^[5]. It has been reported that the phenomenon of the “stuck disc” or “anchored disc phenomenon” occurs because of compromised lubrication to the joint disc and other structures^[25].

Nitzan and associates^[26] studies indicate that the anchorage of the joint disc to the mandibular fossa contradicts the old concept that TMJ-IDs are progressive in nature. For instance, there is no correlation between age of the patient presenting with the anchorage disc phenomenon and the stage of the process and the fact that the phenomenon is not related neither to the shape of the disc, nor to its position in the mandibular fossa. Lack of gliding of the joint disc occurs by the adherence of the disc to the fossa by a vacuum effect or simply by the formation of synovial fluid of high viscosity and poor flow efficacy^[26]. Both the vacuum effect and synovial fluid consistency may create a favorable biologic environment for a suction effect of the disc to the fossa, thus resulting in severe limitation of jaw opening^[26]. The clinical and imaging characteristics of this disorder are summarized as follows:

- 1.The phenomenon occurs suddenly
- 3.There is no previous history of DDW_oR
- 4.The disc is normal in shape and position
- 5.Jaw opening is more severe as compared with subjects presenting with DDW_oR
- 6.It may be reported or observed even in young individuals
- 7.The disorder responds very well to the use of arthrocentesis and debridement.

V. Discussion

Retrodiscitis of the TMJ

The retrodiscal pad is the anatomic region located posteriorly to the posterior band of the joint disc. This anatomic zone is rich in nerve endings and blood vessels. The venous plexus in the retrodiscal pad is located between the upper and lower laminae^[27]. Nerve supply to this region is attributed to numerous branches of the auriculotemporal nerve. Factors that cause strain, distension and pressure to this zone induce inflammation and pain. Thus, macrotrauma and microtrauma from parafunctional behaviors are the most common factors that cause inflammation and pain in this region. Pain elicited when manipulating the mandible in centric relation position and pain elicited when the mandible is moved to the affected side are two signs and symptoms that differentiate retrodiscitis from other painful TMJ- ID.

Retrodiscitis is caused by trauma, parafunctional behaviors or due to progressive disc displacement and dislocation. Further, edema in the retrodiscal tissue may cause anterior displacement of the joint condyle and acute malocclusion with painful limitations of mandibular movements. Lesions in the bilaminar zone caused by distention, trauma or excessive pressure may lead to luxation of the disk and TMDs paving the way for potential degenerative alterations^[28]. Further, one investigation^[10] asserts that macro and microtrauma that press the mandibular condyle towards the profusely innervated and vascularized retrodiscal tissue may cause edema, inflammation and pain^[10]. Additionally, because inflammation is apparent in the retrodiscal tissue, any manipulation of the mandible aimed at placing the head of the mandible posteriorly (manipulation in CR), will induce pain and discomfort. Even though it has been reported that the retrodiscal tissues have adaptive capacity to withstand pressure and often responds appropriately to the functional loads placed on the tissues^[29], such capability has some limitations. Thus, severe diurnal and repetitive uncontrolled nocturnal bruxing behavior may impinge on the posterior band of the joint disk and posteriorly on the profusely innervated and vascularized tissues, causing the release of inflammatory mediators, inflammatory cells, thus resulting in pain and inflammation.

Disk attachment pain (DAP)

DAP is a TMJ- ID associated with pain, inflammation and irritation of the posterior ligaments of the joint disc. Signs and symptoms of this disorder corresponds to those in Wilkes stage II internal derangement. It is considered a more advanced internal derangement stage preceded by retrodiscitis and capsulitis/synovitis^[30]. Even though this stage of internal derangements is rich in signs and symptoms, the descriptions of stabbing or shooting pain, pain closely associated with jaw function and periods of locking constitute the hallmark of this internal derangement. Temporary locking reported by DAP patients disappear in a few minutes if the jaw is kept in the rest position for a few minutes and/or if the mandible is gently manipulated beyond the interference^[9]. One investigation^[27] asserts that DAP is identical to disk displacement with reduction with the additional feature of intermittent limited mandibular opening on the occasions that the disk does not reduce. These considerations regarding diagnosis and major features of DAP are in line with one investigation^[31] reporting that episodes of limited mouth opening, presence of intermittent locking, joint pain with increased function and “hitting and obstruction” during opening are the most common features of DAP.

Additional support for the considerations in the current investigation comes from another study^[22] reporting that the limitation in jaw opening occurs progressively and pain described as shooting or sharp and reciprocal clicking are reported by most patients with this disorder. Further, in reciprocal clicking the click

heard during opening is an unlocking of the joint whereas the click during closing is a displacement of the disk and condyle^[21]. Molina and coworkers^[30] evaluated a large sample of 109 subjects presenting with disk-attachment pain. They found that most subjects reported reciprocal clicking, intermittent periods of locking, decreased mouth opening and pain described as shooting or sharp. It seems apparent that a displaced disk is responsible for most signs and symptoms related with DAP. Eversole and Machado's^[13] study indicates that the criteria for classifying a subject into type 2 TMJ-ID include reciprocal clicking, transitory closed-locked, a complain of pain and locking. Further, the patient is able to overcome the closed lock by jaw manipulation to one side or to the other.

Disk displacement without reduction (DDW_{oR})

DDW_{oR} is defined as a condition in which the joint disc is displaced anteriorly and inferiorly or medially and anteriorly and does not return to its normal position in the mandibular fossa during closing. Thus, jaw movements occur without the protection of the joint disk during opening and closing. Because the joint disk is thicker, deformed and probably shorter, there is obstruction of jaw opening. In chronic DDW_{oR}, the patient narrates a history of previous periods of acute closed lock that resolved over time^[8] indicating that disk attachment pain was the anterior stage of DDW_{oR}. With disease progression, increased laxity of retrodiscal soft tissues result in DDW_{oR} characterized by further thickening of the posterior band of the disc^[32]. One investigation^[5] indicates that insufficient ligamentous structures (probably those in the posterior zone of the TMJ), coupled with the stretched elastic fibers of the bilaminar zone unable to exert a restraining force on the disc as the condyle translates forward, cause anterior DDW_{oR}^[5]. Clinically, patients presenting signs and symptoms of DDW_{oR} complain of severe pain, discomfort, speech difficulties and eating disorders. This observation is reinforced by one investigation^[33] reporting that DDW_{oR} is strongly associated with joint effusion indicating more severe inflammation as joint effusion is more frequently observed in more advanced stages of TMJ-IDs^[33] as joint effusion are more frequently observed in joints with the potential to develop arthrosis^[33].

Regarding clinical cases presenting with DDW_{oR}, most common clinical symptoms and signs include severe pain, severe restriction of jaw opening, jaw deviation to the affected side, severe pain when the jaw moves to the opposite side, a deformed disk which remains anteriorly or anteriorly/medially in the fossa on MRI, very severe pain when further jaw opening is attempted and or when the jaw is manipulated with diagnostic purposes. In line with these clinical observations, one investigation^[25] indicates that clinical features of this disorder include a malpositioned disc that remains anteriorly or anteriorly and medially displaced, a visible obstruction during opening and closing and restricted mouth opening. Additionally, clinical criteria for the differential diagnosis of DDW_{oR} include a jaw locked and difficulties to open the jaw completely, difficulties to eat, the posterior band of the disk is located anterior to the 11:30 position^[15]. Additional criteria which should be added to the diagnostic characteristics of this disorders is that proper manipulation of the jaw increases jaw opening and relax the jaw for a short period of time.

Osteoarthritis (OA)

OA and osteoarthrosis represent both inflammatory degenerative and degenerative/inflammatory processes of the articular surfaces of the TMJs^[18] usually as a result of a long progressive process of disc derangements. OA of the TMJs is a disease that typically occurs after the articular disc is displaced and bone contact is established between the condyle and the glenoid fossa^[3]. Primary OA symptoms are observed more frequently in the fifth to six decade of life whereas signs and symptoms of secondary OA may be observed earlier in life^[8]. Repeated stress related microtraumatic events as those under the umbrella of "oral jaw behaviors" may progressively induce disk displacement and cause a permanent state of inflammation and pain in predisposed individuals. However, oral jaw behaviors do not constitute the only cause of TMJ-OA. Degenerative arthritis of TMJ is a natural consequence of derangement of the disc and condyle^[21]. In any osteoarthritic joint, there is progressive softening and loss of cartilage. Continued cartilage degradation results in significant OA and can ultimately lead to a disc perforation^[19]. Degenerative joint disease is most frequently observed in those subjects with a perforated disc as bone articulates with bone^[14] increasing friction and facilitating resorption of both cartilage and bone.

Patients presenting with signs and symptoms of OA complain of pain associated with increased jaw function and load bearing throughout the day. Pain is more frequently reported at the end of the day and is usually associated with unconscious parafunctional behaviors. Because OA is the result of a chronic pathologic process in which pain and inflammation predominate, the patient frequently reports pain in other anatomic areas including the neck and head. Clinical signs and symptoms of OA useful to establish its differential diagnosis include the following:

1. Pain is described as dull, aching, constant and sometimes burning
2. Joints are tender and exhibit decreased range of motion on palpation and clinical examination^[8]

3. Crepitus is observed during gentle palpation of the joint when the patient is instructed to open and close the jaw and indicates that the cartilage has been progressively lost and there is bone exposure. Crepitus is usually related to roughness of the articular surfaces because of remodeling or OA and usually is observed in patients with a long history of TMJ-IDs including DDW_oR^[20]. Degenerative changes and inflammation in OA probably initiate early in life and constitute a continuation of previous inflammatory degenerative processes. In line with this considerations one investigation^[3] examined a large sample of subjects presenting with TMDs signs and symptoms and reported that degenerative and or inflammatory changes indicating OA were observed in subjects presenting with clinical characteristics including disc deformity, condylar and mandibular fossa degeneration indicating that some signs of OA may be present in previous stages of OA.

4. CT imaging may reveal joint space narrowing, osteophyte formation, condylar head flattening and formation of subchondral cysts^[8].

5. Pain is associated with increased jaw function or loading

6. Pain is reported more frequently as the day progresses or late in the evening.

Tables 1 and 2, shows some key clinical characteristics useful in the differential diagnosis of some TMJ-IDs.

VI. Conclusion

Even though TMJ-IDs occur in a very restricted and complex anatomic area, the complexity of these joints is paralleled by the complexity of individual internal derangements. Because proper treatment is usually based on initial diagnosis and this review shows that each internal derangement presents with its own clinical and diagnostic characteristics, it is highly recommended that before the clinician establishes the treatment plan, each internal derangement be carefully diagnosed using the specific characteristics delineated in the current study. Even though the “clinical diagnosis” of each disorder is not under debate in the current study, there are many reasons to believe that in some specific cases the use of magnetic resonance imaging and computerized tomography are essential in order to establish more accurate diagnosis in many specific cases, for instance, osteoarthritis, disk displacement without reduction and “stuck disk” phenomenon. New studies using clinical and imaging methods should be carried out in order to improve the clinical diagnosis of more complex disorders for instance, disk displacement without reduction, adhesions and the “stuck disk” phenomenon.

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Table 1: Some selected clinical characteristics of some TMJ-IDs (Part I)

Disorder	Clinical characteristics	Reference
Capsulitis/Synovitis	Pain on palpation of the condyle.	Poluha 2018
	Pain during border jaw movements	Molina 2011
	Pain if the joint capsule is stretched	Herb 2006
Retrodiscitis	Pain when manipulating the jaw in CR position	Molina 2020
	Pain when the jaw laterally to the opposite side.	Molina 2020
Disk-attachment pain	Periods of intermittent locking.	Molina 2020
	Pain described as shooting/stabbing	Molina 2020
	Joint pain if function is increased	Molinari 2007
Disc-displacement without reduction	Further thickening of the posterior band of the disc.	Thomas 2014
	Severe limitation of jaw opening. Severer pain if the patient attempts to open the jaw completely.	Toameh 2019

Table 2: Some selected clinical characteristics of some TMJ-IDs (Part II)

Derangement	Some key clinical characteristics	Reference
Arthralgia	Pain is described as dull, aching and burning.	Molina 2010
	Some degenerative signs may be observed on MRI	Molina 2010
Osteoarthritis	Presence of crepitation during joint palpation. Many degenerative changes observed with images.	Okeson-de Leeuw 2011
Anchored-disc phenomenon	MRI shows a disc normal in shape and position.	Nitzan et al. 1991
	Severer limitation of jaw opening. Disc does not glide during opening. Adhesions may be present	Bag 2014
Adhesions	Restricted mouth opening	Molinari 2007
	Pain if the joint capsule is stretched.	Molinari 2007