In The Name Of God

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EVALUATION OF THE FALSE POSITIVE TMJ INTERNAL DERANGEMENT IN SONOGRAPHY BY USING MRI

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با نگارش دکتر عبدالعزیز حق نگهدار در تاریخ بانمره

و درجه مورد تایید قرار گرفت..

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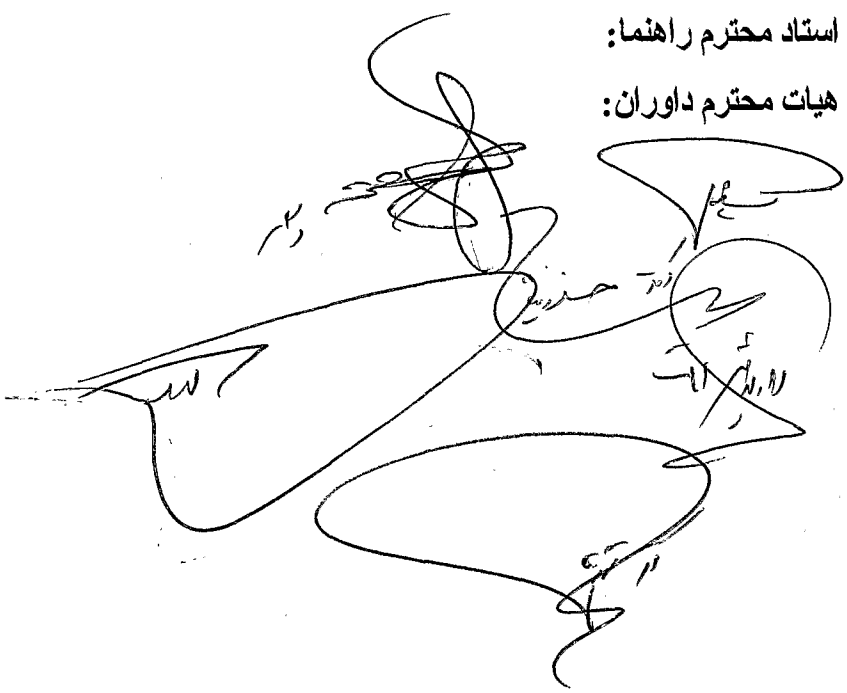

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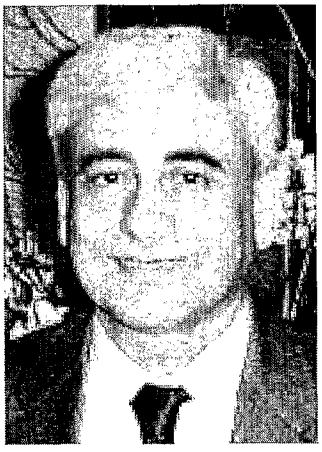

Eisa Mozaffari
(1953-2006)

In Memory of Dr. Eisa Mozaffari,
That gone healer,
Whose healed patients,
Still Remained.

Dedicated to whom that

Each precious point in my

life is somehow related to her:

My wife, Roya.

With profound gratitude to my dear professor Dr. Sh. Shahidi whose most valuable art is teaching.

With Sincere Respect for

Dr. Leila Khojasteh Poor

who provided me with her

knowledge, kindness & support.

Just few of those, performing glorious tasks may be meek; Dr. Maryamnaz Falamaki is one of them.

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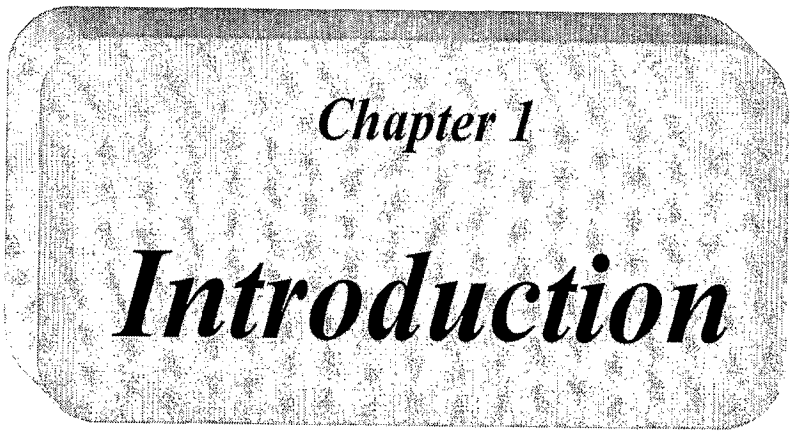
Chapter 1
Introduction

Oral cavity has many critical roles and functions, including food intake and communication . Different movements of the jaws, especially opening and closing, perform these tasks. These movements take place at too strategic, temporomandibular joint (TMJ), which produces a movable connection between mandible and the base of the skull.

The functions of this joint may be impaired or disrupted in a number of diseases or disorders. Many of today's human life style characteristics, such as various stresses , increasing vehicle and occupational accidents and violent sports with their accompanying traumas , have an impact impress on increasing incidence of TMJ disorders. This in turn necessitates considerable efforts to prevent, diagnose and treat these problems.

Managing any TMJ problem often called temporomandibular dysfunction (TMD),would be possible only after proper evaluation of existing situation in the joints . TMJ is consisted of both soft and hard tissues, and a perfect diagnosis, should be conversant with both types of tissues.

MRI (magnetic resonance imaging) and CT (computerized tomography) scan are used to image TMJ's all tissue types, because of inability of conventional radiography to imply soft tissues.

MRI is considered as a golden reference for imaging of TMJ , [1] , [2] but this modality has its own limitations ; this very high cost procedure needs expensive equipments and educated personnel , which limits its application to all patients. It is contraindicated in pregnant women or in persons with metallic implants or heartbeat controlling pace makers . Some people have an illogic fear from such complex procedure.

Additionally some investigators believe that the patient's head is in an abnormal position during obtaining MR images. [3]

Finally some patients , especially older ones, cannot remain still for long period needed to obtain MR images. Thus, Today most of the management approaches for the patients with TMD are symptom-based.

Recently high resolution ultrasonography (HR-US) was used to evaluate various parts of TMJ especially in screening studies .[1] , [2]

HR-US is currently applied to many areas of the musculoskeletal system, being employed in evaluation of joint effusion in diarthrodial joints , such as shoulder and knee for example . Suggestions exist that in those large joints HR-US can produce results similar to those obtained with MRI.

More recently with introduction of smaller and more maneuverable high frequency transducers some investigating attempts to study small joints have been made . For TMJ , studies on the use of HR-US are relatively recent. [3]

HR-US is a noninvasive , easy to access and easy to perform procedure with a relatively very low cost and a high patient acceptance . If HR-US proves to be accurate in TMJ diagnosis, it can play a valuable role in TMD managements.

In present study, we have performed MRI, as a golden reference, for the joints of the patients whose sonographic findings were suggestive of disc displacement, to evaluate the accuracy of sonographic findings.

Chapter 2

Review of the Literature

In this section we will briefly review the anatomy of TMJ accompanied by an explanation of normal biomechanics and pathomechanics of this joint. Then various imaging techniques of the TMJ with their advantages and disadvantages would be explained. After that, comparison between MRI and sonography of the structures of TMJ based on existing literatures will be presented.

Anatomy Of TMJ:

TMJ is a complex joint consisting of two osseous parts and a non- ossified part called disc . The mobile bony part of the joint is condyle or candylar head of the mandible, which is suspended under the base of the skull by various ligaments and muscles of mastication . Condyle is the connecting part of the mandible that articulates with the cranium , around which the movements occur. From the anterior view, it has a lateral and a medial pole. The total mediolateral length of the condyle is 15 to 20 mm and the antero posterior width is between 8 to 10 mm . The articulating surface of the condyle is quite convex anteroposteiorly and only slightly convex mediolaterally.[4]

The second bony part of the joint is the mandibular fossa of the squamous portion of the temporal bone , which is also called glenoid articulating fossa . Immediately anterior to the fossa is a convex bony prominence called articular eminence . The steepness of the articular eminence indicates the pathway of the condyle when the mandible is moving anteriorly.

The thinness of the posterior roof of the glenoid fossa justifies that this surface is not designed to tolerate any force in contrast with articular eminence.[4]

The third and non-ossified part of the joint is articular disc , which

is composed of dense fibrous connective tissue, and has no vascular or nervous supply in the greater central part , only extreme periphery is slightly innervated . In sagital plane it is divided into three regions according to thickness:

There are two thick anterior and posterior regions (the posterior part slightly thicker) interposed by a thin intermediate(central) zone. In the normal joint , condylar articulating surface is seated on the intermediate zone. The disc is also thicker medially than laterally in the anterior view.

The disc is attached posteriorly to a region of loose connective tissue that is highly vascularized and innervated called retrodiscal tissue or posterior attachment. Superiorly it is bounded by a lamina of connective tissue with many elastic fibers called superior retrodiscal lamina, which attaches the disc to the tymphanic plate . The lower border of the retrodiscal tissue is the inferior retrodiscal lamina, which attaches the postero- inferior border of the disc to the posterior margins of the articular surface of the condyle. This lamina in contrast with the superior one is chiefly composed of collagen fibers which inhibit its extension . the remaining body of the retrodiscal tissue is attached posteriorly to a large venous plexus which fills with blood as the condyle move forward . The superior and inferior attachments of the anterior regions of the disc are to the capsular ligament and composed mainly from collagenous fibers. Anteriorly between these two attachments ,

the disc is also attached by tendinous fibers to the superior lateral pterygoid muscle . The disc is also attached to capsular ligament laterally , and medially which results in dividing the joint architecture to a superior and an inferior joint space.

Each space is lined by a synovial tissue which secrets synovial fluid to feed the articular a vascularized surfaces and to create a lubricating medium to facilitate joint movements simultaneously . TMJs also include muscles and ligaments.[4]

LIGAMENTS:

There are five TMJ related ligaments ; three of them have direct effect on the joint movements, including collateral ligament , capsular ligament , temporomandibular ligament and two accessory ligaments including sphenomandibular and stylomandibular ligaments.

A: COLLATERAL LIGAMENTS:

Collateral or discal ligaments attach the medial and lateral borders of the condyle to the lateral borders of the disc , so they can be named discal or lateral discal ligaments. Because they are collagenous and do not stretch, can function to restrict movement of the disc away from the condyle and allow the disc to move passively with the condyle as it glides anteriorly and posteriorly . These are responsible for hinging movement of the condyle and disc. They are innervated and provide proprioception about joint movements and can cause pain sensation if stretched. [4]

B: CAPSULAR LIGAMENT:

The entire TMJ is surrounded and encompassed by the capsular ligament, which resists any medial , lateral, or inferior

forces that tend to separate or dislocate the articular surfaces . it also participates in dividing the joint to two compartments of the lower and upper joint spaces . This ligament is innervated provides proprioceptive impulse regarding position and movements of the joint. [4]

C: TEMPOROMANDIBULAR LIGAMENT:

TM ligament, which reinforces the lateral aspect of the capsular ligament, can be divided into two parts : An outer oblique portion and an inner horizontal portion . The outer portion extends from the outer surface of the articular tubercle and zygomatic process , poster inferiorly to the outer surface of the condylar neck . The inner horizontal part extends from the inner surface of the articular tubercle and zygomatic process posteriorly and horizontally to the lateral pole of the condyle and posterior part of the articular disc. The oblique portion of TM ligament limits the extent of mouth opening . During the initial phase of opening the condyle can rotate around a fixed point until the TMJ ligament becomes tight as its point of insertion on the neck of the condyle is rotated posteriorly. When the ligament is taut the neck of the condyle can not rotate further, if the mouth were to be opened wider the condyle would need to move downward and forward across articular eminence . This unique feature of TM ligament , which limits rotational opening , is found only in human . The inner horizontal portion of the TM ligament limits the posterior movement of the condyle and disc and protects the retrodiscal tissues from trauma , created by sudden posterior displacement of the condyle. Simultaneously lateral pterygoid muscle is guarded against overextension by this protective mechanism. [4]

D: SPHENOMANDIBULAR LIGAMENT:

Sphenomandibular ligament, which does not have any significant, limiting effect on mandibular movements ; arises from the spine of the sphenoid bone and extend downward to the lingual process on the medial side of the ramus. [4]

E: STYLOMANDIBULAR LIGAMENT:

This ligament arises from styloid process and extends downward and forward to the angle and posterior border of the ramus of the mandible . It becomes taut when the mandible is protruded, therefore limits excessive protrusive movement of the mandible. [4]

MUSCLES:

Four pairs of the muscles make up a group called the muscles of mastication, are major components for TMJ movements, resulting in mastication and chewing. These are as follows:

A: MASSETER:

This rectangular muscle originates from the zygomatic arch, extends downward and attaches to the lateral aspect of the lower border of the ramus of the mandible. it is comprised of two portions:

- The superficial portion which runs downward and slightly backward
- The deep portion runs predominantly in a vertical direction . This powerful muscle elevates the mandible and brings the teeth into contact . Its superficial portion may also aid in protruding the mandible . When the mandible is

protruded and chewing forces are applied, the fibers of deep portion stabilize the condyle against the articular eminence.[4]

B: TEMPORALIS:

Fibers of this large fan shaped muscle originate from the temporal fossa and lateral surface of skull, come together as they extend downward between the zygomatic arch and lateral surface of the skull, to form a tendon that inserts on the coronoid process and anterior border of ascending ramus of the mandible . This muscle can be divided into three parts as follows:

- The anterior portion consists of fibers that are directed almost vertically
- The middle portion consists of fibers that run obliquely (slightly forward) across the lateral aspect of the skull.
- The posterior portion is consisted of almost horizontally aligned fibers , coming forward above to the ear to join other portions as they pass the zygomatic arch . When temporalis contracts , the mandible is elevated and the teeth are brought into contact.

If only some portions are contracted, the mandible is moved to the direction of the fibers that are activated . Contraction of the anterior portion raises the mandible vertically, contraction of the middle portion elevates and retrudes the mandible. Although the contraction of posterior portion elevates and retrudes the mandible, this retrusion is not significant. So that temporalis is a significant positioning muscle of the mandible. [4]

C: MEDIAL PTERYGOID:

The medial pterygoid originates from the pterygoid fossa (the concave surface between two pterygoid plates) and extends downward, backward and outward to insert along medial surface of the mandibuar angle. When its fibers are contracted, the mandible is elevated and teeth of the jaws contact each other. The muscle is also active in protruding the mandible. Unilateral contraction will cause a mediotrusive movement of the mandible. [4]

D: LATERAL PTERYGOID:

Today's studies consider this muscle as two distinct muscles in contrast with old belief , which introduced them as two head of a single muscle.

❖ INFERIOR LATERAL PTERYGOID:

The inferior lateral pterygoid originates at the outer surface of the lateral pterygoid plate and extends backward, upward and outward to its insertion, primarily on the neck of the condyle . Simultaneous contraction of both lateral pterygoid muscles pulls the condyle down the articular eminence, which cause the protrusion of the mandible. Unilateral contraction creates a mediotrusive movement of the condyle and causes a lateral movement of the mandible to the opposite side. When these muscles function with the mandibular depressors , the mandible is lowered and the condyles glide forward and downward on articular eminence. [4]

❖ SUPERIOR LATERAL PTERYGOID:

This muscle originates at the infratemporal surface of the greater wing of sphenoid bone , extending almost horizontally