Comparison between Disc Repositioning by Open Surgery and Arthroscopy as a Treatment Modality for Internal Derangement of Temporomandibular Joint

(Meta-analysis study)

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بسم الله الرحمن الرحيم

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Dedicated to my family,

“My father and mother, My wife and kids”

Without you, any accomplishment in my life would be impossible.

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INTRODUCTION

Temporomandibular joint (TMJ) is diarthroidal, ginglymoid, synovial and freely movable joint. It is the area in which the mandible articulates with the cranium. It includes bony parts as well as soft tissue parts. There are several disorders which affect the TMJ that result in pain and dysfunction in millions of patients worldwide. [1 & 2]

The term temporomandibular disorder (TMD) refers to the signs and symptoms associated with pain and functional and structural disturbances of the masticatory system.

These disorders are classified into articular and nonarticular. Articular disorders include noninflammatory and inflammatory arthropathies, growth disorders, and connective tissue disorders. Nonarticular disorders are mainly muscle disorders such as myofascial dysfunction, muscle spasm and myositis. Although TMD have been studied for a long time, there are still many controversies with regard to the etiology, diagnosis and treatment of these problems. It is known that TMD etiology is multifactorial. One of the most common forms of temporomandibular disorders is internal derangement (ID). [2 & 3]

ID is an orthopedic term for disorders causing mechanical disturbances and impediments to the joint function, resulting in interference in smooth action of the joint. Internal derangement (ID) of temporomandibular joint (TMJ) is one of the most controversial issues in the oral and maxillofacial field. Diagnosing and treating temporomandibular disorders(TMDs) usually challenge the oral and maxillofacial surgeons in their practice. [4 & 5]

It has been suggested that ID consists of four sequential stages which are; Disc displacement with reduction; Disc displacement with reduction and intermittent locking; Disc displacement without reduction; perforation of disc or posterior attachment.These stages are represented clinical as; an early or late click with normal mouth opening; a period of intermittent limitation in mouth opening; frank limitation in mouth opening (less than 35 mm); finally when the disc is perforated there is a grinding noise associated with limitation in mouth opening and restriction in lateral movements.(5)

The clinical signs and symptoms of ID are not considered consistently reliable for accurate assessment. Thus, imaging techniques such as arthrography and magnetic resonance imaging (MRI) have been utilized to assist in determining the extent of ID. (6)

The most commonly used classification to describe the severity of ID was proposed by Wilkes in 1989. The Wilkes classification consists of 5 stages based on clinical, radiologic, and intra-operative findings, varying from a slight forward displacement with symptom free normal joints to essentially degenerative arthritic changes with severe clinical symptoms.

Treatment of ID represents a therapeutic challenge for oral and maxillofacial surgeons as many modalities are introduced for its management. These modalities include non surgical and surgical methods. (7)

Non surgical methods shows around 90% of all TMD can be successfully treated by these conservative methods. They include pharmacological therapy, physiotherapy, occlusal adjustment and splint therapy. (8)

The surgical techniques used in treatment of ID are divided into open and closed surgical techniques. The open techniques include disc preservation surgeries and discectomy, while the closed techniques include arthroscopy and arthrocentesis. Historically, clinicians have recognized that surgery for internal derangements should be reserved for patients with pain or dysfunction that is severe and disabling and is refractory to nonsurgical management. These conditions still form the basic indications for surgery. [9 &10)]

Arthroscopy of the TMJ was first reported by Ohnishi [(11)] in 1975. TMJ arthroscopy can be classified into diagnostic and operative arthroscopy. Recently arthroscopic surgery has been used to perform disc repositioning and suturing as well as diskectomy. [**(12)**]

Disc repositioning surgery is indicated in unilateral and bilateral Wilkes stage II to V disease. [(13)]

REVIEW OF LITERATURE

Anatomy of the tempormandibular joint

The masticator system is the functional unit of the body that is responsible for numerous functions such as chewing, speaking, and swallowing. This system is made up of bones, joints, ligaments, and muscles. In addition, a complex neurologic controlling system regulates and coordinates all theses components together.

The tempormandibular joint (TMJ) is a part of the masticatory system and is one of the most complex joints in the body. TMJ is composed of the temporal bone and the mandible, as well as, a specialized dense fibrous structure, the articular disk, several ligaments and numerous associated muscles, the TMJ is a compound joint that can be classified by anatomic type as well as by function. [14]

Anatomically, TMJ is a diarthroidal joint made of bony structures and soft tissue structures. The bony structures include the mandibular condyle, glenoid fossa, and articular eminence of the temporal bone; those bones are permitted to move by the associated muscles and are limited by the ligaments. Whereas the soft tissue structures of TMJ include muscles, articular disc and the TMJ ligaments. [15, 16]

All muscles that are attached to the mandible influence its movement to some degree; however only the four muscles attached to the ramus are considered as the muscles of mastication. The masticatory muscles are generally described as muscles, which originate from the cranium and insert

on to the mandible. Sometimes, however, muscle bundles are attached to the articular disc. [16]

Anatomically, muscles influencing the mandibular motion can be divided into two groups; the inframandibular group of muscles, those muscles are attached to the hyoid bone and to the body and symphyseal area of the mandible, this group include the suprahyoid muscles & the infrahyoid muscles; the second group is the supramandibular muscles group, in this group the muscles are attached primarily to the ramus and condylar neck, this group consists of the medial and the lateral pterygoid muscles; the lateral pterygoid muscle has two portions, that are considered two functionally distinct muscles; the large inferior head that originates from the lateral surface of the lateral pterygoid plate and it inserts in pterygoid fovea, and the superior head that originates from infratemporal surface of the greater sphenoid wing, it inserts in the superior aspect of the pterygoid medial pole of the condyle, the inferior head main function is protrusive and contralateral movement, when the bilateral inferior heads function together, the condyle is pulled forward down the articular eminence, with the disc moving passively with the condyle; whereas, the superior head is predominantly involved closing movement of the mandible, and also with retrusion and ipsilateral movement. [16]

Separating the two articular bones is the articular disc and dividing the joint into superior and inferior compartments. The articular disc is biconcave in shape, composed of dense fibrous connective tissue. It is devoid, for the most part, from blood vessels or nerves. [15,16]

Laskin has described the functional condyle disc relationship as follows: when the mandible is at rest, the disc is located between the antrosuperior

aspect of the condyle and the posterior aspect of the eminence with the posterior region of the disc is at twelve o'clock position .[17]

In the sagittal plane, the disc can be divided into three regions according to thickness: intermediate, anterior, and posterior zones. The central part is the thinnest and is called the intermediate zone. The disc becomes considerably thicker both anterior and posterior to the intermediate zone with the posterior border is generally slightly thicker than the anterior border. The articular disc is attached posteriorly to a region of loose connective tissue that is highly vascularized and innervated which is called retrodiscal tissue or posterior attachment. [18]

TMJ ligaments can be classified into main and accessory ligaments. The capsular and temporomandibular ligaments are considered to be the main or principle. The capsule is attached superiorly to the circumference of the glenoid fossa and the articular eminence and inferiorly is attached to the condylar neck. Laterally, the capsule is reinforced by another main ligament called lateral temporomandibular ligament which is made of outer oblique fibers and inner horizontal ones. Two additional, accessory ligaments play a role in the function of the TMJ: the sphenomandibular ligament and the stylomandibular ligament. These ligaments prevent excessive protrusive movements of the TMJ, even though they are not closely associated with articulation. [14, 19]

Mouth opening requires a complex combination of rotation in the lower TMJ compartment (condyle- articular disc) and of translation in the upper compartment (mandibular fossa-disc); these two components are simultaneously present in each step of jaw motion, TMJ facilitates a mouth

opening of 40-60 mm as measured between the upper and lower incisors.[20,21]

Two types of movements are possible, the rotation and the translation. The center of rotation is considered to be along a horizontal axis passing through both condyles. In theory pure hinge motion of approximately 2.5 mm measured at the incisal edges of the anterior teeth is possible. Nevertheless most mandibular movements as translator as well, involving a gliding motion between the disk and the temporal fossa. The mandible and disk glide together as a unit because they are held together by collateral ligaments. The maximum forward and lateral movements of the upper joint in translation is approximately 1.5 cm. [16]

This wide range of different mandibular movements can only be achieved by healthy strong muscles controlled by intricate neural system. Thus, a proper neuromuscular coordination is needed to facilitate all the mandibular movements in an accurate way without any aberration. [14, 22]

Tempormandibular joint examination and imaging

History taking is considered as the first step before the physical of the patient, it often reveals information that points directly to a general diagnostic classification, if not to a specific diagnosis.

Sir William Osler has described the importance of history “Listen to the patient he is giving you the diagnosis”. The history should include defining each chief complain and the associated symptoms. This includes reviewing the degree of severity which can be determined by visual analog scales, which has the advantage of being reproducible so that it can be used later on to assess the treatment outcome; the characteristics of pain; precipitating and

alleviating factors; onset and history of pain; site of pain to differentiate between intraarticular or extraarticular pain; past and present medication, surgeries and other treatment as well as personal history. [23]

Principles of physical examination of TMJ include inspection, palpitation, auscultation and measurements to ascertain whether an abnormality or dysfunction that is related to chief complaint is present. Inspection can reveal considerable information about the patient such as asymmetry, swelling, weakness loss of function and skin changes. Whereas palpation is another process done by using hands to examine the body for signs of abnormalities. It can include finger palpation of the muscles for myofacial trigger points, the skin for hyperesthesia, lymph nodes for lymph adenopathy; and joint for swelling and tenderness. Auscultation on the other hand, is the act of listening which is useful for hearing joint sounds.

Physical examination of the TMJ starts by cranial nerves examination, followed by assessment of cervical function, then masticatory system were the all the mandibular movements should be assessed including maximum painless opening, maximum active opening, maximum passive opening, maximum lateral excursions to the right, and maximum lateral excursions to the left and maximum protrusion, in addition to palpation of the TMJ and muscles of mastication starting by the lateral pterygoid muscle, medial pterygoid muscle, masseter muscle, temporalis muscle, sternocleidomastoid muscle and ending by the trapezius muscle. Those muscles are palpated to reveal muscle spasm and/or muscle pain; Auscultation of any joint sound is the final step toward competition of the diagnosis as it might reveal important clues which aid in reaching a proper diagnosis, to the extent that some authors consider joint sounds to be a highly sensitive detector of osteoarthritis.[23,24]

It is quite clear that, if a high level of diagnostic uncertainty still exists after the history and clinical examination, consideration should be given to other diagnostic procedures, test or strategies. Such clinical procedures however, should have considerable validity and reliability. This seems to be necessary for correct classification of the status of the TMJ. A clinical measure is reliable if any investigator or clinician can apply the measurement technique to asymptomatic or symptomatic subjects and repeatedly obtain approximately the same value. [25]

Medical imaging of TMJ can be challenging as the TMJ is a three-dimensional structure which is inherently unstable (rotation – translation) and there is individual variability of approximately 20% between the right and left sides. Following Roentgen discovery of x-rays in 1895, imaging has progressed from transcranial views to sophisticated computerized tomography (CT) and magnetic resonance imaging (MRI) examination. [26]

Many radiographic techniques are have been used to view the TMJ, some of them are conventional methods and some are relatively advanced ones. The conventional techniques are seldom used now since they can not reveal the disc shape and position which are needed to reach an accurate diagnosis. [24]

MRI is considered to be the best imaging technique and this is because it has the distinct ability of depicting both the soft and hard tissues and therefore it provides us with the ability to visualize the disc shape and position accurately, which is of extreme importance in determining the disc displacement and the best treatment method. [27,28]